PAVEMENT DESIGN MEMORANDUM

To: Selva Reginold, MTO Central Region
From: Hoda Seddik, M.A.Sc., P.Eng.
Felix Wong, P.Eng.
Date: February 5th 2019
Ref: Wood Project No. TP113112
Subject: Revised Pavement Design for Temporary Detour on Highway 406
Regional Municipality of Niagara, Ontario

1.0 INTRODUCTION

This memorandum was developed in response to the Ministry of Transportation (MTO) meeting to revise the pavement design of the shoulder for detouring. The limits of the detour are approximately 200 m long on both sides of the proposed bridge, in both directions of Highway 406, i.e., eastbound lanes and westbound lanes. The detouring plan consists of diverting traffic onto the existing outer shoulders (on both sides) of the highway. This memo is a supplementary to the Amec Report #TP113112.6000 dated March 5th 2015 and should be read in conjunction with the Amec Report.

2.0 PAVEMENT STRUCTURAL DESIGN

2.1 Traffic Data

MTO provided a revised percent of commercial vehicles of 6% in an e-mail dated January 22nd 2019, and Wood revised the detouring duration to 9 months and the construction year was revised to 2019. This revised traffic data was used to calculate equivalent single axle loads (ESALs) as presented in Table 1 and as described in the Ministry of Transportation Report "Procedures For Estimating Traffic Loads For Pavement Design, 1995" with an assumed growth rate of 2.0% for Hwy 406.

Table 1 – Traffic Data and ESALs

Roadway	AADT			Growth Rate[3] (%)	Comm. Vehicle (%)	Truck Factor	ESALs		Traffic Category
	2010[1]	2015[2]	2019				20-Year	0.75 year	
Detour	34,800	38,422	41,589	-	6.0 [4]	1.925	-	657,483 ~700,000	Category B ESALs 0.3 to <3Million
Mainline				2.0	6.0		15,420,262 ~$16X10^6$	-	Category D ESALs 10 to 30 Million

Note:

(1) AADT in both directions. (2) 2015 is the anticipated construction year.
(3) Assumed. (4) Provided MTO by e-mail dated Jan 22/2019.

The recommended pavement design is presented in Table 2 for new construction of 20 year design life, and for the temporary detours of 0.75 year (9 months) design life using the 1993 AASHTO Guide for the Design of Pavement Structures.

Table 2 – Traffic Data and ESALs

Material Description	AASHTO'93 Hwy 406/NB & SB	
	20 –Year Design ESALs ~ $16X10^6$	0.75 -Year Detour ESALs~ $0.7X10^6$
Hot Mix Asphalt Concrete	210 mm 40+50+60+60 mm	125 mm
Granular Base 'A'	550 mm	400 mm
Design SN (mm)	165 mm	108 mm
Selected SN (mm)	165 mm	109 mm
Total Pavement Thickness (mm)	**760 mm**	**525 mm**

2.2 Pavement Design for Temporary Detour on Existing Shoulders

For reconstruction of the shoulders as temporary widening, excavate to a total depth of 225 mm for NB and SB to accommodate 125 mm of HMA and 100 mm Granular A. However, MTO requested in an e-mail dated January 25th 2019 to avoid placing granular base material and compensate the granular thickness with hot mix. Using the thicknesses in Table 2 and boreholes information, it is recommended to excavate a total depth of 160 mm for detour roadway to accommodate 2 lifts of SP19.0 for the shoulder strengthening as presented in **Table 3**. For the widening and where the existing BH does not provide sufficient base (area within BH10 as presented in Figure 1), it is recommended to excavate a total depth of 460 mm to accommodate 160 mm of HMA and 300 mm Granular A. This full depth construction to be carried out mid distance between the 2 boreholes where the granular is insufficient.



Figure 1 - BH # 10 Location

Table 3 - Temporary Detour Pavement Design

Type	NB and SB	Area with Insufficient Granular	PGAC	Traffic Category
	Thickness (mm)			
SP19.0 mm SP19.0 mm	80 mm 80 mm	80 mm 80 mm	64-28 64-28	B B
Total HMA	160 mm	160 mm		
Granular A	-	300 mm		
Total Pavement Thickness (mm)	**160 mm**	**460 mm**		

3.0 CLOSURE

We trust this memo is complete within the terms of our reference. However, should questions arise concerning this memo, do not hesitate to contact us.

Sincerely,

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

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