APPENDIX C

BECK ROAD SCOPING STUDY UPDATE

Beck Road Scoping Study Update

Prepared For:

CITY OF NOVI

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AECOM

DETROIT – SOUTHFIELD – GRAND RAPIDS – TRAVERSE CITY

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EXECUTIVE SUMMARY

Purpose and Background

Beck Road is a major thoroughfare in the City of Novi. The portion of Beck Road that is encompassed by this study is from 8 Mile Road to Grand River Avenue. The roadway connects M-14 to the south in Plymouth Township with I-96 just north of Grand River Avenue. Traffic along Beck Road includes local traffic with destinations in the area and also regional traffic. The roadway within the study area is generally two lanes wide with additional right-turn and left-turn lanes at the major intersections and at most subdivision intersections.

A detailed Scoping Study for the Beck Road corridor between 8 Mile Road and Grand River Avenue was completed for the City of Novi in 2006 by Fishbeck, Thompson, Carr, and Huber (FTCH). This report is attached as **Appendix B**.

The original report included a traffic capacity analysis, a crash analysis and identified alternative improvements in the corridor. The improvements identified included both long-term improvements and short-term improvements. A complete geotechnical analysis and report as well as construction cost estimates were also completed as part of the original study.

This report is an update of the original Scoping Study and includes:

- Updated Traffic Capacity Analysis
- Updated Crash Analysis
- Updated Cost Estimates
- Recommendations for Long-Term Improvements
- Recommendations for Short-Term Improvements
- An updated geotechnical analysis and report

Implementation of the improvements, potential funding sources, right-of-way acquisition, permitting, maintenance and utility issues are also discussed.

Improvements and Recommended Actions

The existing pavement is in overall poor condition in the corridor, excepting for the section between 8 Mile Road and 9 Mile Road, which was recently rehabilitated. PASER Ratings are included for the corridor in **Appendix D**. The pavement condition on a scale of 1 to 10 (with 1 being poor and 10 excellent) ranges from 2 to 4 from 9 Mile Road to Central Park Boulevard. Between Central Park Blvd. and Grand River Avenue the pavement has a PASER rating of 7. There also are short sections with PASER ratings of 6 and 7 in the corridor which reflect recent widenings and overlays at intersections for new developments.

The pavement will continue to deteriorate and rehabilitation will be needed to extend the life of the roadways until the long-term improvements can be constructed. An HMA pavement preservation overlay could be done to extend the life of the pavement between 9 Mile Road and Central Park Boulevard. The pavement preservation overlay would include cold milling where needed to match existing curbs and driveways and a 2 inch HMA overlay.

The cost for the short-term pavement preservation overlays and turn lane extension work outlined above is summarized below. The estimates were divided into one mile segments, correlating to the long-term improvements. An estimate is not included for the section from 8 Mile Road to 9 Mile Road, as this section was rehabilitated in 2017.

Short-Term Rehabilitation Work	
9 Mile to 10 Mile	$ 884,686.37
10 Mile to 11 Mile	$ 867,902.19
11 Mile to Central Park	$ 690,864.68
TOTAL	**$ 2,443,453.24**

The original study included the widening of Beck Road to five lanes or the addition of a 20 Ft median for the long-term improvements. An additional alternative has also been added for a boulevard with a twenty-five foot wide median which was not included in the original study. A summary of the costs for the long-term improvements follows.

Long-Term Improvements				
	Five Lanes	**20 Ft Median**	**25 Ft Median**	**ROW Parcels**
8 Mile to 9 Mile	$ 7,902,013.69	$ 7,968,081.08	$ 8,009,367.33	26
9 Mile to 10 Mile	$ 7,904,230.52	$ 7,970,297.91	$ 8,011,584.16	14
10 Mile to 11 Mile	$ 8,489,438.41	$ 8,555,505.80	$ 8,596,792.05	4
11 Mile to Grand River	$ 5,180,779.12	$ 5,267,013.17	$ 5,293,281.62	8
TOTAL	**$ 29,476,461.74**	**$ 29,760,897.96**	**$ 29,911,025.16**	**52**

Several improvements have been made to the intersections since 2006 but there are still some short-term improvements that include lengthening storage lanes or adjusting signal timing. The following summary shows the improvement of the signalized intersections with both short-term and long-term improvements.

Signalized Intersection	**Weekday AM Peak-hour**			**Weekday PM Peak-hour**		
	Ex. LOS	**Short-Term LOS**	**Long-Term LOS**	**Ex. LOS**	**Short-Term LOS**	**Long-Term LOS**
Beck Rd / 8 Mile Rd	**E**	D	C	D	D	C
Beck Rd / 9 Mile Rd	B	B	B	B	B	B
Beck Rd / 10 Mile Rd	D	D	C	**E**	D	D
Beck Rd / Cider Mill Dr	B	B	A	A	A	A
Beck Rd / 11 Mile Rd	D	D	C	B	B	B
Beck Rd / Central Park Blvd	B	B	A	C	C	B
Beck Rd / Grand River Ave	D	D	D	D	D	D

Refer to the Traffic Capacity Analysis section of the study for detailed intersection information.

ENGINEERING ANALYSIS

Long-Term Improvements

The updated traffic capacity analysis and crash analysis reveals that the corridor has the same problems which were identified in the 2006 Scoping Study. The corridor experiences heavy congestion during both the weekday morning (7:00 to 9:00 AM) and weekday afternoon (4:00 to 6:00 PM) peak periods. Crash rates are higher than average compared to other roadways in the SEMCOG region with similar traffic volumes, particularly rear-end collisions which are typically associated with higher levels of congestion.

The limits for the widening recommended in the previous study were from 8 Mile Road to Central Park Boulevard. The roadway is already five lanes wide and would not require further widening from Central Park Boulevard to Grand River Avenue, except for intersection improvements as noted below.

The long-term recommendations for widening Beck Road (from 8 Mile Road to Central Park Boulevard) to a five-lane roadway or a four-lane boulevard roadway in the previous study remain valid (Typical Roadway Cross Sections are provided in **Figure 1**). The three viable options (in no particular order) are as follows:

- **Five-Lane Roadway** with narrow (11 foot wide) median areas where left-turns are not needed and dedicated right-turn lanes where needed at signalized intersections.

- **Boulevard with 20 Foot Median** with dedicated right-turn lanes (where needed) and directional median crossovers. The median width is defined as the distance between the edge of travelled way of the inside lanes. The alternative in the original study included the median only for the segment between 9 Mile Road and 10 Mile Road and the segment between 10 Mile Road and 11 Mile Road. For this update, the median has been extended to include the entire corridor from Eight Mile Road to Central Park Boulevard. Direct-left turns would be allowed at each of the Mile Roads and at the signalized intersections at Cider Mill Road and Central Park Boulevard with this alternative. The original study did not include additional right of way or pavement widening opposite the median crossovers to allow turning vehicles larger than a passenger car. This has been added for this update.

  The 20 foot wide median will allow U-turn movements for passenger vehicles provided that the crossover lines up with a subdivision entrance or a right turn lane. If the crossovers do not line up with a subdivision entrance or a right turn lane, a widening of approximately 7 feet would be required opposite the crossover to accommodate passenger car U-turns. To accommodate a school bus making a U-turn, substantial widening and additional right of way is required, as shown in **Figure 2**.

  For purposes of the estimate, two school bus compatible crossovers are included for each segment between signalized intersections. These would be placed just prior to the signalized intersections. For example, there would be one just north of 8 Mile Road for southbound traffic and one just south of 9 Mile Road for northbound traffic.

- **Boulevard with 25 Foot Median** is very similar to the second option, excepting that the median would be twenty five feet wide instead of twenty feet. The additional pavement widening needed to accommodate passenger car U-turns where there is no right turn lane or subdivision entrance pavement available reduces to approximately 2 feet with this option. The widening and additional right-of-way needed to accommodate school bus U-turns is also reduced as shown in **Figure 3**. This option was not included in the previous study.

  As shown in the typical Roadway Cross Section, there is a 14 foot wide greenbelt between the back of curb and the eight foot wide pathway with the 25 foot wide median option. Where there is a right turn lane for an approach to an intersection, the greenbelt reduces to 3 feet, which is the minimum needed for placing traffic signs. A 25 foot wide median could be considered the widest feasible median within the right of way for this reason.

For each of the boulevard options, the median width could remain consistent even through the signalized intersections. This would reduce the "hourglass" effect of narrowing the roadway at the signalized intersections. The left turn lanes for the signalized intersections would be more than a lane wide and line up directly opposite each other. The additional width would be a striped island between the left turn lane and the adjacent through lane.

Note that **Figure 2** and **Figure 3** show the additional right of way to accommodate a standard school bus making a U-turn. Consideration should be given to widening the crossovers an additional five to seven feet. This would allow for single unit trucks and/or WB-50 semi-trucks to make the U-turns also. Additional study is needed to determine the appropriate design vehicle for the crossovers and the exact location of the crossovers before right-of-way requirements are finalized.

Improvements at the Grand River Avenue/Beck Road intersection are included in each of the long-term options. They include:

- Adding a dual left turn lane for the westbound Grand River Avenue to southbound Beck Road. A second 180-foot left turn lane can be added in the available hatched space with pavement marking changes and minor modifications to the traffic signal.
- Adding a dedicated right turn lane for northbound Beck Road to eastbound Grand River Avenue.

For all of the options, the new roadway would feature:

- Continuous curb and gutter in lieu of the existing shoulders.

- Removal and replacement of the existing aggregate base. The alternative in the November 2018 geotechnical report for the project (**Appendix E**) which includes selective undercuts and a layer of Geogrid on the subgrade is assumed.

- An enclosed storm sewer system in lieu of ditches except where permitting requires ditch retention. The storm sewer would run on the outside of the roadway for the five lane option. The storm sewer could be either on the outside or in the median for the boulevard options. The storm sewer would outlet in the same locations as the existing ditches so

that the existing drainage patterns are retained.

- Edge drains are included to drain the subgrade and maximize pavement life.
- Relocation of all water main and sanitary sewers within the Beck Road right-of-way.
- A continuous 8-foot wide HMA pathway on the west side.
- Removal and replacement of all boardwalks within the corridor and new boardwalks where new pathways cross wetland areas.
- A continuous 6-foot wide concrete sidewalk on the east side.

Detailed cost estimates are included in **Appendix A** for each of the alternatives. The estimates are divided into mile long segments. Securing funding and constructing the improvements in mile long sections is anticipated.

Note: A 120-foot wide right-of-way is required for each of the options. Additional right of way beyond the 120 foot wide right-of-way is required to accommodate school bus U-turn crossovers, as shown in **Figure 2** and **Figure 3**.

The cost estimates are based upon total reconstruction of the roadway and include right-of-way acquisition and all other anticipated costs including engineering, inspection and testing. Replacing all of the sanitary sewer and water main in the corridor is also included.

The estimates include the sidewalks and non-motorized pathways outlined in the City of Novi Non-Motorized Master Plan. Boardwalks are included where needed to minimize impacts to wetland areas.

New mast arm traffic signals similar to those along Grand River Avenue are included for each signalized intersection.

Street lighting and landscaping are not included in the estimates but could be added if desired.

Short-Term Improvements

Given the high cost of the long-term improvements, and uncertainty as to when they can be completed, short-term improvements were also identified. The short-term improvements identified in the 2006 Scoping Study have largely already been completed. These included the addition of dedicated turn lanes at the signalized intersections to improve operations. Based on the updated traffic capacity and crash analysis herein we have identified areas where the existing turn lanes could be extended to improve operations. These include:

- Beck Rd/9 Mile Rd: Extend the northbound right-turn lane storage to 300 feet.
- Beck Rd/9 Mile Rd: Extend the southbound left-turn lane storage to 300 feet.
- Beck Rd/10 Mile Rd: Extend the northbound left-turn lane storage to 400 feet.

- Beck Rd/8 Mile Rd: Add a 250-foot long northbound right-turn lane, with overlapping green arrow. ***(This improvement falls within Northville Township, not the City of Novi)***
- Beck Rd/8 Mile Rd: Extend the northbound left-turn lane storage to 250 feet. ***(This improvement falls within Northville Township, not the City of Novi)***

The existing traffic signal at 11 Mile Road has a diagonal span configuration. Other signals in the corridor have a box span configuration. This traffic signal should be upgraded to a box span configuration with flashing yellow arrow displays for all four left-turn movements to improve safety and operations. Signal replacement is included in the construction estimate.

In addition, signal timings could be adjusted to improve operations throughout the corridor. This should be discussed with the Road Commission for Oakland County (RCOC). Beneficial signal timing adjustments along the corridor are:

- Beck Road/8 Mile Road: Shift a small portion of green time from the north/south through movements to the east/west through movements.
- Beck Road/10 Mile Road: Shift a small portion of green time from the north/south through movements to the north/south left-turn movements.
- Beck Road/11 Mile Road: Shift some green time from the north/south through movements to the east/west through movements, and (to a lesser extent) all four left-turn movements.

Dedicated right-turn lanes and left-turn lanes are present at the signalized intersections in the corridor. For the major subdivision entrances there are typically either left-turn lanes or passing lanes to allow turning movements without impeding the heavy through traffic movements. Two exceptions are at Beck Road/Ashley Road and Beck Road/Sanford Road. A passing lane for Sanford Road and a left-turn lane for Ashley Road are recommended.

Right-of-Way

The long-term improvements will require a 120-foot wide right-of-way. The existing right-of-way width varies between the statutory 66-foot easement and 120-foot wide dedicated right-of-way. **Appendix C** provides maps of the right-of-way takes required by parcel for the entire corridor. The maps are divided into one mile long segments.

The required roadway for the long-term improvements total 563,484 square feet from 52 different parcels. The total estimated cost for the right-of-way acquisition is $1,030,974.12. Right-of-way costs are included in the estimates for the long-term improvements along with all other costs. No additional right-of-way is required for the short-term rehabilitation work.

Landscaping/Maintenance

The City of Novi may consider including landscaping and irrigation along Beck Road. The landscaping will require regular mowing, weeding and trimming. Any irrigation lines installed will require annual maintenance and clearing before winter months. Although the option to beautify the corridor may be appealing the long-term feasibility should be analyzed prior to any decisions.

Utilities

There are existing City-owned water mains and sanitary sewers within the corridor. The short-term improvements outlined should not impact these facilities, excepting that structure cover adjustments and hydrant relocations will be needed.

The widening for the long-term improvements will impact the existing water mains and sanitary sewers. The existing water mains and sanitary sewers are located at varying offsets from the centerline of the roadway. Much of this existing infrastructure will be located under the pavement or curb lines if not relocated. Conflicts with the new storm sewer system also are likely and relocation could be needed because of these conflicts. These facilities also may be nearing their useful design life and due for replacement. Relocating to a consistent utility corridor under greenbelt areas or under sidewalks near the right of way line also makes future maintenance much easier.

Costs for replacing all of the water mains and sanitary sewers within the corridor are included in the estimates. During detailed design it may be determined that some of the existing water main and sanitary sewer can remain which would reduce project costs.

Privately owned utilities (electric, gas, CATV, telephone) will need to be relocated to accommodate the widened roadway and this work will need to be coordinated. These costs are typically the responsibility of the utility owners and are not reflected in the estimates.

TRAFFIC CAPACITY ANALYSIS

Existing Conditions

AECOM conducted a high-level capacity analysis for the Beck Road corridor from 8 Mile Road to Grand River Avenue. The capacity analysis was based on new traffic data collected during March 2018. Weekday morning and afternoon peak-hour turning movement counts were collected by Transportation Improvement Association (TIA) personnel. In addition, the latest signal timings were provided by the RCOC for the seven signalized intersections within the study area.

Utilizing the turning movement counts and signal timing data, existing condition traffic models were created for the Beck Road corridor, for the weekday morning and afternoon peak-hours. The traffic models were created using the *Synchro 9.0* analysis software.

In order to quantify intersection traffic operations at the study-area intersections, existing level-of-service (LOS) values were determined using the industry-standard methodology presented in the Highway Capacity Manual (2010), published by the Transportation Research Board (TRB).

The term “level-of-service” (LOS) denotes how well (or poorly) a traffic movement operates under given traffic demands, lane configurations, and traffic controls. Each level is determined by the average amount of control delay per vehicle. Control delay is the total delay associated with stopping for a traffic signal or stop sign, and includes four components: deceleration delay, queue move up time, stopped delay, and final acceleration delay.

As shown in **Table 1**, LOS "A" indicates small average control delays (less than ten seconds per vehicle) whereas LOS "F" indicates intersection failure, resulting in extensive vehicular queues and long delays (over 80 seconds per vehicle at a signalized intersection). LOS "D" (or better) is typically considered acceptable performance and low LOS values are tolerable for short time periods or during peak-hours when heavier traffic volumes are expected.

Table 1. Level-of-Service (LOS) Criteria at Intersections

LOS	Signalized Intersections	Unsignalized Intersections
	Control Delay (sec/veh)	Control Delay (sec/veh)
A	⩽10	⩽10
B	10 - 20	10 - 15
C	20 - 35	15 - 25
D	35 - 55	25 - 35
E	55 - 80	35 - 50
F	>80	>50

Source: Highway Capacity Manual (2010)

Table 2 summarizes the existing (2018) overall intersection LOS values. As shown in Table 2, two Beck Road intersections currently operate with a poor LOS during the weekday peak-hours – 8 Mile Road during the morning peak and 10 Mile Road during the afternoon peak each operate at LOS E.

Table 2. Existing (2018) Overall Intersection LOS

Signalized Intersection	Weekday AM Peak-hour			Weekday PM Peak-hour		
	LOS	Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio
Beck Rd / 8 Mile Rd	**E**	**60.2**	0.98	D	41.0	0.85
Beck Rd / 9 Mile Rd	B	10.5	0.50	B	13.2	0.53
Beck Rd / 10 Mile Rd	D	36.2	0.88	**E**	**57.0**	**1.05**
Beck Rd / Cider Mill Dr	B	10.1	0.50	A	7.1	0.47
Beck Rd / 11 Mile Rd	D	52.9	0.86	B	14.6	0.65
Beck Rd / Central Park Blvd	B	10.7	0.60	C	24.4	0.65
Beck Rd / Grand River Ave	D	48.9	0.86	D	51.4	0.87

Source: AECOM, August 2018

Several individual turning movements currently operate with a poor LOS during the weekday morning and afternoon peak-hours. These poorly operating movements are concentrated at the 11 Mile Road and Grand River Avenue intersections during the morning peak-hour. They are also concentrated at the 10 Mile Road and Grand River Avenue intersections during the afternoon peak-hour. A summary of the poorly operating turning movements is provided in **Table 3**.

As shown in Table 3, several movements are barely operating above the LOS E threshold, with volume-to-capacity (V/C) ratios well under 1.0. The side-street movements at Cider Mill Drive and Central Park Boulevard are relatively low-volume movements and do not represent capacity concerns. There are currently no poorly operating traffic movements at the 9 Mile Road intersection.

Table 3. Existing (2018) Poorly Operating Traffic Movements

Signalized Intersection	Weekday AM Peak-hour			Weekday PM Peak-hour		
	LOS	Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio
Beck Rd / 8 Mile Rd:						
- Eastbound Thru	F	138.9	**1.17**			
- Westbound Thru				F	86.6	**1.00**
- Westbound Left	F	92.8	0.96			
Beck Rd / 10 Mile Rd:						
- Eastbound Thru	E	56.1	0.87			
- Westbound Thru				E	72.5	0.95
- Northbound Left	E	68.1	0.94	F	131.9	**1.16**
- Southbound Thru				E	64.8	0.80
Beck Rd / Cider Mill Dr:						
- Eastbound Left/Thru/Right	E	61.1	0.55	E	55.1	0.08
- Westbound Left/Thru/Right				E	55.1	0.09
Beck Rd / 11 Mile Rd:						
- Eastbound Left	E	75.0	0.82			
- Eastbound Thru/Right	F	146.2	**1.14**	E	55.0	0.36
- Westbound Left	E	57.1	0.37			
- Westbound Thru/Right	F	101.3	0.97			
- Southbound Left	E	55.3	0.17			
Beck Rd / Central Park Blvd:						
- Eastbound Left	E	64.0	0.62	E	65.5	0.74
Beck Rd / Grand River Ave:						
- Eastbound Left	E	55.0	0.78	F	98.1	**1.03**
- Westbound Left				E	55.3	0.58
- Northbound Left	E	68.0	0.60	E	62.1	0.66
- Northbound Thru/Right	E	57.5	0.91			
- Southbound Left	F	97.2	0.99	E	55.1	0.67

Source: AECOM, August 2018

Short-Term Improvements

The high-level capacity analysis focused on improving the poorly operating turning movements listed in Table 3. The previous study (conducted in 2006) identified several short-term capacity improvements that could be implemented. At that time, short-term improvements were recommended at the 8 Mile Road, 9 Mile Road, 10 Mile Road, and 11 Mile Road intersections. The following recommended capacity improvements were subsequently implemented at 8 Mile Road and 10 Mile Road (no improvements were implemented at 9 Mile Road and 11 Mile Road):

- Beck Rd/8 Mile Rd: Add a dedicated right-turn lane to the southbound approach.
- Beck Rd/10 Mile Rd: Add dedicated right-turn lanes to the northbound, southbound, and eastbound approaches.
- Beck Rd/10 Mile Rd: Extend the westbound right-turn lane.
- Beck Rd/10 Mile Rd: Upgrade the traffic signal.

Based on the new traffic data and capacity analysis, AECOM recommends the following short-term capacity improvements:

- Beck Rd/9 Mile Rd: Extend the northbound right-turn lane storage to 300 feet.
- Beck Rd/9 Mile Rd: Extend the southbound left-turn lane storage to 300 feet.
- Beck Rd/10 Mile Rd: Extend the northbound left-turn lane storage to 400 feet.
- Beck Rd/11 Mile Rd: Upgrade the traffic signal to a box-span or mast arm layout, with flashing yellow arrow displays for all four left-turn movements.
- General: Adjust signal timing splits as necessary to optimize operations.
- Beck Rd/8 Mile Rd: Add a 250-foot long northbound right-turn lane, with overlapping green arrow. ***(This improvement falls within Northville Township, not the City of Novi)***
- Beck Rd/8 Mile Rd: Extend the northbound left-turn lane storage to 250 feet. ***(This improvement falls within Northville Township, not the City of Novi)***

These recommended short-term improvements would only be implemented if long-term improvements could not be implemented within a certain number of years, as defined by the City of Novi. These improvements could be implemented as part of lower cost roadway improvement projects, such as a pavement resurfacing or pavement preservation overlay (which is a common construction method used by the RCOC). Implementation of these recommended improvements would improve many of the current poorly-operating areas.

A summary of the overall intersection LOS values, with recommended short-term capacity improvements in place, is provided in **Table 4**. As shown in Table 4, all intersections are projected to operate with an acceptable LOS D or better if the above-bulleted short-term improvements are implemented. All intersections are projected to operate with a V/C ratio of less than 1.0.

Table 4. Projected (2018) Overall Intersection LOS (with Short-Term Improvements)

Signalized Intersection	Weekday AM Peak-hour			Weekday PM Peak-hour		
	LOS	Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio
Beck Rd / 8 Mile Rd	D	50.7	0.97	D	37.4	0.82
Beck Rd / 9 Mile Rd	B	11.3	0.50	B	13.2	0.53
Beck Rd / 10 Mile Rd	D	36.8	0.87	D	54.2	0.99
Beck Rd / Cider Mill Dr	B	10.6	0.50	A	7.1	0.47
Beck Rd / 11 Mile Rd	D	38.9	0.84	B	14.0	0.66
Beck Rd / Central Park Blvd	B	11.2	0.60	C	24.0	0.65
Beck Rd / Grand River Ave	D	47.8	0.84	D	49.9	0.84

Source: AECOM, August 2018

It should be noted that some of the Beck Road/Grand River Avenue intersection was reconstructed in 2014 and 2015 with dual left-turn lanes on the eastbound approach and a lengthened right-turn lane on the westbound approach.

No short-term capacity recommendations are recommended at the Beck Road/Grand River Avenue intersection. However, the addition of a 340-foot long northbound-to-eastbound right-turn lane is recommended (with overlapping right-turn green arrow) to improve the operation of this approach. Also, the addition of dual left-turn lanes on the northbound and westbound approaches are recommended. These improvements are not critical in the short-term, and should be considered as part of any long-term Beck Road widening project.

Long-Term Improvements

AECOM also reviewed the long-term capacity needs of the corridor. The Beck Road corridor will require, at a minimum, a five-lane cross-section throughout the study area. The biggest capacity issues are currently at 8 Mile Road and 10 Mile Road intersections, and to a lesser extent at the 11 Mile Road intersection during the morning peak-hour. Two northbound and two southbound through lanes are needed along Beck Road at all three intersections. Although there are currently no capacity issues at 9 Mile Road, it is not recommended to reduce the number of north/south through lanes along Beck Road at this intersection, only to introduce additional through lanes again to the north and south.

Numerous driveways and intersecting streets also make a five-lane section desirable along Beck Road, by removing left-turning vehicles from the through lanes of traffic. ***From through capacity standpoint, a five-lane cross-section or a four-lane boulevard are essentially the same.***

In order to evaluate the operational impact of long-term improvements, existing (2018) traffic volumes were grown ten years into the future to the year 2028. An annual traffic growth rate was used to estimate growth on the study area roadway network based on information provided by the Southeastern Michigan Council of Governments (SEMCOG). SEMCOG population projections for Novi are only showing a 0.6% per year growth in population from 2015 to 2030. Based on the information, an annual growth rate of 0.5% was applied to existing (2018) traffic volumes to determine future (2028) traffic volumes.

Future (2028) peak-hour traffic volumes were input into the traffic models to produce a long-term capacity analysis. The widening of Beck Road would improve the operation of the signalized intersections along the corridor under future conditions. A summary of the overall intersection LOS values, with recommended long-term capacity improvements in place, is provided in **Table 5**. As shown in Table 5, all intersections are projected to operate with an acceptable LOS D or better.

Table 5. Projected (2028) Overall Intersection LOS (with Long-Term Improvements)

Signalized Intersection	Weekday AM Peak-hour			Weekday PM Peak-hour		
	LOS	Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio
Beck Rd / 8 Mile Rd	C	34.3	0.77	C	30.1	0.64
Beck Rd / 9 Mile Rd	B	11.2	0.33	B	11.8	0.36
Beck Rd / 10 Mile Rd	C	28.6	0.74	D	40.5	0.83
Beck Rd / Cider Mill Dr	A	6.7	0.30	A	4.9	0.27
Beck Rd / 11 Mile Rd	C	29.1	0.62	B	10.2	0.43
Beck Rd / Central Park Blvd	A	8.8	0.38	B	16.3	0.43
Beck Rd / Grand River Ave	D	46.0	0.85	D	46.5	0.87

Source: AECOM, November 2018

CRASH ANALYSIS

Traffic crash data for a four-year period from May 1, 2014 to May 1, 2018 was supplied by the Transportation Improvement Association (TIA) Traffic Crash Analysis Tool (TCAT) 2.0. Crashes were reviewed at five intersections and four roadway segments along Beck Road from 8 Mile Road to Grand River Avenue.

Beck Road Intersections

1. Beck Road at 8 Mile Road
2. Beck Road at 9 Mile Road
3. Beck Road at 10 Mile Road
4. Beck Road at 11 Mile Road
5. Beck Road at Grand River Avenue

Beck Road Segments

1. Beck Road north of 8 Mile Road to south of 9 Mile Road
2. Beck Road north of 9 Mile Road to south of 10 Mile Road
3. Beck Road north of 10 Mile Road to south of 11 Mile Road
4. Beck Road north of 11 Mile Road to south of Grand River Avenue

Intersection Crashes

Total crashes for the four-year period for each of the five intersections varied greatly, ranging from 32 to 134 crashes. No fatalities and three "A" level injury crashes were reported during the four-year period at the five study area intersections. "A" level injury crashes include individuals who sustained incapacitating injuries, such as broken limbs or paralysis.

A breakdown of crashes for each intersection by crash type are depicted in **Table 6**.

Table 6. Beck Road Intersections - Traffic Crash History (05/01/2014 thru 05/01/2018)

Intersection	Crash Type										Injuries		Crash Rate (1)
	TOTAL	Animal	Fixed Object	Misc Single Vehicle	Head-On	Head-On LT	Angle	Rear-End	Side-swipe	Other	Total	"A" Injury	
Beck Rd/ 8 Mile Rd	**134**	3	1	1	1	6	9	108	3	2	30	1	**3.02**
Percent	**100%**	**2%**	**1%**	**1%**	**1%**	**4%**	**7%**	**81%**	**2%**	**1%**			
Beck Rd/ 9 Mile Rd	**33**	0	3	1	0	1	0	25	2	1	8	1	**1.07**
Percent	**100%**	**0%**	**9%**	**3%**	**0%**	**3%**	**0%**	**76%**	**6%**	**3%**			
Beck Rd/ 10 Mile Rd	**111**	0	0	1	1	7	12	80	6	4	22	1	**2.28**
Percent	**100%**	**0%**	**0%**	**1%**	**1%**	**6%**	**11%**	**72%**	**5%**	**4%**			
Beck Rd/ 11 Mile Rd	**32**	2	0	1	0	0	5	23	1	0	5	0	**1.00**
Percent	**100%**	**6%**	**0%**	**3%**	**0%**	**0%**	**16%**	**72%**	**3%**	**0%**			
Beck Rd/ Grand River Ave	**132**	1	1	0	0	1	6	94	22	7	22	1	**1.80**
Percent	**100%**	**1%**	**1%**	**0%**	**0%**	**1%**	**5%**	**71%**	**17%**	**5%**			

Source: Crash Data - Traffic Crash Analysis Tool 2.0, Transportation Improvement Association
Source: Crash Rates - Crash Analysis Process, SEMCOG, Appendix A, Table 1.4, January 2016
(1) Crashes per million entering vehicles.
Note: Intersection crashes include those within a 200-foot buffer.
No fatal crashes were reported for the 4-year study period.

Less than 35% above average crash rate
More than 100% above average crash rate

SEMCOG AVERAGE RATES - SIGNALIZED INTERSECTIONS

Entering ADT	Crash Rate
1 - 10,000	1.55
10-20,000	0.87
20-30,000	0.96
30-40,000	1.07
40-50,000	1.14
50-60,000	1.35

All five intersections had crash rates above the SEMCOG average. However, three intersections (in darker orange in Table 6) had crash rates much higher than the average rate. It is likely the high level of traffic volumes and resultant congestion contribute to the high crash rates at the five Beck Road intersections. Hazardous actions were also likely contributors to crash causation as the incidence of hazardous actions was very high at every intersection. For the five Beck Road intersections, hazardous actions occurred in 80% to 88% of the crashes. A vast majority of the crashes with hazardous actions were failure to stop in an assured clear distance.

A robust rear-end crash pattern occurred at all five intersections - ranging from 71% to 81% of all crashes by intersection. Beck Road is a heavily congested corridor, contributing to the high number of rear-end crashes. In addition, I-275 was closed in 2016 and while Beck Road was not a designated detour route, Beck Road was utilized as an alternative route, which likely was a

contributor toward a spike in Beck Road intersection crashes in 2016 compared to intersection crashes in 2015 and 2017.

The prevalence of rear-end crashes at the five intersections, based on a review of UD-10s indicate that traffic congestion and back-ups at the signals contributed to the pattern of rear-end crashes. Another factor in rear-end crashes was the prevalence of rear-end crashes that included the driver at fault being noted on UD-10s for failure to stop in an assured clear distance.

Angle crashes were most common at the Beck Road/11 Mile Road intersection (16% of intersection crashes) and the Beck Road/10 Mile road intersection (11%). Angle crashes were much less prevalent at the other intersections (7% or less of total intersection crashes).

Side-swipe crashes ranged from 2% to 17% per intersection, with the Beck Road/Grand River Avenue intersection having the highest percentage of side-swipe crashes. The higher percentage of side-swipe crashes at the Beck Road/Grand River Avenue intersection may be at least in part due to the high volume of left-turning and right-turning traffic at the intersection, particularly at the eastbound and southbound approaches, which had 15 of the 22 side-swipe crashes. Most side-swipe crashes occurred during the morning peak-hours (7 crashes from 7:00 to 9:00 AM), after school (4 crashes from 2:30 to 4:00 PM), or the afternoon peak-hours (5 crashes from 4:00 to 6:00 PM).

Segment Crashes

Beck Road segmental crashes ranged from between 50 and 60 crashes on three segments: 8 Mile Road to 9 Mile Road, 9 Mile Road to 10 Mile Road and 10 Mile Road to 11 Mile Road. The 11 Mile Road to Grand River Avenue segment had 84 crashes reports. Amongst the four segments, one fatal crash and one "A" injury crash were reported during the four-year period.

Fatal Crash - The fatal crash was a head-on crash that occurred on November 19, 2017 (Sunday) at 9:16 AM, on Beck Road 650 feet south of 9 Mile Road. A witness stated that they saw Vehicle 1 driving erratically on southbound Beck Road. Vehicle 1 crossed the centerline and struck a northbound vehicle (Vehicle 2). The driver of Vehicle 1 suffered fatal injuries and the driver of Vehicle 2 suffered "A" level injuries. The crash occurred under wet surface conditions in snowy weather. Alcohol was not a factor in the crash. The UD-10 noted a hazardous action by the driver of Vehicle 1 – drove left of center.

Pedestrian Crash - The pedestrian crash occurred on August 21, 2015 (Friday) at 4:57 PM, at the Beck Road/Providence Drive/Central Park Boulevard intersection. The driver of Vehicle 1 was eastbound on Providence Drive and turned left onto northbound Beck Road. A pedestrian was in the Beck Road crosswalk on the north leg of the intersection. The driver of Vehicle 1 failed to yield and struck the pedestrian. The pedestrian suffered minor injuries. The crash occurred under dry surface conditions in clear weather. Alcohol was not a factor in the crash. The driver was cited for failure to yield.

A breakdown of all study area segmental crashes by crash type along Beck Road is depicted in **Table 7**.

Table 7. Beck Road Segments – Traffic Crash History (05/01/2014 thru 05/01/2018)

Segment	Length (miles)	Crash Type										Injuries	
		TOTAL	Animal	Fixed Object	Misc Single Vehicle	Head-On	Head-On LT	Angle	Rear-End	Side-swipe	Other	Total	"A" Injury
Beck Rd – 8 Mile Rd to 9 Mile Rd (1)	0.93	54	7	3	2	1	0	1	37	1	2	14	0
Percent		**100%**	**13%**	**6%**	**4%**	**2%**	**0%**	**2%**	**69%**	**2%**	**4%**		
Beck Rd - 9 Mile Rd to 10 Mile Rd (2)	0.93	52	8	1	3	1	1	5	29	2	2	17	1
Percent		**100%**	**15%**	**2%**	**6%**	**2%**	**2%**	**10%**	**56%**	**4%**	**4%**		
Beck Rd - 10 Mile Rd to 11 Mile Rd (3)	0.92	58	4	2	0	1	1	1	47	2	0	14	0
Percent		**100%**	**7%**	**3%**	**0%**	**2%**	**2%**	**2%**	**81%**	**3%**	**0%**		
Beck Rd - 11 Mile Rd to Grand River Ave (4)	0.60	84	2	1	0	0	0	3	68	7	3	20	0
Percent		**100%**	**2%**	**1%**	**0%**	**0%**	**0%**	**4%**	**81%**	**8%**	**4%**		

Source: Traffic Crash Analysis Tool 2.0, Transportation Improvement Association
(1)From 200 feet north of 8 Mile Road to 200 feet south of 9 Mile Road
(2)From 200 feet north of 9 Mile Road to 200 feet south of 10 Mile Road
(3)From 200 feet north of 10 Mile Road to 200 feet south of 11 Mile Road
(4)From 200 feet north of 11 Mile Road to 200 feet south of Grand River Avenue
NOTE: 1 fatal crash was reported over the four-year study period (Beck Road between 8 Mile Road and 9 Mile Road).
1 pedestrian crash was reported over the four-year study period (Beck Road between 11 Mile Road and Grand River Avenue).

All four segments had a marked rear-end crash pattern, ranging from 56% to 81% amongst the segments. As with the above Beck Road intersection crashes, the I-275 closure in 2016 likely contributed to a spike in Beck Road segmental crashes in 2016, compared to segmental crashes in 2015 and 2017.

The prevalence of rear-end crashes along the four segments, based on a review of UD-10s indicate that traffic congestion and back-ups along Beck road contributed to the pattern of rear-end crashes. Another factor in rear-end crashes was the prevalence of rear-end crashes that included the driver at fault being noted on UD-10s for failure to stop in an assured clear distance.

Animal crashes were somewhat common within the 8 Mile Road to 9 Mile Road segment (13%) and the 9 Mile Road to 10 Mile Road segment (15%). The higher frequency of animal (deer) crashes on these two segments of Beck Road are likely due to the lower density of development along Beck Road between 8 Mile Road and 10 Mile Road compared to segments north of 10 Mile Road.

The only segment with another crash type of 10% or more was angle crashes (10%) within the 9 Mile Road to 10 Mile Road segment. Three of the five angle crashes in this segment of Beck Road involved a vehicle turning into or out of Baker Street and failing to yield to a northbound through vehicle on Beck Road. Traffic backups on northbound Beck Road were a factor in two of these three angle crashes. The other two angle crashes involved a northbound left-turning ve-

hicle at Iroquois Court failing to yield to a southbound Beck Road through vehicle, and an eastbound private residence drive vehicle turning left onto Beck Road (500 feet south of 10 Mile Road) and failing to yield to a southbound Beck Road through vehicle.

Segment Hot Spots

There were six (6) hot spots along Beck Road in the study area. Each cluster revealed a strong pattern of rear-end crashes, as 57 of the 75 total crashes in the six hot spot areas (76%) were comprised of rear-end crashes. Crashes during peak-hours, defined as 7:00 to 9:00 AM and 4:00 to 6:00 PM, were common amongst rear-end crashes. Following is a description of each hot spot.

Beck Road from 200 feet north of 8 Mile Road to 500 feet north of 8 Mile Road - 16 crashes in a 300-foot segment

Thirteen of the sixteen crashes were rear-end and three were single vehicle. Most of the rear-end crashes occurred on southbound Beck Road approaching 8 Mile Road (between 250 feet and 500 feet north of 8 Mile Road). UD-10s for these crashes noted that traffic back-ups on southbound Beck Road as contributing to the pattern of rear-end crashes at this hot spot. Five of the thirteen rear-end crashes occurred during the peak-hour (7:00 to 9:00 AM – 2 crashes, and 4:00 to 6:00 PM – 3 crashes) and five occurred after dark. Three rear-end crashes occurred on a slippery road surface. One of the three single vehicle crashes involved alcohol.

Beck Road from 500 feet south of 8 Mile Road to 200 feet south of 8 Mile Road - 14 crashes in a 300-foot segment

Ten of the fourteen crashes were rear-end, three single vehicle, and one angle. Most of the rear-end crashes occurred on northbound Beck Road approaching 9 Mile Road (between 200 feet and 500 feet south of 9 Mile Road). UD-10s for these crashes noted that traffic back-ups on northbound Beck Road as contributing to the pattern of rear-end crashes at this hot spot. Six (4 morning, 2 afternoon) of the ten rear-end crashes occurred during the peak-hour and two occurred after dark. One rear-end crash occurred on a slippery road surface.

Beck Road from 470 feet south of 10 Mile Road to 200 feet south of 10 Mile Road - 16 crashes in a 270-foot segment

Eleven of the sixteen crashes were rear-end, three angle, one head-on left-turn, one sideswipe-same, and one other. Most of the rear-end crashes occurred on northbound Beck Road approaching 10 Mile Road (between 200 feet and 470 feet south of 10 Mile Road). UD-10s for these crashes noted that traffic back-ups on northbound Beck Road as contributing to the pattern of rear-end crashes at this hot spot. Four of the eleven rear-end crashes occurred during the peak-hour (1 morning, 3 afternoon), two occurred after dark, and two occurred on a slippery road surface. Five of the sixteen crashes occurred at the intersection of Beck Road/Baker Street (all three of the angle crashes noted above occurred at the intersection).

Beck Road from 530 feet south of 11 Mile Road to 250 feet south of 11 Mile Road - 13 crashes in a 280-foot segment

Twelve of the thirteen crashes were rear-end and one was a single vehicle. Most of the rear-end crashes occurred on northbound Beck Road approaching 11 Mile Road (between 200 feet and 480 feet south of 11 Mile Road). UD-10s for these crashes noted that traffic back-ups on northbound Beck Road as contributing to the pattern of rear-end crashes at this hot spot. Three of the

twelve rear-end crashes occurred during the peak-hour (2 morning, 1 afternoon), none occurred after dark, and two occurred on a slippery road surface.

Beck Road from 200 feet north of 11 Mile Road to 300 feet north of 11 Mile Road - 10 crashes in a 100-foot segment

Seven of the ten crashes were rear-end, two were side-swipe, and one was a single vehicle. Most of the rear-end crashes occurred on southbound Beck Road approaching 11 Mile Road (between 200 feet and 300 feet north of 11 Mile Road). UD-10s for these crashes noted that traffic back-ups on southbound Beck Road as contributing to the pattern of rear-end crashes at this hot spot. Two of the seven rear-end crashes occurred during the peak-hour, two occurred after dark, and four occurred on a slippery surface. The two side-swipe crashes occurred during the peak-hour (both afternoon).

Beck Road from 1,750 feet south of Grand River Ave to 1,620 feet south of Grand River Ave - 16 crashes in a 130-foot segment

Eleven of the sixteen crashes were rear-end, three angle, one single vehicle, and one other. All sixteen hot spot crashes occurred at the Beck Road/Providence Drive/Central Park Boulevard intersection. All eleven rear-end crashes occurred on Beck Road (7 northbound, 4 southbound). All of the rear-end crashes, based on a review of UD-10s, occurred when a trailing vehicle struck a stopped or slowing vehicle on one of the Beck Road approaches to the intersection. Five of the eleven rear-end crashes occurred during the peak-hour (1 morning, 4 afternoon), one occurred after dark, and two occurred on a slippery road surface.

IMPLEMENTATION

For the long-term improvements, preparation of an Environmental Assessment would be required if federal funding is used. Much of the information required for the Environmental Assessment has already been developed. Approval of the Environmental Assessment would be required before construction using federal funds can begin.

The long-term improvements also would likely require permits from the Michigan Department of Environmental Quality. The estimates include the cost of boardwalks in anticipation that these would be required by MDEQ to reduce impacts to wetland areas. The MDEQ also may require providing detention to offset the increased runoff which will result from additional impervious pavement area resulting from the widening. Detention, if required, is not accounted for in the estimates.

Permits from the Oakland County Water Resource Commissioner's Office and from the RCOC also will be required. There should be no major issues in obtaining these needed permits.

Each of the roadway segments identified for short-term and long-term improvements could be considered as a separate project. In addition, the City may wish to pursue the right-of-way acquisition and the preparation of an Environmental Assessment for the ultimate improvements for the entire corridor as separate projects and set budgets and schedules for them.

Funding

Completing the long-term widening and reconstruction outlined is needed to address deficiencies in the corridor. The City should pursue obtaining funding for the improvements. Possible sources of funding include:

Michigan Department of Transportation (MDOT) / SEMCOG funding:
This program is the normal Federal Aid highway funding source. The corridor segments have been added to the SEMCOG 2040 RTP, in order to be in line for funding. This type of funding would be most appropriate for funding the improvements in the corridor.

BUILD Funds:
Similar to the TIGER Funds, which have been discontinued, these funds are competitive grants administered by MDOT. The grants are awarded on merit based upon safety, economic competitiveness, innovation, partnership, and the ability to leverage non-federal funds. These funds could potentially be used for the long-term improvements outlined.

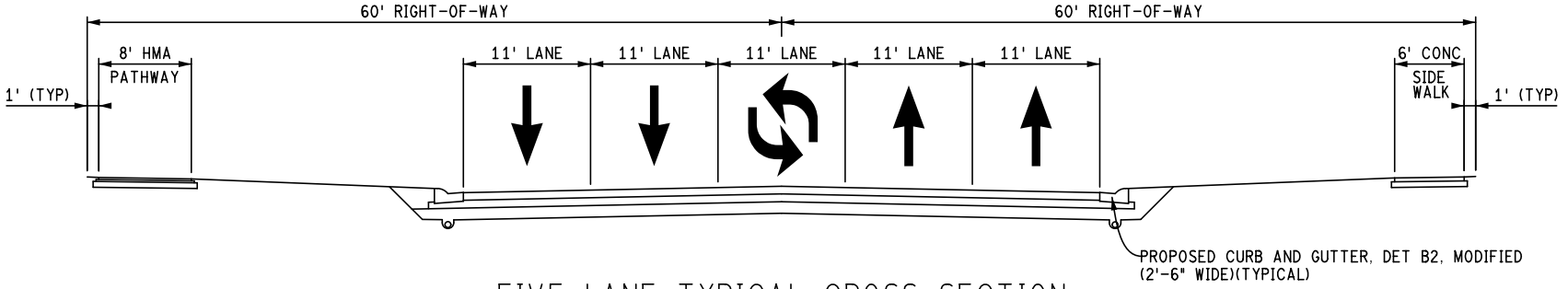
Congestion Mitigation and Air Quality (CMAQ) Funds:
These funds are awarded through MDOT and are for congestion mitigation and air quality improvements. Typically these funds are used for traffic signal improvements and spot intersection turn lane additions. Portions of the short-term improvements proposed could be eligible for these funds.

Safety Funds:
These grants are also awarded by MDOT. Intersection improvements and other measures specifically aimed at reducing crash rates typically are funded through this source. Because the short-term intersection improvements recommended in the original study have largely been completed, this funding source may no longer be available except for possibly for the turn lane improvements included as part of the short-term improvements.

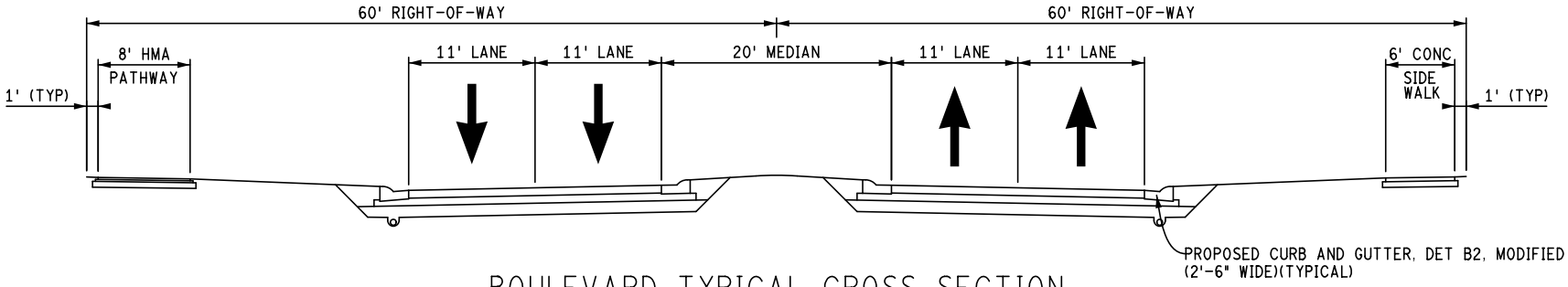
Transportation Enhancement Activity (TAP) Grants:
These MDOT administered competitive grants are typically used for pathways and aesthetic improvements. Pathways and landscaping improvements included as part of the improvements could be eligible for these funds. Storm water quality improvement projects also are eligible to receive these funds. If major detention facilities are required by the MDEQ for the widening of the corridor, then this funding source may be available for that purpose also.

Transportation Economic Development Fund (TEDF Grants):
These competitive grant funds are also administered by MDOT and are for transportation projects that support economic development and job creation. This could be a viable source for funding in the corridor if a new commercial/industrial development or expansion of an existing development is planned. The criteria for selection includes the number of jobs created and the importance of the transportation improvement toward the new jobs.

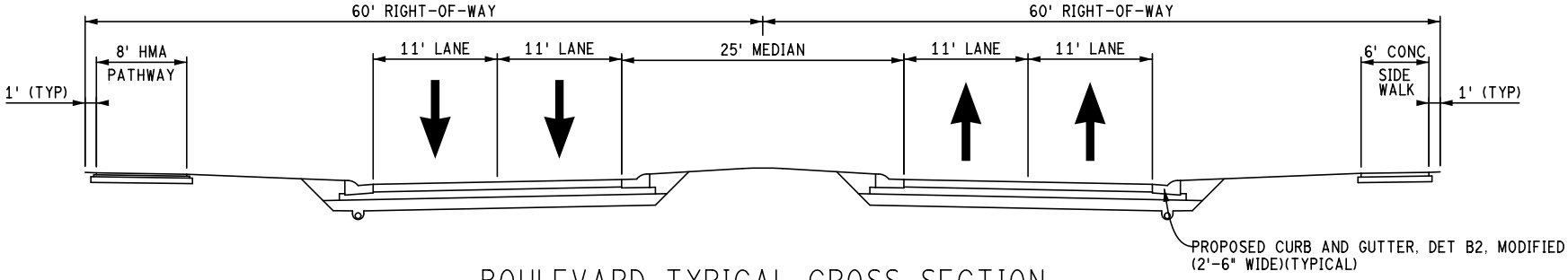
AECOM has assisted numerous agencies in obtaining funds through each of the sources listed above and can assist in preparation of competitive grant applications to maximize the probability of receiving the funds.



FIVE LANE TYPICAL CROSS SECTION



BOULEVARD TYPICAL CROSS SECTION
(20 FOOT MEDIAN)

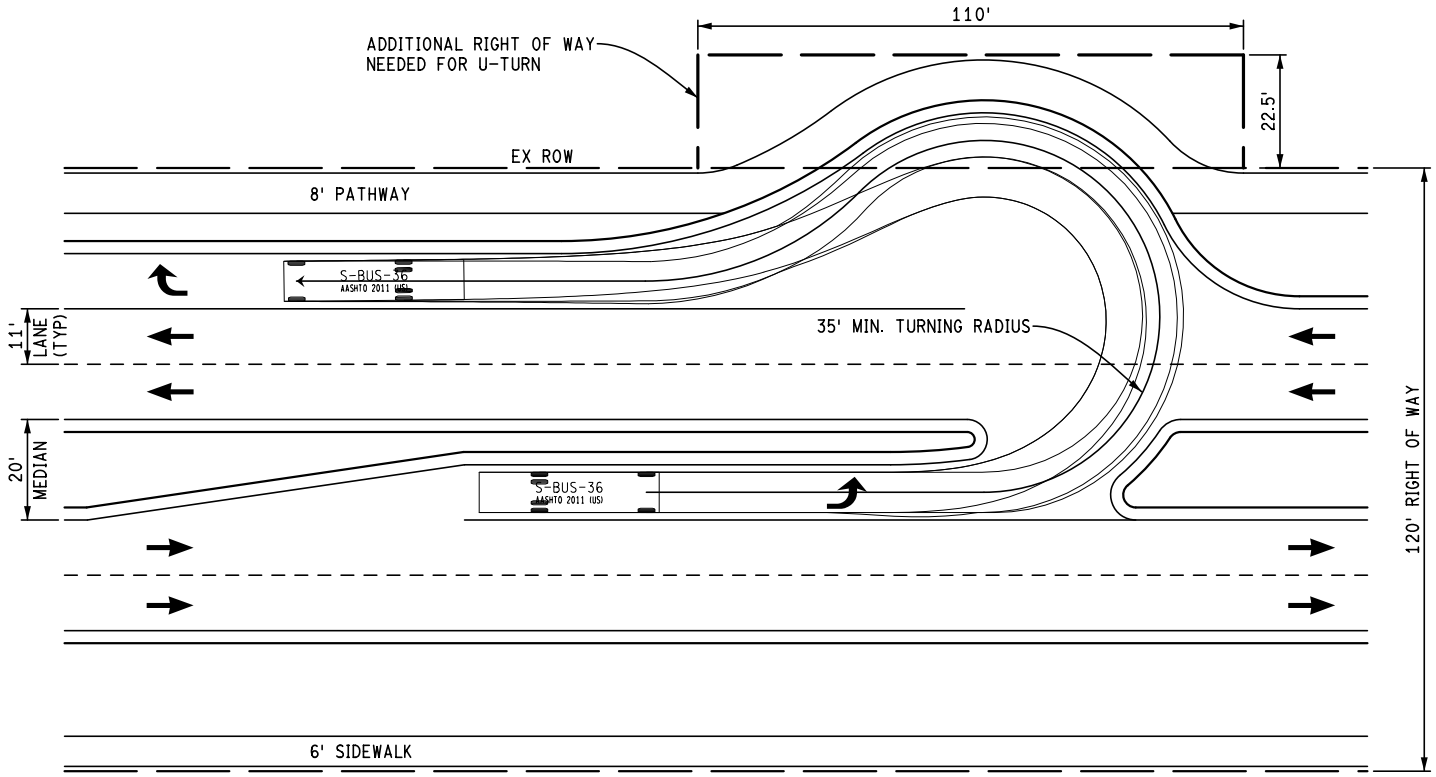


BOULEVARD TYPICAL CROSS SECTION
(25 FOOT MEDIAN)

CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE

TYPICAL ROADWAY CROSS SECTIONS

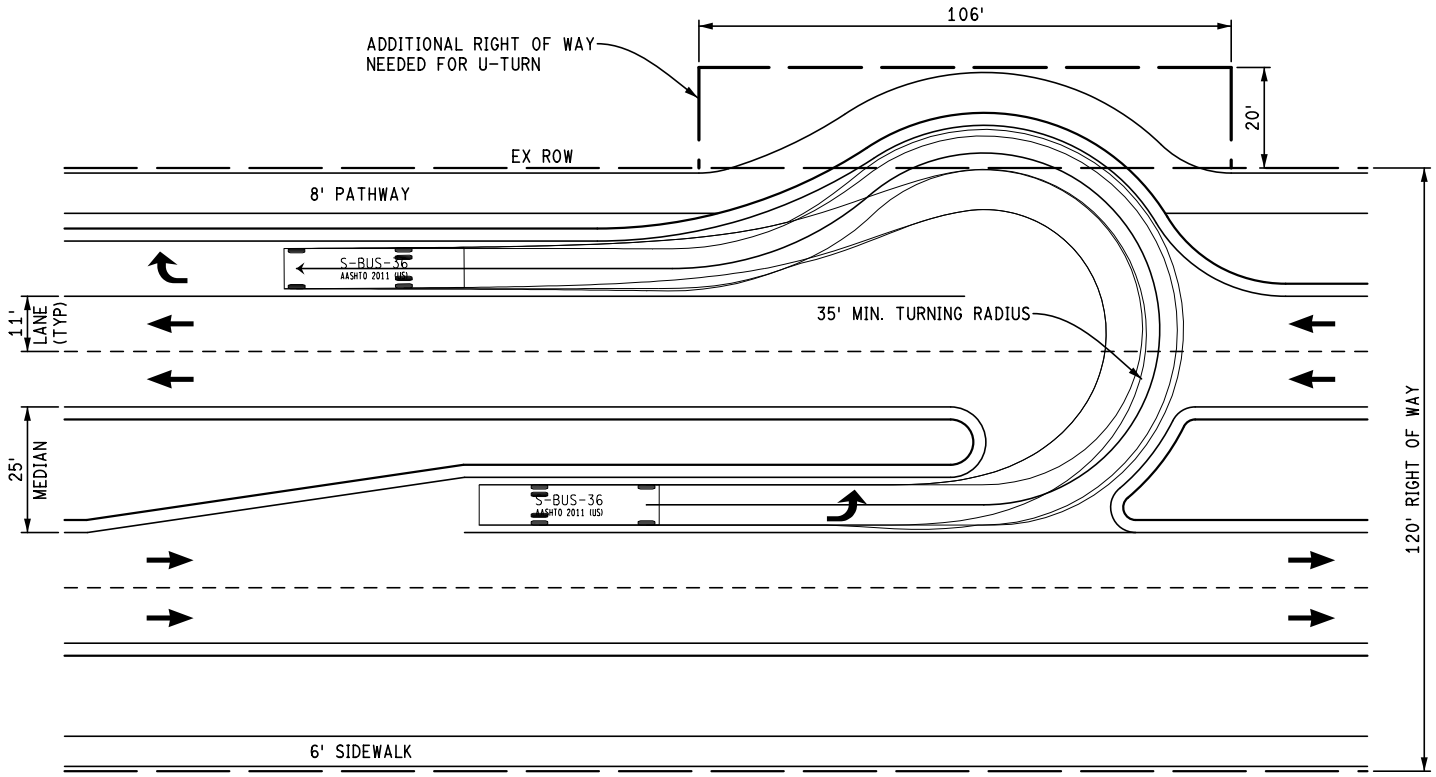
FIGURE 1



BOULEVARD (20' MEDIAN) TYPICAL U-TURN SCHEMATIC

FOR THE SCHOOL BUS DESIGN VEHICLE (S-BUS-36)

CITY OF NOVI / AECOM	CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE TYPICAL U-TURN FOR SCHOOL BUS DESIGN VEHICLE WITH 20 FOOT MEDIAN	FIGURE 2



BOULEVARD (25' MEDIAN) TYPICAL U-TURN SCHEMATIC

FOR THE SCHOOL BUS DESIGN VEHICLE (S-BUS-36)

CITY OF NOVI / AECOM	CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE TYPICAL U-TURN FOR SCHOOL BUS DESIGN VEHICLE WITH 25 FOOT MEDIAN	FIGURE 3

APPENDIX A

PRELIMINARY COST ESTIMATES

City of Novi
Beck Road from 9 Mile to 10 Mile
Pavement Preservation Overlay and Turn Lane Improvements
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
1	Mobilization (10%)	LS	1	$ 63,705.43	$ 63,705.43
2	Pre-Construction Audio-Visual	LS	1	$ 3,500.00	$ 3,500.00
3	HMA Surface, Rem	Syd	667	$ 8.00	$ 5,333.33
4	Cold Milling HMA Surface	Syd	21,483	$ 5.00	$ 107,416.67
5	Trenching and Grading (Widening Areas)	Sta	20.0	$ 2,000.00	$ 40,000.00
6	Subgrade Undercutting	Cyd	100	$ 50.00	$ 5,000.00
7	Soil Erosion Control	LS	1	$ 3,500.00	$ 3,500.00
8	Aggregate Base, 21AA Limestone, 8 inch (Widening)	Syd	1,617	$ 13.00	$ 21,016.67
9	Shoulder, Cl 2, 6 inch (Widening)	Syd	1,111	$ 8.00	$ 8,888.89
10	HMA, 5E3	Ton	2,795	$ 100.00	$ 279,510.00
11	HMA, 3E3 (Widening)	Ton	267	$ 95.00	$ 25,341.25
12	HMA, 3E3 (Patching)	Ton	365	$ 100.00	$ 36,547.50
13	Drainage Improvements	LS	1	$ 5,000.00	$ 5,000.00
14	Underdrain, Subbase, 6 inch	Ft	2,000	$ 8.00	$ 16,000.00
15	Permanent Signing	LS	1	$ 5,000.00	$ 5,000.00
16	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
17	Maintaining Traffic	LS	1	$ 50,000.00	$ 50,000.00
18	Surface Restoration	LS	1	$ 5,000.00	$ 5,000.00
19	Traffic Signal Work	LS	1	$ -	$ -
	Total Construction Cost				**$ 700,759.74**
	Permitting and Mitigation	LS	1		$ -
	Right of Way Acquisition	LS	1		$ -
	Design Engineering	LS	1	6.25%	$ 43,797.48
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 8,759.50
	Contract Administration	LS	1	4.25%	$ 29,782.29
	Inspection (Crew Days)	Day	30	$ 700.00	$ 21,000.00
	Construction Contingency	LS	1	10%	$ 70,075.97
	Materials Testing	LS	1	1.5%	$ 10,511.40
	TOTAL COST				**$ 884,686.37**

Estimate Assumptions:

Estimate includes intersection of Beck and 9 Mile Road

City of Novi
Beck Road from 10 Mile to 11 Mile
Pavement Preservation Overlay and Turn Lane Improvements
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
1	Mobilization (10%)	LS	1	$ 62,467.43	$ 62,467.43
2	Pre-Construction Audio-Visual	LS	1	$ 3,500.00	$ 3,500.00
3	HMA Surface, Rem	Syd	667	$ 8.00	$ 5,333.33
4	Cold Milling HMA Surface	Syd	19,083	$ 5.00	$ 95,416.67
5	Trenching and Grading (Widening Areas)	Sta	20.0	$ 2,000.00	$ 40,000.00
6	Subgrade Undercutting	Cyd	100	$ 50.00	$ 5,000.00
7	Soil Erosion Control	LS	1	$ 3,500.00	$ 3,500.00
8	Aggregate Base, 21AA Limestone, 8 inch (Widening)	Syd	2,417	$ 13.00	$ 31,416.67
9	Shoulder, Cl 2, 6 inch (Widening)	Syd	1,111	$ 8.00	$ 8,888.89
10	HMA, 5E3	Ton	2,602	$ 100.00	$ 260,150.00
11	HMA, 3E3 (Widening)	Ton	399	$ 95.00	$ 37,881.25
12	HMA, 3E3 (Patching)	Ton	326	$ 100.00	$ 32,587.50
13	Drainage Improvements	LS	1	$ 5,000.00	$ 5,000.00
14	Underdrain, Subbase, 6 inch	Ft	2,000	$ 8.00	$ 16,000.00
15	Permanent Signing	LS	1	$ 5,000.00	$ 5,000.00
16	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
17	Maintaining Traffic	LS	1	$ 50,000.00	$ 50,000.00
18	Surface Restoration	LS	1	$ 5,000.00	$ 5,000.00
19	Traffic Signal Work	LS	1	$ -	$ -
	Total Construction Cost				**$ 687,141.74**
	Permitting and Mitigation	LS	1		$ -
	Right of Way Acquisition	LS	1		$ -
	Design Engineering	LS	1	6.25%	$ 42,946.36
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 8,589.27
	Contract Administration	LS	1	4.25%	$ 29,203.52
	Inspection (Crew Days)	Day	30	$ 700.00	$ 21,000.00
	Construction Contingency	LS	1	10%	$ 68,714.17
	Materials Testing	LS	1	1.5%	$ 10,307.13
	TOTAL COST				**$ 867,902.19**

Estimate Assumptions:

Estimate includes intersection of Beck and 10 Mile Road

City of Novi
Beck Road from 11 Mile Rd to Central Park Blvd
Pavement Preservation Overlay and 11 Mile/Beck Traffic Signal Replacement
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
1	Mobilization (10%)	LS	1	$ 49,151.00	$ 49,151.00
2	Pre-Construction Audio-Visual	LS	1	$ 2,000.00	$ 2,000.00
3	Cold Milling HMA Surface	Syd	15,550	$ 5.00	$ 77,750.00
4	Soil Erosion Control	LS	1	$ 1,000.00	$ 1,000.00
5	HMA, 5E3	Ton	1,796	$ 100.00	$ 179,602.50
6	HMA, 3E3 (Patching)	Ton	257	$ 100.00	$ 25,657.50
7	Permanent Signing	LS	1	$ 3,000.00	$ 3,000.00
8	Permanent Pavement Markings	LS	1	$ 12,500.00	$ 12,500.00
9	Maintaining Traffic	LS	1	$ 40,000.00	$ 40,000.00
10	Traffic Signal Work	LS	1	$ 150,000.00	$ 150,000.00
	Total Construction Cost				**$ 540,661.00**
	Permitting and Mitigation	LS	1	$ -	$ -
	Right of Way Acquisition	LS	1	$ -	$ -
	Design Engineering	LS	1	6.25%	$ 33,791.31
	Geotechnical Study and Borings (Complete)	LS	1		$ -
	Design Contingency	LS	1	20%	$ 6,758.26
	Contract Administration	LS	1	4.25%	$ 22,978.09
	Inspection (Crew Days)	Day	35	$ 700.00	$ 24,500.00
	Construction Contingency	LS	1	10%	$ 54,066.10
	Materials Testing	LS	1	1.5%	$ 8,109.92
	TOTAL COST				**$ 690,864.68**

Estimate Assumptions:

Estimate includes intersection of Beck and 11 Mile Road

Estimate includes traffic signal replacement at Beck and 11 Mile Road

City of Novi
Beck Road from 8 Mile to 9 Mile
Five-Lane Roadway
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 448,141.00	$ 448,141.00
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,500	$ 4.00	$ 78,000.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	3,000	$ 45.00	$ 135,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	610	$ 25.00	$ 15,250.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,400	$ 9.50	$ 22,800.00
12	Detectable Warning Surface	Ft	200	$ 45.00	$ 9,000.00
13	Tensar TX-5 Geogrid	Syd	40,010	$ 3.50	$ 140,035.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	40,010	$ 15.00	$ 600,150.00
15	HMA Approach	Ton	120	$ 150.00	$ 18,000.00
16	Driveway, Conc, 6 inch	Syd	275	$ 70.00	$ 19,250.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,500	$ 40.00	$ 180,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	3,075	$ 100.00	$ 307,500.00
26	HMA, 3E3 / HMA, 4E3	Ton	9,675	$ 95.00	$ 919,125.00
27	Curb and Gutter, Conc, Det F2	Ft	11,560	$ 20.00	$ 231,200.00
28	Permanent Signing	LS	1	$ 10,000.00	$ 10,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 50,000.00	$ 50,000.00
32	Conc Sidewalk, 6 feet	Ft	2,650	$ 40.00	$ 106,000.00
33	HMA Pathway, 8 feet	Ft	2,650	$ 40.00	$ 106,000.00
34	Boardwalk, 12 feet	Ft	200	$ 650.00	$ 130,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 4,929,551.00**
	Public Utilities				
1	Mobilization	LS	1	$ 85,267.00	$ 85,267.00
2	Water Main	Ft	3,526	$ 120.00	$ 423,120.00
3	Water Main Services	Ea	16	$ 1,500.00	$ 24,000.00
4	Sanitary Sewer	Ft	4,330	$ 85.00	$ 368,050.00
5	Sanitary Sewer Services	Ea	25	$ 1,500.00	$ 37,500.00
	Public Utilities Cost				**$ 937,937.00**
	Total Construction Cost				**$ 5,867,488.00**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 293,374.40
	Right of Way Acquisition	LS	1	$ 220,285.45	$ 220,285.45
	Design Engineering	LS	1	6.25%	$ 366,718.00
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 73,343.60
	Contract Administration	LS	1	4.75%	$ 278,705.68
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 586,748.80
	Materials Testing	LS	1	2%	$ 117,349.76
	TOTAL COST				**$ 7,902,013.69**

Estimate Assumptions:

Estimate includes intersection of Beck and 11 Mile Road
Estimate includes traffic signal at Beck and 11 Mile Road
Widening ends at Central Park Boulevard except for widening for dual left turn lane on Grand River Avenue ffor WB to SB movement
Traffic signals at Grand River Avenue should not require modification and are not included
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.

City of Novi
Beck Road from 9 Mile to 10 Mile
Five-Lane Roadway
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 474,966.00	$ 474,966.00
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	22,150	$ 4.00	$ 88,600.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	3,000	$ 45.00	$ 135,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	500	$ 10.00	$ 5,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	40,010	$ 3.50	$ 140,035.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	40,010	$ 15.00	$ 600,150.00
15	HMA Approach	Ton	150	$ 150.00	$ 22,500.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,500	$ 40.00	$ 180,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	3,075	$ 100.00	$ 307,500.00
26	HMA, 3E3 / HMA, 4E3	Ton	9,675	$ 95.00	$ 919,125.00
27	Curb and Gutter, Conc, Det F2	Ft	11,560	$ 20.00	$ 231,200.00
28	Permanent Signing	LS	1	$ 10,000.00	$ 10,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 50,000.00	$ 50,000.00
32	Conc Sidewalk, 6 feet	Ft	500	$ 40.00	$ 20,000.00
33	HMA Pathway, 8 feet	Ft	4,900	$ 40.00	$ 196,000.00
34	Boardwalk, 12 feet	Ft	600	$ 650.00	$ 390,000.00
35	Remove Boardwalk	Ft	300	$ 50.00	$ 15,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,224,626.00**
	Public Utilities				
1	Mobilization	LS	1	$ 70,057.00	$ 70,057.00
2	Water Main	Ft	4,975	$ 120.00	$ 597,000.00
3	Water Main Services	Ea	5	$ 1,500.00	$ 7,500.00
4	Sanitary Sewer	Ft	1,042	$ 85.00	$ 88,570.00
5	Sanitary Sewer Services	Ea	5	$ 1,500.00	$ 7,500.00
	Public Utilities Cost				**$ 770,627.00**
	Total Construction Cost				**$ 5,995,253.00**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 299,762.65
	Right of Way Acquisition	LS	1	$ 57,366.02	$ 57,366.02
	Design Engineering	LS	1	6.25%	$ 374,703.31
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 74,940.66
	Contract Administration	LS	1	4.75%	$ 284,774.52
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 599,525.30
	Materials Testing	LS	1	2%	$ 119,905.06
	TOTAL COST				**$ 7,904,230.52**

Estimate Assumptions:

Estimate includes intersection of Beck and 9 Mile Road
Estimate includes traffic signal at Beck and 9 Mile Road
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.

City of Novi
Beck Road from 10 Mile to 11 Mile
Five-Lane Roadway
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 476,956.00	$ 476,956.00
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,750	$ 4.00	$ 79,000.00
4	Curb and Gutter, Rem	Ft	700	$ 10.00	$ 7,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	3,000	$ 45.00	$ 135,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	750	$ 10.00	$ 7,500.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	40,010	$ 3.50	$ 140,035.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	40,010	$ 15.00	$ 600,150.00
15	HMA Approach	Ton	160	$ 150.00	$ 24,000.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,500	$ 40.00	$ 180,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	3,075	$ 100.00	$ 307,500.00
26	HMA, 3E3 / HMA, 4E3	Ton	9,675	$ 95.00	$ 919,125.00
27	Curb and Gutter, Conc, Det F2	Ft	11,560	$ 20.00	$ 231,200.00
28	Permanent Signing	LS	1	$ 10,000.00	$ 10,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 50,000.00	$ 50,000.00
32	Conc Sidewalk, 6 feet	Ft	4,200	$ 40.00	$ 168,000.00
33	HMA Pathway, 8 feet	Ft	5,100	$ 40.00	$ 204,000.00
34	Boardwalk, 12 feet	Ft	400	$ 650.00	$ 260,000.00
35	Remove Boardwalk	Ft	250	$ 50.00	$ 12,500.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,246,516.00**
	Public Utilities				
1	Mobilization	LS	1	$ 95,345.00	$ 95,345.00
2	Water Main	Ft	5,430	$ 120.00	$ 651,600.00
3	Water Main Services	Ea	4	$ 1,500.00	$ 6,000.00
4	Sanitary Sewer	Ft	3,410	$ 85.00	$ 289,850.00
5	Sanitary Sewer Services	Ea	4	$ 1,500.00	$ 6,000.00
	Public Utilities Cost				**$ 1,048,795.00**
	Total Construction Cost				**$ 6,295,311.00**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 314,765.55
	Right of Way Acquisition	LS	1	$ 254,748.94	$ 254,748.94
	Design Engineering	LS	1	6.25%	$ 393,456.94
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 78,691.39
	Contract Administration	LS	1	4.75%	$ 299,027.27
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 629,531.10
	Materials Testing	LS	1	2%	$ 125,906.22
	TOTAL COST				**$ 8,489,438.41**

Estimate Assumptions:

Estimate includes intersection of Beck and 10 Mile Road
Estimate includes traffic signal at Beck and 10 Mile Road
Traffic signal at Cider Mill assumed to not require modifications
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.

City of Novi
Beck Road from 11 Mile Rd to Grand River Avenue
Five-Lane Roadway
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	281,084.00	$ 281,084.00
2	Pre-Construction Audio-Visual	LS	1	3,000.00	$ 3,000.00
3	HMA Surface, Rem	Syd	15,550	$ 5.00	$ 77,750.00
4	Curb and Gutter, Rem	Ft	1,350	$ 10.00	$ 13,500.00
5	Roadway Grading	Sta	24.0	$ 10,000.00	$ 240,000.00
6	Subgrade Undercutting	Cyd	1,500	$ 45.00	$ 67,500.00
7	Silt Fence	Ft	5,000	$ 2.00	$ 10,000.00
8	Curb and Gutter Inlet Filter	Ea	30	$ 150.00	$ 4,500.00
9	Driveway Opening, Conc, Det M	Ft	400	$ 25.00	$ 10,000.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,000	$ 9.50	$ 19,000.00
12	Detectable Warning Surface	Ft	100	$ 40.00	$ 4,000.00
13	Tensar TX-5 Geogrid	Syd	18,600	$ 3.50	$ 65,100.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	18,600	$ 13.00	$ 241,800.00
15	HMA Approach	Ton	75	$ 150.00	$ 11,250.00
16	Driveway, Conc, 6 inch	Syd	150	$ 70.00	$ 10,500.00
17	Dr Structure Cover	Ea	24	$ 750.00	$ 18,000.00
18	Dr Structure	Ea	24	$ 1,500.00	$ 36,000.00
19	Storm Sewer, 12 inch	Ft	1,800	$ 40.00	$ 72,000.00
20	Storm Sewer, 18 inch	Ft	300	$ 50.00	$ 15,000.00
21	Storm Sewer, 24 inch	Ft	150	$ 60.00	$ 9,000.00
22	Storm Sewer, 30 inch	Ft	150	$ 90.00	$ 13,500.00
23	Dr Structure Tap, 6 inch	Ea	2	$ 250.00	$ 500.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	4,800	$ 14.00	$ 67,200.00
25	HMA, 5E3	Ton	1,490	$ 100.00	$ 149,000.00
26	HMA, 3E3 / HMA, 4E3	Ton	4,392	$ 95.00	$ 417,240.00
27	Curb and Gutter, Conc, Det F2	Ft	4,900	$ 20.00	$ 98,000.00
28	Permanent Signing	LS	1	$ 7,000.00	$ 7,000.00
29	Permanent Pavement Markings	LS	1	$ 17,500.00	$ 17,500.00
30	Maintaining Traffic	LS	1	$ 160,000.00	$ 160,000.00
31	Surface Restoration	LS	1	$ 35,000.00	$ 35,000.00
32	Conc Sidewalk, 6 feet	Ft	1,350	$ 40.00	$ 54,000.00
33	HMA Pathway, 8 feet	Ft	2,300	$ 40.00	$ 92,000.00
34	Boardwalk, 12 feet	Ft	1,000	$ 500.00	$ 500,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 235,000.00	$ 235,000.00
37	Miscellaneous Items	LS	1	$ 25,000.00	$ 25,000.00
	Road and Drainage Cost				**$ 3,091,924.00**
	Public Utilities				
1	Mobilization	LS	1	$ 41,350.00	$ 41,350.00
2	Water Main	Ft	1,900	$ 120.00	$ 228,000.00
3	Water Main Services	Ea	8	$ 1,500.00	$ 12,000.00
4	Sanitary Sewer	Ft	1,900	$ 85.00	$ 161,500.00
5	Sanitary Sewer Services	Ea	8	$ 1,500.00	$ 12,000.00
	Public Utilities Cost				**$ 454,850.00**
	Total Construction Cost				**$ 3,546,774.00**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 177,338.70
	Right of Way Acquisition	LS	1	$ 498,573.72	$ 498,573.72
	Design Engineering	LS	1	6.25%	$ 221,673.38
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 44,334.68
	Contract Administration	LS	1	4.75%	$ 168,471.77
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 354,677.40
	Materials Testing	LS	1	2%	$ 70,935.48
	TOTAL COST				**$ 5,180,779.12**

Estimate Assumptions:

Estimate includes intersection of Beck and 11 Mile Road
Estimate includes traffic signal at Beck and 11 Mile Road
Widening ends at Central Park Boulevard except for NB to EB right-turn lane at Grand River Avenue
Traffic signal at Grand River Avenue requires minor modifications for additional turn lanes, but not replacement
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.

City of Novi
Beck Road from 8 Mile to 9 Mile
20 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 451,917.50	$ 451,917.50
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,500	$ 4.00	$ 78,000.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,000	$ 45.00	$ 180,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	610	$ 25.00	$ 15,250.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,400	$ 9.50	$ 22,800.00
12	Detectable Warning Surface	Ft	200	$ 45.00	$ 9,000.00
13	Tensar TX-5 Geogrid	Syd	39,150	$ 3.50	$ 137,025.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,150	$ 15.00	$ 587,250.00
15	HMA Approach	Ton	120	$ 150.00	$ 18,000.00
16	Driveway, Conc, 6 inch	Syd	275	$ 70.00	$ 19,250.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,800	$ 40.00	$ 192,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,575	$ 100.00	$ 257,500.00
26	HMA, 3E3 / HMA 4E3	Ton	8,080	$ 95.00	$ 767,600.00
27	Curb and Gutter, Conc, Det F2	Ft	21,120	$ 20.00	$ 422,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	2,650	$ 40.00	$ 106,000.00
33	HMA Pathway, 10 feet	Ft	2,650	$ 40.00	$ 106,000.00
34	Boardwalk, 14 feet	Ft	200	$ 650.00	$ 130,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 4,971,092.50**
	Public Utilities				
1	Mobilization	LS	1	$ 85,267.00	$ 85,267.00
2	Water Main	Ft	3,526	$ 120.00	$ 423,120.00
3	Water Main Services	Ea	16	$ 1,500.00	$ 24,000.00
4	Sanitary Sewer	Ft	4,330	$ 85.00	$ 368,050.00
5	Sanitary Sewer Services	Ea	25	$ 1,500.00	$ 37,500.00
	Public Utilities Cost				**$ 937,937.00**
	Total Construction Cost				**$ 5,909,029.50**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 295,451.48
	Right of Way Acquisition	LS	1	$ 220,285.45	$ 220,285.45
	Additional ROW for Crossovers	Sft	4,950	$ 2.50	$ 12,375.00
	Design Engineering	LS	1	6.25%	$ 369,314.34
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 73,862.87
	Contract Administration	LS	1	4.75%	$ 280,678.90
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 590,902.95
	Materials Testing	LS	1	2%	$ 118,180.59
	TOTAL COST				**$ 7,968,081.08**

Estimate Assumptions:

Estimate includes intersection of Beck and 8 Mile Road
Estimate includes traffic signal at Beck and 8 Mile Road
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 9 Mile to 10 Mile
20 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 478,742.50	$ 478,742.50
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	22,150	$ 4.00	$ 88,600.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,000	$ 45.00	$ 180,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	500	$ 10.00	$ 5,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	39,150	$ 3.50	$ 137,025.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,150	$ 15.00	$ 587,250.00
15	HMA Approach	Ton	150	$ 150.00	$ 22,500.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,800	$ 40.00	$ 192,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,575	$ 100.00	$ 257,500.00
26	HMA, 3E3 / HMA 4E3	Ton	8,080	$ 95.00	$ 767,600.00
27	Curb and Gutter, Conc, Det F2	Ft	21,120	$ 20.00	$ 422,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	500	$ 40.00	$ 20,000.00
33	HMA Pathway, 10 feet	Ft	4,900	$ 40.00	$ 196,000.00
34	Boardwalk, 14 feet	Ft	600	$ 650.00	$ 390,000.00
35	Remove Boardwalk	Ft	300	$ 50.00	$ 15,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,266,167.50**
	Public Utilities				
1	Mobilization	LS	1	$ 70,057.00	$ 70,057.00
2	Water Main	Ft	4,975	$ 120.00	$ 597,000.00
3	Water Main Services	Ea	5	$ 1,500.00	$ 7,500.00
4	Sanitary Sewer	Ft	1,042	$ 85.00	$ 88,570.00
5	Sanitary Sewer Services	Ea	5	$ 1,500.00	$ 7,500.00
	Public Utilities Cost				**$ 770,627.00**
	Total Construction Cost				**$ 6,036,794.50**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 301,839.73
	Right of Way Acquisition	LS	1	$ 57,366.02	$ 57,366.02
	Additional ROW for Crossovers	Sft	4,950	$ 2.50	$ 12,375.00
	Design Engineering	LS	1	6.25%	$ 377,299.66
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 75,459.93
	Contract Administration	LS	1	4.75%	$ 286,747.74
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 603,679.45
	Materials Testing	LS	1	2%	$ 120,735.89
	TOTAL COST				**$ 7,970,297.91**

Estimate Assumptions:

Estimate includes intersection of Beck and 9 Mile Road
Estimate includes traffic signal at Beck and 9 Mile Road
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 10 Mile to 11 Mile
20 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 480,732.50	$ 480,732.50
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,750	$ 4.00	$ 79,000.00
4	Curb and Gutter, Rem	Ft	700	$ 10.00	$ 7,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,000	$ 45.00	$ 180,000.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	750	$ 10.00	$ 7,500.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	39,150	$ 3.50	$ 137,025.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,150	$ 15.00	$ 587,250.00
15	HMA Approach	Ton	160	$ 150.00	$ 24,000.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,800	$ 40.00	$ 192,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,575	$ 100.00	$ 257,500.00
26	HMA, 3E3 / HMA 4E3	Ton	8,080	$ 95.00	$ 767,600.00
27	Curb and Gutter, Conc, Det F2	Ft	21,120	$ 20.00	$ 422,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	4,200	$ 40.00	$ 168,000.00
33	HMA Pathway, 8 feet	Ft	5,100	$ 40.00	$ 204,000.00
34	Boardwalk, 12 feet	Ft	400	$ 650.00	$ 260,000.00
35	Remove Boardwalk	Ft	250	$ 50.00	$ 12,500.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,288,057.50**
	Public Utilities				
1	Mobilization	LS	1	$ 95,345.00	$ 95,345.00
2	Water Main	Ft	5,430	$ 120.00	$ 651,600.00
3	Water Main Services	Ea	4	$ 1,500.00	$ 6,000.00
4	Sanitary Sewer	Ft	3,410	$ 85.00	$ 289,850.00
5	Sanitary Sewer Services	Ea	4	$ 1,500.00	$ 6,000.00
	Public Utilities Cost				**$ 1,048,795.00**
	Total Construction Cost				**$ 6,336,852.50**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 316,842.63
	Right of Way Acquisition	LS	1	$ 254,748.94	$ 254,748.94
	Additional ROW for Crossovers	Sft	4,950	$ 2.50	$ 12,375.00
	Design Engineering	LS	1	6.25%	$ 396,053.28
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 79,210.66
	Contract Administration	LS	1	4.75%	$ 301,000.49
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 633,685.25
	Materials Testing	LS	1	2%	$ 126,737.05
	TOTAL COST				**$ 8,555,505.80**

Estimate Assumptions:

Estimate includes intersection of Beck and 10 Mile Road
Estimate includes traffic signal at Beck and 10 Mile Road
Traffic signal at Cider Mill assumed to not require modifications
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 11 Mile to Grand River Avenue
20 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	286,278.94	$ 286,278.94
2	Pre-Construction Audio-Visual	LS	1	3,000.00	$ 3,000.00
3	HMA Surface, Rem	Syd	15,550	$ 5.00	$ 77,750.00
4	Curb and Gutter, Rem	Ft	1,350	$ 10.00	$ 13,500.00
5	Roadway Grading	Sta	24.0	$ 10,000.00	$ 240,000.00
6	Subgrade Undercutting	Cyd	1,800	$ 45.00	$ 81,000.00
7	Silt Fence	Ft	5,000	$ 2.00	$ 10,000.00
8	Curb and Gutter Inlet Filter	Ea	30	$ 150.00	$ 4,500.00
9	Driveway Opening, Conc, Det M	Ft	400	$ 25.00	$ 10,000.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,000	$ 9.50	$ 19,000.00
12	Detectable Warning Surface	Ft	100	$ 40.00	$ 4,000.00
13	Tensar TX-5 Geogrid	Syd	18,856	$ 3.50	$ 65,996.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	18,856	$ 13.00	$ 245,128.00
15	HMA Approach	Ton	75	$ 150.00	$ 11,250.00
16	Driveway, Conc, 6 inch	Syd	150	$ 70.00	$ 10,500.00
17	Dr Structure Cover	Ea	24	$ 750.00	$ 18,000.00
18	Dr Structure	Ea	24	$ 1,500.00	$ 36,000.00
19	Storm Sewer, 12 inch	Ft	1,825	$ 40.00	$ 73,000.00
20	Storm Sewer, 18 inch	Ft	300	$ 50.00	$ 15,000.00
21	Storm Sewer, 24 inch	Ft	150	$ 60.00	$ 9,000.00
22	Storm Sewer, 30 inch	Ft	150	$ 90.00	$ 13,500.00
23	Dr Structure Tap, 6 inch	Ea	2	$ 250.00	$ 500.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	4,800	$ 14.00	$ 67,200.00
25	HMA, 5E3	Ton	1,480	$ 100.00	$ 148,040.00
26	HMA, 3E3 / HMA 4E3	Ton	4,341	$ 95.00	$ 412,425.40
27	Curb and Gutter, Conc, Det F2	Ft	6,200	$ 20.00	$ 124,000.00
28	Permanent Signing	LS	1	$ 10,000.00	$ 10,000.00
29	Permanent Pavement Markings	LS	1	$ 17,500.00	$ 17,500.00
30	Maintaining Traffic	LS	1	$ 160,000.00	$ 160,000.00
31	Surface Restoration	LS	1	$ 45,000.00	$ 45,000.00
32	Conc Sidewalk, 6 feet	Ft	1,350	$ 40.00	$ 54,000.00
33	HMA Pathway, 8 feet	Ft	2,300	$ 40.00	$ 92,000.00
34	Boardwalk, 12 feet	Ft	1,000	$ 500.00	$ 500,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 235,000.00	$ 235,000.00
37	Miscellaneous Items	LS	1	$ 25,000.00	$ 25,000.00
	Road and Drainage Cost				**$ 3,149,068.34**
	Public Utilities				
1	Mobilization	LS	1	$ 41,350.00	$ 41,350.00
2	Water Main	Ft	1,900	$ 120.00	$ 228,000.00
3	Water Main Services	Ea	8	$ 1,500.00	$ 12,000.00
4	Sanitary Sewer	Ft	1,900	$ 85.00	$ 161,500.00
5	Sanitary Sewer Services	Ea	8	$ 1,500.00	$ 12,000.00
	Public Utilities Cost				**$ 454,850.00**
	Total Construction Cost				**$ 3,603,918.34**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 180,195.92
	Right of Way Acquisition	LS	1	$ 498,573.72	$ 498,573.72
	Additional ROW for Crossovers	Sft	4,950	$ 2.50	$ 12,375.00
	Design Engineering	LS	1	6.25%	$ 225,244.90
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 45,048.98
	Contract Administration	LS	1	4.75%	$ 171,186.12
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 360,391.83
	Materials Testing	LS	1	2%	$ 72,078.37
	TOTAL COST				**$ 5,267,013.17**

Estimate Assumptions:

Estimate includes intersection of Beck and 11 Mile Road
Estimate includes traffic signal at Beck and 11 Mile Road
Widening ends at Central Park Boulevard except for NB to EB right-turn lane at Grand River Avenue
Traffic signal at Grand River Avenue requires minor modifications for additional turn lanes, but not replacement
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 8 Mile to 9 Mile
25 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 454,946.25	$ 454,946.25
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,500	$ 4.00	$ 78,000.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,500	$ 45.00	$ 202,500.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	610	$ 25.00	$ 15,250.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,400	$ 9.50	$ 22,800.00
12	Detectable Warning Surface	Ft	200	$ 45.00	$ 9,000.00
13	Tensar TX-5 Geogrid	Syd	39,225	$ 3.50	$ 137,287.50
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,225	$ 15.00	$ 588,375.00
15	HMA Approach	Ton	120	$ 150.00	$ 18,000.00
16	Driveway, Conc, 6 inch	Syd	275	$ 70.00	$ 19,250.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,875	$ 40.00	$ 195,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,580	$ 100.00	$ 258,000.00
26	HMA, 3E3 / HMA 4E3	Ton	8,100	$ 95.00	$ 769,500.00
27	Curb and Gutter, Conc, Det F2	Ft	21,170	$ 20.00	$ 423,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	2,650	$ 40.00	$ 106,000.00
33	HMA Pathway, 10 feet	Ft	2,650	$ 40.00	$ 106,000.00
34	Boardwalk, 14 feet	Ft	200	$ 650.00	$ 130,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,004,408.75**
	Public Utilities				
1	Mobilization	LS	1	$ 85,267.00	$ 85,267.00
2	Water Main	Ft	3,526	$ 120.00	$ 423,120.00
3	Water Main Services	Ea	16	$ 1,500.00	$ 24,000.00
4	Sanitary Sewer	Ft	4,330	$ 85.00	$ 368,050.00
5	Sanitary Sewer Services	Ea	25	$ 1,500.00	$ 37,500.00
	Public Utilities Cost				**$ 937,937.00**
	Total Construction Cost				**$ 5,942,345.75**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 297,117.29
	Right of Way Acquisition	LS	1	$ 220,285.45	$ 220,285.45
	Additional ROW for Crossovers	Sft	4,240	$ 2.50	$ 10,600.00
	Design Engineering	LS	1	6.25%	$ 371,396.61
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 74,279.32
	Contract Administration	LS	1	4.75%	$ 282,261.42
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 594,234.58
	Materials Testing	LS	1	2%	$ 118,846.92
	TOTAL COST				**$ 8,009,367.33**

Estimate Assumptions:

Estimate includes intersection of Beck and 8 Mile Road
Estimate includes traffic signal at Beck and 8 Mile Road
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 9 Mile to 10 Mile
25 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 481,771.25	$ 481,771.25
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	22,150	$ 4.00	$ 88,600.00
4	Curb and Gutter, Rem	Ft	500	$ 10.00	$ 5,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,500	$ 45.00	$ 202,500.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	500	$ 10.00	$ 5,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	39,225	$ 3.50	$ 137,287.50
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,225	$ 15.00	$ 588,375.00
15	HMA Approach	Ton	150	$ 150.00	$ 22,500.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,875	$ 40.00	$ 195,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,580	$ 100.00	$ 258,000.00
26	HMA, 3E3 / HMA 4E3	Ton	8,100	$ 95.00	$ 769,500.00
27	Curb and Gutter, Conc, Det F2	Ft	21,170	$ 20.00	$ 423,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	500	$ 40.00	$ 20,000.00
33	HMA Pathway, 10 feet	Ft	4,900	$ 40.00	$ 196,000.00
34	Boardwalk, 14 feet	Ft	600	$ 650.00	$ 390,000.00
35	Remove Boardwalk	Ft	300	$ 50.00	$ 15,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,299,483.75**
	Public Utilities				
1	Mobilization	LS	1	$ 70,057.00	$ 70,057.00
2	Water Main	Ft	4,975	$ 120.00	$ 597,000.00
3	Water Main Services	Ea	5	$ 1,500.00	$ 7,500.00
4	Sanitary Sewer	Ft	1,042	$ 85.00	$ 88,570.00
5	Sanitary Sewer Services	Ea	5	$ 1,500.00	$ 7,500.00
	Public Utilities Cost				**$ 770,627.00**
	Total Construction Cost				**$ 6,070,110.75**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 303,505.54
	Right of Way Acquisition	LS	1	$ 57,366.02	$ 57,366.02
	Additional ROW for Crossovers	Sft	4,240	$ 2.50	$ 10,600.00
	Design Engineering	LS	1	6.25%	$ 379,381.92
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 75,876.38
	Contract Administration	LS	1	4.75%	$ 288,330.26
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 607,011.08
	Materials Testing	LS	1	2%	$ 121,402.22
	TOTAL COST				**$ 8,011,584.16**

Estimate Assumptions:

Estimate includes intersection of Beck and 9 Mile Road
Estimate includes traffic signal at Beck and 9 Mile Road
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 10 Mile to 11 Mile
25 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	$ 483,761.25	$ 483,761.25
2	Pre-Construction Audio-Visual	LS	1	$ 4,000.00	$ 4,000.00
3	HMA Surface, Rem	Syd	19,750	$ 4.00	$ 79,000.00
4	Curb and Gutter, Rem	Ft	700	$ 10.00	$ 7,000.00
5	Roadway Grading	Sta	52.1	$ 10,000.00	$ 521,000.00
6	Subgrade Undercutting	Cyd	4,500	$ 45.00	$ 202,500.00
7	Silt Fence	Ft	10,000	$ 1.50	$ 15,000.00
8	Curb and Gutter Inlet Filter	Ea	60	$ 150.00	$ 9,000.00
9	Driveway Opening, Conc, Det M	Ft	600	$ 25.00	$ 15,000.00
10	Sidewalk, Rem	Syd	750	$ 10.00	$ 7,500.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	1,350	$ 9.50	$ 12,825.00
12	Detectable Warning Surface	Ft	125	$ 45.00	$ 5,625.00
13	Tensar TX-5 Geogrid	Syd	39,225	$ 3.50	$ 137,287.50
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	39,225	$ 15.00	$ 588,375.00
15	HMA Approach	Ton	160	$ 150.00	$ 24,000.00
16	Driveway, Conc, 6 inch	Syd	200	$ 70.00	$ 14,000.00
17	Dr Structure Cover	Ea	54	$ 750.00	$ 40,500.00
18	Dr Structure	Ea	54	$ 1,500.00	$ 81,000.00
19	Storm Sewer, 12 inch	Ft	4,875	$ 40.00	$ 195,000.00
20	Storm Sewer, 18 inch	Ft	900	$ 50.00	$ 45,000.00
21	Storm Sewer, 24 inch	Ft	500	$ 60.00	$ 30,000.00
22	Storm Sewer, 30 inch	Ft	500	$ 90.00	$ 45,000.00
23	Dr Structure Tap, 6 inch	Ea	4	$ 250.00	$ 1,000.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	10,560	$ 10.00	$ 105,600.00
25	HMA, 5E3	Ton	2,580	$ 100.00	$ 258,000.00
26	HMA, 3E3 / HMA 4E3	Ton	8,100	$ 95.00	$ 769,500.00
27	Curb and Gutter, Conc, Det F2	Ft	21,170	$ 20.00	$ 423,400.00
28	Permanent Signing	LS	1	$ 12,000.00	$ 12,000.00
29	Permanent Pavement Markings	LS	1	$ 20,000.00	$ 20,000.00
30	Maintaining Traffic	LS	1	$ 200,000.00	$ 200,000.00
31	Surface Restoration	LS	1	$ 55,000.00	$ 55,000.00
32	Conc Sidewalk, 6 feet	Ft	4,200	$ 40.00	$ 168,000.00
33	HMA Pathway, 8 feet	Ft	5,100	$ 40.00	$ 204,000.00
34	Boardwalk, 12 feet	Ft	400	$ 650.00	$ 260,000.00
35	Remove Boardwalk	Ft	250	$ 50.00	$ 12,500.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 50,000.00	$ 50,000.00
	Road and Drainage Cost				**$ 5,321,373.75**
	Public Utilities				
1	Mobilization	LS	1	$ 95,345.00	$ 95,345.00
2	Water Main	Ft	5,430	$ 120.00	$ 651,600.00
3	Water Main Services	Ea	4	$ 1,500.00	$ 6,000.00
4	Sanitary Sewer	Ft	3,410	$ 85.00	$ 289,850.00
5	Sanitary Sewer Services	Ea	4	$ 1,500.00	$ 6,000.00
	Public Utilities Cost				**$ 1,048,795.00**
	Total Construction Cost				**$ 6,370,168.75**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 318,508.44
	Right of Way Acquisition	LS	1	$ 254,748.94	$ 254,748.94
	Additional ROW for Crossovers	Sft	4,240	$ 2.50	$ 10,600.00
	Design Engineering	LS	1	6.25%	$ 398,135.55
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 79,627.11
	Contract Administration	LS	1	4.75%	$ 302,583.02
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 637,016.88
	Materials Testing	LS	1	2%	$ 127,403.38
	TOTAL COST				**$ 8,596,792.05**

Estimate Assumptions:

Estimate includes intersection of Beck and 10 Mile Road
Estimate includes traffic signal at Beck and 10 Mile Road
Traffic signal at Cider Mill assumed to not require modifications
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

City of Novi
Beck Road from 11 Mile to Grand River Avenue
25 Foot Median Boulevard
APPENDIX A Preliminary Estimate of Cost
12/7/2018

Item No.	Item Description	Unit	Quantity	Unit Price	Cost
	Roadway and Drainage				
1	Mobilization (10%)	LS	1	288,251.40	$ 288,251.40
2	Pre-Construction Audio-Visual	LS	1	3,000.00	$ 3,000.00
3	HMA Surface, Rem	Syd	15,550	$ 5.00	$ 77,750.00
4	Curb and Gutter, Rem	Ft	1,350	$ 10.00	$ 13,500.00
5	Roadway Grading	Sta	24.0	$ 10,000.00	$ 240,000.00
6	Subgrade Undercutting	Cyd	2,000	$ 45.00	$ 90,000.00
7	Silt Fence	Ft	5,000	$ 2.00	$ 10,000.00
8	Curb and Gutter Inlet Filter	Ea	30	$ 150.00	$ 4,500.00
9	Driveway Opening, Conc, Det M	Ft	400	$ 25.00	$ 10,000.00
10	Sidewalk, Rem	Syd	200	$ 10.00	$ 2,000.00
11	Sidewalk Ramp, Conc, 6 inch	Sft	2,000	$ 9.50	$ 19,000.00
12	Detectable Warning Surface	Ft	100	$ 40.00	$ 4,000.00
13	Tensar TX-5 Geogrid	Syd	19,056	$ 3.50	$ 66,696.00
14	Aggregate Base, 21AA Limestone, 8 inch	Syd	19,056	$ 13.00	$ 247,728.00
15	HMA Approach	Ton	75	$ 150.00	$ 11,250.00
16	Driveway, Conc, 6 inch	Syd	150	$ 70.00	$ 10,500.00
17	Dr Structure Cover	Ea	24	$ 750.00	$ 18,000.00
18	Dr Structure	Ea	24	$ 1,500.00	$ 36,000.00
19	Storm Sewer, 12 inch	Ft	1,875	$ 40.00	$ 75,000.00
20	Storm Sewer, 18 inch	Ft	300	$ 50.00	$ 15,000.00
21	Storm Sewer, 24 inch	Ft	150	$ 60.00	$ 9,000.00
22	Storm Sewer, 30 inch	Ft	150	$ 90.00	$ 13,500.00
23	Dr Structure Tap, 6 inch	Ea	2	$ 250.00	$ 500.00
24	Underdrain, Subgrade, Open-Graded, 6 inch	Ft	4,800	$ 14.00	$ 67,200.00
25	HMA, 5E3	Ton	1,485	$ 100.00	$ 148,500.00
26	HMA, 3E3 / HMA 4E3	Ton	4,362	$ 95.00	$ 414,390.00
27	Curb and Gutter, Conc, Det F2	Ft	7,100	$ 20.00	$ 142,000.00
28	Permanent Signing	LS	1	$ 10,000.00	$ 10,000.00
29	Permanent Pavement Markings	LS	1	$ 17,500.00	$ 17,500.00
30	Maintaining Traffic	LS	1	$ 160,000.00	$ 160,000.00
31	Surface Restoration	LS	1	$ 45,000.00	$ 45,000.00
32	Conc Sidewalk, 6 feet	Ft	1,350	$ 40.00	$ 54,000.00
33	HMA Pathway, 8 feet	Ft	2,300	$ 40.00	$ 92,000.00
34	Boardwalk, 12 feet	Ft	1,000	$ 500.00	$ 500,000.00
35	Remove Boardwalk	Ft	200	$ 50.00	$ 10,000.00
36	Traffic Signal	LS	1	$ 220,000.00	$ 220,000.00
37	Miscellaneous Items	LS	1	$ 25,000.00	$ 25,000.00
	Road and Drainage Cost				**$ 3,170,765.40**
	Public Utilities				
1	Mobilization	LS	1	$ 41,350.00	$ 41,350.00
2	Water Main	Ft	1,900	$ 120.00	$ 228,000.00
3	Water Main Services	Ea	8	$ 1,500.00	$ 12,000.00
4	Sanitary Sewer	Ft	1,900	$ 85.00	$ 161,500.00
5	Sanitary Sewer Services	Ea	8	$ 1,500.00	$ 12,000.00
	Public Utilities Cost				**$ 454,850.00**
	Total Construction Cost				**$ 3,625,615.40**
	Miscellaneous Items				
	Permitting and Mitigation	LS	1	5%	$ 181,280.77
	Right of Way Acquisition	LS	1	$ 498,573.72	$ 498,573.72
	Additional ROW for Crossovers	Sft	4,240	$ 2.50	$ 10,600.00
	Design Engineering	LS	1	6.25%	$ 226,600.96
	Geotechnical Study and Borings (Complete)	LS	1	$ -	$ -
	Design Contingency	LS	1	20%	$ 45,320.19
	Contract Administration	LS	1	4.75%	$ 172,216.73
	Inspection (Crew Days)	Day	140	$ 700.00	$ 98,000.00
	Construction Contingency	LS	1	10%	$ 362,561.54
	Materials Testing	LS	1	2%	$ 72,512.31
	TOTAL COST				**$ 5,293,281.62**

Estimate Assumptions:

Estimate includes intersection of Beck and 11 Mile Road
Estimate includes traffic signal at Beck and 11 Mile Road
Widening ends at Central Park Boulevard except for NB to EB right-turn lane at Grand River Avenue
Traffic signal at Grand River Avenue requires minor modifications for additional turn lanes, but not replacement
Water and sanitary sewer per foot costs include hydrants, valves and manholes
12 inch average size for water main and sanitary sewers used
Miscellaneous Items icludes tree removals, drainage removals, utility adjustments,mailboxes, guardrail, etc.
Additonal ROW for bus compatible crossovers based on two locations per detail in report

APPENDIX B

Scoping Study
Beck Road
Eight Mile Road to Grand River Avenue

Prepared for:
City of Novi Engineering Department

December 2006
Project No. G06496

Fishbeck, Thompson, Carr & Huber
engineers • scientists • architects • constructors

SCOPING STUDY

BECK ROAD

EIGHT MILE ROAD TO GRAND RIVER AVENUE

PREPARED FOR:

CITY OF NOVI ENGINEERING DEPARTMENT

NOVI, MICHIGAN

DECEMBER 1, 2006
PROJECT NO. G06496

Fishbeck, Thompson, Carr & Huber, Inc. Engineers • Scientists • Architects • Constructors
39255 Country Club Drive, Suite B-25, Farmington Hills, MI 48331 Telephone: 248-324-2090

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*included on compact disc in PDF file format

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FREQUENTLY USED ABBEVIATIONS AND ACRONYMS

ADT	average daily traffic
Birchler-Arroyo	Birchler-Arroyo Associates
City	City of Novi
CMAQ	Congestion Mitigation and Air Quality Improvement Program
Council	Novi City Council
DPS	Department of Public Services
DPW	Department of Public Works
EB	eastbound
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
FY	fiscal year
Grand River	Grand River Avenue
HMA	hot-mix asphalt
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
mph	miles per hour
NB	northbound
NE	northeast
NW	northwest
PASER	Pavement Surface Evaluation and Rating
RCOC	Road Commission for Oakland County
RFP	Request for Proposals
ROW	right-of-way
RTP	*Regional Transportation Plan*
SB	southbound
SE	southeast
SEMCOG	Southeast Michigan Council of Governments
SW	southwest
TIP	Transportation Improvement Program
VPD	vehicles per day
WB	westbound

1.0 EXECUTIVE SUMMARY

1.1 PURPOSE AND GOALS OF SCOPING STUDY

In August, 2006, FTC&H was selected to perform the *Beck Road Scoping Study* based on a proposal in response to the Request for Proposals (RFP) issued by the City of Novi. The stated purpose of the project is to provide Council with options for potential future improvements on Beck Road from Eight Mile Road to Grand River Avenue. The scope of services included review, estimates, and geotechnical services to be used in the planning, budgeting, and engineering of future work on the Beck Road corridor.

Services completed as a part of this study include:

- Pavement cores and soil borings and a full geotechnical report with recommendations.
- Locating and identifying type of wetland and woodland areas within the influence of Beck Road.
- Review of several alternatives for condition and capacity improvements.
- Incorporating non-motorized pathways.
- Presenting preliminary and developed information to the public at two open meetings.
- Reviewing of traffic counts, growth forecasts, and accident information.
- Developing of potential typical cross sections and layout options.
- Determining potential ROW impacts.
- Preparing cost estimates for each alternative.
- Conducting several meetings and communicating with a scoping committee comprised of City staff.

1.2 BACKGROUND INFORMATION

During the initial stages of the study, it was determined that Beck Road should be evaluated from a regional perspective. The roadway is a direct connection between M-14 to the south and the new interchange at I-96 and Grand River Avenue. The study area, as well as the areas directly north and south of the City limits, is still experiencing growth and development. The portion of Beck Road south of Six Mile Road in Northville Township has been reconstructed to a four-lane boulevard and, according to the Regional Transportation Plan (RTP) prepared by the Southeast Council of Governments (SEMCOG), the portion of Beck Road from Six Mile Road to Eight Mile Road is slated to be a five-lane section, as is the portion of Beck Road north of Grand River Avenue in the City of Wixom. The RTP covers the anticipated needs of the region to 2030 and, according to the plan, the expansion of Beck Road outside Novi is planned to occur during the next 10 to 20 years.

Within the City, Beck Road's current pavement condition ranges from a PASER rating of 3 to 9 (10 being new). In the areas where pavement condition is poor, excessive noise is generated by trucks passing

over the cracked and pot-holed surface. Several areas of Beck are adjacent to wetland areas, making it likely that subgrade soils are poor. As part of this study, 39 pavement cores and soil borings were collected and evaluated; and an additional 9 borings were obtained outside the existing roadway to evaluate soils in areas where widening could occur. In 18 of the 48 borings, fill soils considered unsuitable for the support of pavement were encountered; 13 of these were within the existing paved roadway.

Traffic counts and observations indicate that during peak periods, most intersections along Beck Road back up with motorists experiencing moderate to long delays. Increasing the capacity of Beck Road to handle the current and projected demands will require planning to ensure that project budgeting and scheduling align with the RTP, as well as the needs and desires of the City and its residents.

At an October 3, 2006, public information meeting, residents were presented with several short- and long-term options to improve the capacity of the roadway. The residents in attendance were asked to provide feedback on the long-term options presented.

At the second public meeting on November 2, 2006, the preferred short- and long-term options were presented and more clearly detailed. It was emphasized that the short-term options may occur during the next one to six years, and the long-term options would depend on actual growth. Many residents were interested in the potential scope of the work and expressed an interest in being involved and informed in the process. Any changes to the Beck Road corridor will need to balance the needs of neighboring residents with the recognition that the vast majority of users are primarily passing through this noncommercial area.

The following pages present an area-specific summary of the options and staging for potential projects. The following sections contain detailed descriptions and items of concern for each area of Beck Road.

1.3 SHORT-TERM CAPACITY IMPROVEMENTS

At each mile road intersection along Beck Road there is a traffic signal and various accommodations for turning movements. For example, lack of a NB right-turn lane at Ten Mile leads to delays for both through traffic and turning vehicles during peak periods. If Beck Road were to be widened, there would likely be a minimum of two lanes each NB and SB, in addition to a center left-turn lane at each intersection. In the interim, congestion relief at the intersections can be realized by adding or upgrading turn lanes. Table 1 summarizes the recommended intersection improvements that will increase capacity and should be implemented prior to considering expansion along the entire corridor.

Based on comments received during the public meetings, upgrading the intersections prior to considering expanding the rest of Beck Road is very favorably viewed since current congestion can be mitigated by intersection improvements. After intersection improvements are implemented, the effect of the improvements can be reviewed, and a more accurate assessment of the time frame for further potential expansion of Beck Road can be performed. The proposed intersection modifications will align with future widening of Beck Road if or as it occurs.

Table 1 - Short-Term Intersection Capacity Improvements

Intersection	Time Frame (years)	Improvements	Estimate (2006 dollars)	Notes
10 Mile	1 – 4	Add dedicated right-turn lanes to NB, SB, and EB legs; extend WB right-turn and EB left-turn lanes. Replace traffic signal.	$405,600	ROW impacts in all four quadrants; four parcels affected
9 Mile	2 – 5	Extend existing dedicated NB right-turn lane.	$36,000	ROW impact on two parcels
11 Mile	5 – 10	Add dedicated right-turn lanes to EB and WB legs.	$238,000	ROW impact in SW quadrant
8 Mile	5 – 15	Add dedicated right-turn lane to SB leg.	$216,000	To coordinate with section south of 8 Mile

For future-year inflation factor estimates refer to Appendix 7.
Estimate includes approximate cost of ROW acquisition.
Refer to Short-Term Capacity Improvements in Section 5 for detailed information.

1.4 SHORT-TERM CONDITION IMPROVEMENTS

Based on the assumption that any expansion of Beck Road within the City will be coordinated with the timing of improvements in Northville Township and/or the City of Wixom (in 15 to 20 years), preservation of the existing roadway will be required. The exact type of rehabilitation of each roadway segment will need to be evaluated closer to the time at which the work will be performed, however, for planning purposes, Table 2 provides a summary of short-term (1 to 6 years) condition improvements.

Table 2 - Short-Term Condition Improvements

Segment	Time Frame (years)	Work Type	Estimate (2006 dollars)	Notes
11 Mile to Grand River	1 – 4	Mill and overlay	$218,000	Replace wearing course from 10 Mile to new pavement near Providence Hospital.
10 to 11 Mile	1 – 4	Repair and overlay	$466,000	Existing pavement is thin; overlay will result in longer life section.
9 to 10 Mile	2 – 5	Mill and overlay	$495,000	North half is in good condition; aggregate shoulder requires grading to flatten in locations
8 to 9 Mile	3 – 6	Repair and overlay	$464,000	Thin pavement, poor base; overlay to thicken section.

For future-year inflation factor estimates refer to Appendix 7.
Refer to Short-Term Condition Improvements in Section 6 for detailed information.

1.5 LONG-TERM CAPACITY IMPROVEMENTS

According to the SEMCOG 2030 RTP, it is planned that Beck Road be five lanes at the northern and southern borders of the City, within the City of Wixom and Northville Township, respectively (Appendix 5). The portion of Beck Road within the City is not currently in the 2030 RTP, however, the City engineering department is working with SEMCOG to add this and other roadways to the regional plan. As part of updating the City's master plan, Birchler-Arroyo performed studies in 1992 and 1998; all City roadways were examined. The reports recommended that Beck Road be upgraded to a four-lane divided section or a five-lane roadway throughout the corridor at "build-out" conditions, which, at the time the reports were written, was expected to occur between 2010 and 2020. An excerpt of the 1992 Birchler-Arroyo study is included as Appendix 2; an excerpt of the 1998 study is included as Appendix 3.

Based on Novi's traffic count predictions and the plans for the surrounding communities, Beck Road will need two lanes in each direction to convey the traffic coming from beyond the City limit, as well as to serve the residents as a major north-south road in conjunction with Novi, Haggerty, and Napier Roads, which are arterials spaced every other mile. This need for this widening appears to be 15 years distant

and, depending when Beck is improved outside the City and the results of intersection capacity improvements, may be as much as 20 to 25 years in the future.

In contemplating the potential widening of Beck Road, consideration was given to the fact that along several segments, successful access management and planning have resulted in very few minor road intersections and private driveways. These segments are candidates for a narrow (20-foot) boulevard section resulting in a four-lane divided roadway, which would allow for the addition of some landscaping to the corridor. Table 3 summarizes the recommended option for each segment.

Table 3 - Long-Term Capacity Improvements

Segment	Cross Section	Estimate (2006 dollars)	Parcels Affected (ROW needs)	Notes
8 to 9 Mile	5 lanes	$3,215,000	28	The eastern half of the southern half mile is in the City of Northville
9 to 10 Mile	5 lanes at the mile roads, with a 4-lane boulevard for middle 3,200 feet	$3,153,500	18	
10 to 11 Mile	5 lanes at the mile roads, with a 4-lane boulevard for the middle 3,500 feet	$3,418,000	6	
11 Mile to Grand River	5 lanes	$1,826,000	13	

For future-year inflation factor estimates refer to Appendix 7.
Estimates include the approximate cost of ROW acquisitions.
Refer to Long-Term Capacity Improvements in Section 7 for detailed information.

1.6 RECOMMENDED ACTIONS

The short-term condition and capacity improvements should be implemented within the next one to six years. A new wearing surface will help prevent damage from failing pavement and will greatly reduce the noise from trucks, which is a common resident complaint. Among the first steps is to get Beck Road listed on the 2030 RTP with the Oakland County Federal Aid Committee and SEMCOG to ensure the timing of upgrades is coordinated with surrounding areas. The described intersection improvements can be funded 80/20 (80% grant, 20% match) or better through the Congestion Mitigation and Air Quality Improvement Program (CMAQ) which is funding earmarked to reduce congestion and the corresponding pollution and ozone impacts; however, the application must be made through SEMCOG. Also, responding to the RCOC 2010-11 *Call for Projects* will put Beck Road “in line” for 80/20 federal funding for intersection improvements.

Requesting that SEMCOG add Beck Road to the 2030 RTP will ensure that as funding becomes available, it is considered in turn with other projects of merit. Grants received can be used for all aspects of roadway improvements, including ROW acquisition.

This scoping report can be the background for initial funding requests and may be expanded in the future. The proposed work in this study should be examined in the future, as standards may have changed; the estimates should also be reviewed based on construction material trends, real estate costs, and general inflation.

2.0 REGIONAL AND LOCAL BACKGROUND AND PERSPECTIVE

At the initial kickoff meeting for the scoping and engineering study, the discussion turned from existing capacity issues to a review of what has been done on Beck Road outside the study area. North of Grand River Avenue, the interchange with I-96 has been improved and reopened as a single-point urban interchange, increasing capacity to/from the freeway. Grand River Avenue has been upgraded to five lanes, and Providence Hospital is continuing to expand at Grand River Avenue. North of I-96, Beck Road is within the City of Wixom and, other than improvements related to the interchange reconstruction, has not been widened beyond two lanes.

South of Eight Mile, Beck Road is within Northville Township and under the jurisdiction of the Wayne County DPS. M-14 has an interchange with Beck Road south of Five Mile. From M-14 to Five Mile, Beck Road is five lanes, and from Five Mile to Six Mile it is four lanes with a narrow (20-foot) boulevard. The section of Beck Road from Six Mile to Eight Mile Road is two lanes with passing flares and turn lanes, similar to the sections in the City.

Further south, Beck Road crosses M-153 (Ford Road), and US-12 (Michigan Avenue). Beck Road is the only non-freeway route that is continuous from south of US-12 to north of I-96. The location of Beck Road in relation to these other roadways is depicted on Figure 1.

2.1 TRAFFIC VOLUMES AND ACCIDENTS

Currently, motorists traveling Beck Road experience delays at most intersections during peak periods (Monday through Friday, 7-9 a.m. and 4-6 p.m.) Traffic counts were obtained at the intersections from Eight Mile Road through Grand River Avenue. At Eight Mile Road, the counts were obtained by City DPW traffic collectors for a week in late August 2006. The other intersections have signals that are monitored under the RCOC FAST-TRAC system which utilizes camera-like sensors to detect traffic flow and adjusts the signal timing accordingly. These sensors are able to count vehicles; the RCOC supplied data for a week in May 2006. After reviewing the counts, Thursday was selected as being representative of a typical week. The counts were summarized by intersection with daily and peak-hour flows depicted on Figure 2. Raw traffic data are included in Appendix 13.

Directional traffic (just NB or SB) on Beck Road ranges from approximately 8,000 VPD to more than 12,000 VPD. The peak-hour flows are generally higher for NB traffic, with hourly totals exceeding 1,000 vehicles at NB Nine, Ten, and Eleven Mile Road and at SB Eleven Mile Road. The traffic counting devices are only able to distinguish between through and turning vehicles at locations where there is an existing turn lane. Nine Mile Road, for example, has right-turn lanes both NB and SB, while Ten Mile Road does not. Traffic counts at Nine Mile Road indicate that during peak periods, as many as to 300

vehicles per hour (of 1,000 total for the hour) make a right turn from Beck Road. Based on field observations during peak and off-peak travel times, NB Beck Road at Ten Mile Road experiences similar right-turn volume as a percentage of total traffic. However, at Ten Mile Road the right-turning vehicles impede through movement and most right-turning vehicles are unable to proceed on a red traffic signal as they can at Nine Mile Road, leading to longer backups at Ten Mile Road. Once a vehicle entered the queue, delays of 4 to 5 minutes to clear the intersection were observed.

Based on the recent traffic counts, the total ADT for Beck Road ranges from 17,000 to 24,000 VPD. Although this portion of Beck Road is primarily residential and developed, it can be assumed that traffic will continue to increase as development occurs north and south of the corridor. A traffic impact study for Providence Hospital by Tetra-Tech MPS, Inc., in January 2005, indicated an anticipated annual traffic increase of 4%. Data provided by SEMCOG indicates that traffic is expected to increase at a 1% annual rate (see Appendix 1 for the SEMCOG letter). The Providence study is useful for the area in immediately proximity to the hospital and is based on short-term projections through 2010, while the SEMCOG numbers reflect a regional perspective and are applicable over a longer term. For the purposes of this study, an annual growth rate of 1% was assumed, as recommended by SEMCOG. A summary of historical and current traffic counts, as well as estimates based on 1% and 4% growth factors are presented in Table 4.

Table 4 - 8 Mile to Grand River Two-Way ADT Counts and Projections

Year	Count/Projection	Source
1991	5,000 – 8,500	1992 Birchler/Arroyo Associates study
1997	13,500 – 17,000	1998 Birchler/Arroyo Associates study
2006	17,000 – 24,000	RCOC and City traffic counts
2010	18,000 – 25,000 (at 1%) 20,000 – 28,000 (at 4%)	
2020	19,500 – 28,000 (at 1%)	
2030	21,500 – 30,500 (at 1%)	

For an excerpt of the 1992 Birchler/Arroyo Study refer to Appendix 2.
For an excerpt of the 1998 Birchler/Arroyo Study refer to Appendix 3.

With assistance of the Novi Police Department, accident and citation data for a 12-month period (August 2005 through July 2006) were reviewed and are summarized in Figure 3. The accident information broken down by hour is presented in Figure 4. The data indicates a concentration of accidents near the Ten Mile Road intersection. The individual accident information sheets (UD-10 forms) were reviewed for this area and the majority of accidents (21 of 35) involved a rear-end collision. The reasons given by drivers and officers for hitting the car ahead of them varied, however, in many cases, the following vehicle did not stop in time when the leading vehicle slowed to turn right or slowed to stop for the signal. No geometric factors (curves, crests of hills, etc.) appear to contribute to the accidents.

2.2 CITY PLANNING INFORMATION

In 2005, the Novi City Council set several short- and long-term goals. In the fourth priority ranking of long-term goals is “Set Timetable for Beck Road Improvement - 8 Mile to Grand River.” The goal does not list what sorts of improvements are sought. Based upon discussions with the City Engineering Department, there is no specific cross-section or plan in mind, however, it was felt that Beck Road needed to be managed and planned to avoid issues that have occurred on other roads in the City and around the region.

In Novi, Beck Road is designated “major arterial”, indicating it is considered a principal route through the City. The City receives Act 51 funding from the State of Michigan which can be used for maintenance of any roadway within the City, provided that “major” roadways receive the highest priority. The funding does not dictate how many lanes a road will have, speed limit, or any other aspect of managing a road, other than that it shall be maintained in such a manner that costly repairs are not due to a lack of maintenance.

The City has established a “thoroughfare plan” as part of the Master Plan for Land Use. The plan describes the requirements and rationale for non-motorized pathways, access management, and driveway regulations. As portions of Beck Road were developed before the thoroughfare plan was in place, there are areas that lack access control and pathways, while areas developed later exhibit good access control as well as pathways, as described in the plan. The thoroughfare plan and associated figures from the current City Master Plan are included for reference in Appendix 4.

2.3 REGIONAL PLANNING INFORMATION

SEMCOG is the major regional planning organization in SE Michigan. The counties included in SEMCOG are: Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne. Membership in SEMCOG is open to all counties, cities, villages, townships, community colleges, and public universities within these counties. The group is primarily focused on the areas of regional economic development, environmental issues, and transportation planning, with the intent that shared goals can be achieved with mutual benefit.

Regarding transportation planning, SEMCOG compiles and maintains traffic count data, pavement condition surveys, and lists of current, planned, and potential roadway projects. The TIP is a listing of currently approved and potential projects intended for short-term funding and construction (2 to 5 years). SEMCOG also created and maintains a long-range RTP, currently the *2030 Regional Transportation Plan for Southeast Michigan*. The projects listed in the RTP have intended time frames divided into five-year increments, ranging from 2006 to 2010 to 2026 to 2030. It contains $41 billion in federal, state, and local funding for road and transit projects for FYs 2005 to 2030, as well as policies and initiatives designed to guide the region forward.

SEMCOG acts as a gatekeeper and sets the requirements to be considered for funding as well as initially reviewing and ranking the projects before requests are submitted to the Federal Aid Taskforce. The Federal Aid Taskforce determines whether a project is funded; the projects are administered through MDOT. This provides the greatest benefit to the region as a whole, with SEMCOG helping to allocate the limited funding among the member counties while allowing communities to set realistic time frames and determine local match requirements.

Appendix 5 contains an excerpt from the 2030 RTP, as well as copies of web pages listing three specific projects for Beck Road in Northville Township and the City of Wixom. For example, from page 39 of the RTP, the project with ID No. 1167 is Beck Road from I-96 to Pontiac Trail in the City of Wixom. It shows a Time Code of 4, which is defined as occurring in the FY range of 2016 to 2020. The web page lists details of the project; it is indicated to have an estimated total cost of $13.3 million, with 80% federal funding requested, and 20% non-federal (a blend of state and local funds).

Beck Road in the City of Novi is not listed in the 2030 RTP or current TIP. Determining what improvements may be needed and being placed on the RTP, even if the projects never actually occur, is an important step in ensuring that the City gets a fair shot at available funding should Beck Road need to be widened in the future.

3.0 RESIDENT INPUT AND FEEDBACK

There were two public informational sessions held during the preparation of this report. An open-house style meeting was held on October 3, 2006, at the Police Training Center; a more formal presentation was given on November 2, 2006, in the Council Chambers. During the first meeting, a slideshow was presented detailing the current and predicted traffic counts, as well as potential short- and long-term geometric configurations being considered for Beck Road.

At the October 3, 2006 meeting, feedback was solicited regarding which long-term cross sections were most appealing to the residents. FTC&H and the City received feedback, input, insightful comments, and recommendations from residents. In general, it was felt that pavement condition and intersection improvement should be carried out over the next several years, with any major widening of Beck Road to be evaluated in the future, after the effect of intersection improvements and actual growth were better known.

Figures 5, 6, and 7, as well as Appendix 9 include information from the October 3, 2006, public meeting.

The November 2, 2006, meeting presented more detailed short- and long-term options, with paving and intersection upgrades emphasized as the preferred short-term recommendation, while the long-term capacity improvements (adding lanes between intersections) were presented as potential options to be reexamined in the future, after the short-term improvement impacts are gauged and actual area growth known. The time frame for the short-term improvements was given as 1 to 6 years, and the long-term options as 15 to 25 years. Several concerns were raised regarding impact the long-term improvements would or might have on the residents in the area; these concerns are summarized in Figure 8. Overall, residents are in favor of short-term condition and capacity improvements as presented.

Sections 5 through 7 of this report detail the short-term condition recommendations, short-term capacity recommendations, and long-term capacity options.

4.0 ENGINEERING EVALUATION

The long-term roadway cross sections listed in Table 3 are referred to as options, as they are some of several possibilities proposed to improve capacity. They are listed as the preferred options because, within the framework of this study, they make the most sense from an engineering and planning perspective: a section with two through lanes in each direction offers greater capacity per dollar spent than other options reviewed.

The short term condition and capacity options presented are known as "3R" work by MDOT and SEMCOG, which stands for resurfacing, restoration, and rehabilitation. Full reconstruction that modifies the cross section of the roadway, such as adding lanes, is known as "4R" work; 4R is not an acronym; rather it stands for the "4th R", reconstruction. All short- and long-term improvements listed are eligible for funding; a funding application must be submitted, and it can take time to receive the funds.

During the preliminary stages of the study, the scoping committee met and various potential options for the future of Beck Road were discussed and evaluated. Major options reviewed were also presented at the October 3, 2006, public information meeting. The residents in attendance reported that while congestion was bad at times, they desired that options other than expansion be explored as well. Options such as: finding ways to reduce traffic, reducing the speed limit, eliminating trucks, noise reduction, and other quality of life items were posed at the meeting. These are goals that can be explored, although the purpose of this study is long-range planning and assumes that current trends and traffic needs on Beck Road will continue. A reduction of vehicles would be dependant on shifting traffic to other roadways, which would require a separate study and evaluation of the residents along that corridor.

4.1 SHORT-TERM CAPACITY EVALUATION

In the earliest discussions, intersection improvements were part of the long-term capacity options. The scoping committee determined that the short- and long-term options be considered separately, which would allow for a staged implementation of the improvements. This would spread the costs over several years, and allow for improvements to be made in the interim without waiting until the full sections were needed in 15 to 25 years.

The primary benefit of intersection improvements is an increase in overall capacity through the intersection; turning movements as well as through vehicles clear the intersection faster. The improvements considered the intersection as a whole; not just Beck Road. By providing a right-turn lane on the intersecting street (e.g., Eleven Mile), traffic from the side road clears the intersection faster, allowing for increased green traffic signal time on Beck Road, which in turn further increases the capacity of the Beck legs of the intersection.

4.2 LONG-TERM CAPACITY EVALUATION

To narrow the range of options and possible iterations of this study for the long-range options, the intent was clarified: “plan for providing the needed capacity on Beck Road before congestion becomes so great the community is forced to make unplanned changes.” This does not mean that other options should not be explored, however, those investigations are beyond the limits of this study. The desired end result of this study is to present possible long-term capacity options, plan for potential funding, and be prepared for future changes. Whether or not the long-term options presented herein are implemented, the information presented can be used in future decision-making discussions.

The congestion on Beck Road during peak periods is becoming excessive; trends indicate the congestion will continue to worsen. If forecasted trends transpire, Beck Road will have an ADT at the current levels of Grand River Avenue, Novi Road, and Haggerty Road; delays due to congestion will become excessive. South and north of the City, the roadway will be widened to five lanes in approximately 15 to 25 years.

There are sections of Beck Road for which a 3- or 4-lane segment would be viable; ultimately, however, these segments would be restrictive if adjoining sections of Beck Road were improved to 5 lanes or a 4-lane boulevard. As this study is envisioning the eventual widening of the corridor, sections with two through lanes and either a center turn lane or median were developed schematically and estimates prepared. The schematic drawings were developed depicting 12-foot-wide lanes, which is desired but not required under current guidelines; 11-foot lanes are acceptable and, while not a major reduction in cross section impact or expense, could be considered as they maintain the same capacity while generally at a lower speed. Table 5 summarizes the process used in evaluating the various long-term cross sections.

Table 5 – Comparative Analysis of Long-Term Capacity Sections

Cross Section	Capacity	Implementation	Cost ($)
No Change	No improvement	None	Maintain existing
3 lanes (center turn)	No gain in through capacity; reduce left-turn passing flares.	Can likely construct road within existing ROW, pathways will require additional ROW.	Moderate
4 lanes	Improvement in through capacity, but left-turning vehicles present a hazard.	Requires additional ROW to accommodate road and pathways, public support is moderate.	Moderate-High
5 lanes	Greatest increase in through capacity, clears left-turning vehicles.	Requires most additional ROW, lowest public support.	High
4-lane boulevard	Same through capacity as 5 lanes, limited application; median requires turn islands.	Requires most additional ROW, slightly better public support.	Highest

4.3 ROW IMPACTS

It is understood that the City's long-range plan is to have pathways on both sides of Beck Road. If any widening of the roadway occurs, additional ROW will be needed across several parcels. In reviewing the potential ROW impacts, the final desired ROW width was assumed to be 120 feet total. For most parcels impacted, this would affect a relatively small portion of the front yard, although for other parcels the take is a relatively large percentage of the total property. The relative impacts were not evaluated as part of this study, however, the impact on the use or overall value of a property would be required in performing a property assessment.

The necessary steps in obtaining ROW can be summarized as follows:

1. Determine the ROW requirements.
2. Survey the area, if necessary.
3. Prepare the easement/ROW descriptions and exhibits.
4. Draft the legal documents (attorney input required).
5. Negotiate with the property owners.
6. Convey/purchase the property.
7. File the recorded documents.

This can be a very long process as owner support or resistance can determine whether a project proceeds. Once it has been determined that ROW will be needed, the process should be initiated as quickly as possible.

4.4 UTILITY INFORMATION

Utility information was requested and received from known aboveground and underground utility companies with facilities in the area. There are electric, cable television, and telephone utilities with facilities mounted on poles, and natural gas and telephone utilities underground within or adjacent to the Beck Road ROW. Refer to Appendix 10 for a listing of known utility companies, sample information request correspondence, and information received from each company.

Based on the information received, it appears that a majority of the utilities that would be impacted by proposed work are within the existing ROW. This is important to consider because if a company is required (or wishes) to relocate their utility due to roadway construction or expansion, and the utility is located within the public ROW, the relocation is generally at the utility's expense. If the utility is located outside of the existing ROW in an easement, and is required to be relocated, the expense would be the responsibility of the City.

Any utility relocation requires extensive planning on the part of the City and the utility involved. Involving the utility companies as early as possible in the design phase of any project helps to establish a timeline for relocation and ensure the project can proceed without delays.

4.5 GEOTECHNICAL INFORMATION

As part of this scoping study, pavement corings and soil borings were obtained by SOMAT Engineering, Inc., and a geotechnical report was prepared. The report was referenced in preparing the cost estimates in this study, and will be utilized for future design and estimating purposes.

In general, the existing aggregate base, subbase, and subgrade do not meet guidelines for new construction, but should be adequate for reconstruction provided areas of poor soils are replaced as they are encountered during construction, and underdrains are added to any widened areas. This area is characterized by silty and clayey soils, which perform poorly when not drained. Specific comments are provided in the long-term capacity improvement section of this report, as well as in the geotechnical report in Appendix 11.

The following sections present a discussion of the preferred short- and long-term condition and capacity options for Beck Road from Eight Mile Road to south of Grand River Avenue. Cost estimates can be found in Appendix 6; Figures 9 through 16A present schematic drawings of the potential capacity improvements.

5.0 SHORT-TERM CAPACITY IMPROVEMENTS

The recommended intersection improvements will help alleviate the backups currently experienced during morning and evening peaks. This will result in less delay, reduced driver frustration, and fewer accidents by separating turning vehicles from the through lanes.

For each intersection, the existing lane configuration is different – some have a combined through and right-turn lane, and others have separate right-turn lanes. All intersections currently have a left-turn lane. The recommended improvements presented in Table 2 are repeated in Table 6 below.

The figures for each intersection depict the approximate lane configurations and ROW impacts, and the estimates list the anticipated work items and current year costs.

Table 6 - Short-Term Intersection Capacity Improvements

Intersection	Time frame (years)	Improvements	Estimate (2006 dollars)	Notes
10 Mile	1-4	Add dedicated right-turn lanes to NB, SB, and EB legs; extend WB right-turn and EB left-turn lanes.	$405,600	ROW impacts in all four quadrants.
9 Mile	2-5	Extend existing dedicated NB right-turn lane.	$36,000	ROW impact on two parcels.
11 Mile	5-10	Add dedicated right-turn lanes to EB and WB legs.	$238,000	ROW impact in SW quadrant.
8 Mile	5-15	Add dedicated right-turn lane to SB leg.	$216,000	To coordinate with section south of 8 Mile.

For future-year inflation factor estimates refer to Appendix 7.
Estimate includes approximate cost of ROW acquisition.

5.1 EIGHT MILE ROAD INTERSECTION

The west half of the north leg of the Eight Mile Road intersection is within the City; the eastern half within the City of Northville, and the leg south of Eight Mile Road within Northville Township. The City of Northville has previously been receptive to participating in improvements to the portion of Beck Road that lies within their jurisdiction; however, the level of participation will need to be confirmed in the future once a project scope has been approved.

Beck Road south of Eight Mile Road is under the control of the Wayne County DPS. In the SEMCOG 2030 RTP, Beck Road south of Eight Mile Road is indicated to become five lanes. This was discussed with Mr. Ken Kucel of the Wayne County DPS and the proposed plan was confirmed. The timeline of this expansion is unknown, other than to be more than 10 years in the future. There are significant ROW

needs and some challenging terrain that will have to be addressed before the roadway is designed and issued for construction.

Eight Mile Road itself is under the control of the RCOC; any improvements to this road will be completed under their authority. The upgrades within the City should be discussed and coordinated with the RCOC and the City of Northville. As this is a shared jurisdiction, the costs for upgrades can be shared as well.

The proposed improvements to the north leg of the intersection include adding a SB right-turn lane, and increasing the radius of the NE quadrant. Traffic counts obtained for this intersection did not include turning movements; however, based on observations, SB backups at Eight Mile Road are primarily due to through vehicles, not turning movements.

Refer to Figure 9 for a schematic of the proposed intersection improvements and traffic movements.

5.2 NINE MILE ROAD INTERSECTION

NB and SB Beck Road at Nine Mile Road already have dedicated right-turn lanes. The EB and WB legs are three lanes without dedicated right-turn lanes.

Based on traffic counts and observation, Beck Road flows fairly well through Nine Mile Road; however, the NB right-turn lane is very short, causing some delay, and should be extended. Based on MDOT Geometric Guidelines, the turn lane should be 250 feet with a 130-foot taper.

Based on observation, vehicles on the EB and WB legs of Nine Mile Road primarily turn north or south. The addition of a dedicated right-turn lane does not appear warranted.

Refer to Figure 10 for a schematic of the proposed intersection improvements and traffic movements.

5.3 TEN MILE ROAD INTERSECTION

The Ten Mile Road and Beck Road intersection has high volume for both north-south and east-west traffic. Only the WB leg has a dedicated right-turn lane and backups occur during peak as well as non-peak periods, primarily on the north and south legs of the intersection.

The three legs that do not have right-turn lanes (NB, SB, and EB) should have full-length turn lanes and tapers added. The existing right-turn lane on the WB leg has a short taper due to a commercial drive just east of the intersection. This turn lane should be extended through the commercial drive entrance to allow for greater storage.

The signal at the intersection will need to be relocated due to the widening of three quadrants and should be replaced with a controller and heads providing exclusive left- and right-turning signals. Improvements at this location would achieve a significant reduction in delay through the intersection, however, the increase in flow may require signal modifications at adjacent intersections to accommodate larger groups of vehicles at a time.

Refer to Figure 11 for a schematic of the proposed intersection improvements and traffic movements.

5.4 ELEVEN MILE ROAD INTERSECTION

On average, the EB and WB movements through the Beck Road at Eleven Mile Road intersection are not as heavy as at Ten Mile Road. The morning and evening peak periods, however, are significant, particularly in the WB direction, through traffic and right-turning vehicles queue for several minutes.

The NB and SB legs have existing right-turn lanes, but the EB and WB legs do not. Dedicated right-turn lanes should be added to the EB and WB lanes to alleviate congestion and reduce wait times.

Refer to Figure 12 for a schematic of the proposed intersection improvements and traffic movements.

6.0 SHORT-TERM CONDITION IMPROVEMENTS

Based on the likelihood that any expansion of Beck Road inside or outside the City will not occur for 10 to 15 years, the existing road surface must be repaired and maintained. The work necessary for each section will need to be evaluated at the time the work is proposed to occur. The work type and estimates presented in Table 2 (on page 4of this report) are sorted based upon current pavement condition and expected work.

Beck Road from Eight to Nine Mile Road has a PASER rating of 2 (poor) and has relatively thin (3- to 4-inch) pavement in poor condition with poor underlying base material. The northern half of this section received a thin overlay in 2005, which improved the appearance and reduced noise levels, but a useful life of only 5 years is expected. Beck Road from Ten Mile to Eleven Mile Road has a similar pavement section and has a PASER rating of 2-3 for the southern 0.75 mile, and a rating of 7 for the northern portion, which was paved within the last 5 years. Surface repairs and a full depth overlay should be performed for these sections of Beck Road, resulting in a 15 to 20 year lifespan, provided regular maintenance is performed.

The remaining sections, Nine to Ten Mile Road, and Eleven to Grand River Avenue are generally in better condition, have been recently improved, and/or have thicker (4- to 6-inch) pavement sections. These sections can be milled and overlaid with good results expected to last 15-20 years.

7.0 LONG-TERM CAPACITY IMPROVEMENTS

Within the City, continual development and growth has lead to the point where the City is approaching "build-out", where much less growth is possible due to most of the available land having been developed for commercial or residential uses. At build-out, increased traffic on Beck Road would not be due to changes within the City, but rather growth occurring in other communities and a result of commuter and pass-through traffic. If Beck Road is widened to five lanes in communities north and south of the City to meet the demand, it can be assumed that demands within the City will also increase, regardless of development within Novi.

For the purposes of this study, is was assumed that, at some point, it will be desired for the capacity of Beck Road to be increased, and various options were reviewed. Other options, such as reducing capacity or improving other corridors could also be evaluated, but are beyond the focus of this study. For planning purposes, sections that provided two through lanes in each direction were developed with schematic plans and estimates prepared. This information can be used to establish Beck Road with the City on the SEMCOG 2030 RTP.

Table 3 from the Executive Summary is repeated below as Table 7 and summarizes the recommended option for each segment.

Table 7 - Long-Term Capacity Improvements

Segment	Section	Estimate (2006 dollars)	Parcels affected (ROW needs)	Notes
8 to 9 Mile	5 lanes	$3,215,000	28	The eastern half of the southern half mile is in the City of Northville
9 to 10 Mile	5 lanes at the mile roads, a 4-lane boulevard for the middle 3,200 feet	$3,153,500	18	
10 to 11 Mile	5 lanes at the mile roads, a 4-lane boulevard for the middle 3,500 feet	$3,418,000	6	
11 Mile to Grand River	5 lanes	$1,826,000	13	

For future-year inflation factor estimates refer to Appendix 7.
Estimates include the approximate cost of ROW acquisitions.

The following sections present a discussion of each portion of Beck Road from Eight Mile Road to south of Grand River Avenue. Cost estimates can be found in Appendix 6 and Figures 13A through 16 present schematic drawings of the preferred long-range options.

7.1 EIGHT MILE ROAD TO NINE MILE ROAD

This portion of Beck Road is characterized by flat to gently rolling terrain; it is generally open with few trees adjacent to the roadway. The eastern portion of the southern half mile is within the City of Northville; approximately 25% of the estimated cost may be shared with Northville depending on the work proposed and agreements between the cities. The pavement in the southern portion is very poor with a 2004 PASER rating of 3. The northern half mile received a thin overlay by the Novi DPW in the fall of 2005. The overlay is performing well and the roadway appears to be stable despite the poor base material encountered in the geotechnical review.

7.1.1 ROADWAY SECTION

There are several (approximately 20) private drives and 2 subdivision entrances along Beck Road. The number and spacing of drives would make for a choppy boulevard section; therefore, a continuous 5-lane section is recommended.

7.1.2 ENVIRONMENTAL CONCERNS

There were three areas identified as wetlands within the project limits. It appears that at least two areas could be affected by roadway reconstruction, all three could be affected if pathway construction is considered. Refer to the schematic drawings for locations and Appendix 8 for descriptions of the wetland areas.

7.1.3 GEOTECHNICAL INFORMATION

The soil borings for this portion of Beck Road generally show 3 to 4 inches of HMA over compacted base material. The base material is not a typical road base material (crushed stone, sand, and small amounts of silt), rather, it is native or imported material with concentrations of silt, clay, and organic material (topsoil or peat) considered too high for road base material. This material holds excessive moisture; several borings indicate moisture content (percentage of total weight) in the vicinity of 20%, more than double what is considered the high end of acceptable.

There are also some areas with organic material at the bottom of the boring which is likely to have originated from native material left in place. In general, it is recommended that the existing base material be removed and replaced with 8-inches of MDOT 22A (or similar), and the subgrade removed and replaced with embankment, and with 18-inches of subbase in areas where organic materials are present or water content is very high. Refer to the full geotechnical report in Appendix 11.

Near Nine Mile Road, there is a wetland area on the west side that will be of concern during design and construction. Full-depth subgrade undercut (4 to 5 feet in depth) and backfill should be assumed for this area.

7.1.4 ROW IMPACTS

Approximately 28 parcels will be impacted. The ROW adjacent to unplatted areas is generally 33 feet from the section line (66 feet total); the ROW adjacent to platted areas is 60 foot (120 feet total). To obtain the desired 120-feet-total-width for all areas, a 27-foot-wide strip would need to be acquired from most affected parcels. Approximate areas of affected parcels are shown on the schematic drawings, and an analysis of the existing ROW can be found in Appendix 12.

7.1.5 PATHWAYS

On the west side of the roadway, the 8-foot-wide pathway would be built primarily in acquired ROW. There are several areas of landscaping and wooded areas which may require some alignment shifts. It is assumed that the 5-foot pathway will not be constructed on the Northville portion of Beck Road. There is existing pathway along the southern half of the remaining 0.5 mile; the remainder would be constructed in acquired ROW.

7.1.6 DESIGN AND CONSTRUCTION CONCERNS

There is a series of three cross culverts just south of Stratford Lane, which is just north of the halfway point between Eight Mile Road and Nine Mile Road. The culverts appear to be 2-foot by 3-foot corrugated metal; however, they were buried in such a manner that positive measurement was impossible. These culverts will need to be replaced; based on their proximity to wetland areas, an MDEQ wetlands permit may be required. It appears these are equalization culverts and not flowing at most times, so a hydraulic study may not be required.

Because the existing section is two lanes with a narrow shoulder, maintaining traffic while working will require a lane closures and potentially detours. Deep undercut areas will be safety concerns, and dust generated by vehicles may be an nuisance to adjacent homeowners. Noise and lack of access will be a concern to residents as well.

7.2 NINE MILE ROAD TO TEN MILE ROAD

This portion of Beck Road is characterized by rolling terrain and varies from open with few trees adjacent to the roadway, to wooded areas close by. The pavement in the southern 0.75 mile is poor with a 2004 PASER rating of 3; most of the remainder is in good condition with a PASER of 7.

7.2.1 ROADWAY SECTION

There are approximately eight private drives and seven subdivision entrances along Beck Road. The private drives are fairly close together in the center portion of this section and could be served by one or two crossovers, therefore, this section is considered a candidate for a narrow (20-foot) median boulevard section. The boulevard would begin north of the Beckenham Boulevard subdivision entrance and continue north to just south of Totenham Court. This allows for free access to the subdivisions served by those roads, and for the left-turn tapers and lanes at the mile roads.

7.2.2 ENVIRONMENTAL CONCERNS

There were four areas identified as wetlands which may potentially be impacted within the project limits. It appears at least two of the areas could be affected by roadway reconstruction as well as pathway construction. Refer to the schematic drawings for locations and Appendix 8 for descriptions of the wetland areas.

7.2.3 GEOTECHNICAL INFORMATION

The soil borings for this portion of Beck Road generally show 4 to 6 inches of HMA over compacted base material. It appears engineered fill was used as base material in most locations, but is typically placed directly over native dense clay base material. This section of the roadway is likely trapping water in some locations, although with adequate underdrain, the existing base material can perform well. It should be anticipated that the top 6 to 8 inches of base material will be removed and replaced with subbase undercuts in areas of organic concentration. Refer to the full geotechnical report in Appendix 11.

There are several wetland areas near or within the proposed ROW area. Full-depth subgrade undercut and swamp backfill should be assumed for the widening in these areas.

7.2.4 ROW IMPACTS

Approximately 18 parcels will be impacted. The ROW adjacent to unplatted areas is generally 33 feet from the section line; the ROW adjacent to platted areas is 60 feet. To obtain the desired 60 feet for all areas, a 27-foot-wide strip would need to be acquired from most affected parcels. Approximate areas of affected parcels are detailed on the schematic drawings, and an analysis of the existing ROW can be found in Appendix 12.

7.2.5 PATHWAYS

On the west side of Beck Road, the existing 8-foot-wide pathway ends approximately 0.25 mile north of Nine Mile Road. The remaining portion would be constructed across several acquired parcels and adjacent to or over two wetland areas (likely to be boardwalks). The 5-foot-pathway on the east side is almost complete for the entire mile, the only gap being the northernmost 250 feet. This portion would be constructed in acquired ROW.

7.2.6 DESIGN AND CONSTRUCTION CONCERNS

Maintaining traffic will be a challenge and will require several stages to construct the widened areas of the roadway first, removing the existing roadway to form the median last. Areas of undercut, while not expected to be as extensive as those south of Nine Mile Road, will need to be brought back close to grade before traffic can operate without requiring concrete barrier. Noise and lack of access will be a concern to residents as well.

7.3 TEN MILE ROAD TO ELEVEN MILE ROAD

This portion of Beck Road is characterized by gently rolling terrain and varies from open with few trees adjacent to the roadway, to wooded areas close by. The pavement in the southern 0.75 mile is poor, with a 2004 PASER rating of 3; most of the remainder is in good condition with a PASER of 7.

7.3.1 ROADWAY SECTION

There are approximately 12 private drives, 5 subdivision entrances, and 2 commercial drives along Beck Road. The private drives are fairly close together in the northern portion of this section and could be served by one or two crossovers; therefore, this section is considered a candidate for a narrow (20-foot) median boulevard section. The boulevard would begin north of the Ashley Boulevard subdivision entrance and continue north to just south of Sierra Drive. This allows for free access to the subdivisions served by those roads and for the left-turn tapers and lanes at the mile roads.

7.3.2 ENVIRONMENTAL CONCERNS

There were three individual areas identified as wetlands within the project limits. One connects to a larger wetland on the west side of Beck Road and the remaining two are part of wetland areas larger than five acres. It appears at least two areas could be affected by roadway reconstruction; all four could be affected if pathway construction is considered. Refer to the schematic drawings for locations and Appendix 8 for descriptions of the wetland areas.

7.3.3 GEOTECHNICAL INFORMATION

The borings for this portion of Beck Road generally show 3.5 to 4 inches of HMA over compacted base material. It appears that engineered fill was used as base and subbase material in most locations. The existing aggregate base and subbase can mostly remain in place, with widening adjacent to the existing roadway section. It should be anticipated that there will be subbase undercuts in areas of organic concentration. Refer to the full geotechnical report in Appendix 11.

There are several wetland areas near or within the proposed ROW area. Full-depth subgrade undercut and swamp backfill should be assumed for the widening in these areas.

7.3.4 ROW IMPACTS

Approximately 6 parcels will be impacted; most are large parcels and not individual houses. The ROW adjacent to unplatted areas is generally 33 feet from the section line; the ROW adjacent to platted areas is 60 feet. To obtain the desired 60 feet for all areas, a 27-foot-wide strip would need to be acquired from most affected parcels. Approximate areas of affected parcels are detailed on the schematic drawings, and an analysis of the existing ROW can be found in Appendix 12.

7.3.5 PATHWAYS

The west side of Beck Road has a partially-constructed 8-foot-wide pathway. There is an 800-foot-gap at Ten Mile Road; a 400-foot break in the middle, due to wetland and ROW conflicts; and the northern 1,300 feet is incomplete due to a lack of ROW. The proposed path would be built in acquired ROW. It should be noted that a portion of an existing boardwalk would need to be removed and reconstructed to clear the proposed widening.

7.3.6 DESIGN AND CONSTRUCTION CONCERNS

Maintaining traffic will be a challenge and will require several stages to construct the widened areas of the roadway first, removing the existing roadway to form the median last. A partial or complete detour will likely be required during undercut operations or construction adjacent to wetland areas. Noise and lack of access will be a concern to residents as well.

7.4 ELEVEN MILE ROAD TO SOUTH OF GRAND RIVER AVENUE

This portion of Beck Road is flat and open adjacent to the roadway. From Eleven Mile Road to Grand River Avenue is approximately 3,500 feet; the northern 1,100 feet has been newly widened to five or more lanes due to construction at the Providence Hospital site and the construction of the interchange with I-96. The pavement in the southern 2,400 feet of Beck Road is fair to poor with a 2004 PASER rating of 4.

7.4.1 ROADWAY SECTION

This portion of Beck Road is fairly short and, after allowing for turning movements at Eleven Mile Road and the influence of development at Providence Park, any boulevard section would be very short. A continuous 5-lane section is recommended.

7.4.2 ENVIRONMENTAL CONCERNS

There were five wetland areas identified; it appears two wetland areas on the west side of Beck Road could be potentially impacted within the project limits. It appears both of the areas could be affected by roadway reconstruction as well as pathway construction. Refer to the schematic drawings for locations and Appendix 8 for descriptions of the wetland areas.

7.4.3 GEOTECHNICAL INFORMATION

The soil borings for this portion of Beck Road generally show 4 to 7 inches of HMA over compacted base material. It appears engineered fill was used as base and subbase material in most locations. The existing aggregate base and subbase can mostly remain in place, with widening adjacent to the existing roadway section. Refer to the full geotechnical report in Appendix 11.

There are several wetland areas near or within the proposed ROW area. Full-depth subgrade undercut and swamp backfill should be assumed for the widening in these areas.

7.4.4 ROW IMPACTS

Approximately 13 parcels will be impacted. The ROW is generally 33 feet from the section line on both sides of the road, with the exception of several adjacent parcels near Eleven Mile Road. To obtain the desired 60 feet for all areas, a 27-foot-wide strip would need to be acquired from most affected parcels. Approximate areas of affected parcels are detailed on the schematic drawings, and an analysis of the existing ROW can be found in Appendix 12.

7.4.5 PATHWAYS

On the west side of Beck Road, the proposed 8-foot-pathway would be constructed across several acquired parcels and adjacent to or over two wetland areas (likely to be boardwalks). The 5-foot pathway on the east side is incomplete with the southern 1,300 feet not constructed. This portion would be constructed in acquired ROW.

7.4.6 DESIGN AND CONSTRUCTION CONCERNS

Maintaining traffic will not be as significant a concern as some of the other segments. The existing roadway base appears stable and should not require many undercuts or removals; additionally, there are not as many residents along this area. However, dust and delays will still be a concern and should be planned for during design.

8.0 IMPLEMENTATION PLAN

8.1 SHORT-TERM ACTIVITIES

The first step includes getting Beck Road on the RTP with the Oakland County Federal Aid Committee and SEMCOG to ensure the timing of upgrades are coordinated with surrounding areas. The short-term condition and capacity improvements should be explored immediately. Paving the existing roadway is a maintenance issue; in the interest of preserving the existing roadbed and in response to resident complaints should occur as soon as possible.

A safety upgrade that could be considered for most sections of Beck Road is to add a 3-foot-wide paved shoulder. In many locations the lane line is at the edge of the pavement. Adding a paved shoulder will contribute to the overall stability of the roadway, and enhance the safety for slightly errant vehicles.

The intersection improvements described can be funded 80/20 (80% grant, 20% local match) through the CMAQ. This funding is earmarked to reduce congestion, as well as the corresponding pollution and ozone impacts; however, the application must be made through SEMCOG. Another initial step is to respond to the RCOC 2010-11 Call for Projects, which will put Beck Road “in line” for 80/20 federal funding. These grants can be used for all aspects of the roadway improvements, including ROW acquisition.

This scoping report can be the background for initial funding requests, and may be expanded in the future. The proposed work in this study should be examined in the future, as standards may have changed; the estimates should also be reviewed based on construction material trends, real estate costs, and general inflation.

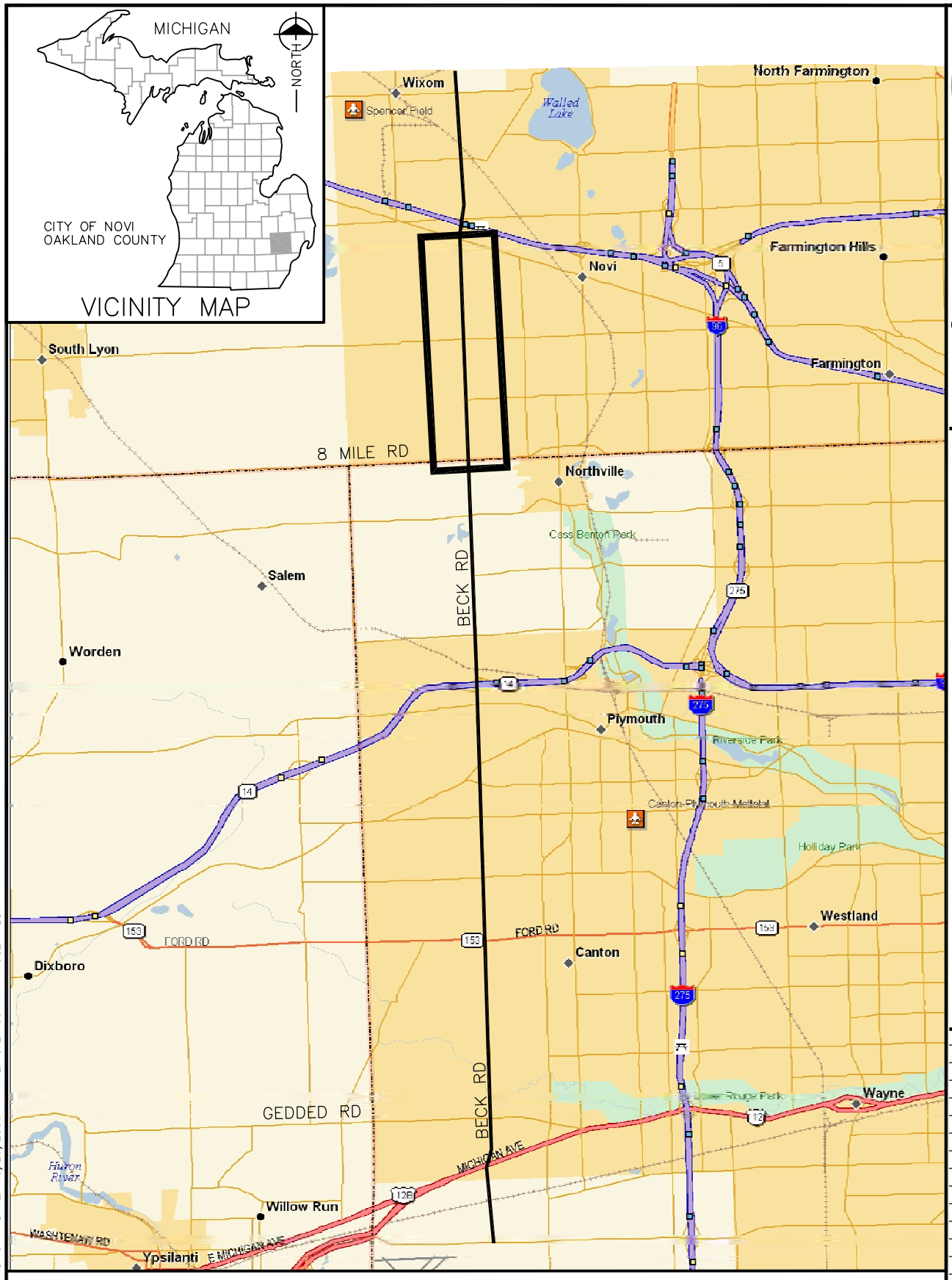
8.2 LONG-TERM

Assuming that the short-term intersection improvements are implemented, congestion at intersections during peak periods will be reduced; however, the effect will diminish over time as more traffic uses Beck Road. When it is felt that the overall capacity of the Beck Road corridor may need to be increased, a full traffic impact study should be performed. This will evaluate Beck Road in relation to other surrounding roads, growth trends in and around the City, and potential improvements that could be performed elsewhere to alleviate some of the Beck Road congestion.

Keeping the corridor on the long-range RTP is critical. If the time frame for potential improvements changes, the roadway plan in the RTP should be updated every five years, or as directed by SEMCOG. At regular intervals, the performance of previous improvements should be monitored and reflected in the

SEMCOG RTP, as well as in City budgeting sessions. Keeping the road in the planning documents ensures that other communities are aware of what the City is considering and keeps the project(s) in line for available funding. This study should be referenced in the future, updated, and kept as current as possible to reflect the current position and opinion of the Engineering Department, City Council, and residents of Novi.

Figures



REFERENCE:
DeLORME STREET ATLAS
USA – 2006

REGIONAL AND SITE LOCATION MAP

fishbeck 50 years

engineers
scientists
architects
constructors

City of Novi
Novi, Michigan

Beck Road Scoping Project

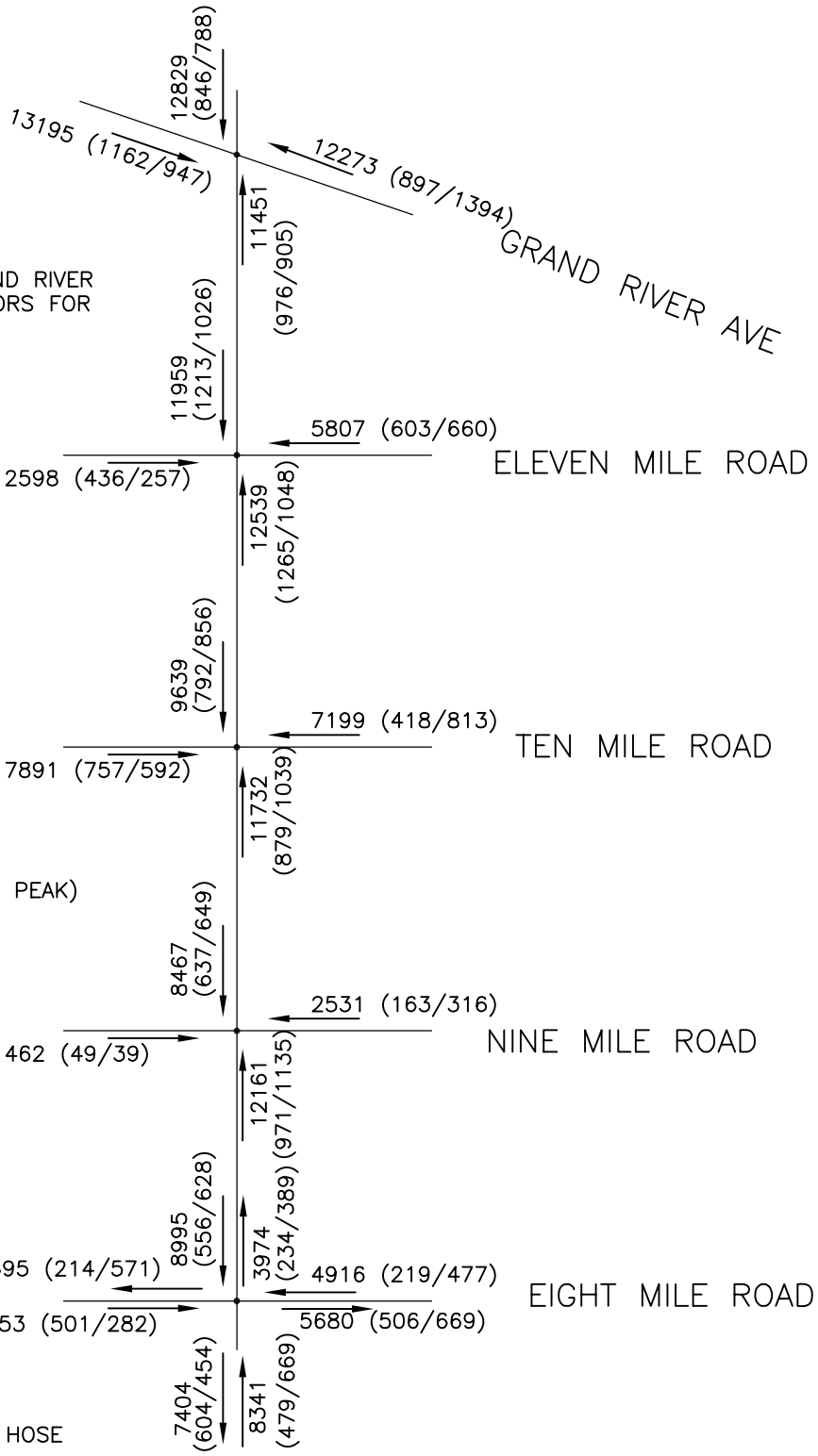
PROJECT NO.
G06496

FIGURE NO.
1

PLOT INFO: N:\06496\CD\FIG-1.DWG DATE: 10/26/2006 TIME: 9:27:56 AM USER: BDR

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fishbeck, thompson, carr & huber, inc.



NINE MILE NORTH THRU GRAND RIVER
COUNTS FROM OCRC DETECTORS FOR
THURSDAY, MAY 18, 2006

KEY:
24HR TOTAL (A.M. PEAK/P.M. PEAK)

EIGHT MILE AT BECK
COUNTS FROM CITY OF NOVI HOSE
DETECTORS FOR
THURSDAY, AUGUST 24, 2006

NORTH

BECK ROAD TRAFFIC COUNT

NO SCALE

fishbeck 50 years

engineers
scientists
architects
constructors

CITY OF NOVI
BECK ROAD SCOPING

EXISTING TRAFFIC DATA

PROJECT NO.
G06496

FIGURE NO.
2

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FIGURE 3

fic&h

BECK ROAD
8 MILE - GRAND RIVER
ACCIDENTS
SPEEDING/COMMERCIAL VEHICLE CITATIONS
August 1, 2005 - July 31, 2006

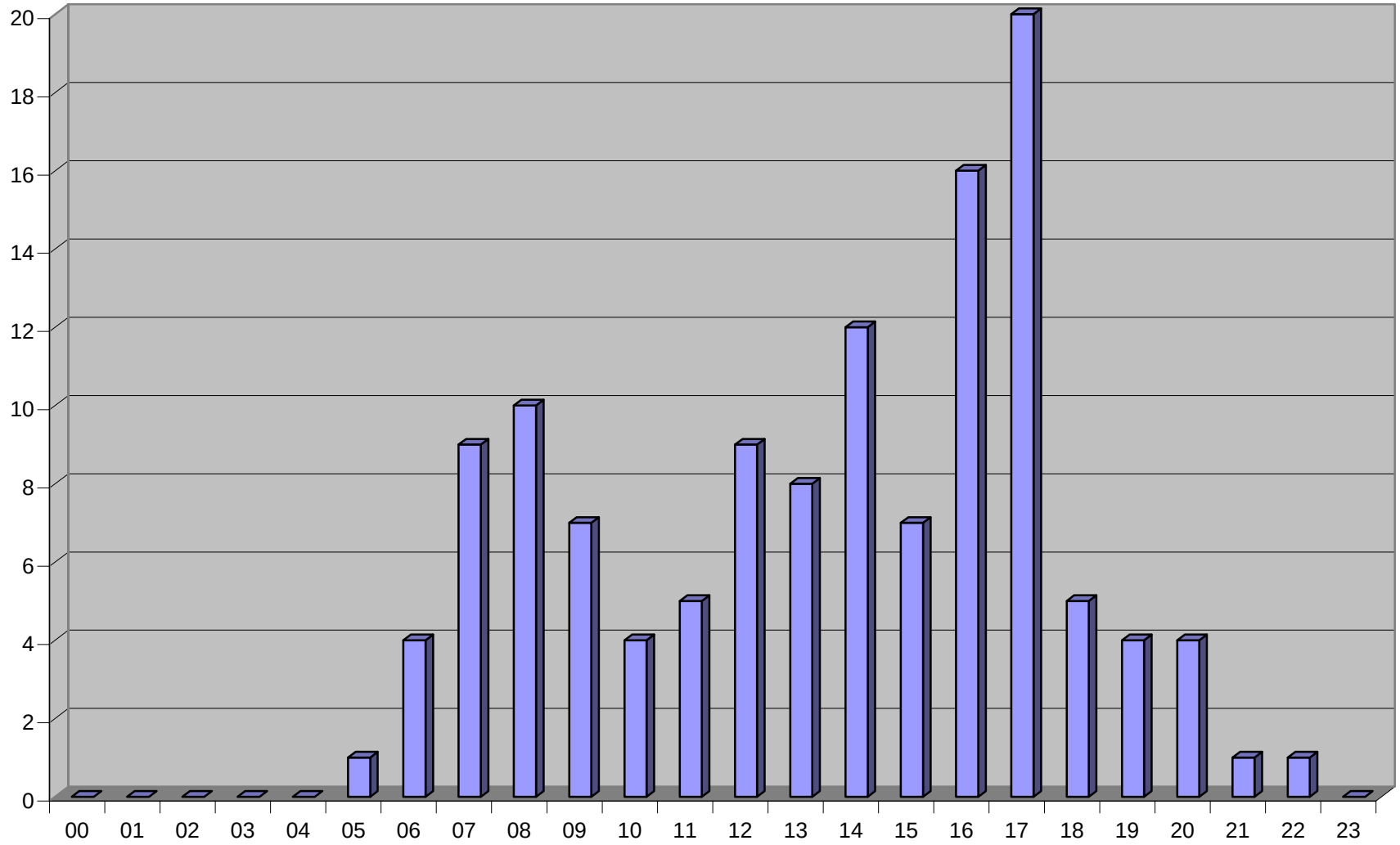
	ACCIDENT	INJURY ACCIDENT	CAR/BIKE	CAR/DEER	HIT & RUN	TOTAL	SPEEDING CITATIONS	COMMERCIAL VEHICLE CITATIONS	TOTAL
8 MILE	7	2	0	0	0	**9**	67	19	**86**
STRATFORD	0	0	0	2	0	**2**	111	38	**149**
BELLAGIO	0	0	0	0	0	**0**	45	7	**52**
9 MILE	5	2	1	0	1	**9**	138	84	**222**
BECKENHAM	0	0	0	0	0	**0**	39	3	**42**
SUNNYBROOK	0	0	0	0	0	**0**	30	0	**30**
CHELTENHAM	0	0	0	0	0	**0**	47	15	**62**
WHITE PINES	1	0	0	0	0	**1**	63	40	**103**
EDINBOROUGH	0	0	0	0	0	**0**	26	4	**30**
IROQUOIS	0	0	0	0	0	**0**	1	0	**1**
TOTTENHAM	0	0	0	0	0	**0**	26	4	**30**
BAKER	1	0	0	0	0	**1**	9	10	**19**
10 MILE	26	6	0	1	2	**35**	171	46	**217**
ASHLEY	0	0	0	0	0	**0**	7	0	**7**
CIDER MILL	2	1	0	2	0	**5**	49	8	**57**
KIRKWAY	0	0	0	1	0	**1**	3	0	**3**
SANFORD	0	0	0	0	0	**0**	20	2	**22**
SIERRA	0	0	0	0	0	**0**	2	0	**2**
11 MILE	6	2	0	1	0	**9**	178	16	**194**
CENTRAL PARK	1	0	0	0	0	**1**	2	0	**2**
GRAND RIVER	43	10	0	0	1	**54**	76	14	**90**
TOTAL	**92**	**23**	**1**	**7**	**4**	**127**	**1,110**	**310**	**1,420**

FIGURE 4

fic&h

BECK ROAD ACCIDENTS BY HOUR

8 MILE - GRAND RIVER **8/1/05-7/31/06**



12/1/2006

J:\06496\REPT\FINAL\FIG03-04_Accidents.xls

FIGURE 5

COMMENTS AND QUESTIONS OBSERVED DURING BECK ROAD PUBLIC INPUT SESSION October 3, 2006

- Was there an analysis of traffic trending for the past five years?
- What was the impact of the M-14/Beck closure and the I-96 interchange opening?
- Is Beck Road a truck route? Why are there so many trucks?
- The issue of speed limits was identified and discussed several time, usually in favor of a lower speed limit.
- Who decides what the cross-section of Beck Road will be?
- There was a discussion of the past proposal to widen Ten Mile Road.
- Why does the data show a decrease in traffic on Ten Mile Road?
- A resident suggested additional traffic signals to decrease accidents.
- A concern was expressed about widening Beck Road in front of Pioneer Meadows because of the number of homes impacted on Beck.
- Why weren't citizens asked to be on the committee? How can they get on the committee?
- Reduce the speed limit to 30 mph on Beck Road.
- Impose weight and truck restrictions.
- The amount of noise from the road must be controlled.
- Wouldn't a three lane road add capacity by allowing turning movements?
- There will never be commercial at Ten Mile and Beck Road.
- What is the objective statement of this study?
- A resident stated that the residents on Beck Road do not want it widened but most others do.
- Why is Beck Road designated as a major road?

By: Brian Coburn 10/4/06

FIGURE 6

SUMMARY OF PREFERRED OPTIONS
Beck Road Public Input Session
October 3, 2006

Response Selection	Number of Responses
3 lanes (1 lane each direction with center turn lane)	4
5 lanes (2 lanes each direction with center turn lane)	5
4 lane narrow boulevard (2 lanes each direction with median)	4
Intersection upgrades (1 lane each direction with safety widening)	13
No improvement other than repaving existing road	1
Multiple responses*	14
No response	6
TOTAL RESPONSES	**47**

*Of multiple responses, the following were chosen:	Number of Responses
3 lanes (1 lane each direction with center turn lane)	9
5 lanes (2 lanes each direction with center turn lane)	2
4 lane narrow boulevard (2 lanes each direction with median)	4
Intersection upgrades (1 lane each direction with safety widening)	14
No improvement other than repaving existing road	7

Response Selection	Total Responses including those with multiple selections
3 lanes (1 lane each direction with center turn lane)	13
5 lanes (2 lanes each direction with center turn lane)	7
4 lane narrow boulevard (2 lanes each direction with median)	8
Intersection upgrades (1 lane each direction with safety widening)	27
No improvement other than repaving existing road	8

FIGURE 7

fTC&h

SUMMARY OF COMMENTS
CATEGORIZED BY RESPONSE
Public Information Meeting - October 3, 2006

Comments	Preferred Alternative						TOTAL
	Intersection Improvements	3-lane Section	5-lane Section	4-lane Boulevard	No Response	Multiple Responses	
Decrease truck traffic	3					6	9
Reduce noise/vibration	4				1	4	9
Improve safety/noise by lowering speed	4	1		1	1	1	8
Consider that Beck is residential/maintain character	3			1	1	2	7
Decrease traffic volume*	4				3		7
Need to improve capacity	2		3	2			7
Improve safety by adding turn lanes	2	1				3	6
Add citizens to the committee to study Beck Road	1			1	2	1	5
Use various cross sections	2			1		1	4
Decrease impact on homes that front on Beck	3						3
Don't add capacity		1				2	3
Look at alternate North-South routes (Napier)	3						3
Provide a map showing where the ROW is limited					3		3
Don’t add non-motorized paths**						2	2
Premature to choose cross-section					2		2
Adding lanes will increase traffic***						1	1
Beck is a major thoroughfare	1						1
Concerned about property values				1			1
Don't design for 3 hours of volume (peak hours)		1					1
Don't listen to just a few, do what's right for City		1					1
Ease traffic flow without widening***	1						1
Find a way to manage peak periods***					1		1
No need for residents on committee, for City Council to decide						1	1
Pavement is in bad condition	1						1
Phase in with intermediate 3-lane section			1				1
Upgrade current road with curbs and drainage						1	1
Use asphalt, not concrete (noise)	1						1

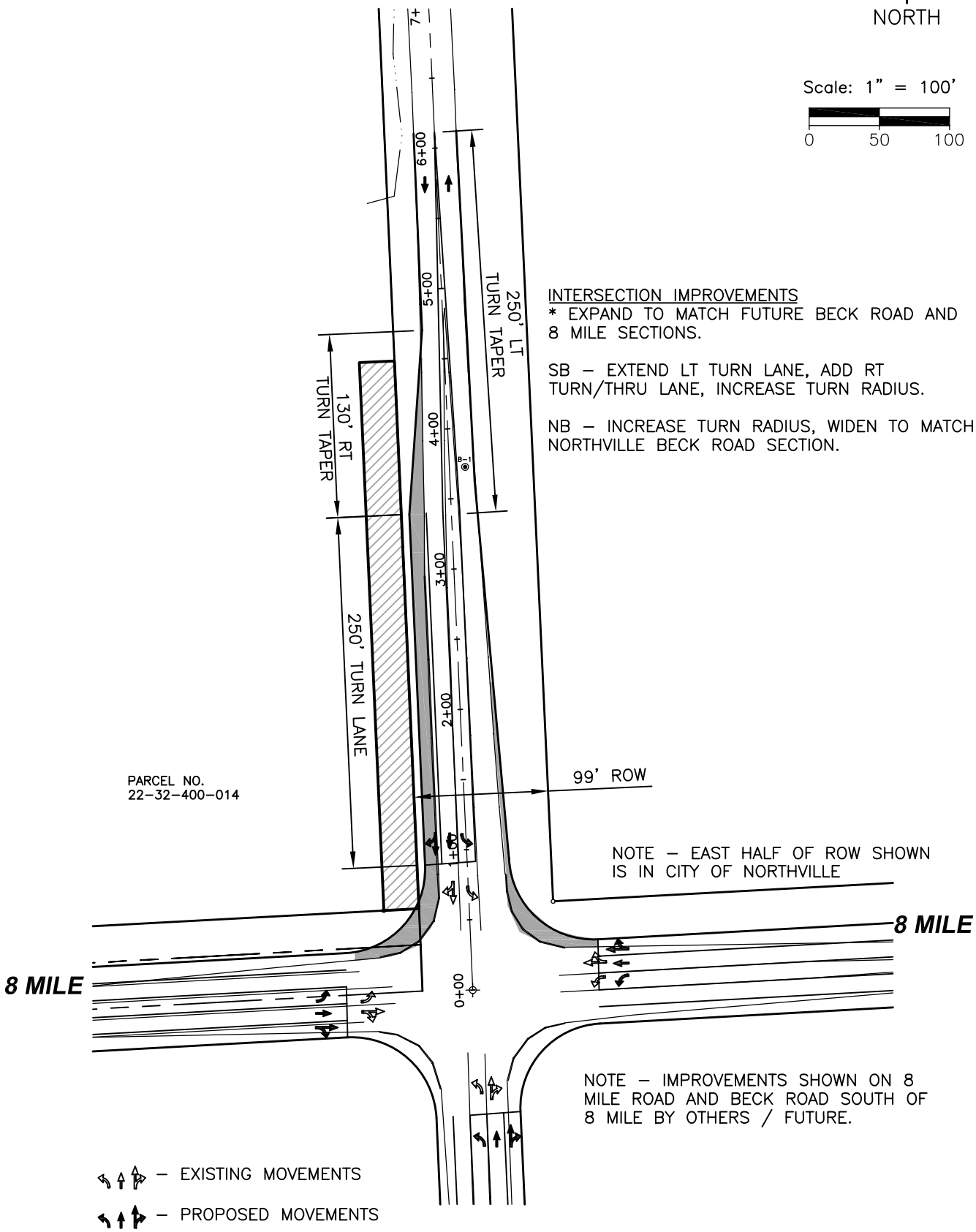
* Only one suggestion provided--alter departure times to decrease traffic.

** The purpose of this may be to reduce ROW needs based on the discussion.

*** Not included in decrease traffic comment

COMMENTS AND QUESTIONS FROM
BECK ROAD PUBLIC INPUT SESSION No. 2
November 2, 2006

- Noise from trucks is a problem now, won't this get worse in the future?
- What can be done to limit trucks? Can the road be reclassified to restrict them?
- It is difficult to turn out of the Cider Mill intersection. What can be done to make this a safer intersection? Can a signal be added and/or speed be reduced on Beck Road?
- The traffic signal timing at the existing signals seems illogical at times.
- What will happen to trees along Beck Road? Can more be added to act as screening? If the road is widened, trees, berms, or walls should be added to act as a buffer.
- Can the short-term improvements happen more quickly than indicated? It seems they would have an immediate positive effect.
- What will happen to the yards of those houses fronting Beck Road if the long-term capacity improvements are made? IT appears there won't be much left of some.
- Can other roads, like Napier, be improved to get traffic away from Beck Road?
- Refuse trucks seem to be violating axle weight restrictions and cause a majority of the damage to residential streets. It would make sense to have a designated hauler instead of several competing trucks entering the subdivisions.
- Would any of the parcels be rezoned with these options?
- Safety is a concern now, how will this be improved with any of the options presented?
- The quality of life for the residents needs to be a top priority. The road should be redesignated at a natural beauty route, similar to Nine Mile or a portion of Halsted in Farmington Hills.
- Find ways to discourage traffic and reduce speed, not encourage both.



INTERSECTION IMPROVEMENTS
* EXPAND TO MATCH FUTURE BECK ROAD AND 8 MILE SECTIONS.

SB – EXTEND LT TURN LANE, ADD RT TURN/THRU LANE, INCREASE TURN RADIUS.

NB – INCREASE TURN RADIUS, WIDEN TO MATCH NORTHVILLE BECK ROAD SECTION.

NOTE – EAST HALF OF ROW SHOWN IS IN CITY OF NORTHVILLE

NOTE – IMPROVEMENTS SHOWN ON 8 MILE ROAD AND BECK ROAD SOUTH OF 8 MILE BY OTHERS / FUTURE.

– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

BECK ROAD AT 8 MILE INTERSECTION

fteh 50 years

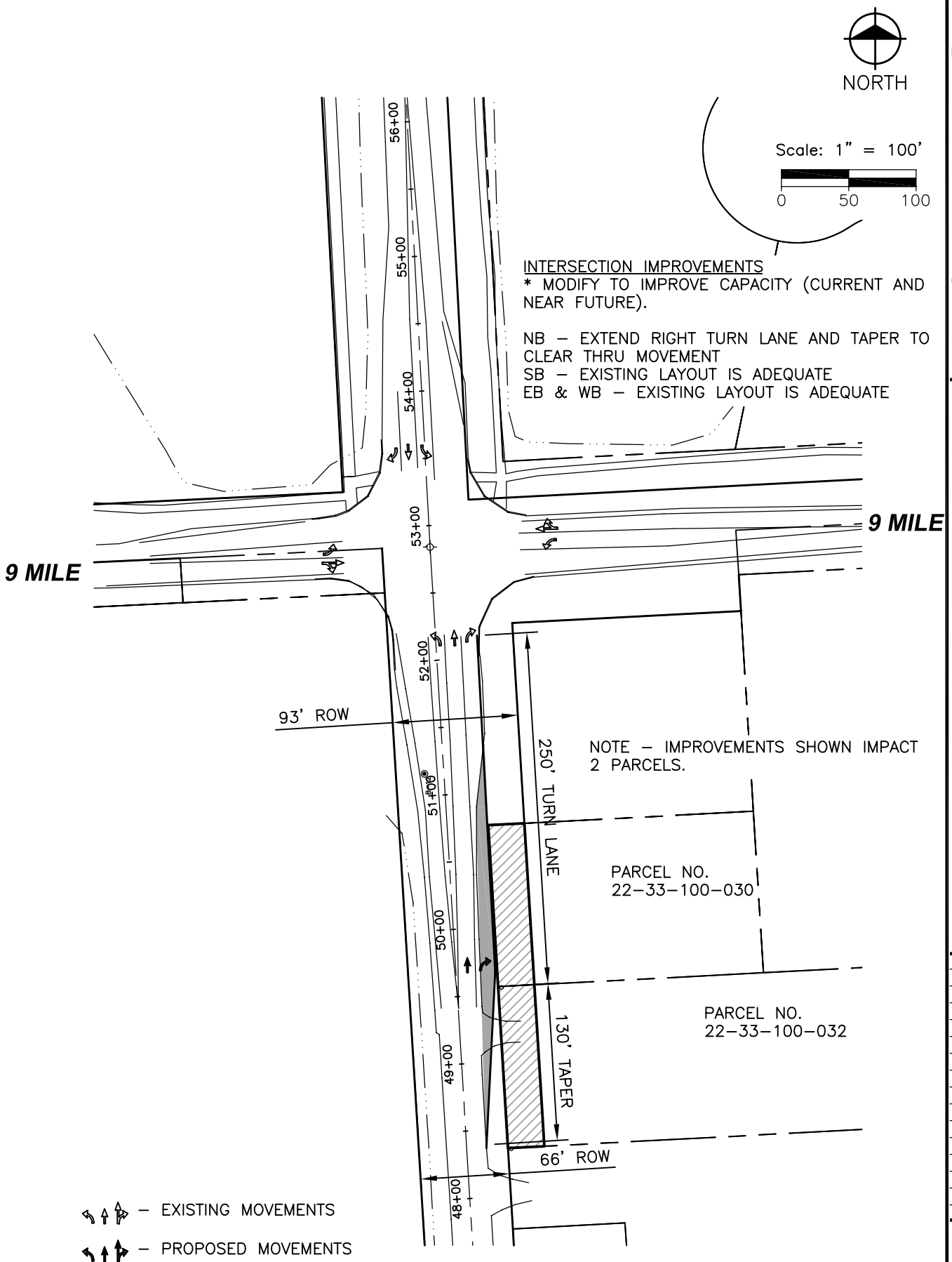
engineers
scientists
architects
constructors

CITY OF NOVI
BECK ROAD SCOPING STUDY
INTERSECTION IMPROVEMENTS

PROJECT NO.
06496

FIGURE NO.
9

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BECK ROAD AT 9 MILE INTERSECTION

fishbeck 50 years

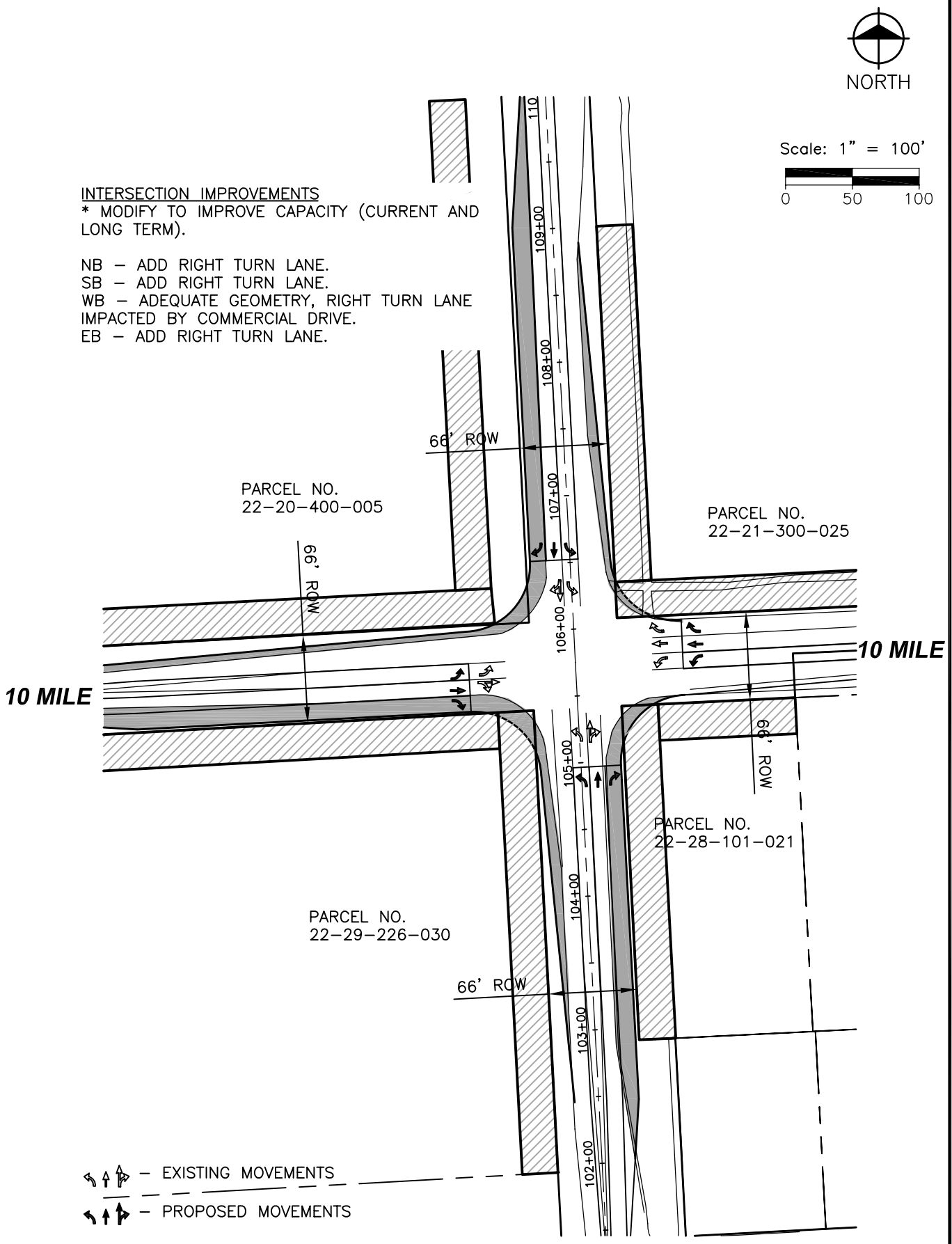
engineers
scientists
architects
constructors

CITY OF NOVI
BECK ROAD SCOPING STUDY
INTERSECTION IMPROVEMENTS

PROJECT NO.
06496

FIGURE NO.
10

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BECK ROAD AT 10 MILE INTERSECTION

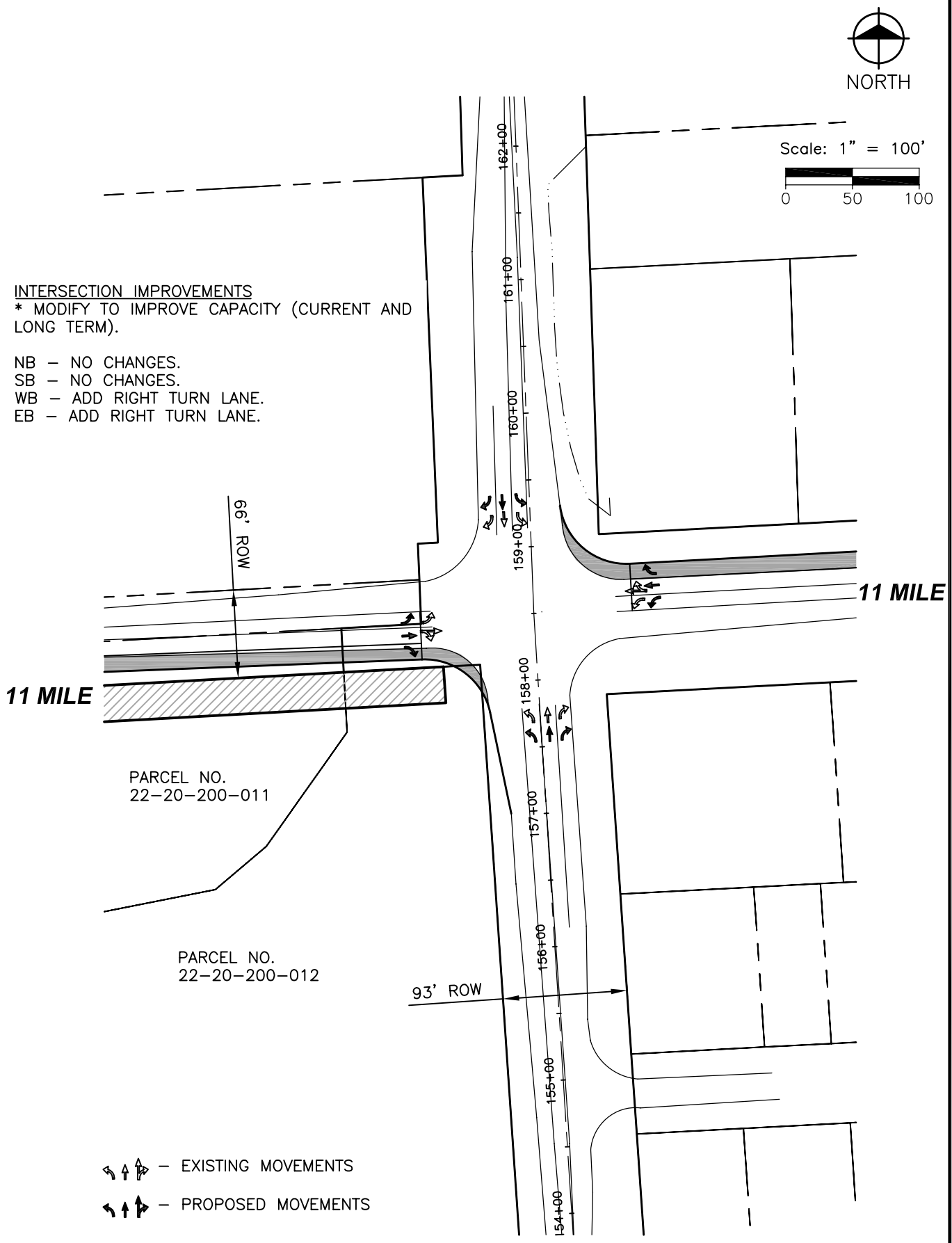
fishbeck
50 years
engineers
scientists
architects
constructors

CITY OF NOVI
BECK ROAD SCOPING STUDY
INTERSECTION IMPROVEMENTS

PROJECT NO.
06496

FIGURE NO.
11

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BECK ROAD AT 11 MILE INTERSECTION

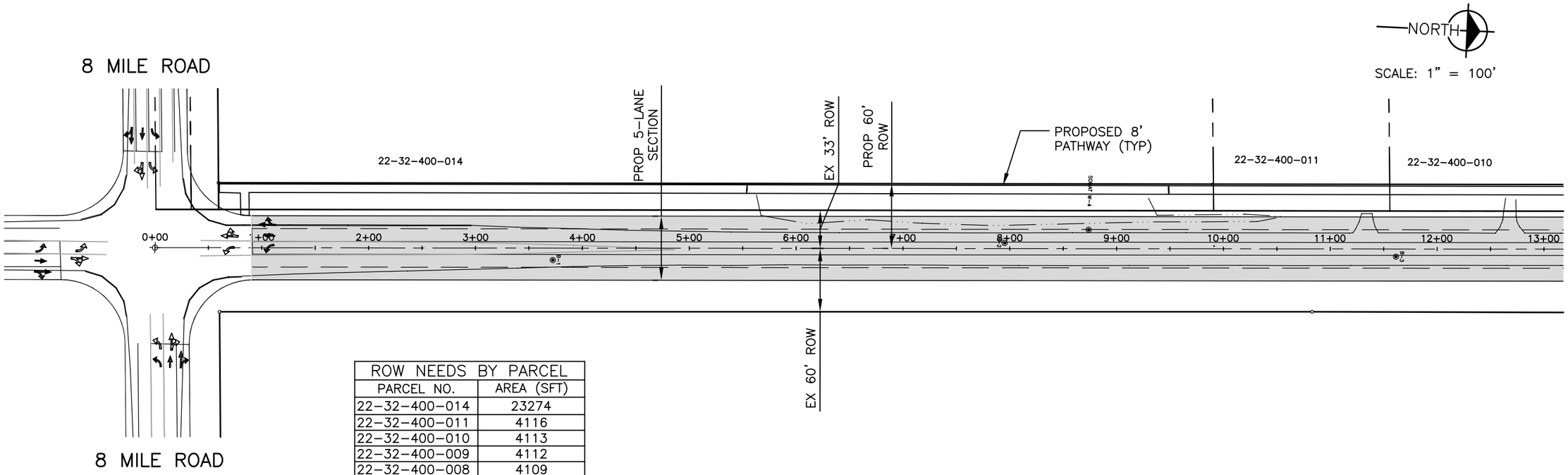
fishbeck
50 years
engineers
scientists
architects
constructors

CITY OF NOVI
BECK ROAD SCOPING STUDY
INTERSECTION IMPROVEMENTS

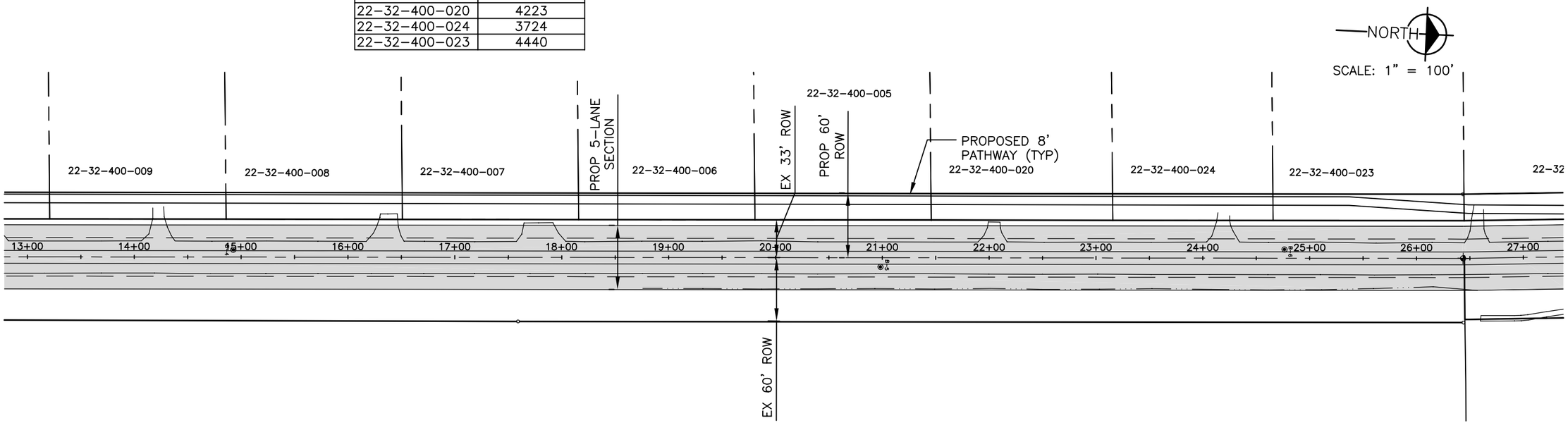
PROJECT NO.
06496

FIGURE NO.
12

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ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-32-400-014	23274
22-32-400-011	4116
22-32-400-010	4113
22-32-400-009	4112
22-32-400-008	4109
22-32-400-007	4106
22-32-400-006	4104
22-32-400-005	4102
22-32-400-020	4223
22-32-400-024	3724
22-32-400-023	4440



– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

NOTE – DRAWINGS SHOW OVERALL SCHEMATIC DESIGN AND LAYOUT FOR PLANNING PURPOSES ONLY.

BECK ROAD EIGHT MILE TO NINE MILE LONG TERM CAPACITY IMPROVEMENTS

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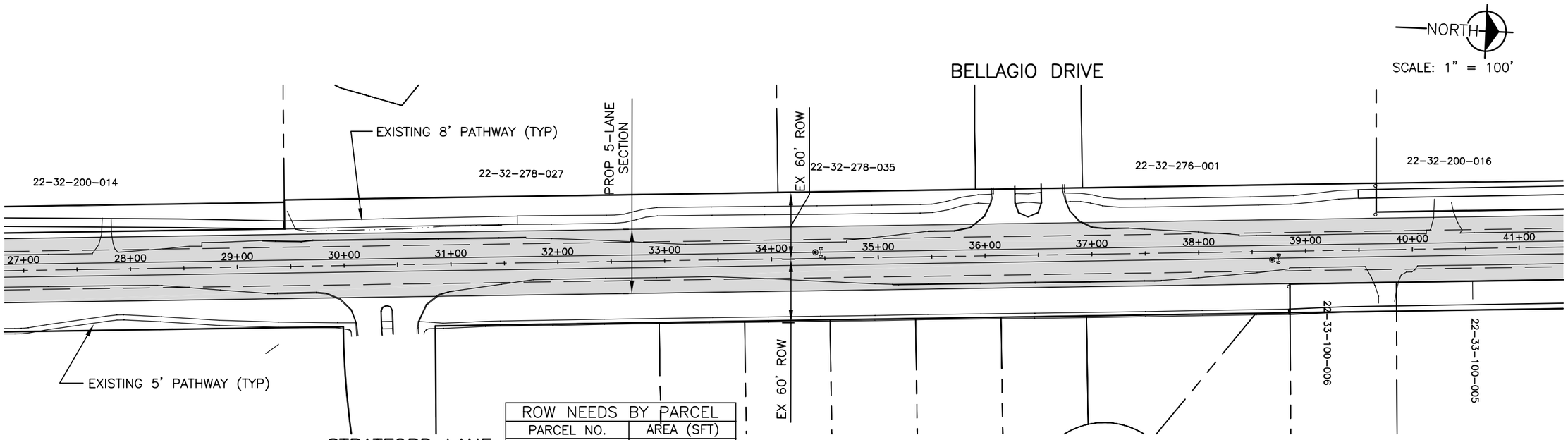
fish 50 years

engineers
scientists
architects
constructors

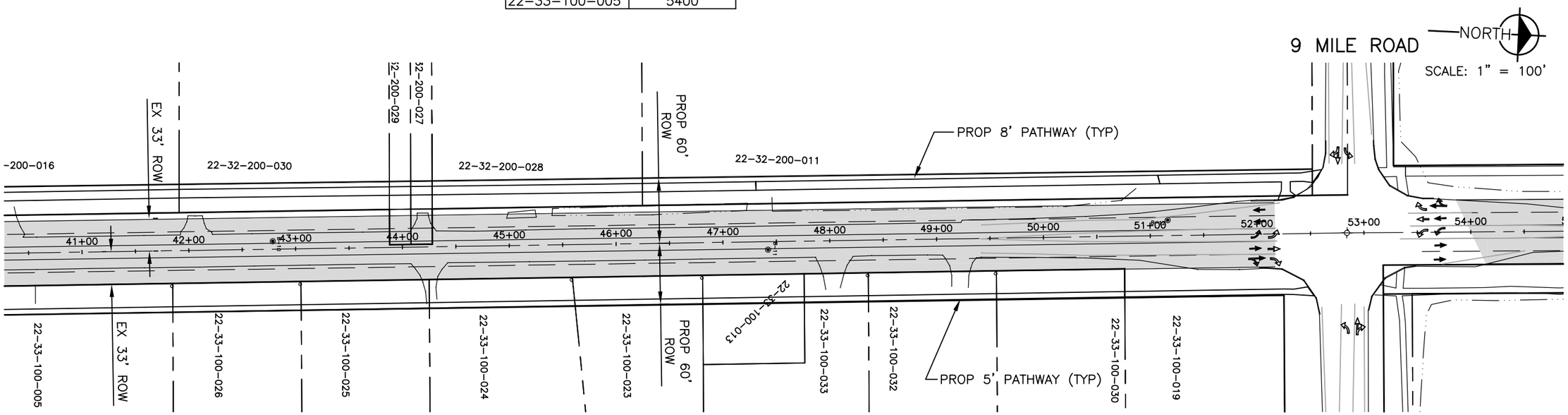
City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
13A



ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-32-200-014	7431
22-32-200-016	6019
22-33-100-006	2691
22-33-100-005	5400



ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-32-200-030	5187
22-32-200-028	5098
22-32-200-011	15745
22-32-200-029	523
22-32-200-027	523
22-33-100-026	3242
22-33-100-025	3240
22-33-100-024	3652
22-33-100-023	3260
22-33-100-013	2565
22-33-100-033	1620

ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-33-100-032	3240
22-33-100-030	3240

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– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

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BECK ROAD EIGHT MILE TO NINE MILE LONG TERM CAPACITY IMPROVEMENTS

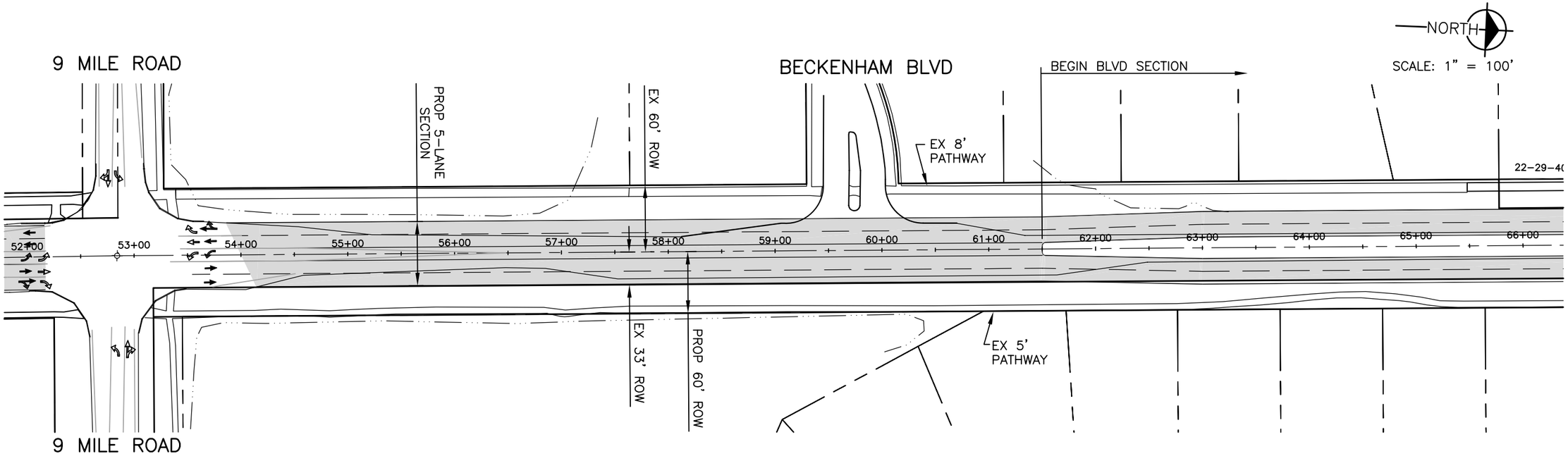
fishbeck 50 years

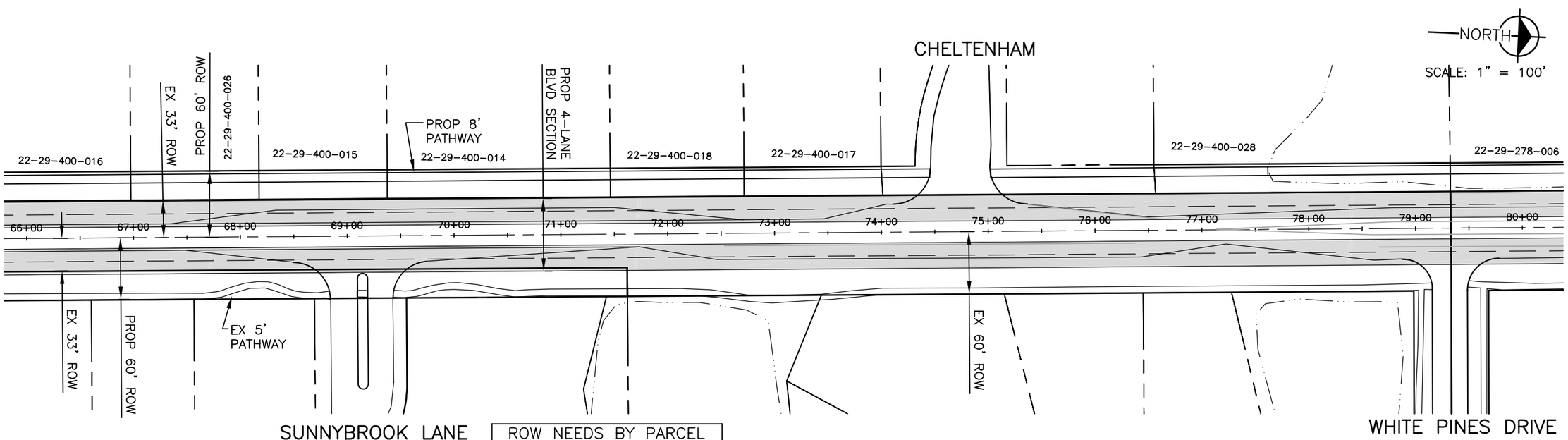
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constructors

City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
13B





ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-29-400-016	3240
22-29-400-026	3248
22-29-400-015	3238
22-29-400-014	5632
22-29-400-018	2962
22-29-400-017	3477
22-29-400-028	7437
22-29-278-006	10142

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– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

BECK ROAD NINE MILE TO TEN MILE LONG TERM CAPACITY IMPROVEMENTS

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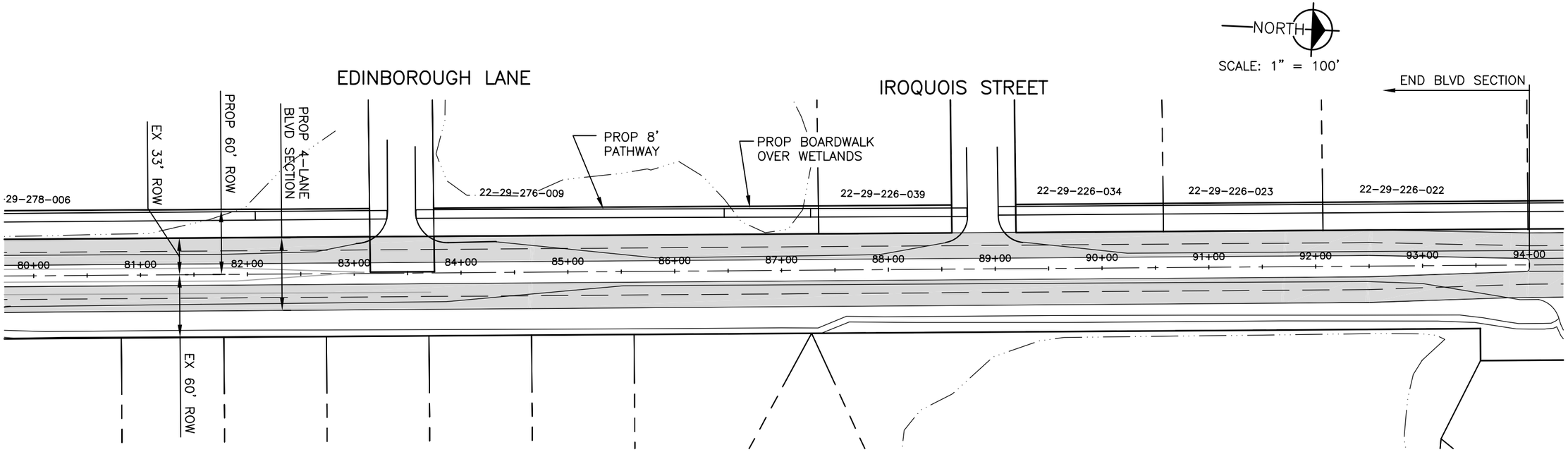
fishbeck 50 years

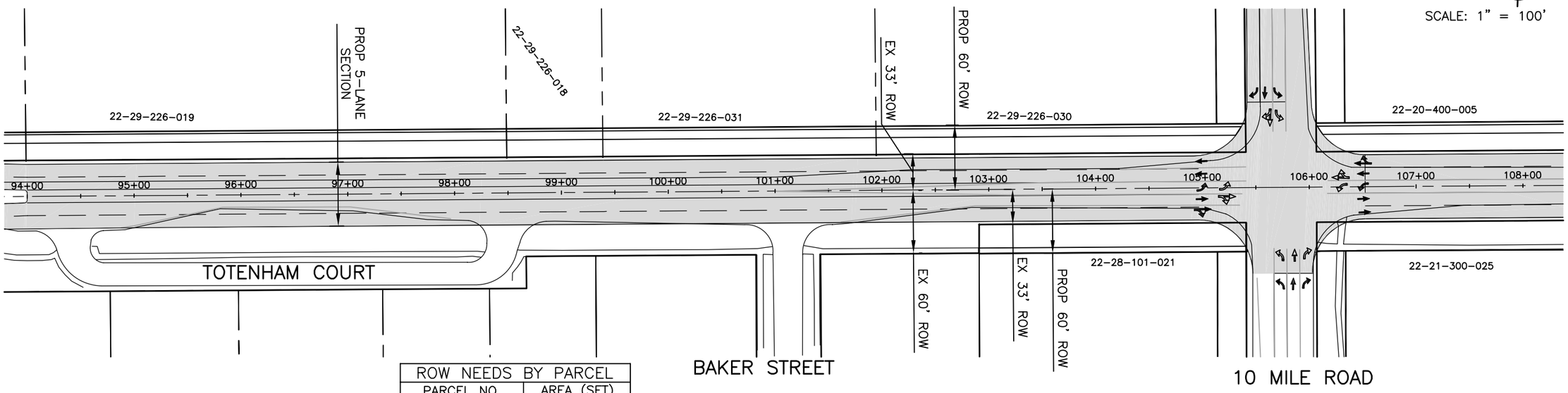
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City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
14A





ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-29-276-009	9442
22-29-226-039	3261
22-29-226-034	3607
22-29-226-023	3911
22-29-226-022	5049
22-29-226-019	11896
22-29-226-018	2390
22-29-226-031	6816
22-29-226-030	9262
22-28-101-021	6760

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– PROPOSED MOVEMENTS

BECK ROAD NINE MILE TO TEN MILE LONG TERM CAPACITY IMPROVEMENTS

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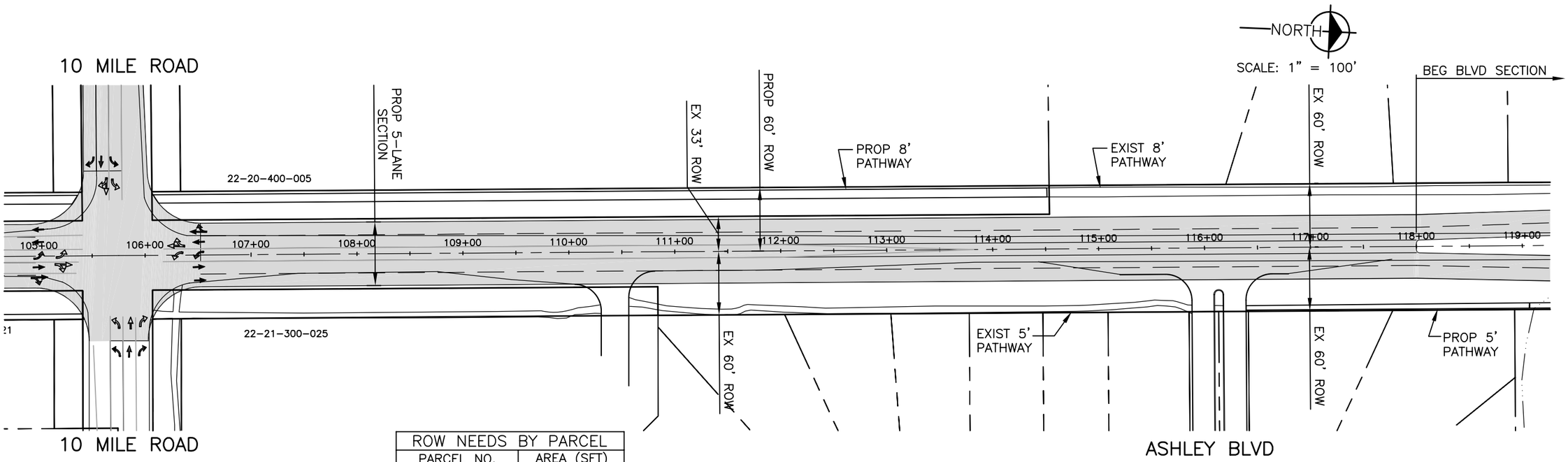
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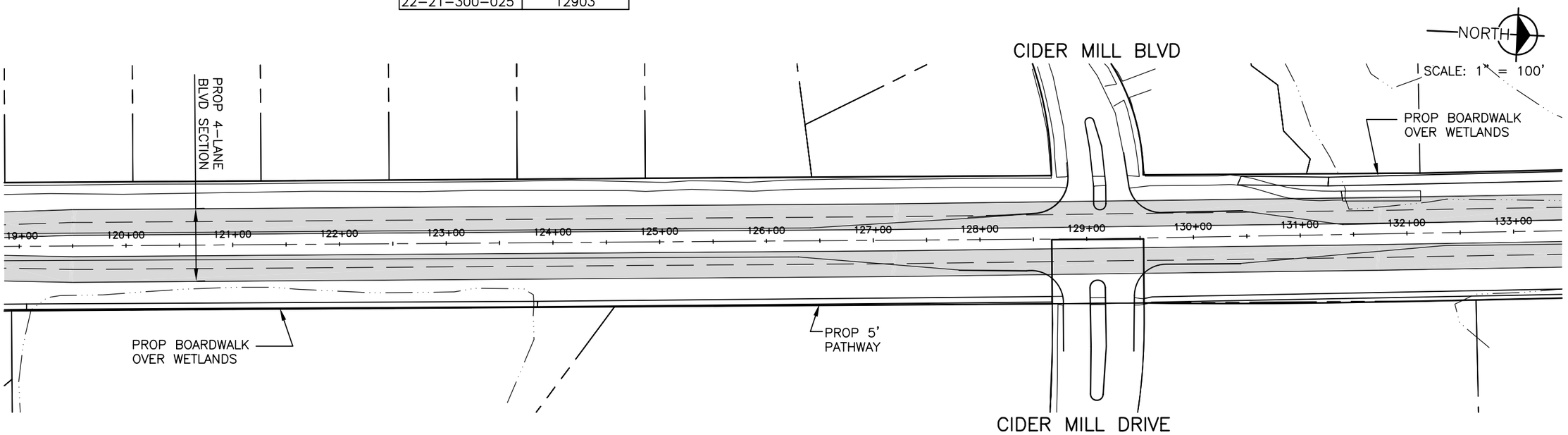
City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
14B



ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-20-400-005	22871
22-21-300-025	12903



– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

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BECK ROAD TEN MILE TO ELEVEN MILE LONG TERM CAPACITY IMPROVEMENTS

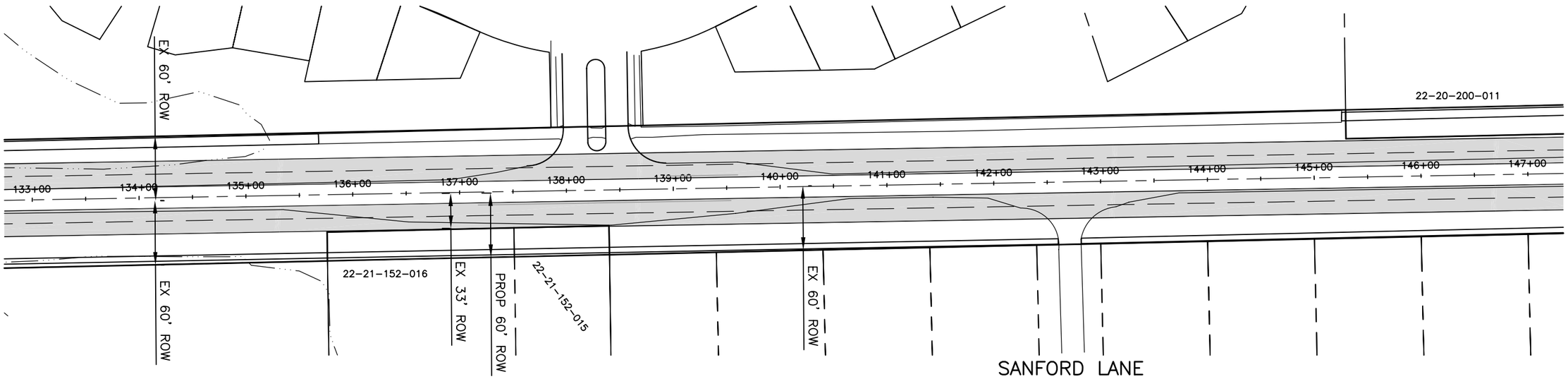
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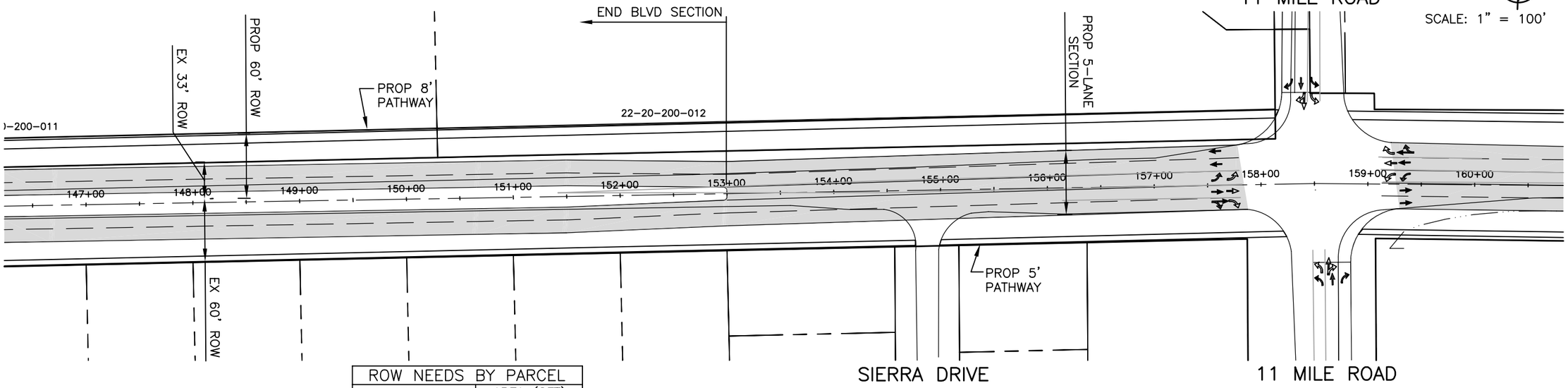
City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
15A

fishbeck, thompson, carr & huber, inc.





ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-21-152-016	4726
22-21-152-015	2403
22-20-200-011	13544
22-20-200-012	21526

– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

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BECK ROAD TEN MILE TO ELEVEN MILE LONG TERM CAPACITY IMPROVEMENTS

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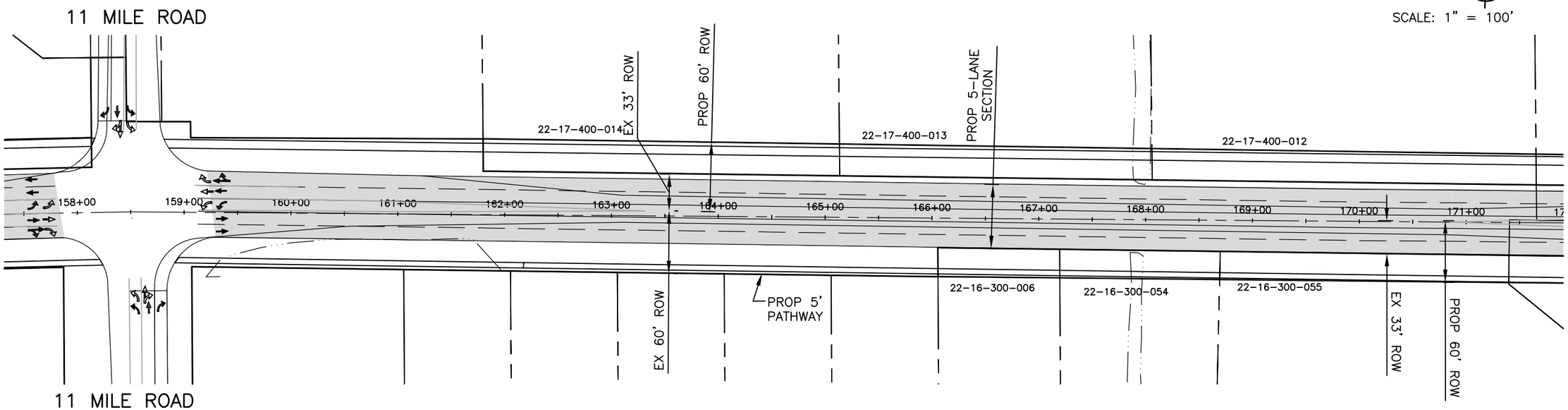
City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

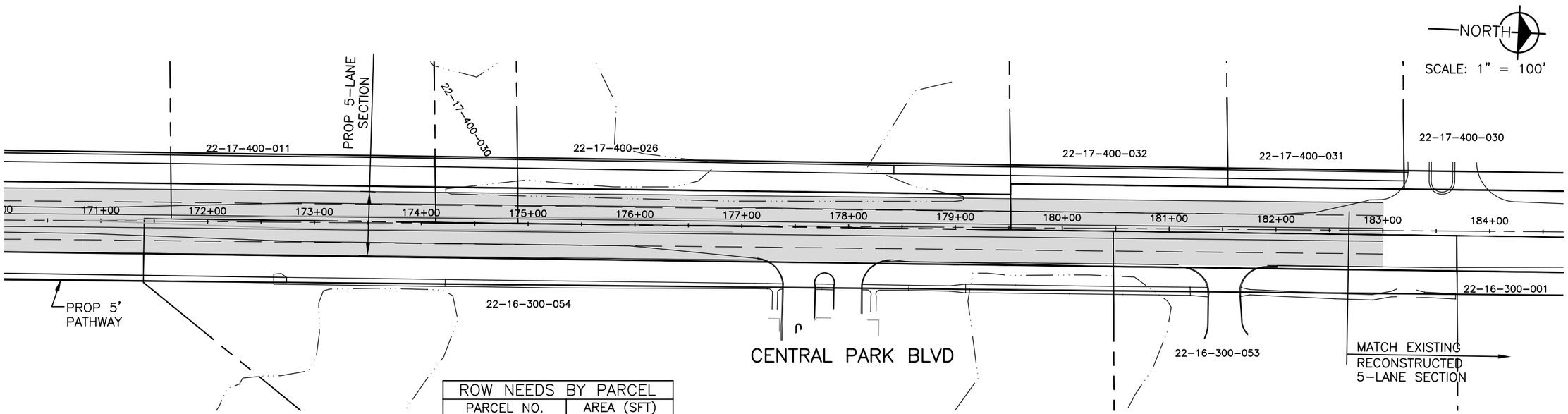
PROJECT NO.
G06496

FIGURE NO.
15B

PLOT INFO: N:\06496\CD\BECK ROAD ALTS.DWG DATE: 12/7/2006 TIME: 10:02:42 AM USER: BDR
..\REF\B-24X36
..\REF\B-85X11

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ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-17-400-014	9979
22-17-400-013	8626
22-17-400-012	10443
22-16-300-006	3071
22-16-300-054	3976
22-16-300-055	7187
22-17-400-011	7085
22-17-400-030	2186
22-17-400-026	12937
22-16-300-054	21879
22-17-400-032	3580
22-17-400-031	2861
22-16-300-053	7153

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– EXISTING MOVEMENTS

– PROPOSED MOVEMENTS

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BECK ROAD ELEVEN MILE TO GRAND RIVER LONG TERM CAPACITY IMPROVEMENTS

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City of Novi
Beck Road Scoping and Study
Eight Mile to Grand River

PROJECT NO.
G06496

FIGURE NO.
16

Appendices

SEMCOG ... *Local Governments Advancing Southeast Michigan*

Southeast Michigan Council of Governments • 535 Griswold Street, Suite 300 • Detroit, Michigan 48226-3602 • 313-961-4266 • Fax 313-961-4869
www.semcog.org

October 20, 2006

Mr. Brian Coburn
City of Novi
45175 West 10 Mile Road
Novi, MI 48375

Dear Mr. Coburn:

Per your request, enclosed are the projected SEMCOG travel demand forecast model results. Enclosed please find a spreadsheet of model volumes in the Beck Rd. study area.

The projections use SEMCOG 2030 Regional Transportation Plan land use data sets. The input data for the travel model are based on the forecasted socio-economic data adopted for SEMCOG 2030 RTP process. Please note that the model is designed to analyze traffic patterns and congestion on a regional level. When looking at the community level, the data may be skewed due to the relatively large size of our regional activity zones, the detail level of roadway network (i.e., only major roadways are included in our regional model), and the location of centroid connectors.

To determine the growth rates, traffic count and socioeconomic data should be used. Further study of the socioeconomic impacts to the study area is highly recommended.

If you have any questions regarding the enclosed information, please give me a call at 313-961-4266.

Sincerely,

Stephanie J. Taylor

Stephanie J. Taylor
Senior Transportation Planner

Cc: Li-yang Feng, Coordinator

Enclosure

John F. Jones
Chairperson
Supervisor,
Ira Township

William T. Roberts
First Vice Chair
Mayor,
City of Walled Lake

Mary Blackmon
Vice Chairperson
President, Wayne County
Regional Education
Service Agency

Robert J. Cannon
Vice Chairperson
Supervisor,
Clinton Township

Philip M. Cavanagh
Vice Chairperson
Commissioner,
Wayne County Board
of Commissioners

Robert Hixon
Vice Chairperson
Mayor,
City of St. Clair Shores

Paul E. Tait
Executive Director

Beck Rd (8 Mile to Grand River)

Table 1. Projected Beck Rd Volume Changes Between Model Years 2005 and 2030

Link ID	Name	Intersection		2005 Volume	2030 Volume	Changing Percentage (%)	No. of Lanes	
		From	To				AB	BA
1872	Beck	8 Mile	9 Mile	17,800	22,700	27.5%	1	1
1873	Beck	9 Mile	10 Mile	17,600	22,300	26.7%	1	1
1874 & 1875	Beck	10 Mile	Grand River	19,100	21,300	11.5%	1	1
Total/Avg				54,500	66,300			

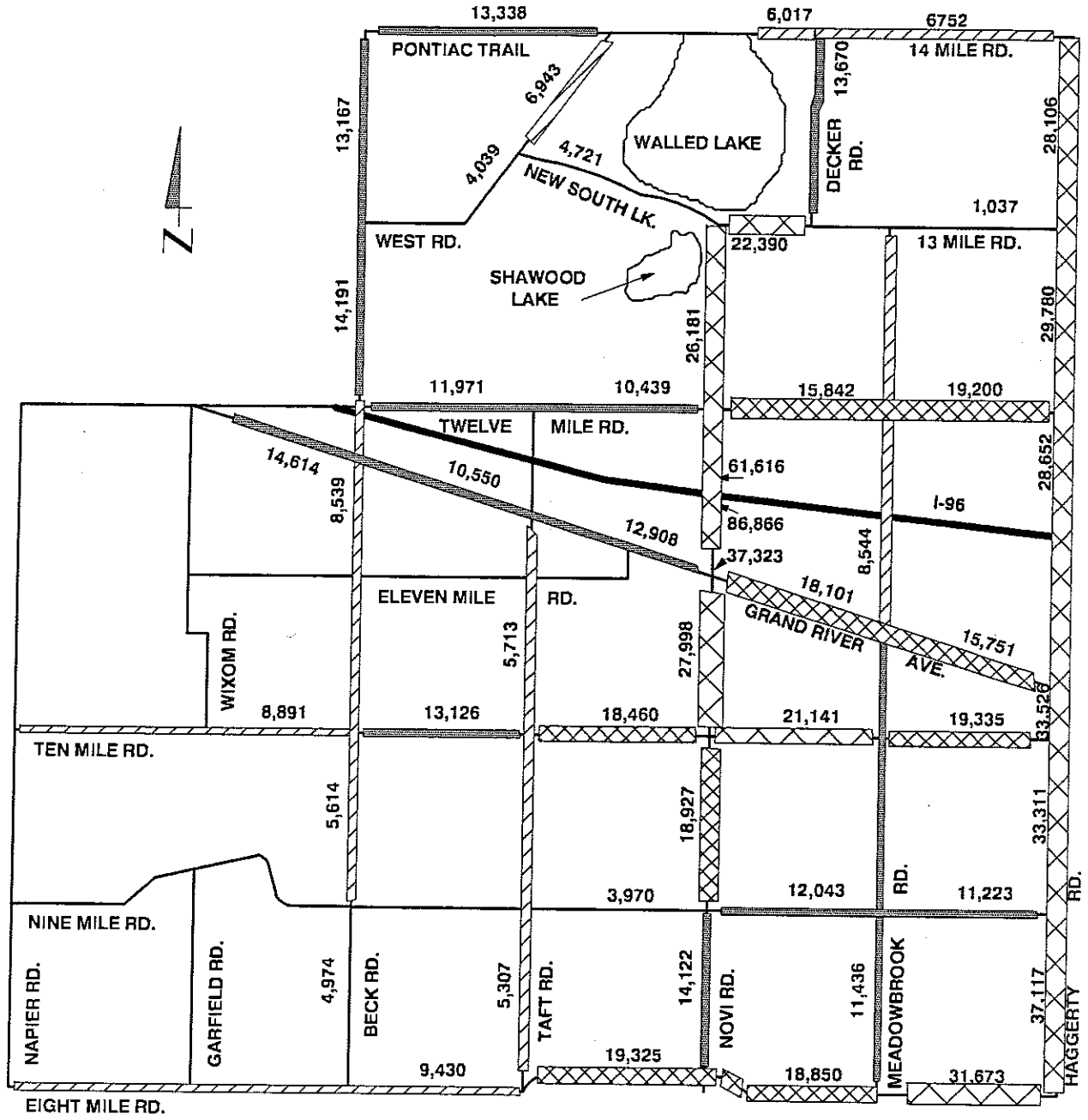
Oct-20-06 11:53am From-SEMCOG3139614869 +3139614869 T-472 P.03/03 F-197

City of Novi
MASTER PLAN FOR LAND USE
THOROUGHFARE PLAN ELEMENT UPDATE

Prepared for:
City of Novi

Prepared By:
Birchler/Arroyo Associates, Inc.

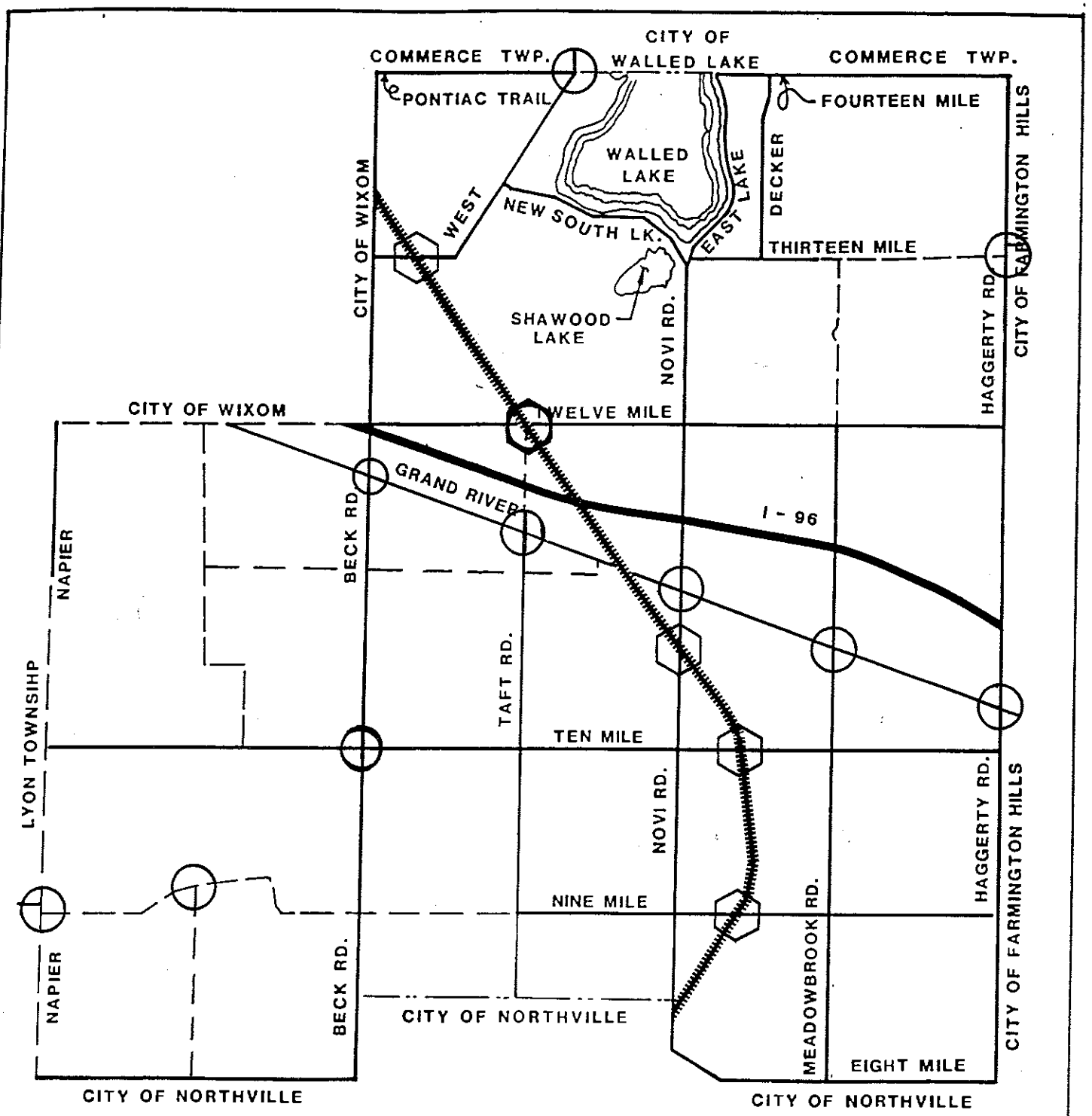
September 1992



AVERAGE DAILY TRAFFIC VOLUMES - 1991

BARTON-ASCHMAN ASSOCIATES, INC. of Michigan

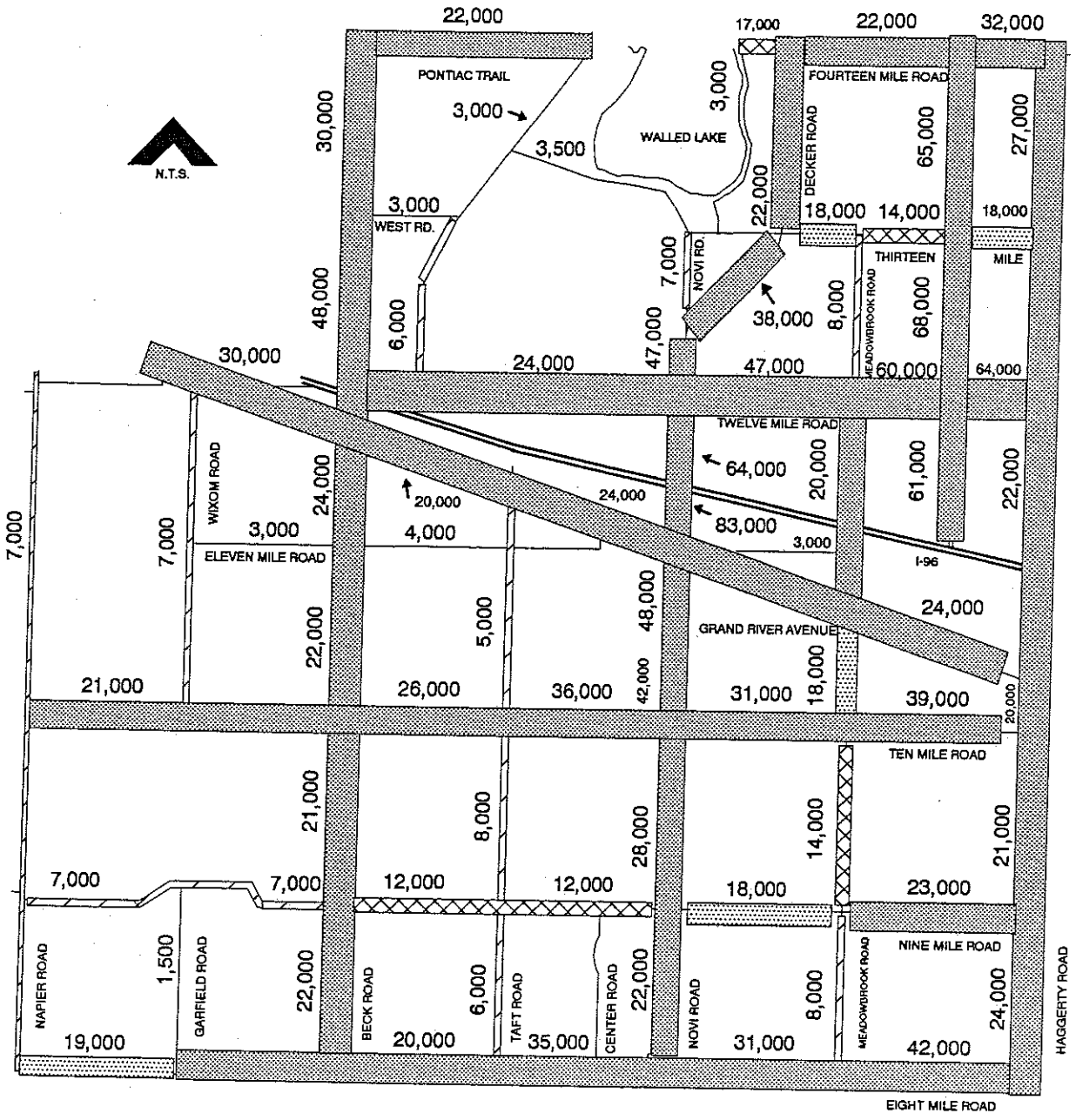
MAP 7



MAP 11

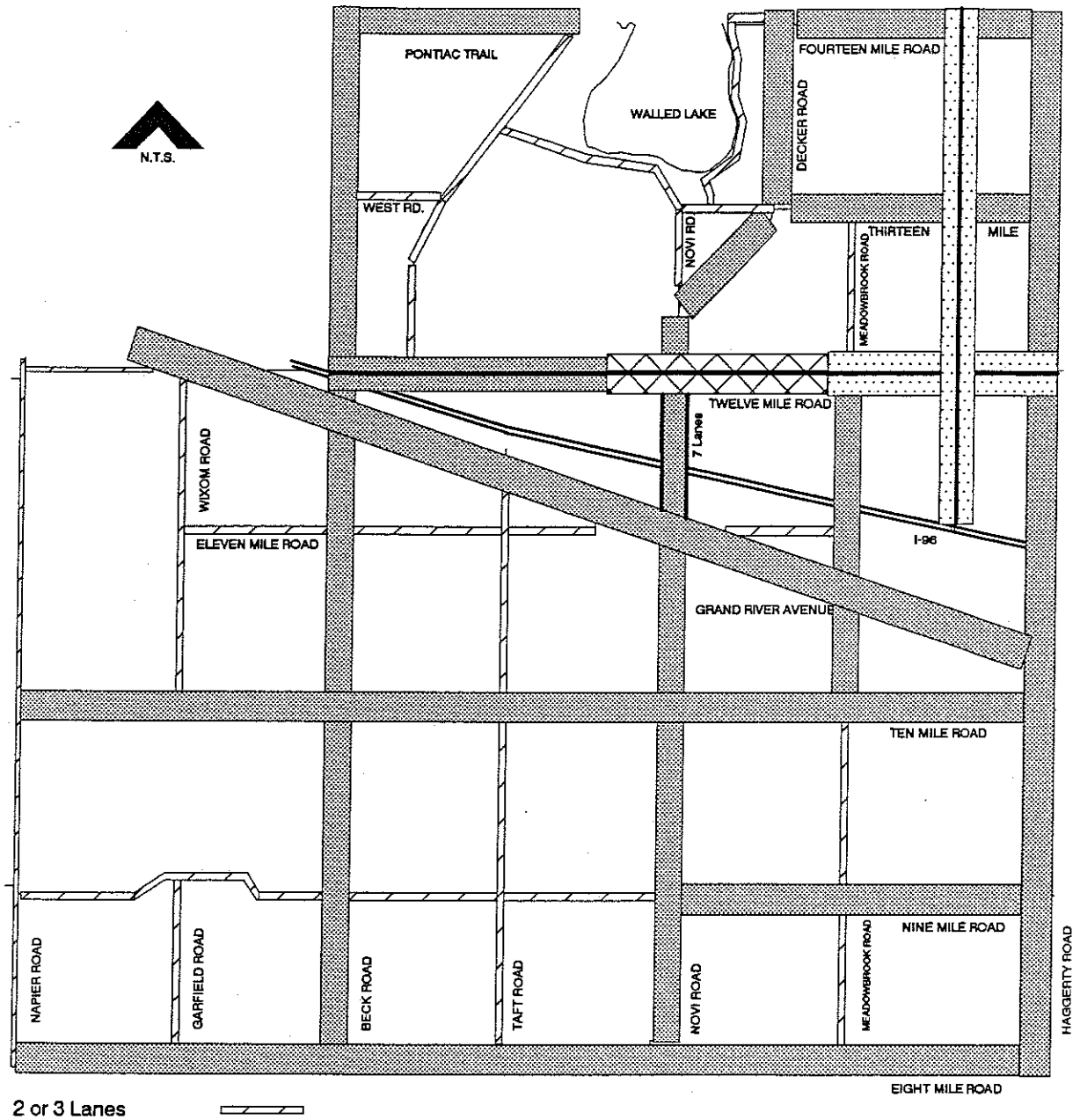
ROADWAY PROBLEM AREAS

BARTON-ASCHMAN ASSOCIATES, INC.



FUTURE AVERAGE DAILY TRAFFIC VOLUMES

Source: Novi Traffic Model



2 or 3 Lanes

5 Lanes

4 Lanes Divided

6 Lanes Divided

8 Lanes Divided

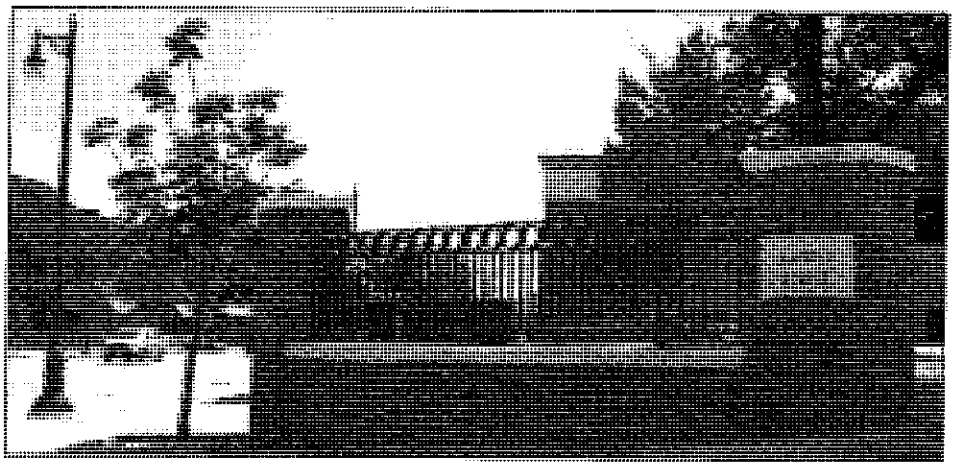
FUTURE TRAFFIC LANES

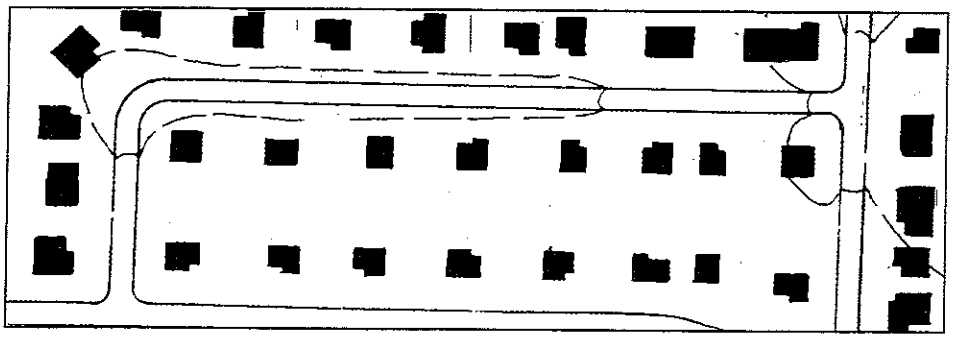
10/92

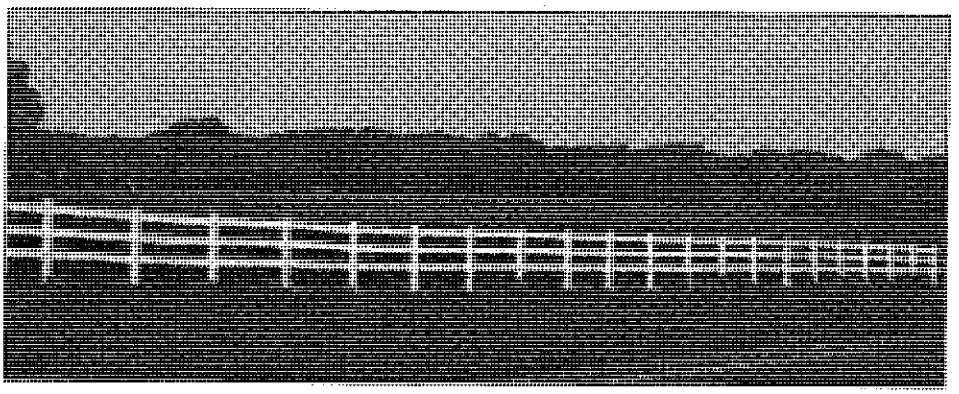
NOVI 2020

Master Plan for Land Use

Thoroughfare Plan Summary



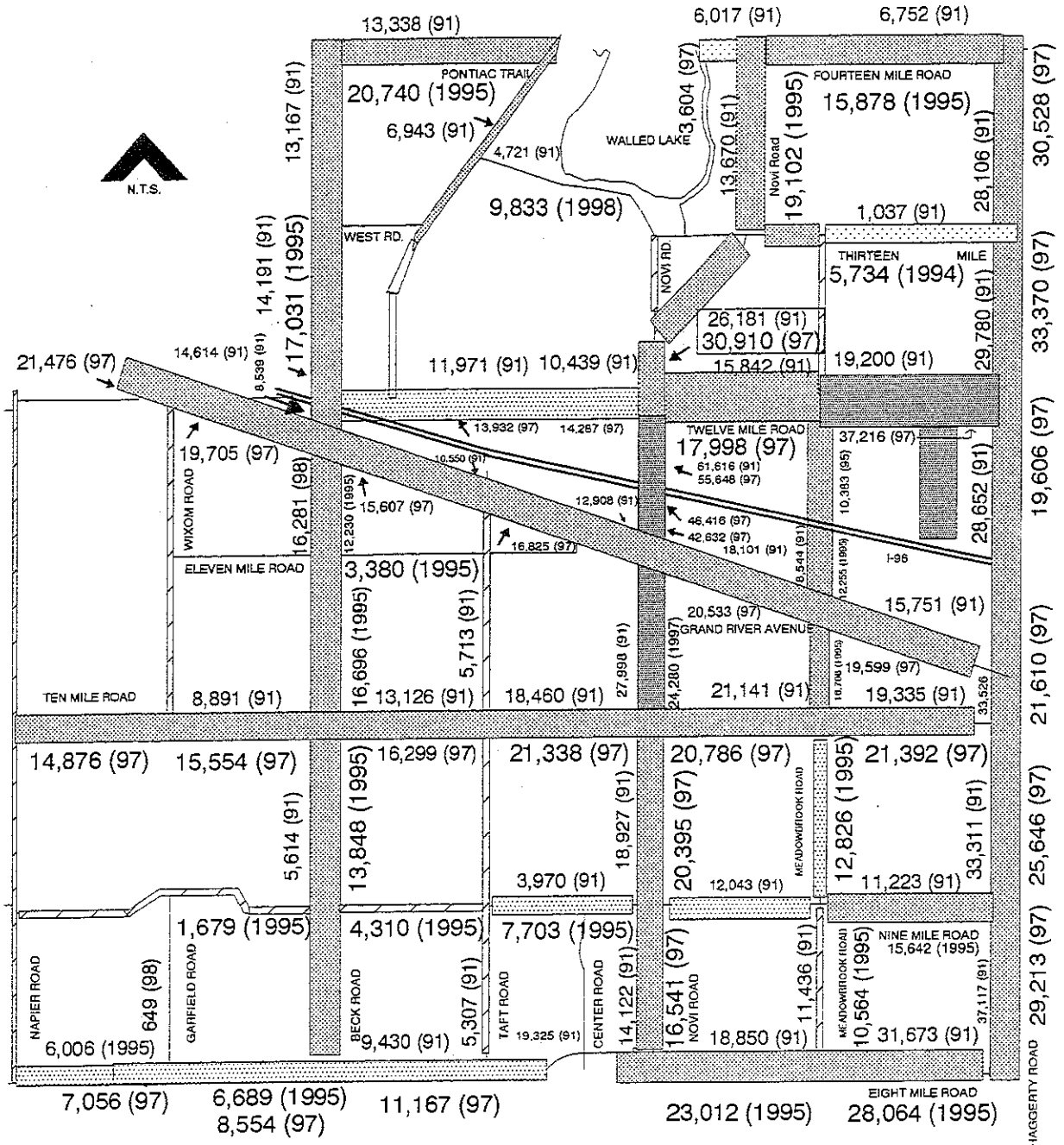




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CITY OF NOVI

Prepared by:
City of Novi Planning Commission

Assisted by:
Birchler Arroyo Associates, Inc.



Daily Volume

Under 5K

5K - 15 K

15K - 35K

Over 35K

12,300 1991 Volume

21,300 (1995) Volume (Year)

DAILY TRAFFIC VOLUME COMPARISON (1991-1998)

BIRCHLER ARROYO ASSOCIATES, INC.

Table 2
ANNUAL GROWTH RATES FOR DAILY TRAFFIC, 1991-1997

Road Name	Crossroad 1	Crossroad 2	1991 ADT	1997 ADT	Annual Growth Rate (%)
Haggerty	12 Mile	13 Mile	29,780	33,370	1.9
Haggerty	Ten Mile	Nine Mile	33,311	25646	- 4.4
Grand River	Novi	Taft	12,908	16,825	4.5
12 Mile	Novi	Taft	10,439	14,287	5.3
12 Mile	Meadowbrook	Haggerty	19,201	37,216	11.7
Pontiac Tr.	West	Beck	13,338	20,740 (95)	13.9
Novi	13 Mile	14 Mile	13,670	19,102 (95)	9.9
East Lake	13 Mile	14 Mile	7,996	3,604	- 7.6

Traffic volumes on Haggerty Road south of Ten Mile Road, have declined since 1991 due to the impact of the M-5 interchange at Twelve Mile Road.

Some road also have seen a reduction in traffic volumes. For example, Haggerty Road, south of Ten Mile Road, had a drop in traffic volumes from 33,311 in 1991 to 25,646 in 1997 due to the impact of the M-5 interchange at Twelve Mile Road.

Another measurement related to traffic volumes and roadway classification is the level of service (LOS). The City's study examined LOS for both intersections and segments of roadways. LOS is defined in terms of delay to motorists. For an intersection, LOS is measured by the average stop time it takes to travel through an intersection. LOS along a street segment is based on average through-vehicle travel speed and delays, which are often caused by vehicular turning movements.

Level of service is rated on a scale with LOS A having very low delays at intersections and free-flow traffic along roadways. On the other end of the spectrum, LOS F is characterized by lengthy delays at intersections and extremely slow speeds along roadways. From a road design perspective, LOS D is generally considered to be the limit of an acceptable delay.

The LOS analysis of intersections and roadways indicated that most areas operate at a LOS C or better. Nevertheless, the study indicated there were seven intersections operating at a LOS F and 15 operating at a LOS D. The LOS analysis for roadway segments indicates most roadways also operated at a LOS C or better. However, problem areas during the morning peak hour include segments of Novi Road, Haggerty Road, Thirteen Mile Road, and Nine Mile Road. During the evening peak hour, some sections of Haggerty Road, Beck Road, Ten Mile Road, and Meadowbrook Road have a LOS below C.



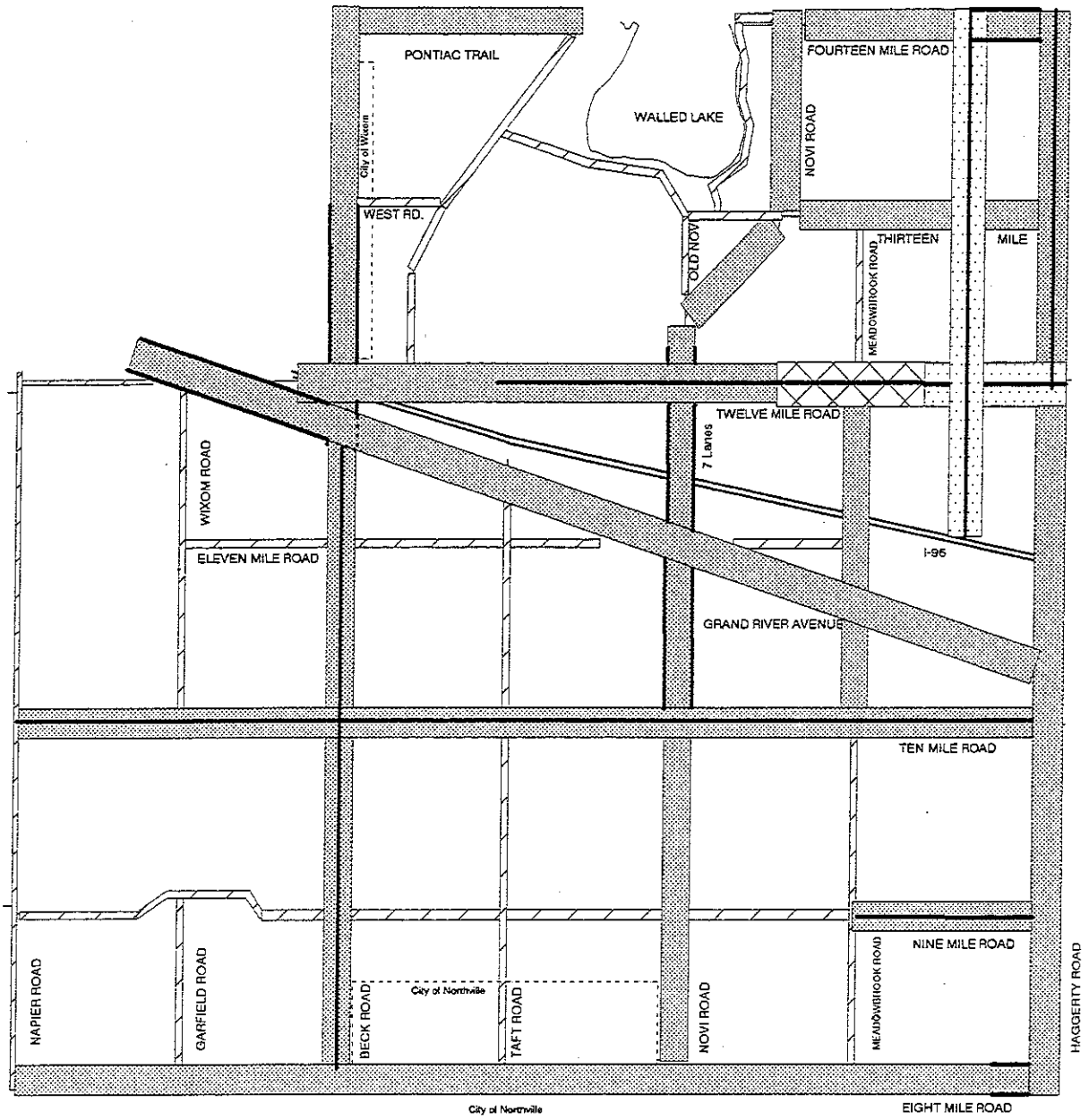
0 - 5,000
5,000 - 10,000
10,000 - 15,000
15,000 - 20,000
> 20,000

FUTURE DAILY TRAFFIC VOLUMES

Source: Novi Traffic Model w/ 1999 Adjustments

Based on Build - out Conditions

BIRCHLER ARROYO ASSOCIATES, INC.



2 or 3 Lanes

5 Lanes

4 Lanes Divided

6 Lanes Divided

6 Lanes Divided or 7 Lanes

8 Lanes Divided

FUTURE TRAFFIC LANES

3/99

Based on Build - out Conditions

BIRCHLER ARROYO ASSOCIATES, INC.

Non-motorized Pathways

The Bicycle and Pedestrian Master Plan (fig. 55) illustrates the required widths and locations for non-motorized paths throughout the city. For collector and arterial roads, five foot sidewalks are required on both sides of the road unless the plan shows a bicycle path, in which case an eight-foot wide bicycle path is required. The only exception is collector roads in Industrial (I-1 and I-2) districts, where the Design and Construction Standards Ordinance does not require pathways along internal non-residential collectors and local industrial roadways. Pathways are still required along all classes of arterial roads in industrial zoning districts. Specific requirements for construction of these links are detailed in the City's Design and Construction Standards. New developments are required to implement the Bicycle and Pedestrian Master Plan along road frontages. The city's Bicycle and Pedestrian Pathways Phasing Plan (fig. 54) was developed to assure that gaps in the existing pathways are connected. The priority areas to connect are those that connect neighborhoods to schools, recreation and public facilities, cultural and commercial centers. The plan prioritizes these connections accordingly in five year increments.

Access Management

There are many access management techniques that can be implemented by the city, ranging from adequate driveway spacing to commercial service roads. These techniques are usually implemented through the site plan and plat review process. The techniques described below are suggested as guidelines in the development review process. Each case will require an individual judgment and analysis to determine the appropriate action, given the characteristics of the site and use.

The principal goal of access management is that all developments should be provided with safe and reasonable access from public streets using the minimum number of access points (driveways) necessary to achieve this goal. Access through a shared driveway, frontage road or rear service road (located in rear yard) should be encouraged along busy corridors. If these techniques are not feasible, one (1) two-way driveway or two (2) one-way driveways (one inbound and one outbound) should be the rule unless a development is so large that volumes or emergency access requirements warrant additional driveways.

The following describes in more detail various forms of access management that are available for consideration and use as part of the implementation of the Master Plan.

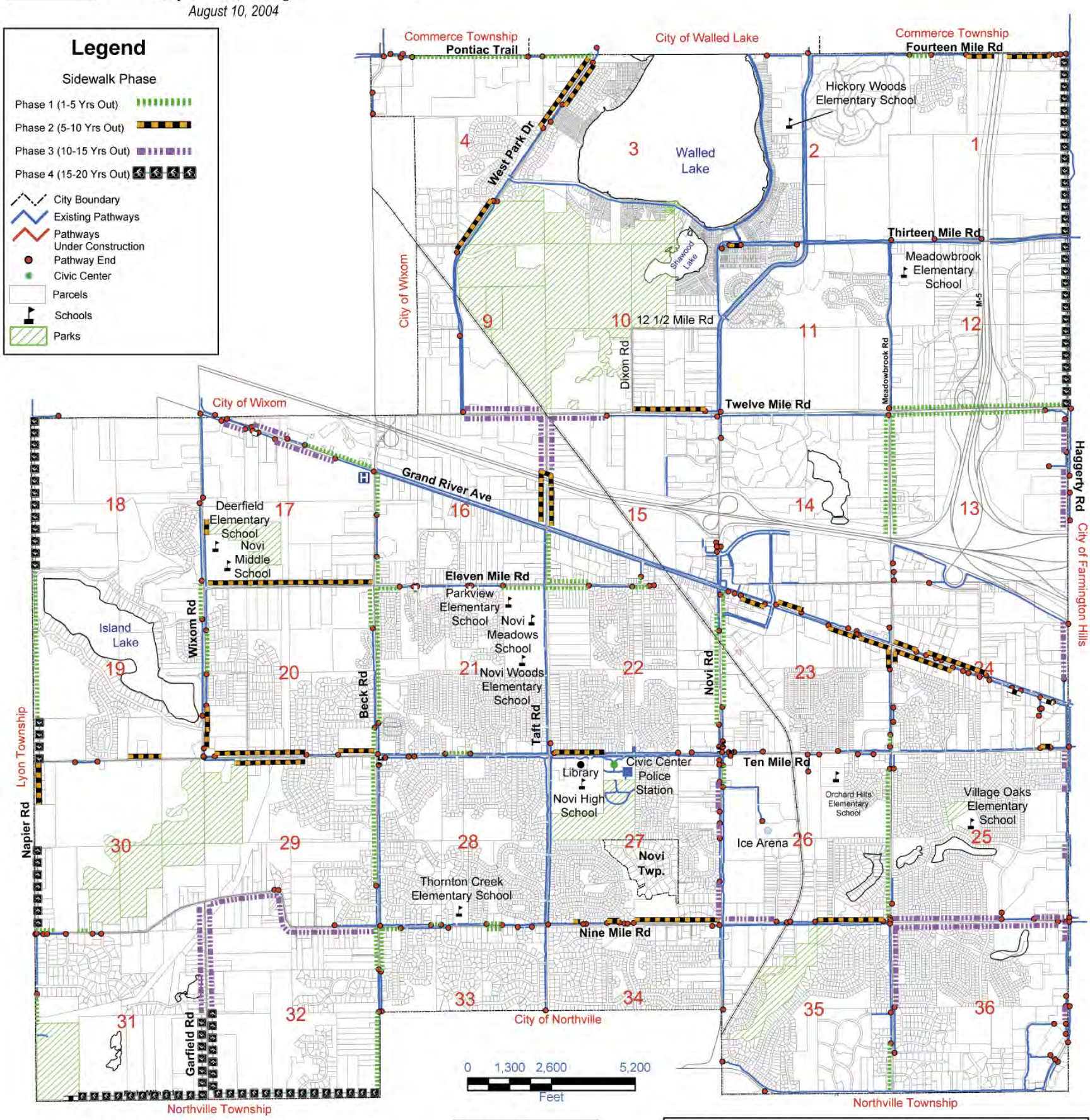
Number of Driveways

For many of the reasons noted above, it is also important to regulate the number of driveways each development has onto a major roadway. In general, the following guidelines should be followed:

- All development should be provided with safe and reasonable access from public streets using the minimum number of access points (driveways) necessary to achieve this goal.
- When access via a shared driveway, frontage road (located between public street and front building setback), or rear service road (located in rear yard) is not possible, one two-way drive or two one-way drives (one inbound and one outbound) may be provided.

Pathway Phasing Map

City of Novi, Michigan
August 10, 2004



Created using the (GIS) Geographic Information System of the City of Novi
45175 W. Ten Mile Road
Novi, Michigan 48375

Created by:
Bill Berdelman
GIS Technician
Department of GIS/ Environmental Services

Date Initially Created:
February 28, 2001
Date of Last Revision:
August 10, 2004
Project Filename:
P:\Proj2003\Pathway.mxd
Map Name: Pathway

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Figure 54.a. Boardwalk along Nine Mile Road.

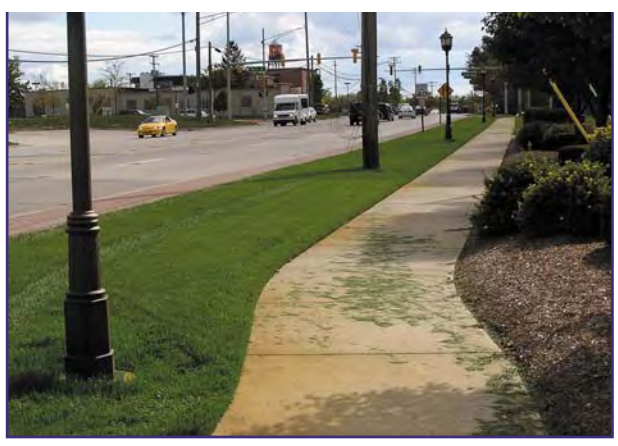
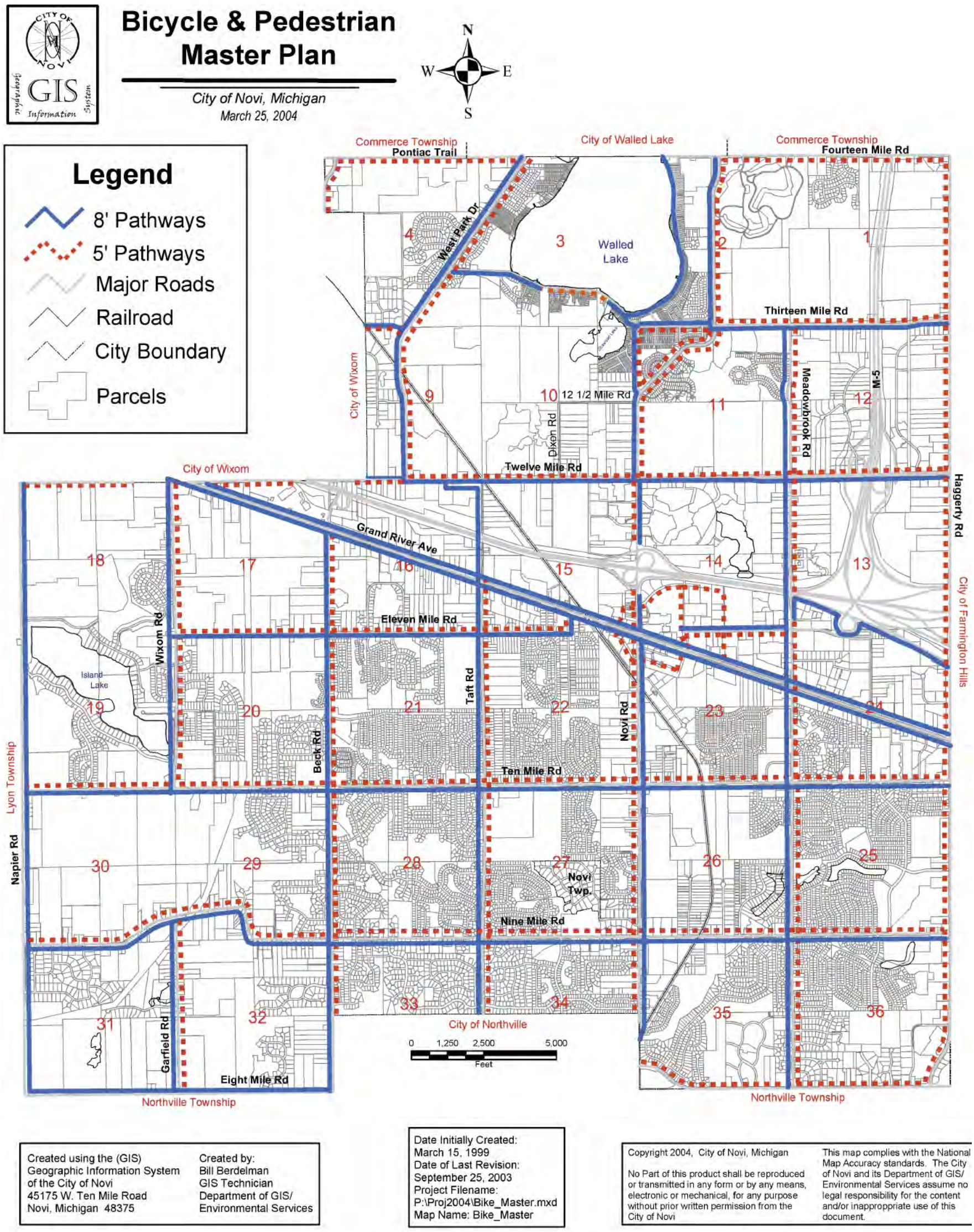


Figure 54.b. Sidwalk along Novi Road.

Figure 54. Pathway Phasing Map.

Bicycle & Pedestrian Master Plan

City of Novi, Michigan
March 25, 2004



Created using the (GIS) Geographic Information System of the City of Novi 45175 W. Ten Mile Road Novi, Michigan 48375	Created by: Bill Berdelman GIS Technician Department of GIS/ Environmental Services

Date Initially Created:
March 15, 1999
Date of Last Revision:
September 25, 2003
Project Filename:
P:\Proj2004\Bike_Master.mxd
Map Name: Bike_Master

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Figure 55. Bicycle & Pedestrian Master Plan.

- Additional driveways may be provided when it is demonstrated that one driveway cannot safely and efficiently handle the volume of traffic anticipated by the proposed development.

Driveway Spacing / Placement

One of the primary access management techniques is driveway spacing and placement. Driveways located too close together are safety hazards and they can negatively impact capacity.

The City's Design and Construction Standards Ordinance contains the recommended spacing of driveways based on roadway speed. These standards are implemented through the site plan and plat review process.

Alternative Access

As noted above, a reduction in the number of driveways provides many benefits to the community and property owners. This reduction can be accomplished by limiting each development to one driveway, where feasible. But there are other alternatives that can provide even greater benefits by having more than one development share one access point.

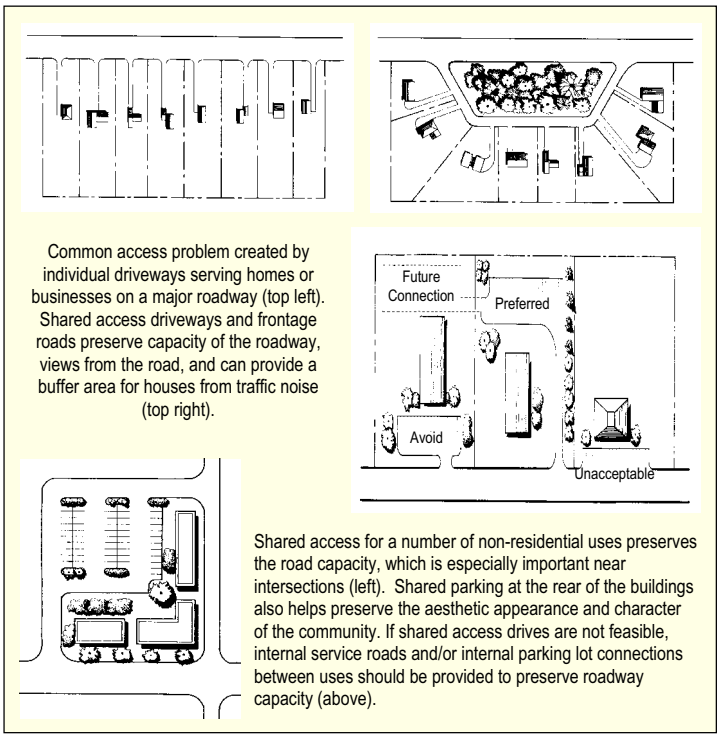


Figure 56. Shared access drives.

Shared Access

Providing shared access to a site reduces the number of access points, preserves the capacity of the road, and can even help to maintain the character of the community. Shared access can be achieved through a variety of techniques including shared driveways, frontage roads, and internal connections between sites. As discussed on page 99, access management is critical for non-residential land uses because of their intensive nature and tendency to demand a higher number of access points. The following graphics illustrate ways in which residential and non-residential uses can utilize access management techniques.

Service Roads

Rear service roads provide common access to several properties from the rear of the parcels. The road is constructed parallel to the public road right-of-way, and it is typically constructed by property owners.

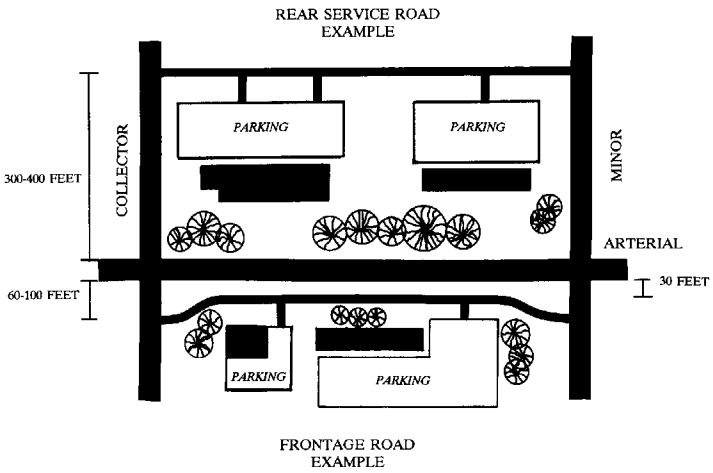


Figure 57. Frontage Roads

Frontage Roads

A frontage road is located parallel to the public street right-of-way, and is located between the right-of-way and the front building setback (fig. 57). This type of road crosses several properties but only has one or two access points (typically). In the case of a major frontage road system, it may run for one mile or more, providing an access point to the thoroughfare every 1/8 to 1/4 mile.

This type of roadway is often implemented in underdeveloped areas prior to the on-set of new development because of the separate parallel right-of-way necessary. There must be ample setbacks in place to install this type of system.

Deceleration/Acceleration Tapers and Lanes

When right turns into a driveway are numerous, it can cause significant disruption to through traffic. Providing a deceleration taper or taper and turn lane combination can improve the time it takes a right turning vehicle to exit the through traffic stream, thereby improving road capacity and reducing delay.

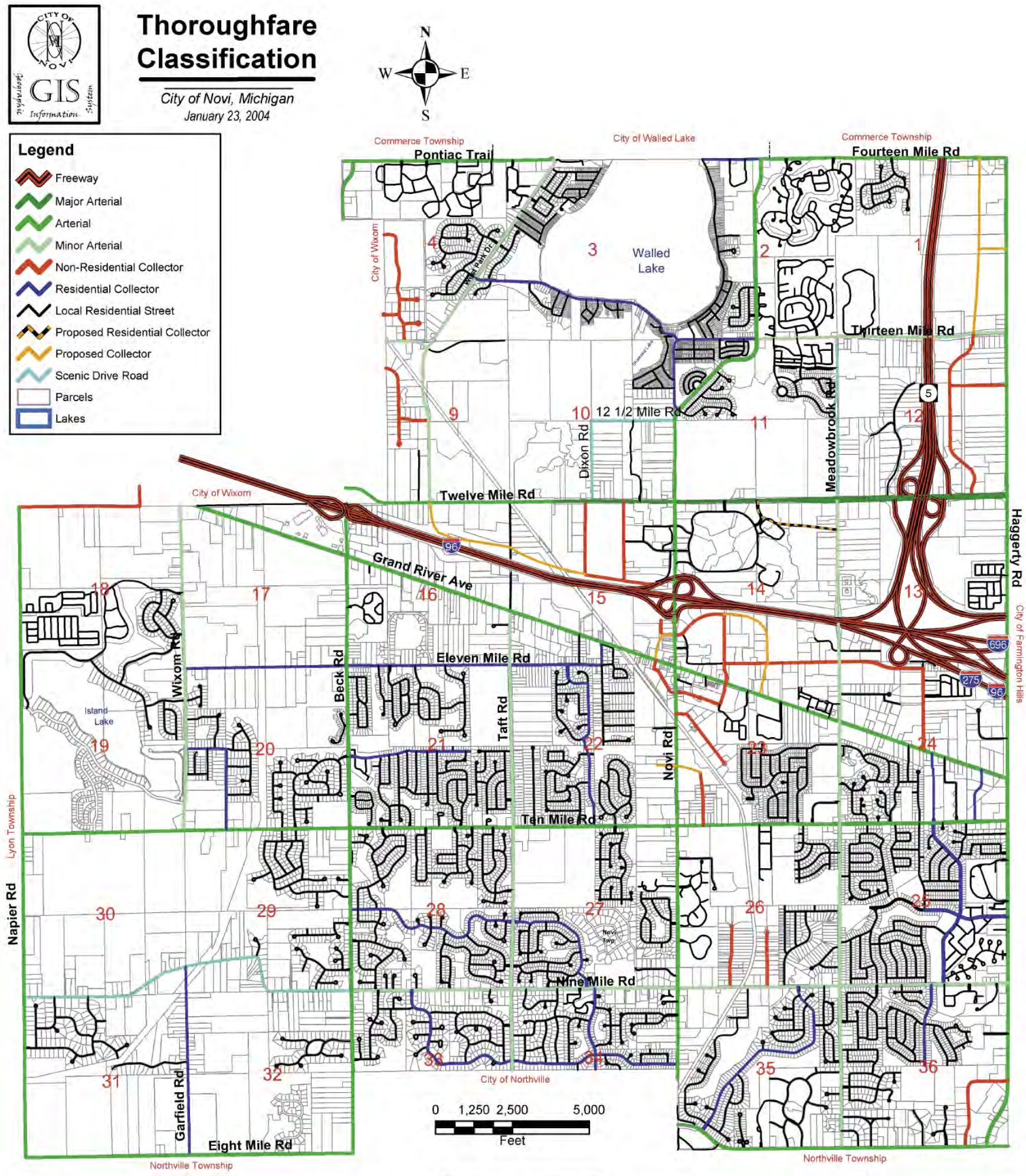
The City of Novi and the Road Commission for Oakland County have established warrants for determining when a taper or taper/lane combination is necessary. The warrants are based on mining volume and total volume on the main road. When two (2) or more lanes are provided in each direction, the outside lane serves as a deceleration lane. In this instance, right turn tapers and lanes are only installed for high volume driveways such as those serving large shopping centers.

Internal Site Design

Regardless of the types of limitations placed on driveway design, spacing and location, congestion

Thoroughfare Classification

City of Novi, Michigan
January 23, 2004



Created using the (GIS)
Geographic Information System
of the City of Novi
45175 W. Ten Mile Road
Novi, Michigan 48375

Created by:
Bill Berdelman
GIS Technician
Department of GIS/
Environmental Services

Date Initially Created:
February 28, 2001
Date of Last Revision:
January 23, 2004
Project Filename:
P:\Proj2003\Thoroughfare.mxd
Map Name: Thoroughfare

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This map complies with the National Map Accuracy standards. The City of Novi and its Department of GIS/ Environmental Services assume no legal responsibility for the content and/or inappropriate use of this document.

Figure 58. Thoroughfare Classification.

and safety concerns can still be caused by poor internal circulation. Parking lot and internal driveway layouts must be coordinated with the access points to the public right-of-way to ensure a smooth transition from the public road to the "private road network." The review of site plans should treat each development as an internal road network, with parking bays feeding into higher volume internal drives, which in turn feed into the road network. Some of the key review issues should include the following:

- Internal turning radii and driveway width should be reviewed using the same concepts applied to main driveways.
- Smooth internal circulation requires a design conducive to passenger cars and delivery/service vehicles. If semi-trucks will serve the site, the internal truck route must be specially designed with a larger turning radii.
- Sight distance at internal intersections is as important as at intersections with public streets. End-islands and proper landscaping can improve sight distance.
- Properly designed end islands can permit smooth internal traffic flow.

As illustrated in Figure 59, raised concrete end islands also discourage dangerous cross-traffic maneuvers by defining' the perimeter drive.

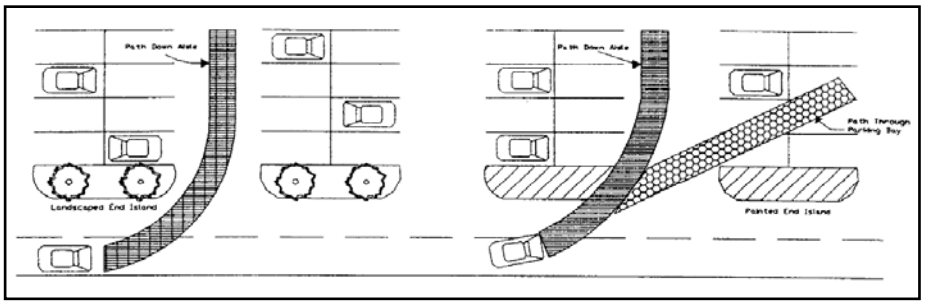


Figure 59. Cross access maneuvers.

CONCLUSION

The Thoroughfare Plan is designed to provide for a road network that addresses both the need for mobility and access to property. The functional classification system is the foundation upon which the road network is designed. The Future Volumes map and Future Lanes map provide guidance for road planning, and they provide residents, business owners, and developers with a snapshot of the city's future road network. The access management section includes a number of techniques that can be used to maximize the road network's capacity, by reducing the impact of development abutting the major road network. As with any plan, periodic re-evaluation is important to keep the concepts and goals up-to-date.

2030 Regional Transportation Plan for Southeast Michigan

Project List

November 2004



excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

SEMCOG . . . Local Governments Advancing Southeast Michigan
Southeast Michigan Council of Governments

Understanding the 2030 RTP Project List

The 2030 Regional Transportation Plan for Southeast Michigan (RTP) is the "blueprint" for transportation planning in the Southeast Michigan region. A key component of the RTP is a compilation of transportation improvement projects proposed for implementation through FY 2030. This project list is a companion document to the 2030 RTP. The list is ordered by county, time period, and project name. For example, projects in Livingston County are grouped together and contain the following information:

- RTP ID used for SEMCOG project management;
- County where the project is located (regardless of the agency responsible for maintaining the facility or funding the project);
- Project Name, generally consisting of a road name or transit activity;
- Project Limits, generally consisting of cross streets or service area;
- Length of the project in miles, if applicable;
- Proposed Work to be completed;
- Jurisdiction, which is the agency responsible for maintaining the facility;
- Time Code in which the proposed work will begin (noting that, in some cases, the project may span more than one time code);
- Funding Submitter/Source, where the funding submitter is the agency proposing the project for inclusion in the list and providing the project details (regardless of the agency responsible for maintaining the facility or funding the project), and the source is the federal, state, or local revenue category; and
- Cost by time code, funding submitter, and funding source, in thousands of dollars.

These and other terms found in the project list are defined in greater detail starting on the following page.

Figure 1 illustrates mappable projects by type (i.e., projects with sufficient geographic data for mapping, such as facility name and limits).

All projects are also available for review online at www.semcog.org/TranPlan/RTP. The online project review program contains various search and sort options, additional project details, and an electronic public comment tool.

The RTP is a dynamic document. The transportation projects outlined in time codes 1 and 2 (FY 2005-2010) are considered relatively firm commitments by the implementing agencies, meaning they will likely be completed unless unforeseen circumstances arise. Projects in time codes 3 through 6 (FY 2011-2030) represent priorities for the future based on anticipated needs, land uses, and development conditions and forecasts of available revenues. That said, the priorities of the many agencies involved in regional transportation planning can change in response to new

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

conditions. The RTP must be flexible enough to permit periodic amendments to the project list, thereby avoiding delay of federal highway and transit funding to the region. Amendments to the RTP are subject to the same evaluations and requirements as the original RTP, must be approved by the full SEMCOG committee structure, and are submitted for applicable state and federal review. Once a project is in an approved or amended RTP, it is eligible for inclusion in the Transportation Improvement Program (TIP) and receipt of federal funding.

Time code

The following time codes are used to identify the likely time frame for project implementation, although it should be noted this does not represent a commitment to fund or implement a project in any particular year.

1 — FY 2005

2 — FY 2006-2010

3 — FY 2011-2015

4 — FY 2016-2020

5 — FY 2021-2025

6 — FY 2026-2030

Funding submitters

The following funding submitters are responsible for proposing projects for inclusion in the 2030 RTP and for submitting the project details, although it should be noted these do not necessarily represent the agencies of legal jurisdiction or funding responsibility.

1 — Livingston County Road Commission, including Livingston Essential Transportation Services

2 — Road Commission of Macomb County

3 — Monroe County Road Commission

4 — Road Commission for Oakland County

5 — St. Clair County Transportation Study, including Blue Water Area Transit

6 — Washtenaw Area Transportation Study, including Ann Arbor Transportation Authority

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

7 — Wayne County Department of Public Services

8 — City of Detroit Department of Public Works, including Detroit Department of Transportation and Detroit Transportation Corporation

9 — Suburban Mobility Authority for Regional Transportation, including Lake Erie Transit

10 — Michigan Department of Transportation

11 — SEMCOG

Funding sources

The following funding sources are identified in the 2030 RTP Project List, although it should be noted these are estimates of total funding and likely funding sources and may change as projects are further defined for implementation.

5307 (Section 5307) — Federal transit funds for urban transit agencies used for capital investment in buses, new equipment, maintenance and passenger facilities, fixed-guideway systems, and preventive maintenance.

5309 (Section 5309) — Federal transit funds used for buses for fleet expansion or replacement, ancillary equipment, and bus facilities.

5310 (Section 5310) — Federal transit funds to meet the transportation needs of the elderly or persons with disabilities where traditional service is unavailable, insufficient, or inappropriate to meet those needs.

5311 (Section 5311) — Federal transit funds for capital and operating expenses and administrative assistance for areas with less than 50,000 population.

BOND (State Bond) — State bond funds used by the Michigan Department of Transportation.

BRRP (Highway Bridge Rehabilitation and Replacement Program) — Federal funds used for replacement or rehabilitation of bridges on public roads.

CMAQ (Congestion Mitigation Air Quality Program) — Federal funds designed to improve air quality through signal improvements, intersection improvements, travel demand management programs that improve traffic flow, and transit and nonmotorized projects that provide alternatives to automobile travel.

CTF (Comprehensive Transportation Fund) — State funds for transit-related projects generated through fuel tax revenues.

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

DDA (Downtown Development Authority) — Funds raised by districts established under state law in downtown areas to finance improvements to those areas.

DEMO (Demonstration Funds) — Federal funds for Congressionally earmarked projects under the Intermodal Surface Transportation Efficiency Act.

EDF (Transportation Economic Development Fund) — State program funding transportation projects necessary to support economic growth and improve quality of life. The program is divided into a number of categories as defined below.

- EDFA (Transportation Economic Development Fund - Category A) — Funds for infrastructure improvements related to specific economic development and redevelopment activities.
- EDFC (Transportation Economic Development Fund - Category C) — Funds for infrastructure improvements to reduce traffic congestion in urban counties (Macomb, Oakland, and Wayne Counties in the Southeast Michigan region).
- EDFD (Transportation Economic Development Fund - Category D) — Funds for infrastructure improvements to create an all-season road network in rural counties (Livingston, Monroe, St. Clair, and Washtenaw Counties in the Southeast Michigan region).

FAA (Federal Aviation Administration) — Federal funds provided by the federal agency responsible for oversight of the nation's air transportation system.

GF (General Fund) — Funds provided by local jurisdictions from their own budgets, as opposed to federal, state, millage, special assessment, or bond funding.

HPP (High Priority Projects) — Federal funds for Congressionally earmarked projects under the Transportation Equity Act for the 21st Century.

IM (Interstate Maintenance) — Federal funds for the maintenance of the interstate system. In Michigan, this money is used by the Michigan Department of Transportation and is not suballocated to county road commissions, cities, or villages.

LBND (Local Bond) — Funds raised through the sale of bonds by a local government.

MG (Minimum Guarantee) — Federal funds available as a result of adjustments made to the core federal apportionment programs to ensure each state's share of apportionments in federal programs is at least 90.5 percent of its contributions to the Highway Trust Fund.

MILL (Millage) — Funds raised through an assessment on real property.

MTF (Michigan Transportation Fund) — State funds generated primarily through state fuel tax receipts and vehicle registration fees. The MTF was established by Public Act 51 of 1951 and is the principle state funding source for transportation projects. Funding is divided between the state, county road commissions, cities, and villages based upon a series of formulas.

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

NHS (National Highway System) — Federal funds for projects on the National Highway System (a network of the most important highways in the United States, including the entire interstate system, a large percentage of principal arterials, the defense strategic highway network, and strategic highway connectors). In Michigan, NHS funding is used exclusively by the Michigan Department of Transportation.

OTHF (Other Federal Funds) — Federal government or agency funds not otherwise specified.

OTHL (Other Local Funds) — Local government or agency funds not otherwise specified.

OTHS (Other State Funds) — State government or agency funds not otherwise specified.

PRIV (Private Funds) — Funding from private sources (such as corporations) or donations.

SA (Special Assessment) — Funds for a project raised through charges against real property in the area that will benefit from that project. Special assessments are not based upon the value of the property being charged.

STP (Surface Transportation Program) — Main federal funding program for highway infrastructure under the Transportation Equity Act for the 21st Century. The program is divided into a number of categories as defined below.

- STPC (Surface Transportation Program - Small City) — Federal funds for eligible roadways in Census-designated "urban clusters." Currently, Southeast Michigan's urban clusters are the Village of Holly in Oakland County, the City of Richmond in Macomb and St. Clair Counties, and the City of Milan in Monroe and Washtenaw Counties.
- STPE (Surface Transportation Program - Enhancement) — Federal funds for landscaping, beautification, and nonmotorized improvements. Federal law requires each state to set aside ten percent of total STP funding for enhancement projects.
- STPF (Surface Transportation Program - Flexible) — Federal funds "flexed" from one purpose to another as allowed by federal law. In Michigan, all "flexed" money is used by the Michigan Department of Transportation.
- STPR (Surface Transportation Program - Rural) — Federal funds for eligible roadways in rural areas (i.e., anywhere outside the Federal-aid Urban Boundary). STPR funding can also be used for rural transit.
- STPS (Surface Transportation Program - Safety) — Federal funds for items such as turn lanes, signal improvements, lane markings, guardrails, and railroad grade crossings that enhance motorist and pedestrian safety. Federal law requires each state to set aside ten percent of total STP funding for safety projects.
- STPU (Surface Transportation Program-Urban) — Federal funds used for a comprehensive list of improvements to eligible roadways. STPU is the largest single federal transportation funding category received by the Southeast Michigan region and can be used in rural areas, but not vice versa.

UOFM (University of Michigan) — State funds for road and transit projects in the vicinity of university facilities.

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

RTP ID	County	Project Name	Project Limits	Length (miles)	Proposed Work	Jurisdiction	Time Code	Funding Submitter/ Source	Cost ($1,000s)
2752	Oakland	Various Capital Expenses	Countywide	0.0	Capital Expenses for County	RCOC	3	4 / MTF	77,478
2759	Oakland	Various Gravel Roads	Countywide	0.0	Pave Gravel Roads	RCOC	3	4 / STPU	5,000
							3	4 / MTF	1,250
2767	Oakland	Various Operating Expenses	Countywide	0.0	Operating Expenses for Cities and Villages	Various Agencies	3	4 / MTF	138,624
2763	Oakland	Various Operating Expenses	Countywide	0.0	Operating Expenses for Cities, Villages and County	Various Agencies	3	4 / OTHL	78,000
2771	Oakland	Various Operating Expenses	Countywide	0.0	Operating Expenses for County	RCOC	3	4 / MTF	204,767
2774	Oakland	Various Roads	Countywide	0.0	Congestion Mitigation/Air Quality Projects	Various Agencies	3	4 / CMAQ	8,913
							3	4 / MTF	2,228
2778	Oakland	Various Roads	Countywide	0.0	Improve Safety	Various Agencies	3	4 / STPS	851
							3	4 / MTF	213
2781	Oakland	Various Roads	Countywide	0.0	Resurface, Reconstruct or Rehabilitate	Various Agencies	3	4 / STPU	15,000
							3	4 / MTF	3,750
2783	Oakland	Various Roads	Countywide	0.0	Transportation Enhancements	Various Agencies	3	4 / STPE	13,049
							3	4 / MTF	3,262
2785	Oakland	Various Rural Roads	Countywide	0.0	Resurface, Reconstruct or Rehabilitate	Various Agencies	3	4 / STPR	1,882
							3	4 / MTF	470
2786	Oakland	Various Rural Roads	Countywide	0.0	Resurface, Reconstruct or Rehabilitate (Rural Transfer)	RCOC	3	4 / STPU	2,500
							3	4 / MTF	625
1152	Oakland	Walton Boulevard	Opdyke to Squirrel	1.3	Widen from 2 to 5 Lanes	RCOC	3	4 / STPU	4,800
							3	4 / MTF	1,200
4309	Oakland	Williams Lake Road	Cooley Lake to M-59	3.2	Study Widening from 2 to 5 Lanes	RCOC	3	4 / STPU	960
							3	4 / MTF	240
1157	Oakland	Williams Lake Road	Gale to Maceday Lake	0.7	Widen from 2 to 5 Lanes	RCOC	3	4 / EDFC	3,052
							3	4 / MTF	763
1178	Oakland	12 Mile Road	Beck to Dixon	1.4	Widen from 2 Lanes to 4 Lane Boulevard	RCOC	4	4 / EDFC	12,000
							4	4 / MTF	3,000
4305	Oakland	Adams Road	Auburn to Avon	2.9	Study Widening from 2 to 5 Lanes	RCOC	4	4 / STPU	480
							4	4 / MTF	120
1167	Oakland	Beck Road	I-96 to Pontiac Trail	2.1	Widen from 2 to 5 Lanes	Wixom	4	4 / STPU	10,640
							4	4 / MTF	2,660
1170	Oakland	Benstein Road	Commerce to Cooley Lake	1.1	Construct New 2 Lane Road	RCOC	4	4 / STPU	7,420
							4	4 / MTF	1,855
1171	Oakland	Benstein Road	Pontiac Trail to Maple	0.6	Construct New 2 Lane Road	RCOC	4	4 / STPU	4,500
							4	4 / MTF	1,125

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

RTP ID	County	Project Name	Project Limits	Length (miles)	Proposed Work	Jurisdiction	Time Code	Funding Submitter/ Source	Cost ($1,000s)
1976	Wayne	Various Major Streets	City of Detroit	0.0	Resurface (117 Miles)	Detroit	4	8 / MTF	37,757
4028	Wayne	Various Operating Expenses	City of Detroit	0.0	Operating Expenses	Detroit	4	8 / MTF	137,288
4010	Wayne	Various Operating Expenses	Countywide	0.0	Operating Expenses	Various Agencies	4	7 / OTHL	263,470
							4	7 / MTF	551,126
1595	Wayne	Various Roads	City of Detroit	0.0	Improve Lane Markings	Detroit	4	8 / STPU	1,086
							4	8 / MTF	272
1890	Wayne	Various Roads	Countywide	0.0	Congestion Mitigation Strategies	Wayne DPS	4	7 / CMAQ	8,299
							4	7 / MTF	2,075
1902	Wayne	Various Roads	Countywide	0.0	Improve Safety	Wayne DPS	4	7 / STPS	734
							4	7 / MTF	184
4004	Wayne	Various Roads	Countywide	0.0	Improve Traffic Operations	Wayne DPS	4	7 / EDFC	819
							4	7 / MTF	205
1879	Wayne	Various Roads	Countywide	0.0	Transportation Enhancements	Wayne DPS	4	7 / STPE	7,658
							4	7 / MTF	1,915
1870	Wayne	Various Rural Roads	Countywide	0.0	Resurface, Reconstruct or Rehabilitate	Wayne DPS	4	7 / STPR	672
							4	7 / MTF	168
1872	Wayne	Various Rural Roads	Countywide	0.0	Resurface, Reconstruct or Rehabilitate	Wayne DPS	4	7 / MTF	148
							5	7 / STPR	651
1589	Wayne	Vista	Over Canoe	0.0	Reconstruct Bridge	Detroit	4	8 / BRRP	300
							4	8 / MTF	111
1922	Wayne	West Road	Telegraph to Hall	1.0	Widen from 3 to 5 Lanes	Wayne DPS	4	7 / STPU	1,643
							4	7 / EDFC	1,637
							4	7 / MTF	820
1721	Wayne	Woodside	Over Canoe	0.0	Reconstruct Bridge	Detroit	4	8 / BRRP	300
							4	8 / MTF	105
1938	Wayne	Beck Road	6 Mile to 7 Mile	1.0	Widen from 2 to 5 Lanes	Wayne DPS	5	7 / STPU	1,901
							5	7 / EDFC	1,379
							5	7 / MTF	820
1941	Wayne	Beck Road	7 Mile to Base Line	0.9	Widen from 2 to 5 Lanes	Wayne DPS	5	7 / STPU	1,901
							5	7 / EDFC	1,379
							5	7 / MTF	820
1942	Wayne	Belleville Road	Tyler to Ecorse	1.0	Widen from 2 to 5 Lanes	Wayne DPS	5	7 / STPU	1,901
							5	7 / EDFC	1,379
							5	7 / MTF	821
1930	Wayne	Canton Center Road	Geddes to Palmer	1.1	Widen from 2 to 5 Lanes	Wayne DPS	5	7 / EDFC	1,379
							5	7 / STPU	2,221
							5	7 / MTF	900

excerpt from: "2030 Regional Transportation Plan for Southeast Michigan Project List", SEMCOG, 2004

Search 2030 Regional Transportation Plan (RTP) Projects

Detailed report for RTP Project Number 1167

Submit comment on th project

TIP ID Number :	None
MDOT Job Number :	None
County :	Oakland
Project Name :	Beck Road
Project Limits :	I-96 to Pontiac Trail
Proposed Work :	Widen from 2 to 5 Lanes
Project Type :	Capacity Improvement - 21
Project Deficiency :	☐ Bridge ☑ Congestion ☐ Nonmotorized ☐ Pavement ☑ Safety ☐ Transit ☐ Other
Length :	2.12 miles
Urban Area :	Detroit
Jurisdiction :	Wixom
Community :	Novi, Wixom
Submitter :	Oakland County Federal Aid Committee - 4
Public Involvement :	August 27, 2003 RTP Public Hearing
Justification :	Road is congested
Approval Status :	Approved
PR Number :	662105
From Mile Point :	0.000
To Mile Point :	2.126

Time Code	Phase	Federal Funds (in $1,000s)		Non-Federal Funds (in $1,000s)	
2016-2020	Construction	STPU	8,400	MTF	2,100
2016-2020	Preliminary Engineering	STPU	840	MTF	210
2016-2020	Right of Way	STPU	1,400	MTF	350
Totals (in $1,000s) $ 13,300			**$ 10,640 (80.0%)**		**$ 2,660 (20.0%)**

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Search 2030 Regional Transportation Plan (RTP) Projects

Detailed report for RTP Project Number 1938

Submit comment on th project

TIP ID Number :	None
MDOT Job Number :	None
County :	Wayne
Project Name :	Beck Road
Project Limits :	6 Mile to 7 Mile
Proposed Work :	Widen from 2 to 5 Lanes
Project Type :	Capacity Improvement - 21
Project Deficiency :	☐ Bridge ☑ Congestion ☐ Nonmotorized ☑ Pavement ☐ Safety ☐ Transit ☐ Other
Length :	1.00 miles
Urban Area :	Detroit
Jurisdiction :	Wayne DPS
Community :	Northville Twp
Submitter :	Wayne County Federal Aid Committee - 7
Public Involvement :	Approved by Wayne FAC on 12/10/03 and posted to county Website at www.waynecounty.com
Justification :	Congestion and pavement condition
Approval Status :	Approved
PR Number :	1595603
From Mile Point :	9.760
To Mile Point :	10.764

Time Code	Phase	Federal Funds (in $1,000s)		Non-Federal Funds (in $1,000s)	
2021-2025	Construction	EDFC	1,379	MTF	820
		STPU	1,901		
Totals (in $1,000s) $ 4,100			**$ 3,280 (80.0%)**		**$ 820 (20.0%)**

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Source: search of http://webdev2.semcog.org/cgi-bin/data/att-rtp.cfm

Search 2030 Regional Transportation Plan (RTP) Projects

Detailed report for RTP Project Number 1941

Submit comment on th project

TIP ID Number :	None
MDOT Job Number :	None
County :	Wayne
Project Name :	Beck Road
Project Limits :	7 Mile to Base Line
Proposed Work :	Widen from 2 to 5 Lanes
Project Type :	Capacity Improvement - 21
Project Deficiency :	☐ Bridge ☑ Congestion ☐ Nonmotorized ☑ Pavement ☐ Safety ☐ Transit ☐ Other
Length :	0.91 miles
Urban Area :	Detroit
Jurisdiction :	Wayne DPS
Community :	Northville Twp
Submitter :	Wayne County Federal Aid Committee - 7
Public Involvement :	Approved by Wayne FAC on 12/10/03 and posted to county Website at www.waynecounty.com
Justification :	Congestion and pavement condition
Approval Status :	Approved
PR Number :	1595603
From Mile Point :	10.764
To Mile Point :	11.682

Time Code	Phase	Federal Funds (in $1,000s)		Non-Federal Funds (in $1,000s)	
2021-2025	Construction	EDFC	1,379	MTF	820
		STPU	1,901		
Totals (in $1,000s) $ 4,100			**$ 3,280 (80.0%)**		**$ 820 (20.0%)**

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Construction Cost Estimate

Fishbeck, Thompson, Carr & Huber, Inc.
39255 Country Club Drive, Suite B-25, Farmington Hills, MI 48331
Telephone: (248) 324-2090 FAX: (248) 324-0930

Short Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**11/26/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Add dedicated right turn lane to SB**		
		Prepared by:	**DPE**

8 Mile Intersection

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Sawcut Pavement Edge	LF	450	5.00	2,250.00
2	Remove Curb and Gutter	LF		5.00	-
3	Aggregate Base, 8"	SYD	500	10.00	5,000.00
4	Curb and Gutter	LF	350	15.00	5,250.00
5	HMA Paving (5.5" in 3 lifts)	SYD	500	20.00	10,000.00
6	Shoulder, Cl II, 4 inch	SYD	100	8.00	800.00
7	Maintaining Traffic	LS	1	5,000.00	5,000.00
8	Permanent Pavement Marking and Signing	LS	1	1,500.00	1,500.00
9	Restoration	LS	1	2,500.00	2,500.00
				Subtotal	32,300.00
		Mobilization and Contingency (20%)			6,460.00
	Total Unit Price items estimate				**$ 38,760**

		+ Design Fees Estimate (8.5%)	$ 3,295
		+ Construction Observation Estimate (13%)	$ 5,039
		= Total Estimated Roadway Cost:	**$ 47,093**
		+ estimated signal replacement costs:	$ 150,000
**acres @ $85,000 / acre:*	*0.22*	+ *Estimated ROW Costs:	$ 18,700
		Total Estimated Project Cost	**$ 215,793**

Notes

The replacement of the signal would be required based on the improvements shown, however as this is at the intersection with a county road, if the improvements are done at the same time the county works on Eight Mile the signal costs would be borne by the RCOC.

Construction Cost Estimate

Fishbeck, Thompson, Carr & Huber, Inc.
39255 Country Club Drive, Suite B-25, Farmington Hills, MI 48331
Telephone: (248) 324-2090 FAX: (248) 324-0930

Short Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**11/26/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Extend existing NB right turn lane**		
		Prepared by:	**DPE**

9 Mile Intersection

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Sawcut Pavement Edge	LF	280	5.00	1,400.00
2	Remove Curb and Gutter	LF		5.00	-
3	Aggregate Base, 8"	SYD	125	10.00	1,250.00
4	Curb and Gutter	LF	250	15.00	3,750.00
5	HMA Paving (5.5" in 3 lifts)	SYD	125	20.00	2,500.00
6	Shoulder, Cl II, 4 inch	SYD	80	8.00	640.00
7	Maintaining Traffic	LS	1	3,500.00	3,500.00
8	Permanent Pavement Marking and Signing	LS	1	1,000.00	1,000.00
9	Restoration	LS	1	1,500.00	1,500.00
				Subtotal	15,540.00
		Mobilization and Contingency (20%)			3,108.00
	Total Unit Price items estimate				**$ 18,648**

		+ Design Fees Estimate (8.5%)	$ 1,585
		+ Construction Observation Estimate (13%)	$ 2,424
		= Total Estimated Roadway Cost:	**$ 22,657**
		+ estimated signal replacement costs:	$ -
**acres @ $85,000 / acre:*	*0.15*	+ *Estimated ROW Costs:	$ 12,750
		Total Estimated Project Cost	**$ 35,407**

Notes
The proposed work does not directly impact the existing signal, replacement not required for work as shown.

Construction Cost Estimate

Fishbeck, Thompson, Carr & Huber, Inc.

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Short Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**11/26/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Add dedicated right turn lanes to NB, SB, and EB legs;**		
	extend WB right turn lane and EB left turn lane	**Prepared by:**	**DPE**

10 Mile Intersection

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Sawcut Pavement Edge	LF	1,300	5.00	6,500.00
2	Remove Curb and Gutter	LF	220	5.00	1,100.00
3	Aggregate Base, 8"	SYD	1,500	10.00	15,000.00
4	Curb and Gutter	LF	880	15.00	13,200.00
5	HMA Paving (5.5" in 3 lifts)	SYD	1,500	20.00	30,000.00
6	Shoulder, Cl II, 4 inch	SYD	300	8.00	2,400.00
7	Maintaining Traffic	LS	1	8,500.00	8,500.00
8	Permanent Pavement Marking and Signing	LS	1	3,000.00	3,000.00
9	Restoration	LS	1	7,000.00	7,000.00
				Subtotal	86,700.00
		Mobilization and Contingency (20%)			17,340.00
	Total Unit Price items estimate				**$ 104,040**

		+ Design Fees Estimate (8.5%)	$ 8,843
		+ Construction Observation Estimate (13%)	$ 13,525
		= Total Estimated Roadway Cost:	**$ 126,409**
		+ estimated signal replacement costs:	$ 150,000
**acres @ $85,000 / acre:*	*1.52*	+ *Estimated ROW Costs:	$ 129,200
		Total Estimated Project Cost	**$ 405,609**

Construction Cost Estimate

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Short Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**11/26/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Add dedicated right turn lanes to EB and WB legs**		
		Prepared by:	**DPE**

11 Mile Intersection

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Sawcut Pavement Edge	LF	650	5.00	3,250.00
2	Remove Curb and Gutter	LF	120	5.00	600.00
3	Aggregate Base, 8"	SYD	850	10.00	8,500.00
4	Curb and Gutter	LF	600	15.00	9,000.00
5	HMA Paving (5.5" in 3 lifts)	SYD	850	20.00	17,000.00
6	Shoulder, Cl II, 4 inch	SYD	160	8.00	1,280.00
7	Maintaining Traffic	LS	1	5,000.00	5,000.00
8	Permanent Pavement Marking and Signing	LS	1	1,500.00	1,500.00
9	Restoration	LS	1	3,000.00	3,000.00
				Subtotal	49,130.00
		Mobilization and Contingency (20%)			9,826.00
	Total Unit Price items estimate				**$ 58,956**

		+ Design Fees Estimate (8.5%)	$ 5,011
		+ Construction Observation Estimate (13%)	$ 7,664
		= Total Estimated Roadway Cost:	**$ 71,632**
		+ estimated signal replacement costs:	$ 150,000
**acres @ $85,000 / acre:*	*0.19*	+ *Estimated ROW Costs:	$ 16,150
		Total Estimated Project Cost	**$ 237,782**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Repair and overlay of existing pavement**		
		Prepared by:	**DPE**

8 Mile to 9 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	19,500	1.50	29,250.00
2	HMA Patching	TON	200	75.00	15,000.00
3	HMA Leveling, 2"	SYD	19,500	6.00	117,000.00
4	HMA Top, 1.5"	SYD	19,500	4.50	87,750.00
5	Shoulder, Cl II, 4 inch	SYD	6,800	8.00	54,400.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	323,400.00
		Mobilization and Contingency (20%)			64,680.00
	Total Unit Price items estimate				**$ 388,080**

Design Fees Estimate (8.5%)	$	32,987
Construction Observation Estimate (11%)	$	42,689
Total Estimated Project Cost:	**$**	**463,756**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Mill and Overlay Existing Pavement**		
		Prepared by:	**DPE**

9 Mile to 10 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	22,160	1.50	33,240.00
2	HMA Patching	TON	20	75.00	1,500.00
3	HMA Leveling, 2"	SYD	22,160	6.00	132,960.00
4	HMA Top, 1.5"	SYD	22,160	4.50	99,720.00
5	Shoulder, Cl II, 4 inch	SYD	7,200	8.00	57,600.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	345,020.00
		Mobilization and Contingency (20%)			69,004.00
	Total Unit Price items estimate				**$ 414,024**

Design Fees Estimate (8.5%)	$	35,192
Construction Observation Estimate (11%)	$	45,543
Total Estimated Project Cost:	**$**	**494,759**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Repair and overlay of existing pavement**		
		Prepared by:	**DPE**

10 Mile to 11 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	19,750	1.50	29,625.00
2	HMA Patching	TON	200	75.00	15,000.00
3	HMA Leveling, 2"	SYD	19,750	6.00	118,500.00
4	HMA Top, 1.5"	SYD	19,750	4.50	88,875.00
5	Shoulder, Cl II, 4 inch	SYD	6,600	8.00	52,800.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	324,800.00
		Mobilization and Contingency (20%)			64,960.00
	Total Unit Price items estimate				**$ 389,760**

Design Fees Estimate (8.5%)	$	33,130
Construction Observation Estimate (11%)	$	42,874
Total Estimated Project Cost:	**$**	**465,763**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Mill and Overlay Existing Pavement**		
		Prepared by:	**DPE**

11 Mile to S. of Grand River

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	9,680	1.50	14,520.00
2	HMA Patching	TON	20	75.00	1,500.00
3	HMA Leveling, 2"	SYD	9,680	6.00	58,080.00
4	HMA Top, 1.5"	SYD	9,680	4.50	43,560.00
5	Shoulder, Cl II, 4 inch	SYD	2,800	8.00	22,400.00
6	Restoration	LS	3,000	4.00	12,000.00
					-
				Subtotal	152,060.00
		Mobilization and Contingency (20%)			30,412.00
	Total Unit Price items estimate				**$ 182,472**

Design Fees Estimate (8.5%)	$	15,510
Construction Observation Estimate (11%)	$	20,072
Total Estimated Project Cost:	**$**	**218,054**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Repair and overlay of existing pavement**		
		Prepared by:	**DPE**

8 Mile to 9 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	19,500	1.50	29,250.00
2	HMA Patching	TON	200	75.00	15,000.00
3	HMA Leveling, 2"	SYD	19,500	6.00	117,000.00
4	HMA Top, 1.5"	SYD	19,500	4.50	87,750.00
5	Shoulder, Cl II, 4 inch	SYD	6,800	8.00	54,400.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	323,400.00
		Mobilization and Contingency (20%)			64,680.00
	Total Unit Price items estimate				**$ 388,080**

Design Fees Estimate (8.5%)	$	32,987
Construction Observation Estimate (11%)	$	42,689
Total Estimated Project Cost:	**$**	**463,756**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Mill and Overlay Existing Pavement**		
		Prepared by:	**DPE**

9 Mile to 10 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	22,160	1.50	33,240.00
2	HMA Patching	TON	20	75.00	1,500.00
3	HMA Leveling, 2"	SYD	22,160	6.00	132,960.00
4	HMA Top, 1.5"	SYD	22,160	4.50	99,720.00
5	Shoulder, Cl II, 4 inch	SYD	7,200	8.00	57,600.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	345,020.00
		Mobilization and Contingency (20%)			69,004.00
	Total Unit Price items estimate				**$ 414,024**

Design Fees Estimate (8.5%)	$	35,192
Construction Observation Estimate (11%)	$	45,543
Total Estimated Project Cost:	**$**	**494,759**

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Repair and overlay of existing pavement**		
		Prepared by:	**DPE**

10 Mile to 11 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	19,750	1.50	29,625.00
2	HMA Patching	TON	200	75.00	15,000.00
3	HMA Leveling, 2"	SYD	19,750	6.00	118,500.00
4	HMA Top, 1.5"	SYD	19,750	4.50	88,875.00
5	Shoulder, Cl II, 4 inch	SYD	6,600	8.00	52,800.00
6	Restoration	LS	5,000	4.00	20,000.00
					-
				Subtotal	324,800.00
		Mobilization and Contingency (20%)			64,960.00
	Total Unit Price items estimate				**$ 389,760**

Design Fees Estimate (8.5%)	$	33,130
Construction Observation Estimate (11%)	$	42,874
Total Estimated Project Cost:	**$**	**465,763**

Construction Cost Estimate

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Short Term Pavement Condition Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Mill and Overlay Existing Pavement**		
		Prepared by:	**DPE**

11 Mile to S. of Grand River

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Cold Mill Asphalt Surface	SYD	9,680	1.50	14,520.00
2	HMA Patching	TON	20	75.00	1,500.00
3	HMA Leveling, 2"	SYD	9,680	6.00	58,080.00
4	HMA Top, 1.5"	SYD	9,680	4.50	43,560.00
5	Shoulder, Cl II, 4 inch	SYD	2,800	8.00	22,400.00
6	Restoration	LS	3,000	4.00	12,000.00
					-
				Subtotal	152,060.00
		Mobilization and Contingency (20%)			30,412.00
	Total Unit Price items estimate				**$ 182,472**

Design Fees Estimate (8.5%)	$	15,510
Construction Observation Estimate (11%)	$	20,072
Total Estimated Project Cost:	**$**	**218,054**

Construction Cost Estimate

Fishbeck, Thompson, Carr & Huber, Inc.

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Long Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/26/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Proposed 5-lane section**		
		Prepared by:	**DPE**

8 Mile to 9 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Preconstruction Audio-Visual	LS	1	3,500.00	3,500.00
2	Soil Erosion and Sedimentation Control Measures	LS	1	15,000.00	15,000.00
3	Maintaining Traffic	LS	1	15,000.00	15,000.00
4	Remove Asphalt Surface	SYD	19,500	2.00	39,000.00
5	Remove Curb and Gutter	LF	500	5.00	2,500.00
6	Subgrade Undercut and Backfill	CYD	250	25.00	6,250.00
7	Underdrain	LF	10,400	6.00	62,400.00
8	Storm Sewer, 12"	LF	2,650	25.00	66,250.00
9	Storm Sewer, 18"	LF	900	35.00	31,500.00
10	Storm Sewer, 24"	LF	500	45.00	22,500.00
11	Storm Catch Basin	EA	36	900.00	32,400.00
12	Storm Manhole	EA	17	1,200.00	20,400.00
13	Subbase (12")	SYD	22,000	15.00	330,000.00
14	Aggregate Base (8")	SYD	36,000	7.00	252,000.00
15	Concrete Curb and Gutter	LF	10,000	12.00	120,000.00
16	HMA Paving (5.5" in 3 lifts)	SYD	34,700	17.00	589,900.00
17	Driveway Approaches	SYD	800	35.00	28,000.00
18	Side Road Approaches	SYD	600	30.00	18,000.00
19	5' Concrete Pathway	LF	1,370	25.00	34,250.00
20	8' HMA Pathway	LF	3,460	15.00	51,900.00
21	8' Boardwalk	LF	780	300.00	234,000.00
22	Pavement Marking and Permanent Signs	LS	1	3,500.00	3,500.00
23	Restoration	LS	1	30,000.00	30,000.00
				Subtotal	2,008,250.00
		Mobilization and Contingency (25%)			502,062.50
	Total Unit Price items estimate				**$ 2,510,312.50**

+ Design Fees Estimate (7.5%)	$	188,273
+ Construction Observation Estimate (10%)	$	251,031
= Total Estimated Roadway Cost	**$**	**2,949,617**
**acres @ $85,000 / acre: 3.123* + *Estimated ROW Costs:	$	265,455
Total Estimated Project Cost	**$**	**3,215,072**

Construction Cost Estimate

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Long Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Proposed 5-lane section and 4-lane boulevard**		
		Prepared by:	**DPE**

9 Mile to 10 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Preconstruction Audio-Visual	LS	1	3,500.00	3,500.00
2	Soil Erosion and Sedimentation Control Measures	LS	1	15,000.00	15,000.00
3	Maintaining Traffic	LS	1	10,000.00	10,000.00
4	Remove Asphalt Surface	SYD	22,160	2.00	44,320.00
5	Remove Curb and Gutter	LF	450	5.00	2,250.00
6	Subgrade Undercut and Backfill	CYD	250	25.00	6,250.00
7	Underdrain	LF	16,800	6.00	100,800.00
8	Storm Sewer, 12"	LF	1,850	25.00	46,250.00
9	Storm Sewer, 18"	LF	1,200	35.00	42,000.00
10	Storm Sewer, 24"	LF	600	45.00	27,000.00
11	Storm Catch Basin	EA	54	900.00	48,600.00
12	Storm Manhole	EA	28	1,200.00	33,600.00
13	Subbase (12")	SYD	24,000	15.00	360,000.00
14	Aggregate Base (8")	SYD	30,100	7.00	210,700.00
15	Concrete Curb and Gutter	LF	16,800	12.00	201,600.00
16	HMA Paving (5.5" in 3 lifts)	SYD	30,100	17.00	511,700.00
17	Driveway Approaches	SYD	700	35.00	24,500.00
18	Side Road Approaches	SYD	1,800	30.00	54,000.00
19	5' Concrete Pathway	LF	250	25.00	6,250.00
20	8' HMA Pathway	LF	3,335	15.00	50,025.00
21	8' Boardwalk	LF	525	300.00	157,500.00
22	Pavement Marking and Permanent Signs	LS	1	6,000.00	6,000.00
23	Restoration	LS	1	50,000.00	50,000.00
				Subtotal	2,011,845.00
		Mobilization and Contingency (25%)			502,961.25
	Total Unit Price items estimate				**$ 2,514,806.25**

+ Design Fees Estimate (7.5%)		$	188,610
+ Construction Observation Estimate (10%)		$	251,481
= Total Estimated Roadway Cost		**$**	**2,954,897**
**acres @ $85,000 / acre:*	*2.336* + *Estimated ROW Costs:	$	198,560
Total Estimated Project Cost		**$**	**3,153,457**

Construction Cost Estimate

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Long Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Proposed 5-lane section and 4-lane boulevard**		
		Prepared by:	**DPE**

10 Mile to 11 Mile

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Preconstruction Audio-Visual	LS	1	3,500.00	3,500.00
2	Soil Erosion and Sedimentation Control Measures	LS	1	15,000.00	15,000.00
3	Maintaining Traffic	LS	1	14,000.00	14,000.00
4	Remove Asphalt Surface	SYD	19,750	2.00	39,500.00
5	Remove Curb and Gutter	LF	700	5.00	3,500.00
6	Subgrade Undercut and Backfill	CYD	250	25.00	6,250.00
7	Underdrain	LF	17,300	6.00	103,800.00
8	Storm Sewer, 12"	LF	2,650	25.00	66,250.00
9	Storm Sewer, 18"	LF	900	35.00	31,500.00
10	Storm Sewer, 24"	LF	600	45.00	27,000.00
11	Storm Catch Basin	EA	54	900.00	48,600.00
12	Storm Manhole	EA	29	1,200.00	34,800.00
13	Subbase (12")	SYD	25,000	15.00	375,000.00
14	Aggregate Base (8")	SYD	29,660	7.00	207,620.00
15	Concrete Curb and Gutter	LF	17,300	12.00	207,600.00
16	HMA Paving (5.5" in 3 lifts)	SYD	29,660	17.00	504,220.00
17	Driveway Approaches	SYD	600	35.00	21,000.00
18	Side Road Approaches	SYD	2,000	30.00	60,000.00
19	5' Concrete Pathway	LF	3,580	25.00	89,500.00
20	8' HMA Pathway	LF	2,210	15.00	33,150.00
21	8' Boardwalk	LF	920	300.00	276,000.00
22	Pavement Marking and Permanent Signs	LS	1	6,000.00	6,000.00
23	Restoration	LS	1	50,000.00	50,000.00
				Subtotal	2,223,790.00
		Mobilization and Contingency (25%)			555,947.50
	Total Unit Price items estimate				**$ 2,779,737.50**

+ Design Fees Estimate (7.5%)		$	208,480
+ Construction Observation Estimate (10%)		$	277,974
= Total Estimated Roadway Cost		**$**	**3,266,192**
**acres @ $85,000 / acre:*	*1.79* + *Estimated ROW Costs:	$	152,150
Total Estimated Project Cost		**$**	**3,418,342**

Construction Cost Estimate

Fishbeck, Thompson, Carr & Huber, Inc.

39255 Country Club Drive, Suite B-25, Farmington Hills, MI 48331

Telephone: (248) 324-2090 FAX: (248) 324-0930

Long Term Capacity Improvements

Project:	**Beck Road Corridor Scoping Study**	**Date:**	**10/23/2006**
Location:	**Beck Road**	**Project No.**	**G06496**
Work:	**Proposed 5-lane section**		
		Prepared by:	**DPE**

11 Mile to 1050 feet S. of Grand River

Item No.	Item Description	Unit	Est. Quantity	Unit Price ($)	Total Cost ($)
1	Preconstruction Audio-Visual	LS	1	3,500.00	3,500.00
2	Soil Erosion and Sedimentation Control Measures	LS	1	8,000.00	8,000.00
3	Maintaining Traffic	LS	1	9,000.00	9,000.00
4	Remove Asphalt Surface	SYD	9,680	2.00	19,360.00
5	Remove Curb and Gutter	LF	350	5.00	1,750.00
6	Subgrade Undercut and Backfill	CYD	200	25.00	5,000.00
7	Underdrain	LF	4,700	6.00	28,200.00
8	Storm Sewer, 12"	LF	900	25.00	22,500.00
9	Storm Sewer, 18"	LF	600	35.00	21,000.00
10	Storm Sewer, 24"	LF	900	45.00	40,500.00
11	Storm Catch Basin	EA	20	900.00	18,000.00
12	Storm Manhole	EA	11	1,200.00	13,200.00
13	Subbase (12")	SYD	9,400	15.00	141,000.00
14	Aggregate Base (8")	SYD	15,700	7.00	109,900.00
15	Concrete Curb and Gutter	LF	4,700	12.00	56,400.00
16	HMA Paving (5.5" in 3 lifts)	SYD	15,700	17.00	266,900.00
17	Driveway Approaches	SYD	500	35.00	17,500.00
18	Side Road Approaches	SYD	1,000	30.00	30,000.00
19	5' Concrete Pathway	LF	1,050	25.00	26,250.00
20	8' HMA Pathway	LF	2,005	15.00	30,075.00
21	8' Boardwalk	LF	755	300.00	226,500.00
22	Pavement Marking and Permanent Signs	LS	1	2,500.00	2,500.00
23	Restoration	LS	1	12,000.00	12,000.00
				Subtotal	1,109,035.00
		Mobilization and Contingency (25%)			277,258.75
	Total Unit Price items estimate				**$ 1,386,293.75**

+ Design Fees Estimate (7.5%)		$	103,972
+ Construction Observation Estimate (10%)		$	138,629
= Total Estimated Roadway Cost		**$**	**1,628,895**
**acres @ $85,000 / acre:*	*2.318* + *Estimated ROW Costs:	$	197,030
Total Estimated Project Cost		**$**	**1,825,925**

Annual Inflation Rate Factors

	Inflation Percentage				
Year	**2%**	**3%**	**4%**	**5%**	**6%**
2007	1.02	1.03	1.04	1.05	1.06
2008	1.04	1.06	1.08	1.10	1.12
2009	1.06	1.09	1.12	1.16	1.19
2010	1.08	1.13	1.17	1.22	1.26
2015	1.20	1.30	1.42	1.55	1.69
2020	1.32	1.51	1.73	1.98	2.26
2030	1.61	2.03	2.56	3.23	4.05

The rates shown are for whole year averages; $FV = PV(1+r)^n$
Average annual U.S. inflation from 1995 - 2005 was 2.54%

Recent actual annual inflation

YEAR	AVG.
2005	3.39%
2004	2.68%
2003	2.27%
2002	1.59%
2001	2.83%
2000	3.38%
1999	2.19%
1998	1.55%
1997	2.34%
1996	2.93%
1995	2.81%

Source: http://inflationdata.com/inflation/Inflation_Rate/HistoricalInflation.aspx accessed 10/11/2006

These factors may be applied to present value estimates to approximate future value costs.

Ex. $100,000 estimate in 2006; if assume 3% annual inflation, would need $151,000 in 2020.

DESCRIPTION OF BECK ROAD WETLANDS BETWEEN GRAND RIVER AVENUE AND 8 MILE ROAD

Location	Station Locations	Wetland Type	Description	Regulatory Status	Justification of Regulatory Status
Between Grand River and 11 Mile:					
West side of Beck:	167+90 to 168+10	Emergent	Drainageway: reed canarygrass, cress	Regulated	Contiguous with a stream.
	174+20 to 179+10	Emergent	Marsh\wet meadow: cattails, reed canarygrass	Regulated	Part of a wetland system greater than 5 acres in size.
East side of Beck	159+20 to 161+75	Forested	Box elder, American elm	Regulated	Part of a wetland system greater than 5 acres in size.
	167+80 to 168+00	Emergent	Drainageway: cattails, reed canarygrass	Regulated	Contiguous with a stream.
	179+25 to 181+00	Emergent	Marsh: cattails, reed canarygrass	Regulated	Part of a wetland system greater than 5 acres in size.
Between 11 Mile and 10 Mile:					
West side of Beck:	131+40 to 135+25	Emergent	Marsh/forested: cattails, green ash	Regulated	Part of a wetland system greater than 5 acres in size.
East side of Beck:	119+10 to 123+85	Forested	Cottonwood, American elm, black willow	Regulated	Part of a wetland system greater than 5 acres in size.
	132+50 to 135+05	Forested	Willows, cattails, red maple	Regulated	Culvert connects wetland to large wetland to west.
Between 10 Mile and 9 Mile:					
West side of Beck:	53+35 to 57+15	Emergent	Marsh: Common reed, cattails	Regulated	Part of a wetland system greater than 5 acres in size.
	77+70 to 81+20	Forested	Silver maple, American elm, glossy buckthorn	Regulated	Part of a wetland system greater than 5 acres in size.
	83+85 to 87+15	Forested	Roadside ditch joining with forested wetland	Regulated	Part of a wetland system greater than 5 acres in size.
East side of Beck:	53+50 to 60+40	Various	Common reed, red-osier dogwood, American elm	Regulated	Part of a wetland system greater than 5 acres in size.
	71+50 to 72+90	Forested	Common reed, black willow	Regulated	Hydraulically connected to wetland west of Beck Road.
	77+50 to 78+80	Emergent	Cattails, reed canarygrass, common reed	Unknown	Same wetland as between WB-10 and WB-11.
	89+40 to 93+25	Emergent	Cattails, reed canarygrass, common reed	Unknown	Unable to determine the size or if connected to a nearby wetland.
Between 9 Mile and 8 Mile:					
West side of Beck:	5+70 to 10+55	Forested	Box elder, red maple, American elm	Regulated	Part of a wetland system greater than 5 acres in size.
	29+45 to 31+50	Emergent	Common reed, cattails	Regulated	Part of a wetland system greater than 5 acres in size.
	45+00 to 50+80	Forested	Silver maple, dogwood, cattails	Regulated	Regulated by Novi, not the State of Michigan.

Notes:
A wetlands permit, pursuant to Sections 30307 and 30311 of Act 451, and R281.922 and R281.923 of Michigan's Administrative Rules, will be required prior to any construction activities in wetland areas greater than 5 acres in size, or contiguous with a body of water. In addition, erosion and sedimentation controls must be implemented to prevent unlawful discharge of soil into the wetland areas.

The City of Novi Code of Ordinances regulates activities within wetlands that are greater than 2 acres in size. However, Section 12-171(b)(12) of the Code of Ordinances exempts “construction, maintenance, repair or improvement by a governmental entity .... of a sewer system, drainage system or water main facility.” A use permit is not required from the City of Novi for these activities. However, all such work should be “ conducted in compliance with state law and all City of Novi Ordinances and in such a manner as to assure that any adverse effect on the wetland will be otherwise minimized.”

Utility Information
City of Novi
Beck Road Scoping Study
Updated: 9/29/2006

Owner	Utility	Information Received / Status	Notes
Consumers Energy Attention: Dominic King 11801 Farmington Rd Livonia, MI 48150 734-513-6268, fax 734-513-6266 dkking@cmsenergy.com	gas	8/15/2006 Printed maps off SIMS website.	First fax map request form then send final drawings to Dominic. Access SIMS website for drawings: www.consumersenergy.com/sims
Michigan Consolidated Gas Company Drafting Clerk 2nd Floor Noble 3200 Hobson Street Detroit, MI 48201 313-577-7236 Bill McClelland 313-577-7323	gas	8/16/2006 Faxed request 08/22/2006 Received fax stating no Michcon gas mains in the project area.	Fax requests to: Michigan Consolidated Gas Company Main Location 313-577-7061
Robert Houbeck Detroit Edison 2000 Second Ave, Rm. 518 S.B. Detroit, MI 48226 313-235-8811 Office 313-235-9366 Fax 313-440-6432 pager	electric	8/16/2006 Mailed request 8/28/2006 Received maps	Detroit Edison Contact for relocation of street lighting Greggory Tchozewski 8001 South Haggerty Belleville, MI 48111 734-397-4174 734-397-4018 fax Detroit Edison Contact for relocation of electric and gas Nancy Bacigalupo 56500 Grand River Ave New Hudson, MI 48165 248-486-6306, fax 248-486-6305

Utility Information
City of Novi
Beck Road Scoping Study
Updated: 9/29/2006

Owner	Utility	Information Received / Status	Notes
Bright House Networks Attention: Bob Hendzell Construction Department 25000 Capitol Redford, MI 48239 313-538-3911 ext 1112 313-538-1237 (fax)	cable/FO	8/16/2006 Mailed request 9/11/2006 Left voice mail inquiring on status 9/11/2006 Received maps via fax	313-538-1313 Customer Service
SBC Attention: Shanquetha Gentry (goes by Shawn) contact for utility location only 550 South Maple Ann Arbor, MI 48103 734-996-5329 734-996-5344 (fax)	tele	8/16/2006 Mailed request 9/11/2006 Called Shawn to check on status, she will try to send out by the end of the week 9/14/2006 Received voice mail from Shawn stating she is mailing out the maps today. 9/15/2006 Received e-mail from Shawn with plan view maps attached. She stated that conduit drawings were too large to e-mail and being sent via mail. 9/26/2006 Received conduit drawings in mail.	SBC Engineer Greg Smith contact for relocation 550 South Maple Ann Arbor, MI 48106 734-996-2197 734-817-2197 pager
West Bay Exploration (Somoco) Joline Dorer Operations Assistant 5555 N. Hogback Road Fowlerville, MI 48836 517-223-4011, fax 517-223-4020	pipeline		Delta Trucking Pipeline Pipeline runs midway between Wixom Road and Beck Road, does not cross or come closer to Beck Road than 1/2 mile.
Steve Rudzinski Comcast Regional Design Center 27800 Franklin Road Southfield, MI 48034 248-359-6544 office 248-359-6535 fax steve_rudzinski@cable.comcast.com	cable	8/16/2006 Sent contact info. request on comcast website. 8/29/2006 Received e-mail with contact info. 8/29/2006 Mailed request 9/11/2006 Received letter stating they do not service the project area	
Norlight Telecommunications Attention: Paul Neumann 13935 Bishops Drive Brookfield, WI 53005 262-792-7219 Fax 262-792-7991 pbn@norlight.com	fiber optic	8/16/2006 Mailed request 9/11/2006 Left voice mail inquiring on status 9/12/2006 Received voice mail from Paul stating he can't find the request 9/13/2006 Left voice mail asking him to call me back 9/15/2006 Talked to Paul, he stated that the only buried line they have is along the south side of Nine Mile crossing Beck Road	

Fishbeck, Thompson, Carr & Huber, Inc.

engineers
scientists
architects
constructors

August 16, 2006

Utility Company
123 Address
City, State, Zip

39255 Country Club Dr.
Suite B-25
Farmington Hills, MI
48331
ph: 248.324.2090
fax: 248.324.0930
www.ftch.com

To Whom It May Concern:

Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) is preparing plans for a scoping project as part of a long range planning tool for the City of Novi, Oakland County, Michigan. Your utility information is being requested to be used as a part of developing alternatives, cost estimates, staging plans, etc. The information you provide will be part of the scoping report and furnished to planners and consultants as the project stages are released.

The project is a study of the Beck Road corridor between 8 Mile Road and Grand River Avenue. Enclosed is a general location map of the proposed project for your reference. The survey sections are as follows:

- T01N, R08E, Sections 16, 17, 20, 21, 28, 29, 32, 33

If your firm has utilities in the project area, please forward your record utility maps indicating the location, approximate elevation, size, material, and type of utility present. If your firm has no utilities in the area, send us a letter indicating this or contact Ms. Jenean Bullis at 248-324-2131 and a memo will be generated for the utility records. Please provide us with the name, address and telephone number of a contact person for your company should we need to reach you during construction, if necessary and advise if you are interested in attending the preconstruction meeting.

If you have any questions or require additional information, please call. For prompt fax delivery, use 248-324-0930.

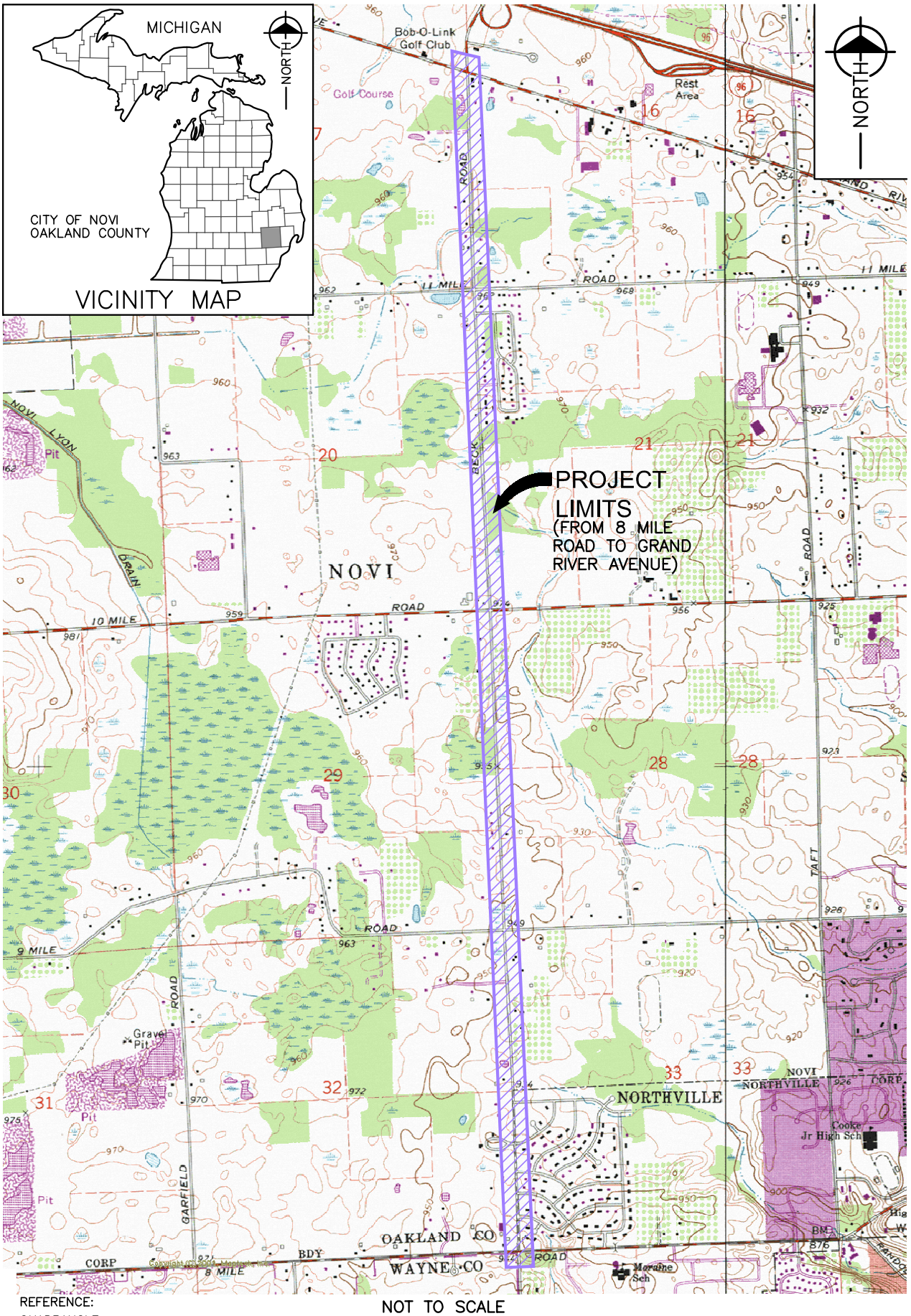
Sincerely,

FISHBECK, THOMPSON, CARR & HUBER, INC.

Jenean M. Bullis

krn
Enclosure

SAMPLE



NOT TO SCALE

REFERENCE:
QUADRANGLE
7.5 MINUTE SERIES
DATED: 1900
PHOTOREVISED: 1900
Terrain Navigator Pro v. 6.01,
(c)2003, Maptech Inc.

USGS TOPOGRAPHIC MAP

PLOT INFO: U:\CADD\06496\CD\C00106496_FIG1.DWG DATE: 8/15/2006 TIME: 4:48:08 PM USER: BDR
U:\CADD\06496\RASTER\BECK3.TIF
U:\CADD\06496\RASTER\BECK4.TIF
U:\CADD\06496\RASTER\BECK2.TIF

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fishbeck, thompson, carr & huber, inc.

fteh 50 years

engineers
scientists
architects
constructors

City of Novi
Oakland County, Novi, Michigan

Beck Road Scoping Study

PROJECT NO.
G06496

REPORT ON GEOTECHNICAL INVESTIGATION
BECK ROAD SCOPING STUDY PROJECT
EIGHT MILE ROAD TO GRAND RIVER AVENUE
NOVI, MICHIGAN

OWNER:
CITY OF NOVI

PREPARED FOR:
FISHBECK, THOMPSON, CARR & HUBER, INC.
39255 COUNTRY CLUB DRIVE, SUITE B-25
FARMINGTON HILLS, MICHIGAN 48331

Somat Engineering, INCORPORATED
Infrastructure Engineering Solutions

G06119A
September 15, 2006

Somat Engineering, INCORPORATED

September 15, 2006
G06119A

Mr. David Eno, P.E.
Fishbeck, Thompson, Carr & Huber, Inc.
39255 Country Club Drive, Suite B-25
Farmington Hills, Michigan 48331

Regarding: Report on Geotechnical Investigation
Beck Road Scoping Study Project
Eight Mile Road to Grand River Avenue
Novi, Michigan

Dear Mr. Eno:

We have completed the geotechnical investigation for the Beck Road Scoping Study Project in Novi, Michigan. This report presents the results of our observations, geotechnical recommendations, and construction considerations.

The soil samples collected during our field investigation will be retained in our laboratory for 60 days, at which time these samples will be discarded unless otherwise directed by you.

SOMAT Engineering, Inc. is a full service geotechnical and construction/materials testing company. We would be pleased to be involved during the construction phase of this project and would welcome the opportunity to discuss any questions you may have regarding these services.

It was a pleasure working with you on this phase of the project. If you have any questions regarding this report, please do not hesitate to contact us.

Sincerely,

SOMAT Engineering, Inc.

Jonathan D. Zaremski, P.E.
Project Engineer

2 pc

660 Woodward Ave, Suite 1243, Detroit, Michigan 48226 web: www.somateng.com phone: 313-963-2721 fax: 313-963-2736 email: info@somateng.com

REPORT SUMMARY

A general summary of the report conclusions and recommendations is provided below:

1. If a mill and overlay rehabilitation option is selected for the existing pavement, it should be noted that some portions of the existing Beck Road pavement may not be thick enough to allow milling of the pavement. The existing pavement thicknesses at four of the boring locations were only 2½ to 3 inches. In addition, no aggregate or sand base was reported below the pavement in most of the borings between 8 Mile and 9 Mile Road, and the subgrade soil conditions consisted of relatively poorly draining clay or clayey sand soils. With a resurfaced pavement constructed over the existing pavement and clay subgrade soils, one can expect less than optimum performance of this pavement system due to the lack of drainage and aggregate base below the existing pavement sections, amplifying the normal freeze thaw effects.

2. The existing fill soils and natural clay soils encountered in the borings are generally considered suitable for support of a pavement reconstruction section of Beck Road; provided they are properly prepared and suitable base material is used below the pavement. However, the fill soils in the following borings should be considered unsuitable for the support of the proposed pavement.

Boring	Fill Soil Unsuitability	Depth of Unsuitable Soils	Boring	Fill Soil Unsuitability	Depth of Unsuitable Soils
B-3	Loose (N<10) Organic Content 3.6%	2.5 feet	B-29	Loose (N<10)	8 feet
B-5	Loose (N<10) Organic Content 4.5%	5 feet	B-30	Loose (N<10)	6 feet
B-6	Loose (N<10)	5 feet	B-33	Loose (N<10)	6 feet
B-7	Loose (N<10)	2.5 feet	B-37	Loose (N<10)	3 feet
B-9	Loose (N<10) Organic Content 3.8%	6 feet	W-1	Loose (N<10)	8 feet
B-12	Loose (N<10)	> 7.5 feet	W-2	Loose (N<10)	>10 feet
B-16	Organic Content 3.4%	6 feet	W-3	Loose (N<10)	>10 feet
B-26	Organic Content 10.5%	5.5 feet	W-6	Loose (N<10) Organic Content 9.7%	6 feet
B-28	Organic Content 4.4%	3.5 feet	W-7	Loose (N<10)	5 feet

Depending upon the proposed pavement grades, the proposed pavement subgrade level may be situated within these loose fill soils in these portions of the site. In this case, additional undercutting to a depth of 18 inches below the proposed pavement subgrade level is recommended in these areas. In areas where the fill soils are unsuitable due to the excessive organic contents, we recommend that these fill soils be completely removed. The existing unsuitable soils to be undercut should be replaced with granular engineered fill (such as MDOT Class II or IIA sand or MDOT 21AA aggregate). The lateral limits of the existing unsuitable soils could be determined by a backhoe-excavated test pit investigation during or prior to construction or with further probing by a drill rig. For bidding purposes, we recommend that areas extending 200 to 250 feet on either side of the above referenced

REPORT SUMMARY (CON'T)

borings be recommended for the undercutting limits. The actual extents of this undercutting will need to be determined at the time of subgrade inspection by a qualified geotechnical inspector.

3. The recommended subgrade resilient moduli provided below assume the soil conditions encountered at borings B-1 through B-40 and W-1 thru W-8 are representative of the soil conditions within the proposed pavement reconstruction areas. If during construction (within excavations below the existing pavement), the subgrade is found to vary from the expected soil conditions, we should be contacted so we may re-evaluate our subgrade resilient moduli values. For flexible pavement design, based on our experience with similar soil conditions, we recommend that a subgrade resilient moduli (M_R) of 6,600 psi (CBR of 6) be used for the design of a new flexible pavement section.

The summary presented above is general in nature and should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned therein. Details of our findings and recommendations are discussed in the following sections and in the appendices of this report.

REPORT PREPARED BY:

Jonathan D. Zaremski, P.E.
Project Engineer

REPORT REVIEWED BY:

Richard O. Anderson, P.E.
Principal Engineer

REPORT ON GEOTECHNICAL INVESTIGATION
BECK ROAD SCOPING STUDY PROJECT
EIGHT MILE ROAD TO GRAND RIVER AVENUE
NOVI, MICHIGAN

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REPORT ON GEOTECHNICAL INVESTIGATION
BECK ROAD SCOPING STUDY PROJECT
EIGHT MILE ROAD TO GRAND RIVER AVENUE
NOVI, MICHIGAN

1.0 INTRODUCTION

1.1 General

Upon authorization from Fishbeck, Thompson, Carr & Huber, Inc. (FTCH) of Farmington Hills, Michigan, SOMAT Engineering, Inc. (SOMAT) has conducted a geotechnical investigation for the proposed Beck Road Scoping Study Project, between 8 Mile Road and Grand River Avenue in Novi, Michigan. The geotechnical investigation was performed in general accordance with SOMAT Proposal No. PP06164RB, dated August 3rd, 2006 and the previously completed project in July of 2005.

The following sections of this report will provide our understanding of the project, a description of our field investigation, the results of the field and laboratory tests, the logs of test borings, our interpretation of subsoil and groundwater conditions, and recommendations related to the geotechnical aspects of the proposed construction.

1.2 Project Information

This project will provide information and project phasing for the future reconstruction of Beck Road from Eight Mile Road to Grand River Avenue. We anticipate that the future reconstruction of the roadway will require widening of the pavement. In July of 2005, a geotechnical investigation was performed for the portion of this project between 8 Mile and 9 Mile Roads, which has been included in this report. We anticipate that the majority of the reconstruction will consist of milling of the existing asphalt pavement and resurfacing, with the reuse of the existing pavement base, if feasible. Some areas of the road will need to be widened from the current two lane configuration to a proposed three lane configuration. New pavement will be constructed to

the outside shoulders of the existing road in these cases. There is no utility work or culvert repair associated with this project.

1.3 Site Conditions

Beck Road is generally a two lane asphalt paved road, with intermittent center and right turn lanes between 8 Mile Road and Grand River Avenue Mile Road. The intersection with Grand River Avenue is newly reconstructed pavement, widened to five lanes with Portland cement concrete pavement at the intersection. Based on available topographic information, the grade difference between the north and south ends of the project is about 40 feet.

2.0 SUBSURFACE INVESTIGATION

2.1 Field Exploration

The field exploration program for the original portion of the Beck Road project, between 8 Mile and 9 Mile Roads consisted of performing a total of twelve (12) soil borings, each to a depth of 7½ to 10 feet below the existing roadway. In addition, four (4) borings, designated "W" borings, were performed near apparent existing wetlands, near the intersection of 8 Mile Road and 9 Mile Road.

This continuation of the project scope, extending from 9 Mile Road to just south of the reconstructed Grand River Intersection, consisted of performing an additional twenty-eight (28) borings, each extending to depths between 7½ and 15 feet below grades, along with an additional five (5) wetland borings, each extending to depths of 10 feet below grades. Boring B-40 originally was located in the reconstructed pavement area of Beck Road at Grand River Avenue, but was relocated to the intersection of 11 Mile Road. In total, forty-nine (49) borings were performed between 8 Mile Road and Grand River Avenue for the scoping study project. The number of borings and the boring depths were selected and laid out in the field by SOMAT, generally spaced about every 500 feet, taking into consideration the locations of the utilities (underground and overhead). Ground surface elevations at the boring locations were not determined for this project. Soil boring location schematics are presented in Appendix A.

2.1.1 Drilling Operations

The drilling operations for the original scope were performed on July 20th and 21st, 2005, while the second phase was performed between August 25th and 29th, 2006. The borings were drilled using 4¼-inch diameter solid stem augers. Upon completion, all boreholes were backfilled with auger cuttings and patched at the surface with asphalt patch, where needed.

2.1.2 Standard Penetration Test (SPT)

Soil samples collected during the drilling portion of the subsoil exploration were labeled with the soil boring designation and a unique sample number. Soil boring samples were obtained by Standard Penetration Tests in general accordance with ASTM D-1586 procedures, whereby a conventional 2-inch O.D. split-spoon sampler is driven into the soil with a 140 pound hammer repeatedly dropped through a free-fall distance of 30 inches. The sampler is generally driven three successive 6-inch increments, with the blows for each 6-inch increment being recorded. The number of blows required to advance the sampler through 12 inches after an initial penetration of 6 inches, is termed the Standard Penetration Test resistance (N-value) and is presented graphically on the individual Logs of Test Borings. As added information, the number of blows for each 6-inch increment are also presented on the boring logs.

2.1.3 Sampling

Soil samples from the borings were recovered using split-spoon sampling procedures in general accordance with ASTM Standard D-1586 ("Standard Method for Penetration Tests and Split Barrel Sampling of Soils"). In general, the samples were obtained at a regular interval of 2½ feet for the top 10 feet, and proceeding every five feet to the bottom of the boring. The samples were sealed in glass jars in the field to protect the soil and maintain the soil's natural moisture content. All soil samples were transported to SOMAT's laboratory for further analysis and testing.

The soil samples collected for this investigation will be retained in our laboratory for a period of 60 days, after which they will be discarded unless we are notified otherwise.

2.1.4 Groundwater Level Observation Procedures

Whenever possible, groundwater level observations were made during the drilling operations and immediately after completion of drilling, and are shown on the individual Logs of Test Borings. During drilling, the depth at which free water was observed, where drill cuttings became saturated or where saturated samples were collected, was indicated as the groundwater level during drilling. In granular, pervious soils, the indicated water levels are considered relatively reliable when solid or hollow-stem augers are used for drilling. However, in cohesive soils, groundwater observations are not necessarily indicative of the static water table due to the low permeability rates of the soils, and due to the sealing off of natural paths of groundwater flow during drilling operations.

It should be noted that seasonal variations and recent rainfall conditions may influence the level of the groundwater table significantly. Groundwater monitoring wells are generally used if accurate groundwater table variation records are needed for design purposes. However, for the purposes of this investigation, precise groundwater level readings are not considered critical.

2.2 Laboratory Testing

All samples were classified in general accordance with the Unified Soil Classification System. Representative soil samples were subjected to laboratory tests consisting of moisture content determinations, unconfined compression tests and hand penetrometer tests. In addition, organic contents were determined for selected samples, by means of Loss-on-Ignition (LOI) tests.

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small, calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square foot.

The unconfined compression test consists of axially loading a small cylindrical soil sample at a slow rate of strain, until failure occurs. Failure is defined as the maximum stress level in the soil sample or the stress level at 15 percent strain, whichever is less.

The organic content is determined using the Loss-On-Ignition (LOI) test. The soil sample is super-heated as a means to burn off all present organic matter and the percentage of organic matter is then calculated.

The results of the laboratory tests are included in Appendix B on the respective logs of test borings. All laboratory tests were performed in general accordance with applicable ASTM procedures.

2.3 Limitations

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Stratification

Soil conditions encountered at the test boring locations have been evaluated and are presented in the form of Logs of Test Borings. The Logs of Test Borings presented in Appendix B include approximate soil stratification with detailed soil descriptions and selected physical properties for each stratum encountered in the test borings. In addition to the observed subsoil stratigraphy, the boring logs present information relating to sample data, Standard Penetration Test results, groundwater level conditions observed in the boring, personnel involved, and other pertinent data. For information, and to aid in understanding the data as presented on the boring logs, General Notes defining nomenclature used in soil descriptions are presented immediately following the Logs of Test Borings in Appendix B. It should be noted that the Logs of Test Borings included with this report have been prepared on the basis of laboratory classifications and testing as well as field logs of the soils encountered.

A generalized description of the soils encountered, beginning at the existing ground surface of the **Beck Road pavement** and proceeding downward, is provided below:

Stratum 1a: Pavement. Pavement consisting of asphaltic cement concrete was encountered at the surface of each of the borings performed within the Beck Road pavement. The asphaltic cement concrete thicknesses ranged from 2½ to 9 inches. A summary of the pavement thickness follows:

Boring	Roadway	ACC Thick.	Boring	Roadway	ACC Thickness
B-1	NB Beck Rd	4 ½ inches	B-21	NB Beck Rd	4 ½ inches
B-2	SB Beck Rd	3 inches	B-22	NB Beck Rd	3 inches
B-3	NB Beck Rd	4 inches	B-23	NB Beck Rd	4 inches
B-4	SB Beck Rd	4 inches	B-24	SB Beck Rd	3 ½ inches
B-5	NB Beck Rd	3 ½ inches	B-25	NB Beck Rd	3 ½ inches
B-6	SB Beck Rd	3 ½ inches	B-26	SB Beck Rd	3 ½ inches
B-7	NB Beck Rd	3 ½ inches	B-27	NB Beck Rd	3 ½ inches
B-8	SB Beck Rd	3 ½ inches	B-28	SB Beck Rd	3 ½ inches
B-9	NB Beck Rd	2 ½ inches	B-29	NB Beck Rd	2 ½ inches
B-10	SB Beck Rd	4 inches	B-30	SB Beck Rd	4 inches
B-11	NB Beck Rd	4 inches	B-31	NB Beck Rd	4 inches
B-12	SB Beck Rd	4 inches	B-32	SB Beck Rd	4 inches
B-13	NB Beck Rd	4 inches	B-33	NB Beck Rd	4 inches
B-14	SB Beck Rd	4 inches	B-34	SB Beck Rd	4 inches
B-15	NB Beck Rd	5 inches	B-35	NB Beck Rd	5 inches
B-16	SB Beck Rd	5 inches	B-36	SB Beck Rd	5 inches
B-17	NB Beck Rd	5 inches	B-37	NB Beck Rd	5 inches
B-18	SB Beck Rd	7 inches	B-38	SB Beck Rd	7 inches
B-19	NB Beck Rd	8 ½ inches	B-39	NB Beck Rd	8 ½ inches
B-20	SB Beck Rd	6 inches	B-40	NB Beck Rd	6 inches

Stratum 1b: Pavement Base. Sand and gravel fill base material was reported in twenty-six of the soil borings, generally between 9 Mile Road and Grand River Ave. The thickness of the base material ranged 3 and 19 inches.

Stratum 2: Fill. Fill or possible fill soils consisting of fine to coarse sand, fine to medium sand, silty sand, clayey sand, sandy clay, silty clay, silty sandy clay or mixtures of these materials was encountered below the pavement in each of the borings except B-8, B-11, B-14, B-15, B-22. The fill soils extended to depths ranging from 2 to 13 feet below existing grades in borings B-2, B-3, B-5, B-6, B-9, B-10, B-13, B-17 thru B-21, and B-23 thru B-40 and to the explored depths of the remaining borings. The apparent density of the sand fill was dense to very loose and the clay fill soils were hard to stiff.

Loss-on-ignition tests performed on samples of the fill soils in borings B-3, B-5, B-7, B-9, B-16, B-26, B-28, B-38 indicated organic contents ranging from 2.2 to 10.5 percent.

Stratum 3: Brown Clay. Natural brown silty clay was encountered below the fill soils in borings B-3, B-5, B-6, B-7, B-9, B-10 B-11, B-13, B-18, B-19, B-20, B-23, B-26, B-35, B-36, B-37, B-38, B-39 and below the pavement in borings B-8, B-14, B-15, B-22. These natural clay soils generally extended to the explored depths of the borings, except in

borings B-10, B-11, B-20, B-22, B-23, B-36, where they extended to depths of 2½ to 7 feet. The consistency of these clay soils was hard to stiff.

Stratum 4: Brown Sand/Silt. Natural brown silty sand and sandy silt was encountered below the brown clay soils in borings B-20, B-22, B-23, and B-36 and below the fill soils in boring B-21, B-29, and B-30, extending to the explored depths. The apparent density of these sand and silt soils was loose to dense

Stratum 4: Gray Clay. Natural hard to very stiff gray clay was encountered below the fill, brown clay or brown sand in borings B-2, B-10, B-1, B-17, B-27, B-31 thru B-34, and B-36 extending to depths of 6 to 7 feet in borings B-11, B-17, and B-27 and to the explored depths of the remaining borings.

Stratum 5: Gray Sand. Loose to medium dense gray sand was encountered below the gray clay in borings B-11, B-17, and B-27 and below the fill soils in borings B-24, B-25, B-28 and B-40 extending to the explored depths.

A generalized description of the soils encountered, beginning at the existing ground surface of the **Wetland Borings** and proceeding downward, is provided below:

Stratum 1a: Topsoil. Topsoil was encountered at the surface of borings W-1 and W-2, with thicknesses of 3 and 6 inches.

Stratum 1b: Gravel. Gravel shoulder pavement was encountered at the surface of borings W-3, W-4, W-6, W-7 and W-8, ranging in thickness from 5 to 15 inches.

Stratum 1c: Asphalt. 4 inches of asphalt pavement was encountered at the surface of boring B-8.

Stratum 2: Fill. Fill and possible fill soils consisting of fine to medium sand, sandy clay, silty clay, silty sand and clayey sand was encountered below the surficial material in all borings except W-4. These fill soils extended to the explored depths in borings W-2, W-3, and W-7 and to depths ranging from 2 to 8 feet in the remaining borings. The clay fill soils were stiff to hard in consistency and the apparent density of the sand fill soils was medium dense to very loose.

A Loss-on-ignition test performed on a sample of the fill soils in boring W-6 indicated an organic content of 9.7 percent.

Stratum 3: Brown Clay. Natural stiff to hard brown clay was encountered below the gravel shoulder in boring W-4 and below the fill soils in borings W-5 and W-9. These brown clay soils extended to depths of 5½ and 6 feet in borings W-4 and W-9 and to the explored depth of W-5.

Stratum 4: Gray Clay. Natural very stiff to hard gray clay was encountered below the fill in borings W-1, W-6 and W-8 and below the brown clay in borings W-4, extending to the explored depths of each except W-8.

Stratum 5: Gray Sand. Natural medium dense gray sand was encountered below the gray clay in boring W-8, extending to the explored depth.

Please refer to the boring logs for the soil conditions at the specific boring locations along specific streets. It is emphasized that the stratification lines shown on the Logs of Test Borings are approximate indications of change from one soil type to another at the locations of the boreholes. The actual transition from one stratum to the next may be gradual, and may vary within the area represented by the test boring.

3.2 Groundwater Level Observations

Groundwater was reported in twenty of the forty-nine borings during drilling and in twelve of the borings upon completion of drilling, at depths ranging from 2½ to 12 feet below grades.

Based on the available soil boring information, we estimate the long term groundwater level along Beck Road is generally situated below the bottom of the borings, or deeper than 7½ feet below existing grades. However, at some points within the alignment, generally between 10 Mile and 11 Mile Road, it appears that the long term groundwater level is about 6 feet below existing grades. Groundwater levels near the wetlands could be situated 3 to 7 feet below existing road grades. Additionally, because of the granular base material and granular fill soils situated over the relatively impermeable natural clay subgrade, it can be expected that, depending on the time of year, these granular fill soils could become saturated as the trapped groundwater migrates toward the pavement edges. It should be noted that the elevation of the natural groundwater table is likely to vary throughout the year depending on the amount of precipitation, runoff, evaporation and percolation in the area, as well as the water level in nearby surface water bodies in the vicinity affecting the groundwater flow pattern.

4.0 ANALYSIS AND RECOMMENDATIONS

We anticipate that the future reconstruction of Beck Road from Eight Mile Road to Grand River Avenue will require widening of the pavement. Some areas of the road will need to be widened from the current two lane configuration to a proposed three lane configuration. The anticipated repair of Beck Road would consist of the milling and overlaying of the existing asphaltic cement concrete, with new pavement constructed on the outside to develop the desired three lane cross section. New pavement will be constructed to the outside shoulders of the existing road in these cases. There is no utility work or culvert repair associated with this project.

4.1 Pavement Overlay Considerations

If a mill and overlay rehabilitation option is selected for the existing pavement, it should be noted that some portions of the existing Beck Road pavement may not be thick enough to allow milling of the pavement. The existing pavement thicknesses at four of the boring locations were only 2½ to 3 inches. In addition, no aggregate or sand base was reported below the pavement in most of the borings between 8 Mile and 9 Mile Road, and the subgrade soil conditions consisted of relatively poorly draining clay or clayey sand soils.

With a resurfaced pavement constructed over the existing pavement and clay subgrade soils, one can expect less than optimum performance of this pavement system due to the lack of drainage and aggregate base below the existing pavement sections, amplifying the normal freeze thaw effects. We strongly advise the city to reconsider this current overlay plan and consider a project consisting of the complete reconstruction of Beck Road to improve the existing subgrade soils. We have provided recommendations in the following sections for both options; milling and resurfacing and reconstruction of Beck Road.

4.2 Pavement Reconstruction Recommendations

4.2.1 Site Preparation and Earthwork Recommendations

The existing fill soils and natural clay soils encountered in the borings are generally considered suitable for support of a pavement reconstruction section of Beck Road; provided they are

properly prepared and suitable base material is used below the pavement. However, the fill soils near the surface of borings B-3, B-6, B-7, B-12, B-29, B-30, B-33, and B-37 appear to be in a soft or loose condition and may require undercutting to stabilize the pavement subgrade prior to the placement of engineered fill. The fill soils encountered in borings B-5, B-26, B-28 and W-6 should be considered unsuitable for the support of a new pavement section due to the excessive organic contents (greater than 4 percent). Additionally, the fill soils encountered in borings B-3, B-9 and B-16 should be considered marginal for the support of the proposed pavement sections due to organic contents between 3.5 and 4 percent.

Boring	Fill Soil Unsuitability	Depth of Unsuitable Soils
B-3	Loose (N<10) Organic Content 3.6%	2.5 feet
B-5	Loose (N<10) Organic Content 4.5%	5 feet
B-6	Loose (N<10)	5 feet
B-7	Loose (N<10)	2.5 feet
B-9	Loose (N<10) Organic Content 3.8%	6 feet
B-12	Loose (N<10)	> 7.5 feet
B-16	Organic Content 3.4%	6 feet
B-26	Organic Content 10.5%	5.5 feet
B-28	Organic Content 4.4%	3.5 feet
B-29	Loose (N<10)	8 feet
B-30	Loose (N<10)	6 feet
B-33	Loose (N<10)	6 feet
B-37	Loose (N<10)	3 feet
W-1	Loose (N<10)	8 feet
W-2	Loose (N<10)	>10 feet
W-3	Loose (N<10)	>10 feet
W-6	Loose (N<10) Organic Content 9.7%	6 feet
W-7	Loose (N<10)	5 feet

Depending upon the proposed pavement grades, the proposed pavement subgrade level may be situated within these loose fill soils in these portions of the site. In this case, additional undercutting to a depth of 18 inches below the proposed pavement subgrade level is recommended in these areas. In areas where the fill soils are unsuitable due to the excessive organic contents, we recommend that these fill soils be completely removed. The existing unsuitable soils to be undercut should be replaced with granular engineered fill (such as MDOT

Class II or IIA sand or MDOT 21AA aggregate). A "clean" sand fill will permit better drainage below the pavement section and reduce the potential for frost heave. The exposed subgrade should be proofrolled as described below prior to the replacement with granular engineered fill. If these subgrade soils still appear to be unsuitable, then further undercutting may be required. The lateral limits of the existing unsuitable soils could be determined by a backhoe-excavated test pit investigation during or prior to construction or with further probing by a drill rig. For bidding purposes, we recommend that areas extending 200 to 250 feet on either side of the above referenced borings be recommended for the undercutting limits. The actual extents of this undercutting will need to be determined at the time of subgrade inspection by a qualified geotechnical inspector.

Special attention should be paid to any areas that are to be widened or reconstructed, where existing pavement will be completely removed. In these areas, after rough grade has been achieved, and prior to placement of fill, pavement or pavement base, the exposed subgrade should be visually checked for the presence of debris, organic matter and other unsuitable materials. If unsuitable or organic subgrade soils (organic content over 4 percent) are encountered at subgrade level during earthwork operations, these soils should be removed and replaced with engineered fill.

The risk of pavement cracking, faulting or uneven settlement should be considered when placing a pavement on a non-engineered fill material. If the risk of this type of distress is not tolerable, then it may be necessary to remove some or all of the existing non-engineered fill material and replace it with engineered fill. However, based on the available boring information, the existing fill soils encountered in the borings (exclusive of the areas noted above) appear suitable for support of new pavement base material, provided they are properly prepared.

The pavement subgrade areas should be thoroughly compacted before placement of new fill or pavement. The purpose of the compaction is to uniformly compact the subgrade surface. Compaction should be performed with a heavy (minimum 30 ton) vibratory roller. Loose or soft

areas, in addition to those described above, which are unable to be compacted should be removed and replaced with granular engineered fill.

Within any new pavement construction and pavement removal and replacement areas, the top 12 inches of subgrade should be compacted to a minimum of 100 percent of the maximum dry density as determined by ASTM D-698 (Standard Proctor). It may be necessary in some of these areas to remove disturbed subgrade soils and replace them with a stabilization layer of engineered crushed aggregate fill. The thickness and extent of the required aggregate stabilization layer can be determined in the field by the site geotechnical engineer. We recommend crushed limestone aggregate meeting the gradation requirements of MDOT 21AA material.

Some of the fill soils encountered below the pavement in some of the borings had moisture contents in excess of 17 percent. These fill soils and other site clay, clayey sand or mixed sand and clay soils with relatively high moisture contents (more than 4 percent over optimum) may tend to become disturbed by construction traffic and may be difficult to compact, especially if the earthwork is performed during the typically wet spring and fall seasons. It may be necessary to disc and aerate the clay, clayey sand and mixed sand and clay subgrade soils during earthwork operations to achieve the desired amount of compaction in some areas of the site. This may also be required to stabilize the soils for placement of fill, aggregate base, or for support of paving equipment. Thus, site earthwork should preferably be performed during the typically drier May to September construction season, if possible.

Material for backfill or engineered fill required to achieve design grade should consist of free draining granular soils meeting MDOT Class II gradation requirements.

4.2.2 Drainage Considerations

The soils at the anticipated pavement subgrade elevation are expected to include existing fill soils consisting of sand, silty sand, clayey sand, sandy clay, silty clay, silty sandy clay or mixtures of these materials or natural clay soils. Most of these soils are considered susceptible to frost. The

effects of frost heave are anticipated to be more significant in areas where water is not allowed to drain freely either due to subsoil conditions, site grades, or other factors. A provision for an open-graded base course, such as MDOT 4G crushed aggregate, separated from the subgrade by a woven geotextile (such as Mirafi 600x, Amoco 2006, Synthetic Industries Geotex 2X2, or equivalent) and allowed to drain to the adjacent ditches to enhance drainage conditions and to reduce the effects of frost heave.

4.2.3 Pavement Design Recommendations

Based on the soil boring results, we anticipate the subgrade soils for the proposed pavement reconstruction will mostly consist of the existing fill soils consisting of sand, silty sand, clayey sand, sandy clay, silty clay, silty sandy clay or mixtures of these materials or engineered fill.

The recommended subgrade resilient moduli provided below assume the soil conditions encountered at borings B-1 through B-40 and W-1 thru W-8 are representative of the soil conditions within the proposed pavement reconstruction areas. If during construction (within excavations below the existing pavement), the subgrade is found to vary from the expected soil conditions, we should be contacted so we may re-evaluate our subgrade resilient moduli values.

For flexible pavement design, based on our experience with similar soil conditions, we recommend that a subgrade resilient moduli (M_R) of 6,600 psi (CBR of 6) be used for the design of a new flexible pavement section.

The new bituminous courses should be compacted to a density of 97 percent of the maximum field density as determined by the nuclear gauge method (MDOT section 4.00.11), but not less than 95 percent of the maximum density as determined by the Marshall unit weight (50 blows). If more than one course of pavement is to be constructed, a bond coat should be required between the base course and wearing course when either 48 hours have elapsed between placement of the bituminous courses, or if the surface of the pavement has been contaminated with dirt, dust or foreign material. The bond coat should not be applied unless the existing pavement surface is free of moisture.

For new bituminous pavements, final pavement elevations should be designed to provide positive surface drainage. The minimum surface slope of 1.5 percent is recommended. The pavement surface should be smooth, free of roller marks or depressions, and should not contain any irregularities which would pond or impede water flow.

All new pavements should be constructed in accordance with current Oakland County Road Commission or City of Novi standards and specifications.

The engineer preparing the pavement design should consider other factors in addition to the subgrade modulus values. These factors may include, but are not limited to, adequate subgrade preparation, adequate placement of engineered fill and pavement layers, and surface and subsurface drainage. SOMAT's services related to pavement design and construction on this project were limited to preparing general guidelines for subgrade conditions and estimation of modulus values from the surficial soils encountered at the three soil boring locations. The estimates were based on general guidelines found in the literature and our experience with similar soil conditions. If any grade changes are expected, the modulus value above may require modifications.

4.4 Excavation Considerations

Based on the anticipated scope of the construction, we do not anticipate excavations deeper than 3 feet along Beck Road. Appropriate measures will be required to maintain the stability of excavation sidewalls. These measures will likely involve methods and equipment standard for excavations extending to these relatively shallow depths. In general, trench walls should be sloped back to a stable angle in accordance with published MI-OSHA guidelines. If sufficient room is not available for sloping the trench walls, shoring will be required by means such as trench boxes, sliding trench shields or sheeting. Sheeting could also be required depending on the proximity of the proposed excavations to existing pavements and structures. Construction traffic, stockpiles of soil and construction materials should be kept away from the edges of the excavations for a distance equal to the depth of the excavation. If such clearances cannot be

maintained, the resulting surcharge loads should be considered in the design of the shoring system. Likewise, loads from traffic on adjacent road areas also need to be considered in the design. In all cases, MI-OSHA and other regulatory requirements must be followed and adequate protection provided for workers.

Care should be exercised when excavating near existing pavement, utilities and structures that are to remain, to protect them from damage. The contractor should be aware of the existing utility locations before excavating and be prepared to support or brace them, as required.

4.5 Ground Water Considerations

The long term groundwater level along Beck Road is generally situated deeper than 7½ feet below existing grades. However, at some points within the alignment, generally between 10 Mile and 11 Mile Road, it appears that the long term groundwater level is about 6 feet below existing grades. Groundwater levels near the wetlands could be situated 3 to 7 feet below existing road grades. Additionally, because of the granular base material and granular fill soils situated over the relatively impermeable natural clay subgrade, it can be expected that, depending on the time of year, these granular fill soils could become saturated as the trapped groundwater migrates toward the pavement edges. Groundwater seepage could also occur into excavations crossing backfilled trenches for existing utilities. We anticipate groundwater seepage can be controlled by standard sump pit and pumping procedures for the excavations for the storm sewer installation, if applicable to this project, provided the existing groundwater levels do not rise above their present levels.

4.6 Engineered Fill Requirements

Any fill placed below proposed pavement areas should be an approved, engineered material, free of frozen soil, organics, or other deleterious material. Engineered fill should be spread in level layers, not exceeding 9 inches in loose thickness, and be compacted to a minimum of 100 percent of the maximum dry density as determined by ASTM D-698 (Standard Proctor). Below landscaped (unpaved) areas, the fill should be compacted to a minimum of 95 percent of the

maximum dry density as determined in accordance with ASTM D-698. Fill should not be placed on frozen subgrades.

The existing fill materials should not be re-used for backfill within paved areas and within utility excavations below paved areas due to the fill composition of mixed sand and clay soils encountered in the borings. Backfill for utility trenches below paved areas should consist of granular engineered fill meeting requirements of MDOT Class II sand. Soils containing greater than 4 percent organics are considered unsuitable for use as engineered backfill. Any clayey sand fill, clay fill and mixed sand and clay fill will be difficult to compact within the confines of the trench, and some drying would be required in order to arrive at a suitable water content for compaction.

5.0 GENERAL QUALIFICATIONS

Uncompacted or inadequately compacted fill placed within proposed pavement areas will likely undergo some settlement over time, causing distress to pavement and other structures. Therefore, all earthwork construction activities should be monitored, including testing and observation of placing and compacting of fill and trench backfill, under the direction of a qualified engineering inspector.

This report and the attached Logs of Test Borings are instruments of service, which have been prepared in accordance with generally accepted soil and foundation engineering practices. We make no other warranties either expressed or implied as to the professional advice included in this report.

The contents of this report have been prepared in order to aid in the evaluation of expected subsoil properties to assist the engineer in the design of this project. In the event that any changes are made in the geotechnically related aspects of the project, however slight, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified in writing by our office.

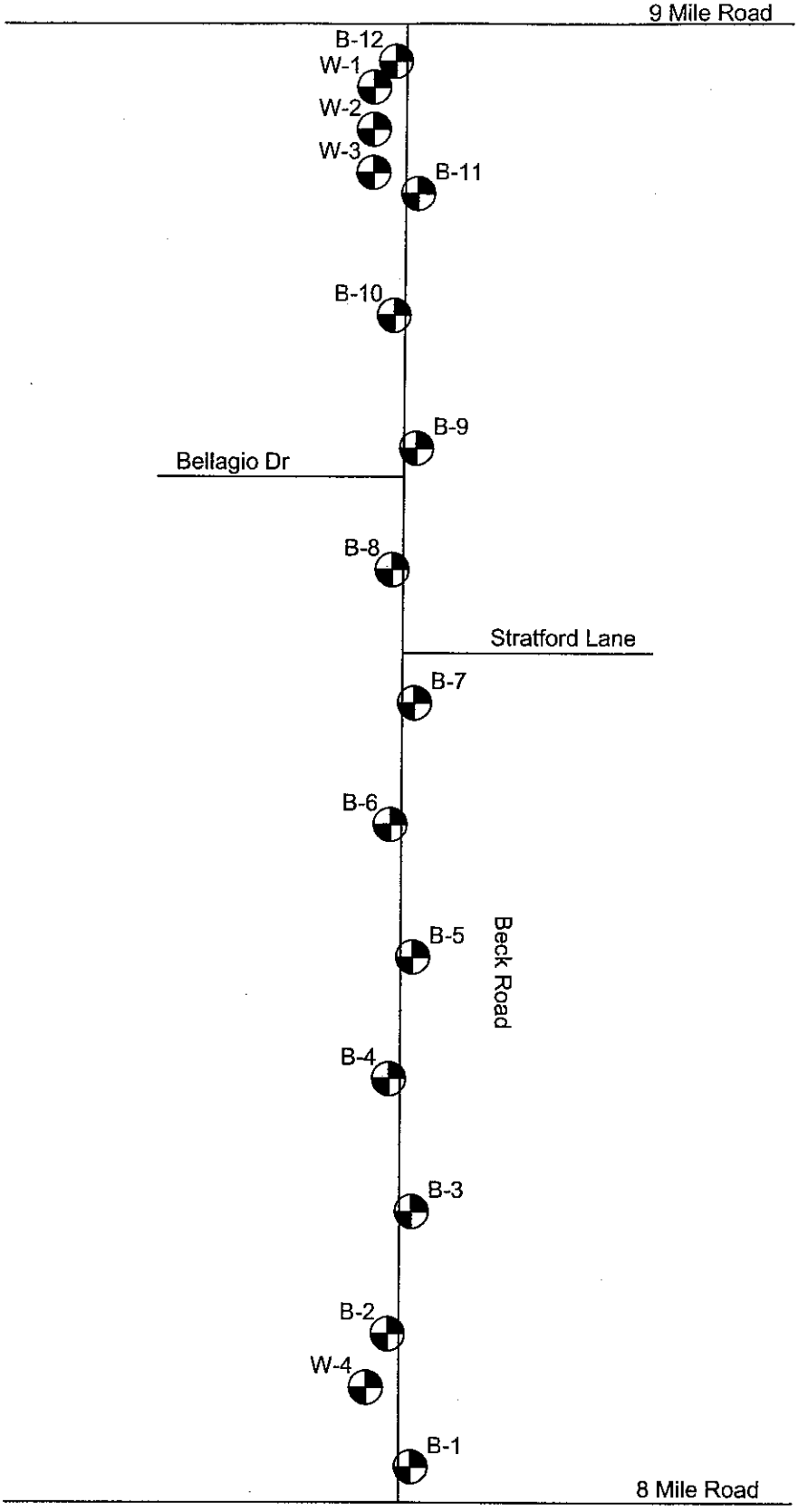
Since the information obtained from test borings is specific to the exact test boring locations, soil and water information could be different from those occurring at other locations of the site. This report does not reflect variations that may occur between the borings. The nature and extent of these variations may not become evident until the time of construction. If significant variations then become evident, it may be necessary for us to re-evaluate the recommendations provided in this report.

This report should be made available to bidders prior to submitting their proposals and to the successful contractor and subcontractors for their information only, and to supply them with facts relative to the subsurface investigation, laboratory tests, etc.

The discussions and recommendations submitted in this report are based on the soil information contained in the Logs of Test Borings and test results appended to this report. We expect that the Logs of Test Borings included in this report along with our discussions and conclusions will assist you in designing the proposed structures. If you have any questions regarding this report, please contact us.

APPENDIX A

SOIL BORING LOCATION SCHEMATICS



LEGEND

Soil Boring

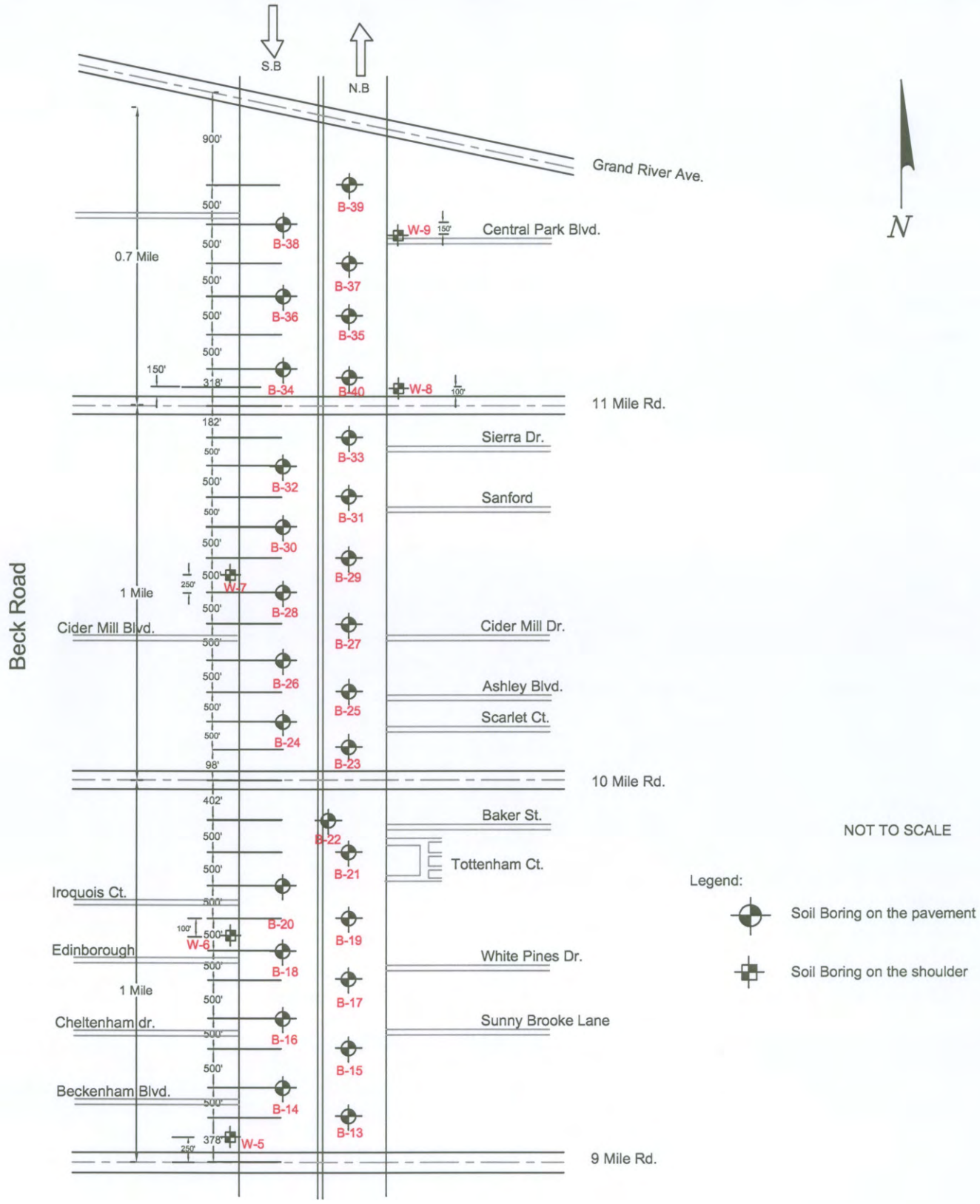
Soil Boring Location Schematic
Beck Road Reconstruction
8 Mile Road to 9 Mile Road
Novi, Michigan

SOMAT Engineering, Inc.

Detroit - Taylor

SOMAT Project No. G05106A

July 15, 2005



SOIL BORING LOCATION SCHEMATIC
BECK ROAD RECONSTRUCTION
9 MILE ROAD TO GRAND RIVER
NOVI, MICHIGAN

SOMAT Engineering, Inc.
Detroit - Taylor

SOMAT Project No. G06119A
Sept 14, 2006

APPENDIX B

LOGS OF SOIL BORINGS AND GENERAL NOTES

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **B-1**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-Inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	Driller reported 4.5 inches of ASPHALTIC CEMENT CONCRETE								
		FILL - Medium dense fine to coarse sand, with gravel, trace silt and clay, brown, moist (SP)		SS1	8-10-13	23	2.5			
				SS2	4-11-9	20	5.0			
			5	SS3	5-9-8	17	7.5			
				SS4	4-14-9	23	10.0			
	10.0	End of Boring at 10 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **B-2**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.3	Driller reported 3 inches of ASPHALTIC CEMENT CONCRETE								
		FILL - Medium dense clayey fine to coarse sand, with gravel, brown, moist (SC)		SS1	20-11-5	16	2.5		7.8	
				SS2	3-8-6	14	5.0		11.3	
	5.5		5							
		Hard SANDY CLAY, some gravel, trace silt, gray (CL)		SS3	3-6-13	19	7.5	9000+*	12.6	
	7.5	End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 4 feet
Upon Completion: 4 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

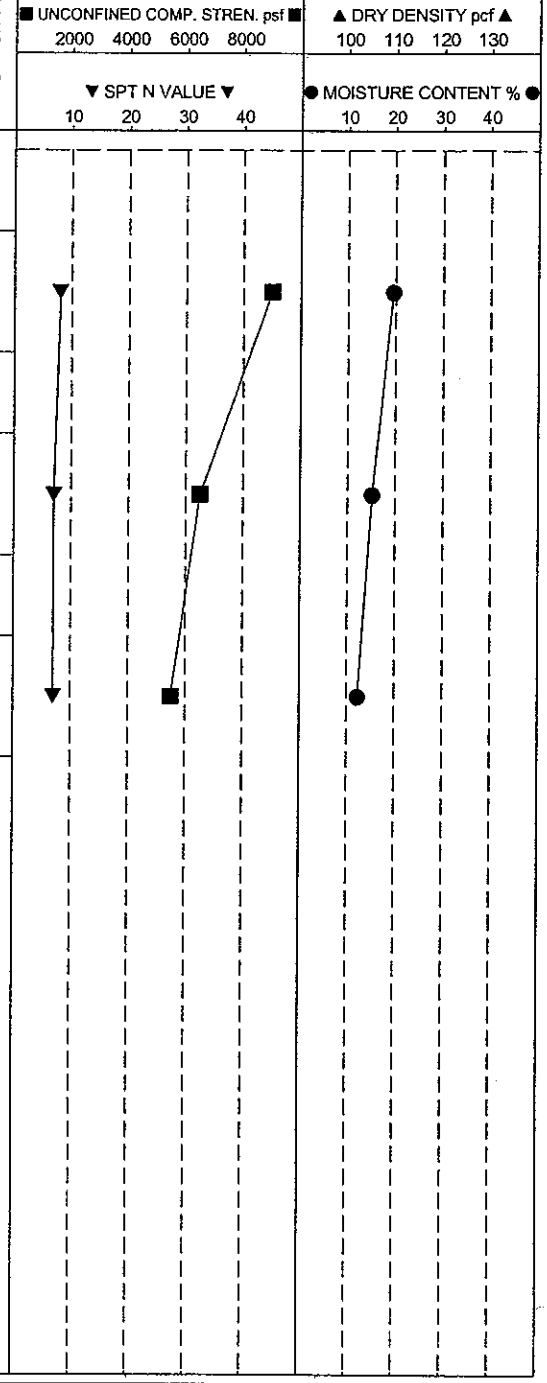
PROJECT NO. G05106A BORING NO. B-2 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **B-3**

ELEVATION ft MSL	Depth	Ground Surface Elevation	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	0.3	Driller reported 4 inches of ASPHALTIC CEMENT CONCRETE	0							
	2.5	FILL - Hard sandy clay, some gravel, trace organics, brown and gray (CL)		SS1	6-4-4	8	2.5	9000+*	19.5	
	7.5	Very stiff SILTY CLAY, some sand, trace to some gravel, frequent sand seams, mottled brown and gray to brown (CL)	5	SS2	2-3-4	7	5.0	6500*	15.2	
		End of Boring at 7.5 ft.		SS3	3-3-4	7	7.5	5500*	12.3	
			10							
			15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None

Remarks:
An LOI test on sample SS1 indicated an organic content of 3.6%.

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A **BORING NO.** B-3 **PAGE 1 of 1**

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **B-4**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 4 inches of ASPHALTIC CEMENT CONCRETE 0.3								
	FILL - Hard to very stiff sandy clay, some gravel, occasional sand layers, brown (CL)		SS1	4-8-29	37	2.5	9000+*	13.3	
			SS2	10-3-3	6	5.0	4500*	14.2	
		5	SS3	2-1-3	4	7.5	<>	13.5	
	7.5 End of Boring at 7.5 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 7 feet
Upon Completion: 7 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A BORING NO. B-4 PAGE 1 of 1

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** B-5

ELEVATION ft MSL	Depth	Ground Surface Elevation	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	0.4	Driller reported 3.5 inches of ASPHALTIC CEMENT CONCRETE	0							
	2.5	FILL - Dense fine to coarse sand, some gravel, trace clay, occasional concrete pieces, brown, moist (SP)		SS1	33-24-21	45	2.5		4.5	
	5.0	FILL - Very stiff sandy clay, trace gravel and organics, brown (CL)	5	SS2	2-4-2	6	5.0	4000*	21.5	
	7.5	Very stiff SILTY CLAY, some sand, trace gravel, mottled brown and gray (CL)		SS3	4-6-10	16	7.5	6000*	17.8	
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None

Remarks:
An LOI test on sample SS2 indicated an organic content of 4.5%.

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A BORING NO. B-5 PAGE 1 of 1

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **B-6**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	Driller reported 3.5 inches of ASPHALTIC CEMENT CONCRETE								
		FILL - Very stiff sandy clay, trace gravel, brown and gray (CL)		SS1	2-3-4	7	2.5	5500*	21.6	
				SS2	5-4-5	9	5.0	<>	30.3	
	5.0		5							
		Hard SILTY CLAY, some sand, trace gravel, brown (CL)		SS3	8-10-11	21	7.5	9000+*	12.5	
	7.5	End of Boring at 7.5 ft.	10							
			15							

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

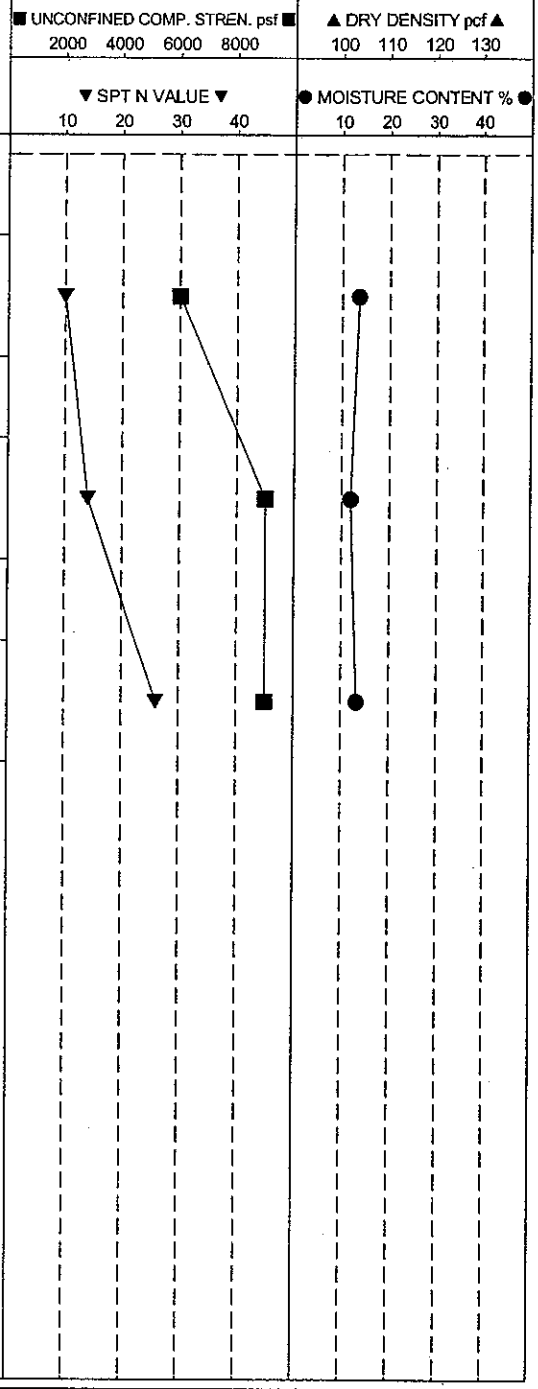
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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** **B-7**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 3.5 inches of ASPHALTIC CEMENT CONCRETE 0.4								
	FILL - Very stiff sandy clay, trace to some gravel, trace organics, occasional sand seams, brown (CL) 2.5		SS1	4-5-5	10	2.5	6000*	13.5	
	Hard SILTY CLAY, some sand, trace to some gravel, mottled brown and gray (CL)	5	SS2	5-7-7	14	5.0	9000+*	11.9	
	7.5		SS3	4-11-15	26	7.5	9000+*	13.3	
	End of Boring at 7.5 ft.	10							
		15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None

Remarks:
An LOI test on sample SS1 indicated an organic content of 2.2%.

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** **B-8**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 3.5 inches of ASPHALTIC CEMENT CONCRETE 0.4								
	Hard to very stiff SILTY CLAY, some sand, trace to some gravel, occasional silt partings, brown (CL)		SS1	6-8-9	17	2.5	9000+*	10.5	
			SS2	6-7-8	15	5.0	7500*	12.9	
		5	SS3	5-6-9	15	7.5	8000*	11.7	
	7.5 End of Boring at 7.5 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▼ SPT N VALUE ▼ (10 20 30 40)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** **B-9**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.2	Driller reported 2.5 inches of ASPHALTIC CEMENT CONCRETE								
		FILL - Very stiff sandy clay, trace to some silt and gravel, trace organics, black and brown (CL)		SS1	7-3-4	7	2.5	4000*	19.1	
				SS2	2-4-5	9	5.0	4500*	17.0	
	6.0		5							
		Hard SILTY CLAY, some sand, trace gravel, brown (CL)		SS3	3-7-9	16	7.5	9000+*	11.6	
	7.5									
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None

Remarks:
An LOI test on sample SS1 indicated an organic content of 3.8%.

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** **B-10**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.3	Driller reported 4 inches of ASPHALTIC CEMENT CONCRETE								
	2.5	FILL - Driller reported medium dense clayey sand, brown, moist (SC)		NR1	9-13-11	24	2.5			
	5.0	FILL - Hard silty clay, some sand, trace gravel, frequent sand seams, brown (CL)	5	SS2	5-5-7	12	5.0	8000*	13.2	
	7.0	Very stiff SILTY CLAY, some sand, trace gravel, brown (CL)		SS3	3-7-8	15	7.5	5500*	11.6	
	10.0	Very stiff SILTY CLAY, some sand, trace gravel, gray (CL)	10	SS4	3-6-8	14	10.0	5000*	11.4	
		End of Boring at 10 ft.	15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** B-11

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 4 inches of ASPHALTIC CEMENT CONCRETE 0.3								
	14 inches of sand and gravel FILL (Base Material) 1.5		SS1	13-7-8	15	2.5	9000+*	13.2	
	Hard SILTY CLAY, some sand and gravel, brown (CL) 3.0								
	Hard SILTY CLAY, some sand, trace to some gravel, gray (CL) 6.0	5	SS2	2-5-5	10	5.0	9000*	11.4	
	Loose FINE TO MEDIUM SAND, trace gravel and silt, gray, wet (SP) 7.5		SS3	2-3-2	5	7.5			
	End of Boring at 7.5 ft.	10							
		15							

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)
▼ SPT N VALUE ▼ (10 20 30 40)
▲ DRY DENSITY pcf ▲ (100 110 120 130)
● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 7 feet
Upon Completion: 7 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/21/2005 **LOG OF TEST BORING** **B-12**

ELEVATION ft MSL	Depth	Ground Surface Elevation / Description	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Driller reported 4 inches of ASPHALTIC CEMENT CONCRETE	0							
	0.3									
		FILL - Loose to very loose fine to medium sand, trace to some silt, trace gravel, brown, moist (SP)		SS1	5-5-3	8	2.5			
				SS2	3-3-3	6	5.0			
			5	SS3	2-2-2	4	7.5			
	7.5	End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings & ACC Patch
Date Started: 07-21-05
Date Completed: 07-21-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

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8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-13**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-Inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	4 inches of ASPHALTIC CEMENT CONCRETE	0.3							
	4 inches of gravel and broken asphalt pieces (Base Material)	0.7							
	FILL - Silty clay, some sand, trace gravel and asphalt pieces, brown and black (CL)	2.0	SS1	4-9-15	24	2.5			
	Hard SILTY CLAY, some sand, trace gravel, brown (CL)	5	SS2	5-9-10	19	5.0	9000+*	12.4	
			SS3	11-10-14	24	7.5	9000+*	11.6	
	End of Boring at 7.5 ft.	7.5							
		10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

▼ SPT N VALUE ▼ (10 20 30 40)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-14**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	4 inches of ASPHALTIC CEMENT CONCRETE 0.3								
	4 inches of coarse sand FILL (Base Material) 0.7								
	Hard SILTY CLAY, some sand, trace gravel, occasional silt partings, brown (CL)		SS1	3-6-7	13	2.5	8500*	20.7	
			SS2	5-8-12	20	5.0	9200	17.2	126
		5	SS3	6-9-11	20	7.5	9000+*	11.4	
	7.5 End of Boring at 7.5 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-15**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	5 inches of ASPHALTIC CEMENT CONCRETE 0.4								
	6 inches of sand and gravel FILL (Base Material) 0.9								
	Hard SILTY SANDY CLAY, trace gravel and organics, dark brown / black (CL)		SS1	11-8-6	14	2.5	9000+*	16.2	
	3.0								
	Hard SILTY CLAY, some sand, trace gravel, occasional silt partings, brown (CL)	5	SS2	5-6-9	15	5.0	9000+*	12.1	
			SS3	7-11-15	26	7.5	9000+*	13.0	
	7.5 End of Boring at 7.5 ft.	10							
		15							

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-16**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	5 inches of ASPHALTIC CEMENT CONCRETE								
	1.1	8 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Medium dense silty fine to medium sand, trace clay and gravel, occasional sandy clay pockets, brown (SM)		SS1	6-8-10/0"	18/6"	2.0			
	6.0	FILL - Hard silty clay, with sand, trace gravel and organics, black (CL)	5	SS2	16-2-8	10	5.0	8000*	17.9	
	7.5	FILL - Medium dense clayey fine sand, trace gravel. brown, moist (SC)		SS3	2-3-8	11	7.5			
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▲ DRY DENSITY pcf ▲ 100 110 120 130

▼ SPT N VALUE ▼ 10 20 30 40

● MOISTURE CONTENT % ● 10 20 30 40

>>

BORING COORDINATES

GROUNDWATER READINGS

First Encountered: None

Upon Completion: None

Remarks:
An LOI test on sample SS2 indicated an organic content of 3.4 percent.

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **BORING NO.** B-16 **PAGE 1 of 1**

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-17**

ELEVATION ft MSL	Depth	Ground Surface Elevation	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	0.4	5 inches of ASPHALTIC CEMENT CONCRETE	0							
	1.1	8 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Medium dense clayey fine to medium sand, trace gravel, brown, moist (SC)		SS1	5-7-8	15	2.5			
	6.0	Very stiff SILTY CLAY, some sand, trace gravel, gray (CL)	5	SS2	7-6-5	11	5.0	7000*	11.2	
	7.5	Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, gray, moist to wet (SM)		SS3	4-6-7	13	7.5			
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

▼ SPT N VALUE ▼ (10 20 30 40)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: 5 feet
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

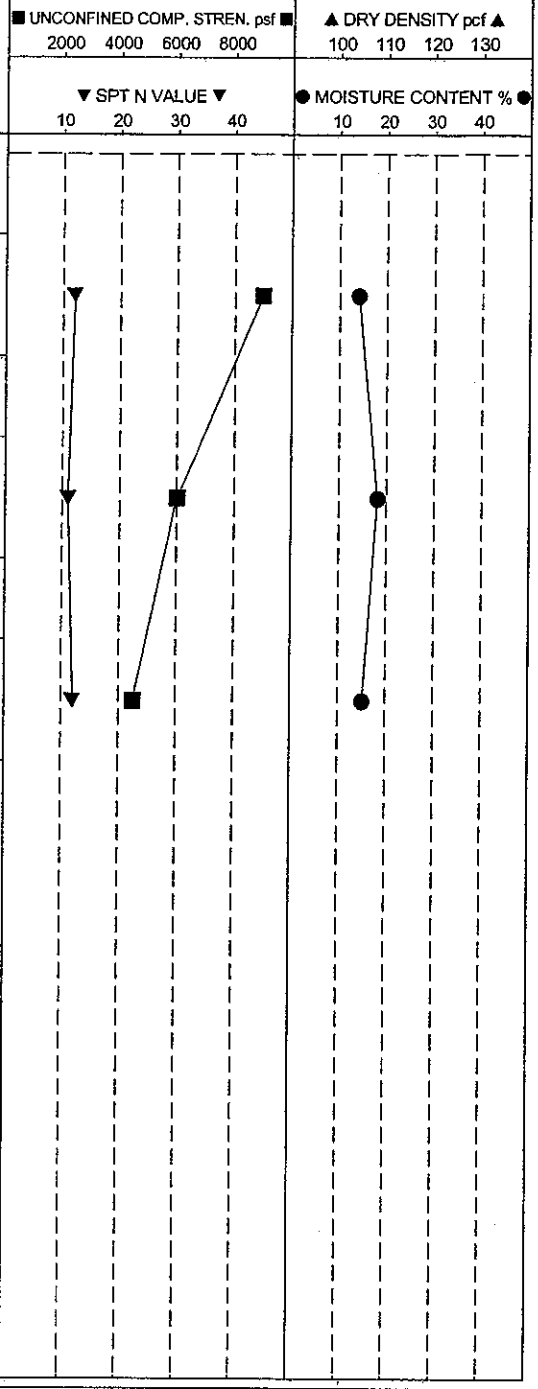
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-18**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.6	7 inches of ASPHALTIC CEMENT CONCRETE								
	0.8	3 inches of sand and gravel FILL (Base Material)								
		Hard to very stiff SILTY CLAY, some sand, trace gravel, brown/gray (possible fill) (CL)		SS1	6-6-6	12	2.5	9000+*	14.0	
				SS2	2-4-7	11	5.0	6000*	18.1	
	5.5		5							
		Very stiff SILTY CLAY, some sand, trace gravel, brown (CL)		SS3	4-5-7	12	7.5	4500*	15.1	
	7.5									
		End of Boring at 7.5 ft.	10							
			15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **BORING NO.** B-18 **PAGE 1 of 1**

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **B-19**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	8.5 inches of ASPHALTIC CEMENT CONCRETE 0.7								
	5 inches of sand and gravel FILL (Base Material) 1.1								
	FILL - Very stiff silty sandy clay, trace gravel, brown (CL)		SS1	6-6-7	13	2.5	5000*	11.4	
			SS2	2-3-5	8	5.0	4000*	15.1	
		5							
	6.5 Stiff SILTY CLAY, some sand, trace gravel, occasional sand seams, mottled brown and gray (CL) 7.5		SS3	2-3-3	6	7.5	3500*	12.4	
	End of Boring at 7.5 ft.	10							
		15							

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-20**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	6 inches of ASPHALTIC CEMENT CONCRETE								
	1.5	12 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Medium dense clayey fine to medium sand, trace gravel, brown, moist (SC)		SS1	14-11-13	24	2.5			
	6.0	Hard SILTY CLAY, some sand, trace gravel, frequent gray silt partings, brown (CL)	5	SS2	6-10-12	22	5.0	8000*	12.8	
	7.5	Medium dense SILTY FINE SAND, trace gravel, brown, moist (SM)		SS3	7-10-11	21	7.5			
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▲ DRY DENSITY pcf ▲ 100 110 120 130

▼ SPT N VALUE ▼ 10 20 30 40

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 55
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Manual
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-21**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation								
	7.5 inches of ASPHALTIC CEMENT CONCRETE 0.6	0							
	14 inches of sand and gravel FILL (Base Material) 1.8		SS1	13-32-17	49	2.5			
	FILL - Dense silty fine sand, trace gravel, brown, moist (SM) 2.5								
	Medium dense SILTY FINE SAND, trace gravel, brown, moist (SM) 5.5	5	SS2	10-14-12	26	5.0			
	Dense CLAYEY FINE TO MEDIUM SAND, trace gravel, brown, moist (SC) 7.5		SS3	20-20-15	35	7.5			
	End of Boring at 7.5 ft.	10							
		15							

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▲ DRY DENSITY pcf ▲ 100 110 120 130

▼ SPT N VALUE ▼ 10 20 30 40

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 55
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Manual
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
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Somat Engineering

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8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-22**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	6 inches of ASPHALTIC CEMENT CONCRETE 0.5								
	8 inches of sand and gravel FILL (Base Material) 1.2								
	Hard SILTY CLAY, some sand, trace gravel, occasional sand pockets, brown (CL) 2.5		SS1	9-9-11	20	2.5	8500*	13.8	
			SS2	9-12-8	20	5.0			
	Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, brown, moist (SM) 7.5	5	SS3	13-10-10	20	7.5			
	End of Boring at 7.5 ft.	10							
		15							

■ UNCONFINED COMP. STREN, psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 55
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Manual
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

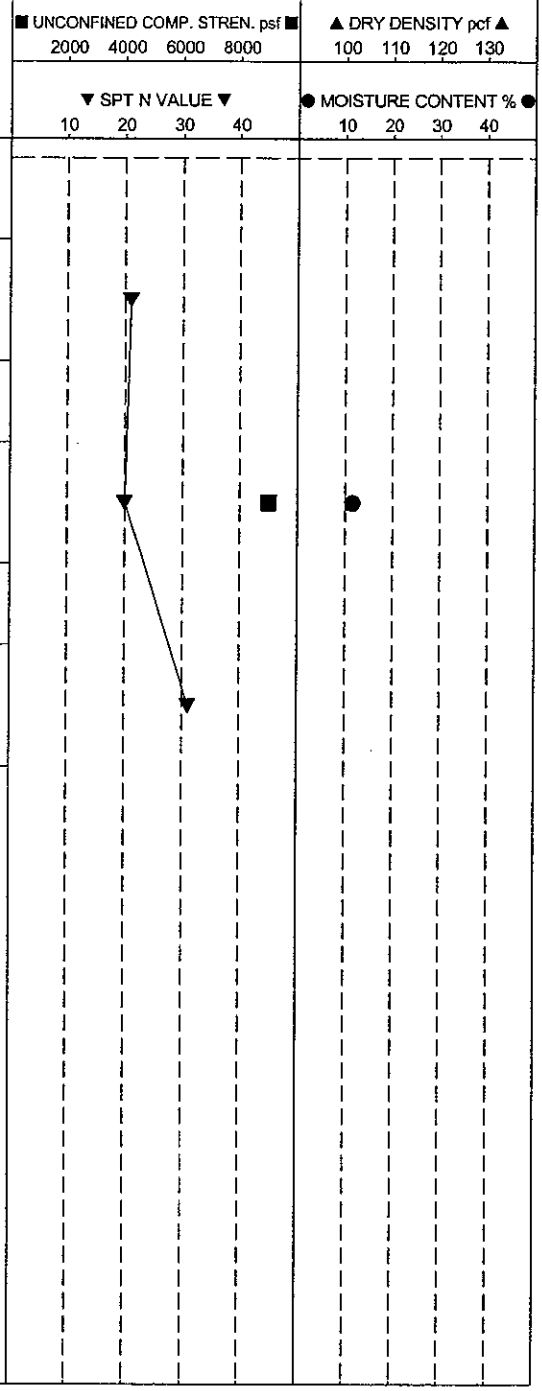
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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-23**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	5 inches of ASPHALTIC CEMENT CONCRETE								
	1.1	9 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Medium dense silty fine sand, trace gravel, brown, moist (SM)		SS1	40-11-10	21	2.5			
	6.0	Hard SILTY CLAY, some sand, trace gravel, occasional sand partings, brown (CL)	5	SS2	5-7-13	20	5.0	9000+*	11.5	
	7.5	Dense FINE TO MEDIUM SAND, trace silt and gravel, brown, moist (SP)		SS3	10-20-11	31	7.5			
		End of Boring at 7.5 ft.	10							
			15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 55
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Manual
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-24**

ELEVATION ft MSL	Depth	Ground Surface Elevation	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	0.5	3.5 inches of ASPHALTIC CEMENT CONCRETE	0							
	3.0	FILL - Medium dense silty fine to medium sand, trace gravel, dark brown and gray, moist (SM)		SS1	11-16-8	24	2.5			
	6.0	FILL - Very stiff silty clay, with sand, trace gravel, dark brown and gray (CL)	5	SS2	4-4-4	8	5.0	5000*	17.8	
	8.0	FILL - Loose clayey fine to medium sand trace gravel, dark brown and gray, moist (SC)		SS3	2-2-3	5	7.5			
	13.0	FILL - Very loose clayey fine sand, trace gravel, brown, wet (SC)	10	SS4	1-1-1	2	10.0			
	15.0	Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, gray, wet (SM)	15	SS5	4-6-7	13	15.0			

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

▼ SPT N VALUE ▼ (10 20 30 40)

● MOISTURE CONTENT % ● (10 20 30 40)

End of Boring at 15 ft.

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 12.5 feet
Upon Completion: 8 feet
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

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8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

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PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-25**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	5 inches of ASPHALTIC CEMENT CONCRETE								
	1.6	14 inches of sand and gravel FILL (Base Material)								
		FILL - Very stiff to stiff silty clay, some sand, trace gravel, occasional sand seams, orange/brown/gray (CL)		SS1	17-9-7	16	2.5	4500*	24.9	
				SS2	7-7-7	14	5.0	3500*	19.3	
	6.0		5							
		Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, gray, moist to wet (SM)		SS3	2-5-5	10	7.5			
	7.5									
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

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8 Mile Road to Grand River Avenue
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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-26**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	5 inches ASPHALTIC CEMENT CONCRETE								
	2.0	Sand and gravel FILL (Base Material)		SS1	12-19-6	25	2.5		30.1	
	5.3	FILL - Mixed very stiff silty clay and silty fine to medium sand, trace to some organics, trace gravel, black/brown/gray (CL)	5	SS2	4-6-9	15	5.0	5000*	18.1	
	7.5	Very stiff SILTY SANDY CLAY, trace gravel, brown (CL)		SS3	4-4-7	11	7.5	6000*	13.0	
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: 6 feet

Remarks:
An LOI test on sample SS1 indicated an organic content of 10.5 percent.

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-27**

ELEVATION ft MSL	Depth	Material Description	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	5.5 inches of ASPHALTIC CEMENT CONCRETE								
	1.0	6.5 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Very stiff silty sandy clay, trace gravel, orangish brown (CL)		SS1	5-5-6	11	2.5	6500*	19.5	
	6.0	FILL - Loose clayey fine to medium sand, trace gravel brown and gray, moist (SC)	5	SS2	3-3-4	7	5.0		11.8	
	7.0	Very stiff SILTY CLAY, some sand, trace gravel, gray (CL)		SS3	4-7-7	14	7.5	4500*		
	7.5	SILTY FINE SAND, trace gravel, gray, wet (SM)								
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▼ SPT N VALUE ▼ (10 20 30 40)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-28**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	5.5 inches of ASPHALTIC CEMENT CONCRETE								
	2.0	Sand and gravel FILL (Base Material)		SS1	16-15-8	23	2.5	3750*	15.7	
	3.5	FILL - Stiff silty clay, with sand, trace gravel and organics, dark brown (CL)								
	6.0	FILL - Silty sandy clay, trace gravel, brown/dark brown/orange (CL)	5	SS2	2-5-6	11	5.0	<>	19.6	
	7.5	Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, brownish gray, moist (SM)		SS3	6-6-7	13	7.5			
		End of Boring at 7.5 ft.	10							
			15							

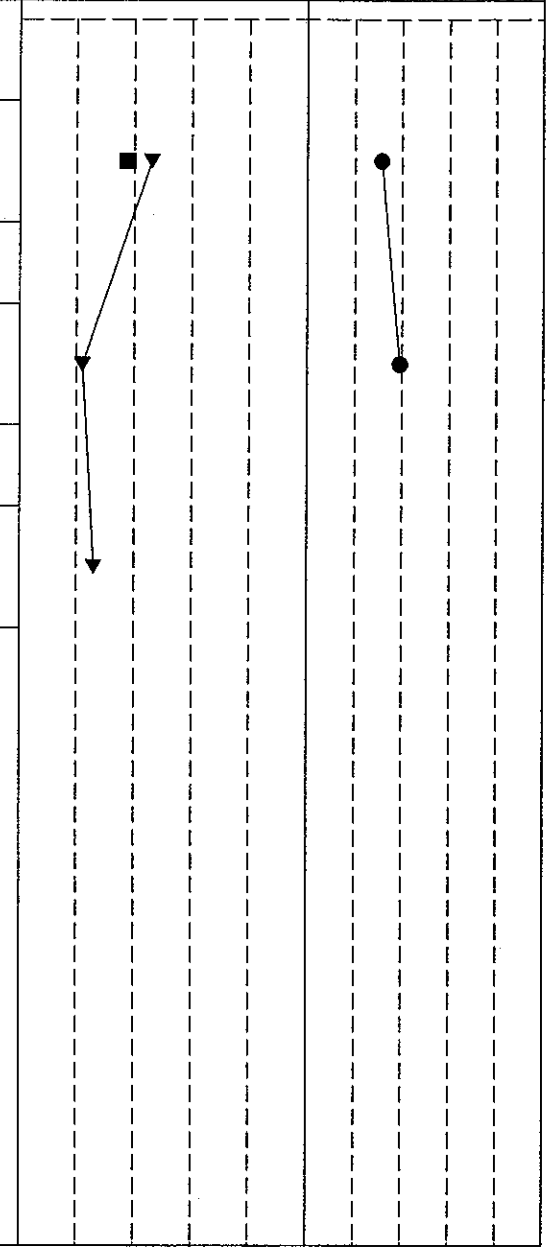
LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: 4.5 feet

Remarks:
An LOI test on sample SS1 indicated an organic content of 4.4 percent.

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **B-29**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.8	9 inches of ASPHALTIC CEMENT CONCRETE								
	1.5	9 inches of sand and gravel FILL (Base Material)								
				SS1	2-2-2	4	2.5			
		FILL - Very loose fine to medium sand, trace to some silt, trace gravel, brown, moist (SP/SM)	5	SS2	2-2-2	4	5.0			
	6.0									
		FILL - Very loose silty fine to medium sand, trace gravel, brown, moist to wet (SM)		SS3	2-2-2	4	7.5			
	8.0									
		Alernating layers of loose SANDY SILT and SILTY FINE SAND, trace gravel, brown, wet (ML) (SM)		SS4	3-4-5	9	10.0			
	10.0		10							
		End of Boring at 10 ft.								
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▼ SPT N VALUE ▼ (10 20 30 40)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 8 feet
Upon Completion: None
Remarks:

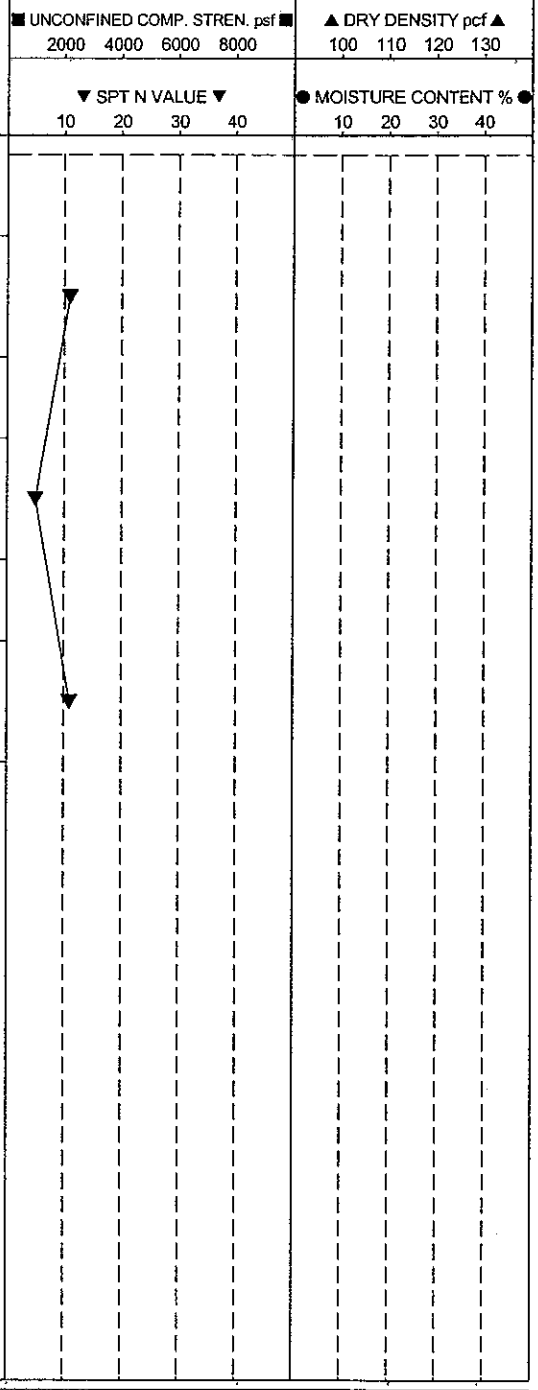
Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-30**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	6.25 inches of ASPHALTIC CEMENT CONCRETE								
	1.2	FILL - 8 inches of sand and gravel FILL (Base Material)								
		FILL - Medium dense to loose silty fine to medium sand, trace gravel, dark brown to brown, moist (SM)		SS1	10-6-5	11	2.5			
				SS2	3-3-2	5	5.0			
	6.0		5							
	7.5	Medium dense SILTY FINE TO MEDIUM SAND, trace gravel, brown, moist to wet (SM)		SS3	4-4-7	11	7.5			
		End of Boring at 7.5 ft.	10							
			15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 6 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **BORING NO.** B-30 **PAGE 1 of 1**

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-31**

ELEVATION ft MSL	Depth	Ground Surface Elevation	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	0.5	6 inches of ASPHALTIC CEMENT CONCRETE	0							
	1.3	FILL - 9 inches of sand and gravel FILL (Base Material)								
	2.5	FILL - Medium dense fine to medium sand, trace to some silt, trace gravel, brown, moist (SP/SM)		SS1	6-7-7	14	2.5			
	5.5	FILL - Mixed medium dense clayey fine to coarse sand and silty clay, trace gravel, brown/dark brown/gray, moist to wet (SC) (CL)	5	SS2	9-9-6	15	5.0			
	7.5	Hard SILTY CLAY, some sand, trace gravel, gray (CL)		SS3	5-5-7	12	7.5	8000*	11.6	
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-32**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	6.5 inches of ASPHALTIC CEMENT CONCRETE								
	3.0	FILL - Medium dense fine to medium sand, trace to some silt, trace gravel, brown, moist (SP/SM)		SS1	10-10-11	21	2.5			
	5.5	FILL - Medium dense clayey fine to medium sand, trace gravel, brown, moist (SC)	5	SS2	11-15-8	23	5.0			
	7.5	Hard SILTY CLAY, some sand, trace gravel, gray (CL)		SS3	4-5-6	11	7.5	8500*	9.4	
		End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-33**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	5.5 inches of ASPHALTIC CEMENT CONCRETE 0.5								
	6 inches of agrregate FILL (Base Material) 1.0								
	FILL - Mixed clayey fine to medium sand and silty clay, trace gravel, brown and gray, moist to wet (SC) (CL)		SS1	6-5-3	8	2.5			
		5	SS2	2-3-4	7	5.0			
	6.0								
	Very stiff SILTY CLAY, with sand, trace gravel, gray (CL)		SS3	3-5-6	11	7.5	5500*	14.3	
	7.5 End of Boring at 7.5 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 4.5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-34**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.4	4.5 inches of ASPHALTIC CEMENT CONCRETE								
	1.0	7 inches of sand and gravel FILL (Base Material)								
		FILL - Very stiff to stiff silty sandy clay, trace gravel, occasional sand seams, brown and gray (CL)		SS1	6-5-5	10	2.5		19.4	
				SS2	3-4-6	10	5.0	5000*	26.7	
	6.0		5							
		Hard SILTY CLAY, some sand, trace gravel, gray (CL)		SS3	3-5-7	12	7.5	9300	13.7	139
	7.5	End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None

Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-35**

ELEVATION ft MSL	Depth	Ground Surface Elevation
	0.3	4 inches of ASPHALTIC CEMENT CONCRETE
	1.0	8 inches of sand and gravel FILL (Base Material)
	3.0	FILL - Mixed silty fine sand and silty clay, trace gravel, gray and brown (SM) (CL)
	7.5	Hard SILTY CLAY, some sand, trace gravel, occasional silt partings, brown (CL)
		End of Boring at 7.5 ft.

DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
0							
	SS1	4-6-6	12	2.5			
	SS2	5-5-5	10	5.0	9000+*	14.5	
5							
	SS3	5-8-11	19	7.5	8000*	11.2	
10							
15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A BORING NO. B-35 PAGE 1 of 1

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LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-36**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.8	9 inches of ASPHALTIC CEMENT CONCRETE								
	1.0	4 inches of sand and gravel FILL (Base Material)								
	3.0	FILL - Very stiff silty sandy clay, trace gravel, brown/dark brown/gray (CL)		SS1	5-5-8	13	2.5	4500*	17.6	
	6.0	Hard SILTY CLAY, some sand, trace gravel, brown (CL)	5	SS2	6-7-8	15	5.0	9000+*	12.8	
	6.5	SILTY FINE TO COARSE SAND, brown, moist (SM)								
	7.5	Very stiff SILTY CLAY, some sand, trace gravel, brownish gray (CL)		SS3	7-9-9	18	7.5	7500*	10.3	
		End of Boring at 7.5 ft.	10							
			15							

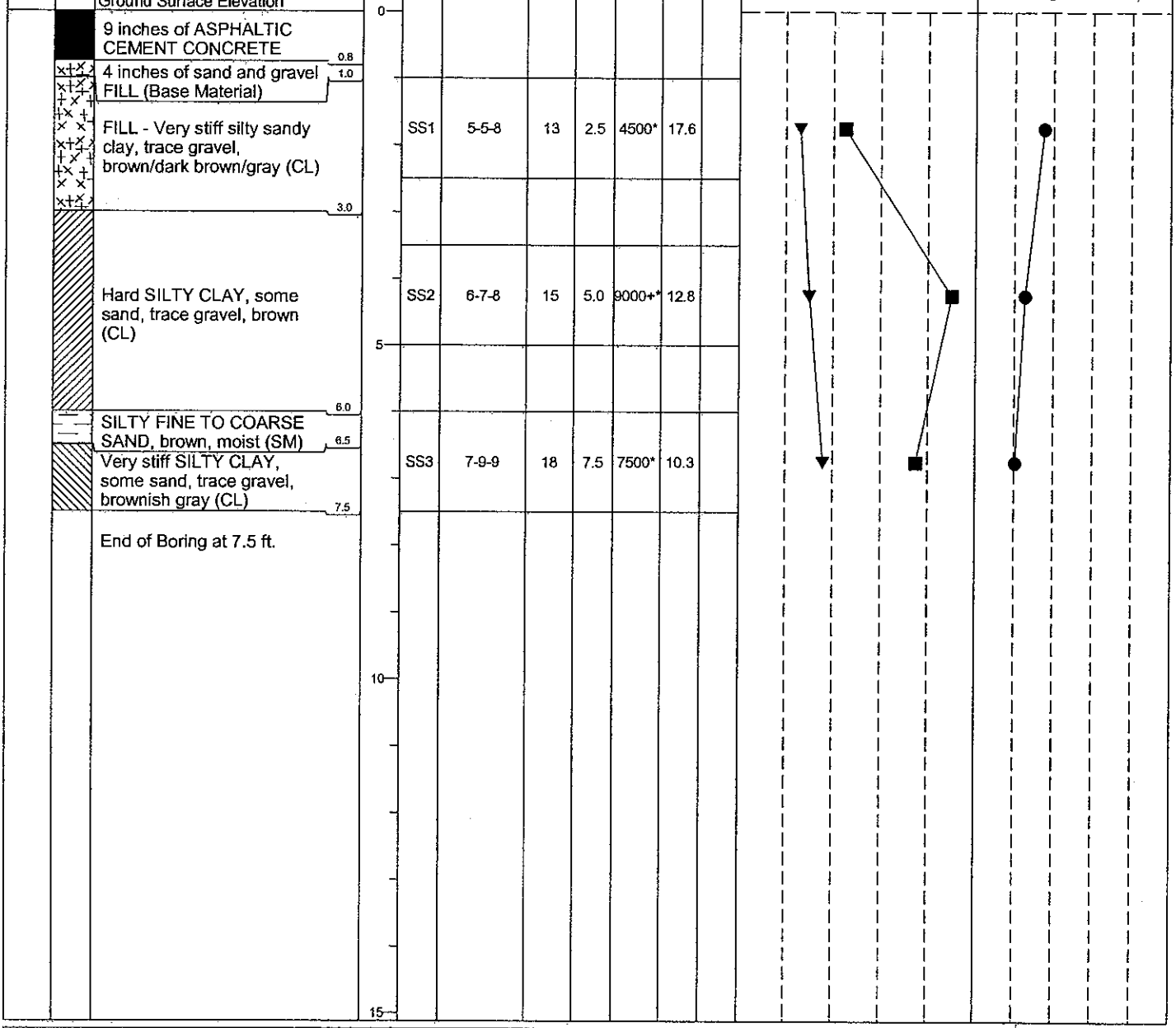
LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A BORING NO. B-36 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** B-37

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	3.5 inches of ASPALTIC CEMENT CONCRETE 0.3								
	4 inches of sand and gravel FILL (Base Material) 1.0								
	FILL - Very stiff silty clay with sand, trace gravel, brown and dark brown (CL) 3.0		SS1	6-5-4	9	2.5	7000*	21.8	
	Very stiff SILTY CLAY, trace sand and gravel, frequent sand and silt seams, mottled brown and gray (CL) 6.0	5	SS2	4-4-7	11	5.0	5000*	18.0	
	Very stiff SILTY CLAY, with sand, trace gravel, brown (CL) 7.5		SS3	6-7-8	15	7.5	6000*	11.6	
	End of Boring at 7.5 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▼ SPT N VALUE ▼ (10 20 30 40)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

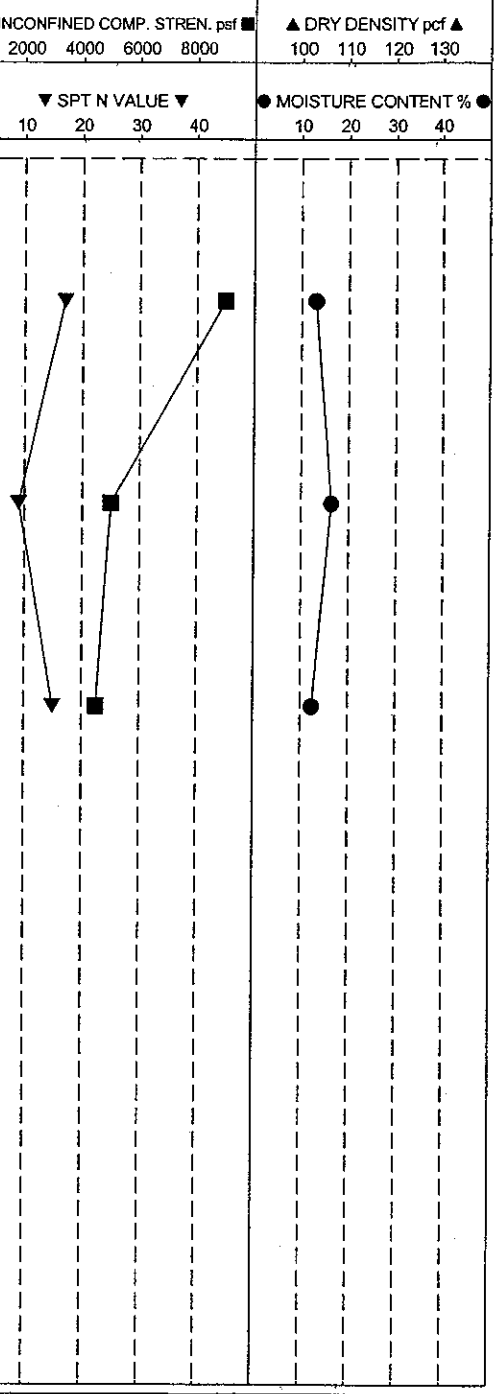
PROJECT NO. G06119A BORING NO. B-37 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** B-38

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-Inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.3	3 inches of ASPHALTIC CEMENT CONCRETE								
		16 inches of sand and gravel FILL (Base Material)								
	1.6	FILL - Hard silty sandy clay, trace gravel and organics, occasional sand seams, brown and dark brown (CL)		SS1	12-11-6	17	2.5	9000+*	13.0	
	4.0	Very stiff SILTY SANDY CLAY, trace gravel, occasional sand partings, mottled brown and gray (CL)	5	SS2	2-4-5	9	5.0	5000*	16.3	
	5.0	Very stiff SILTY CLAY, some sand, trace gravel, brown (CL)		SS3	5-6-9	15	7.5	4500*	12.4	
	7.5	End of Boring at 7.5 ft.	10							
			15							



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 4.5 feet
Upon Completion: None

Remarks:
An LOI test on sample SS1 indicated an organic content of 3.0 percent.

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A BORING NO. B-38 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** **B-39**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.6	7.5 inches of ASPHALTIC CEMENT CONCRETE								
	1.0	Limestone fines FILL (Base Material)								
	2.5	FILL - Medium dense clayey fine to medium sand, trace gravel, occasional pockets of limestone fines, brown and light brown, moist (SC)		SS1	11-12-6	18	2.5			
				SS2	4-7-8	15	5.0	9000+*	10.9	
		Hard SILTY CLAY, some sand, trace gravel, brown (CL)	5							
				SS3	7-7-8	15	7.5	9000+*	13.4	
	7.5	End of Boring at 7.5 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/29/2006 **LOG OF TEST BORING** B-40

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	6 inches of ASPHALTIC CEMENT CONCRETE								
	1.2	8 inches of sand and gravel FILL (Base Material)								
		FILL - Medium dense clayey fine to medium sand, trace gravel, brown, moist (SC)		SS1	5-6-6	12	2.5			
				SS2	5-6-6	12	5.0			
	6.0		5							
		Medium dense SILTY FINE TO COARSE SAND, trace gravel, gray, wet (SM)		SS3	8-10-10	20	7.5			
	7.5	End of Boring at 7.5 ft.	10							
			15							

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 6 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-29-06
Date Completed: 08-29-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

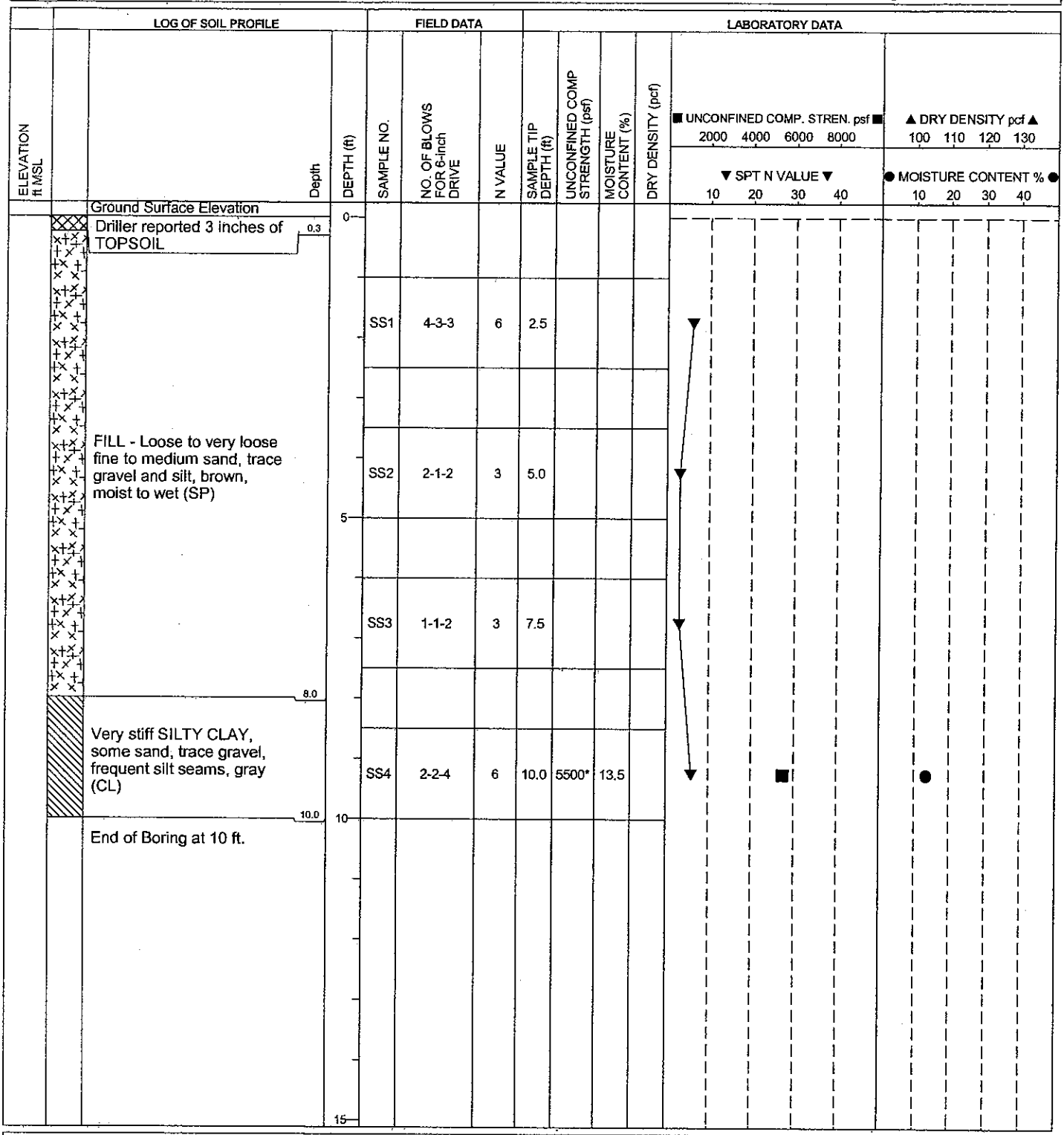
Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2_G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** W-1



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 6.5 feet
Upon Completion: 6.5 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A **BORING NO.** W-1 **PAGE 1 of 1**

9/12/06

LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **W-2**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	Driller reported 6 inches of TOPSOIL								
		FILL - Medium dense to very loose fine to medium sand, trace gravel and silt, brown, moist to wet (SP)	5	SS1	5-5-5	10	2.5			
				SS2	2-4-2	6	5.0			
				SS3	0-1-1	2	7.5			
				SS4	0-0-1	1	10.0			
	10.0	End of Boring at 10 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 7 feet
Upon Completion: 7 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A BORING NO. W-2 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **W-3**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 5 inches of GRAVEL SHOULDER 0.4								
			SS1	6-7-6	13	2.5			
			SS2	5-7-8	15	5.0			
	FILL - Medium dense to very loose fine to medium sand, trace gravel and silt, brown, moist to wet (SP)	5							
			SS3	2-1-2	3	7.5			
			SS4	0-1-1	2	10.0			
	10.0	10							
	End of Boring at 10 ft.								
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 7 feet
Upon Completion: 7 feet
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G05106A **DATE** 7/20/2005 **LOG OF TEST BORING** **W-4**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	Driller reported 6 inches of GRAVEL SHOULDER 0.5								
	Hard SILTY CLAY, some sand, trace to some gravel, occasional silt partings, brown (CL)		SS1	3-3-7	10	2.5	9000+*	14.1	
			SS2	3-6-8	14	5.0	9000+*	13.9	
	5.5	5							
	Hard SILTY CLAY, some sand and gravel, gray (CL)		SS3	7-11-12	23	7.5	9000+*	11.6	
			SS4	4-6-7	13	10.0	9000+*	11.4	
	10.0 End of Boring at 10 ft.	10							
		15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: None
Upon Completion: None
Remarks:

Drilling Company: B. Sienkiewicz
Drill Rig: CME 45C
Engineer on Rig: S. Seydi
Drilling Method: 4 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 07-20-05
Date Completed: 07-20-05
Checked By: JDZ
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G05106A BORING NO. W-4 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G05106A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **W-5**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	1.0	FILL - Medium dense clayey fine to medium sand, trace gravel, brown, moist (SC)								
		FILL - Stiff silty sandy clay, trace gravel, brown (CL)		SS1	3-7-11	18	2.5	2500*	11.8	
	3.0									
		Very stiff to hard SILTY CLAY, some sand, trace gravel, occasional silt partings, brown (CL)	5	SS2	4-4-7	11	5.0	7500*	14.1	
				SS3	6-8-12	20	7.5	8000*	12.2	
	10.0		10	SS4	10-12-17	29	10.0	9000+*	11.8	
		End of Boring at 10 ft.	15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■
2000 4000 6000 8000

▼ SPT N VALUE ▼
10 20 30 40

▲ DRY DENSITY pcf ▲
100 110 120 130

● MOISTURE CONTENT % ●
10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 8.5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A BORING NO. W-5 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **W-6**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-Inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	1.3	15 inches of gravel FILL								
	3.0	FILL - Hard silty sandy clay, trace gravel. occasional sand seams, brown and dark brown (CL)		SS1	4-5-6	11	2.5		9.9	
	4.0	FILL - Hard silty clay, some sand, trace to some organics, trace gravel, black (CL)		SS2	3-4-5	9	5.0	6500*	35.7	
	8.0	FILL - Very stiff silty clay with sand, trace gravel, orangish brown (CL)	5	SS3	2-2-3	5	7.5	4500*	13.8	
	10.0	Very stiff SILTY SANDY CLAY, trace gravel, occasional silt partings, gray (CL)		SS4	3-4-6	10	10.0	6500*	12.0	
		End of Boring at 10 ft.	10							
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ (2000 4000 6000 8000)

▼ SPT N VALUE ▼ (10 20 30 40)

▲ DRY DENSITY pcf ▲ (100 110 120 130)

● MOISTURE CONTENT % ● (10 20 30 40)

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 5.5 feet
Upon Completion: None

Remarks:
An LOI test on sample SS2 indicated an organic content of 9.7 percent.

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A BORING NO. W-6 PAGE 1 of 1

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/28/2006 **LOG OF TEST BORING** **W-7**

ELEVATION ft MSL	Depth	Material Description	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.9	11 inches of FILL (Shoulder Material)								
		FILL - Loose to very loose clayey fine to medium sand, trace gravel, dark brown, moist to wet at 4 feet (SC)		SS1	4-4-5	9	2.5			
				SS2	2-1-1	2	5.0			
	5.0		5							
		Loose SILTY FINE TO MEDIUM SAND, trace gravel, brown, moist to wet (Possible Fill) (SM)		SS3	5-5-4	9	7.5			
				SS4	4-4-4	8	10.0			
	10.0		10							
		End of Boring at 10 ft.								
			15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 3.5 feet
Upon Completion: 4 feet
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-28-06
Date Completed: 08-28-06
Checked By: JSS
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

PROJECT NO. G06119A **BORING NO.** W-7 **PAGE 1 of 1**

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **W-8**

ELEVATION ft MSL	Depth	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
		Ground Surface Elevation	0							
	0.5	6 inches of gravel FILL								
	2.0	FILL - Medium dense fine to medium sand, trace to some silt, trace gravel, brown, moist (SP/SM)		SS1	5-5-5	10	2.5			
	6.0	FILL - Stiff silty clay, some sand, trace gravel and roots, dark gray (CL)	5	SS2	2-1-2	3	5.0	3500*	12.9	
	8.0	SILTY SANDY CLAY, trace gravel, gray (CL)		AU3	2-2-4	6	7.5			
	10.0	Medium dense SILTY FINE TO MEDIUM SAND, trace to some gravel, gray, moist to wet (SM)	10	SS4	6-5-7	12	10.0			
		End of Boring at 10 ft.	15							

LABORATORY DATA

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 2.5 feet
Upon Completion: 3 feet
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

9/12/06

LOG OF TEST BORING VER2 G06119A.GPJ SOMAT.GDT 9/12/06

PROJECT NO. G06119A **DATE** 8/25/2006 **LOG OF TEST BORING** **W-9**

ELEVATION ft MSL	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Ground Surface Elevation	0							
	4 inches of ASPHALTIC CEMENT CONCRETE 0.3								
	FILL - Mixed silty sandy clay and limestone fines, light brown and brown 2.0		SS1	5-5-5	10	2.5			
	Stiff SILTY CLAY, some sand, trace gravel and roots, brown and gray (CL) 6.0	5	SS2	4-3-4	7	5.0	3000*	17.6	
	Very stiff SILTY CLAY, with sand, trace gravel, brown (CL) 10.0		SS3	8-8-6	14	7.5	4500*	12.5	
	End of Boring at 10 ft.	10	SS4	5-8-12	20	10.0	7000*	9.5	
		15							

■ UNCONFINED COMP. STREN. psf ■ 2000 4000 6000 8000

▼ SPT N VALUE ▼ 10 20 30 40

▲ DRY DENSITY pcf ▲ 100 110 120 130

● MOISTURE CONTENT % ● 10 20 30 40

BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 3.5 feet
Upon Completion: None
Remarks:

Drilling Company: Strata Drilling
Drill Rig: CME 45C
Engineer on Rig: J. Abadir
Drilling Method: 2 1/4 inch SSA
Hammer Type: Automatic
Backfilled With: Cuttings/Patch
Date Started: 08-25-06
Date Completed: 08-25-06
Checked By: JSS

Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Beck Road Scoping Study Project
8 Mile Road to Grand River Avenue
Novi, Michigan

Somat Engineering

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1 3/8" I.D., 2" O.D., (unless otherwise noted)	PS:	Piston Sample
ST:	Thin-Walled Tube – 3" O.D., (unless otherwise noted)	WS:	Wash Sample
LS:	Liner Sample	RC:	Rock Core with diamond bit, NX size, (unless otherwise noted)
PA:	Power Auger		
HA:	Hand Auger	RB:	Rock Bit/Roller Bit
AU:	Auger Sample	WR:	Wash Rotary
BS:	Bulk Sample	NR:	No Recovery
HS:	Hollow Stem Auger	VS:	Vane Shear Test

Standard Penetration Test Resistance, N-Value: Sum of 2nd and 3rd 6-inch increments, in blows per foot of a 140-pound hammer falling 30 inches and driving an 18-inch long, 2-inch OD split spoon, unless otherwise noted.

WATER LEVEL MEASUREMENT:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of a groundwater table. In low permeability soils (clays and silts), the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil classification is based on the Unified Soil Classification (USC) System and ASTM Standards D-2487 and D-2488. Coarse-grained soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts, if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their apparent in-place density and fine-grained soils on the basis of their consistency.

SECONDARY SOIL CONSTITUENT

Percentage Range	Primary Constituent	
	Sand & Gravel	Clay & Silt
≤ 5%	Trace	Trace
>5% → ≤12%	Trace to Some	Trace to Some
>12% → ≤25%	Secondary Constituent	Some
>25% → <50%	Secondary Constituent	Secondary Constituent

COARSE-GRAINED SOILS

N-Value	Apparent Density
0 – 4	Very Loose
5 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50 – 80	Very Dense
>80	Extremely Dense

DEFINITIONS OF STRUCTURAL AND DEPOSITIONAL FEATURES

Term	Definition
Parting	≤ 1/16 inch (1.6 mm) thick
Seam	> 1/16 inch (1.6 mm) → ½ inch (12.7 mm) thick
Layer	> ½ inch (12.7 mm) to ≤ 12 inches (305 mm) thick
Pocket	Small, erratic deposits of limited lateral extent
Lens	Lenticular deposit
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Varved	Alternating partings or seams (1 mm – 12 mm) of silt and/or clay and sometimes fine sand
Stratified	Alternating layers of varying material or color with layers ≥ 6 mm thick
Laminated	Alternating layers of varying material or color with layers < 6 mm thick
Fissured	Contains shears or separations along planes of weakness
Slickensided	Shear planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Homogeneous	Same color and appearance throughout
Occasional	One or less per foot (305 mm) of thickness
Frequent	More than one per foot (305 mm) of thickness
Interbedded	Applied to strata of soil lying between or alternating with other strata of a different nature

FINE-GRAINED SOILS

Unconfined Compressive Strength Qu, psf	Consistency
< 500	Very Soft
500 - <1000	Soft
1000 - <2000	Medium
2000 - <4000	Stiff
4000 - <8000	Very Stiff
≥ 8000	Hard

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Size Range
Boulders	≥ 12" (300 mm)
Cobbles	< 12" - 3" (300 mm – 75 mm)
Gravel - Coarse	< 3" - ¾" (75 mm – 19 mm)
Gravel – Fine	< ¾" - #4 (19 mm – 4.75 mm)
Sand – Coarse	< #4 - #10 (4.75 mm – 2 mm)
Sand – Medium	< #10 - #40 (2 mm - 0.425 mm)
Sand – Fine	< #40 - #200 (0.425 mm -0 .074 mm)
Silt	< 0.074 mm - 0.005 mm
Clay	<0 .005 mm

APPENDIX C

"IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT"

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

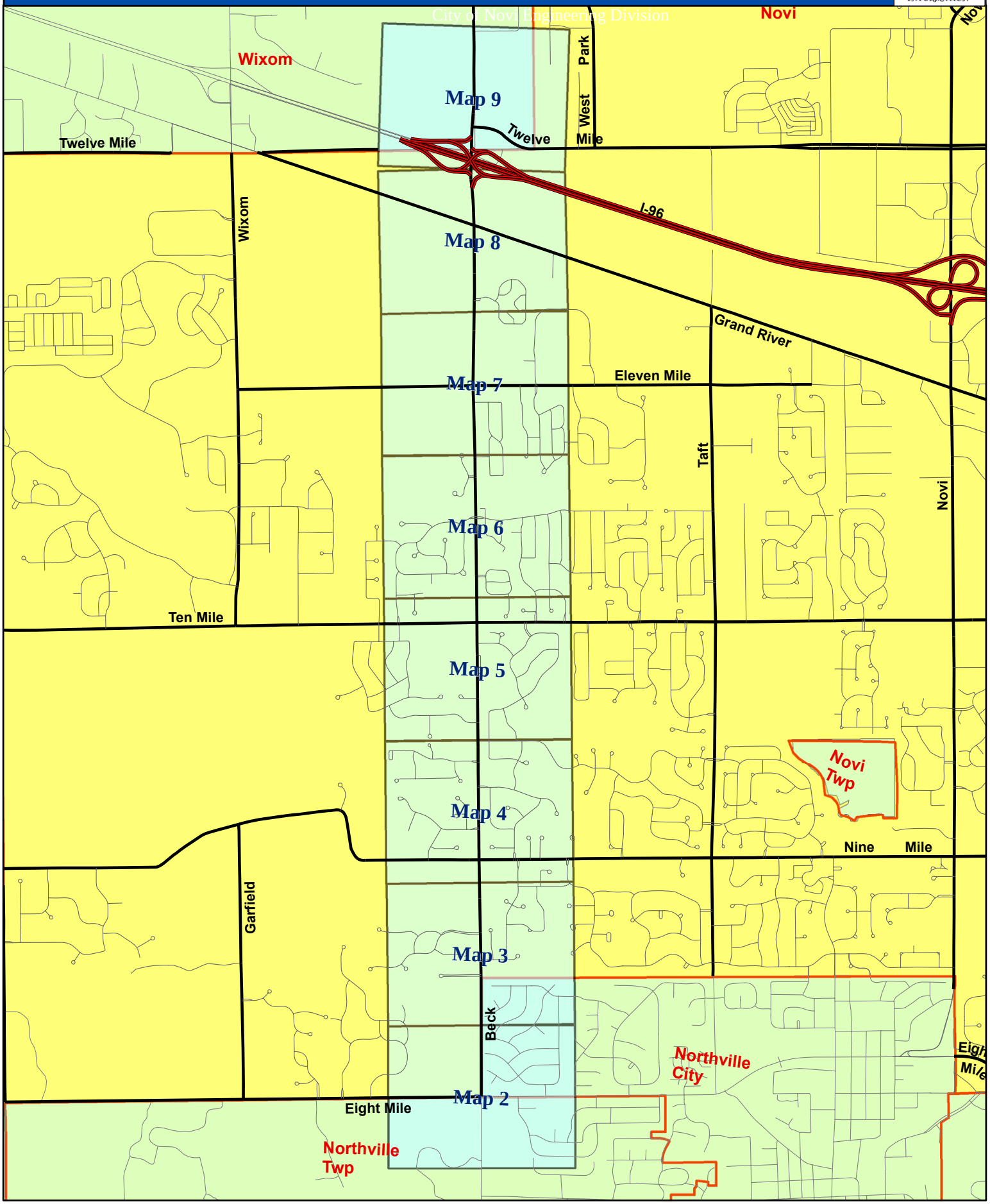
A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (300 Feet Each Way From Centerline)

City of Novi Engineering Division



Map # 2
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION

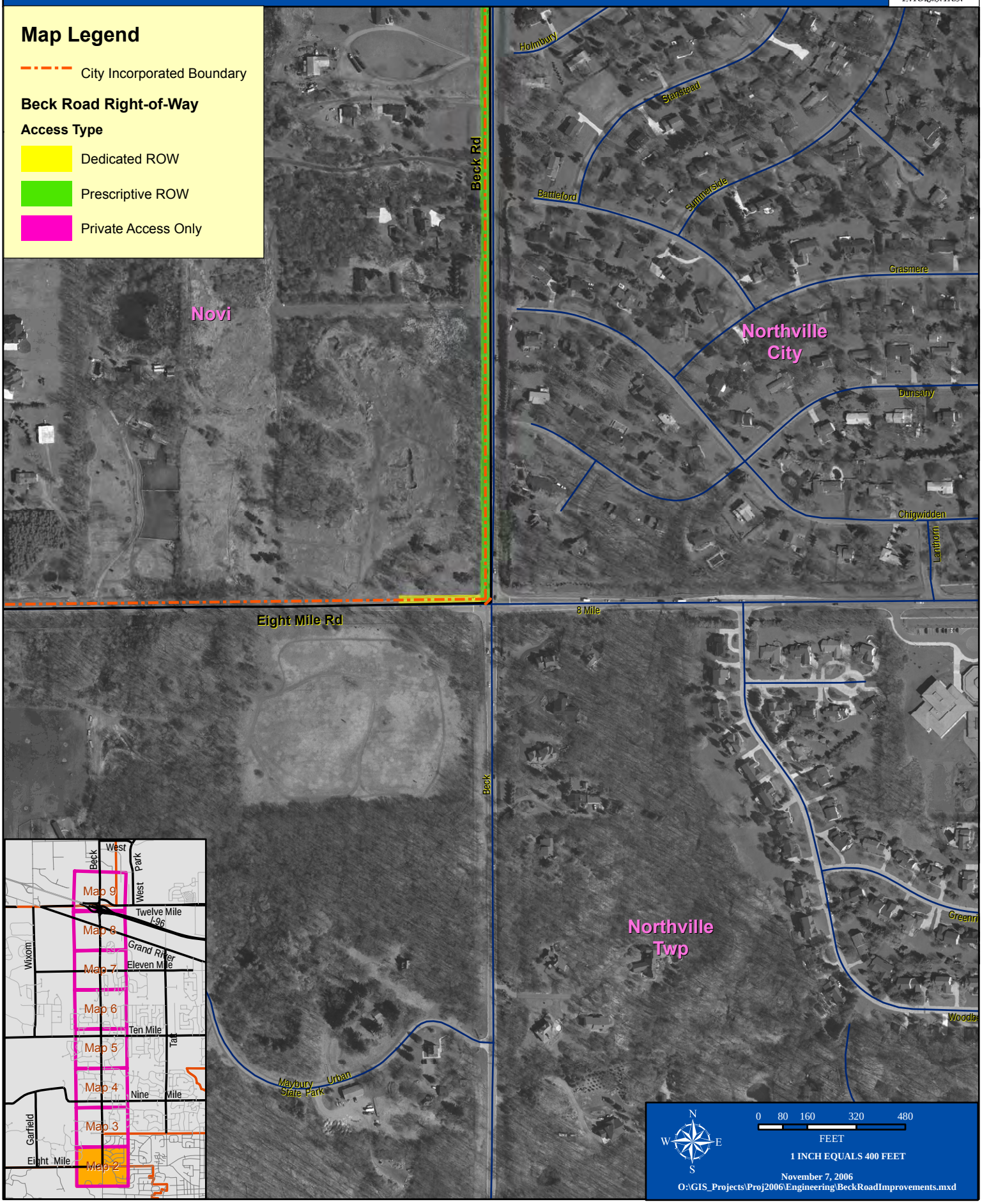
Map Legend

City Incorporated Boundary

Beck Road Right-of-Way

Access Type

- Dedicated ROW
- Prescriptive ROW
- Private Access Only



N
W E
S

0 80 160 320 480

FEET

1 INCH EQUALS 400 FEET

November 7, 2006

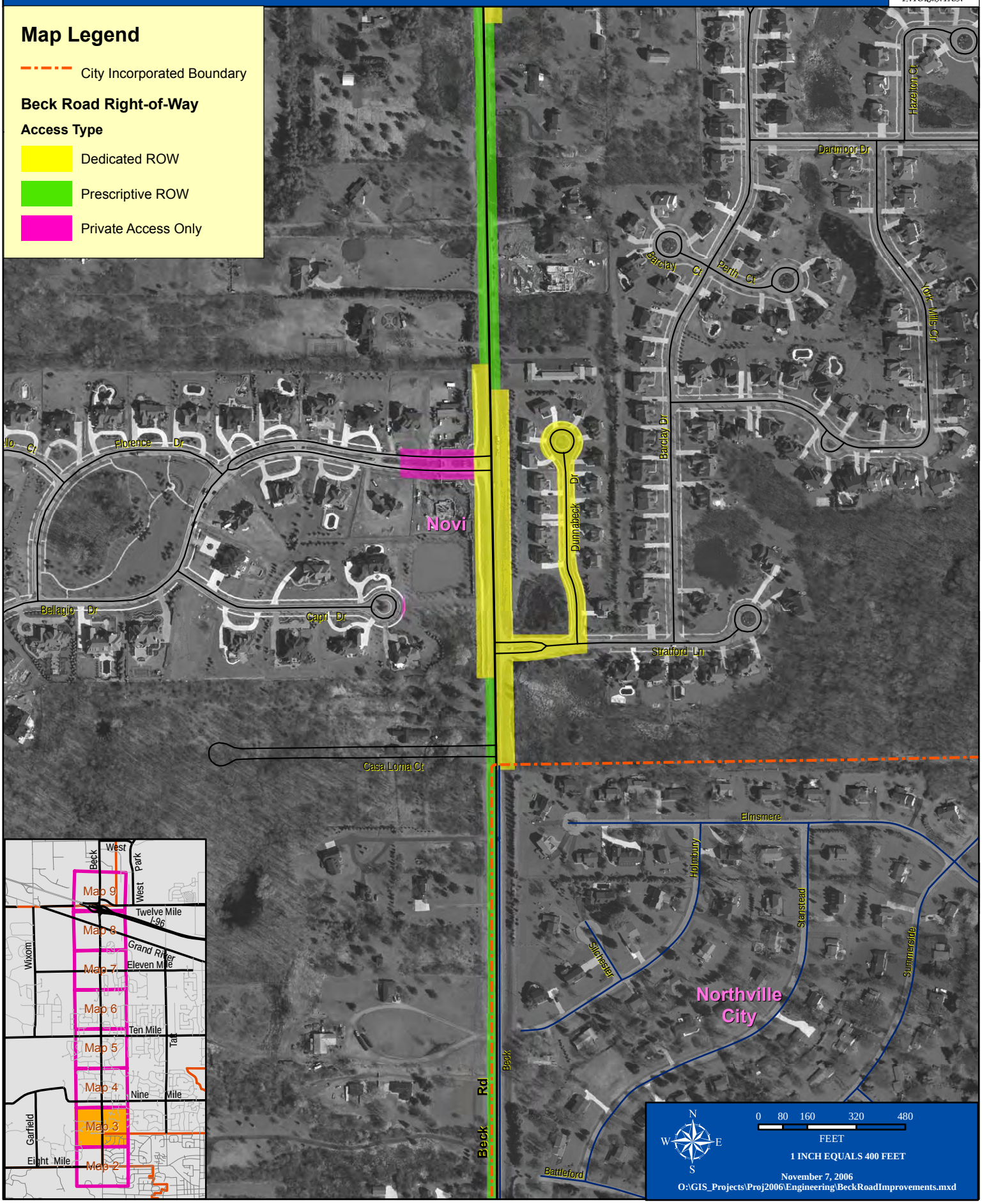
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Map # 3
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division



Map # 4
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION



Map # 5
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION

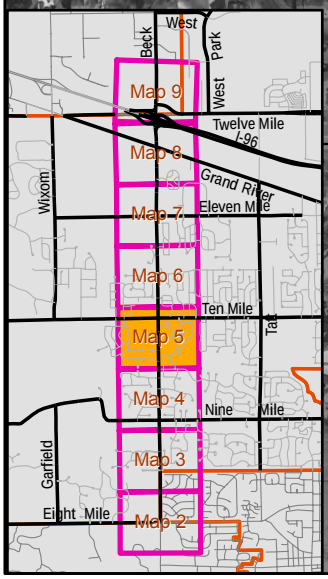
Map Legend

City Incorporated Boundary

Beck Road Right-of-Way

Access Type

- Dedicated ROW
- Prescriptive ROW
- Private Access Only



Scarlet Dr
Scarlet Ct
Roma Ridge Dr
Briarglewood Dr
Robin Ct
Ten Mile Rd
Broadmoor Park Blvd
Broadmoor Park Ln
Trafalgar Ct
Baker St
Northumberland
Novi
Tottenham Ct
Forest Park Dr
Andover Dr
Andover Dr
Iroquois Ct
Argyle St
Whitehall Dr
Beck Rd
White Pines Dr

N
W E
S

0 80 160 320 480
FEET

1 INCH EQUALS 400 FEET

November 7, 2006
O:\GIS_Projects\Proj2006\Engineering\BeckRoadImprovements.mxd

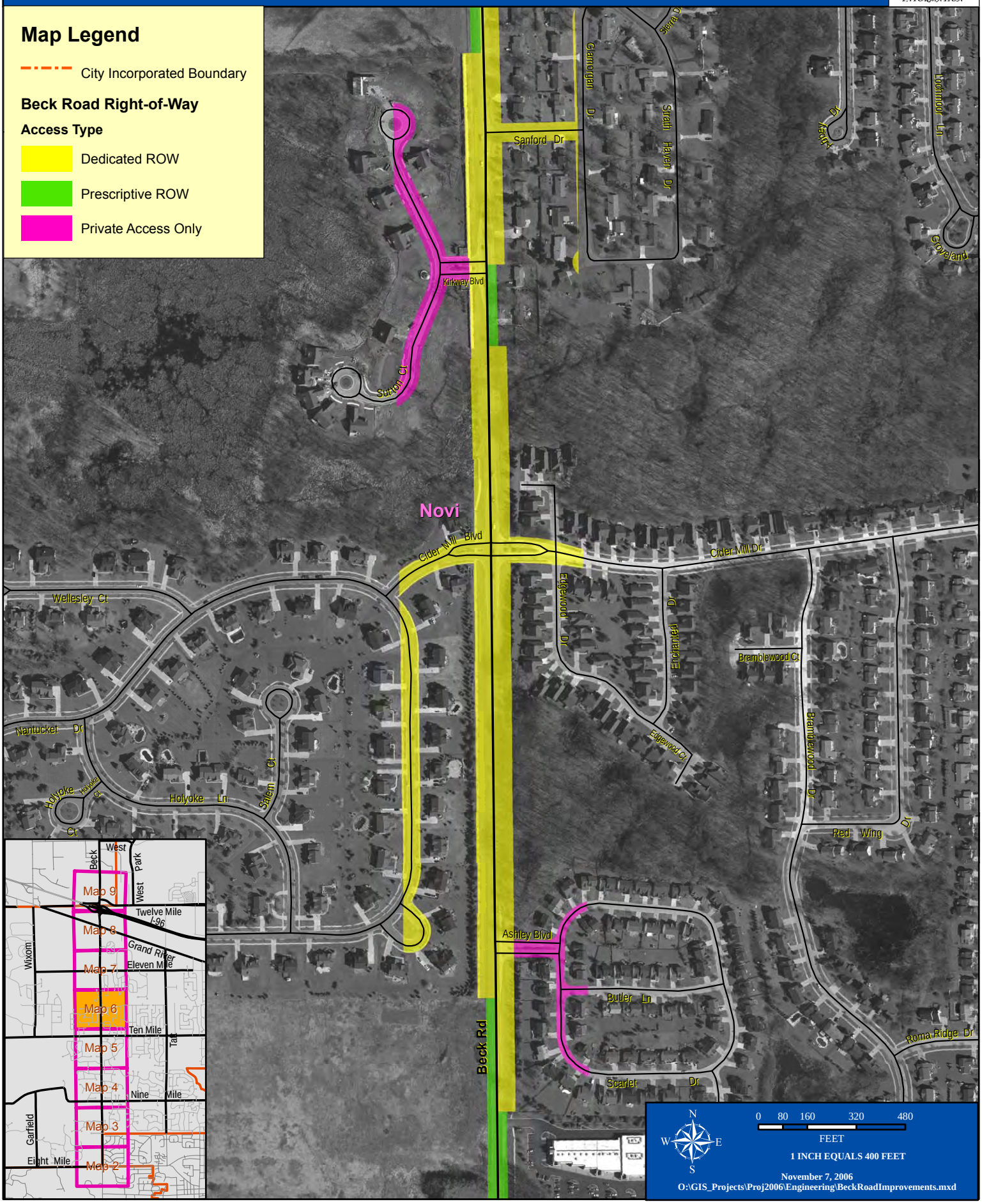
Map # 6
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION



Map # 7
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION

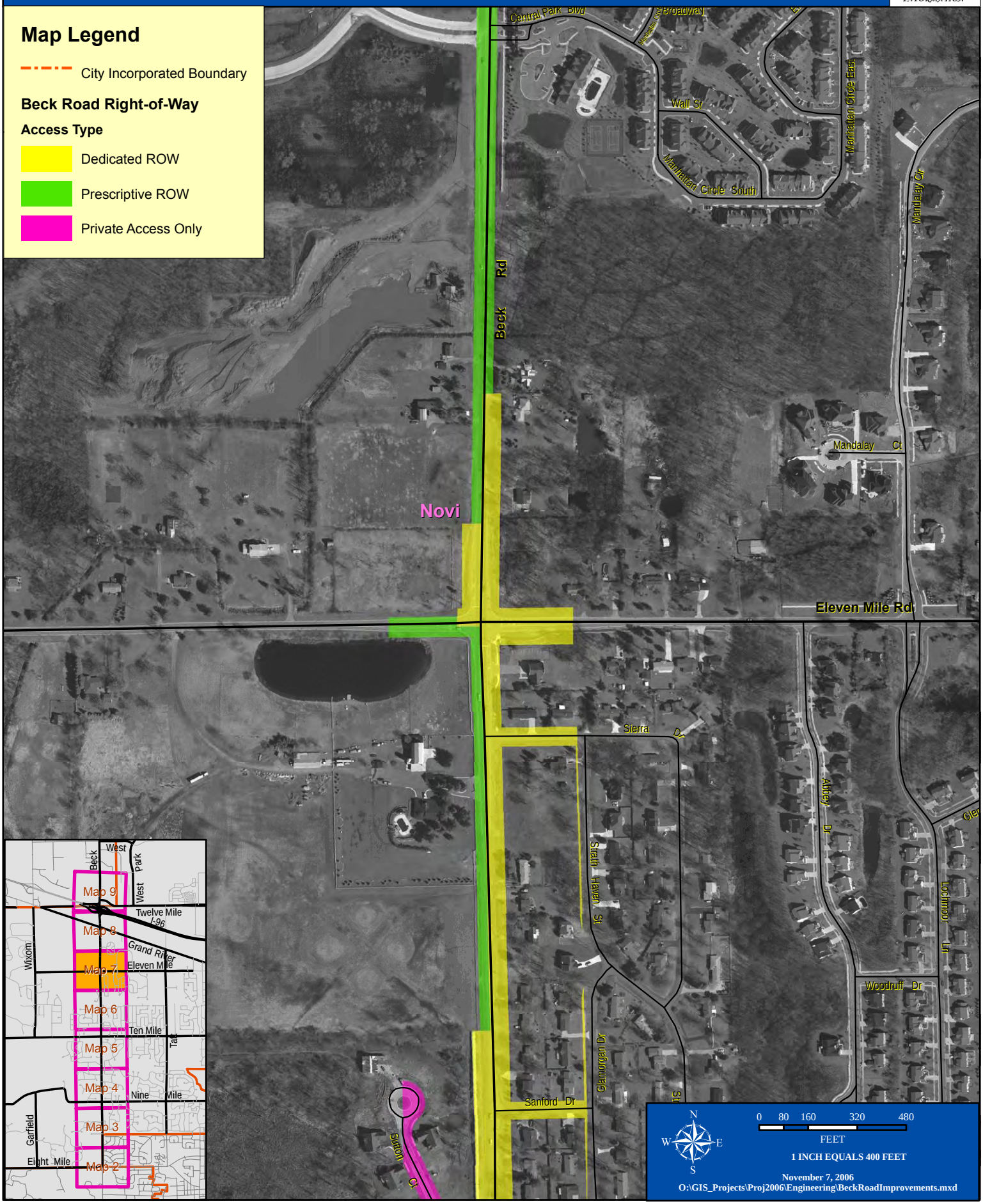
Map Legend

City Incorporated Boundary

Beck Road Right-of-Way

Access Type

- Dedicated ROW
- Prescriptive ROW
- Private Access Only



N W E S

0 80 160 320 480

FEET

1 INCH EQUALS 400 FEET

November 7, 2006

O:\GIS_Projects\Proj2006\Engineering\BeckRoadImprovements.mxd

Map # 8
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

City of Novi Engineering Division

CITY OF NOVI GEOGRAPHIC SYSTEM GIS INFORMATION

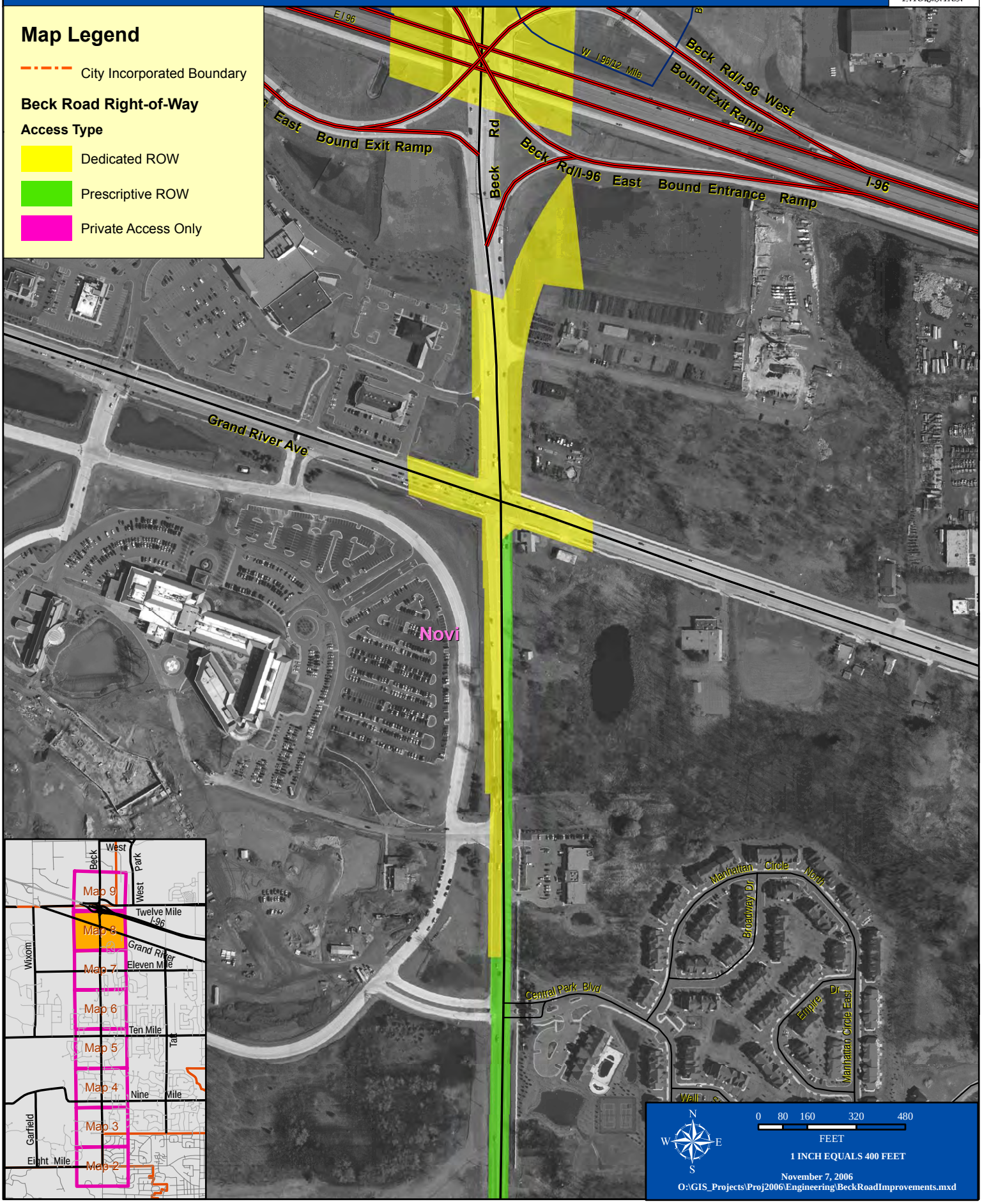
Map Legend

City Incorporated Boundary

Beck Road Right-of-Way

Access Type

- Dedicated ROW
- Prescriptive ROW
- Private Access Only



N W E S

0 80 160 320 480

FEET

1 INCH EQUALS 400 FEET

November 7, 2006

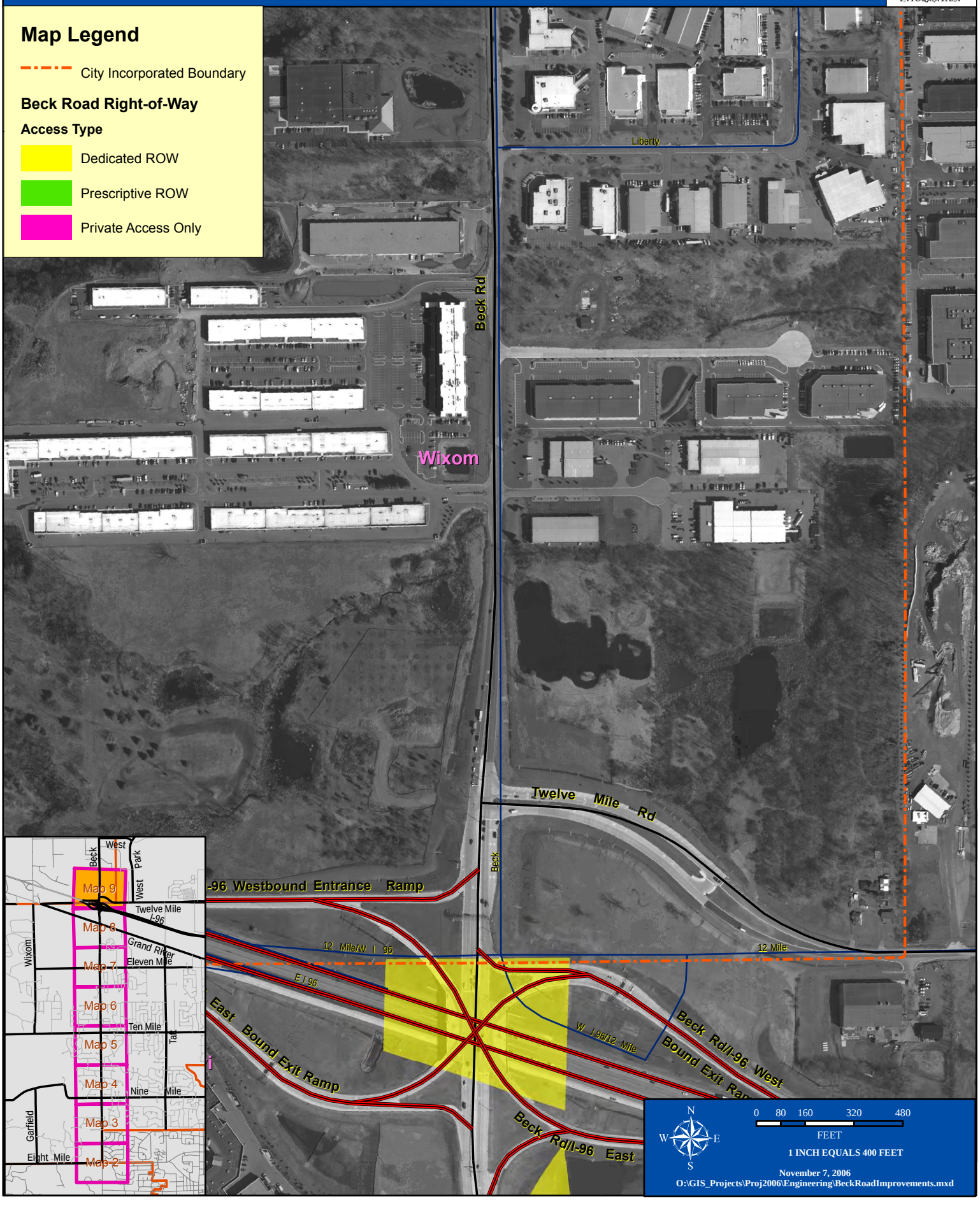
O:\GIS_Projects\Proj2006\Engineering\BeckRoadImprovements.mxd

Map # 9
Linear Reference of
Beck Road Improvements

Beck Road Improvement Project

Beck Road Right-of-Way Analysis (120 Feet Each Way From Centerline)

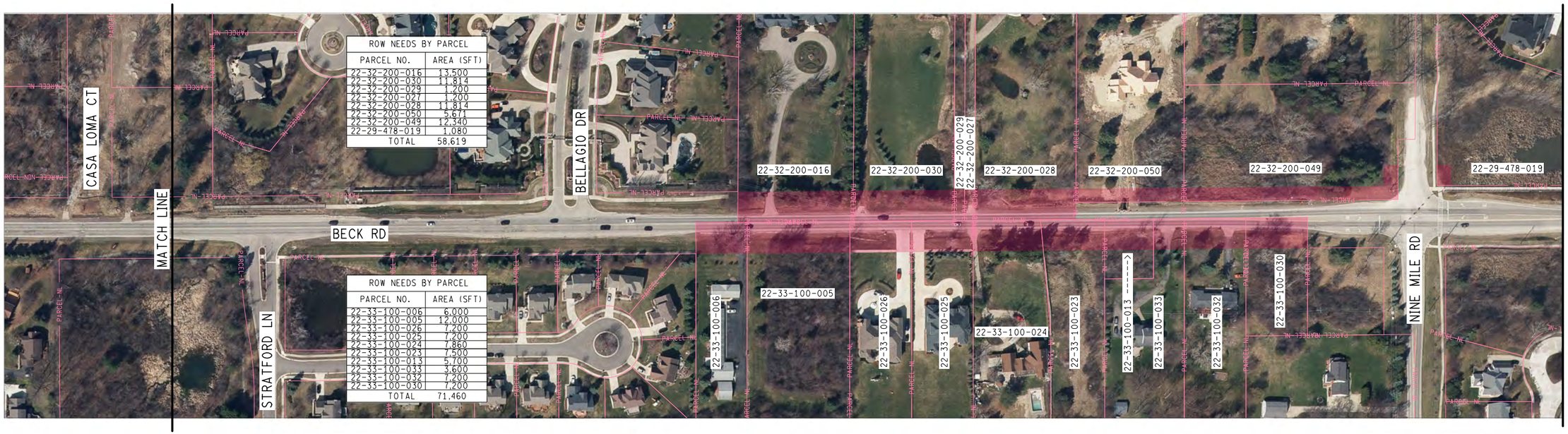
City of Novi Engineering Division





LEGEND

PARCEL BOUNDARY
REQUIRED ROW



N

0 HORZ. (FT) 200

FILE:
AUTH | DATE | REVISION

AECOM

CITY OF NOVI

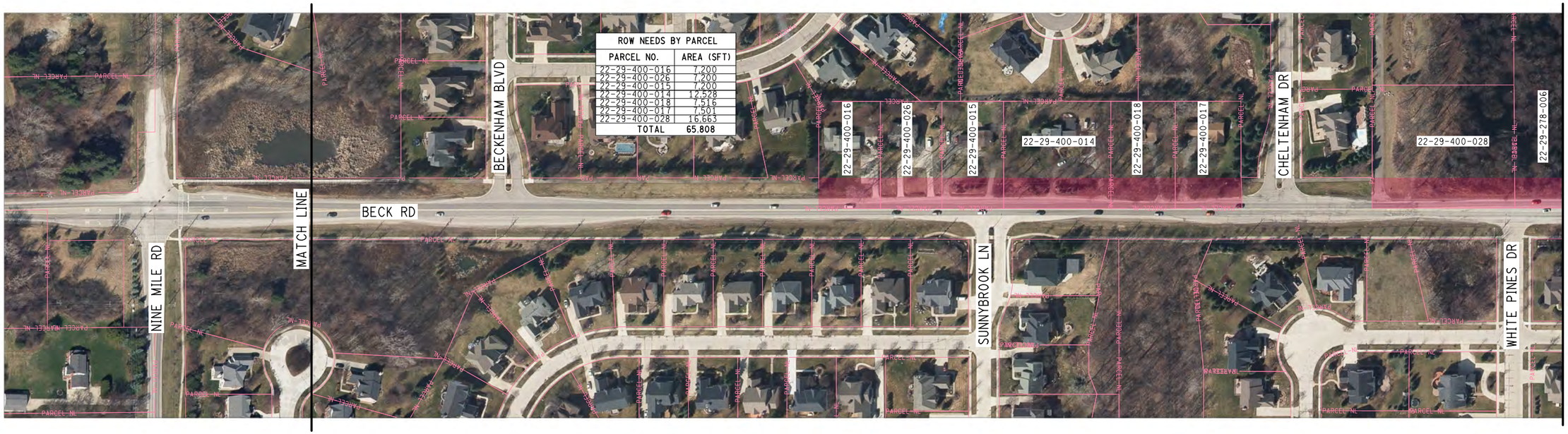
CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE

APPENDIX C: EIGHT MILE RD TO NINE MILE RD

JOB

DATE
12/07/18

SHEET
C-1



LEGEND

PARCEL BOUNDARY

REQUIRED ROW

N



0 HORZ. (FT) 200

FILE:

AUTH	DATE	REVISION

AECOM

CITY OF NOVI

CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE

APPENDIX C: NINE MILE RD TO TEN MILE RD

JOB

DATE 12/07/18

SHEET C-2



LEGEND

PARCEL BOUNDARY

REQUIRED ROW

ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-21-300-025	33,000
22-21-152-016	10,484
22-21-152-015	5,340
TOTAL	48,824

ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-20-200-022	19,368
22-17-400-028	1,500
TOTAL	20,868

N



0 HORZ. (FT) 200

FILE:

AUTH	DATE	REVISION

AECOM

CITY OF NOVI

CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE

APPENDIX C: TEN MILE RD TO ELEVEN MILE RD

JOB

DATE 12/07/18

SHEET C-3



ROW NEEDS BY PARCEL	
PARCEL NO.	AREA (SFT)
22-16-300-006	6,900
22-16-300-054	9,025
22-16-300-055	16,201
22-16-300-054	54,422
22-16-300-053	19,285
22-16-300-001	6,998
22-16-300-012	52,956
TOTAL	165,785

LEGEND

PARCEL BOUNDARY

REQUIRED ROW

ROW NEEDS BY SHEET	
SHEET NO.	AREA (SFT)
C-1	190,950
C-2	139,410
C-3	69,692
C-4	165,785
GRAND TOTAL	565,837

N



0 HORZ. (FT) 200

FILE:

AUTH	DATE	REVISION

AECOM

CITY OF NOVI

CITY OF NOVI - 2018 BECK ROAD SCOPING STUDY UPDATE

APPENDIX C: ELEVEN MILE RD TO GRAND RIVER AVE

JOB

DATE 12/07/18

SHEET C-4

City of Novi
Current PASER Ratings

Pavement Surface Evaluation and Rating System
City of Novi Department of Public Services

Legend

PASER Rating Scale

1 — Poor
2
3
4
5
6
7
8
9
10 — Good

Rating Scale

Road Classification

- Freeway
- Major Streets
- Unpaved or Private Streets

Other Features

- Railroad
- Lakes
- Parkland
- City of Novi
- Novi Township

0 0.225 0.45 0.9
Miles
1 inch = 950 feet

NORTH

MAP INTERPRETATION NOTICE

Map information depicted is not intended to replace or substitute for any official or primary source. This map was intended to meet National Map Accuracy Standards and use the most recent, accurate sources available to the people of the City of Novi. Boundary measurements and area calculations are approximate and should not be construed as survey measurements performed by a licensed Michigan Surveyor as defined in Michigan Public Act 132 of 1970 as amended. Please contact the City GIS Manager to confirm source and accuracy information related to this map.

Map Author: Keri Blough | Print Date: June 7, 2017

Walled Lake Western High School
Walled Lake Geisler Middle School
Walled Lake
Hickory Woods Elementary
Fire Station #2
Franklin Road Christian
Meadowbrook Elementary
MSU Tollgate Farm
Lakeshore Park
Pavilion Shore Park
Shawood Lake
Wastewater Treatment Plant
Fourteen Mile Rd
Thirteen Mile Rd
Twelve Mile Rd
Eleven Mile Rd
Ten Mile Rd
Nine Mile Rd
Eight Mile Rd
W Pontiac Trl
West Rd
Beck Rd
West Park Dr
East Lake Dr
South Lake Dr
Novi Rd
Old Novi Rd
Taft Rd
Wixom Rd
Grand River Ave
Haggerty Rd
Meadowbrook Rd
Napier Rd
Garfield Rd
Lewis Dr
Cabot Dr
MacKenzie Dr
Energy Way
Summit Dr
Lenox Park Dr
Viewcrest Dr
Fox Run Rd
Lanford Dr
Blenheim Dr
Bridge St
Gardenbrook Rd
Lee BeGole Dr
Crescent Blvd
Expo Center Dr
Town Center Dr
Ingerson Dr
Haven Mile Rd
Crossroads Dr
Pondview Dr
Solomon Blvd
Peach Tree Edge
Sandpoint Lake
High Pointe Blvd
Sandpointe Way
Sunflower Rd
Sunrise Blvd
Seeley Rd
Regency Dr
Brookfarm Park
Village Oaks Elementary
Village Wood Lake Park
Village Wood Lake
Village Oaks Lake
Meadowbrook Lake
Novi Dog Park
Novi Ice Arena
Orchard Hills Elementary
Sundai Academy
Flextech High School
Meadowbrook Activities Center
Rotary Park
Post Office
Fuerst Park
Ella Mae Power Park
Novi Public Library
Civic Center
Novi Way
Police Station
Novi High School
Cooke School
Hillside Middle School
Amerman Elementary
Moraine Elementary
St Pauls School
Maybury State Park
ITC Community Sports Park
West Novi Lake
Island Lake
Garfield Lake
Twelve Oaks Lake
Deerfield Elementary
Wildlife Woods Park
Novi Middle School
Catholic Central High School
Northwest Neighborhood Park
Providence Park Hospital
Suburban Collection Showplace
52-1 District Court
MDOT Rideshare Parking
Parkview Elementary
Early Childhood Education Center
Novi Meadows Elementary
Japanese School of Detroit
Novi Woods Elementary
Thornton Creek Elementary
CEMS Satellite Facility
Fire Station #1
Fire Station #3
Fire Station #4
City Recycling Center
Firearms Training Center
Walsh College
City of Novi Field Services Complex
South University
The Art Institute of Michigan
Villa Barr Art Park
Twelve Oaks Ring Rd
Access Rd
Bridge St
Neston St
Harrison
Jefferson
Lincoln
Jackson
Monroe
Washington
Adams
Woodruff
Wallen Ct
Wales Ct
Wallace Ct
Walnut Ln
Warfield Dr
Warrington Ct
Warrington Dr
Warwick Ct
Washington
Waterbury Blvd
Waterland Dr
Waterstone Dr
Watkins Ct
Watson Ct
Waverly Dr
Waycroft Dr
Weatherstone Ct
Webster Ct
Wedgewood Dr
Weiland Dr
Wellington Dr
Wendingo Ct
West Lake Dr
West Oaks Access Dr
West Oaks Dr
Westchester Ct
Westcreek Dr
Westminster Ct
Weston Dr
Westridge Ln
Wexford Blvd
Wheaton Ln
Whipple
Whispering Ln
Whistler Dr
Whitcomb Rd
White Pines Dr
White Plains Dr
Whitehall Dr
Whitman Way
Whittier Tri
Wilder Ct
Williams Dr
Willingham Dr
Willow Ln
Willowbrook Dr
Willowbrook Rd
Wilshire Ct
Wimbleton Way
Windermere Ct
Winding Trl
Windmill Ct
Windridge Ln
Windsor Ct
Winfield Rd
Winnsborough Dr
Wintergreen Ct
Winthrop Ct
Winthrop Dr
Witherspoon Dr
Wixom Rd
Wolcott Dr
Wolfe Pass
Woodglen Dr
Woodham Rd
Woodland Creek Dr
Woodland Glen Dr
Woodmont Dr
Woodshire Ct
Woodside Ct
Woodstone Ln
Woodview Dr
Woodward Dr
Woolsey Dr
Worcester Dr
Worthington Ct
Wyandotte Dr
Wyngate Ct
Wynterberry Ct
Yale Dr
Yorkshire Dr
Yosemite Dr
Yukon Dr
Zinser Dr

Abbey Dr	21	Beacon Rd	36	Byrne Ct	34	Club Ln	36	Duchess Ct	27	Forest Park Dr	29	Harvest Ct	27	Jonathan Dr	27	Linhart St	11	Mission Ln	35	Overlook Trl	20	Red Pine Ct	20	Settlers Creek Ct	22	Tennyson Ct	20	Walden Ct	4	Woodruff	21
Aberdeen Dr	29	Beck Rd	4, 32	Byrne Dr	34	Clymer Dr	10	Dukesbury Ct	35	Foster Dr	23	Harvest Dr	27	Joseph Dr	24	Little Falls Blvd	26	Mitchell Rd	11	Owenton St	3	Redwing Dr	21	Sevilla Cir	18	Tera Ln	23	Wales Ct	32	Woodshire Ct	25
Ackert Ct	24	Beckenham Blvd	29	**C**		Cobblestone Dr	3	Dunbarton Ct	27	Fountain Park Dr E	23	Hathaway Ln	11	Joyce Ln	11	Little Rapids Ct	26	Mocking Bird Ct	20	Oxford Ct	35	Reeds Pointe Dr	19	Shadybrook Dr	36	Terra Del Mar Dr	19	Wall St	16	Woodside Ct	34
Acorn Trl	20	Beckenham Ct	25	Cabaret Dr	15	Cody Ln	21	Dunbarton Dr	27, 28	Fountain Park Dr N	23	Hawbridge Ln	26	Junction	22	Little Stones Ct	26	Mondavi Dr	30	**P**		Regency Dr	24	Shadybrook Dr	36	Terrace Ct	25	Walnut Ln	32	Woodside Dr	3
Adams	24	Bedford Dr	34	Cabot Dr	1, 12	Collingdale Dr	1	Dundee Dr	35	Fountain Park Dr S	23	Hawthorne Ln	26	Juniper Cir	2	Livingston Dr	2	Monroe	24	Paddington Ct	33	Reindeer Dr	35	Shamrock Hl	10	Thatcher Ct	22	Warley Ct	2	Woodworth Dr	20
Addington Ln	28	Belden Ct	1	Calvert Isle Dr	19	Colony Ct	28	Dunhill Ct	32	Fountain Park Dr W	23	Hazelton Ct	33	**K**		Llewelyn Ct	36	Montana Ave	18	Paine Dr	10	Remington Ln	28	Shawood Dr	10	The Crossing	11	Warrington Ct	20	Woolsey Dr	20
Adorne Dr	2	Belgrave Pl	18	Cambourne Ln	24	Columbia Dr	1	Dunhill Dr	32	Fountain Walk Dr	15	Hearthstone Dr	11	Kali Ct	22	Llewlyn Rd	36	Monterey Dr	2	Painted Lake Trl	1	Renford Dr	25	Sheffield Dr	33	Thirteen Mile Rd	12	Warrington Dr	20	Worcester Dr	33
Aichebaun	18	Bellagio Ct	32	Cambridge Dr	36	Concord Dr	22	Dunnabeck Ct	33	Fourteen Mile Rd	1	Heatherbrae Way	36	Karim Blvd	24	Llorrac Ln	36	Monticello St	2	Painter Ln	1	Revere Dr	10	Sheridan Dr	25	Thomas Rd	11	Warwick Ct	2	Worthington Ct	2
Albatross Dr	20	Bellagio Dr	32	Canal Cir	11	Congress	23	Dunston Rd	26	Fox Run Rd	16	Heatherbrae Way S	36	Kartar Ln	25	Lochmoor Ln	21	Montmorency Dr	2	Palace Ct	25	Rexton St	3	Sheridan Dr	25	Thomton Ln	15	Waterbury Blvd	2	Worthington Ct	2
Albert St	18	Bellingham Dr	19	Canal Ct	11	Connecticut Ave	18	Durson St	22	Foxmoor Dr	28	Heatherbrook Ln	25	Katar Dr	36	Lochrisen Way	26	Moorgate St	28	Palmer Dr	2	Richmond Dr	32	Shilo Ct	29	Thorburn Ct	4	Waterford Dr	31	Wright Way	24
Alcott Cir	11	Belmont Dr	1	Canal St	11	Connemara Dr	34	Dylan Dr	9	Foxton Dr	27	Heatherbrook Pl	25	Keenan Ct	22	Lodge Ct	25	Mooringside Dr	25	Pamplona Ln	18	Ridge Rd E	23	Shilo Dr	29	Thoreau Rd	11	Waterland Dr	31	Wyoming Ave	18
Algonquin Dr	27	Benjamins Way	18	Canterbury Dr	2	Constitution Dr	23			Franklin Mill Rd	25	Heatherbrooke Ct	25	Kelsey Bay Dr	19	Logan Ct	19	Moreau Ct	2	Paramount St	2, 11	Ridge Rd W	23	Shore Line Dr	19	Timberlane Ct	4	Waverly Dr	2		
Almafi Ct	30	Bennington Dr	27	Capitol	23	Copland Ln	22	**E**		Freemont Dr	21	Heatherwoode Dr	28	Kenilworth Ln	2	Loganberry Rdg N	23	Morgan Creek Ct	2	Park Forest Ct	25	Ridgeview Blvd	26	Shorecrest Dr	4	Tiverton Dr	3	Waycroft Dr	27		
Alpine Dr	29	Berkshire Blvd	2	Capri Ct	32	Copper Ln	2	E Bourne Ter	18	Fuller Dr	28	Hemingway Dr	31	Kennebec Dr	19	Loganberry Rdg S	23	Muir Ln	11	Park Place Ct	31	Ripple Creek Rd	25	Siegal Ct	36	Todd Ln	36	Weathervane Ct	21		
Alton Ct	27	Bernstadt St	3	Cardinal Way	26	Coral Ln	24	E Ellison Ln	11	Fulton Dr	11	Hempshire St	35	Kensington	29	Londonderry Dr	25	Mulberry Ln	21	Park Place Dr	31	Riverbridge Ct	35	Siegal Dr	36	Torino Dr	30	Webster Ct	2		
Amadora Cir	18	Bertram Dr	28	Carlisle Ct	33	Cordoba Dr	21	E Le Best Dr	25			Henning Dr	3	Long Point Way	26	Murcia Rd	18	Park Ridge Ct	23	Riverview Ln	21	Sierra Dr	21	Tottenham Ct	28	Wedgewood Dr	4				
Amanda Ln	24	Berwick Ct	31	Carlton Way Dr	10	Cornell Dr	1	Eagle Dr	1	**G**		Heritage Dr	17	Louisiana Ave	18	Myrtle Ct	23	Park Ridge Rd	23	Roberts Rd	31	Silverdale Dr	2	Tower Ct	25	Welch Rd	34				
Amberlund Ct	28	Bethany Way	24	Carmela Ct	35	Cortes St	25	East Lake Dr	2	Galway Dr	33, 34	Herman St	2	Louvert Ct	22	Mystic Blvd	27	Parkview St	2	Robertson Brothers Dr	1	Silvery Ln	26	Town Center Dr	14	Wellesley Ct	20				
Amesbury Dr	19	Billenca Dr	19	Carolina Ave	18	Cortland Blvd	27	Eastman Trl	11	Gardenbrook Rd	14	Heslip Dr	16	Lowery St	13	Mystic Forest Dr	27	Pavilion Dr	25	Rock Hill Ln	25	Simmons Dr	21	Traci Trl	10	Wellington Dr	4				
Amherst Dr	21	Birchwoods Ct	20	Carousel Dr	2	Cottage Ct	25	Eaton Ct	27	Garfield Rd	31	Hewes Ln	10	Ludlow Dr	3	**N**		Peachtree	36	Roethel Dr	35	Singh Blvd	36	Trafalgar Ct	28	Wendingo Ct	27				
Amis Ave	3	Birchwoods Dr	20	Carriage Hill Dr	36	Cottisford Rd	27	Eckschtay	18	Garrison Ct	2	Heyn Dr	16	Luke Ln	18	N Ellison Ln	11	Peary Ct	4	Rolling Grove Dr	2	Sister Xavier Way	17	Trailside Ct	25	West Lake Dr	3				
Amy Dr	36	Blackberry Trl	18	Cartier Dr	4	Cottonwood Ln	26	Eden Dr	35	Gas Dr	22	Hickory Grove Ct	27	Lydgate Ct	27	N Karevich Dr	15	Pebble Ln	20	Roma Ridge Dr	21	Sixth Gate	23	Trails X Rd	21	West Oaks Access Dr	15				
Anchorage Ct	18	Blair Dr	2	Casa Loma Ct	32	Country Ln	25	Edgewater	36	Georgetown	23	Hickory Grove Ln	27	Lynwood Dr	20, 29	N Le Best Dr	25	Pelton Rd	35	Ronayton St	13	Sleepy Hollow Dr	2	Treatment Plant Access Rd	9	West Oaks Dr	15				
Andes Hills Ct	16	Blakeston St	13	Cascade Dr	36	Courtview Trl	27	Edgewood Ct N	21	Georgia Ave	18	Hidden Cove Ct	26			N McMahon Cir	25	Pembine St	3	Rorie St	13	Sloan St	18	Trent Ct	35	West Park Dr	9				
Andover Ct	29	Bloomfield Ct	24	Castellwood Dr	27	Coventry Rd	18	Edgewood Dr	21	Gilbar Dr	26	High Pointe Blvd	36	**M**		Neston St	13	Penhill St	3	Rosaron St	13	Solomon Blvd	36	Trestle	22	West Rd	4				
Andre Ct	2	Blueridge Dr	2	Catherine Industrial Rd	23	Coveside Cir	26	Edinborough Ln	29	Gilbert Ct E	30	Highlands Dr	23	MacKenzie Dr	1	Nestlewood Dr	2	Penniman Ave	18	Rosedale Ct	34	Somerset Ct	28	Trillium Dr	25	Westchester Ct	35				
Anna Maria Ct	33	Boardwalk Ave	31	Catholic Central School Dr	18	Cranbrooke Dr	25	Eight Mile Rd	32, 36	Gilbert Ct W	30	High-Meadow Dr	27	Mackinac Blvd	14	Nestlewood Dr	2	Pennington Ct	4	Rosedale Ct	34	South Lake Ct	3, 4	Trillium Loop	25	Westgate Blvd	4				
Anthony Dr	22	Boileau Dr	8	Cavendish Ave E	22	Cranbrooke Ln	25	Eleven Mile Rd	14, 23	Gilbert Ct E	30	Hilldrige Dr	34	Madison	24	Nestlewood Dr	2	Pennington Ln	4	Rosedale Ct	34	South Lake Dr	3, 4	Turnberry Blvd	36	Westminster Ct	25				
Antler Dr	35	Bonnie Brook Dr	21	Cavendish Ave W	22	Crane Way	11	Elizabeth Ln	28	Gilbert Ct W	30	Hillsdale Dr	19	Magellan Dr	9	Nestlewood Dr	2	Pennsylvania Ave	23	Rosedale Ct	34	Southwyck Ct	28	Tuscany Ct	25	Westmont Ct	28				
Apple Crest Dr	23	Borchart Dr	26	Cavendish Ct	22	Creek Crossing	22	Ellery Ln	10	Glen Haven Cir E	35	Hillside Ct	31	Magnolia Ct	2	Newberry Dr	19	Penton Rise Ct	26	Rosedale Ct	34	Sports Park Dr	31	Twain Pl	11	Westmont Dr	28				
Applebrooke Dr	31	Border Hill Rd	24	Cedarwood Dr	29	Crescent Blvd	14, 15	Elliot Ln	11	Glen Haven Cir W	35	Hillside Dr	31	Main St	23	Nicholas Dr	2	Peppermill Ct	25	Rosedale Ct	34	Springlake Blvd	4	Twelve 1/2 Mile Rd	10	Weston Dr	11				
Arbor Ln	36	Boulder Ct	26	Celeste Ct	2	Crestview Dr	21	Elm Ct	3	Glen Ridge Ct	25	Hollydale	25	Mallard Trl	20	Nicholas Rd	2	Percival Ln	22	Rosedale Ct	34	Springlake Blvd	4	Twelve Mile Rd	10, 18	Westridge Ln	34				
Arcadia Dr	21	Braebum Ln	20	Centennial Dr	2	Crestwood Dr	18	Emerald Forest Dr	21	Glenda Ave	22	Holmes Rd	11	Malot Dr	25, 26	Nicholson Dr	2	Perch Ct	33	Rosedale Ct	34	Springlake Blvd	4	Twelve Oaks Crescent Dr	14	Wexford Blvd	2				
Ardell Blvd	13	Brambleswood Ct	21	Center Ct	34	Cromwell Rd	18	Emerson Way	11	Glenhurst	21	Holyoke Ct	20	Manchester Rd	11	Nielsen Ct	13	Petros Blvd	22	Rosedale Ct	34	Springlake Blvd	4	Twelve Oaks Ring Rd	14	Wharton Ct	2				
Arden Glen Ct	28	Brambleswood Dr	21	Central Park Blvd	16	Crosswinds Dr	36	Emery Dr	34	Glenmoor	21	Holyoke Ln	20	Mandalay Ct	16	Nielsen Ct	13	Petrovich Dr	35	Rosedale Ct	34	Springlake Blvd	4	Twelve Oaks S	14	Wheaton Ln	35				
Ardmore Ct	4	Branton St	13	Central Park Blvd	16	Crowe Dr	14	Emily Ct	35	Glenwood Dr	18	Homestead Ct	21	Manchester Ct	16	Nine Mile Rd	2	Phillip Dr	36	Rosedale Ct	34	Springlake Blvd	4	Twelve Oaks Trl	14	Whipple	15				
Argyle St	28	Braydon Ct	28	Chamberlin Ct	31	Crown Dr	10	Empire Dr	16	Glyme Dr	26	Hooper Cir	10	Manhattan Ct	16	Nineteen Mile Rd	1	Pickard Ct	35	Rosedale Ct	34	Springlake Blvd	4	Twin Cummings Ln	11	Whispering Ln	36				
Arizona Ave	18	Brenda Ln	24	Chamberlin Dr	29	Cumberland Dr	34	Enchanted Dr	21	Golden Rdg	2	Hooper Ln	10	Manor Park Dr	23	Nob Hill Ct	33	Pickadilly Cir	35	Rosedale Ct	34	Springlake Blvd	4	Twin Lakes Blvd	26	Whistler Dr	11				
Arlington Cir	2	Brentwood Ct	28	Chapman Dr	2	Cummings Ln	11	Endwell St	2	Gomada St	13	Hopkins Dr	10	Mansfield Dr	22	Nob Hill Rd	33	Picara Dr	21	Rosedale Ct	34	Springlake Blvd	4	Twin Oaks Ct	26	Whitcomb Rd	36				
Arro St	13	Briar Rdg	21	Charlemorton Dr	2	Cypress Way	1	Energy Way	13	Graham Ln	20	Hudson Dr	4	Mansion Ct	25	Nolan Dr	36	Pickford St	3	Rosedale Ct	34	Springlake Blvd	4	Twin Rivers Dr	1	White Pines Dr	27, 28				
Arrowhead Dr	2	Brickscape Dr	35	Charlotte St	3	**D**		English Way	2	Grand River Ave	23	Humboldt Dr	9	Lamier Dr	2	Norcross Ct	25	Picnic Ct	25	**S**		Rosedale Ct	34	Stonehenge Blvd	25	White Plains Dr	21				
Ashbury Dr	35	Bridge St	13	Chase Dr	35	Daleview Dr	33	Ennishore Dr	26	Grandview Ln	23	Huntingcross Dr	27	Lancaster Ct	33	Normandy Ct	35	Pierre Dr	2	S Karevich Dr	15	Rosedale Ct	34	Stonewall Ct	11	Whitehall Dr	28				
Ashford Cir	28	Bridle Run	32	Chatsford St	1	Danberry Ln	25	Equestrian Trl	32	Greening Ct	27	Huntington Rd	22	Lancelot Ct	2	North Haven Dr	3	Pine Crest Dr	23	S McMahon Cir	25	Rosedale Ct	34	Stratford Ln	33	Whitman Way	11				
Ashley Blvd	21	Brighwood Dr	1	Chattman Dr	26	Danyas Way	22	Erin Cir	33	Greening Dr	27	Huron Cir	14	Lanford Dr	1	North Hills Dr	34	Plaisance Blvd	27	Sagebrush	26	Rosedale Ct	34	Strath Haven Dr	21	Whittier Tri	11				
Aspen Dr	26	Bristol Cir	4	Chelsea Ln	34	Darcey Ct	28	Estrada Ln	18	Greenbrier Rd	36	**I**		Langley Dr	19	North Hills Dr	34	Plateau Dr	2	Salem Ct	20	Rosedale Ct	34	Streamwood Dr	18	Veneto Dr	32	Williams Dr	22				
Augusta Cir	1	Bristol Circle Ct	4	Cheltenham Dr	29	Daroca Ct	18	Eubank St	3	Greenview Dr	21	Idaho Ave	18	Lannys Rd	15	Northumberland St	28	Pleasant Cove Dr	10	Samoset Ct	20	Rosedale Ct	34	Streamwood Dr	18	Venice Dr	21	Willingham Dr	28			
Austin Dr	10	Bristol Ln	4	Cherry Hill Rd	23	Dartmoor Dr	33	Everbrook Ln	17	Greenwich Dr	20	Independence Dr	2	Laramie Dr	21	Norwich Dr	4	Pomino Dr	32	Samuel Linden Ct	9	Sudbury Ct	35	Venice Dr	21	Willow Ln	24				
Autumn Park Blvd	28	Brittany Ct	29	Chesapeake Dr	19	Davenport Ave	21	Evergreen Ct	30	Griswold St	35	Indiana Ave	18	Larkspur Ln	3	Nottingham Dr	20	Pondview Dr	36	Sandalwood Cir	2	Sullivan Ln	22	Venture Dr	26	Willowbrook Dr	25				
Autumn Park Ct	28	Broadmoor Park Blvd	28	Cheshire Ct	28	Declaration Dr	10	Exeter Ct	27	Grove Ct	25	Ingersol Dr	14	Lashbrook St	2	Novi Meadows Blvd	18	Portage Way	26	Sandpiper Ct	20	Summer House Ct	25	Veranda Dr	35	Willowbrook Rd	24				
Avon Ct	21	Broadmoor Park Ln	28	Chesterfield Ct	35	Deer Run	31	Expo Center Dr	15	Groveland	21	Ingram Rd	36	Lathum Dr	28	Novi Rd	2, 34	Porter St	2	Sandpointe Dr	36	Summer Ln	28	Vermont Ave	18	Wilshire Ct	3				
B		Broadway	16	Chestnut Tree Way	25	Deerfield Rd	25	**F**		Gwinnett Loop	10	Inverness Ct	29	Laurel Dr	30	Novi Way	27	Portico Ln	23	Sandstone Dr	11	Summerlin Blvd	3	Vero Ct	34	Wimbleton Way	12				
Baker St	28	Brockshire St	35	Cheyenne Dr	21	Delaware Ave	18	Fairway Hills Dr	21	**H**		Ironside Ct	34	Lawrence Dr	11	**O**		Portside Dr	4	Sanford Dr	21	Summit Ct	12	Victoria Rd	18	Windermere Ct	33				
Balcombe Dr	26	Broken Stone Ct	26	Chianti Dr	32	Delmont Dr	20	Falmouth Ave	21	Hadlock Dr	19	Iroquois Ct	29	Le Best Dr	24	Oak Tree Rd	25	Portsmouth Ave	21	Sarnia Dr	29	Summit Dr	1	Viewcrest Dr	1	Winding Trl	3				
Baldwin Ct	29	Brompton	18	Chipmunk Trl	26	Denali Ct	19	Faulkner Dr	11	Haggerty Rd	12	Irvine Dr	28	Le Best Dr	25	Oakland Dr	25	Potomac	23	Savannah Ct	1	Sunbury Ct	16	Viewcrest Dr	1	Windmill Ct	35				
Balfour Ct	4	Brookstone Dr	11	Christina Ln	22	Denby Ct	28	Fawn Trl	35	Halifax Ln	29	Isabella Way	20	Le Grand Blvd	27	Oakwood Dr	25	Prestwick Ct	36	Savoie Rd	36	Sunday Dr	31	Village Lake Rd	25	Windridge Ln	28				
Balfour Dr	4	Brookstown Blvd	23	Churchill Blvd	22	DeSoto Ct	4	Faywood St	3	Hallfield St	18	Island Lake Dr	18	Lebenta St	3	Oakwood Ln	27	Princeton Blvd	33	Saybrook Ct	19	Sunflower Rd	36	Village Oaks Rd	25	Windsor Ct	2				
Bancroft Dr	3	Broquet Dr	35	Cider Mill Blvd	20	Devonshire Dr	28	Fenmore Way	25	Halston Ct	28	**J**		Ledgeview Dr	11	Oakwood Rd	14, 36	Providence Pkwy	17	Scarborough Ln	24	Sunningbrook Ln	28	Village Wood Ln	25	Winfield Rd	25				
Barcellos Ln	18	Browinstone Dr	11	Cider Mill Dr	21	Devron Ct	28	Fenway Dr	34	Hamlet Ln	23	J R Blvd	13	Lee BeGole Dr	14	Oberlin Ct	20	Purlingbrook Rd	36	Scarlet Ct	21	Sunrise Blvd	36	Village Wood Rd	25	Winnsborough Dr	27				
Barclay Ct	33	Brush Park Ct	4	Citation	26	Dinser Dr	20	Ferhoodle	18	Hampton Ct	23	Jacob Dr	22	Leeds St	27	Oberlin Dr	20			Scarlet Dr N	21	Surfside Rd	21	Village Wood Ln	25	Wintergreen Ct	28				
Barclay Dr	33	Buckingham Ct	25	Citygate Dr	16	Dixon Rd	10	Fieldstone Dr	18	Hampton Hill Rd	23	Jamestowne Rd	22	Lemay St	3	Oberlin Ct	20	**Q**		Scarlet Dr S	21	Surfside Rd	21	Vincenti Ct	24	Winthrop Ct	27				
Barola Ct	32	Buckminster Dr	22	Clarinette Ct	2	Dogwood Ln	19	Fireside Ct	25	Hampton Ln	23	Jaslyn Ln	28	Lenox Park Dr	1	Oberlin Dr	20	Quarry Ct	11	Scenic Ln	34	Sussex Dr	3	Vine Ct	2	Winthrop Dr	27				
Barola Dr	32	Buffington Dr	3	Clark St	22	Donelson Dr	15	Fitzgerald Blvd	11	Hannah Ct	35	Jasper Rdg	2	Leonard Ct	18	Oberlin Rd	20	Queens Pointe Dr	23	Scenic Rd	22	Sutherland Dr	21	Virginia Ave	18	Witherspoon Dr	10				
Barra St	13	Burlington Ct	28	Clay Ct	11	Donnington Ct	29	Fleddermouse	18	Harbor Cv	3	Jasper Ln	25	Leyland Cir	18	Old Novi Rd	11, 35	Quince Dr	26	Seaglen Dr	19	Sutton Ct	20	Vista Ln	34	Wixom Rd	18				
Barrington Dr	2	Burntwood Ct	29	Clearwater Ct	25	Douglas Dr	11	Flint St	22	Harrier Pl	18	Jefferson	24	Liberte Dr	2	Old Orchard St	24			Sedra Ct	22	Sycamore Dr	26			Wolcott Dr	10				
Bartlett Dr	10	Burroughs Ave	11	Clemens Cir	11	Dover Blvd	21	Florence Dr	32	Harrington Way	18	Jo Dr	24	Lightfoot Ln	10	Onaway Ct	35	**R**		Seeley Rd	24	**T**		**W**		Wolfe Pass	11				
Bashian Dr	24	Burton Ct	25	Clermont Ave	24	Drakes Bay Dr	19	Floyd Ln	10	Harrison	3	Joindre Dr	2	Lightway Dr	27	Onaway Dr	35	Raftingway Ct	26	Seminole Ct	26	Taft Rd	16, 33			Woodglen Dr	26				
Bassett Ln	4	Burton Dr	25	Cliffside Ct	26	Driftwood Dr	20	Foothills Ct	34	Hartwick Cir	18	Joliet Ct	2	Lilley Trl	3	Orchard Hill Pl	36	Randall Ct	28	Seminole Trl	26	Talford St	25	W Le Best Dr	25	Woodham Rd	20, 29				
Bayview Dr	3	Butler Ln	21	Clinton Dr	1	Drocton Ct	27	Ford Way Dr	27	Hartwick Dr	18	Jonathan Dr	27	Lincoln	2	Oregon Ave	18	Rathlone Dr	34	Senate Pl	23	Tamara Dr	26	W Pontiac Trl	4	Woodland Creek Dr	26				
Beachwalk Dr	2	Butternut Ln	26	Clover Ln	36	Duana Ave	3							Lindbergh Ln	3	Orianna Ln	23	Ravello Ct	32	Senseca Ln	2	Tanglewood Dr	2	Wainwright St	11	Woodland Glen Dr	35				
																		Ravine Dr	19	Serenity Dr	34	Ten Mile Rd	19, 24	Wakefield Dr	2						

PAVEMENT EVALUATION REPORT

BECK ROAD REHABILITATION - FROM 9 MILE ROAD TO WHITE PINES Drive
AND 10 MILE ROAD TO APPROX. 2,900 FEET NORTH OF 11 MILE ROAD
NOVI, MICHIGAN

SME Project Number: 079555.00
November 26, 2018

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November 26, 2018

Mr. Joseph Akers
City of Novi
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26300 Lee BeGole Drive
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Via e-mail: *jakers@cityofnovi.org*

RE: Pavement Evaluation Report
Beck Road Rehabilitation – From 9 Mile Road to White Pines Drive and 10 Mile Road to approx. 2,900 Feet North of 11 Mile Road
Novi, Michigan
SME Project No. 079555.00

Dear Mr. Akers:

We have completed our pavement evaluation for Beck Road from 9 Mile Road to White Pines Drive and from 10 Mile Road to approximately 2,900 Feet North of 11 Mile Road. This report presents the results of our field sampling and testing, analyses, and recommendations for pavement rehabilitation.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact us.

Sincerely,

SME

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Vice President

Report Written by:
Max Reed
Staff Engineer

Report Reviewed by:
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Mr. Aaron Staup, City of Novi

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APPENDIX A
TEST HOLE LOCATION DIAGRAM
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APPENDIX B
IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT
GENERAL COMMENTS
LABORATORY TESTING PROCEDURES

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1. INTRODUCTION

This report presents the results of the pavement evaluation for the proposed rehabilitation of Beck Road from 9 Mile Road to White Pines and 10 Mile Road to approximately 2,900 feet north of 11 Mile Road. This evaluation was conducted in general accordance with the scope of services outlined in SME's Proposal No. P01501.18, dated June 21, 2018. Our scope of work included reviewing existing site conditions, obtaining pavement, base and subgrade samples and developing feasible rehabilitation options for the road. We understand roadway and embankment widening are planned for left hand turning lanes at two intersections.

1.1 EXISTING SITE CONDITIONS

Beck Road primarily consists of two-lane (two-way) asphalt pavement, with additional dedicated turning lanes at some intersections. The lane layout is generally similar going north of 9 Mile Road until the intersection of Beck Road and 11 Mile Road where is widens to up to 5 lanes. The majority of the road is crowned and sloped to ditch lines along east and west shoulders of Beck Road. Concrete curb and gutter are present at the approaches of the cross roads.

Based on a review of available USGS information, this section of Beck Road passes over flat to gently sloping ground. Ground surface elevations are shown ranging from about 950 feet in lower areas around the 9 Mile Road and Beck Road intersection to just over 960 feet at the 10 Mile Road and Beck Road intersection. Based on available USDA soil data, the soils along this section of Beck Road consists of sandy loam with some silty clay loam.

Specific grading information and preliminary plans for the project were not provided, however, we anticipate the proposed pavement will be constructed within a few inches of the existing pavement surface elevations due to the grade constraints at the cross roads and approaches.

Based on our field observations of existing construction joints, we divided the road into the following sections:

- 9 Mile Road to Sunnybrook Lane
- Sunnybrook Lane to White Pines Drive
- 10 Mile Road to Ashley Blvd
- Ashley Blvd to 690 feet south of 11 Mile Road
- 690 feet south of 11 Mile Road to 2,900 feet north of 11 Mile Road

1.2 EXISTING TRAFFIC CONDITIONS

Beck Road serves as a main north south arterial road through Novi. The minor cross roads through the evaluated sections are primarily residential with commercial businesses at the main intersections with 9 Mile Road, 10 Mile Road and 11 Mile Road. Based on information provided by Mr. Phillip Vogelsang of AECOM on October 16, 2018, the estimated two-way ADT for Beck Road is shown below.

TABLE 1.2.1: AVERAGE DAILY TRAFFIC (ADT) VALUES

Beck Road – Section	TWO WAY ADT
9 Mile Road to 10 Mile Road	19,400
10 Mile Road to 11 Mile Road	17,500
11 Mile Road to Grand River Ave	20,600

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2 EVALUATION PROCEDURES

2.1 FIELD EXPLORATION

On July 30 through August 3, 2018, SME performed fifty-five test holes (B1 through B55) near the locations shown in the Test Hole Location Diagram in Appendix A. The approximate station and offset of the test holes are shown on the attached Test Hole Logs and the tables in Section 3. We used the centerline of 9 Mile Road as station 0+00. Offsets are listed as right or left of centerline looking up-station. The test hole locations are as follows:

TABLE 2.1.1: TEST HOLE LOCATIONS

Beck Road - Section	Test hole
9 Mile Road to Sunnybrook Lane	B1 through B8
Sunnybrook to White Pines Drive	B9 through B13
10 Mile Road to Ashley Blvd	B14 through B17
Ashley Blvd to 690 feet south of 11 Mile Road	B18 through B34
690 feet south of 11 Mile Road to 2,900 feet north of 11 Mile Road	B35 through B55

The test hole locations were selected based on visual evaluation of the road and in key distress areas, and other considerations such as traffic control, overhead wires and marked utilities. SME did not estimate the existing pavement surface elevations at the test holes.

The existing pavement was cored with a 4-inch-diameter core barrel. Prior to performing soil sampling, the existing base and subgrade soils were evaluated with a Dynamic Cone Penetrometer (DCP) designed by the U.S. Army Corps of Engineers (USACE). The USACE DCP test is used to estimate the California Bearing Ratio (CBR) of the upper subgrade soils. The USACE DCP consists of a 5/8-inch-diameter steel rod with a steel cone attached to one end that is driven into the subgrade by means of a sliding, dual-mass hammer. The rate of cone penetration per blow is measured at selected penetration or hammer drop intervals. CBR is an index commonly used in pavement design that gives an indication of subgrade support characteristics. The USACE has developed relationships to estimate the CBR value from the results of the DCP test. Soil strength with depth profiles were developed for each DCP test location and are included on the Test Hole Logs in Appendix A.

TABLE 2.1.2: AGGREGATE BASE AND SUBGRADE SUPPORT CONDITIONS

SUPPORT CONDITIONS	CBR RANGE FOR AGGREGATE BASE MATERIAL (%)	CBR RANGE FOR SUBGRADE SOILS (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3

After completion of the USACE DCP tests, aggregate base materials (if present) were sampled by hand augering in order to accurately measure the depth of the aggregate base. Soil sampling was then performed using a truck-mounted Geoprobe® rig. The Geoprobe® uses a pneumatic hammer device to obtain continuous liner samples at the test hole locations using acetate-lined piston samplers. Groundwater measurements were attempted immediately after completion of probing operations at each location. Immediately after sampling, the test hole were backfilled with gravel and capped with asphalt

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cold patch. Therefore, long-term groundwater levels are not available from this evaluation. The soil samples were sent to the SME laboratory for further evaluation.

SME also performed muck depth soundings in the ditch/right-of-way areas in the proposed new center turn lane portions of the site at Ashley Blvd and Sanford Dr.

2.2 LABORATORY TESTING

The pavement cores and soil samples were returned to our laboratory for further evaluation by SME. The thickness of the pavement cores was measured to the nearest ¼-inch. The pavement cores were also photographed in our laboratory. The photographs of the cores are included on the attached Test Hole Logs. The laboratory testing program consisted of visual soil classification on recovered samples along with moisture content and hand penetrometer shear tests on portions of cohesive samples obtained. The Laboratory Testing Procedures in Appendix B provide descriptions of the laboratory tests.

Upon completion of the laboratory testing, we prepared test hole logs including materials encountered, estimated CBR values, pertinent field observations made during the drilling operations, and the results of certain laboratory tests. We developed the soil descriptions included on the test hole logs from both visual classification and the results of the laboratory tests.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, we retain soil samples in our laboratory for 60 days unless instructed otherwise.

3 PAVEMENT AND SUBSURFACE CONDITIONS

3.1 9 MILE ROAD TO SUNNYBROOK LANE

The pavement surface through this section is exhibiting low to medium severity longitudinal and transverse cracking. We also observed frequent low to medium severity fatigue cracking in the wheel paths. The fatigue cracking severity increases and the pavement conditions worsen as the roadway approaches Sunnybrook Lane. The cracks have been overband cracksealed. This section of the road primarily consists of two lanes with partial paved and gravel shoulders. There are widenings at the intersection of the cross roads and curb and gutter at the cross road approaches. A low lying swamp area exists along the west side of the road from 9 Mile Road to about 425 feet north of 9 Mile Road and on the east side about 450 to 500 feet north of 9 Mile Road.

The existing pavement section encountered at test holes B1 through B8 ranged from 4.5 to 6 inches of asphalt pavement and 8 to 20.25 inches of crushed limestone aggregate base. Table 3.1.1 lists the approximate asphalt and aggregate base thicknesses at the test hole locations.

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TABLE 3.1.1: PAVEMENT LAYER APPROXIMATE THICKNESS - 9 MILE ROAD TO SUNNYBROOK

TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B1	4.75	20.25	25	2+01	25 Feet Right of Center Line	North Bound
B2	5.25	17.75	23	3+53	9 Feet Left of Center Line	South Bound
B3	6	20	26	5+43	18 Feet Right of Center Line	North Bound
B4	6	10	16	7+32	6 Feet Left of Center Line	South Bound
B5	5.25	18.75	24	9+32	8 Feet Right of Center Line	North Bound
B6	4.75	9.25	14	11+20	8 Feet Left of Center Line	South Bound
B7	5	8	13	13+29	8 Feet Right of Center Line	North Bound
B8	4.5	11.5	16	15+09	6 Feet Left of Center Line	South Bound

The subgrade underlying the base consisted of sand at B1, clayey sand at B2 and clay at B3 through B8. Groundwater was encountered at B1, B6 and B8 at depths of 4 feet, 3.5 feet, and 5 feet below the pavement surface, respectively. Groundwater was not encountered at the remaining test holes. CBR values estimated from the USACE DCP tests indicated the aggregate base support conditions were very poor to poor at B7. Table 3.1.2 indicates the approximate depths below the existing ground surface where very poor to poor subgrade conditions were encountered.

TABLE 3.1.2: SUMMARY OF VERY POOR TO POOR SUBGRADE SUPPORT CONDITIONS

TEST HOLE	DEPTH BELOW PAVEMENT SURFACE OF VERY POOR TO POOR SUPPORT CONDITIONS (INCHES)	
	FROM	TO
B5	31	36
B7	22	26

3.2 SUNNYBROOK LANE TO WHITE PINES DRIVE

The pavement surface in this section is exhibiting low severity cracking along the longitudinal paving joints. Fatigue cracking was observed in the southbound lane in the wheel paths. The fatigue cracking severity was high on the inside wheel path of the southbound lane just north of Sunnybrook Lane and on the outside wheel path just south of White Pine (this area has some surficial asphalt patch material). The cracks have not been sealed. This section of the road primarily consists of three lanes (northbound and southbound mainline with a center turn lane) with partial paved and gravel shoulders. The widening to three lanes was completed in 2015. Prior to 2015 widening, the road was only widened at Sunnybrook Lane, Cheltenham and White Pines Drive. There is curb and gutter at the cross road approaches.

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The existing pavement section encountered at test holes B9 through B13 ranged from 5.75 to 8.75 inches of asphalt pavement and 9.25 to 19 inches of aggregate base. The aggregate base consisted of crushed limestone at B9 through B11 and B13. The aggregate base consisted of crushed concrete at B13. Table 3.2.1 lists the approximate asphalt and aggregate base thickness at the test hole locations.

TABLE 3.2.1: PAVEMENT LAYER APPROXIMATE THICKNESS – SUNNYBROOK LANE TO WHITE PINES DRIVE

TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B9	5.75	9.25	15	17+36	5 Feet Right of Center Line	North Bound
B10	6	10	16	20+11	11 Feet Left of Center Line	South Bound
B11	8.75	12.25	21	21+31	13 Feet Right of Center Line	North Bound
B12	6.5	19	25.5	23+03	25 Feet Left of Center Line	South Bound
B13	5.75	14.25	20	24+41	13 Feet Right of Center Line	North Bound

The subgrade underlying the aggregate base consisted of clay. Clayey sand was encountered under the clay at B11. Groundwater was encountered at B11 at a depth of 4 feet below the pavement surface. Groundwater was not encountered at the remaining test holes. CBR values estimated from the USACE DCP tests indicated the aggregate base exhibited very poor to poor support at B9, B11 and B13. The subgrade exhibited marginal to good support conditions.

3.3 10 MILE ROAD TO ASHLEY BLVD

From about 500 feet south of 10 Mile Road to just south of Ashley Blvd, the pavement surface is in poor condition. The pavement is exhibiting high severity longitudinal and transverse cracking. Fatigue cracking is evident in the wheel paths and extensive surficial patching was been performed. The cracks have not been sealed. This section of the road primarily consists of four lanes (northbound and southbound mainline with a center turn lane and a right turn lane) just north and south of the 10 Mile Road intersection and narrows to two lanes near Ashley Blvd. There is a decel/accel lane on the east edge of the northbound lane for Ashley Blvd. Widening of the road is present at the approaches to Valencia Circle and the Briar Point Plaza parking lot.

The road was resurfaced and widened approximately 400 feet north and south of 10 Mile Road in 2009. The widening at Valencia Circle was constructed between 2012 and 2014 based on aerial imagery. A portion of Beck Road 200 feet south to 300 feet north of Valencia was resurfaced with the widening. The pavement in this widening area is exhibiting similar fatigue cracking as the older portion to the south. Similar to the other sections there is curb and gutter at the cross road approaches and paved/gravel shoulders in between. We understand the intersection at Ashley Blvd is planned to be widened to accommodate a center turn lane.

The existing pavement section encountered at test holes B14 through B16 ranged from 7 to 10 inches of asphalt pavement and 9 to 14 inches of aggregate base. The bottom 2 inches of the core at B16 was deteriorated into gravel. The aggregate base consisted of crushed limestone at B14 and B16 and

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crushed concrete at B15. B14 was located in the right turn lane of the southbound lane at 10 Mile Road, B15 was located in the northbound widening near Briar Point Plaza, and B16 was in the southbound widening at Valencia. Table 3.3.1 lists the approximate asphalt and aggregate base thickness at the test hole locations.

TABLE 3.3.1: PAVEMENT LAYER APPROXIMATE THICKNESS – 10 MILE ROAD TO ASHLEY BLVD

TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B14	10	9	19	54+47	32 Feet Left of Center Line	South Bound
B15	7	14	21	56+95	14 Feet Right of Center Line	North Bound
B16	10	14	24	60+60	23 Feet Left of Center Line	South Bound

The subgrade underlying the base consisted of sand over clay at B14 and clay at B15 and 16. There was clayey sand under the clay at B11. Groundwater was not encountered at the test holes. The aggregate base exhibited very poor to poor support at all three test holes B14, B15 and B16. The subgrade exhibited marginal to good support.

3.4 ASHLEY BLVD TO APPROX. 690 FEET SOUTH OF 11 MILE ROAD

This portion of the road was resurfaced in 2009. From approximately 50 feet south of Ashley Blvd to about 1,000 feet north of Ashley Blvd, the pavement surface is in fair condition with low severity longitudinal and transverse cracking and a small amount of fatigue cracking in the wheel paths. At the widening just north and south of the intersection with Cider Mill Drive, the edge of the pavement along Beck and the widenings are in very poor condition with a substantial amount of cracking. North of Cider Mill Drive, the pavement surface is generally in worse condition than south of Cider Mill Drive. The pavement is exhibiting high severity longitudinal and transverse cracking. Fatigue cracking is present in the wheel paths and extensive surficial patching was been performed. The cracks along the entire portion of the road have not been sealed. This section of the road primarily consists of two lanes. The road is widened at the approaches to the cross roads. Most of the road has a gravel shoulder with curb and gutter at the cross road approaches. We understand the intersection at Sanford is planned to be widened to accommodate traffic during the mainline rehabilitation.

The existing pavement section consisted of asphalt pavement. The thickness of the asphalt at B17 through B25 ranged from 5.25 to 6.5 inches. At B26, the thickness of the asphalt was 8 inches. At B27, the thickness of the asphalt 10 inches. At B28 to B34, thickness of the asphalt the ranged from 5.5 to 8.5 inches. The aggregate base at B17 through B34 ranged from 10.5 to 23 inches. The aggregate base consisted of crushed limestone at B17 through B29, B32, B36 through B38 and B40, pulverized asphalt at B30, B31, and B34, crushed limestone with some pulverized asphalt mix at B33, B35, and B39. Table 3.4.1 lists the approximate asphalt and aggregate base thickness at the test hole locations.

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TABLE 3.4.1: PAVEMENT LAYER APPROXIMATE THICKNESS –ASHLEY BLVD TO APPROX. 690 FEET SOUTH OF 11 MILE ROAD

TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B17	5.5	13.5	19	62+80	10 Feet Right of Center Line	North Bound
B18	5.5	12.5	18	64+42	8 Feet Left of Center Line	South Bound
B19	5	17	22	67+06	7 Feet Right of Center Line	North Bound
B20	6	12.5	18.5	68+60	8 Feet Left of Center Line	South Bound
B21	5.5	13.5	19	70+97	7 Feet Right of Center Line	North Bound
B22	5.5	12.5	18	72+85	7 Feet Left of Center Line	South Bound
B23	6	14	20	74+84	29 Feet Right of Center Line	North Bound
B24	5.25	12.75	18	76+96	31 Feet Left of Center Line	South Bound - Right Turn Lane
B25	6.5	13.5	20	78+75	10 Feet Right of Center Line	North Bound
B26	8	14	22	81+73	7 Feet Left of Center Line	South Bound
B27	11.5	10.5	22	84+56	20 Feet Right of Center Line	North Bound
B28	5.5	10.5	16	86+55	20 Feet Left of Center Line	South Bound
B29	8	23	31	88+60	8 Feet Right of Center Line	North Bound
B30	6	20	26	90+13	8 Feet Left of Center Line	South Bound
B31	5	18	23	92+46	9 Feet Right of Center Line	North Bound
B32	6	17	23	94+55	7 Feet Left of Center Line	South Bound
B33	8.5	12.5	21	96+56	6 Feet Right of Center Line	North Bound
B34	7	23	30	98+39	8 Feet Left of Center Line	South Bound

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The subgrade at the test holes varied from clay, to clay over sand to sand over clay. At B34, peat was encountered at 44-54 inches and organic clay at 54-60 inches. At B40, peat was encountered from 57 inches until the end of the test hole at 60 inches. Groundwater was not encountered at the test holes. The aggregate base encountered exhibited very poor to poor support at B18, B20, B22, B23, B24, B26, B27, B28, B31, B32, and B33. Table 3.4.2 indicates the approximate depths below the existing ground surface where very poor to poor subgrade conditions were encountered.

TABLE 3.4.2: SUMMARY OF VERY POOR TO POOR SUBGRADE SUPPORT CONDITIONS

TEST HOLE	DEPTH BELOW PAVEMENT SURFACE OF VERY POOR TO POOR SUPPORT CONDITIONS (INCHES)	
	FROM	TO
B19	28	32
B28	28	34*
B30	31	39*
B32	34	39*

*to extent of DCP test

3.5 APPROX. 690 FEET SOUTH OF 11 MILE ROAD TO 2,900 FEET NORTH OF 11 MILE ROAD

Beck Road ranges from 3 to 5 lanes wide through this section. The pavement is exhibiting high severity longitudinal and transverse cracking. The longitudinal paving joints are separating. Fatigue cracking is evident in the wheel paths. Extensive surficial patching was been performed throughout the road section. The cracks along the entire portion of the road have not been sealed. The road is widened at the approaches to the cross roads. Most of the road has paved shoulder with curb and gutter at the cross road approaches.

The existing pavement section consists of 3.75 to 5.5 inches of asphalt pavement at B35 through B47, 8.5 inches to 10 inches at B48 through B51 and B53 through B55, and 3.5 inches at B52. The aggregate base ranged from 7 to 31 inches at B35 through B55. The aggregate base was crushed limestone. Table 3.5.1 lists the approximate asphalt and aggregate base thickness at the test hole locations.

TABLE 3.5.1: PAVEMENT LAYER APPROXIMATE THICKNESS –ASHLEY BLVD TO APPROX. 690 FEET SOUTH OF 11 MILE ROAD

TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B35	5	26	31	101+43	10 Feet Right of Center Line	North Bound
B36	4.75	21.25	26	102+56	21 Feet Left of Center Line	South Bound
B37	5.5	15.5	21	103+77	32 Feet Right of Center Line	North Bound
B38	5.5	11.5	17	106+61	28 Feet Left of Center Line	South Bound right turn lane

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TEST HOLE	ASPHALT THICKNESS (IN)	AGGREGATE BASE THICKNESS (IN)	TOTAL THICKNESS (IN)	STATION	OFFSET	LANE
B39	5.25	28.75	34	107+80	5 Feet Left of Center Line	Center Lane
B40	5.5	15.5	21	108+34	1 Feet Left of Center Line	Center Lane
B41	5	11	16	109+89	13 Feet Right of Center Line	North Bound
B42	5.25	11.75	17	110+51	12 Feet Left of Center Line	South Bound
B43	3.75	15.75	19.5	112+01	13 Feet Right of Center Line	North Bound
B44	6.5	17.5	24	112+74	13 Feet Left of Center Line	South Bound
B45	5.5	16	21.5	116+64	1 Feet Right of Center Line	Center Lane
B46	4.75	12.25	17	118+36	28 Feet Left of Center Line	South Bound Right Turn Lane
B47	5.25	14.25	19.5	120+79	13 Feet Right of Center Line	North Bound
B48	10	7	17	121+72	14 Feet Left of Center Line	South Bound
B49	9.5	6.5	16	122+65	15 Feet Right of Center Line	North Bound
B50	10	10	20	124+04	8 Feet Left of Center Line	South Bound
B51	8.5	9	17.5	125+77	8 Feet Right of Center Line	North Bound
B52	3.5	23.5	27	128+23	0 Feet from Center Line	Center Lane
B53	9	9	18.0	129+95	25 Feet Right of Center Line	North Bound Right Turn Lane
B54	9.25	17.75	27	132+21	28 Feet Left of Center Line	South Bound Right Turn Lane
B55	8.5	19.5	28	133+98	5 Feet Right of Center Line	Center Lane

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The subgrade at the test holes varied from clay, to clay over sand to sand over clay. At B40, peat was encountered from 57 inches until the end of the test hole at 60 inches. Groundwater was encountered at B46 at a depth of 2 feet below the pavement surface. Groundwater was not encountered at the remaining test holes. The aggregate base exhibited very poor to poor support at B37 through B40, B42, B44, B46 through B55. Table 3.5.2 indicates the approximate depths below the existing ground surface where very poor to poor subgrade conditions were encountered.

TABLE 3.5.2: SUMMARY OF VERY POOR TO POOR SUBGRADE SUPPORT CONDITIONS

TEST HOLE	DEPTH BELOW PAVEMENT SURFACE OF VERY POOR TO POOR SUPPORT CONDITIONS (INCHES)	
	FROM	TO
B43	30	36*
B46	30	35
B47	25	30
B48	22	36*
B49	25	33
B52	34	37
B54	36	37*

*to extent of DCP test

4 ANALYSIS

4.1 EXISTING CONDITIONS

The asphalt surface along the evaluated sections of Beck Road were generally in a fair to poor condition. Each section noted in Section 3 has variable surface conditions based on the last construction date, however, we observed common theme with the crack patterns: fatigue cracking in wheel path and longitudinal joint and edge cracking. Fatigue cracking along the wheel path was evident along a majority of the road. Surficial patching of the wheel paths has been performed along the wheel paths. We also observed longitudinal cracking and longitudinal joint cracking both along the mainline paving joints and the edges between the mainline and widening sections. Transverse cracking was evident and is typical for asphalt pavements related to thermal movement. We also observed raveling of the surface and patched potholes. Based on the pavement surface distress, subgrade conditions encountered, and the heavy traffic loadings, we believe a major rehabilitation or reconstruction will be required in order to improve the pavement conditions and restore its serviceability and longevity.

Muck depth soundings performed revealed a maximum depth of soft to very soft soils of about 33 inches in the wet areas at the center of the deeper ditches, however most soft areas were less than 18 inches deep. Based on this information, proof rolling, test pits and undercutting may be needed to evaluate and strengthen these areas during construction of the road widening in these intersections. Peat was encountered at B40. The peat was about 4.75 feet to 5 feet below the pavement surface. If peat is encountered during construction it should be removed and replaced, however, the peat encountered at B40 doesn't necessarily need to be removed and replaced as part of the pavement construction as it is a low risk to the long term pavement performance. Once widening plans are developed, we should be requested to review the plans and the available soil information to comment on any possible soft or organic areas.

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4.2 PAVEMENT REHABILATION OPTIONS

Major rehabilitation without addressing the widespread weak aggregate base conditions and high moisture clay subgrade will likely result in a reduced service life compared with a major reconstruction option. In addition, improvements to the edges and shoulders should be addressed.

Our options presented below are listed in terms of long to short term pavement service life:

- Long Term Option A - Full reconstruction, with new subbase, aggregate base, and pavement. This option will expose most of the underlying subgrade and allow for subgrade improvements. (Estimated service life of 15 to 20 years)

- Long Term Option B - Full reconstruction, with new geogrid, aggregate base, and pavement. This option will leave some of the existing aggregate base in place. (Estimated service life of 15 to 20 years)

- Mid-term Option A – Full Depth Reclamation - Surface reconstruction consisting of crushing/removing the existing pavement surface, add supplemental aggregate, chemical stabilization of the existing aggregate base, and installing a new asphalt surface. This option will help stabilize and stiffen the existing aggregate base layer (Estimated service life of 10 to 12 years)

- Mid-term Option B – Surface reconstruction consisting of crushing/removing the existing pavement surface, adding supplemental aggregate base and undercutting and replacing of yielding areas of existing aggregate base and installing a new surface. (Estimated service life of 8 to 10 years)

- Short-term Option – Partial Depth Mill and Overlay - A partial mill and resurfacing will require patching a significant portion of the distressed pavement areas below the planned milled depth (Estimated service life of 3 to 5 years, with reflective cracking after 1 year).

5 RECOMMENDATIONS

5.1 LONG TERM PAVEMENT RECONSTRUCTION AND WIDENING AREAS

5.1.1 SUBGRADE PREPARATIONS

The proposed section for the full reconstruction option and widening areas consists of removing the existing pavement/grade, excavating to the final subgrade elevation to install the pavement system, installing continuous edge drains (where possible), compacting the exposed subgrade, and installing a new sand subbase, aggregate base, and asphalt concrete surface. We recommend a sand subbase be utilized due to the poor subgrade support. Utilities should be located and depths should be confirmed as some shallow utilities could be exposed during subgrade cutting. As an option, a geogrid may be utilized in lieu of a sand subbase, however, additional undercutting may be required.

The pavement areas should be cleared, grubbed, and excavated to grade by removing existing pavement base and other deleterious materials to expose suitable subgrade soils and then shaped and graded to promote drainage of surface water away from the pavement section.

The subgrade should be prepared by drying and compacting and then thoroughly proof rolling using a fully loaded tandem-axle dump truck or other suitable rubber-tired equipment. The upper 12 inches of exposed subgrade should be compacted to a minimum of 95 percent of the maximum modified Proctor

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dry density. Transitions from clay to sand subgrade should be blended and compacted 10 feet on either side of the transition.

Based on the observed distress along the existing widening paving joints, the subgrade at the edges of the existing pavement should be thoroughly blended and compacted 10 feet on either side of the widening joint. In addition, we recommend the subgrade preparation and aggregate base placement should extend 1 foot beyond the edge of the gravel shoulder or the back of curbs to provide support for the outer edges of pavement.

The criteria for the proof roll should be a maximum of 1/4 inch of deflection or rutting. Areas exhibiting excessive deformations should be further stabilized using undercuts and backfilling with engineered fill and possibly using geotextile reinforcement, until a relatively uniform and suitably stiff subgrade is developed. SME should be onsite to determine the type and quantity of subgrade stabilization to be used, based on the conditions encountered during construction. Without proper subgrade preparation, proper compaction of the pavement layers could be difficult affecting long-term pavement performance. Once the subgrade is stable, the pavement layers should be placed soon thereafter to prevent further subgrade disturbance. If additional subgrade disturbance occurs prior to pavement placement, the disturbed areas should be proof rolled, recompacted, and/or repaired.

Subgrade manipulation in the form of compaction and moisture conditioning should be performed and required in the contract documents. Also, some undercutting may be required in order to provide a stable subgrade in some areas. Therefore, some contingencies for subgrade compaction and some undercutting should be included in the project budget. If the earthwork operations are performed during times of seasonally cold and wet conditions, anticipate the need for additional undercutting and subgrade stabilization to achieve a suitably prepared subgrade.

5.1.2 RECOMMENDED RECONSTRUCTION/NEW PAVEMENT SECTION

The pavement sections recommended below were selected based on the discussions stated in the previous sections of this report and our experience with similar projects and pavements in the area. The recommended layer materials refer to standard material designations listed in the 2012 edition of the “Standard Specifications for Construction” prepared by the Michigan Department of Transportation (MDOT), including latest Special Provisions and the Local Agency Programs (LAP) HMA Selection Guideline (11/17), unless otherwise modified in this report.

Typical routine maintenance such as crack sealing, patching and overlays should be anticipated and performed over the life of the pavement system.

The final grade of asphalt cement should be PG64-22 in the production of all bituminous mixtures. The amount of reclaimed asphalt pavement (RAP) should be limited to 30 percent for base and leveling course layers. RAP should be limited to 15 percent in the surface course.

Per the LAP HMA Selection Guidelines, High Stress HMA mixture should be specified for pavement 1,000 feet on either side of signalized intersections and other areas where stop/start traffic. The adjacent approaches at these intersections should use High Stress HMA. For the HMA High Stress pavement, the final asphalt cement should be PG70-22P

We utilized the following pavement design parameters in developing the recommended pavement cross sections.

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TABLE 5.1.1: PAVEMENT DESIGN PARAMETERS

DESIGN PARAMETER	VALUE
20 Year Design ESALs	2,000,000
Truck Factor	0.75
Commercial Traffic	3 percent
Percent Growth	1 percent
Reliability	85 percent
Standard Deviation	0.45
Subgrade Modulus	3,000
Initial Serviceability	4.8
Terminal Serviceability	2.5
Hot Mix Asphalt Structural Coefficient	0.42
Aggregate Base Structural Coefficient	0.14
Subbase Structural Coefficient	0.08
Drainage Coefficient (all layers)	1.0
Calculated 20 Year Design Structural Number	4.74

The following table provides the recommended minimum section for pavement reconstruction and new pavement areas. This section is estimated to provide a structural number of 4.88

TABLE 5.1.2: NEW ASPHALT PAVEMENT

LAYER	MATERIAL	THICKNESS (IN)	THICKNESS (IN)
		Sand Subbase Option A	Geogrid Option B
Surface	MDOT 5E3	1.5	1.5
Leveling	MDOT 4E3	2.0	2.0
Leveling	MDOT 3E3	2.5	2.5
Aggregate Base	MDOT 21AA Crushed Limestone*	10.0	12.0
Geogrid	Tensar TX 160	N/A	Yes
Subbase	Stabilized Subgrade or MDOT Class II	12.0	N/A

*Crushed concrete should not be substituted for the recommended crushed limestone due to structural differences of the materials.

5.2 MID TERM PAVEMENT SURFACE RECONSTRUCTION

When considering removing and replacing the asphalt surface, there will be areas to add supplemental aggregate base and areas where there will still be asphalt layers left on the ground. The asphalt was between 3.5 and 6 inches at thirty-six of the fifty-five test hole locations. The asphalt was greater than 6 inches at 19 locations. The existing pavement surface averaged 6.4 inches throughout all the cores. Taking out the cores that were over 8 inches thick, the average thickness was 5.5 inches. The variable

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core thickness will result in the need for supplemental aggregate base or deeper pulverizing/removal of thicker asphalt.

5.2.1 FULL DEPTH RECLAMATION

This strategy would include pulverizing the existing asphalt and aggregate base material and blending with a portion of the underlying subgrade soils and stabilizing the salvaged base with Portland cement to improve support conditions and mitigate need for undercutting. In the FDR process, areas of unstable base/subgrade are cut, the underlying material treated in place, and the cut material is treated and reused.

The asphalt should be pre-pulverized and mixed with base subgrade to a depth of 18 inches. The mixed base should be cut and graded to allow for the installation of the new pavement layers. The mixed base should be stabilized to a depth of 12 inches below the top of the proposed base layer.

As an option, the asphalt surface can be milled (nominal 6 inches) and the underlying existing aggregate base can be stabilized. As noted above, pre-pulverizing and mixing of the aggregate base and remaining asphalt pavement (where the asphalt is greater than 6 inches) will be required. Also, some areas will require removal of the existing base where the existing asphalt is less than 6 inches.

Based on the soils encountered at the test hole locations, we preliminarily recommend utilizing Type 1 Portland cement as the stabilization agent. A combination of Lime Kiln Dust (LKD) and Type 1 cement may be necessary in areas that contain higher clay contents in the upper 12 inches of the material cross sections. Areas of proposed widening that do not have existing pavement layers will require the addition of crushed aggregates to improve the overall performance of a cement treated soil blend. A detailed mix design should be performed to select the final stabilization agent(s) and application rate(s) if this option is chosen. SME would be pleased to provide a proposal to complete FDR mix design services if this option is selected. We can also assist in preparing a technical specification for the FDR strategy. The mix design will be based on providing a seven day compressive strength of 150 to 500 psi per ASTM D1633.

During stabilization, the blended material should be moisture conditioned to approximately 2 percent above the optimum moisture content, the stabilization agent should be thoroughly mixed with the salvaged base material and underlying subgrade to a depth of 12 inches at an application rate determined based on the mix design. The treated base layer should then be graded, and compacted to a minimum of 98 percent of the maximum dry density per the Standard Proctor Test (ASTMD698). Compressive strength samples should be molded during construction to be later tested to verify the required compressive strength is achieved. The surface should be allowed to cure for a minimum of five days without servicing construction or truck traffic. Low volumes of passenger vehicle traffic would still be allowed to traffic the treated base prior to the five day curing period. A comprehensive underdrain/edgedrain plan should be utilized to allow for adequate subsurface drainage. Edgedrain and underdrain should be installed after the FDR treatment. Tables 5.2.1 below presents the recommended pavement sections for FDR.

There is a possibility of longitudinal paving lane joint cracking and reflective cracking from the cement treated base course. This can occur within 1 to 3 years after paving and these cracks should be sealed to prevent water infiltration into the pavement system. The road should be reviewed in the spring following the first winter after paving to evaluate the need for any crack sealing.

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TABLE 5.2.1: NEW ASPHALT PAVEMENT AND CHEMICALLY STABILIZE EXISTING BASE

LAYER	MATERIAL	THICKNESS (IN)
Bituminous Surface	MDOT 5E3	1.5
Bituminous Leveling	MDOT 4E3	2.0
Bituminous Base	MDOT 3E3	2.5
Aggregate Base	Chemically Stabilized Base	12.0

(1) Mix design is required to determine amount of stabilizing agent / appropriate depth

5.2.2 SURFACE RECONSTRUCTION

In this option, the existing asphalt can either be crushed and mixed the underlying base or milled and removed. In the crush and shape option, there will be excess material generated which can be used in widening and shoulder areas.

The exposed aggregate base should be graded, compacted and proofrolled. The upper 12 inches of exposed base should be compacted to a minimum of 95 percent of the maximum modified Proctor dry density or to a minimum of 98 percent of the Modified T-180. The base should be thoroughly proofrolled using a fully loaded tandem-axle dump truck or other suitable rubber-tired equipment.

This option has high risk since it will expose the aggregate base and subgrade to additional stress during construction. Based on the DCP tests, significant undercutting is likely as the existing aggregate base offers very poor to poor support and will need to be compacted in place to improve the support conditions. If this option is considered, we recommend a high undercutting contingency to address weak subgrade areas.

TABLE 5.2.2: SURFACE RECONSTRUCTION ASPHALT PAVEMENT OVERLAY

LAYER	MATERIAL	THICKNESS (IN)
Bituminous Surface	MDOT 5E3	1.5
Bituminous Leveling	MDOT 4E3	2.0
Bituminous Base	MDOT 3E3	2.5
Aggregate Base	Existing Aggregate Base	12.0

5.3 SHORT TERM – PARTIAL MILL AND OVERLAY

This option has high risk since most of the pavement distress appears to be caused by traffic loading and poor base/subgrade support. In addition, a majority of the cracking will likely reflective through the new surface layer within 1 to 3 years. The existing surface can be milled to a depth of about 2 inches and overlaid with a new surface. This option could be considered for areas of high pavement distress in order to provide a suitable surface until funding for a long-term or mid-term option is available.

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TABLE 5.3.1: MILL AND OVERLAY OPTION

LAYER	MATERIAL	THICKNESS (IN)
Bituminous Surface	MDOT 5E3	2.0
Base	Existing Milled Surface	--

5.4 DRAINAGE CONSIDERATIONS

Drainage conditions should be improved where possible to avoid standing water in ditch lines and near drainage crossings. Any standing water will result in a reduced pavement service life if allowed to enter into the pavement structure. Edge drains should be installed where outlets can be tapped into drainage structures or day lighted in the drainage ditches above the anticipated high water surface. Without significant drainage improvements, poor pavement performance is expected to continue due to freeze-thaw cycles.

5.5 CONSTRUCTION NOTES

To provide adequate service life and protect the pavement investment, we present the following construction notes. These notes should be included in the project specifications and should be implemented during the construction activities:

1. In general, earthwork and pavement construction shall be performed in accordance with the most current edition of the MDOT Standard Specifications for Construction, unless otherwise noted in the following items.

2. Remove any existing pavements, topsoil, tree roots, unstable fill, and other deleterious materials to expose stable subgrade soils.

3. Excavate to the depth of the final subgrade elevation to allow for grade changes and the placement of the recommended pavement system.

4. On-site fill material can be used if the specified compaction requirements can be achieved. If on site material is used, it shall be clean and free of frozen soil, organics, or other deleterious materials.

5. The top 12 inches of the exposed subgrade, as well as individual fill layers shall be compacted to achieve a minimum of 95 percent of the maximum modified Proctor dry density.

6. The aggregate base shall be compacted to achieve a minimum of 95 percent of the maximum modified Proctor dry density.

7. All bituminous material shall be compacted to a density of 92 to 96 percent of the theoretical maximum density as determined by the Rice method.

8. A bond coat of SS-1h emulsion shall be required between the leveling course and the wearing course. The bond coat shall be applied in a uniform manner over the surface at a rate of 0.1 gallons/s.y.

9. The final grade of asphalt cement shall be PG64-22 in the production of all bituminous mixtures. The amount of reclaimed asphalt pavement (RAP) shall be limited to 30 percent for base and leveling course layers. RAP shall be limited to 15 percent in the surface course.

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10. Per the MDOT HMA Selection Guidelines, High Stress HMA mixture should be specified for pavement 1,000 feet on either side of signalized intersections and other areas where stop/start traffic. The adjacent approaches at these intersections should use High Stress HMA. For the HMA High Stress pavement, the final asphalt cement shall be PG70-22P.

11. Final pavement elevations shall be so designed to provide positive surface drainage. A minimum surface slope of 2 percent is recommended.

12. These recommendations were developed assuming typical conditions during the June through September construction season. Any substitution of materials or deviation from these stated assumptions should be reviewed by SME.

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APPENDIX A

TEST HOLE LOCATION DIAGRAM
TEST HOLE LOG TERMINOLOGY
TEST HOLE LOGS (B1 THROUGH B55)

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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

TEST HOLE LEGEND

TEST HOLE LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 9 MILE RD. TO WHITE PINES DR. NOVI, MI

Sheet Name

TEST HOLE LOCATION DIAGRAM

No.	Revision Date

Date 08/28/2018

CADD MWR

Designer JAS

Scale 1" = 400'

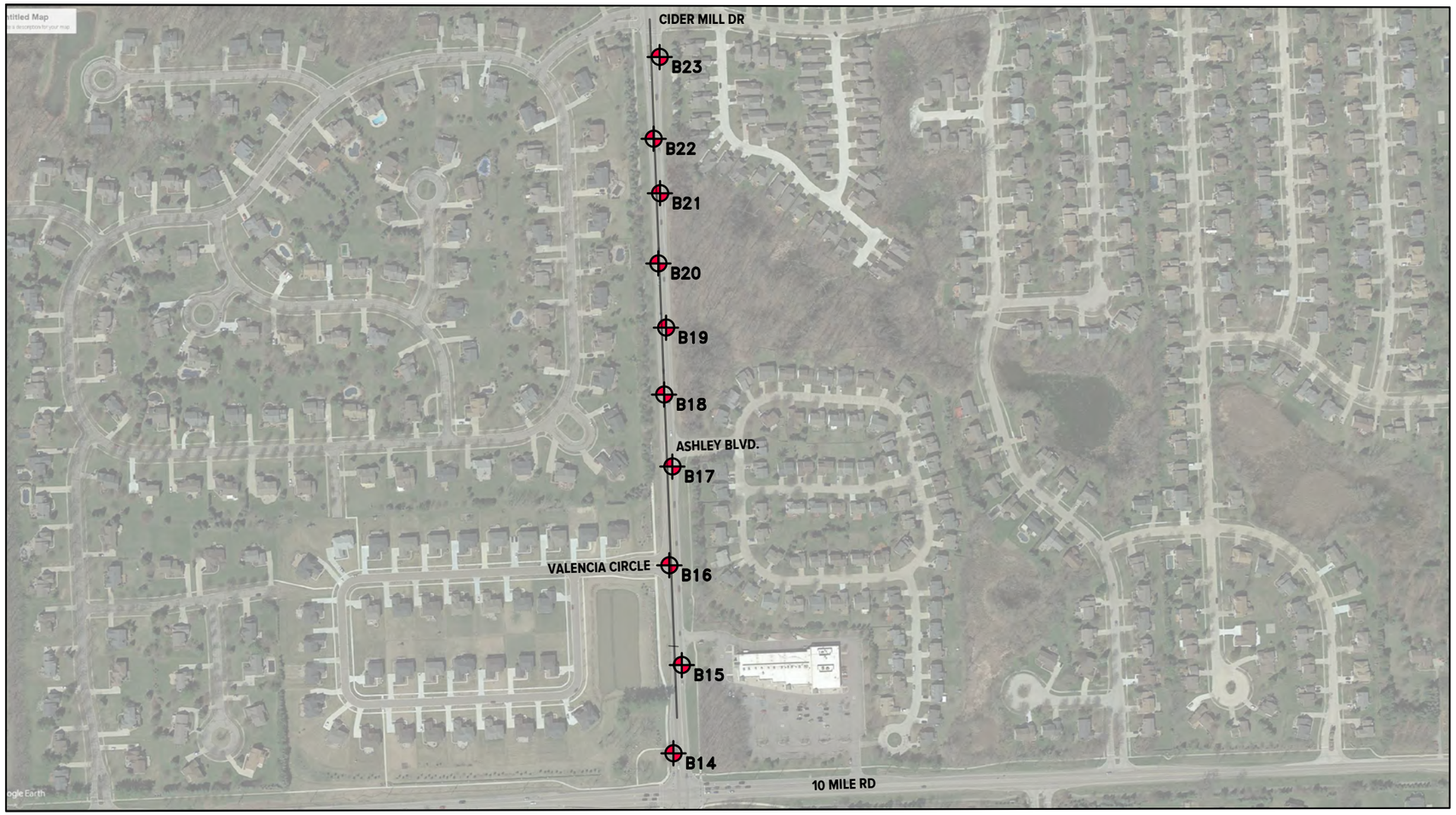
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Figure No. 1

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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

TEST HOLE LEGEND

TEST HOLE LOCATION

NOTE:
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BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 10 MILE RD. TO CIDER MILL DR. NOVI, MI

Sheet Name

TEST HOLE LOCATION DIAGRAM

No.	Revision Date

Date 08/28/2018

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Designer JAS

Scale 1" = 400'

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Figure No. 2

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0' 400' 800'

GRAPHIC SCALE: 1" = 400'

TEST HOLE LEGEND

TEST HOLE LOCATION

NOTE:
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Project
BECK ROAD PAVEMENT EVALUATION

Project Location
BECK RD. FROM CIDER MILL DR. TO 11 MILE RD. NOVI, MI

Sheet Name
TEST HOLE LOCATION DIAGRAM

No.	Revision Date

Date 08/28/2018
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Scale 1" = 400'
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Figure No. 3

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NOTE:
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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

TEST HOLE LEGEND

TEST HOLE LOCATION

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Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 11 MILE RD. TO GRAND RIVER AVE. NOVI, MI

Sheet Name

TEST HOLE LOCATION DIAGRAM

No.	Revision Date

Date 08/28/2018

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Designer JAS

Scale 1" = 400'

Project 079555.00

Figure No. 4

DRAWING NOTE: SCALE DEPICTED IS MEANT FOR 11" X 17" AND WILL SCALE INCORRECTLY IF PRINTED ON ANY OTHER SIZE MEDIA

NO REPRODUCTION SHALL BE MADE WITHOUT THE PRIOR CONSENT OF SME
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TEST HOLE LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt, Glacial Till, Siltstone, Base, Coal, Limestone, Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

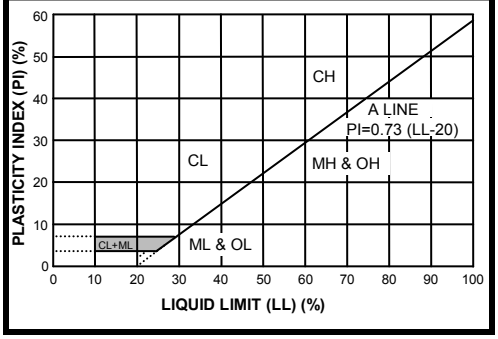
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)
- GM-GC (CLAYEY SILTY GRAVEL or CLAYEY SILTY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.0074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)
- OL/OH (ORGANIC SILT or ORGANIC CLAY)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressure Meter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N-Value (Blows per foot)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	Over 80

Cohesive Soils

Consistency	N-Value (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	0 - 2	0.25 or less
Soft	2 - 4	0.25 to 0.50
Medium	4 - 8	0.50 to 1.0
Stiff	8 - 15	1.0 to 2.0
Very Stiff	15 - 30	2.0 to 4.0
Hard	> 30	4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted.

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B1
LANE: North Bound
STATION: 2+01
OFFSET: 25' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.25	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.25	4.75	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
4.75	25	20.25	Crushed Concrete	(GP/Agg Base)
25	60	35	Fine to Coarse SAND with Gravel - Brown - Moist to Wet	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

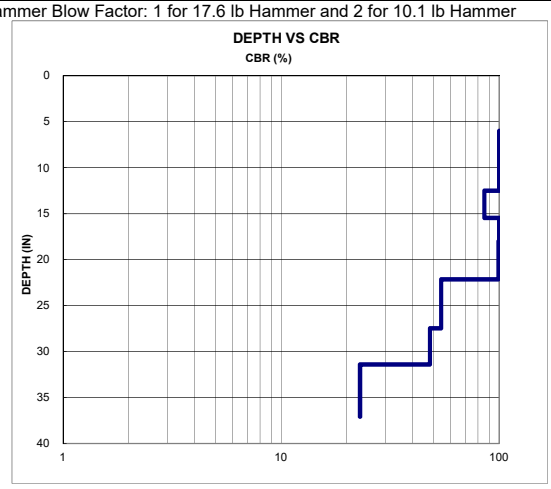
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	285	0		1					
50	370	85	2	1	9.3	100.0	Good	Agg Base	
50	450	80	2	1	12.5	100.0	Good	Agg Base	
25	525	75	3	1	15.4	85.3	Good	Agg Base	
40	590	65	2	1	18.0	100.0	Good	Agg Base	
40	695	105	3	1	22.1	99.1	Good	Agg Base	97.1
30	830	135	5	1	27.5	54.2	Good	Subgrade	
20	930	100	5	1	31.4	48.1	Good	Subgrade	
15	1075	145	10	1	37.1	23.0	Good	Subgrade	40.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B2
LANE: South Bound
STATION: 3+53
OFFSET: 9' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.5	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	5.25	2.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.25	23	17.75	Crushed Concrete	(GP/Agg Base)
23	50	27	Fine to Medium CLAYEY SAND with Gravel - Brown - Moist	(SC)
50	60	10	LEAN CLAY with Sand - Trace Organics - Gray - Very Stiff	(CL) At 52" Qp= 2.25 tsf, MC= 23%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

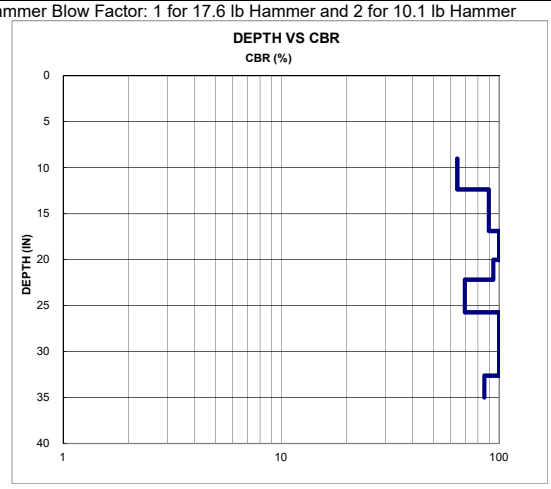
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 9 inches

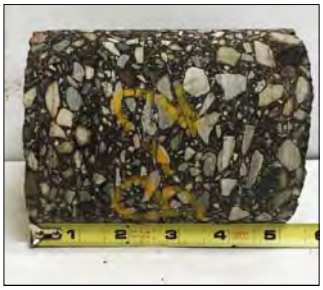
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	365	0		1					
22	450	85	4	1	12.3	64.3	Marginal	Agg Base	
40	565	115	3	1	16.9	89.5	Good	Agg Base	
35	645	80	2	1	20.0	100.0	Good	Agg Base	
20	700	55	3	1	22.2	94.0	Good	Agg Base	86.3
25	790	90	4	1	25.7	69.6	Good	Subgrade	
50	890	100	2	1	29.7	100.0	Good	Subgrade	
30	965	75	3	1	32.6	100.0	Good	Subgrade	
20	1025	60	3	1	35.0	85.3	Good	Subgrade	88.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B3
LANE: North Bound
STATION: 5+43
OFFSET: 18' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	6	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
6	26	20	Crushed Concrete	(GP/Agg Base)
26	60	34	LEAN CLAY with Sand - Brown/Gray - Very Stiff to Hard	(CL) At 38" Qp= 3.5 tsf; MC= 13% At 55" Qp= 4.25 tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

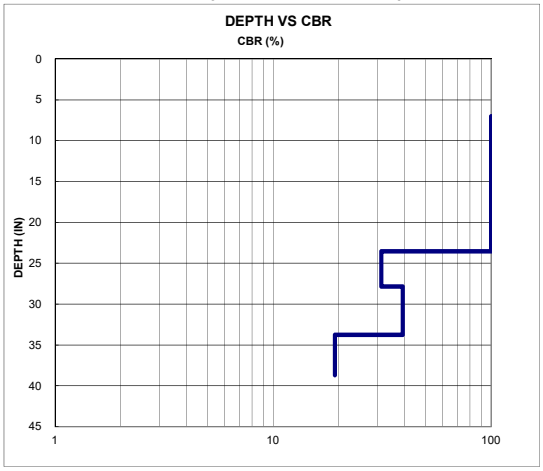
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	290	0		1					
55	410	120	2	1	11.7	100.0	Good	Agg Base	
40	475	65	2	1	14.3	100.0	Good	Agg Base	
45	525	50	1	1	16.3	100.0	Good	Agg Base	
40	560	35	1	1	17.6	100.0	Good	Agg Base	
40	595	35	1	1	19.0	100.0	Good	Agg Base	
50	640	45	1	1	20.8	100.0	Good	Agg Base	
50	710	70	1	1	23.5	100.0	Good	Agg Base	100
15	820	110	7	1	27.9	31.4	Good	Subgrade	
25	970	150	6	1	33.8	39.3	Good	Subgrade	
11	1095	125	11	1	38.7	19.2	Good	Subgrade	30.5

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B4
LANE: South Bound
STATION: 7+32
OFFSET: 6' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1	1	Asphalt Pavement Wearing Course	Intact - Many Voids
1	2.75	1.75	Asphalt Pavement Leveling Course	Intact - Moderate Voids
2.75	6	3.25	Asphalt Pavement Leveling Course	Intact - Moderate Voids
6	16	10	Crushed Concrete	(GP/Agg Base)
16	60	44	LEAN CLAY with Sand - Brown - Very Stiff to Hard	(CL) At 21" Qp= 3.5 tsf; MC= 13% At 45" Qp= 4.5+ tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

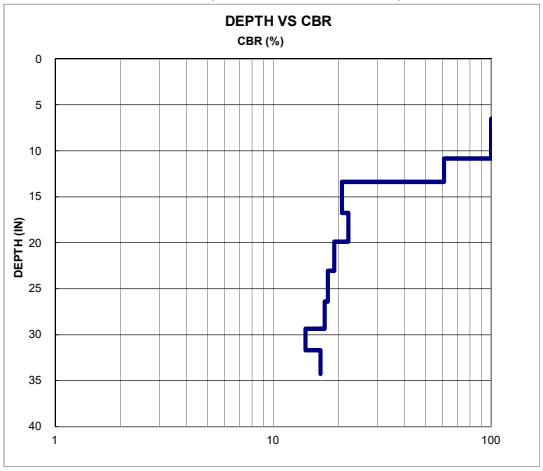
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6.5 inches

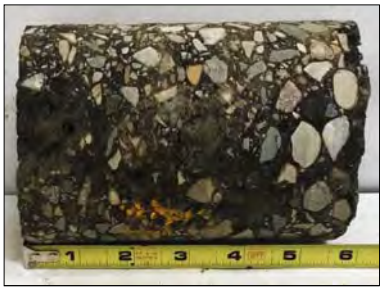
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
30	375	55	2	1	8.7	100.0	Good	Agg Base	
40	430	55	1	1	10.8	100.0	Good	Agg Base	
16	495	65	4	1	13.4	60.7	Marginal	Agg Base	85.4
8	580	85	11	1	16.7	20.7	Good	Subgrade	
8	660	80	10	1	19.9	22.2	Good	Subgrade	
7	740	80	11	1	23.0	19.1	Good	Subgrade	
7	825	85	12	1	26.4	17.8	Good	Subgrade	
6	900	75	13	1	29.3	17.3	Good	Subgrade	
4	960	60	15	1	31.7	14.1	Good	Subgrade	
5	1025	65	13	1	34.3	16.5	Good	Subgrade	18.5

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B5
LANE: North Bound
STATION: 9+32
OFFSET: 8' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2.75	2.75	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.75	4	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
4	5.25	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.25	24	18.75	Crushed Concrete	(GP/Agg Base)
24	40	16	LEAN CLAY with Sand - Trace Organics - Gray - Very Stiff	(CL) At 28" Qp= 2.5 tsf, MC= 26%
40	60	20	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 48" Qp= 2.0 tsf, MC= 25%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

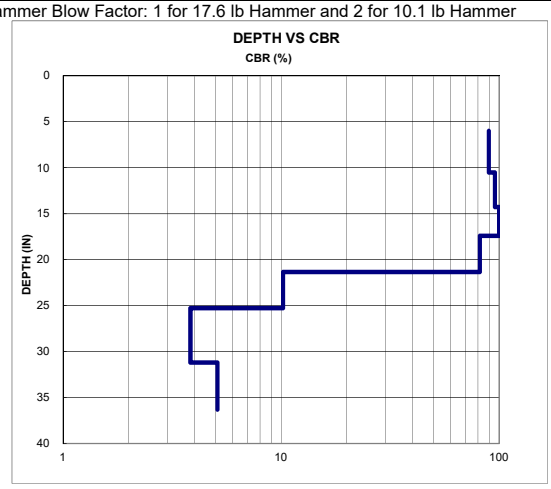
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	270	0		1					
40	385	115	3	1	10.5	89.5	Good	Agg Base	
35	480	95	3	1	14.3	95.4	Good	Agg Base	
40	560	80	2	1	17.4	100.0	Good	Agg Base	
32	660	100	3	1	21.4	81.5	Good	Agg Base	91
5	760	100	20	1	25.3	10.2	Good	Subgrade	
5	910	150	30	1	31.2	3.8	Poor	Subgrade	
5	1040	130	26	1	36.3	5.1	Marginal	Subgrade	5.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B6
LANE: South Bound
STATION: 11+20
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.5	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	4.75	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids - Vertical Crack
4.75	14	9.25	Crushed Limestone	(GP/Agg Base)
14	30	16	SILTY SANDY CLAY - Brown - Soft to Medium	(CL-ML) At 21" Tv= 0.4 tsf, MC= 21%
30	60	30	LEAN CLAY with Sand - Trace Organics - Gray - Very Stiff	(CL) At 33" Qp= 3.75 tsf, MC= 15%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: 42"

NOTES:

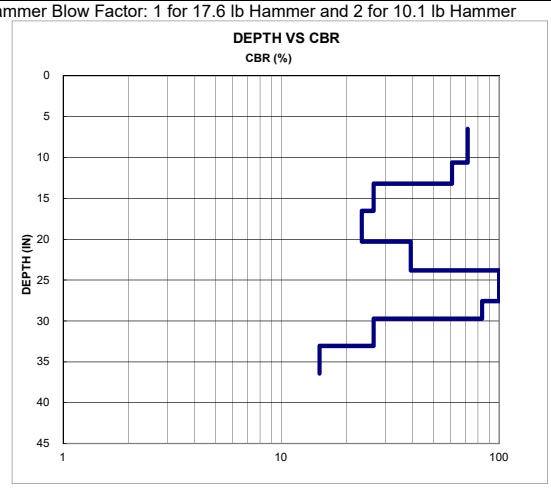
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6.5 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	295	0		1					
30	400	105	4	1	10.6	71.8	Marginal	Agg Base	
16	465	65	4	1	13.2	60.7	Marginal	Agg Base	67.6
10	550	85	9	1	16.5	26.6	Good	Subgrade	
10	645	95	10	1	20.3	23.5	Good	Subgrade	
15	735	90	6	1	23.8	39.3	Good	Subgrade	
25	785	50	2	1	25.8	100.0	Good	Subgrade	
20	830	45	2	1	27.6	100.0	Good	Subgrade	
18	885	55	3	1	29.7	83.6	Good	Subgrade	
10	970	85	9	1	33.1	26.6	Good	Subgrade	
6	1055	85	14	1	36.4	15.0	Good	Subgrade	43.5

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B7
LANE: North Bound
STATION: 13+29
OFFSET: 8' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1	1	Asphalt Pavement Wearing Course	Intact - Slight Voids
1	2	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2	3.5	1.5	Asphalt Pavement Leveling Course	Intact - Moderate Voids
3.5	5	1.5	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5	13	8	Crushed Limestone with Sand	(GP/Agg Base)
13	23	10	LEAN CLAY with Sand - Trace Organics - Gray - Stiff	(CL) At 14" Qp= 1.75 tsf, MC= 18%
23	60	37	LEAN CLAY with Sand - Brown - Hard	(CL) At 24" Qp= 4.0 tsf, MC= 19%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

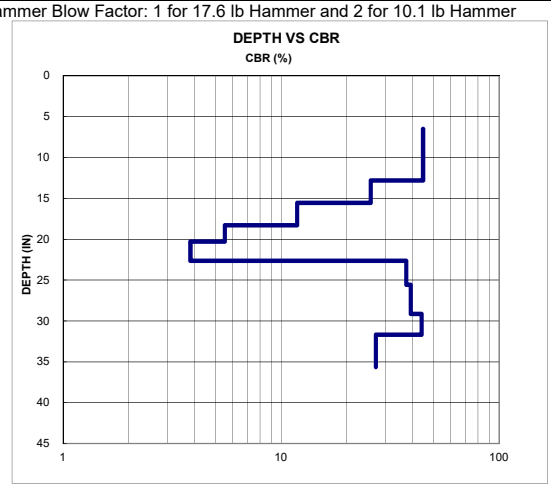
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6.5 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	290	0		1					
15	370	80	5	1	9.6	44.8	Poor	Agg Base	
15	450	80	5	1	12.8	44.8	Poor	Agg Base	44.8
8	520	70	9	1	15.6	25.7	Good	Subgrade	
4	590	70	18	1	18.3	11.8	Good	Subgrade	
2	640	50	25	1	20.3	5.5	Marginal	Subgrade	
2	700	60	30	1	22.6	3.8	Poor	Subgrade	
12	775	75	6	1	25.6	37.5	Good	Subgrade	
15	865	90	6	1	29.1	39.3	Good	Subgrade	
12	930	65	5	1	31.7	44.0	Good	Subgrade	
12	1030	100	8	1	35.6	27.2	Good	Subgrade	26

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B8
LANE: South Bound
STATION: 15+09
OFFSET: 6' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1	1	Asphalt Pavement Wearing Course	Intact - Slight Voids
1	3.25	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	4.5	1.25	Asphalt Pavement Leveling Course	Partially Deteriorated - Slight Voids
4.5	16	11.5	Crushed Limestone	(GP/Agg Base)
16	34	18	Sandy LEAN CLAY - Brown - Stiff	(CL) At 22" Qp= 1.75 tsf, MC= 14%
34	60	26	LEAN CLAY with Sand - Brown - Hard	(CL) At 36" Qp= 4.25 tsf, MC= 11%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: 60"

NOTES:

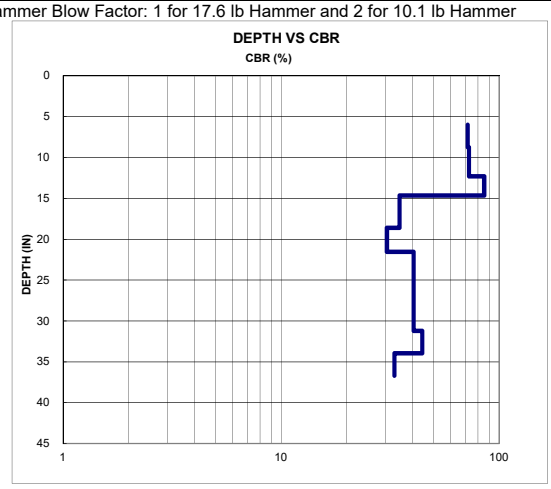
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	270	0		1					
20	340	70	4	1	8.8	71.8	Marginal	Agg Base	
26	430	90	3	1	12.3	72.7	Marginal	Agg Base	
20	490	60	3	1	14.7	85.3	Good	Agg Base	75.8
15	590	100	7	1	18.6	34.9	Good	Subgrade	
10	665	75	8	1	21.6	30.6	Good	Subgrade	
18	770	105	6	1	25.7	40.5	Good	Subgrade	
12	840	70	6	1	28.4	40.5	Good	Subgrade	
12	910	70	6	1	31.2	40.5	Good	Subgrade	
13	980	70	5	1	34.0	44.3	Good	Subgrade	
10	1050	70	7	1	36.7	33.0	Good	Subgrade	37.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B9
LANE: North Bound
STATION: 17+36
OFFSET: 5' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	5.75	2.75	Asphalt Pavement Leveling Course	Partially Deteriorated - Slight Voids
5.75	15	9.25	Crushed Limestone	(GP/Agg Base)
15	36	21	LEAN CLAY with Sand - Sand Layer at 30" - Gray - Stiff	(CL) At 16" Qp= 1.75 tsf, MC= 15%
36	60	24	LEAN CLAY with Sand - Trace Organics - Gray to Black - Very Stiff	(CL) At 38" Qp= 2.75 tsf, MC= 20%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

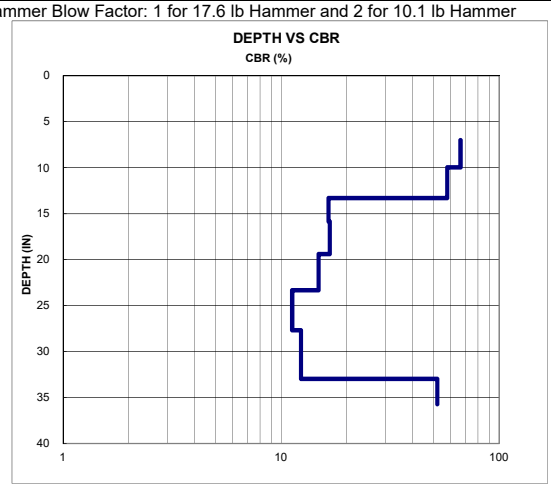
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

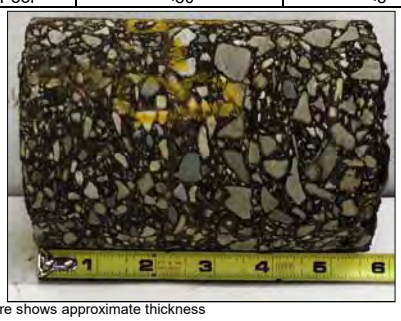
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
20	385	75	4	1	10.0	66.4	Marginal	Agg Base	
20	470	85	4	1	13.3	57.8	Poor	Agg Base	
5	535	65	13	1	15.9	16.5	Very Poor	Agg Base	48.7
7	625	90	13	1	19.4	16.7	Good	Subgrade	
7	725	100	14	1	23.3	14.9	Good	Subgrade	
6	835	110	18	1	27.7	11.2	Good	Subgrade	
8	970	135	17	1	33.0	12.3	Good	Subgrade	
15	1040	70	5	1	35.7	52.0	Good	Subgrade	18.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B10
LANE: South Bound
STATION: 20+11
OFFSET: 11' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1	1	Asphalt Pavement Wearing Course	Intact - Slight Voids
1	3.25	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	6	2.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
6	16	10	Crushed Limestone	(GP/Agg Base)
16	24	8	Sandy LEAN CLAY - Gray - Very Stiff	(CL) At 20" Qp= 3.5 tsf, MC= 23%
			End of Test Hole at 24" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

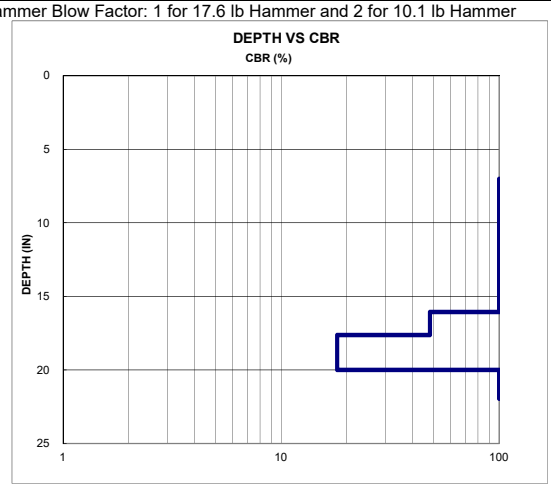
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

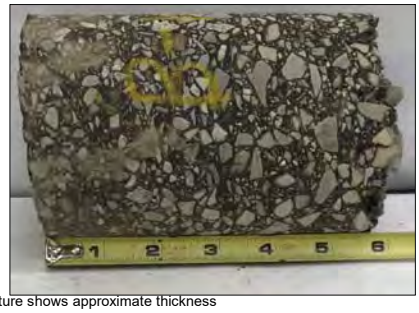
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
30	370	50	2	1	9.0	100.0	Good	Agg Base	
50	405	35	1	1	10.3	100.0	Good	Agg Base	
50	420	15	0	1	10.9	100.0	Good	Agg Base	
50	440	20	0	1	11.7	100.0	Good	Agg Base	
50	460	20	0	1	12.5	100.0	Good	Agg Base	
50	495	35	1	1	13.9	100.0	Good	Agg Base	
37	550	55	1	1	16.1	100.0	Good	Agg Base	100
8	590	40	5	1	17.6	48.1	Good	Subgrade	
5	650	60	12	1	20.0	18.1	Good	Subgrade	
25	680	30	1	1	21.2	100.0	Good	Subgrade	
25	700	20	1	1	22.0	100.0	Good	Subgrade	53.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B11
LANE: North Bound
STATION: 21+31
OFFSET: 13' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.75	1.75	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.75	3.5	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	6	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
6	8.75	2.75	Asphalt Pavement Leveling Course	Partially Deteriorated - Slight Voids
8.75	21	12.25	Crushed Limestone	(GP/Agg Base)
21	34	13	LEAN CLAY with Sand - Brown to Gray - Very Stiff	(CL) At 22" Qp= 2.5 tsf, MC= 22%
34	60	26	Fine to Medium CLAYEY SAND - Brown - Moist to Wet	(SC) At 35" MC= 14%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: 48"

NOTES:

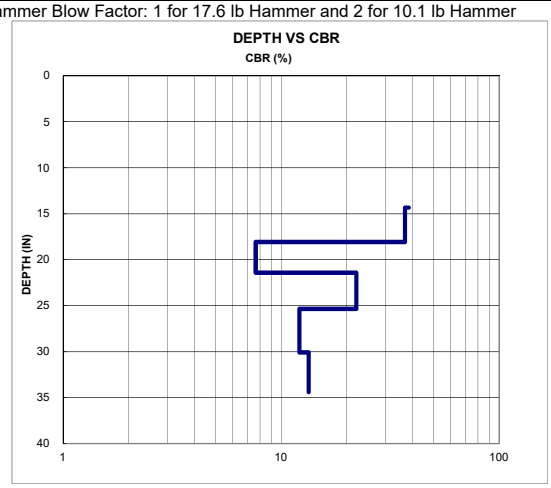
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10 inches

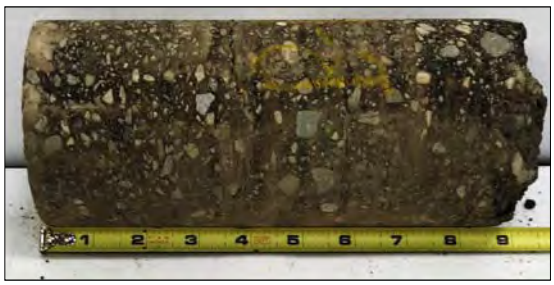
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	400	0		1					
18	510	110	6	1	14.3	38.5	Poor	Agg Base	
15	605	95	6	1	18.1	36.9	Poor	Agg Base	
4	690	85	21	1	21.4	7.6	Very Poor	Agg Base	33.4
10	790	100	10	1	25.4	22.2	Good	Subgrade	
7	910	120	17	1	30.1	12.1	Good	Subgrade	
7	1020	110	16	1	34.4	13.4	Good	Subgrade	15.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B12
LANE: South Bound
STATION: 23+03
OFFSET: 25' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact- Delaminated From Layer Below- Slight Voids
2.5	6.5	4	Asphalt Pavement Leveling Course	Intact - Slight Voids
6.5	25.5	19	Crushed Concrete	(GP/Agg Base)
25.5	60	34.5	LEAN CLAY with Sand - Brown to Gray - Hard	(CL) At 26" Qp= 4.5+ tsf; MC= 13% At 49" Qp= 4.5+ tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

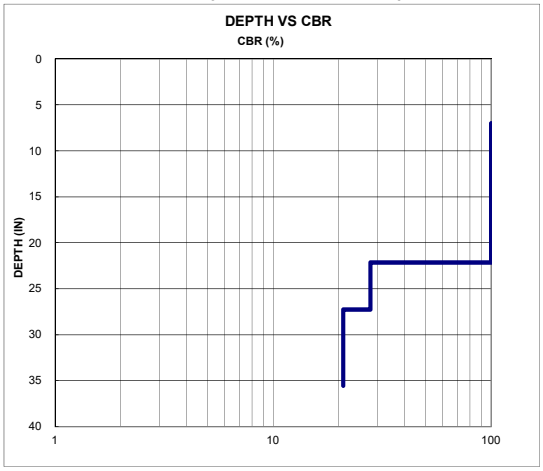
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

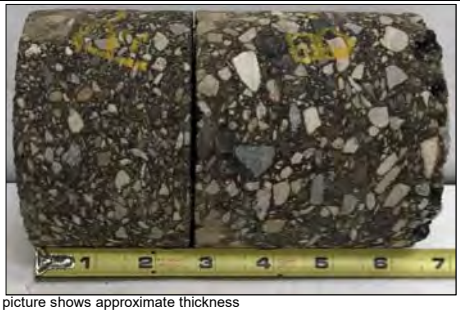
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
30	380	70	2	1	9.8	100.0	Good	Agg Base	
40	425	45	1	1	11.5	100.0	Good	Agg Base	
40	475	50	1	1	13.5	100.0	Good	Agg Base	
40	520	45	1	1	15.3	100.0	Good	Agg Base	
32	560	40	1	1	16.8	100.0	Good	Agg Base	
40	620	60	2	1	19.2	100.0	Good	Agg Base	
30	695	75	3	1	22.2	100.0	Good	Agg Base	100
16	825	130	8	1	27.3	27.9	Good	Subgrade	
10	930	105	11	1	31.4	21.0	Good	Subgrade	
10	1035	105	11	1	35.5	21.0	Good	Subgrade	24.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/30/18
BY: MR/JC

TEST HOLE: B13
LANE: North Bound
STATION: 24+41
OFFSET: 13' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.5	3.5	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.75	2.25	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5.75	20	14.25	Crushed Limestone	(GP/Agg Base)
20	36	16	LEAN CLAY with Sand - Gray - Stiff	(CL) At 21" Qp= 1.5 tsf, MC= 17%
36	46	10	Sandy LEAN CLAY - Brown - Stiff	(CL) At 40" Qp= 1.0 tsf, MC= 15%
46	60	14	Fine to Medium SAND with Gravel - Brown to Gray - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

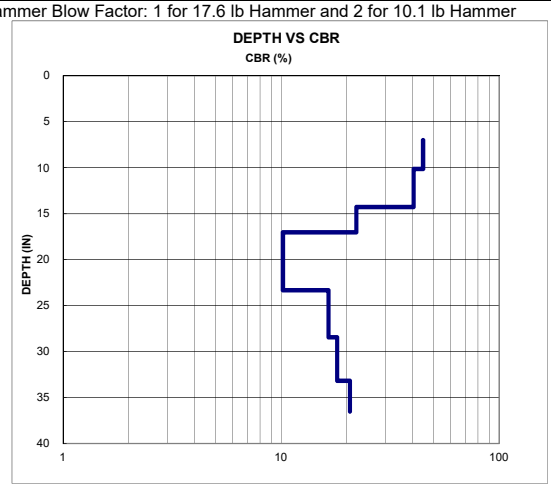
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

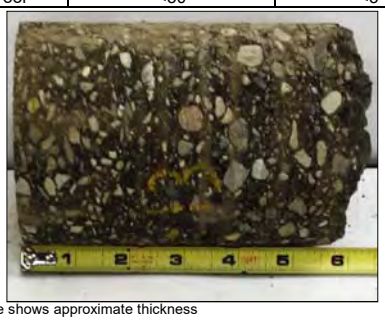
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	335	0		1					
15	415	80	5	1	10.1	44.8	Poor	Agg Base	
18	520	105	6	1	14.3	40.5	Poor	Agg Base	
7	590	70	10	1	17.0	22.2	Very Poor	Agg Base	
4	670	80	20	1	20.2	10.2	Very Poor	Agg Base	30.5
4	750	80	20	1	23.3	10.2	Good	Subgrade	
10	880	130	13	1	28.5	16.5	Good	Subgrade	
10	1000	120	12	1	33.2	18.1	Good	Subgrade	
8	1085	85	11	1	36.5	20.7	Good	Subgrade	16.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B14
LANE: South Bound
STATION: 54+47
OFFSET: 32' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.75	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.75	10	4.25	Asphalt Pavement Base Course	Intact - Slight Voids
10	19	9	Crushed Limestone with Sand	(GP/Agg Base)
19	45	26	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
45	60	15	LEAN CLAY with Sand - Brown - Stiff	(CL) At 45" Qp= 1.5 tsf, MC= 21%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

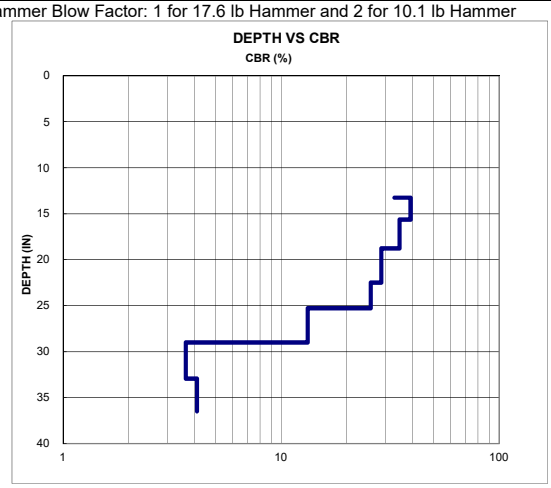
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10.5 inches

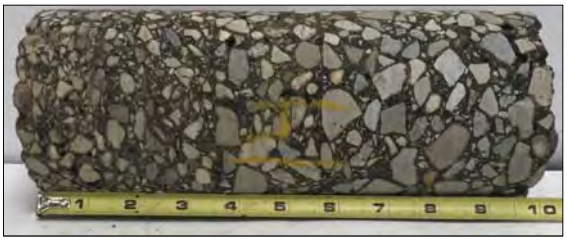
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	400	0		1					
10	470	70	7	1	13.3	33.0	Poor	Agg Base	
10	530	60	6	1	15.6	39.3	Poor	Agg Base	
12	610	80	7	1	18.8	34.9	Poor	Agg Base	34.1
12	705	95	8	1	22.5	28.8	Good	Subgrade	
8	775	70	9	1	25.3	25.7	Good	Subgrade	
6	870	95	16	1	29.0	13.2	Good	Subgrade	
2	970	100	50	1	32.9	3.7	Poor	Subgrade	
2	1060	90	45	1	36.5	4.1	Poor	Subgrade	14.5

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B15
LANE: North Bound
STATION: 56+95
OFFSET: 14' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	2.5	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	5	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
5	7	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
7	21	14	Crushed Concrete	(GP/Agg Base)
21	34	13	LEAN CLAY with Sand - Trace Organics - Gray - Stiff	(CL) At 24" Qp= 1.0 tsf, MC= 14%
34	60	26	Sandy LEAN CLAY - Brown - Medium	(CL) At 35" Qp= 0.75 tsf, MC= 16%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

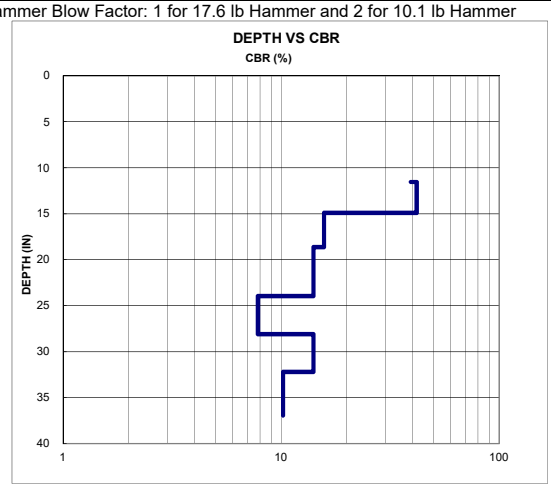
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 8 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	340	0		1					
15	430	90	6	1	11.5	39.3	Poor	Agg Base	
15	515	85	6	1	14.9	41.8	Poor	Agg Base	
7	610	95	14	1	18.6	15.7	Very Poor	Agg Base	
9	745	135	15	1	23.9	14.1	Very Poor	Agg Base	30.4
5	850	105	21	1	28.1	7.8	Marginal	Subgrade	
7	955	105	15	1	32.2	14.1	Good	Subgrade	
6	1075	120	20	1	36.9	10.2	Good	Subgrade	10.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B16
LANE: South Bound
STATION: 60+60
OFFSET: 23' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2.25	2.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.25	3.75	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.75	5.5	1.75	Asphalt Pavement Leveling Course	Intact - Delaminated From Layer Below - Slight Voids
5.5	10	4.5	Asphalt Pavement Leveling Course	Partially Deteriorated - Moderate Voids
10	24	14	Crushed Limestone	(GP/Agg Base)
24	48	24	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 26" Qp= 2.0 tsf, MC= 14%
48	60	12	LEAN CLAY with Sand - Trace Organics - Gray - Stiff	(CL) At 50" Qp= 1.5 tsf, MC= 22%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

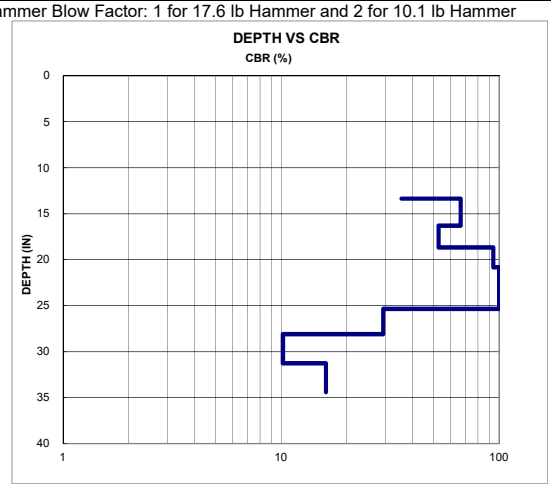
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	390	0		1					
13	475	85	7	1	13.3	35.6	Poor	Agg Base	
20	550	75	4	1	16.3	66.4	Marginal	Agg Base	
13	610	60	5	1	18.7	52.7	Poor	Agg Base	
20	665	55	3	1	20.8	94.0	Good	Agg Base	
13	690	25	2	1	21.8	100.0	Good	Agg Base	
22	720	30	1	1	23.0	100.0	Good	Agg Base	
25	780	60	2	1	25.4	100.0	Good	Agg Base	57.3
9	850	70	8	1	28.1	29.4	Good	Subgrade	
4	930	80	20	1	31.3	10.2	Good	Subgrade	
6	1010	80	13	1	34.4	16.0	Good	Subgrade	18.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B17
LANE: North Bound
STATION: 62+80
OFFSET: 10' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.5	5.5	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	19	13.5	Crushed Limestone	(GP/Agg Base)
19	28	9	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
28	36	8	LEAN CLAY with Sand - Gray - Stiff	(CL) At 27" Qp= 1.25 tsf, MC= 14%
36	60	24	Fine to Coarse SAND with Gravel - Trace Organics - Brown to Gray - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

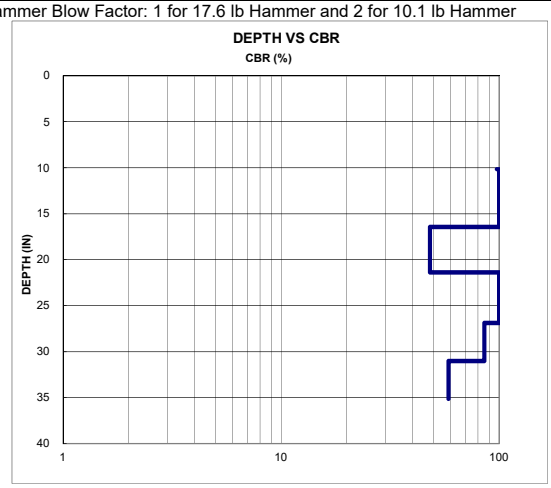
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

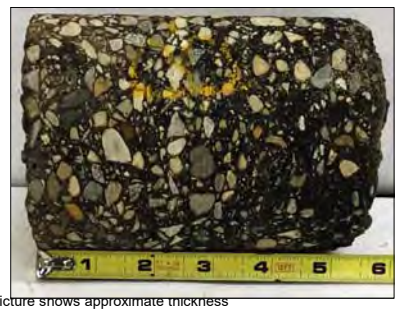
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	305	0		1					
30	385	80	3	1	10.1	97.3	Good	Agg Base	
40	470	85	2	1	13.5	100.0	Good	Agg Base	
30	545	75	3	1	16.4	100.0	Good	Agg Base	
25	670	125	5	1	21.4	48.1	Poor	Agg Base	86.8
40	770	100	3	1	25.3	100.0	Good	Subgrade	
40	810	40	1	1	26.9	100.0	Good	Subgrade	
35	915	105	3	1	31.0	85.3	Good	Subgrade	
25	1020	105	4	1	35.1	58.5	Good	Subgrade	83.2

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B18
LANE: South Bound
STATION: 64+42
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.25	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	5.5	2.25	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5.5	18	12.5	Crushed Limestone	(GP/Agg Base)
18	42	24	SILTY CLAY with Sand - Trace Organics - Gray - Medium	(CL-ML) At 20" Tv= 0.5 tsf, MC= 15%
42	60	18	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 43" Qp= 2.0 tsf, MC= 28%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

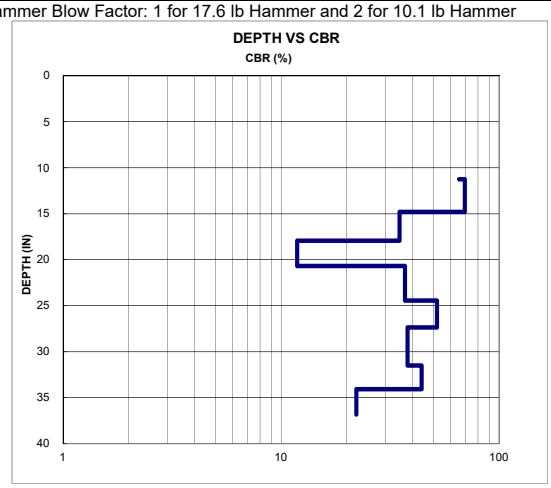
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7.5 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
25	415	95	4	1	11.2	65.5	Marginal	Agg Base	
25	505	90	4	1	14.8	69.6	Marginal	Agg Base	
12	585	80	7	1	17.9	34.9	Poor	Agg Base	60.9
4	655	70	18	1	20.7	11.8	Good	Subgrade	
15	750	95	6	1	24.4	36.9	Good	Subgrade	
16	825	75	5	1	27.4	51.8	Good	Subgrade	
17	930	105	6	1	31.5	38.0	Good	Subgrade	
12	995	65	5	1	34.1	44.0	Good	Subgrade	
7	1065	70	10	1	36.8	22.2	Good	Subgrade	34.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B19
LANE: North Bound
STATION: 67+06
OFFSET: 7' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	3.25	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	5	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
5	22	17	Crushed Limestone	(GP/Agg Base)
22	51	29	LEAN CLAY with Sand - Brown - Stiff	(CL) At 24" Qp= 1.75 tsf; MC= 27% At 44" Qp= 1.75 tsf; MC= 12%
51	60	9	Fine to Medium SAND - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

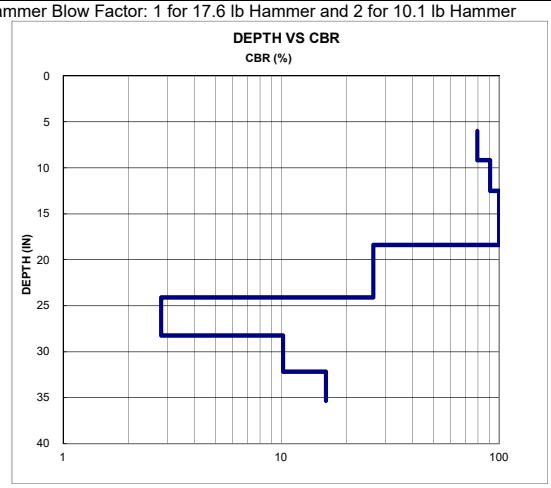
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	295	0		1					
25	375	80	3	1	9.1	79.4	Marginal	Agg Base	
30	460	85	3	1	12.5	91.0	Good	Agg Base	
40	530	70	2	1	15.3	100.0	Good	Agg Base	
40	610	80	2	1	18.4	100.0	Good	Agg Base	
17	755	145	9	1	24.1	26.5	Very Poor	Agg Base	71.6
3	860	105	35	1	28.2	2.8	Very Poor	Subgrade	
5	960	100	20	1	32.2	10.2	Good	Subgrade	
6	1040	80	13	1	35.3	16.0	Good	Subgrade	9.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B20
LANE: South Bound
STATION: 68+60
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	6	3	Asphalt Pavement Leveling Course	Intact - Moderate Voids
6	18.5	12.5	Crushed Limestone	(GP/Agg Base)
18.5	41	22.5	SILTY CLAY with Sand - Trace Organics - Occasional Sand Layer - Brown to Gray - Medium	(CL-ML) At 21" Qp= 0.75 tsf, MC= 16%
41	60	19	LEAN CLAY with Sand - Trace Organics - Black to Gray - Very Stiff	(CL) At 43" Qp= 2.5 tsf, MC= 23%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

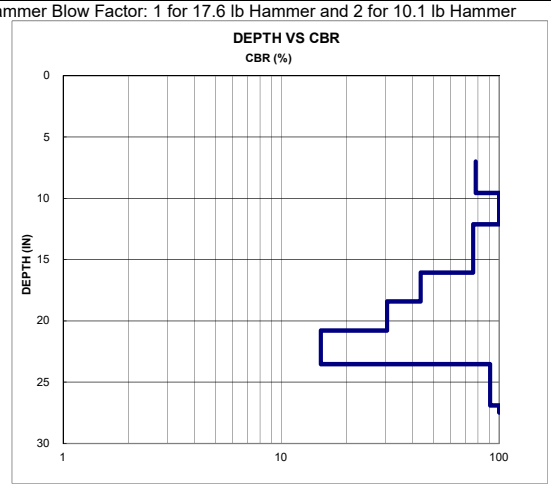
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
20	385	65	3	1	9.6	78.0	Marginal	Agg Base	
30	450	65	2	1	12.1	100.0	Good	Agg Base	
30	550	100	3	1	16.1	75.8	Marginal	Agg Base	
11	610	60	5	1	18.4	43.7	Poor	Agg Base	75.1
8	670	60	8	1	20.8	30.6	Good	Subgrade	
5	740	70	14	1	23.5	15.2	Good	Subgrade	
30	825	85	3	1	26.9	91.0	Good	Subgrade	
50	840	15	0	1	27.5	100.0	Good	Subgrade	52.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B21
LANE: North Bound
STATION: 70+97
OFFSET: 7' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	2.5	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	5.5	3	Asphalt Pavement Leveling Course	Intact - Moderate Voids - Vertical Crack
5.5	19	13.5	Crushed Limestone	(GP/Agg Base)
19	33	14	SILTY CLAY - Gray - Soft	(CL-ML) At 29" Tv= 0.3 tsf, MC= 16%
33	44	11	Fine to Coarse SAND with Gravel - Brown - Moist	(SP)
44	60	16	LEAN CLAY with Sand - Brown to Gray - Hard	(CL) At 51" Qp= 4.5+ tsf, MC= 16%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

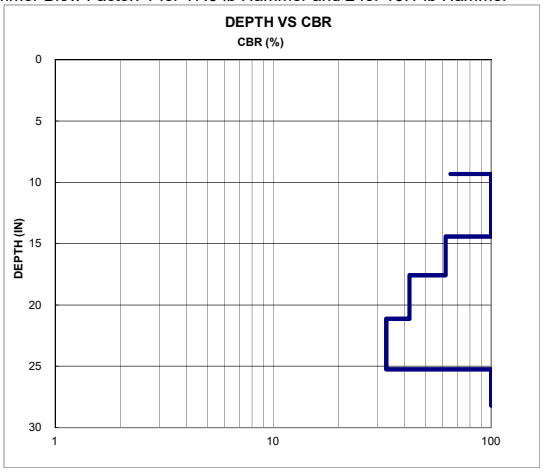
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6.75 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	295	0		1					
17	360	65	4	1	9.3	65.0	Marginal	Agg Base	
40	435	75	2	1	12.3	100.0	Good	Agg Base	
35	490	55	2	1	14.4	100.0	Good	Agg Base	
20	570	80	4	1	17.6	61.8	Marginal	Agg Base	
16	660	90	6	1	21.1	42.2	Poor	Agg Base	69.2
15	765	105	7	1	25.3	33.0	Good	Subgrade	
40	805	40	1	1	26.8	100.0	Good	Subgrade	
40	825	20	1	1	27.6	100.0	Good	Subgrade	
40	840	15	0	1	28.2	100.0	Good	Subgrade	60.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B22
LANE: South Bound
STATION: 72+85
OFFSET: 7' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.5	2	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5.5	18	12.5	Crushed Limestone	(GP/Agg Base)
18	44	26	SILTY CLAY with Sand - Gray - Stiff	(CL-ML) At 22" Qp= 1.0 tsf, MC= 12%
44	60	16	LEAN CLAY with Sand - Trace Organics - Black to Gray - Very Stiff	(CL) At 45" Qp= 2.25 tsf, MC= 24%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

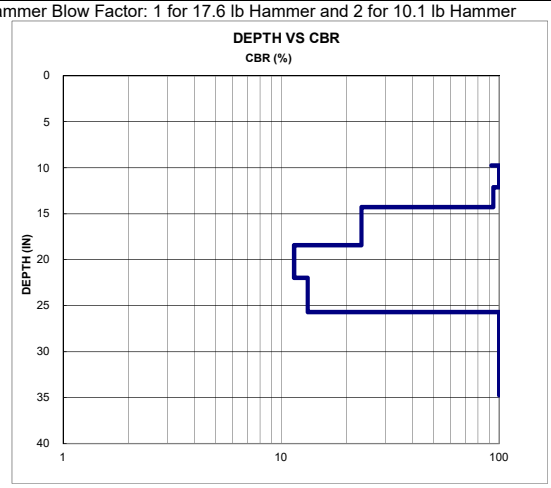
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
25	380	70	3	1	9.8	92.2	Good	Agg Base	
30	440	60	2	1	12.1	100.0	Good	Agg Base	
20	495	55	3	1	14.3	94.0	Good	Agg Base	
11	600	105	10	1	18.4	23.3	Very Poor	Agg Base	77.9
5	690	90	18	1	22.0	11.5	Good	Subgrade	
6	785	95	16	1	25.7	13.2	Good	Subgrade	
20	830	45	2	1	27.5	100.0	Good	Subgrade	
25	860	30	1	1	28.7	100.0	Good	Subgrade	
25	890	30	1	1	29.8	100.0	Good	Subgrade	
35	935	45	1	1	31.6	100.0	Good	Subgrade	
35	1015	80	2	1	34.8	100.0	Good	Subgrade	60.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 7/31/18
BY: MR/JC

TEST HOLE: B23
LANE: North Bound
STATION: 74+84
OFFSET: 29' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	3	3	Asphalt Pavement Wearing Course	Deteriorated into Pieces
3	6	3	Asphalt Pavement Leveling Course	Deteriorated into Pieces
6	20	14	Crushed Limestone	(GP/Agg Base)
20	60	40	LEAN CLAY with Sand - Occasional Sand layer - Brown - Very Stiff	(CL) At 28" Qp= 2.75 tsf, MC= 14%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

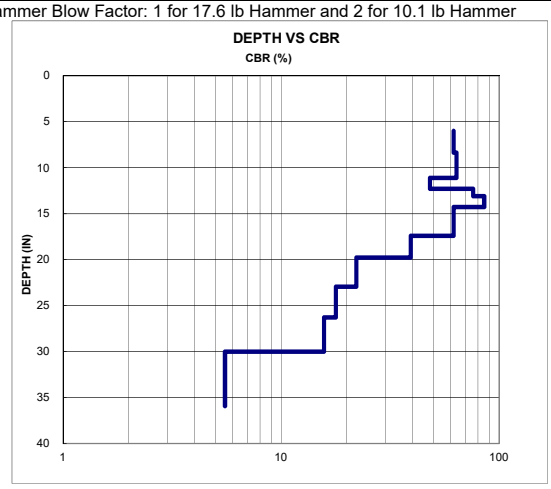
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	290	0		1					
15	350	60	4	1	8.4	61.8	Marginal	Agg Base	
18	420	70	4	1	11.1	63.8	Marginal	Agg Base	
6	450	30	5	1	12.3	48.1	Poor	Agg Base	
6	470	20	3	1	13.1	75.8	Marginal	Agg Base	
10	500	30	3	1	14.3	85.3	Good	Agg Base	
20	580	80	4	1	17.4	61.8	Marginal	Agg Base	
10	640	60	6	1	19.8	39.3	Poor	Agg Base	60
8	720	80	10	1	22.9	22.2	Good	Subgrade	
7	805	85	12	1	26.3	17.8	Good	Subgrade	
7	900	95	14	1	30.0	15.7	Good	Subgrade	
3	975	75	25	1	33.0	5.5	Marginal	Subgrade	
3	1050	75	25	1	35.9	5.5	Marginal	Subgrade	13.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B24
LANE: South Bound - Right Turn Lane
STATION: 76+96
OFFSET: 31' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.5	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.25	1.75	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5.25	18	12.75	Crushed Limestone	(GP/Agg Base)
18	57	39	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
57	60	3	Sandy LEAN CLAY - Brown - Medium	(CL) At 58" Qp= 0.5 tsf, MC= 16%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

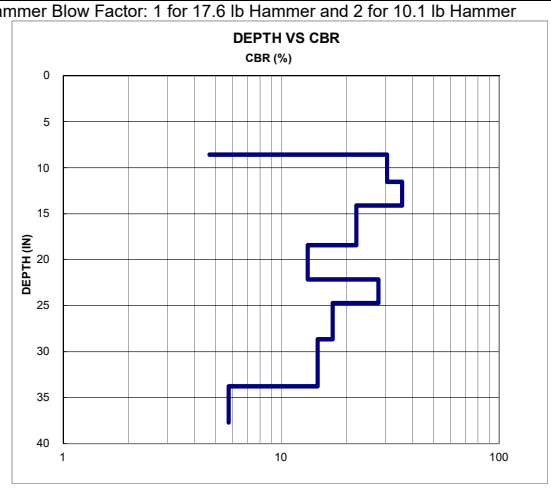
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

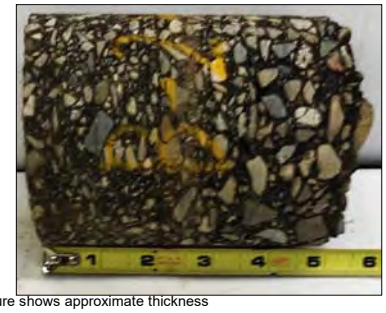
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
1	350	40	40	1	8.6	4.7	Very Poor	Agg Base	
10	425	75	8	1	11.5	30.6	Poor	Agg Base	
10	490	65	7	1	14.1	35.9	Poor	Agg Base	
6	550	60	10	1	16.4	22.2	Very Poor	Agg Base	
5	600	50	10	1	18.4	22.2	Very Poor	Agg Base	17.3
6	695	95	16	1	22.2	13.2	Good	Subgrade	
8	760	65	8	1	24.7	27.9	Good	Subgrade	
8	860	100	13	1	28.7	17.3	Good	Subgrade	
9	990	130	14	1	33.8	14.7	Good	Subgrade	
3	1090	100	33	1	37.7	5.8	Marginal	Subgrade	14.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B25
LANE: North Bound
STATION: 78+75
OFFSET: 10' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	4	2.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
4	6.5	2.5	Asphalt Pavement Leveling Course	Intact - Moderate Voids
6.5	20	13.5	Crushed Limestone	(GP/Agg Base)
20	39	19	Sandy LEAN CLAY - Trace Organics - Black to Gray - Stiff	(CL) At 28" Qp= 1.0 tsf, MC= 21%
39	51	12	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 44" Qp= 2.0 tsf, MC= 16%
51	60	9	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

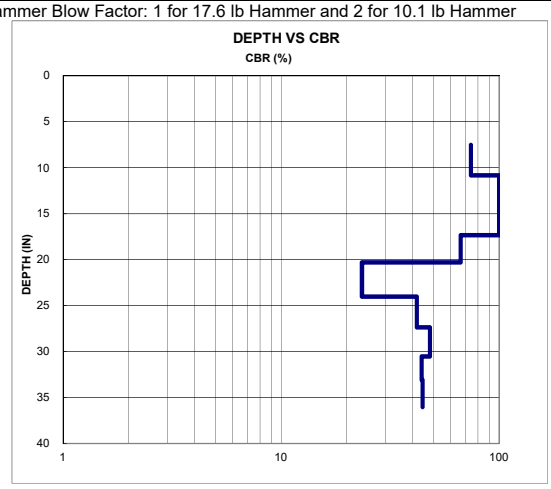
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7.5 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	315	0		1					
25	400	85	3	1	10.8	74.2	Marginal	Agg Base	
30	450	50	2	1	12.8	100.0	Good	Agg Base	
30	515	65	2	1	15.4	100.0	Good	Agg Base	
20	565	50	3	1	17.3	100.0	Good	Agg Base	
20	640	75	4	1	20.3	66.4	Marginal	Agg Base	85.5
10	735	95	10	1	24.0	23.5	Good	Subgrade	
15	820	85	6	1	27.4	41.8	Good	Subgrade	
16	900	80	5	1	30.5	48.1	Good	Subgrade	
12	965	65	5	1	33.1	44.0	Good	Subgrade	
14	1040	75	5	1	36.0	44.6	Good	Subgrade	39.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B26
LANE: South Bound
STATION: 81+73
OFFSET: 7' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.25	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	5	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
5	8	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
8	22	14	Crushed Limestone	(GP/Agg Base)
22	37	15	Sandy LEAN CLAY - Brown - Stiff	(CL) At 29" Qp= 1.75 tsf, MC= 8%
37	60	23	LEAN CLAY with Sand - Trace Organics - Black to Brown - Stiff	(CL) At 48" Qp= 1.75 tsf, MC= 20%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

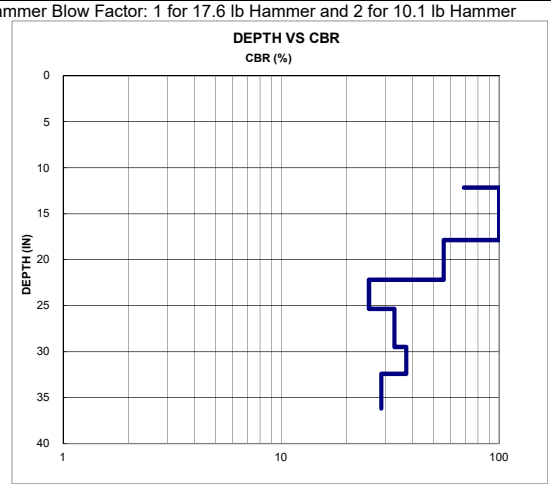
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 9 inches

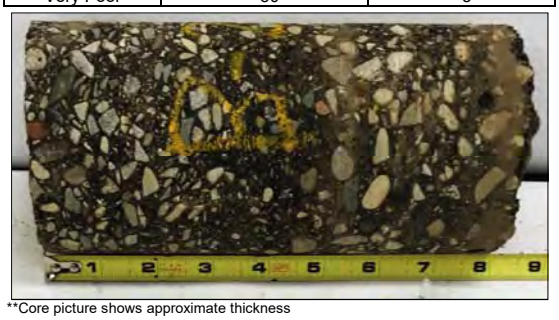
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	355	0		1				Agg Base	
22	435	80	4	1	12.1	68.8	Marginal	Agg Base	
30	510	75	3	1	15.1	100.0	Good	Agg Base	
27	580	70	3	1	17.9	100.0	Good	Agg Base	
25	690	110	4	1	22.2	55.6	Poor	Agg Base	74.2
9	770	80	9	1	25.3	25.3	Good	Subgrade	
15	875	105	7	1	29.5	33.0	Good	Subgrade	
12	950	75	6	1	32.4	37.5	Good	Subgrade	
12	1045	95	8	1	36.2	28.8	Good	Subgrade	31.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B27
LANE: North Bound
STATION: 84+56
OFFSET: 20' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.5	6	3.5	Asphalt Pavement Leveling Course	Intact - Delaminated From Layer Below - Moderate Voids
6	9	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
9	11.5	2.5	Asphalt Pavement Base Course	Intact - Slight Voids
11.5	22	10.5	Fine to Medium SAND with Gravel - Brown - Moist	(SP/Agg Base)
22	30	8	Sandy LEAN CLAY - Brown - Medium	(CL) At 30" Tv= 0.5 tsf, MC= 17%
30	60	30	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

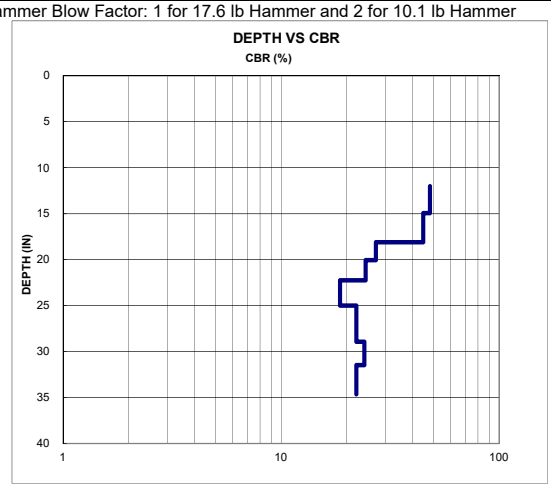
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 12 inches

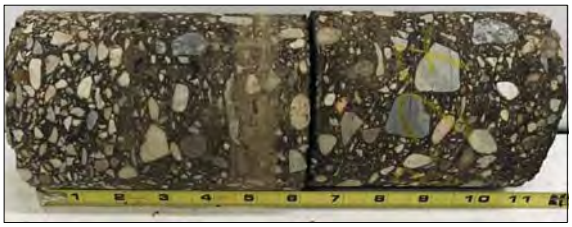
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	435	0		1					
15	510	75	5	1	15.0	48.1	Poor	Agg Base	48.1
15	590	80	5	1	18.1	44.8	Poor	Agg Base	
6	640	50	8	1	20.1	27.2	Very Poor	Agg Base	
6	695	55	9	1	22.2	24.4	Very Poor	Agg Base	
6	765	70	12	1	25.0	18.6	Good	Subgrade	
10	865	100	10	1	28.9	22.2	Good	Subgrade	
7	930	65	9	1	31.5	24.1	Good	Subgrade	
8	1010	80	10	1	34.6	22.2	Good	Subgrade	26.3

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B28
LANE: South Bound
STATION: 86+55
OFFSET: 20' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2	2	Asphalt Pavement Wearing Course	Intact - Delaminated From Layer Below - Slight Voids
2	5.5	3.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	16	10.5	Crushed Limestone	(GP/Agg Base)
16	43	27	Sandy LEAN CLAY - Brown - Medium	(CL) At 30" Qp= 0.75 tsf, MC= 14%
43	60	17	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

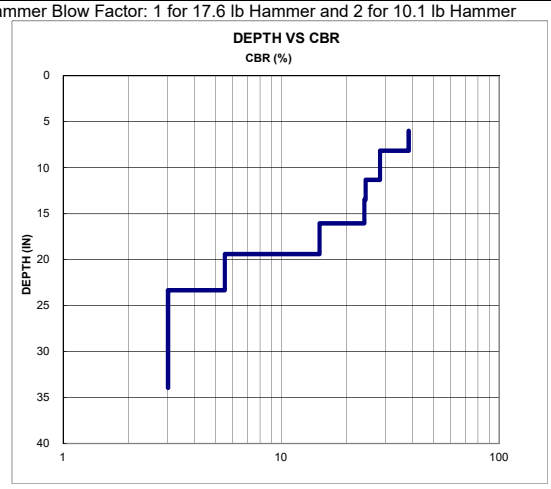
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
9	375	55	6	1	8.2	38.5	Poor	Agg Base	
10	455	80	8	1	11.3	28.4	Very Poor	Agg Base	
6	510	55	9	1	13.5	24.4	Very Poor	Agg Base	
7	575	65	9	1	16.0	24.1	Very Poor	Agg Base	28.6
6	660	85	14	1	19.4	15.0	Good	Subgrade	
4	760	100	25	1	23.3	5.5	Marginal	Subgrade	
4	895	135	34	1	28.6	3.0	Poor	Subgrade	
4	1030	135	34	1	34.0	3.0	Poor	Subgrade	5.8

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B29
LANE: North Bound
STATION: 88+60
OFFSET: 8' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.75	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.75	5.25	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.25	8	2.75	Asphalt Pavement Base Course	Partially Deteriorated - Moderate Voids
8	31	23	Crushed Limestone	(GP/Agg Base)
31	43	12	Fine to Medium SILTY SAND with Gravel - Brown - Moist	(SM)
43	60	17	Sandy LEAN CLAY - Trace Organics - Black to Brown - Stiff	(CL) At 45" Qp= 1.0 tsf, MC= 14%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

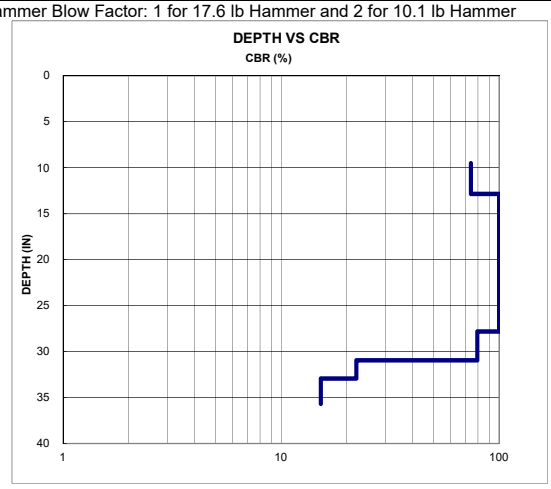
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 9.5 inches

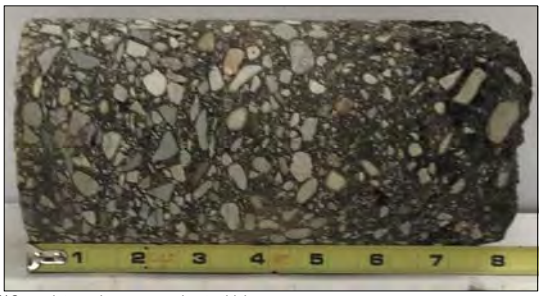
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	375	0		1					
25	460	85	3	1	12.8	74.2	Marginal	Agg Base	
30	515	55	2	1	15.0	100.0	Good	Agg Base	
30	570	55	2	1	17.2	100.0	Good	Agg Base	
30	625	55	2	1	19.3	100.0	Good	Agg Base	
30	670	45	2	1	21.1	100.0	Good	Agg Base	
30	700	30	1	1	22.3	100.0	Good	Agg Base	
30	730	30	1	1	23.5	100.0	Good	Agg Base	
30	750	20	1	1	24.3	100.0	Good	Agg Base	
30	780	30	1	1	25.4	100.0	Good	Agg Base	
30	810	30	1	1	26.6	100.0	Good	Agg Base	
30	840	30	1	1	27.8	100.0	Good	Agg Base	
25	920	80	3	1	31.0	79.4	Marginal	Agg Base	92.9
5	970	50	10	1	32.9	22.2	Good	Subgrade	
5	1040	70	14	1	35.7	15.2	Good	Subgrade	18.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B30
LANE: South Bound
STATION: 90+13
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	3	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	6	3	Asphalt Pavement Leveling Course	Partially Deteriorated - Slight Voids
6	26	20	Pulverized Asphalt	(GP/Agg Base)
26	60	34	Sandy LEAN CLAY - Brown - Stiff	(CL) At 43" Qp= 1.25 tsf, MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

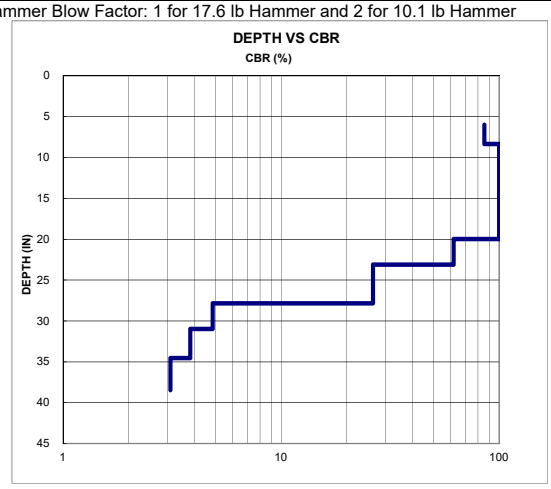
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	285	0		1					
20	345	60	3	1	8.4	85.3	Good	Agg Base	
40	385	40	1	1	9.9	100.0	Good	Agg Base	
40	430	45	1	1	11.7	100.0	Good	Agg Base	
40	470	40	1	1	13.3	100.0	Good	Agg Base	
40	495	25	1	1	14.3	100.0	Good	Agg Base	
40	510	15	0	1	14.9	100.0	Good	Agg Base	
40	530	20	1	1	15.6	100.0	Good	Agg Base	
40	550	20	1	1	16.4	100.0	Good	Agg Base	
40	580	30	1	1	17.6	100.0	Good	Agg Base	
40	640	60	2	1	20.0	100.0	Good	Agg Base	
20	720	80	4	1	23.1	61.8	Marginal	Agg Base	91
14	840	120	9	1	27.9	26.3	Good	Subgrade	
3	920	80	27	1	31.0	4.9	Poor	Subgrade	
3	1010	90	30	1	34.5	3.8	Poor	Subgrade	
3	1110	100	33	1	38.5	3.1	Poor	Subgrade	10.8

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B31
LANE: North Bound
STATION: 92+46
OFFSET: 9' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	3	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	5	2	Asphalt Pavement Leveling Course	Partially Deteriorated - Slight Voids
5	23	18	Pulverized Asphalt	(GP/Agg Base)
23	57	34	Fine to Medium SAND - Brown - Moist	(SP)
57	60	3	LEAN CLAY with Sand - Brown - Stiff	(CL) At 57" Qp= 1.0 tsf, MC= 20%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

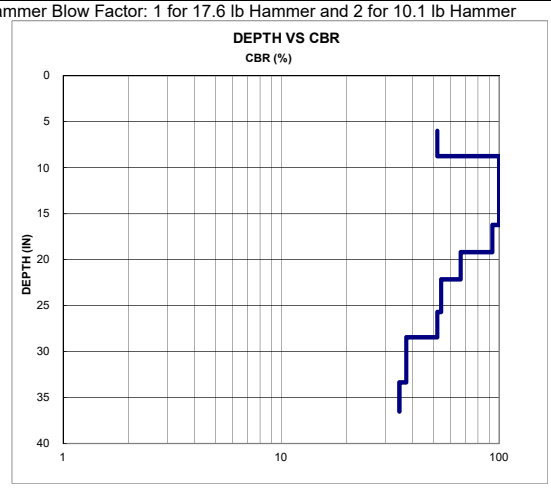
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	260	0		1					
15	330	70	5	1	8.8	52.0	Poor	Agg Base	
30	390	60	2	1	11.1	100.0	Good	Agg Base	
30	460	70	2	1	13.9	100.0	Good	Agg Base	
30	520	60	2	1	16.2	100.0	Good	Agg Base	
27	595	75	3	1	19.2	93.0	Good	Agg Base	
20	670	75	4	1	22.1	66.4	Marginal	Agg Base	84.4
20	760	90	5	1	25.7	54.2	Good	Subgrade	
15	830	70	5	1	28.4	52.0	Good	Subgrade	
20	955	125	6	1	33.4	37.5	Good	Subgrade	
12	1035	80	7	1	36.5	34.9	Good	Subgrade	43.8

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B32
LANE: South Bound
STATION: 94+55
OFFSET: 7' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	6	3	Asphalt Pavement Leveling Course	Partially Deteriorated - Moderate Voids
6	23	17	Crushed Limestone	(GP/Agg Base)
23	45	22	LEAN CLAY with Sand - Brown - Stiff	(CL) At 32" Qp= 1.75 tsf, MC= 17%
45	60	15	Fine to Coarse SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

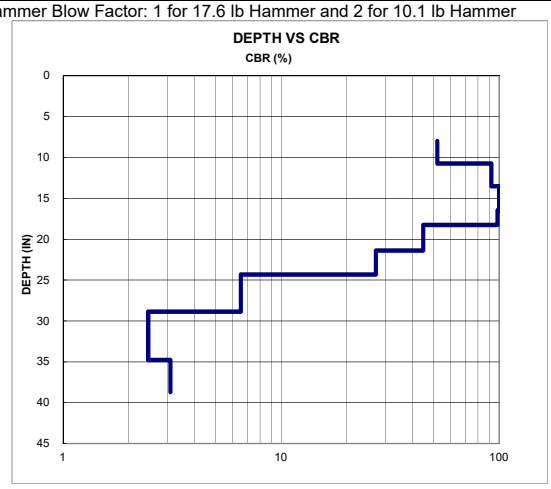
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 8 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	330	0		1					
15	400	70	5	1	10.8	52.0	Poor	Agg Base	
25	470	70	3	1	13.5	92.2	Good	Agg Base	
30	545	75	3	1	16.5	100.0	Good	Agg Base	
17	590	45	3	1	18.2	98.1	Good	Agg Base	
15	670	80	5	1	21.4	44.8	Poor	Agg Base	
9	745	75	8	1	24.3	27.2	Very Poor	Agg Base	66.6
5	860	115	23	1	28.9	6.5	Marginal	Subgrade	
4	1010	150	38	1	34.8	2.5	Very Poor	Subgrade	
3	1110	100	33	1	38.7	3.1	Poor	Subgrade	3.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B33
LANE: North Bound
STATION: 96+56
OFFSET: 6' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.75	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.75	5.5	2.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	8.5	3	Asphalt Pavement Base Course	Partially Deteriorated - Many Voids
8.5	21	12.5	Crushed Limestone with Pulverized Asphalt	(GP/Agg Base)
21	60	39	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

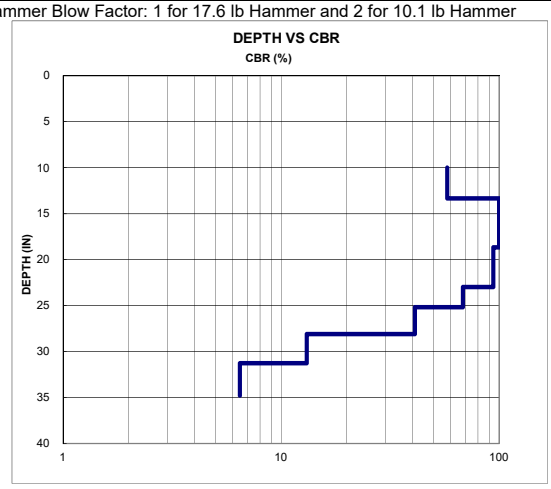
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10 inches

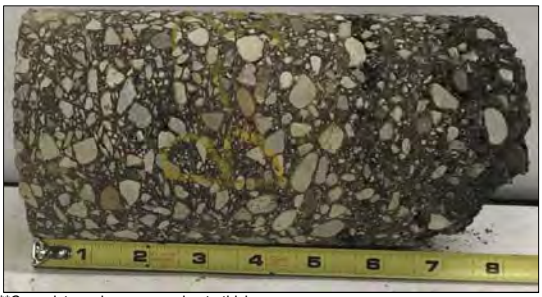
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	370	0		1					
20	455	85	4	1	13.3	57.8	Poor	Agg Base	
30	520	65	2	1	15.9	100.0	Good	Agg Base	
35	590	70	2	1	18.7	100.0	Good	Agg Base	
40	700	110	3	1	23.0	94.0	Good	Agg Base	87.1
15	755	55	4	1	25.2	68.1	Good	Subgrade	
13	830	75	6	1	28.1	41.0	Good	Subgrade	
5	910	80	16	1	31.3	13.1	Good	Subgrade	
3	1000	90	30	1	34.8	6.5	Marginal	Subgrade	28.2

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B34
LANE: South Bound
STATION: 98+39
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	2.75	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.75	5	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
5	7	2	Asphalt Pavement Base Course	Partially Deteriorated - Moderate Voids
7	30	23	Pulverized Asphalt	(GP/Agg Base)
30	44	14	LEAN CLAY with Sand - Gray - Stiff	(CL) At 36" Qp= 1.75 tsf, MC= 9%
44	54	10	PEAT - Black - Moist	(PT) At 48" MC= 80%
54	60	6	ORGANIC CLAY - Black to Gray - Stiff	(OH) At 56" Qp= 1.5 tsf, MC= 31%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

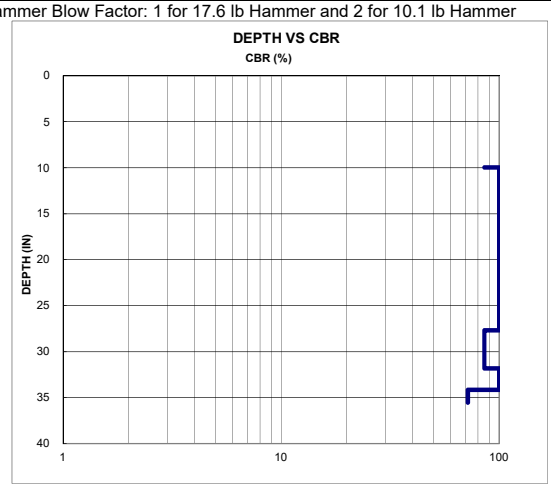
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

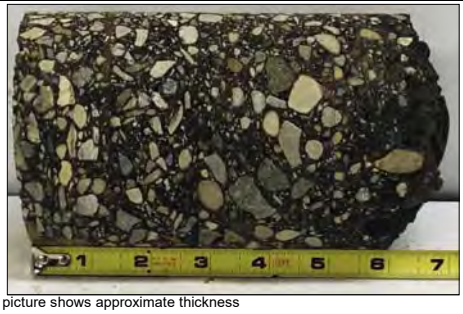
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	300	0		1					
25	375	75	3	1	10.0	85.3	Good	Agg Base	
40	445	70	2	1	12.7	100.0	Good	Agg Base	
40	500	55	1	1	14.9	100.0	Good	Agg Base	
40	570	70	2	1	17.6	100.0	Good	Agg Base	
40	645	75	2	1	20.6	100.0	Good	Agg Base	
40	725	80	2	1	23.7	100.0	Good	Agg Base	
40	825	100	3	1	27.7	100.0	Good	Agg Base	94.7
35	930	105	3	1	31.8	85.3	Good	Subgrade	
36	990	60	2	1	34.2	100.0	Good	Subgrade	
10	1025	35	4	1	35.5	71.8	Good	Subgrade	87.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B35
LANE: North Bound
STATION: 101+43
OFFSET: 10' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3	5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
5	31	26	Crushed Limestone with Pulverized Asphalt	(GP/Agg Base)
31	46	15	Sandy LEAN CLAY - Occasional - Asphalt Layer - Brown to Gray - Medium	(CL) At 32" Qp= 0.75 tsf, MC= 8%
46	60	14	LEAN CLAY with Sand - Gray - Very Stiff	(CL) At 47" Qp= 2.5 tsf, MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

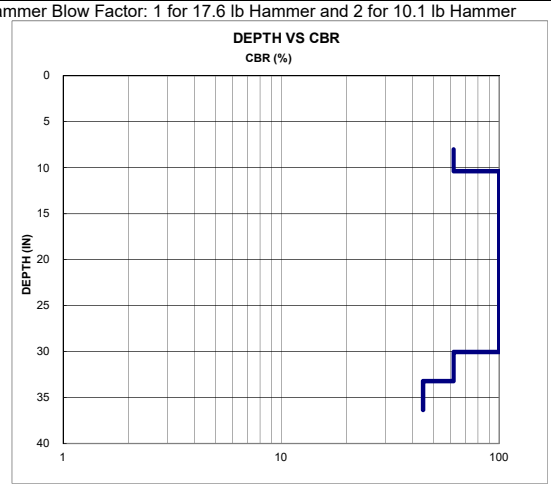
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 8 inches

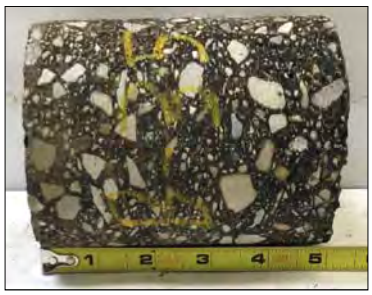
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	320	0		1					
15	380	60	4	1	10.4	61.8	Marginal	Agg Base	
35	460	80	2	1	13.5	100.0	Good	Agg Base	
35	550	90	3	1	17.1	100.0	Good	Agg Base	
30	620	70	2	1	19.8	100.0	Good	Agg Base	
40	700	80	2	1	23.0	100.0	Good	Agg Base	
40	780	80	2	1	26.1	100.0	Good	Agg Base	
40	880	100	3	1	30.0	100.0	Good	Agg Base	95.9
20	960	80	4	1	33.2	61.8	Good	Subgrade	
15	1040	80	5	1	36.3	44.8	Good	Subgrade	53.3

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B36
LANE: South Bound
STATION: 102+56
OFFSET: 21' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1	1	Asphalt Pavement Wearing Course	Intact - Slight Voids
1	2.5	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	4.75	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
4.75	26	21.25	Crushed Limestone	(GP/Agg Base)
26	60	34	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

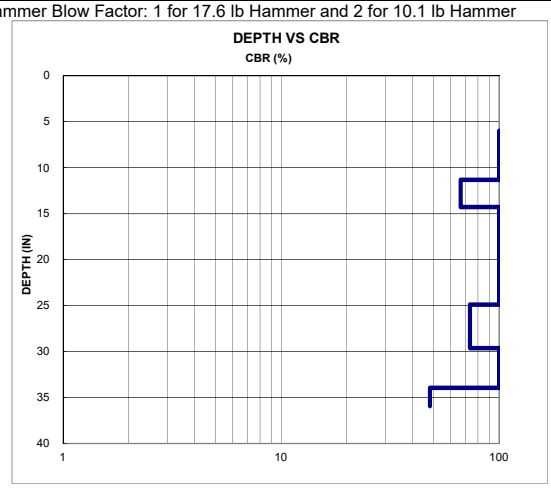
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	280	0		1					
25	345	65	3	1	8.6	100.0	Good	Agg Base	
30	415	70	2	1	11.3	100.0	Good	Agg Base	
20	490	75	4	1	14.3	66.4	Marginal	Agg Base	
30	545	55	2	1	16.4	100.0	Good	Agg Base	
40	595	50	1	1	18.4	100.0	Good	Agg Base	
40	660	65	2	1	21.0	100.0	Good	Agg Base	
40	760	100	3	1	24.9	100.0	Good	Agg Base	94.8
35	880	120	3	1	29.6	73.5	Good	Subgrade	
45	990	110	2	1	34.0	100.0	Good	Subgrade	
10	1040	50	5	1	35.9	48.1	Good	Subgrade	79.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/1/18
BY: MR/JC

TEST HOLE: B37
LANE: North Bound
STATION: 103+77
OFFSET: 32' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.5	3.5	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	21	15.5	Crushed Limestone	(GP/Agg Base)
21	38	17	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
38	51	13	Sandy LEAN CLAY with Occasional Sand Layers - Gray - Medium	(CL) At 38" Qp= 0.75 tsf, MC= 14%
51	60	9	LEAN CLAY with Sand - Gray - Hard	(CL) At 52" Qp= 4.5+ tsf, MC= 11%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

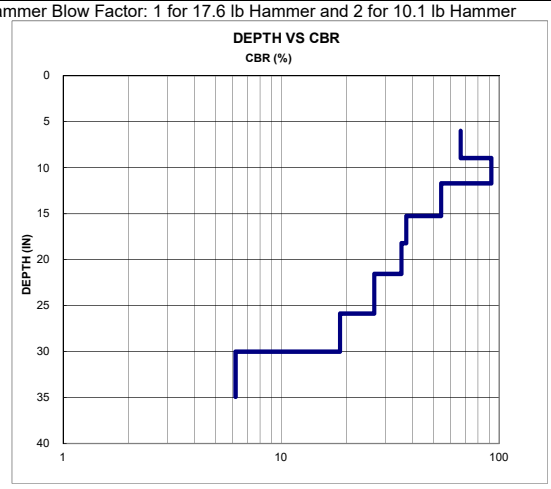
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

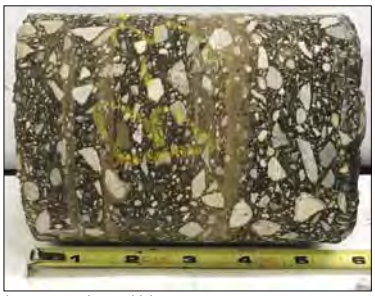
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	285	0		1					
20	360	75	4	1	9.0	66.4	Marginal	Agg Base	
25	430	70	3	1	11.7	92.2	Good	Agg Base	
20	520	90	5	1	15.3	54.2	Poor	Agg Base	
12	595	75	6	1	18.2	37.5	Poor	Agg Base	
13	680	85	7	1	21.6	35.6	Poor	Agg Base	56.1
13	790	110	8	1	25.9	26.7	Good	Subgrade	
9	895	105	12	1	30.0	18.6	Good	Subgrade	
4	1020	125	31	1	34.9	6.2	Marginal	Subgrade	16.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

TEST HOLE: B38
LANE: South Bound right turn lane
STATION: 106+61
OFFSET: 28' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.5	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	17	11.5	Crushed Limestone	(GP/Agg Base)
17	60	43	Fine to Coarse SAND with Gravel - Brown to Gray - Moist	(SP)
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

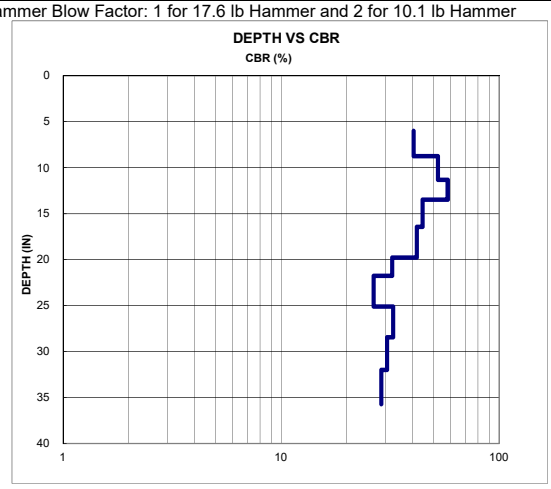
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

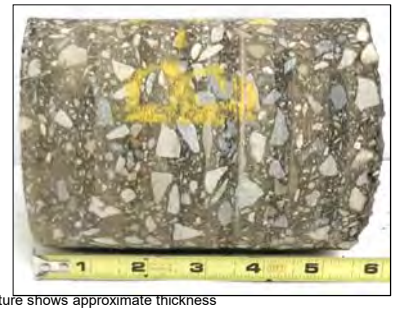
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	290	0		1					
12	360	70	6	1	8.8	40.5	Poor	Agg Base	
14	425	65	5	1	11.3	52.3	Poor	Agg Base	
13	480	55	4	1	13.5	58.0	Poor	Agg Base	
14	555	75	5	1	16.4	44.6	Poor	Agg Base	48.2
15	640	85	6	1	19.8	41.8	Good	Subgrade	
7	690	50	7	1	21.7	32.3	Good	Subgrade	
10	775	85	9	1	25.1	26.6	Good	Subgrade	
12	860	85	7	1	28.4	32.6	Good	Subgrade	
12	950	90	8	1	32.0	30.6	Good	Subgrade	
12	1045	95	8	1	35.7	28.8	Good	Subgrade	32

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

TEST HOLE: B39
LANE: Center Lane
STATION: 107+80
OFFSET: 5' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.25	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	5.25	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.25	34	28.75	Crushed Stone with Pulverized Asphalt	(GP/Agg Base)
34	57	23	Sandy LEAN CLAY - Brown to Gray - Medium	(CL) At 33" Tv= 0.5 tsf, MC= 8%
57	60	3	PEAT - Black - Moist	(PT) At 58" MC= 113%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

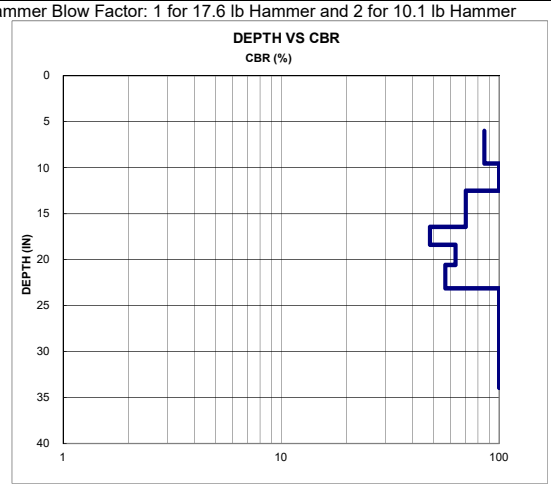
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

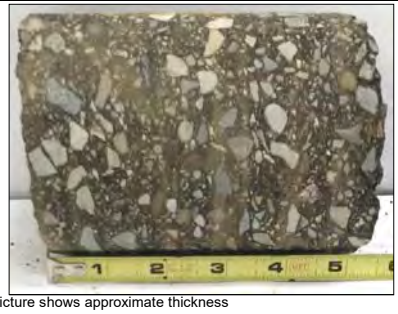
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	290	0		1					
30	380	90	3	1	9.5	85.3	Good	Agg Base	
32	455	75	2	1	12.5	100.0	Good	Agg Base	
28	555	100	4	1	16.4	70.2	Marginal	Agg Base	
10	605	50	5	1	18.4	48.1	Poor	Agg Base	
14	660	55	4	1	20.6	63.1	Marginal	Agg Base	
15	725	65	4	1	23.1	56.5	Poor	Agg Base	
42	800	75	2	1	26.1	100.0	Good	Agg Base	
27	860	60	2	1	28.4	100.0	Good	Agg Base	
30	900	40	1	1	30.0	100.0	Good	Agg Base	
25	950	50	2	1	32.0	100.0	Good	Agg Base	
25	1000	50	2	1	34.0	100.0	Good	Agg Base	83.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

TEST HOLE: B40
LANE: Center Lane
STATION: 108+34
OFFSET: 1' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	3.5	2.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	21	15.5	Crushed Limestone	(GP/Agg Base)
21	55	34	Sandy LEAN CLAY - Brown - Stiff	(CL) At 24" Qp= 1.5 tsf, MC= 15%
55	60	5	LEAN CLAY with Sand - Brown to Gray - Very Stiff	(CL) At 56" Qp= 3.25 tsf, MC= 15%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

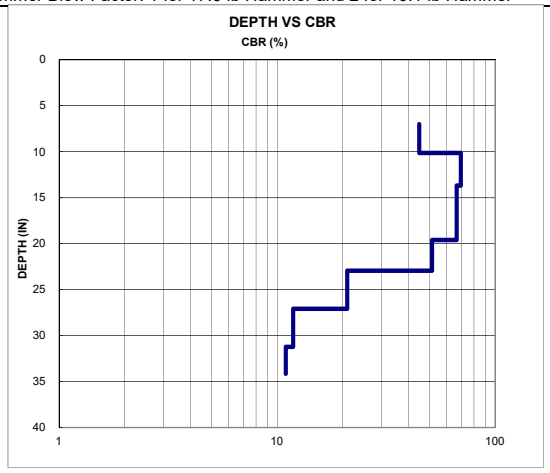
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

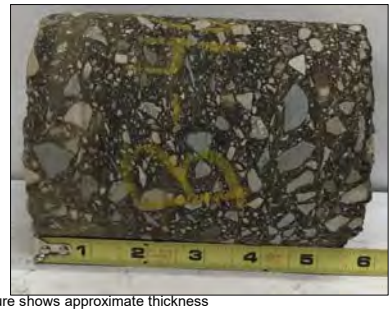
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
15	390	80	5	1	10.1	44.8	Poor	Agg Base	
25	480	90	4	1	13.7	69.6	Marginal	Agg Base	
20	555	75	4	1	16.6	66.4	Marginal	Agg Base	
20	630	75	4	1	19.6	66.4	Marginal	Agg Base	
18	715	85	5	1	22.9	51.3	Poor	Agg Base	59.7
10	820	105	11	1	27.1	21.0	Good	Subgrade	
6	925	105	18	1	31.2	11.8	Good	Subgrade	
4	1000	75	19	1	34.2	11.0	Good	Subgrade	15

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B42
LANE: South Bound
STATION: 110+51
OFFSET: 12' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.25	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	5.25	2	Asphalt Pavement Leveling Course	Intact - Moderate Voids
5.25	17	11.75	Natural Limestone	(GP/Agg Base)
17	60	43	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 24" Qp= 2.75 tsf; MC= 18% At 48" Qp= 3.5 tsf; MC= 12%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

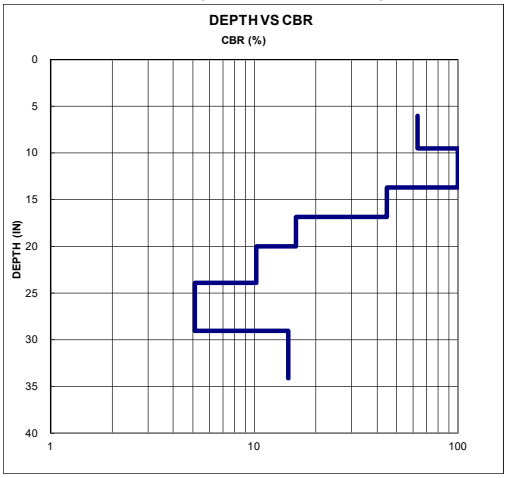
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	295	0		1					
23	385	90	4	1	9.5	63.4	Marginal	Agg Base	
30	440	55	2	1	11.7	100.0	Good	Agg Base	
20	490	50	3	1	13.7	100.0	Good	Agg Base	
15	570	80	5	1	16.8	44.8	Poor	Agg Base	71.9
6	650	80	13	1	20.0	16.0	Good	Subgrade	
5	750	100	20	1	23.9	10.2	Good	Subgrade	
5	880	130	26	1	29.0	5.1	Marginal	Subgrade	
9	1010	130	14	1	34.1	14.7	Good	Subgrade	11.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B43
LANE: North Bound
STATION: 112+01
OFFSET: 13' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	1	1	Asphalt Pavement Wearing Course	Intact - Slight Voids
1	2	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2	3.75	1.75	Asphalt Pavement Leveling Course	Partially Deteriorated - Moderate Voids
3.75	19.5	15.75	Natural Limestone	(GP/Agg Base)
19.5	41	21.5	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
41	60	19	LEAN CLAY with Sand - Gray - Very Stiff	(CL) At 44" Qp= 2.75 tsf; MC= 23%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

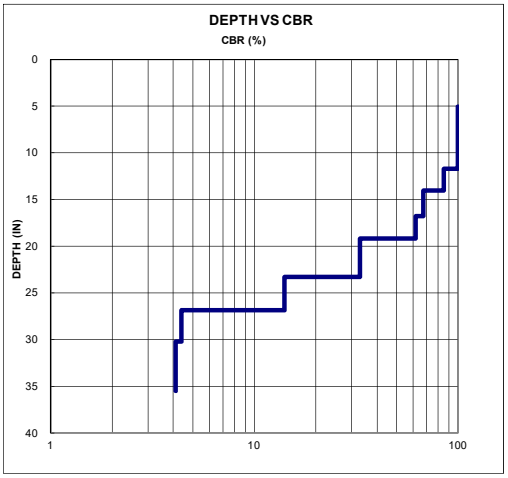
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 5 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	265	0		1					
40	345	80	2	1	8.1	100.0	Good	Agg Base	
45	435	90	2	1	11.7	100.0	Good	Agg Base	
20	495	60	3	1	14.1	85.3	Good	Agg Base	
19	565	70	4	1	16.8	67.8	Marginal	Agg Base	
15	625	60	4	1	19.2	61.8	Marginal	Agg Base	84.9
15	730	105	7	1	23.3	33.0	Good	Subgrade	
6	820	90	15	1	26.9	14.1	Good	Subgrade	
2	905	85	43	1	30.2	4.4	Poor	Subgrade	
3	1040	135	45	1	35.5	4.1	Poor	Subgrade	13.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B44
LANE: South Bound
STATION: 112+74
OFFSET: 13' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Delaminated From Layer Below - Slight Voids
1.5	2.75	1.25	Asphalt Pavement Leveling Course	Intact - Delaminated From Layer Below - Slight Voids
2.75	4	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
4	6.5	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
6.5	24	17.5	Crushed Limestone	(GP/Agg Base)
24	40	16	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
40	60	20	LEAN CLAY with Sand - Gray - Very Stiff	(CL) At 40" Qp= 2.0 tsf; MC= 24%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

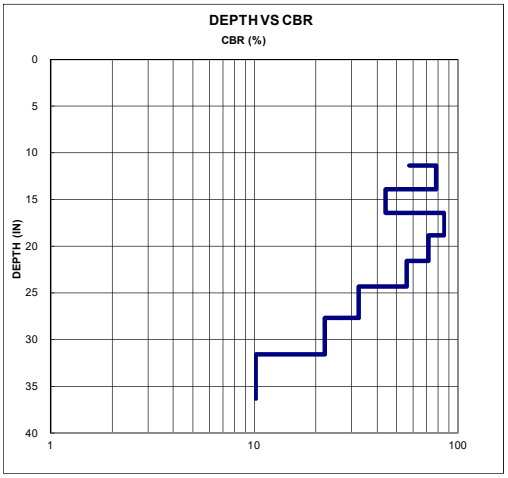
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 8 inches

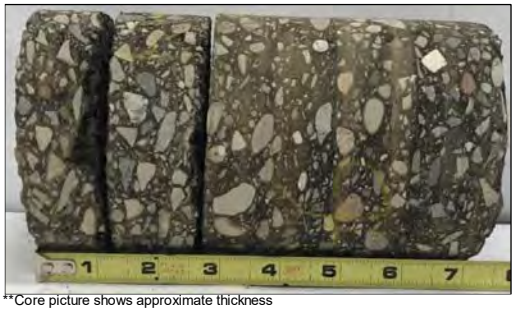
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	335	0		1					
20	420	85	4	1	11.3	57.8	Poor	Agg Base	
20	485	65	3	1	13.9	78.0	Marginal	Agg Base	
12	550	65	5	1	16.5	44.0	Poor	Agg Base	
20	610	60	3	1	18.8	85.3	Good	Agg Base	
20	680	70	4	1	21.6	71.8	Marginal	Agg Base	
16	750	70	4	1	24.3	55.9	Poor	Agg Base	64.8
12	835	85	7	1	27.7	32.6	Good	Subgrade	
10	935	100	10	1	31.6	22.2	Good	Subgrade	
6	1055	120	20	1	36.3	10.2	Good	Subgrade	20.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B45
LANE: Center Lane
STATION: 116+64
OFFSET: 1' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Vertical Crack Through - Delaminated From Layer Below - Moderate Voids
1.5	3.25	1.75	Asphalt Pavement Leveling Course	Intact - Moderate Voids
3.25	5.5	2.25	Asphalt Pavement Leveling Course	Partially Deteriorated - Moderate Voids
5.5	21.5	16	Natural Limestone	(GP/Agg Base)
21.5	60	38.5	LEAN CLAY with Sand - Brown/Gray - Very Stiff	(CL) At 22" Qp= 3.5 tsf; MC= 14% At 50" Qp= 2.5 tsf; MC= 19%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

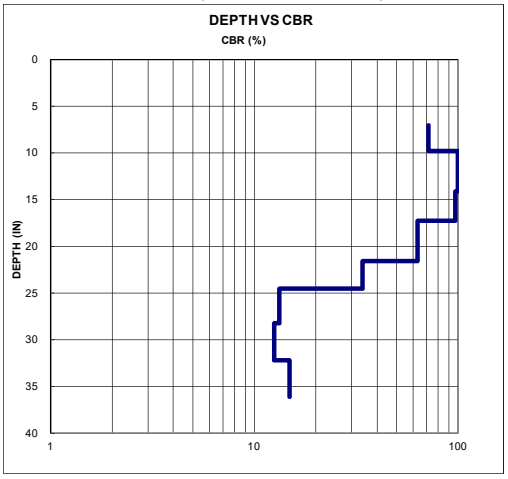
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	310	0		1					
20	380	70	4	1	9.8	71.8	Marginal	Agg Base	
25	435	55	2	1	11.9	100.0	Good	Agg Base	
30	490	55	2	1	14.1	100.0	Good	Agg Base	
30	570	80	3	1	17.2	97.3	Good	Agg Base	
28	680	110	4	1	21.6	63.1	Marginal	Agg Base	83.1
11	755	75	7	1	24.5	34.0	Good	Subgrade	
6	850	95	16	1	28.3	13.2	Good	Subgrade	
6	950	100	17	1	32.2	12.5	Good	Subgrade	
7	1050	100	14	1	36.1	14.9	Good	Subgrade	17.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B46
LANE: South Bound Right Turn Lane
STATION: 118+36
OFFSET: 28' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2	2	Asphalt Pavement Wearing Course	Intact - Slight Voids
2	3.25	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	4.75	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
4.75	17	12.25	Crushed Limestone	(GP/Agg Base)
17	60	43	LEAN CLAY with Sand - Brown - Very Stiff to Hard	(CL) At 20" Qp= 2.5 tsf; MC= 14% At 50" Qp= 4.0 tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: 24"

NOTES:

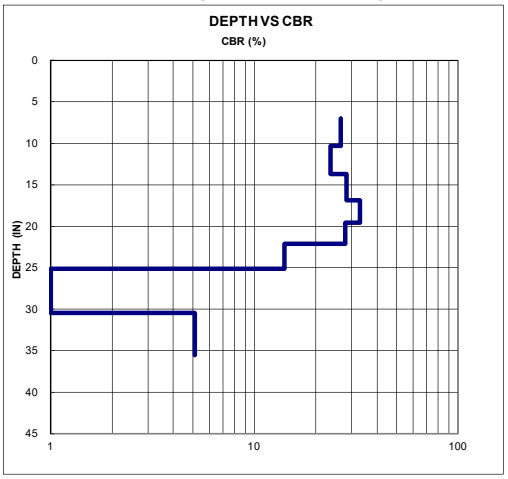
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 7 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	300	0		1					
10	385	85	9	1	10.3	26.6	Very Poor	Agg Base	
9	470	85	9	1	13.7	23.6	Very Poor	Agg Base	
10	550	80	8	1	16.8	28.4	Very Poor	Agg Base	26.2
10	620	70	7	1	19.6	33.0	Good	Subgrade	
8	685	65	8	1	22.2	27.9	Good	Subgrade	
5	760	75	15	1	25.1	14.1	Good	Subgrade	
2	895	135	68	1	30.4	0.8	Very Poor	Subgrade	
5	1025	130	26	1	35.5	5.1	Marginal	Subgrade	12.5

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B47
LANE: North Bound
STATION: 120+79
OFFSET: 13' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.25	1.25	Asphalt Pavement Wearing Course	Slightly Deteriorated - Moderate Voids
1.25	3.5	2.25	Asphalt Pavement Leveling Course	Slightly Deteriorated - Moderate Voids
3.5	5.25	1.75	Asphalt Pavement Leveling Course	Partially Deteriorated - Moderate Voids
5.25	19.5	14.25	Natural Limestone	(GP/Agg Base)
19.5	60	40.5	LEAN CLAY with Sand - Brown to Gray - Very Stiff	(CL) At 22" Qp= 2.0 tsf; MC= 20% At 49" Qp= 3.0 tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

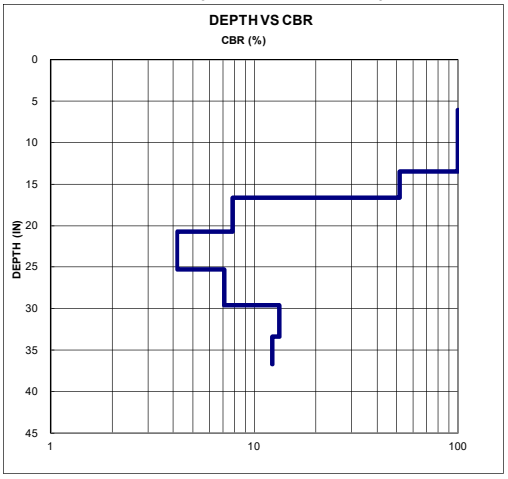
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	280	0		1					
40	370	90	2	1	9.5	100.0	Good	Agg Base	
46	470	100	2	1	13.5	100.0	Good	Agg Base	
17	550	80	5	1	16.6	51.5	Poor	Agg Base	85.6
5	655	105	21	1	20.8	7.8	Marginal	Subgrade	
4	770	115	29	1	25.3	4.2	Poor	Subgrade	
5	880	110	22	1	29.6	7.1	Marginal	Subgrade	
6	975	95	16	1	33.4	13.2	Good	Subgrade	
5	1060	85	17	1	36.7	12.2	Good	Subgrade	8.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B48
LANE: South Bound
STATION: 121+72
OFFSET: 14' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.25	1.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.25	7.5	4.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
7.5	10	2.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
10	17	7	Natural Limestone	(GP/Agg Base)
17	28	11	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
28	48	20	LEAN CLAY with Sand - Trace Organics - Black to Gray - Stiff	(CL) At 29" Qp= 1.5 tsf; MC= 19%
48	60	12	Sandy LEAN CLAY - Gray - Stiff	(CL) At 51" Qp= 1.0 tsf; MC= 13%

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:
End of Test Hole at 60" Below Ground Surface

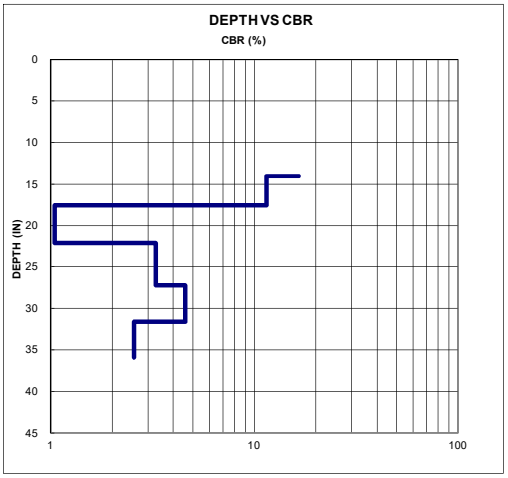
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 11.5 inches

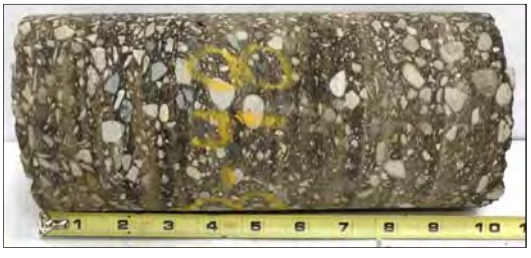
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	430	0		1					
5	495	65	13	1	14.1	16.5	Very Poor	Agg Base	
5	585	90	18	1	17.6	11.5	Very Poor	Agg Base	13.6
2	700	115	58	1	22.1	1.0	Very Poor	Subgrade	
4	830	130	33	1	27.2	3.3	Poor	Subgrade	
4	940	110	28	1	31.6	4.6	Poor	Subgrade	
3	1050	110	37	1	35.9	2.6	Very Poor	Subgrade	2.9

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B49
LANE: North Bound
STATION: 122+65
OFFSET: 15' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.75	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.75	6	3.25	Asphalt Pavement Leveling Course	Intact - Delaminated From Layer Below - Slight Voids
6	9.5	3.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
9.5	16	6.5	Natural Limestone	(GP/Agg Base)
16	37	21	LEAN CLAY with Sand - Trace Organics - Black to Brown - Stiff	(CL) At 20" Qp= 1.75 tsf; MC= 18%
37	60	23	LEAN CLAY with Sand - Brown to Gray - Very Stiff	(CL) At 38" Qp= 2.5 tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

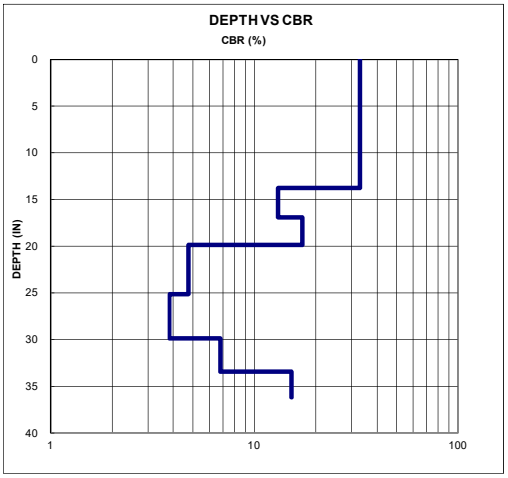
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 11 inches

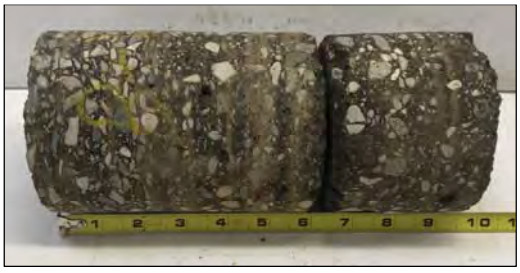
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	410	0		1					
10	480	70	7	1	13.8	33.0	Poor	Agg Base	
5	560	80	16	1	16.9	13.1	Very Poor	Agg Base	22.4
6	635	75	13	1	19.9	17.3	Good	Subgrade	
5	770	135	27	1	25.2	4.7	Poor	Subgrade	
4	890	120	30	1	29.9	3.8	Poor	Subgrade	
4	980	90	23	1	33.4	6.8	Marginal	Subgrade	
5	1050	70	14	1	36.2	15.2	Good	Subgrade	8.3

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B50
LANE: South Bound
STATION: 124+04
OFFSET: 8' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	2.5	1	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	5.25	2.75	Asphalt Pavement Leveling Course	Intact - Delaminated From Layer Below - Slight Voids
5.25	8	2.75	Asphalt Pavement Leveling Course	Intact - Slight Voids
8	10	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
10	20	10	Natural Limestone	(GP/Agg Base)
20	48	28	SILTY CLAY - Trace Organics - Black to Gray - Stiff	(CL-ML) At 26" Qp= 1.0 tsf; MC= 18%
48	60	12	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 49" Qp= 2.25 tsf; MC= 13%

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:
End of Test Hole at 60" Below Ground Surface

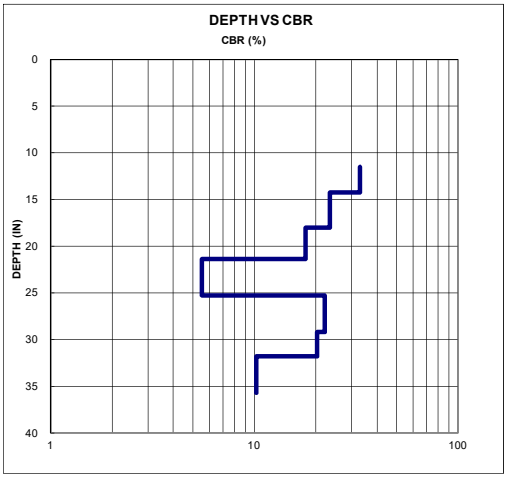
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 11.5 inches

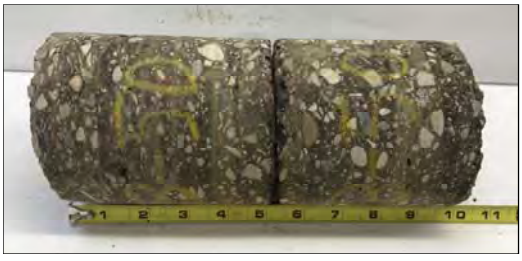
No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	435	0		1					
10	505	70	7	1	14.3	33.0	Poor	Agg Base	
10	600	95	10	1	18.0	23.5	Very Poor	Agg Base	27.5
7	685	85	12	1	21.3	17.8	Good	Subgrade	
4	785	100	25	1	25.3	5.5	Marginal	Subgrade	
10	885	100	10	1	29.2	22.2	Good	Subgrade	
6	950	65	11	1	31.8	20.3	Good	Subgrade	
5	1050	100	20	1	35.7	10.2	Good	Subgrade	14.7

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B51
LANE: North Bound
STATION: 125+77
OFFSET: 8' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.5	1.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.5	3.5	2	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	5.25	1.75	Asphalt Pavement Leveling Course	Horizontal Crack Through - Slight Voids
5.25	8.5	3.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
8.5	17.5	9	Natural Limestone	(GP/Agg Base)
17.5	51	33.5	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
51	60	9	LEAN CLAY with Sand - Trace Organics - Occasional Sand Seams - Black to Gray - Stiff	(CL) At 52" Qp= 1.0 tsf; MC= 27%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

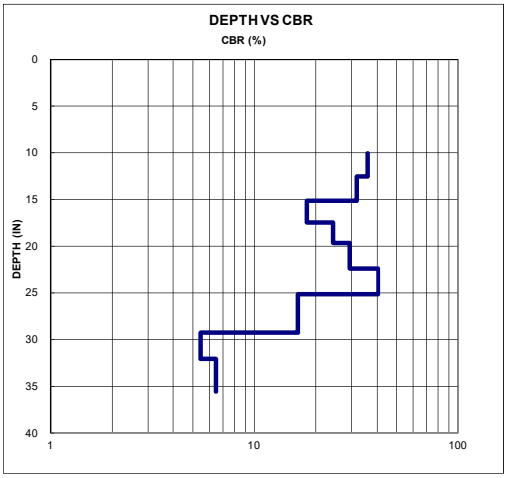
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	390	0		1					
10	455	65	7	1	12.6	35.9	Poor	Agg Base	
9	520	65	7	1	15.1	31.9	Poor	Agg Base	
5	580	60	12	1	17.5	18.1	Very Poor	Agg Base	28.9
6	635	55	9	1	19.6	24.4	Good	Subgrade	
9	705	70	8	1	22.4	29.4	Good	Subgrade	
12	775	70	6	1	25.2	40.5	Good	Subgrade	
8	880	105	13	1	29.3	16.3	Good	Subgrade	
2	950	70	35	1	32.0	5.4	Marginal	Subgrade	
3	1040	90	30	1	35.6	6.5	Marginal	Subgrade	19.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B52
LANE: Center Lane
STATION: 128+23
OFFSET: 0' from Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2	2	Asphalt Pavement Wearing Course	Intact - Moderate Voids
2	3.5	1.5	Asphalt Pavement Leveling Course	Intact - Slight Voids
3.5	27	23.5	Natural Limestone	(GP/Agg Base)
27	43	16	Sandy LEAN CLAY - Trace Organics - Brown to Gray - Very Stiff	(CL) At 22" Qp= 2.0 tsf; MC= 10%
43	60	17	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 44" Qp= 2.5 tsf; MC= 18%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface Upon Completion: Not Encountered

NOTES:

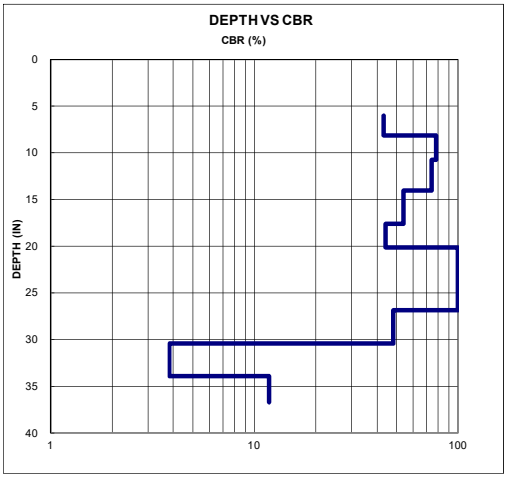
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 6 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	260	0		1					
10	315	55	6	1	8.2	43.3	Poor	Agg Base	
20	380	65	3	1	10.7	78.0	Marginal	Agg Base	
25	465	85	3	1	14.1	74.2	Marginal	Agg Base	
20	555	90	5	1	17.6	54.2	Poor	Agg Base	
12	620	65	5	1	20.2	44.0	Poor	Agg Base	
21	660	40	2	1	21.7	100.0	Good	Agg Base	
25	725	65	3	1	24.3	100.0	Good	Agg Base	
25	790	65	3	1	26.9	100.0	Good	Agg Base	72.6
18	880	90	5	1	30.4	48.1	Good	Subgrade	
3	970	90	30	1	34.0	3.8	Poor	Subgrade	
4	1040	70	18	1	36.7	11.8	Good	Subgrade	22

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B53
LANE: North Bound Right Turn Lane
STATION: 129+95
OFFSET: 25' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2.5	2.5	Asphalt Pavement Wearing Course	Intact - Slight Voids
2.5	5.75	3.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.75	9	3.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
9	18	9	Crushed Limestone	(GP/Agg Base)
18	51	33	Fine to Coarse SAND with Gravel - Gray - Moist	(SP)
51	60	9	LEAN CLAY with Sand - Gray - Very Stiff	(CL) At 52" Qp= 2.25 tsf; MC= 16%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

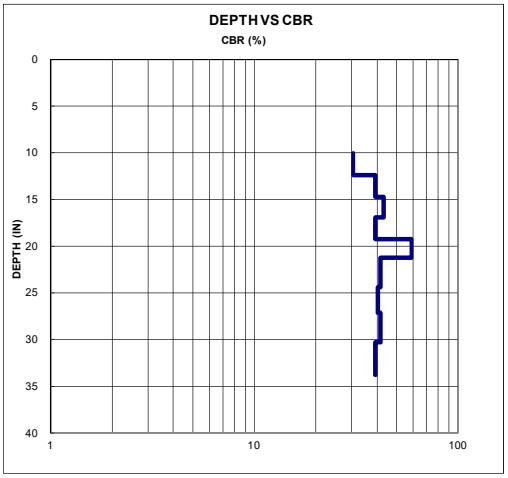
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 10 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	415	0		1					
8	475	60	8	1	12.4	30.6	Poor	Agg Base	
10	535	60	6	1	14.7	39.3	Poor	Agg Base	
10	590	55	6	1	16.9	43.3	Poor	Agg Base	37.5
10	650	60	6	1	19.3	39.3	Good	Subgrade	
12	700	50	4	1	21.2	59.0	Good	Subgrade	
14	780	80	6	1	24.4	41.5	Good	Subgrade	
12	850	70	6	1	27.1	40.5	Good	Subgrade	
14	930	80	6	1	30.3	41.5	Good	Subgrade	
15	1020	90	6	1	33.8	39.3	Good	Subgrade	42.6

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/2/18
BY: MR/JC

PROBE/CORE: B54
LANE: South Bound Right Turn Lane
STATION: 132+21
OFFSET: 28' Left of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in.		Layer Thickness, in.	Description	Comment
From	To			
0	2	2	Asphalt Pavement Wearing Course	Intact - Delaminated From Layer Below - Slight Voids
2	5.25	3.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.25	9.25	4	Asphalt Pavement Leveling Course	Intact - Slight Voids
9.25	27	17.75	Crushed Limestone	(GP/Agg Base)
27	36	9	Fine to Coarse SAND with Gravel - Gray - Moist	(SP)
36	42	6	LEAN CLAY with Sand - Gray - Stiff	(CL) At 38" Qp= 1.75 tsf; MC= 14%
42	49	7	Fine to Medium SAND with Gravel - Brown - Moist	(SP)
49	60	11	LEAN CLAY with Sand - Brown/Gray - Very Stiff	(CL) At 51" Qp= 2.75 tsf; MC= 18%

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:
End of Test Hole at 60" Below Ground Surface

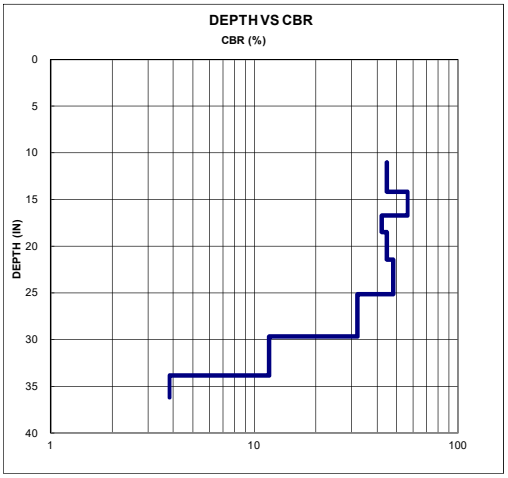
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 11 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	400	0		1					
15	480	80	5	1	14.1	44.8	Poor	Agg Base	
15	545	65	4	1	16.7	56.5	Poor	Agg Base	
8	590	45	6	1	18.5	42.2	Poor	Agg Base	
14	665	75	5	1	21.4	44.6	Poor	Agg Base	
19	760	95	5	1	25.2	48.1	Poor	Agg Base	47.4
16	875	115	7	1	29.7	32.1	Good	Subgrade	
6	980	105	18	1	33.8	11.8	Good	Subgrade	
2	1040	60	30	1	36.2	3.8	Poor	Subgrade	18.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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TEST HOLE LOG

PROJECT NAME: City of Novi - Beck Rd 2018
PROJECT NO.: 079555.00
LOCATION: Novi, MI
CLIENT: City of Novi
A/E: AECOM
DATE: 8/3/18
BY: MR/JC

PROBE/CORE: B55
LANE: Center Lane
STATION: 133+98
OFFSET: 5' Right of Center Line

PAVEMENT AND SUBSURFACE CONDITIONS

Layer, in. From	Layer, in. To	Layer Thickness, in.	Description	Comment
0	1.25	1.25	Asphalt Pavement Wearing Course	Intact - Slight Voids
1.25	2.5	1.25	Asphalt Pavement Leveling Course	Intact - Slight Voids
2.5	5.5	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
5.5	8.5	3	Asphalt Pavement Leveling Course	Intact - Slight Voids
8.5	28	19.5	Crushed Limestone	(GP/Agg Base)
28	60	32	LEAN CLAY with Sand - Brown - Very Stiff	(CL) At 30" Qp= 4.0 tsf; MC= 10% At 50" Qp= 3.0 tsf; MC= 13%
			End of Test Hole at 60" Below Ground Surface	

Depth to Groundwater From Ground Surface
Upon Completion: Not Encountered

NOTES:

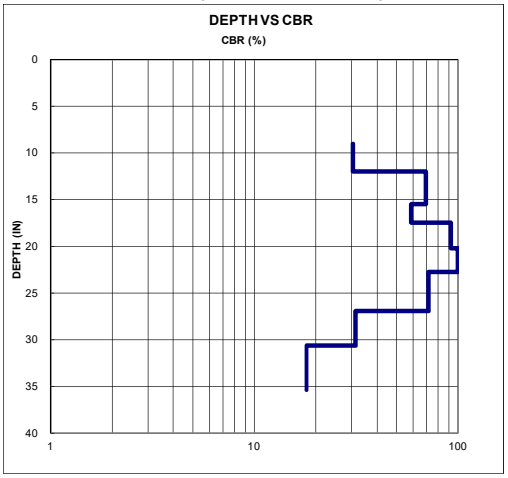
DCP TEST RESULTS

Depth to start of test from ex. ground surface: 9 inches

No. of Blows	Pen. (mm)	Blow Set (mm)	Pen./Blow (mm)	Blow Factor	Depth from Surface (inches)	CBR (%)	Comment	Soil Type	Average CBR (%)
0	350	0		1					
10	425	75	8	1	12.0	30.6	Poor	Agg Base	
25	515	90	4	1	15.5	69.6	Marginal	Agg Base	
12	565	50	4	1	17.5	59.0	Poor	Agg Base	
25	635	70	3	1	20.2	92.2	Good	Agg Base	
30	700	65	2	1	22.8	100.0	Good	Agg Base	
30	805	105	4	1	26.9	71.8	Marginal	Agg Base	70.3
13	900	95	7	1	30.7	31.5	Good	Subgrade	
10	1020	120	12	1	35.4	18.1	Good	Subgrade	24

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

*CBR breaklines are based on blow counts performed prior to sampling. Depths are approximate.



Support Conditions	CBR Range for Aggregate Base Materials (%)	CBR Range for Subgrade Soils (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3



**Core picture shows approximate thickness

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APPENDIX B

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

GENERAL COMMENTS

LABORATORY TESTING PROCEDURES

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org

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GENERAL COMMENTS

BASIS OF PAVEMENT EVALUATION REPORT

This report has been prepared in accordance with generally accepted pavement and geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the data obtained from the field exploration at the locations indicated in the report. Variations in the pavement system (surface course, aggregate base course, subbase) thickness and materials as well as soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the existing pavement system and actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of pavement and geotechnical engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF PAVEMENT/GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the pavement system or subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the evaluation and laboratory test results. If the selected contractor encounters conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and pavement construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

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LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the TEST HOLE logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the TEST HOLE logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

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January 25, 2019

Mr. Joseph Akers
City of Novi
Department of Public Services
Field Service Complex
26300 Lee BeGole Drive
Novi, MI 48375

Transmitted Via Email: *jakers@cityofnovi.org*

RE: Greenbelt Evaluation
Beck Road Rehabilitation – From 9 Mile Road to White Pines Drive and 10 Mile Road to approx. 2,900 Feet North of 11 Mile Road
Novi, Michigan
SME Project No. 079555.00

Dear Mr. Akers:

We have completed the additional field testing of the shoulder and green areas for Beck Road from 9 Mile Road to White Pines Drive and from 10 Mile Road to approximately 2,900 Feet East of 11 Mile Road. This report presents the results of our field sampling and laboratory testing.

UNDERSTANDING OF THE PROJECT

We understand that the City of Novi is considering the possibilities of widening Beck Road from 9 Mile Road to White Pines Drive and from 10 Mile Road to approximately 2,900 Feet East of 11 Mile Road. During this stretch, Beck Road is generally unconfined, i.e. no curb and gutter, with a three (3) foot to six (6) foot gravel shoulder running along both sides of the road. There is curb and gutter at the intersections of Beck Road and 9 Mile Road, 10 Mile road, and 11 Mile Road, but the curb and gutter does not extend more than twenty (20) feet north or south of the intersection.

FIELD EXPLORATION

SME conducted hand augers at thirty seven (37) locations within the green areas to the East and West of Beck road between 9 Mile Road and White Pines Drive, and from 10 Mile Road to approximately 2,900 Feet North of 11 Mile Road. Each boring was conducted to three (3) feet. A boring location diagram is attached to this report.

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LABORATORY TESTING

The laboratory testing program consisted of performing visual soil classification on recovered samples in accordance with ASTM D2488. The attached Laboratory Testing Procedures provides descriptions of the

laboratory tests. Following the laboratory testing, a group symbol was assigned to the various soil strata encountered based on the Unified Soil Classification System (USCS).

Upon completion of the laboratory testing, we prepared a table, which includes information on materials encountered, depth of topsoil layers, penetration resistances, moisture contents, and results of the laboratory testing. The table can be found below. We developed the soil descriptions included on the logs from both visual classification and the results of laboratory tests. Explanations of symbols and terms used on the logs are provided on the Boring Log Terminology sheet included in the attachments.

Soil samples, retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, soil samples are normally retained in our laboratory for 60 days and then disposed, unless we are instructed otherwise.

As stated previously, hand augers at each boring location were conducted to a depth of three (3) feet.

HAND AUGER RESULTS

Clayey topsoil was encountered to varying depths at all locations except HA28. A boring table is attached to this report with information on boring offsets, topsoil thickness, subgrade description, and moisture content and shear strength of encountered clays.

We appreciate the opportunity to provide you this report. If you have any questions, please do not hesitate to contact us.

Very truly yours,

SME

Kevin Bennett
Staff Engineer

Jason A. Schwartzenberger, PE
Vice President

Attachments: Boring Location Diagram
Boring Log Terminology
Boring Table
Important Information about Your Geotechnical Engineering Report
General Comments
Laboratory Test Procedures

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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

LEGEND

HAND AUGER LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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www.sme-usa.com

Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 9 MILE RD. TO WHITE PINES DR. NOVI, MI

Sheet Name

BORING LOCATION DIAGRAM

No.	Revision Date

Date	01/09/2019
CADD	MWR
Designer	JAS
Scale	1" = 400'
Project	079555.00
Figure No.	1

DRAWING NOTE: SCALE DEPICTED IS MEANT FOR 11" X 17" AND WILL SCALE INCORRECTLY IF PRINTED ON ANY OTHER SIZE MEDIA

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0' 400' 800'

GRAPHIC SCALE: 1" = 400'

LEGEND

HAND AUGER LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 10 MILE RD. TO CIDER MILL DR. NOVI, MI

Sheet Name

BORING LOCATION DIAGRAM

No.	Revision Date

Date 01/09/2019

CADD MWR

Designer JAS

Scale 1" = 400'

Project 079555.00

Figure No. 2

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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

LEGEND

HAND AUGER LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM CIDER MILL DR. TO 11 MILE RD. NOVI, MI

Sheet Name

BORING LOCATION DIAGRAM

No.	Revision Date

Date	01/09/2019
CADD	MWR
Designer	JAS
Scale	1" = 400'
Project	079555.00
Figure No.	3

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NORTH

0' 400' 800'

GRAPHIC SCALE: 1" = 400'

LEGEND

HAND AUGER LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO.

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Project

BECK ROAD PAVEMENT EVALUATION

Project Location

BECK RD. FROM 11 MILE RD. TO GRAND RIVER AVE. NOVI, MI

Sheet Name

BORING LOCATION DIAGRAM

No.	Revision Date

Date: 01/09/2019
CADD: MWR
Designer: JAS
Scale: 1" = 400'
Project: 079555.00
Figure No.: 4

DRAWING NOTE: SCALE DEPICTED IS MEANT FOR 11" X 17" AND WILL SCALE INCORRECTLY IF PRINTED ON ANY OTHER SIZE MEDIA

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BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL
(more than 50% of material is larger than No. 200 sieve size.)

GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures

FINE-GRAINED SOIL
(50% or more of material is smaller than No. 200 sieve size)

SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt, Glacial Till, Siltstone, Base, Coal, Limestone, Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……..GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……..Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

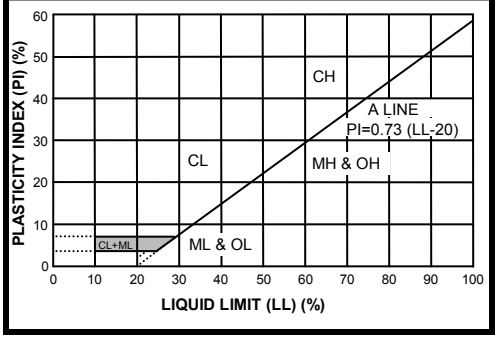
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)
- GM-GC (CLAYEY SILTY GRAVEL or CLAYEY SILTY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.0074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)
- OL/OH (ORGANIC SILT or ORGANIC CLAY)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressure Meter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N-Value (Blows per foot)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	Over 80

Cohesive Soils

Consistency	N-Value (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	0 - 2	0.25 or less
Soft	2 - 4	0.25 to 0.50
Medium	4 - 8	0.50 to 1.0
Stiff	8 - 15	1.0 to 2.0
Very Stiff	15 - 30	2.0 to 4.0
Hard	> 30	4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted.

Boring Number	Offset (ft.)	Depth of Topsoil (inches)	Description of Subgrade	Subgrade USCS Classification	Moisture Content (%)	Shear Strength (kips/sq.ft)
HA1	45’ East of Center Line	6”	Sandy Lean Clay, Trace Organics, Brown, Stiff	(CL)	18.8%	1.25
HA2	30’ West of Center Line	4”	Sandy Lean Clay, Occasional Sand Layers, Trace Organics, Brown, Medium/Soft	(CL)	22.8%	0.75
HA3	43’ East of Center Line	7”	Sandy Lean Clay, Trace Organics, Brown/Gray, Stiff	(CL)	12.5%	1.25
HA4	31’ West of Center Line	3”	Lean Clay with Sand and Gravel, Trace Organics, Brown, Stiff	(CL)	19.2%	1.5
HA5	31’ East of Center Line	17”	Sandy Lean Clay, Brown, Very Stiff	(CL)	21.7%	2.25
HA6	28’ West of Center Line	15”	Lean Clay with Sand, Occasional Silt Seams, Trace Organics, Brown/Gray, Stiff	(CL)	15.6%	1.75
HA7	36’ East of Center Line	5”	Sandy Lean Clay with Gravel, Trace Organics, Dark Gray, Very Stiff	(CL)	19.6%	2.0
HA8	31’ West of Center Line	3”	Lean Clay with Sand, Frequent Sand Layers, Trace Organics, Brown/Gray, Stiff	(CL)	18.2%	1.75
HA9	38’ East of Center Line	6”	Silty Clayey Sand, Trace Organics, Brown/Gray, Moist	(SC-SM)	-	-
HA10	35’ East of Center Line	3”	Sandy Lean Clay with Gravel, Trace Organics, Brown, Very Stiff	(CL)	14.8%	2.25
HA11	10’ West of Edge of Metal	2”	Clayey Sand with Gravel, Frequent Silt Seams, Trace Organics, Brown, Moist	(SP-SC)	-	-
HA12	31’ East of Center Line	4”	Silty Clayey Sand, Trace Organics, Brown, Moist	(SC-SM)	-	-
HA13	31’ West of Center Line	2”	Sandy Lean Clay, Frequent Silt Layers, Gray, Stiff	(CL)	18.8%	1.0

Boring Number	Offset (ft.)	Depth of Topsoil (inches)	Description of Subgrade	Subgrade USCS Classification	Moisture Content (%)	Shear Strength (kips/sq.ft)
HA14	29’ East of Center Line	4”	Sandy Lean Clay, Trace Organics, Brown/Gray, Stiff	(CL)	18.4%	1.0
HA15	25’ West of Center Line	2”	Silty Clayey Sand with Gravel, Trace Organics, Brown, Moist	(SC-SM)	-	-
HA16	24’ East of Center Line	6”	Silty Clayey Sand with Gravel, Trace Organics, Brown, Moist	(SC-SM)	-	-
HA17	27’ West of Center Line	6”	Sandy Lean Clay, Frequent Sand Seams, Trace Organics, Brown/Gray. Very Stiff	(CL)	14.1%	2.25
HA18	27’ East of Center Line	4”	Silty Clayey Sand with Gravel, Trace Organics, Brown, Moist	(SC-SM)	-	-
HA19	30’ West of Center Line	3”	Sandy Lean Clay with Gravel, Trace Organics, Brown, Medium	(CL)	17.3%	0.75
HA20	33’ East of Center Line	4”	Silty Clayey Sand with Gravel, Trace Organics, Brown, Moist	(SC-SM)	-	-
HA21	29’ West of Center Line	4”	Sandy Lean Clay with Gravel, Brown/Gray, Stiff	(CL)	11.4%	1.5
HA22	26’ East of Center Line	6”	Silty Sand with Gravel, Brown, Moist	(SP-SM)	-	-
HA23	35’ West of Center Line	3”	Sandy Lean Clay with Gravel, Trace Organics, Gray, Very Stiff	(CL)	6.4%	3.75
HA24	23’ East of Center Line	8”	Lean Clay with Sand, Frequent Silt Seams, Brown, Stiff	(CL)	21.5%	1.25
HA25	24’ West of Center Line	5”	Fine to Coarse Silty Sand with Gravel, Brown, Moist	(SP-SM)	-	-
HA26	29’ East of Center Line	9”	Lean Clay with Sand and Gravel, Trace Organics, Brown/Gray, Stiff	(CL)	20%	1.25
HA27	25’ West of Center Line	4”	Sandy Lean Clay with Gravel, Brown, Moist	(SP-SC)	-	-

Boring Number	Offset (ft.)	Depth of Topsoil (inches)	Description of Subgrade	Subgrade USCS Classification	Moisture Content (%)	Shear Strength (kips/sq.ft)
HA28	33’ East of Center Line	0”	Sandy Lean Clay, Trace Organics and Gravel, Black/Brown, Stiff	(CL)	22.5%	1.25
HA29	45’ West of Center Line	6”	Fine to Coarse Silty Sand with Clay and Gravel, Trace Organics, Brown/Gray, Moist	(SP-SM)	-	-
HA30	29’ East of Center Line	3”	Clayey Sand with Gravel, Brown, Moist	(SP-SC)	-	-
HA31	29’ West of Center Line	2”	Lean Clay, Trace Organics, Blue/Gray, Stiff	(CL)	27.4%	1.5
HA32	39’ East of Center Line	3”	Sandy Lean Clay with Gravel, Frequent Sand and Gravel Layers, Brown/Gray, Stiff	(CL)	14.3%	1.25
HA33	29’ West of Center Line	2”	Sandy Lean Clay with Gravel, Frequent Gravel Layers, Brown, Soft	(CL)	13.9%	1.0
HA34	28’ East of Center Line	4”	Sandy Lean Clay with Gravel, Frequent Sand Layers, Brown, Soft	(CL)	17.2%	0.3
HA35	40’ West of Center Line	4”	Sandy Lean Clay with Gravel Frequent Silt Seams, Gray, Medium	(CL)	14.8%	0.75
HA36	33’ East of Center Line	5”	Lean Clay with Sand, Trace Gravel, Gray, Very Stiff	(CL)	16.2%	2.5
HA37	41’ West of Center Line	16”	Sandy Lean Clay with Gravel, Brown, Stiff	(CL)	18.7%	1.25

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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GENERAL COMMENTS

BASIS OF PAVEMENT EVALUATION REPORT

This report has been prepared in accordance with generally accepted pavement and geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the data obtained from the field exploration at the locations indicated in the report. Variations in the pavement system (surface course, aggregate base course, subbase) thickness and materials as well as soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the existing pavement system and actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of pavement and geotechnical engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF PAVEMENT/GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the pavement system or subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the evaluation and laboratory test results. If the selected contractor encounters conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and pavement construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

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LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

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