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September 14, 2022

Mr. Mark Witsman, PE
Town Engineer
Town of McCordsville
6280 W 800
McCordsville, IN 46055

Re.: Carroll Road South of 96th Street
Guardrail Assessment – McCordsville, IN

Dear Mr. Witsman:

Etica Group has completed an assessment for roadside safety along Carroll Road approximately 1,550' south of 96th Street. The goal of the assessment was to determine whether an existing run of deficient guardrail can be removed or will require replacement.

As part of the assessment, Etica Group performed a series of field measurements at 25' intervals which included embankment slope and length. This information was utilized to calculate the embankment's average side slope and height at each location. Additionally, the INDOT traffic count database system contained an annual average daily traffic count of 11,557 vehicles per day in year 2019.

Etica Group then evaluated this data against criteria outlined in the Indiana Design Manual to determine if the existing guardrail along Carroll Road south of 96th Street could be removed or if replacement is required. With a posted speed limit on Carroll Road of 40 mph, Indiana Design Manual (IDM) Figure 49-3B (35,40) was used to compare the embankment side slope to the embankment height based on daily traffic. The embankment slopes along the 303' of existing guardrail were no steeper than 2.5:1 (see attached calculations). As a result, regardless of the embankment height and daily traffic volume, guardrail was not warranted for a 2-lane, 2-way roadway based on this criterion.

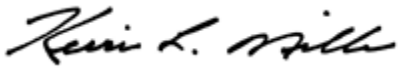
The INDOT requirement that was next applied to this section of guardrail was the roadway's clear-zone width. Based on IDM Figure 49-2A, for a roadway with design speed of 40 mph or less and AADT over 6,000 vehicles per day, a clear-zone of 16' to 18' is required. During the field investigations, trees along Carroll Road were measured to be within the 16' to 18' range (numerous ones were within 12'-14').

Based on Carroll Road's clear-zone width requirements as noted above, removal of the existing guardrail without replacement is not recommended since the objects in the clear-zone would be

unprotected. Additionally, leaving the existing guardrail in place is also not recommended due to its substandard height, which could pose as an additional danger to vehicles that exit the roadway. For these reasons, it is recommended that the existing run of deficient guardrail be removed and new guardrail installed. A preliminary construction cost estimate has been prepared for this alternative, which is estimated to cost approximately $32,500 including a 15% contingency.

Attached are the field measurements taken in August 2022, site photos, IDM criteria applied to this assessment and preliminary construction cost for your reference. Please do not hesitate to contact me at kmiller@eticagroup.com or by phone at 317-626-1671 if you have any questions or require additional information.

Respectfully Submitted,



Kevin Miller, PE
Director of Engineering Services

Enclosures
cc: file

Carroll Road Guardrail Field Photos

Figure 1: Face of guardrail at the north end of the guardrail limits. Large trees located within the clear-zone.

Figure 2: Existing guardrail laying flat on the ground.

Carroll Road Guardrail Field Photos (Cont.)

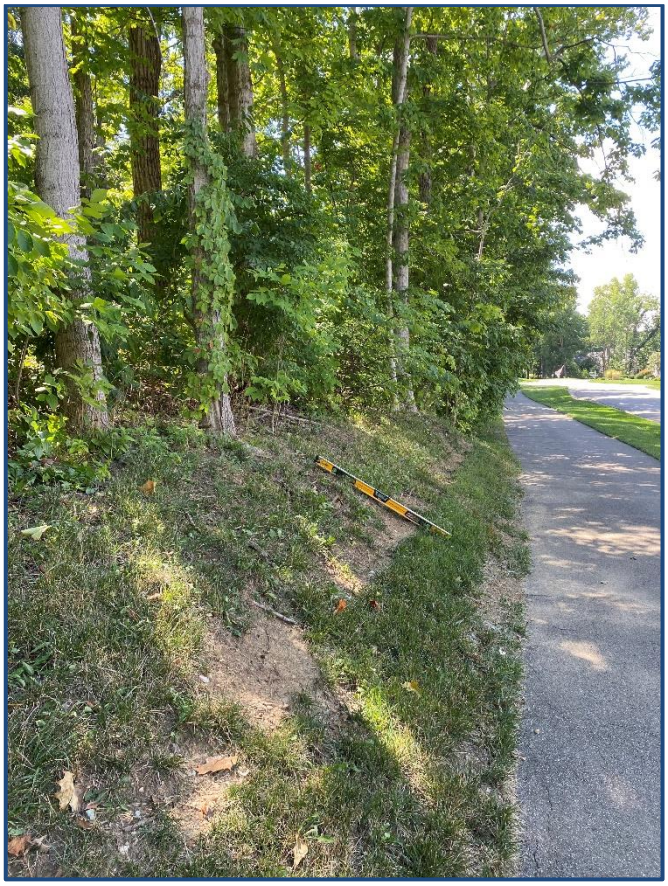


Figure 3: Slope tying into existing multi-use path at bottom of embankment.

Sta: 0+00

	Road	
Measurement	1	
Slope	24.6	
Distance (ft)	4	
Height(ft)	1.67	**1.67**

Avg. Sideslope
2.5 :1

Sta: 0+25

	Road		Path	
Measurement	1	2	3	
Slope	30	14.5	19.1	
Distance (ft)	4	4	5	
Height(ft)	2.00	1.00	1.64	**4.64**

Avg. Sideslope
2.8 :1

Sta: 0+50

	Road				Path	
Measurement	1	2	3	4	5	
Slope	14.5	21.7	21.5	22.9	24.3	
Distance (ft)	4	4	4	4	4	
Height(ft)	1.00	1.48	1.47	1.56	1.65	**7.15**

Avg. Sideslope
2.8 :1

Sta: 0+75

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	14.4	26.5	23	17.4	14.5	14.8	
Distance (ft)	4	4	4	4	4	4	
Height(ft)	0.99	1.78	1.56	1.20	1.00	1.02	**7.56**

Avg. Sideslope
3.2 :1

Sta: 1+00

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	18.6	21.1	22	25.1	15.9	15.8	
Distance (ft)	4	4	4	4	4	4	
Height(ft)	1.28	1.44	1.50	1.70	1.10	1.09	**8.10**

Avg. Sideslope
3.0 :1

Sta: 1+25

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	21.8	20.7	18.6	8	18.1	18.6	
Distance (ft)	4	4	4	4	4	6	
Height(ft)	1.49	1.41	1.28	0.56	1.24	1.91	**7.89**

Avg. Sideslope
3.3 :1

Sta: 1+50

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	12.5	18.4	10.2	11.6	10.1	19.3	
Distance (ft)	4	4	4	4	4	4	
Height(ft)	0.87	1.26	0.71	0.80	0.70	1.32	**5.66**

Avg. Sideslope
4.3 :1

Sta: 1+75

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	6.8	7.5	12.9	7.2	15.3	29.4	
Distance (ft)	4	4	4	4	4	6	
Height(ft)	0.47	0.52	0.89	0.50	1.06	2.95	**6.39**

Avg. Sideslope
4.4 :1

Sta: 2+00

	Road					Path	
Measurement	1	2	3	4	5	6	
Slope	7.2	6.8	14	6.5	14.9	31.1	
Distance (ft)	4	4	4	4	4	6	
Height(ft)	0.50	0.47	0.97	0.45	1.03	3.10	**6.52**

Avg. Sideslope
4.3 :1

Sta: 2+25

	Road			Path	
Measurement	1	2	3	4	
Slope	14.4	19.8	27.1	25.2	
Distance (ft)	4	4	4	2	
Height(ft)	0.99	1.35	1.82	0.85	**5.02**

Avg. Sideslope
2.8 :1

Sta: 2+50

	Road		Path	
Measurement	1	2	3	
Slope	9.5	25.4	26.3	
Distance (ft)	4	4	3	
Height(ft)	0.66	1.72	1.33	**3.71**

Avg. Sideslope
2.9 :1

Sta: 2+75

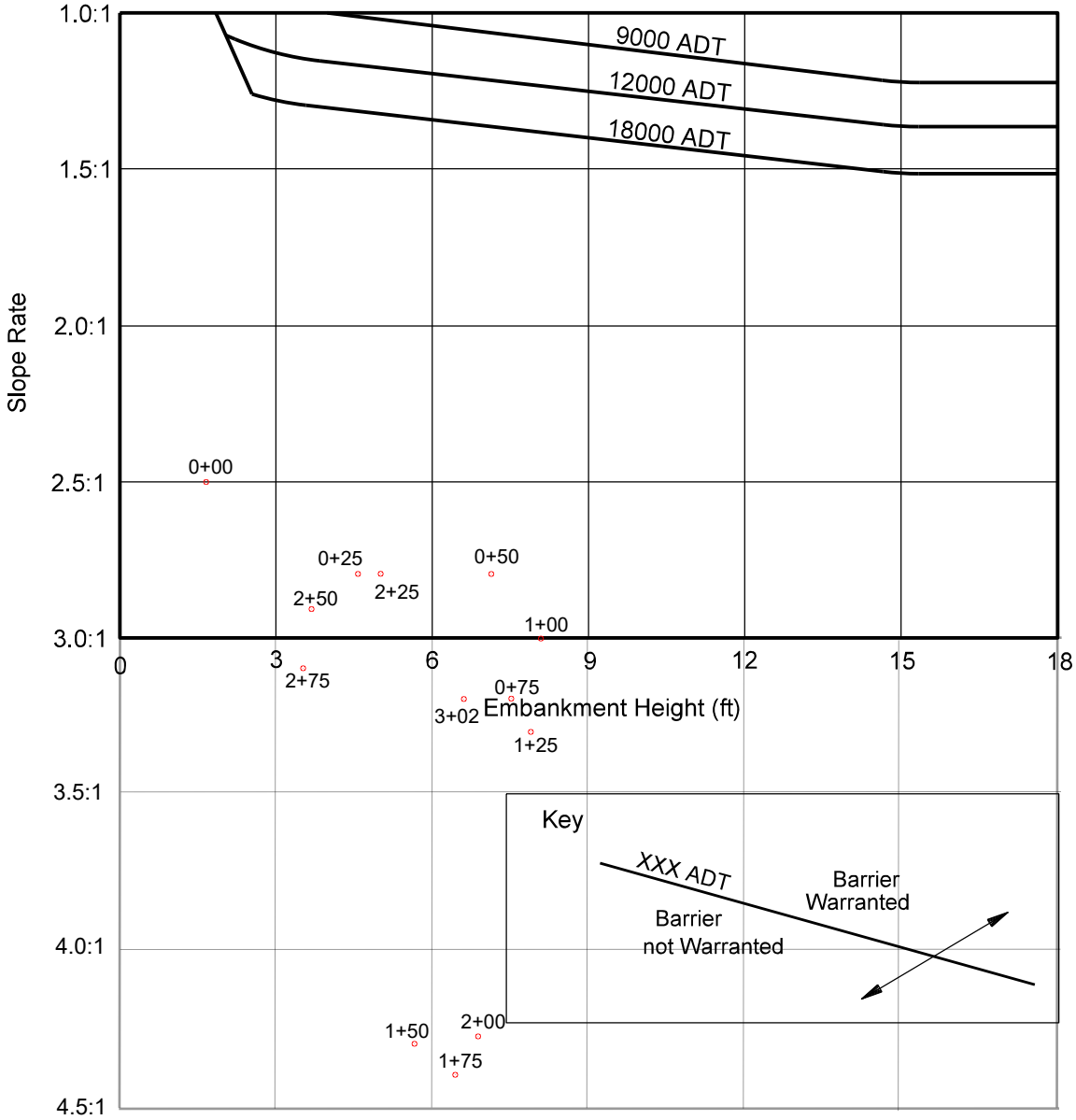
	Road		Path	
Measurement	1	2	3	
Slope	7.2	26.1	25	
Distance (ft)	4	4	3	
Height(ft)	0.50	1.76	1.27	**3.53**

Avg. Sideslope
3.1 :1

Sta: 3+03

	Road				Path	
Measurement	1	2	3	4	5	
Slope	7.2	16.3	15.6	23.1	29	
Distance (ft)	4	4	4	4	5	
Height(ft)	0.50	1.12	1.08	1.57	2.42	**6.69**

Avg. Sideslope
3.2 :1



BARRIER WARRANT FOR EMBANKMENT,
2-LANE, 2-WAY ROADWAY, 35 or 40 mph

Figure 49-3B (35,40)

Design Speed (mph)	Design Year AADT, T	Foreslopes		Backslopes		
		6:1 or Flatter	5:1 or 4:1	3:1	4:1 or 5:1	6:1 or Flatter
≤ 40	< 750	7–10	7–10	7–10	7–10	7–10
	750 ≤ T < 1500	10-12	12-14	10-12	10-12	10-12
	1500 ≤ T ≤ 6000	12-14	14-16	12-14	12-14	12-14
	> 6000	14-16	16-18	14-16	14-16	14-16
45 or 50	< 750	10-12	12-14	8-10	8-10	10-12
	750 ≤ T < 1500	12-14	16-20	10-12	10-14	14-16
	1500 ≤ T ≤ 6000	16-18	20-26	12-14	14-16	16-18
	> 6000	18-20	24-28	14-16	18-20	20-22
55	< 750	12-14	14-18	8-10	10-12	10-12
	750 ≤ T < 1500	16-18	20-24	10-12	14-16	16-18
	1500 ≤ T ≤ 6000	20-22	24-30	14-18	16-18	20-22
	> 6000	22-24	26-32*	16-18	20-22	22-24
60	< 750	16-18	20-24	10-12	12-14	14-16
	750 ≤ T < 1500	20-24	26-32*	12-14	16-18	20-22
	1500 ≤ T ≤ 6000	26-30	32-40*	14-18	18-22	24-26
	> 6000	30-32*	36-44*	20-22	24-26	26-28
65 or 70	< 750	18-20	20-26	10-12	14-16	14-16
	750 ≤ T < 1500	24-26	28-36*	12-16	18-20	20-22
	1500 ≤ T ≤ 6000	28-32*	34-42*	16-20	22-24	26-28
	> 6000	30-34*	38-46*	22-24	26-30	28-30

Notes:

** Where a site-specific investigation indicates a high probability of continuing crashes, or such occurrences are indicated by crash history, a clear-zone distance greater than that shown in the table may be provided. The clear-zone width may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs has indicated satisfactory performance.*

1. For a foreslope of 3:1, recovery is less likely if it is unshielded. Fixed objects should not be present. Recovery of a high-speed vehicle that encroaches beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should take into consideration right of way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through travel lane and the beginning of the 3:1 slope should influence the recovery area provided at the toe of slope.

CLEAR-ZONE WIDTH (ft)
FOR NEW CONSTRUCTION OR RECONSTRUCTION

Figure 49-2A

PROJECT SUMMARY REPORT

Project: Guardrail Assessment	Job Number: 220104-3	Bid Date: 09-13-2022	State: IN

Location: Carroll Road

Project Settings

Primary County:	HANCOCK	**Urban / Rural:**	URBAN
Addl Counties:		**Project Type:**	GUARD RAIL WORK
District:	Greenfield	**Work Type:**	URBAN MAJOR COLLECTOR
Latitude:	39° 55' 27"	**Traffic:**	FALL
Longitude:	85° 56' 16"	**Estimator:**	jearleywine@eticagroup.com
Log Mile:	**Beg:**	**Constr Eng:**	2.00%
	End:	**Priced Date:**	
Station:	**Beg:**	**Create Date:**	2022-09-13
	End:	**Fed Project No:**	
Project Length:	0.0000 miles	**Mobe Percent:**	5.00%
Route:		**Survey Percent:**	0.00%

Project Sections

100	General Provisions	$5,500.00	16.90%
200	Earthwork	$1,309.00	4.02%
300	Aggregate Pavement and Bases	$0.00	0.00%
400	Asphalt Pavement	$0.00	0.00%
500	Concrete Pavement	$0.00	0.00%
600	Incidental Construction	$20,330.00	62.48%
700	Structures	$0.00	0.00%
800	Traffic Control Devices and Lighting	$5,400.00	16.60%
900	Materials Details	$0.00	0.00%
Total		**$32,539.00**	**100.0%**

STIP Information

Construction Cost	$32,539.00	100.00%
R/W	$0.00	0.00%
R/W Incidentals	$0.00	0.00%
Utilities	$0.00	0.00%
Incentive	$0.00	0.00%
PE (0.00% of construction cost)	$0.00	0.00%
CE (0.00% of construction cost)	$0.00	0.00%
Total	**$32,539.00**	**100.0%**

Major Categories

MISC.	$100.00	100.00%
Total	**$100.00**	**100.0%**

Project: Guardrail Assessment	Job Number: 220104-3	Bid Date: 09-13-2022	State: IN

Location: Carroll Road

Pay Item	Description	Quantity	Unit	Unit Price	Extension
105-06845	CONSTRUCTION ENGINEERING	1.000	L.S.	500.00	$500.00
110-01001	MOBILIZATION AND DEMOBILIZATION	1.000	L.S.	5,000.00	$5,000.00
201-52370	CLEARING RIGHT OF WAY	1.000	L.S.	300.00	$300.00
205-12108	STORMWATER MANAGEMENT BUDGET	1,009.000	$	1.00	$1,009.00
601-02103	GUARDRAIL, W-BEAM, SHOP CURVED, 6 FT 3 IN. SPACING	303.000	L.F.	40.00	$12,120.00
601-02241	GUARDRAIL, REMOVE	303.000	L.F.	10.00	$3,030.00
601-05999	CURVED TERMINAL END	1.000	EACH	110.00	$110.00
621-06560	MULCHED SEEDING U	169.000	S.Y.	30.00	$5,070.00
801-06775	MAINTAINING TRAFFIC	1.000	L.S.	1,100.00	$1,100.00
809-87000	CONTINGENCY {15 PERCENT}	1.000	L.S.	4,300.00	$4,300.00
				Total:	**$32,539.00**

REPORT PARAMETERS	
Project	220104-3 - Guardrail Assessment
Comparison	Bid Price