WITMER ROAD RECONSTRUCTION

Design Report

Project Location:
Witmer Road, From Jackson Harvest Farms
To Entrance on Queen Street
Township of Wilmot

Prepared for:
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Referenced Tables

1.0 INTRODUCTION

MTE Consultants Inc. was retained by Jackson Harvest Farms to prepare the design for the reconstruction of Witmer Road from the future entrance to Jackson Harvest Farms east to Queen Street (Regional Road 12) as per an agreement reached with the Township of Wilmot.

Witmer Road is a rural local road with a currently posted speed limit of 80km/h. The road cross section consists of a pavement width varying from 6.8 – 7.2m equating to 3.4 – 3.6m lanes in each direction and a 0.5 – 1.0m gravel shoulder. The road is currently marked on the centerline with a double solid yellow paint line and no edge lines. As per the TIS, the AM and PM peak hour volumes ranged from 9-20 vehicles in either direction.

2.0 PROJECT BACKGROUND AND DESIGN

MTE performed a topographic survey of the road from Queen Street to 200m west of the proposed pit entrance. Using that survey information MTE prepared a horizontal alignment and vertical profile of the existing roadway to analysis the existing gradient and vertical curves. It was found that the sharpness of many existing vertical curves did not meet the minimum requirements for an 80km/h design speed with a few notably well below the requirements as laid out in the Transportation Association of Canada's Geometric Design Guide for Canadian Roads (TAC GDGCR).

In consultation with Wilmot Township, it was agreed that this project will utilize a posted and design speed of 70km/h with efforts intended to be made to incorporate design aids to try and encourage drivers to adhere to the lower posted limit. The proposed design profile ensures that all vertical curves meet or exceed the TAC GRDGCR vertical curve design standards for 70km/h, with K values of 17 and 23 used for crest and sag curves respectively (found in **Tables 3.3.2 and 3.3.4**), which provide the minimum Stopping Site Distances for vehicles traversing the alignment. Refer to **Table 1.0** for design curve details and the reference tables for TAC charts. Due to the rolling nature of the vertical curves within this stretch of roadway Passing Sight distances are not able to be met and thus passing will not be allowed and the centerline will be denoted with a solid double yellow line to delineate that to road users.

Table 1.0 – Wilmot Road Proposed Vertical Curve Design					
Start Station	End Station	Delta	Crest	Sag	Calculated Design Speed
7+733.625	7+794.825	-3.40%	18		71km/h
7+815.187	7+897.987	3.60%		23	70km/h
7+906.792	7+938.792	-0.40%	80		>90km/h
7+966.881	7+993.881	0.90%		30	80km/h
8+070.393	8+162.193	-5.10%	18		71km/h
8+204.359	8+338.559	3.05%		44	>90km/h
8+376.912	8+462.762	-5.05%	17		70km/h
8+480.186	8+501.188	-0.70%	30		83km/h
8+515.611	8+628.391	4.90%		23	70km/h
8+762.134	8+841.334	-4.40%	18		71km/h
8+858.431	8+948.406	4.65%		21.5	67km/h
8+958.957	9+087.207	4.75%		27	76km/h
9+126.937	9+204.637	-3.70%	21		74km/h
9+209.673	9+285.673	2.00%		38	90km/h
9+312.868	9+447.168	-7.90%	17		70km/h
9+477.374	9+544.974	2.60%		26	74km/h
9+558.173	9+618.173	-1.00%	60		>90km/h
9+646.768	9+737.768	3.50%		26	74km/h
9+767.651	9+840.151	2.90%		25	73km/h
9+869.342	9+941.342	-2.40%	30		83km/h
9+941.757	9+696.757	-2.00%	14		65km/h
9+975.262	9+988.462	1.10%		12	48km/h

3.0 PROPOSED CROSS-SECTION

The proposed cross section for the reconstruction is a 9.0m wide asphalt width, with a 3.5m lane and 1.0m paved shoulder in each direction with embankments down to existing. The lane width of 3.5m is the recommended lower limit for a rural road with an AADT less than 450 as per TAC GRDGCR **Table 4.2.1** (referenced below). The shoulder width of 1.0m is in line with the TAC GRDGCR **Table 4.4.1** which recommends a minimum 1.0m shoulder width for local rural roads (referenced below)

As mentioned above, there is a desire to encourage lower speeds as an element of this project with the new posted speed limit of 70km/h. There are various traffic calming techniques that are commonly used by municipalities including speed cushions/bumps, curb extensions, on-lane chicane, raised median island, signage, bollards and road diets. Many, if not most, of these traffic calming options are more commonly used in urban areas and are not suitable for a rural road application with routine use by trucks and farming vehicles. Three traffic calming measures were identified for consideration on this project: 70km/h speed zone signage, white painted edge lines and shoulder rumble strips.

4.0 PROPOSED PAVEMENT STRUCTURE

The proposed design consists of the edge lines at 3.5m from centerline with the shoulder rumble strip being placed directly behind the edge line, in accordance with MTOD-503.020. Consideration could be given to narrow the lane width to 3.30m in an effort to provide a more narrow feel, which may help in reducing speeds and is highlighted as the practical lower limit within the TAC manual **Table 4.2.1** (referenced below), but this will need to be approved by the Township.

The proposed pavement structure for this reconstruction consists of 120mm asphalt reclamation, with expanded asphalt (resulting in a finished depth of 130mm) and 60mm of new surface asphalt, resulting in a slight raise in grade of 70mm through the project extents. There will be areas where vertical curve improvements are being made where grades changes may be higher or lower depending on the curve improvements required.

As the grading design was progressed, we utilized a design cross section as described above, with the addition of a 0.3m wide rounding behind the asphalt shoulder prior to the embankment grading. With the rounding and a consistent 1.0m shoulder being established for the entire length of road at 2% in line with the lane, the grading design shows the need to adjust the ditch foreslope within most of the project limits. The desired foreslope used in the design was 3:1 with some areas being up to 2:1 where the existing slope was already at or steeper than 2:1. We encountered three locations where slopes will be required to be steeper than 2:1, at which we will specify the requirement for a soil reinforcement mat.

5.0 ADDITIONAL DESIGN CONSIDERATIONS

In addition to the road base reconstruction the Township has identified the need to replace a 300mmØ CSP cross culvert located at station 9+800 (200m east of Queen Street). We have identified this location on the drawings and have specified its replacement with a like size 300mmØ HDPE culvert.

During the design it was noted that near the driveway to #1785 on the south side there were existing wood posts on the edge of the roadway which was presumably an old roadside safety feature. Within that area we are proposing to raise the road slightly to improve the sag vertical curve to bring the design up to minimum design standards for 70km/h. Due to those changes

the wood posts would need to be removed and replaced and it was felt that the replacement should be up to current roadside safety standards. We recommend to replace the posts with a M20 steel beam guide rail system, complete with energy attenuators for each direction of travel and curved rails on either side of the entrance to #1785. Refer to design drawings for additional details.

Reference Tables:

Table 3.3.2: K Factors to Provide Stopping Sight Distance on Crest Vertical Curves[60]

Design Speed (km/h)	Stopping Sight Distance (m)	Rate of Vertical Curvature K[a]	
		Calculated	Design
20	20	0.6	1
30	35	1.9	2
40	50	3.8	4
50	65	6.4	7
60	85	11.0	11
70	105	16.8	17
80	130	25.7	26
90	160	38.9	39
100	185	52.0	52
110	220	73.6	74
120	250	95.0	95
130	285	123.4	124

Note: [a] Rate of vertical curvature, *K*, is the length of curve (m) per percent algebraic difference intersecting grades (*A*), $K = L/A$.

Table 3.3.4: K Factors to Provide Minimum Stopping Sight Distance on Sag Vertical Curves

Design Speed (km/h)	Stopping Sight Distance (m)	Rate of Vertical Curvature K[a]	
		Calculated	Design
20	20	2.1	3
30	35	5.1	6
40	50	8.5	9
50	65	12.2	13
60	85	17.3	18
70	105	22.6	23
80	130	29.4	30
90	160	37.6	38
100	185	44.6	45
110	220	54.4	55
120	250	62.8	63
130	285	72.7	73

Note: [a] Rate of vertical curvature, *K*, is the length of curve (m) per percent algebraic difference intersecting grades (*A*), $K = L/A$.

Table 4.2.1: Through Lane Widths – Rural Roadways (Design Hour Directional Volume <=450)

Design Speed (km/h)	Design Domain			
		Recommended Range		
	Practical Lower Limit	Recommended Lower Limit	Recommended Upper Limit	Practical Upper Limit
60 and less	2.7m	3.0m	3.7m	4.0m
70 to 100	3.3m	3.5m	3.7m	4.0m
110 and higher	3.5m	3.5m	3.7m	4.0m

1. Where buses and larger trucks are expected to regularly use a lane, a minimum lane width of 3.3m is recommended regardless of the design speed or traffic volume.

Table 4.4.1: Shoulder Widths for Undivided Rural Roads (m)[15]

Design Speed (km/h)	Designation and Design Hour Directional Volume					
	Rural	Collector			Arterial	
	Local	Design Hour Directional Volume			Design Hour Directional Volume	
		<250	250-450	>450	<450	>450
60	1.0	1.5	2.0	2.5		
70	1.0	1.5	2.0	2.5		
80	1.0	2.0	2.5	2.5	2.5	3.0
90	1.0	2.0	2.5	2.5	2.5	3.0
100	1.0	2.5	2.5	3.0	2.5	3.0
110					2.5	3.0
120					3.0	3.0
130					3.0	3.0

All of which is respectfully submitted,

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