

Multi-Speed Deflectometer Testing

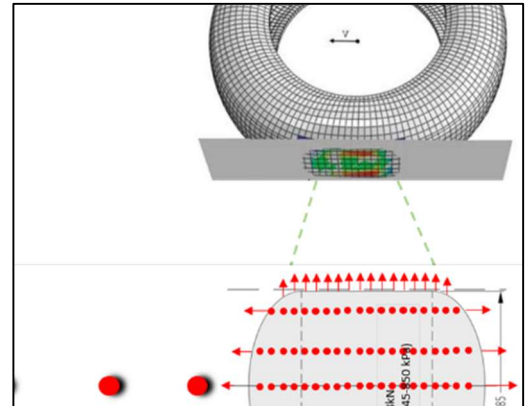
Various Roadways, Southern Ontario

Prepared for:

Good Roads
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Prepared by:

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Introduction

The Multi-Speed Deflectometer (MSD) is manufactured by Geosolve Engineering Consultants of New Zealand. The MSD consists of an instrumented standard truck tire (size 425/65 R22.5) mounted on the front right outside wheelpath of a commercial truck (Figure 1) along with a second balanced tire on the opposite side of the axle. The existing tires are removed and replaced with the MSD tires. The front axle weight of the MSD truck used for the data collection was 6,560 kgs. A sensor box is mounted to the truck axle which is then connected to the laptop in the truck cab via Bluetooth. A GPS receiver and dashboard camera are also connected to the laptop. The system operation is then verified on a test run of about 1 km in length.

Figure 1. MSD Truck.



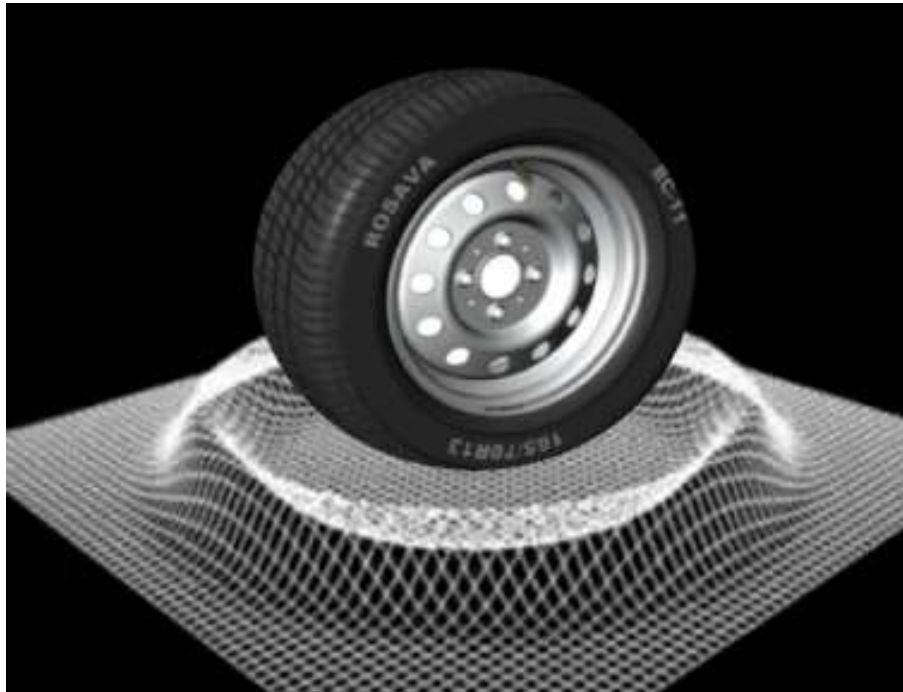
Sensors characterize the asymmetric deformations in 3 dimensions (3-D) that occur in the pavement under dynamic loading (The most common use of the MSD is for network level structural screening to determine the structural capacity of roads in a network, which when paired with pavement structure and traffic data can then be used to predict pavement remaining life. The MSD also has applications in determining the optimum time to remove spring load restrictions, determining the impact of flooding on pavements, assessing the consistency of individual pavement layers during construction, and testing large pavement areas such as airports, ports and industrial yards.

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Figure 2). Sensors, mounted equidistantly around the tire collect data at approximately 1 m centres which is averaged to 10 m intervals, enabling a near-continuous profile of the pavement's structural response to the applied load.

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Figure 2. Truck Wheel Dynamic Loading.



Data analysis for the MSD data begins with the relative deflection (centre deflection) directly under the load. This deflection can then be “calibrated” by comparing it with a dataset of Falling Weight Deflectometer (FWD) data from the same or similar roads to those tested. This provides conventional FWD pavement response parameters such as central deflection and surface curvature index. Additional data analysis for the MSD can include calculation of a Base Layer Index (BLI) and Lower Layer Index (LLI), Structural Number (SNP) and remaining structural life based on the structural number and design equivalent single axle loads (ESALs) for the pavement section. MSD data are geo-referenced using an onboard GPS unit with data available for viewing on Geosolve’s in-house GIS software, a web application called *PaveState*. This technology assists in identifying weak pavement areas and in prioritizing pavement sections for preservation and rehabilitation treatments.

The MSD can survey at traffic speeds, in one or both wheel paths, in wet and dry conditions, allowing pavements to be surveyed rapidly in their weakest (most critical) condition, with next-day reporting for immediate decision making. The MSD is best suited to weaker flexible pavements including gravel surfaces, chip seal and relatively thin (less than 150 mm) asphalt concrete surfaced pavements over flexible granular base. Stiffer pavements can be tested if suitably heavy axle loads can be mobilized.

Scope

MSD data was collected for some representative municipal roadways as well as Ontario secondary highways. Prior to the commencement of testing a route map of the roads to be tested is developed to optimize travel and maximize testing. In dense urban areas, short sections and roadway orientation reduces test efficiency and the typical length of roadway that can be tested is in the order of 100 km/day. For rural roadways about 200 to 300 km per day can be tested. The maximum testing speed is

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50 km/hr. Testing can be completed at higher speeds but more “noise” is introduced which may influence the data quality.

Data Collection

The route coverage for which MSD data was collected is shown in Figure 3. The MSD data was collected at 1 m intervals in the right wheelpath and then consolidated and reported at 10 m intervals. A total of 55,928 data points is reported. The colour scheme for the points is dynamically based on the normalized deflection value and ranges from dark blue (low deflection) to dark red (high deflection) as shown in Figure 4.

Figure 3. MSD Data Route Coverages.

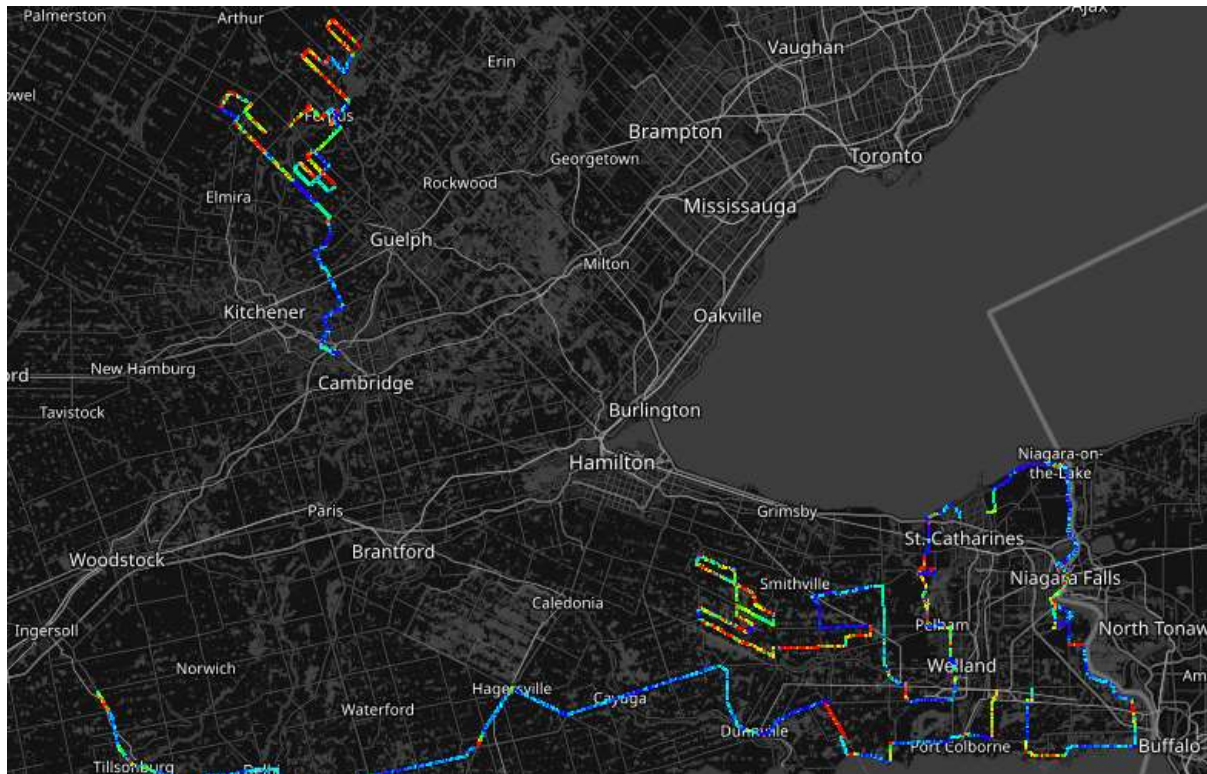
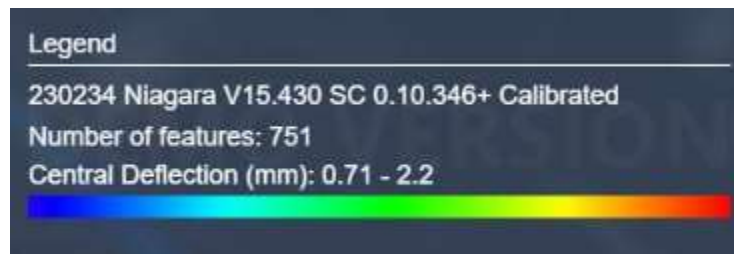


Figure 4. Colour Schema for Central Deflection.



In total, 212 individual sections were surveyed from Ostrander in the west to Fort Erie in the east and from Port Colborne in the south to Arthur in the north. The breakdown of the number of kilometers surveyed in each area is shown in Table 1.

Table 1. Road Section General Distribution.

Agency	Sections	Kilometers
Brant County	4	6.503
Haldimand County	20	34.524
Ministry of Transportation of Ontario	15	101.967
Niagara Region and Townships	110	308.551
Region of Waterloo	8	8.071
Wellington County	57	142.267
SLA Station (Highway 19/Plank Line, Ostrander	1	2.880
Total	216	604.763

Test Results

A summary of the average MSD centre deflection by roadway section is provided in the Appendix. The detailed results of the MSD testing are accessible through the PaveState web browser. Permission to access the dataset included in this testing campaign can be requested by going to www.pavestate.com and signing up for an account. An access key will need to be requested from the undersigned. Some examples of the type of information and its display are provided below. A PaveState manual and tutorial is also available.

Figure 5. Example of Deflection Variability for Various Roads.

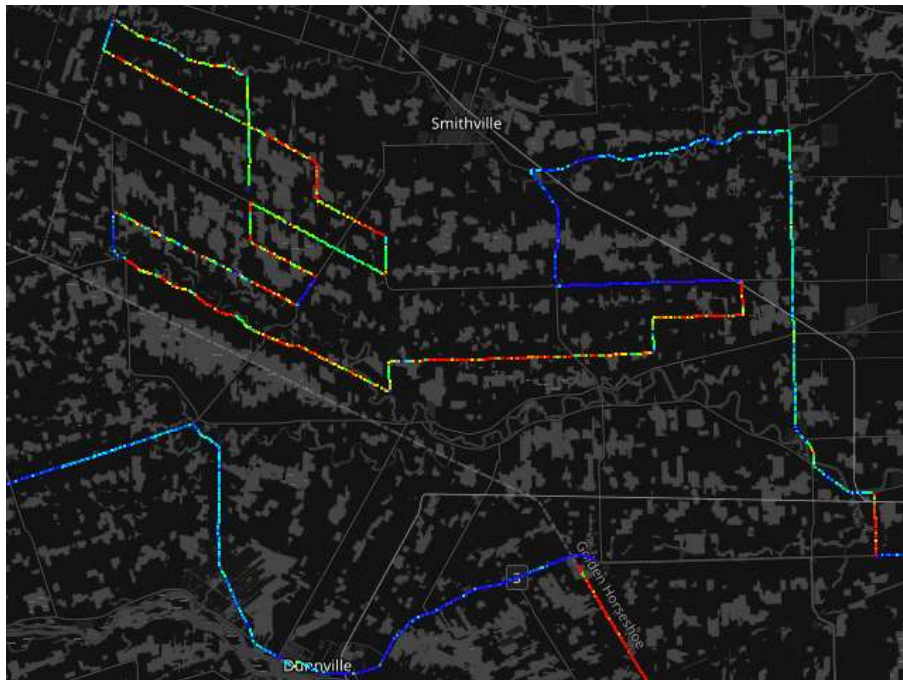


Figure 6. Example of Deflection Variability Along a Roadway.

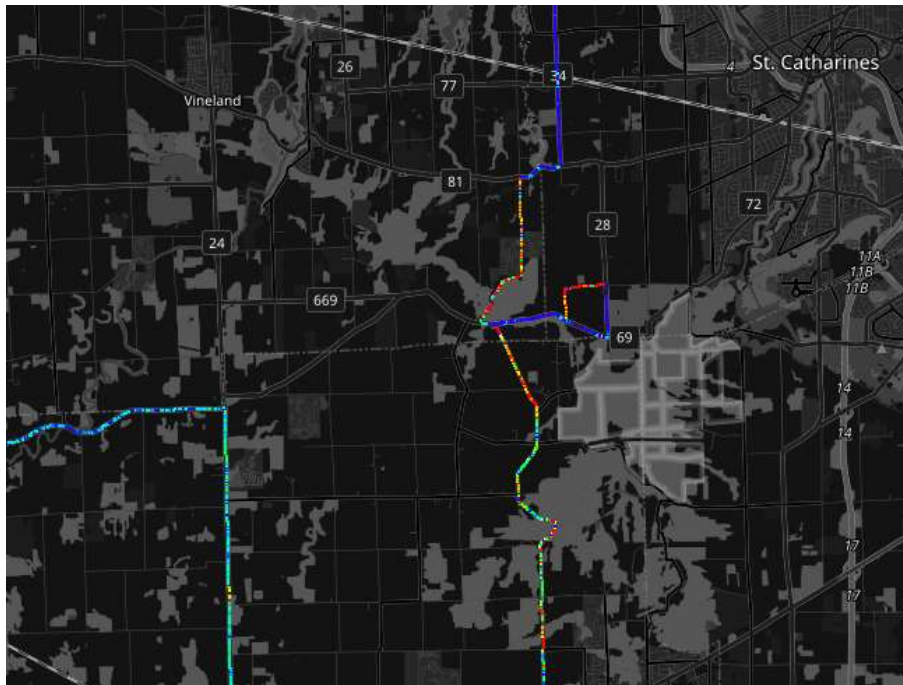
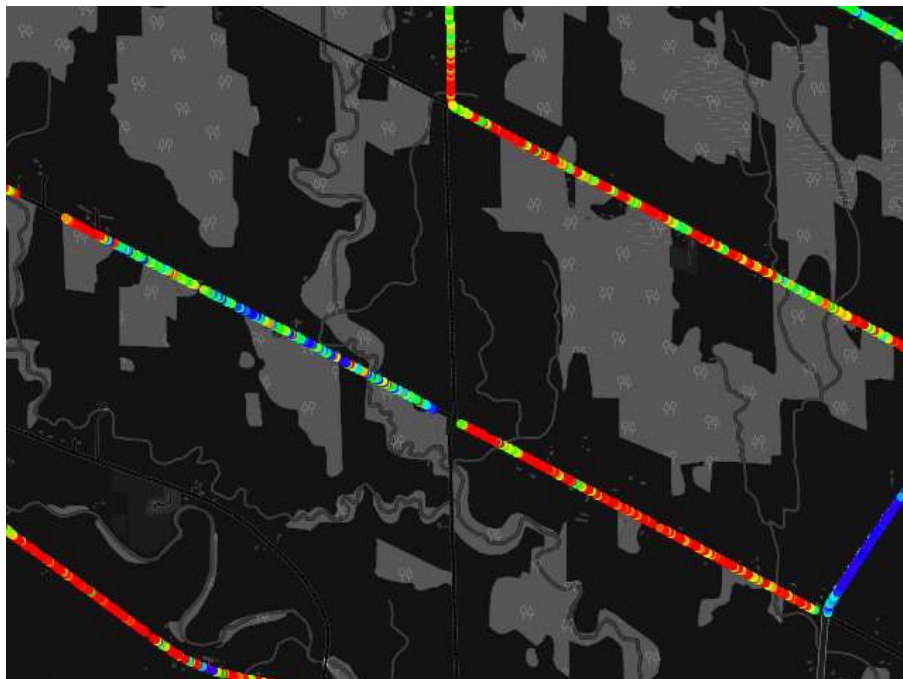


Figure 7. Closeup of Test Points.



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Figure 8. Example of Sections with Variable Deflections.



Figure 9. Example of High Deflection on a Gravel Surface.



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Figure 10. Detailed Section Deflection Data and 5 Point Moving Average Plot.

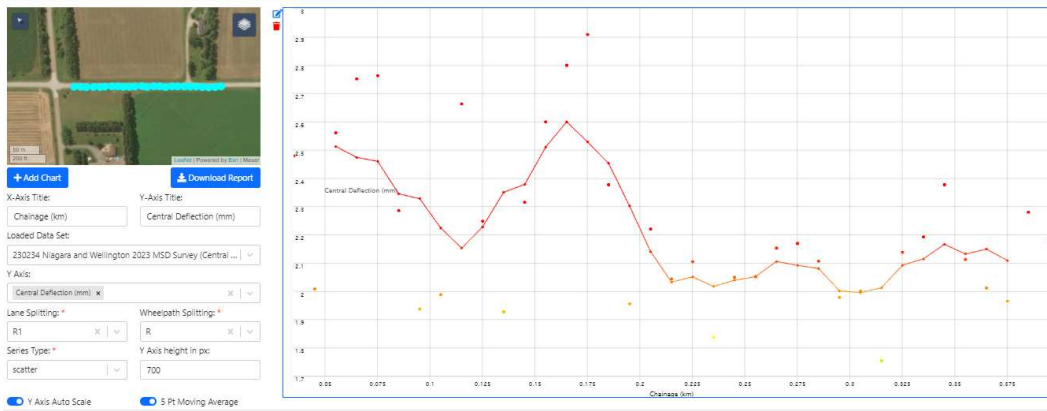


Figure 11. Example of a Roadway Tested in Both Directions.



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Figure 12. Example of a Test Location with Low Deflection and Good Condition.

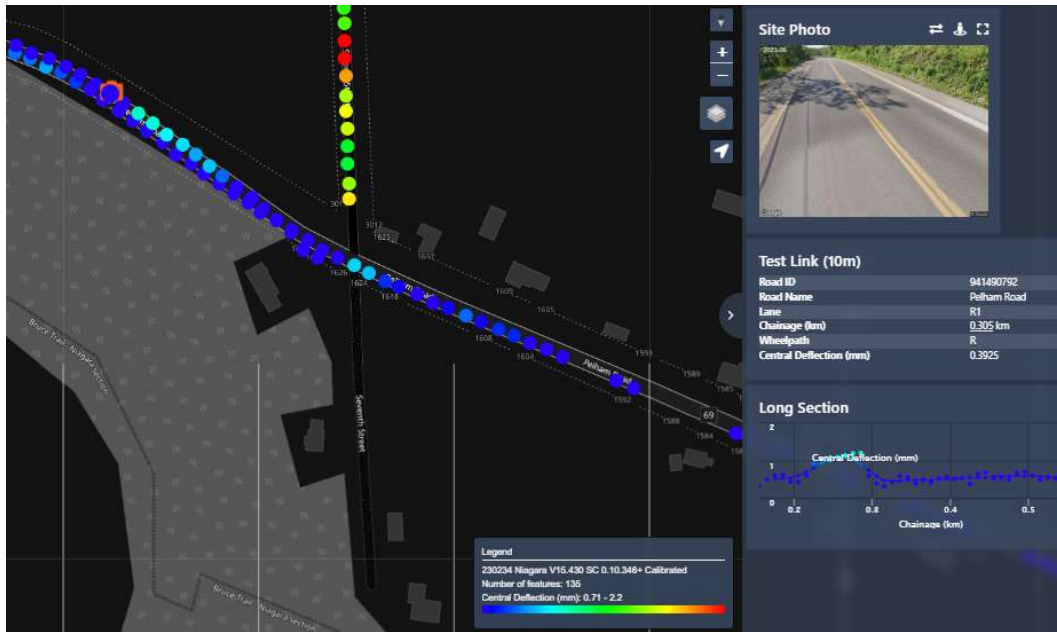
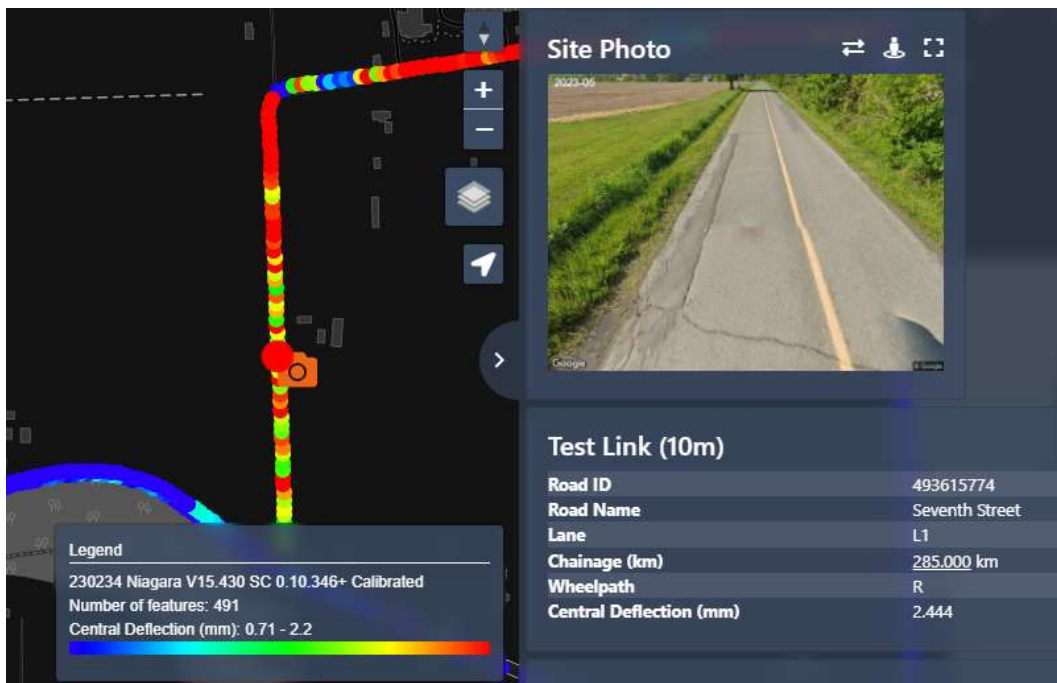


Figure 13. Example of a Test Location with Low Deflection and Poor Condition.



Closure

We trust that the information provided in this test data report is sufficient for your immediate needs. If any clarification is required, please do not hesitate to contact the undersigned.

Prepared and Submitted by:

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A handwritten signature in blue ink, appearing to read "David K. Hein".

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Appendix

Summary of MSD Centre Deflection by Roadway Section and Location

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Summary of MSD Average Centre Deflection by Roadway Section

Road Name	From	To	Length (km)	Location	Average Centre Deflection (mm)
Broadway Street	Highway 19	Oxford Street	3.570	Brant	1.56
Oxford Street	Broadway	Simcoe Street	0.307	Brant	1.45
Simcoe Street	Oxford Street	Highway 3	2.530	Brant	1.55
To Simcoe Street	Simcoe Street	Simcoe Street	0.096	Brant	1.31
Church Street	Fertilizer Road	Callen's Avenue	0.833	Haldimand	1.56
Church Street East	Callen's Avenue	James Street	0.968	Haldimand	1.04
Concession 12 Walpole	106 Concession 12 Walpole	Highway 6	0.147	Haldimand	0.84
Dunnville Road	Robinson Road	2338 Highway 3	11.530	Haldimand	1.03
Fertilizer Road	Wilson Avenue	Church Street	1.390	Haldimand	1.09
George Street	Main Street West	Broad Street West	0.253	Haldimand	1.87
Haldimand Road 20	Highway 3	70 King Street East	7.310	Haldimand	0.97
King Street	James Street	Norwich Road	0.623	Haldimand	0.96
King Street East	70 King Street East	Main Street South	1.620	Haldimand	1.01
Main Street North	Peel Street West	Nanticoke Creek Parkway	1.490	Haldimand	1.93
Main Street South	Parkview Road	King Street East	0.797	Haldimand	1.63
Main Street West	George Street	Robinson Road	0.722	Haldimand	0.92
NaN	524 Queensway West	Park Road	0.071	Haldimand	1.04
Queensway East	Donly Drive N	Norfolk Steet	1.330	Haldimand	1.08
Queensway West	524 Queensway West	Frederick Hobson Vc Dr	0.263	Haldimand	0.97
Queensway West	Norfolk Steet	Park Road	1.730	Haldimand	0.94
Talbot Street	55 Talbot Street	Highway 6 North	0.466	Haldimand	0.84
Talbot Street East	Munsee St S	Monture Street	0.839	Haldimand	0.93
Talbot Street West	Ouse St S	Munsee St S	0.362	Haldimand	0.94
Wilson Avenue	Highway 3	Fertilizer Road	1.780	Haldimand	2.09
Highway 19	Mount Elgin	Broadway Street	5.730	MTO	1.03
Highway 20	Effingham Street	Pelham Street South	2.120	MTO	0.80
Highway 3	Simcoe Street	Highway 3	4.150	MTO	0.94
Highway 3	Norwich Road	Highway 59	11.680	MTO	1.00
Highway 3	Frederick Hobson Vc Dr	Wilson Avenue	14.110	MTO	1.10
Highway 3	Donly Drive N	3.8 km West of Frederick Hobson Vc Dr	3.800	MTO	0.84
Highway 3	3.8 km West of Frederick Hobson Vc Dr	55 Talbot Street	11.010	MTO	0.96
Highway 3	Haldimand Road 20	Ouse St S	7.970	MTO	0.90
Highway 3	Monture Street	2338 Highway 3	13.260	MTO	0.88
Highway 3	Inman Road	Buckner Road	9.800	MTO	0.79
Highway 3	Concession 1	Townline Road	7.010	MTO	0.90
Highway 3	Elizabeth Street	Miller Road	3.410	MTO	0.80
Highway 3	Empire Road	Wilhelm Road	0.174	MTO	0.82
Highway 6	Nanticoke Creek Parkway	Parkview Road	7.590	MTO	0.97
Highway 6 North	Talbot Street	Peel Street West	0.153	MTO	1.22
20 Mile Road	Regional Road 20	Victoria Avenue	10.660	Niagara	0.95
5th Louth Street	5th Street Louth	Eighth Louth Avenue	0.055	Niagara	0.31
5th Street Louth	Pelham Road	Eighth Louth Avenue	1.030	Niagara	0.69
7th Street	N Traffic Circle N of QEW	St Paul Street West	4.360	Niagara	0.68
7th Street North	S Traffic Circle N of QEW	South Service Road	0.154	Niagara	1.48
7th Street South	Lakeshore Road West	N Traffic Circle N of QEW	0.352	Niagara	0.90
Ailanthus Avenue	Marineland Parkway	Dunn Street	0.879	Niagara	1.62
Allen Road	Caistor Gainsborough Townline Road	Sixteen Road	1.490	Niagara	2.46
Beach Road	Pleasant Beach Road	Empire Road	0.835	Niagara	1.69

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Road Name	From	To	Length (km)	Location	Average Centre Deflection (mm)
Boyle Road	Vaughan Road	Regional Road 20	1.370	Niagara	2.04
Bridgewater Street	12266 Bridgewater Street	12612 Niagara Parkway	0.229	Niagara	1.77
Broad Street East	Inman Road	Cedar Street	2.900	Niagara	0.75
Broad Street West	Cedar Street	George Street	0.859	Niagara	1.10
Broadway	Prince Charles Drive South	St George Street	0.204	Niagara	1.40
Caistor Centre Road	Concession 3 Road	Silver Street	1.550	Niagara	1.87
Caistor Centre Road	Caistor Center Public School	Twenty Road	4.540	Niagara	1.45
Caistor Gainsborough Townline Road	South Chippawa Road	Elcho Road	1.190	Niagara	1.61
Caistor Gainsborough Townline Road	Cosby Road	Concession 5 Road	1.510	Niagara	1.41
Caistorville Road	South Chippawa Road	Concession 2 Road	2.180	Niagara	0.89
Carlton Street	Welland Canals Parkway	Stewart Road	1.350	Niagara	1.63
Castlereagh Street	King Street	Wellington Street	0.299	Niagara	1.92
Cleveland Avenue	One Point Only		0.050	Niagara	1.34
Concession 1	Station Road	Highway 3	0.818	Niagara	1.66
Concession 2 Road	Smithville Road	Caistorville Road	8.190	Niagara	1.75
Concession 3 Road	Smithville Road	Caistor Centre Road	2.960	Niagara	2.07
Concession 5 Road	Caistor Gainsborough Townline Road	Allen Road	3.040	Niagara	2.18
Cosby Road	Caistor Gainsborough Townline Road	Silver Street	0.169	Niagara	2.21
Cummington Square West	Main Street	Portage Road	0.054	Niagara	1.11
Dominion Road	Gorham Road	Helena Street	9.720	Niagara	0.93
Dunn Street	Ailanthus Avenue	Cleveland Avenue	0.221	Niagara	1.31
Dunnville Wainfleet Road	Feeder Road West	Flanagan Road	1.800	Niagara	2.54
Effingham Street	Highway 20	Wessel Drive	6.430	Niagara	1.51
Eighth Louth Avenue	Seventh Street	5th Street Louth	0.810	Niagara	2.10
Elcho Road	Caistor Gainsborough Townline Road	Heaslip Road	10.490	Niagara	2.09
Empire Road	Beach Road	Highway 3	1.560	Niagara	1.95
Farr Avenue	Michener Road	Gorham Road	0.579	Niagara	0.96
Feeder Road West	Hutchinson Road	Dunnville Wainfleet Road	0.676	Niagara	2.08
Forkes Road	Wilhelm Road	Schihl Road	0.712	Niagara	1.85
Forks Road	Hewitt Road	Nugent Road	6.670	Niagara	0.83
Gorham Road	Farr Avenue	Dominion Road	0.903	Niagara	0.93
Heaslip Road	Elcho Road	Vaughan Road	1.390	Niagara	1.44
Helena Street	Dominion Road	Garrison Road	2.120	Niagara	1.08
Hewitt Road	Forks Road	Riverside Drive	2.490	Niagara	2.28
Hutchinson Road	North Shore Drive	Feeder Road West	2.710	Niagara	1.11
Killaly Street West	Main Street West	Main Street West	0.065	Niagara	0.89
King Street	Mary Street	Castlereagh Street	0.456	Niagara	1.29
Lake Street	Secord Drive	Lakeport Road	0.297	Niagara	0.98
Lakeport Road	Lake Street	Ontario Street	1.090	Niagara	0.81
Lakeshore Road	0.451 km east of Etling Road	Station Road	4.840	Niagara	0.87
Lakeshore Road	Stewart Road	Mary Street	9.970	Niagara	0.71
Lakeshore Road West	7th Street South	3rd Street Louth	1.810	Niagara	1.69
Lock Street	Lakeport Road	Main Street	0.123	Niagara	1.46
Lyons Creek Road	Sodom Road	Stanley Avenue	2.380	Niagara	0.67

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Road Name	From	To	Length (km)	Location	Average Centre Deflection (mm)
Main Street	Sodom Road	Cummington Square West	1.030	Niagara	1.06
Main Street	3rd Street Louth	Lock Street	2.240	Niagara	0.89
Main Street East	Chippawa Road	Elizabeth Street	0.831	Niagara	1.67
Main Street West	Townline Road	Chippawa Road	3.260	Niagara	0.97
Marineland Parkway	Portage Road	Ailanthus Avenue	1.000	Niagara	0.95
Marshall Road	Sodom Road	Niagara Parkway	2.210	Niagara	2.43
Mary Street	King Street	Lakeshore Road	1.100	Niagara	1.66
McLeod Road	One Point Only		0.000	Niagara	0.67
Michener Road	Pleasant Beach Road	Farr Avenue	4.700	Niagara	1.98
Miller Road	Highway 3	0.234 km South of Townline Tunnel Road	7.110	Niagara	1.90
Murray Street	Stanley Avenue	Niagara Parkway	0.576	Niagara	1.25
Niagara Parkway	12612 Niagara Parkway	Thompson Road	10.190	Niagara	0.97
Niagara Parkway	12266 Bridgewater Street	Marshall Road	2.000	Niagara	1.00
Niagara Parkway	Murray Street	River Road	0.721	Niagara	1.13
Niagara Parkway	Victoria Avenue	Service Road 61	12.380	Niagara	0.92
Niagara River Parkway	Service Road 61	Ricardo Street	4.460	Niagara	0.88
Ninth Street	Pelham Road	St Paul Street West	3.290	Niagara	1.90
North Shore Drive	.451 km East of Etling Road	Hutchinson Road	1.770	Niagara	1.94
Nugent Road	Forks Road	Nugent Road	0.097	Niagara	1.28
Pelham Road	5th Street Louth	Ninth Street	2.640	Niagara	0.67
Pelham Street South	Port Robinson Road	Highway 20	0.537	Niagara	1.01
Picton Street	One Point Only		0.000	Niagara	1.72
Pleasant Beach Road	Michener Road	Beach Road	0.357	Niagara	1.61
Port Robinson Road	Pelham Street South	Rice Road	1.230	Niagara	1.60
Portage Road	Cummington Square West	Marineland Parkway	2.310	Niagara	0.88
Prince Charles Drive North	Riverside Drive	Thorold Road	1.800	Niagara	0.75
Prince Charles Drive South	Humberstone Road	Broadway	1.440	Niagara	0.92
Queens Parade	Ricardo Street	Wellington Street	1.390	Niagara	0.97
Regional Road 20	Boyle Road	20 Mile Road	12.210	Niagara	0.75
Rice Road	Thorold Road	Port Robinson Road	4.110	Niagara	1.52
River Road	Niagara Parkway	Victoria Avenue	4.160	Niagara	1.56
Riverside Drive	316 Riverside Drive	Prince Charles Drive North	1.870	Niagara	1.34
Riverside Drive	Hewitt Road	Victoria Avenue	2.780	Niagara	1.19
Schihl Road	Forkes Road	0.161 km South of Netherby Road	1.550	Niagara	1.15
Seventh Street	Pelham Road	Eighth Louth Avenue	0.624	Niagara	2.10
Silver Street	Cosby Road	Caistor Centre Road	5.930	Niagara	1.49
Sixteen Road	Allen Road	Westbrook Road	9.490	Niagara	1.93
Smithville Road	Concession 2 Road	Concession 3 Road	1.360	Niagara	0.70
Sodom Road	Lyons Creek Road	Marshall Road	3.650	Niagara	0.83
South Chippawa Road	Caistor Gainsborough Townline Road	Caistorville Road	11.820	Niagara	2.02
St George Street	175 St George Street	Broadway	0.663	Niagara	2.07
St Paul Street West	7th Street	Ninth Street	0.889	Niagara	0.77
Stanley Avenue	Lyons Creek Road	Marineland Parkway	3.150	Niagara	1.30
Stanley Avenue	Marineland Parkway	Murray Street	1.550	Niagara	1.90
Station Road	Lakeshore Road	Concession 1	2.680	Niagara	1.69
Stewart Road	Carlton Street	Lakeshore Road	3.150	Niagara	1.44

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Road Name	From	To	Length (km)	Location	Average Centre Deflection (mm)
Thompson Road	Garrison Road	Niagara Parkway	4.920	Niagara	1.94
Townline Dunnville Wainfleet	Flanagan Road	Buckner Road	3.710	Niagara	2.31
Twenty Road	Caistor Centre Road	Westbrook Road	5.760	Niagara	1.59
Vaughan Road	Heaslip Road	Boyle Road	3.560	Niagara	2.14
Victoria Avenue	Riverside Drive	20 Mile Road	13.430	Niagara	3.18
Wellington Street	Castlereagh Street	Queens Parade	0.287	Niagara	1.85
Wessel Drive	Effingham Street	Oille Street	1.570	Niagara	2.14
Wessel Road	Oille Street	Pelham Road	0.360	Niagara	2.00
West Side Road	Forks Road	Humberstone Road	1.690	Niagara	0.89
Westbrook Road	Twenty Road	Sixteen Road	1.270	Niagara	1.02
Wilhelm Road	Highway 3	Forkes Road	6.100	Niagara	0.85
Fountain Street North	Maple Grove Road	Kossuth Road	2.190	Waterloo	0.81
Fountain Street South	Shantz Hill Road	King Street	0.285	Waterloo	0.86
King Street	Fountain Street South	King Street East	0.355	Waterloo	0.97
King Street East	Sportsworld Drive	Shantz Hill Road	1.400	Waterloo	1.12
King Street East	King Street	Westminster Drive South	0.692	Waterloo	0.92
Maple Grove Road	Fountain Street North	Sportsworld Drive	1.550	Waterloo	0.92
Shantz Hill Road	King Street East	Fountain Street South	0.750	Waterloo	0.90
Sportsworld Drive	King Street East	Maple Grove Road	0.849	Waterloo	0.89
12th Line	Sideroad 19	Wellington Road 17	3.590	Wellington	1.71
2nd Line	Wellington Road 18	Sideroad 20	9.240	Wellington	2.14
2nd Line	Wellington Road 7	Tower Street South	5.050	Wellington	1.64
3rd Line	Sideroad 15	Sideroad 20	3.070	Wellington	2.03
3rd Line West	Wellington Road 17	Sideroad 11	4.180	Wellington	1.82
4th Line East	Sideroad 10	Sideroad 4	3.270	Wellington	2.00
6th Line	Side Road 20	Wellington Road 19	5.480	Wellington	2.06
7th Line	Wellington Road 19	Sideroad 20	5.530	Wellington	2.20
8th Line West	0.068 km North of County Road 21	Wellington Road 17	11.140	Wellington	1.79
Barnett Crescent	Guelph Street	Guelph Street	0.463	Wellington	2.14
Beatty Line	Garafraxa Street West	Sideroad 15	2.530	Wellington	1.91
Belsyde Avenue East	Belsyde Avenue West	Wellington Road 18	1.450	Wellington	0.91
Belsyde Avenue West	Elora Street	Belsyde Avenue East	0.269	Wellington	0.97
Chambers Crescent	Guelph Street	Guelph Street	0.470	Wellington	2.11
Cummings Crescent	One Point Only	0	0.000	Wellington	2.07
Eighth Line East	Shaefer Road	Wellington Road 21	13.300	Wellington	0.96
Eighth Line West	Wellington Road 21	Wellington Road 17	6.100	Wellington	1.65
Elora Street	Guelph Street	Belsyde Avenue West	0.618	Wellington	1.73
Fourth Line East	Sideroad 14	Sideroad 10	2.640	Wellington	1.19
Garafraxa Street East	Gartshore Street	Highway 6	1.010	Wellington	1.07
Garafraxa Street West	Highway 6	Beatty Line	1.010	Wellington	1.92
Gartshore Street	St. Andrews Street East	Garafraxa Street East	0.395	Wellington	0.90
Guelph Street	Elora Street	Cummings Crescent	0.270	Wellington	1.07
Kossuth Road	Shantz Station Road	Fountain Street North	3.300	Wellington	0.80
Orangeville Road	Scotland Street	Wellington Road 18	0.863	Wellington	2.41
Saint Charles Street East	Maryhill Road	Crowsfoot Road	3.880	Wellington	0.78
Saint Charles Street West	Maryhill Road	Shantz Station Road	1.190	Wellington	0.89
Schaefer Road	Crowsfoot Road	Eighth Line East	1.120	Wellington	2.24
Scotland Street	Orangeville Road	St. Andrew Street East	0.425	Wellington	0.88
Second Line East	Sideroad 14	Sideroad 4	5.910	Wellington	2.11
Shantz Station Road	Saint Charles Street West	Kossuth Road	9.000	Wellington	0.93
Sideroad 10	Sixth Line East	Wellington Road 7	3.820	Wellington	1.01

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Road Name	From	To	Length (km)	Location	Average Centre Deflection (mm)
Sideroad 14	4th Line East	Second Line East	1.290	Wellington	1.23
Sideroad 15	Wellington road 16	3rd Line	1.290	Wellington	2.04
Sideroad 19	Wellington Road 8	12th Line	2.690	Wellington	1.96
Sideroad 20	7th Line	6th Line	1.380	Wellington	2.16
Sideroad 20	2nd Line	3rd Line	1.300	Wellington	2.52
Sideroad 4	Second Line East	Wellington Road 7	1.280	Wellington	2.04
Sideroad 4	Wellington Road 21	4th Line East	1.110	Wellington	1.39
Sixth Line East	Sideroad 10	Wellington Road 21	3.130	Wellington	1.23
Tower Street South	Gates of Fergus Driveway	2nd Line	0.877	Wellington	0.95
Victoria Street	Woolwich Street West	William Street	0.290	Wellington	2.65
Washington Street	Woolwich Street East	Union Street	0.050	Wellington	1.30
Water Street	William Street	Wellington Road 18	0.290	Wellington	2.06
Wellington 17 Road	Eight Line West	12th Line	2.125	Wellington	1.62
Wellington 8 Road	Wellington Road 17	Side Road 19	2.850	Wellington	0.83
Wellington Road 16	Wellington Road 19	Sideroad 15	3.080	Wellington	0.98
Wellington Road 18	Belsyde Avenue East	2nd Line	1.980	Wellington	0.91
Wellington Road 19	Wellington Road 16	6th Line	3.000	Wellington	0.96
Wellington Road 21	Sixth Line East	.106 km north	0.106	Wellington	0.78
Wellington Road 7	Sideroad 10	Sideroad 4	3.270	Wellington	0.90
William Street	Victoria Street	Water Street	0.096	Wellington	2.06
Woolwich Street East	Millford Crescent	Irvine Street	0.100	Wellington	2.28
Woolwich Street West	Victoria Street	Washington Street	0.100	Wellington	1.08
Plank Line	Graydon Drive	0.158 kms North of Prouse Road	2.880	SLA	1.90