GEMTEC Consulting Engineers and Scientists Limited
[redacted]

December 13, 2024 File: 101335.007 – LTR02, Rev0

Peck's Marina
[redacted]

Attention: Greg Robichaud

Re: Falling Weight Deflectometer Investigation for Pavement Strength Assessment Fitzsimmons Road, Township of Leeds and Thousand Islands, Ontario

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) is pleased to submit the following memorandum summarizing the Falling Weight Deflectometer (FWD) investigation undertaken along Fitzsimmons Road in the Township of Leeds and Thousand Islands, Ontario.

BACKGROUND

It is understood that Peck's Marina is planning to construct a boat storage facility at the southeast corner of Fitzsimmons Road and Granite Ridge Road. The facility will store approximately between 100 to 150 boats. The boats would be moved between the storage facility and Peck's Marina located at 505 Thousand Islands Parkway at the start and end of each boating season.

GEMTEC has previously issued a letter titled *Pavement Condition and Traffic Impact Assessment, Fitzsimmons Road, Township of Leeds and Thousand Islands, Ontario* dated December 4, 2023. The letter detailed results of a pavement condition assessment which noted that Fitzsimmons Road is presently a surface treated road in good condition. It was concluded from review of the estimated additional traffic caused by construction of the boat storage facility would produce an additional 30 Equivalent Standard Axle Loads (ESAL) on the road. At this time, the subgrade was assessed through desktop review and not through a technical testing procedure.

Following issuance of this letter, GEMTEC entered discussions with the Township of Leeds and the Thousand Islands (Township). It was discussed during a meeting occurring on October 2, 2024, that the subgrade along Fitzsimmons Road should be assessed through technical methods to evaluate the potential impact of the additional 30 ESALs on the pavement structure. Various methods were considered, but it was ultimately decided in consultation with the Township and Peck's Marina that Falling Weight Deflectometer (FWD) testing would be undertaken.

METHODOLOGY

FWD Testing was carried out on November 27, 2024 by a subconsultant to GEMTEC. The test section on Fitzsimmons Road was from Thousand Island Parkway to Granite Ridge Road (approximately 850 metres). Specific test locations were completed at 50 metre intervals in one direction, with a 25 metre offset from the starting position in the opposing lane, for a total of 25 metre intervals along the road. FWD testing and analysis procedures were in accordance with Ministry of Transportation, Materials Engineering and Research Office Report (MERO-053), *Falling Weight Deflectometer (FWD) Testing Manual.*

Based on the anticipated traffic volumes, Fitzsimmons Road is considered a low volume road. As such, FWD load levels of 27 kilonewtons, 40 kilonewtons, and 53 kilonewtons were selected.

RESULTS

The deflection measurements gathered during the FWD investigation were used to back calculate the subgrade resilient modulus at each test location, as per methodology outlined in the MERO-053 Report. The average corrected subgrade resilient modulus was calculated to be approximately 26 Megapascals. The back-calculated subgrade resilient modulus along Fitzsimmons Road, measured starting from the intersection of Thousand Island Parkway, northerly for 850 m, is shown in Figure 1.

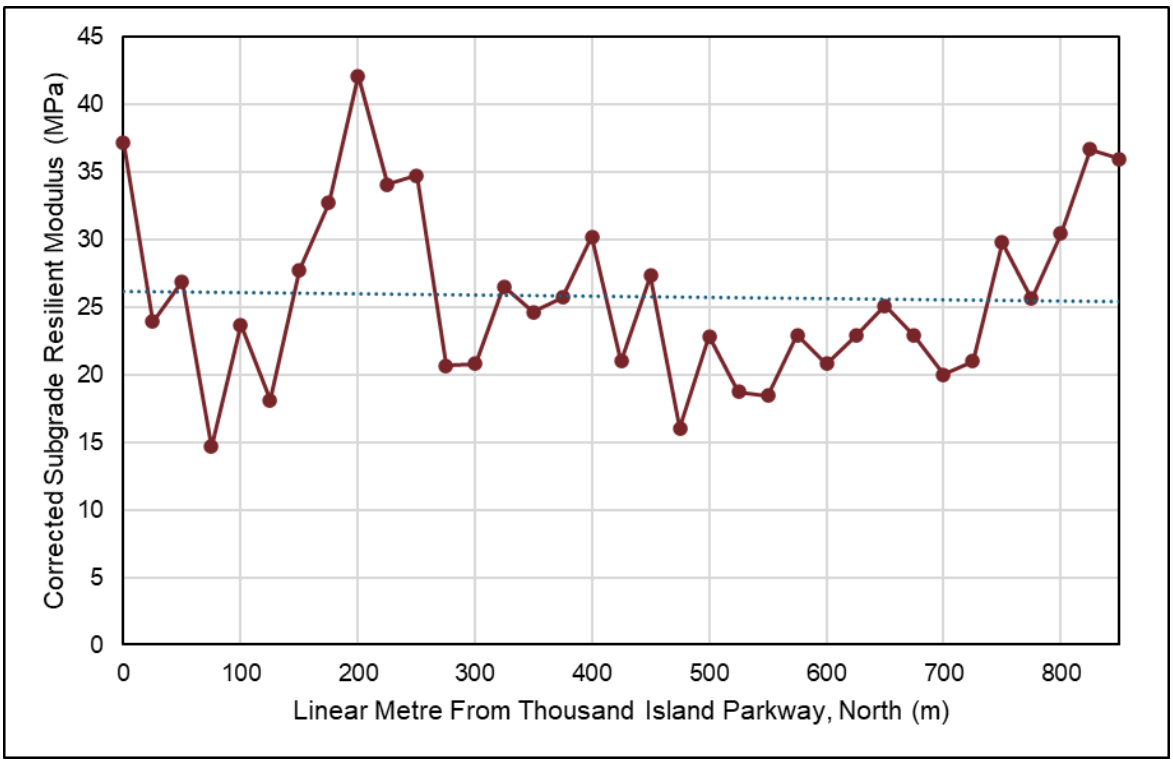

Figure 1 – Back-calculated Subgrade Resilient Modulus along Fitzsimmons Road, from the Intersection of Thousand Island Parkway to the Intersection of Granite Ridge Road

As discussed in the GEMTEC December 2023 letter, several areas of bedrock outcropping were observed in the northern limit of the project area, near the new boat storage entrance, which corresponds to the upward trend in subgrade resilient modulus back-calculated from the FWD data. Furthermore, the subgrade resilient modulus peak, calculated at 200 metres north of Thousand Island Parkway, corresponds to the mid-point of the sharp horizontal and vertical curve on Fitzsimmons Road. Reviewing street imaging confirms the presence of an exposed rock face in the west ditch line at this area, resulting in the increase in subgrade resilient modulus at this location.

Subgrade performance is known to vary seasonally, with the lowest strength measured immediately following the spring thaw. As the field work for this investigation was completed in November, the subgrade has been corrected according to Ontario's Seasonal Factors as outlined in the MERO-053 Report and the results are summarized in Table 1.

Table 1 – Back-calculated Subgrade Resilient Modulus and Monthly Correction Factors

Month	Ontario's Seasonal Factors	Seasonal Adjusted Back-calculated Modulus (MPa)	Reduced Subgrade Modulus (MPa)
January	5	245	81
February	5	245	84
March	2.2	108	36
April	0.83	41	14
May	0.65	32	11
June	1	49	16
July	1	49	16
August	1	49	16
September	1	49	16
November	**1.6**	**78**	**26**

December	3.3	162	53

Based on Table 1, the spring adjusted subgrade resilient modulus to be used for design is 11 Megapascals. According to Ministry of Transportation of Ontario (MTO) *Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions* Report MI-183, the subgrade corresponding most closely to the calculated subgrade resilient modulus is either a low, high, or medium plasticity clay, which corresponds with Ministry of Environment well records and available geologic mapping of the region.

DISCUSSION

As discussed in the GEMTEC December 2023 letter, the new boat traffic caused by the construction of the storage facility is estimated to cause an additional 30 ESALs per year, with only part of that increase occurring during the spring thaw. To assess the impact of the additional ESALs on the pavement, the following AASHTO 93 design inputs have been used:

- Initial Serviceability, PSI = 4.2;
- Terminal Serviceability, PSI =2.0;
- Overall Standard Deviation = 0.49;
- Design Reliability = 85 percent;
- Modulus of Subgrade Reaction, M_r = 11 Megapascals.

As per the AASHTO 93 design guidelines, average values of subgrade modulus are to be used as opposed to the lowest value or a percentile of the mean, as the AASHTO calculation method has built in statistical factors of safety based on the input standard deviation. As such, the average spring modulus has been used.

Traffic Data for Fitzsimmons Road was provided to GEMTEC by the Township. A traffic count completed in July of 2023 reported the Summer Annual Daily Traffic (SADT) as 591 vehicles per day. There is presently no agency providing a standard method for interpolating Average Annual Daily Traffic (AADT) from SADT, however a review of various literature suggests that the SADT exceeds the AADT on such low-volume roads by approximately 25 percent. As such, it has been assumed that the AADT of Fitzsimmons Road is approximately 443 vehicles per day.

It is understood based on discussions with the Township that some traffic use Fitzsimmons Road and Granite Ridge Road as an alternate route to access Reynolds Road and, consequently, Highway 401, when heading East on Thousand Island Parkway. As such, it has been conservatively assumed that 3 percent of the AADT is due to truck traffic with a 1 percent annual growth factor, as is common in general practice.

Using an average truck factor of 2.0 ESALs per truck, the anticipated 10-year design ESALs along Fitzsimmons Road is approximately 53,360.

As discussed in the December 2023 GEMTEC letter, the new boat storage facility is proposed to store 150 small to medium size boats. The boats will be hauled to the facility using a standard super duty pickup truck and a custom trailer fitted with tandem axles and dual tires. The pickup truck and trailer combined have a Load Equivalency Factor (LEF) ranging from 0.044 to 0.16. When adding the additional projected 30 ESALs per year to the previously calculated traffic volumes, the anticipated 10-year design ESALs along Fitzsimmons Road following construction of the boat storage facility is approximately 53,660.

Table 2 details the required Structural Number (SN) corresponding to both traffic scenarios, and the required increase in traffic that would require strengthening of the existing pavement structure.

Table 2 – Required Structural Number for Existing and Increased Traffic Loading

ESALs	Required Structural Number (mm)	Δ ESALs
53,360 (existing)	91	-
53,660 (with boat storage)	91	300
54,000	91	640
56,000	91	2,640
57,000	**92**	**3,640**

Based on the back-calculated subgrade modulus and the provided traffic data, the required SN of Fitzsimmons Road under the present loading is 91 millimetres. With the construction of the boat storage facility, the SN remains at 91 millimetres. Under the assumed loading, an additional 3,640 ESALs would be required to demand an increase in the SN by 1 millimetre, which is the equivalent of constructing approximately 12 such storage facilities along the road. Based on this estimation, the additional traffic caused by the proposed boating facility storage facility represents 0.6 percent of the 10 year traffic loading.

CONCLUSIONS

Based on the above study it is GEMTEC's opinion that the additional boat traffic will not appreciably shorten the service life of Fitzsimmons Road when compared with the general traffic loading. Furthermore, the FWD results suggest that the localized high points of resilient modulus (rock subgrade conditions) are positioned to support the heavier traffic demand, such as at the sharp horizontal/vertical curve and at the driveway to access the proposed facility.

CLOSURE

It is trusted that the above information is satisfactory to your intended purposes. Please do not hesitate to reach out to the undersigned for further information.

Sincerely,

GEMTEC Consulting Engineers and Scientists Limited

LICENSED PROFESSIONAL ENGINEER
J. B. HAGAN
100171186
Feb/2025
PROVINCE OF ONTARIO

Alyssa Bernier, M.A.Sc.
Pavement and Materials Analyst

John Hagan, P.Eng.
Senior Pavement Engineer

AB/JH

Enclosures
N:\Projects\101300\101335.007\05_Technical Work\FWD Report\101335.007_LTR01_FWD_2024-12-04.docx

Attachments: FWD Raw Data

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D0 13058 0.991 1.023           .
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000+0.0 000+0.0 St ...
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D2 13052 0.988 1.038           .
D3 13053 0.986 1.036           .
D4 13054 0.983 1.028           .
D5 13055 0.986 1.033           .
D6 12794 0.994 1.031           .
D7 13056 0.993 1.011           .
D0 13058 0.991 1.023           .
D0 13059 0.996 1.021           .
D0 13060 0.996 1.024           .
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