Orangeville Road
Stephenson County, IL
Sampling Report

HERITAGE RESEARCH GROUP

Orangeville Road; Stephenson Co, IL - Sampling Report Summary

Background

- Per request of Stephenson County, Orangeville Road was sampled on November 8th , 2023, from West McConnell Road to 0.25 miles east of IL-26. The roadway was sampled to explore existing material, as well as evaluate the roadway's candidacy for a Cold In-Place Recycling (CIR) treatment utilizing engineered emulsion.
- The total project length is approximately 5.5 miles, averaging 20.8 feet wide, with a total existing pavement area of approximately 67,100 square yards.
- A total of 16 locations were sampled throughout the roadway to measure material thickness and examine material type.

Findings

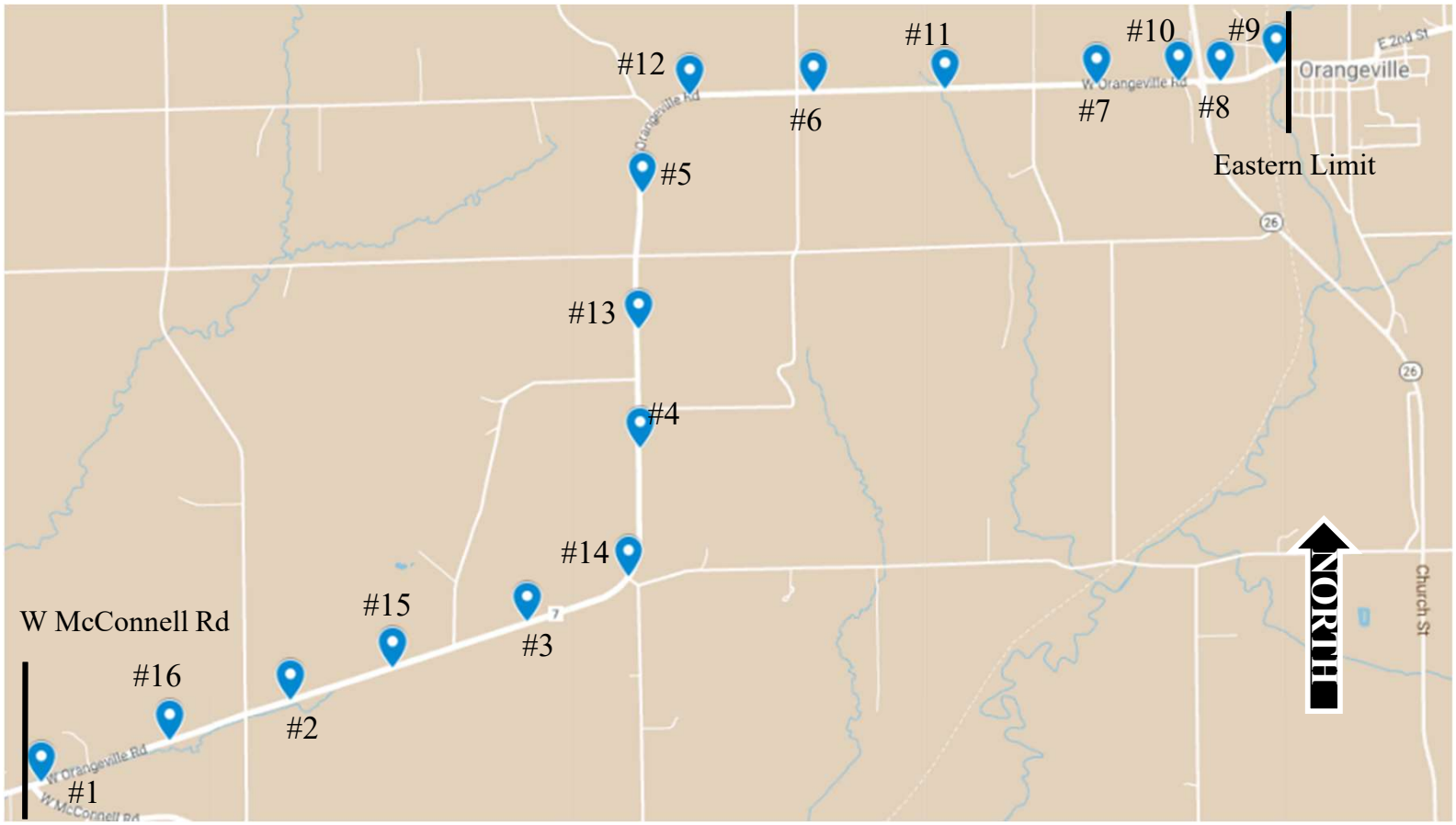
- Bituminous material thicknesses ranged from 3.5 to 7.0 inches, with an average of 5.3 inches.
  - The bituminous material throughout the project consisted of several layers of HMA.
- The aggregate base observed below the bituminous material was a crushed aggregate.
- Common failures and distresses throughout the project include alligator cracking and transverse cracking.
- Existing drainage conditions along the roadway appear adequate for a potential cold recycling treatment.
- Dynamic Cone Penetrometer (DCP) testing was performed at each of the sampling locations to estimate base and subgrade strength. Additional information about DCP testing can be found in Appendix A.
  - The estimated California Bearing Ratio (CBR) values determined from DCP testing represent subgrade strength, with low numbers for weaker materials, and high numbers for stronger subgrade.
  - DCP test results are included on individual location pages and indicate that the locations tested appear to have adequate subgrade strength for cold recycling treatment.

Orangeville Road; Stephenson Co, IL - Sampling Report Summary

Recommendations

- Per conversations with Stephenson County, a 4.0-inch CIR is planned for Orangeville Road. Full-depth cracking and stripping similar to that observed at locations #2, 4, 11, 12, 13, 14, and 16 cannot be addressed with a 4.0-inch CIR treatment.
  - Some of the distresses throughout the pavement were observed to extend deeper than the recommended 4.0-inch treatment depth. The recommended CIR treatment depth is submitted with the consideration that a CIR cannot repair the materials or distresses left unprocessed by the treatment but can delay further damage to the final surface.
  - Should Stephenson County wish to address the entirety of the distresses observed on East River Road, a Full Depth Reclamation (FDR) treatment is recommended for the roadway. Based on the existing pavement depths, an 8.0-inch FDR would incorporate the entire depth of HMA pavement along with the underlying aggregate base, eliminating the observed distresses on the roadway.
- A thorough pavement design is recommended to be performed to determine the proper surface treatment for a recycled pavement based on the expected traffic.
  - It is recommended to overlay with a minimum single lift HMA surface.
- For estimating purposes, the recommended asphalt emulsion yield for the proposed 4.0-inch CIR treatment is approximately 1.5 gallons per square yard. The mix design, per LR 1000-1 of the Bureau of local Road and Streets, will dictate final yield.

Sampling and Testing Locations
Orangeville Road – Stephenson Co, IL



Pavement Thickness by Locations
Orangeville Road – Stephenson Co, IL

Location #	Lane Direction	Approximate Distance from County Highway 10 (mi.):	Average Bituminous Pavement Thickness (in.):
1	EB	0.02	6.0
2	EB	0.85	5.5
3	EB	1.63	5.1
4	EB	2.40	5.1
5	NB	3.21	4.5
6	NB	3.98	4.9
7	EB	4.86	6.0
8	EB	5.26	3.5
9	WB	5.44	7.0
10	WB	5.13	3.5
11	WB	4.39	6.8
12	WB	3.59	6.0
13	SB	2.78	4.0
14	SB	1.99	6.0
15	WB	1.18	4.8
16	WB	0.45	5.6
Average			**5.3**

Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 1: Westbound Lane

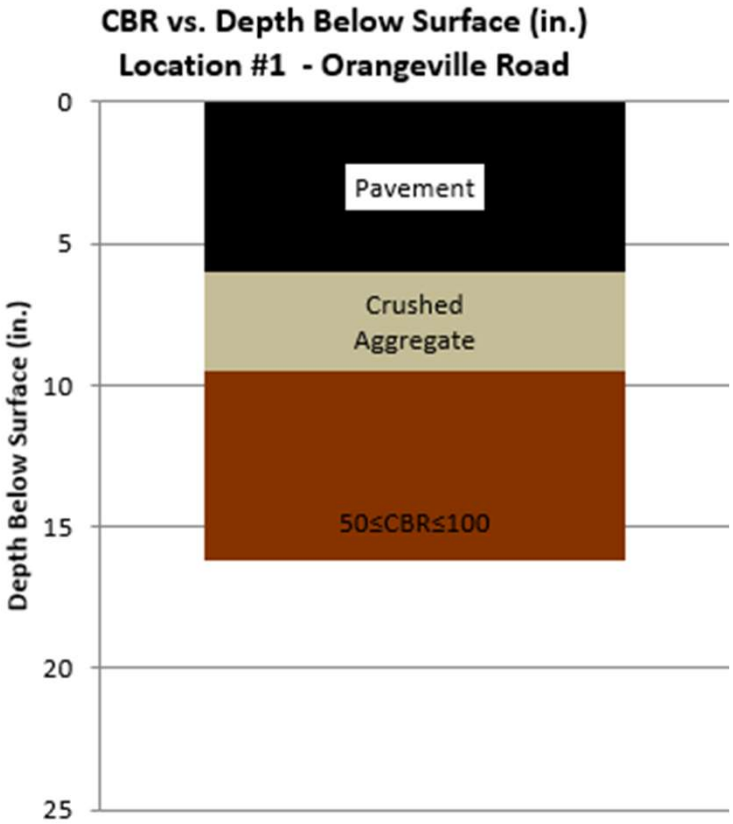
Existing Roadway Condition

Sampling Observations:

- Transverse cracking was observed
- Block cracking was observed
- An average of 6.0 inches of bituminous material was observed at this location
- Debonding in core #2 and 3 was observed at a depth of 3.8 inches
- A crushed aggregate base was observed directly below the bituminous material past a depth of 9.5 inches

Pictured Bituminous Thickness

#1-5.5” #2-6.0” #3-6.5”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 2: Westbound Lane

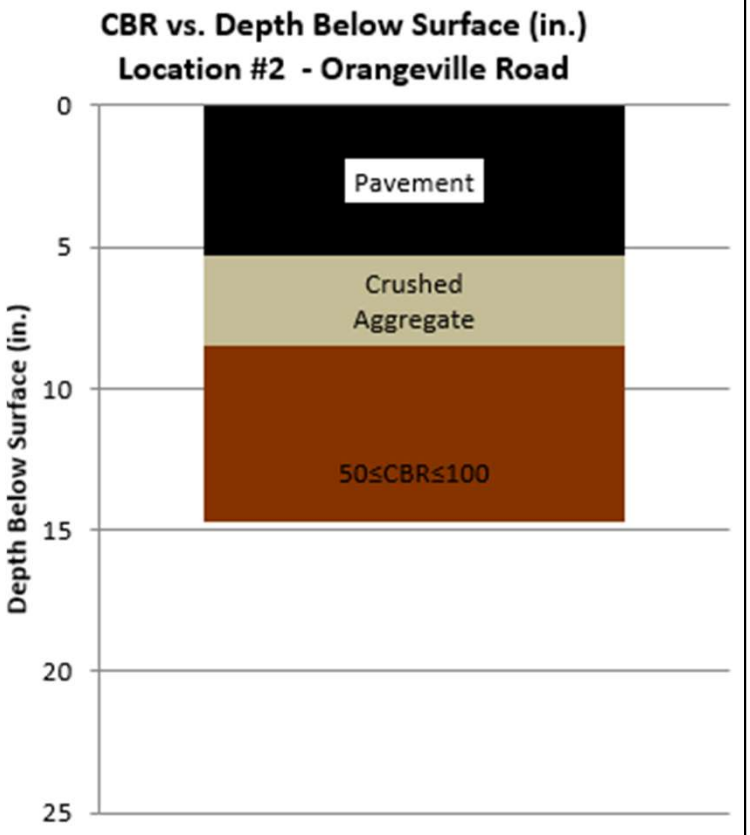
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- Alligator cracking was observed
- An average of 5.5 inches of bituminous material was observed at this location
- Full depth cracking was observed in core #3
- A crushed aggregate base was observed directly below the bituminous material past a depth of 8.5 inches

Pictured Bituminous Thickness

#1-5.3” #2-6.0” #3-5.3”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 3: Westbound Lane

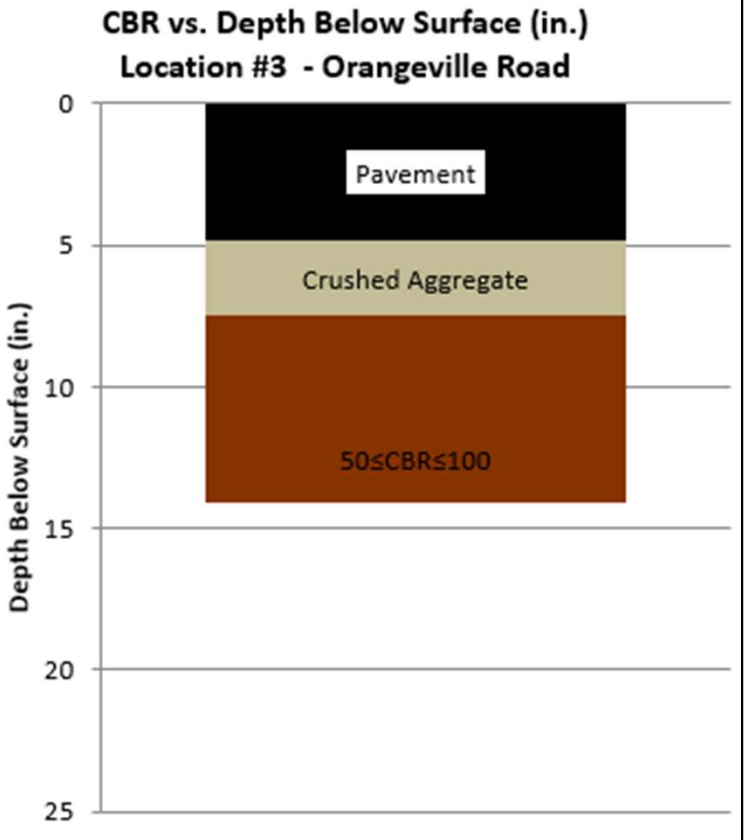
Existing Roadway Condition

Sampling Observations:

- Alligator cracking was observed
- An average of 5.1 inches of bituminous material was observed at this location
- Debonding was observed at depth of 3.0 inches
- A crushed aggregate base was observed directly below the bituminous material past a depth of 7.5 inches

Pictured Bituminous Thickness

#1-4.8” #2-5.0” #3-5.5”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 4: Westbound Lane

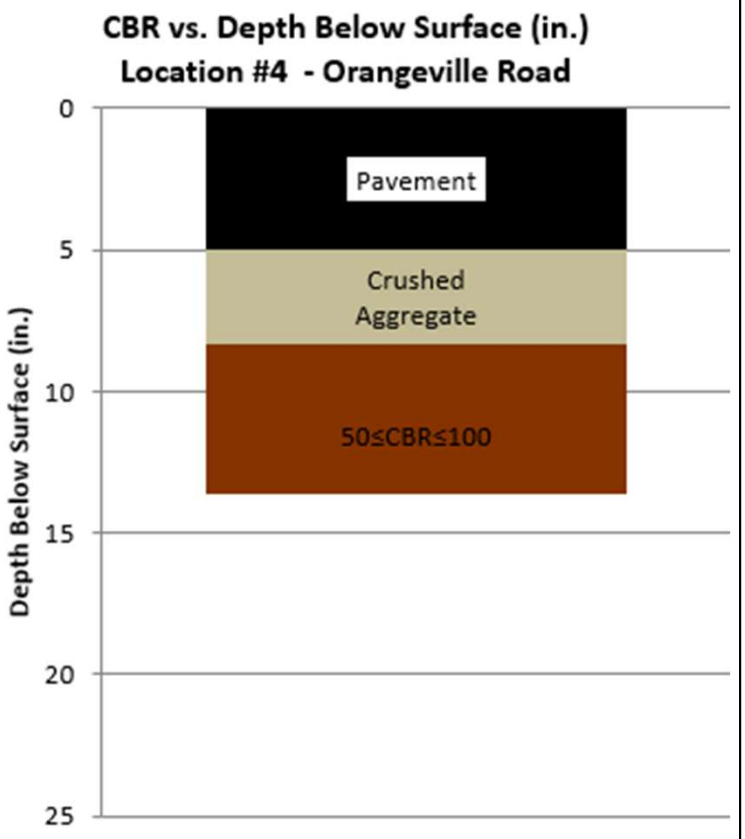
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- An average of 5.1 inches of bituminous material was observed at this location
- Full depth samples unable to be extracted intact due to stripping was observed
- Full depth cracking was observed in cores #1 and 2
- A crushed aggregate base was observed below the bituminous material past a depth of 8.3 inches

Pictured Bituminous Thickness

#1-5.5” #2-5.3” #3-4.8”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 5: Northbound Lane

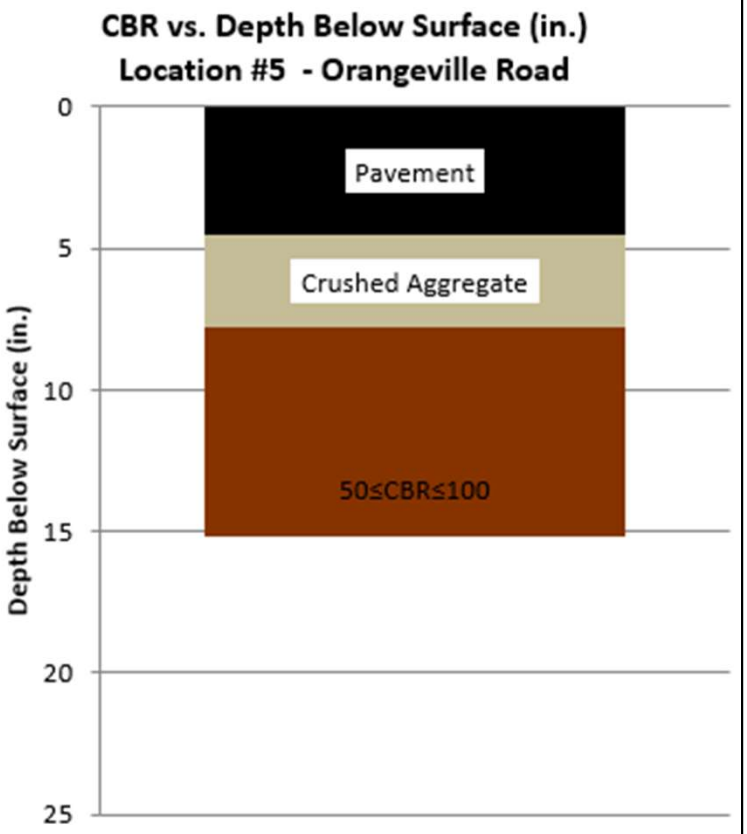
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- Loss of surface material was observed
- Loss of edge material was observed
- An average of 4.5 inches of bituminous material was observed at this location
- A crushed aggregate base was observed below the bituminous material past a depth of 8.3 inches

Pictured Bituminous Thickness

#1-4.8” #2-4.5” #3-4.3”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 6: Northbound Lane

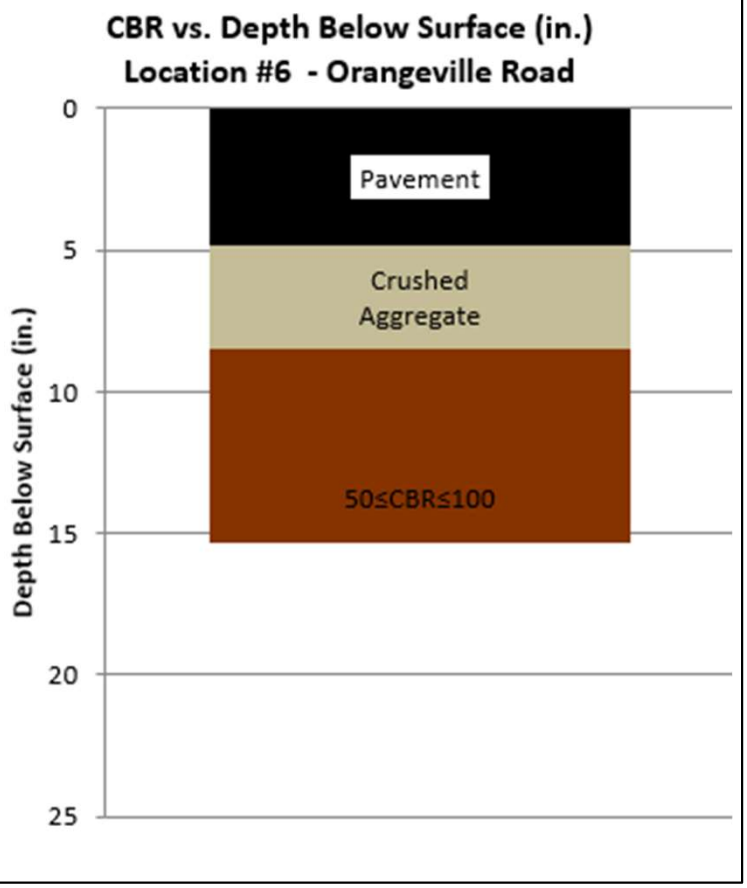
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- An average of 4.9 inches bituminous material was observed at this location
- A crushed aggregate base was observed directly below the bituminous material past a depth of 8.5 inches

Pictured Bituminous Thickness

#1-4.8” #2-5.0” #3-5.0”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 7: Eastbound Lane

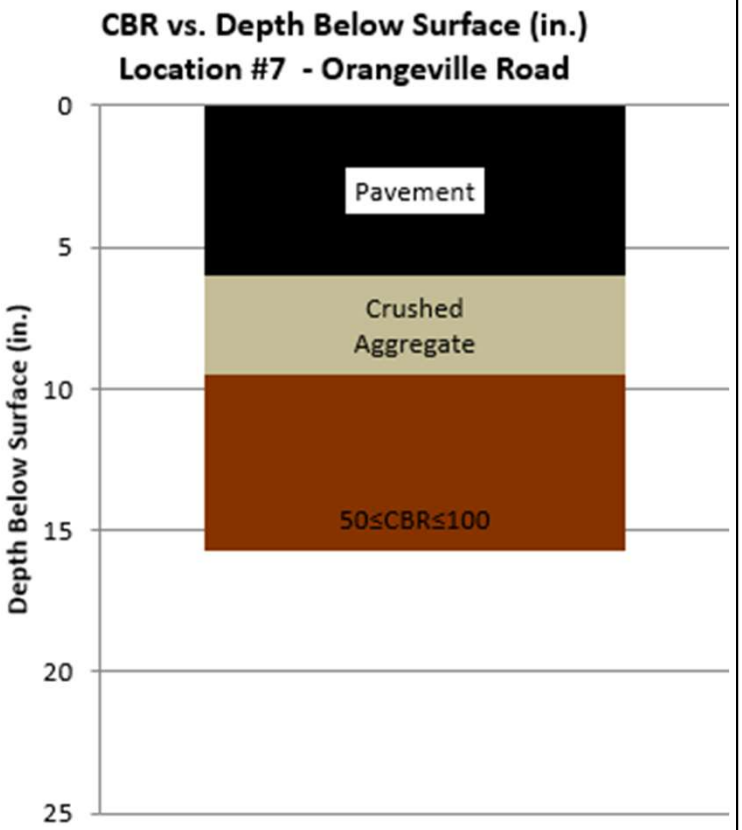
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- A total of 6.0 inches of bituminous material was observed at this location
- Bottom-up cracking was observed to a depth of 4.0 inches in cores #2 and 3
- A crushed aggregate base was observed below the bituminous material past a depth of 9.5 inches

Pictured Bituminous Thickness

#1-6.0” #2-6.0” #3-6.0”

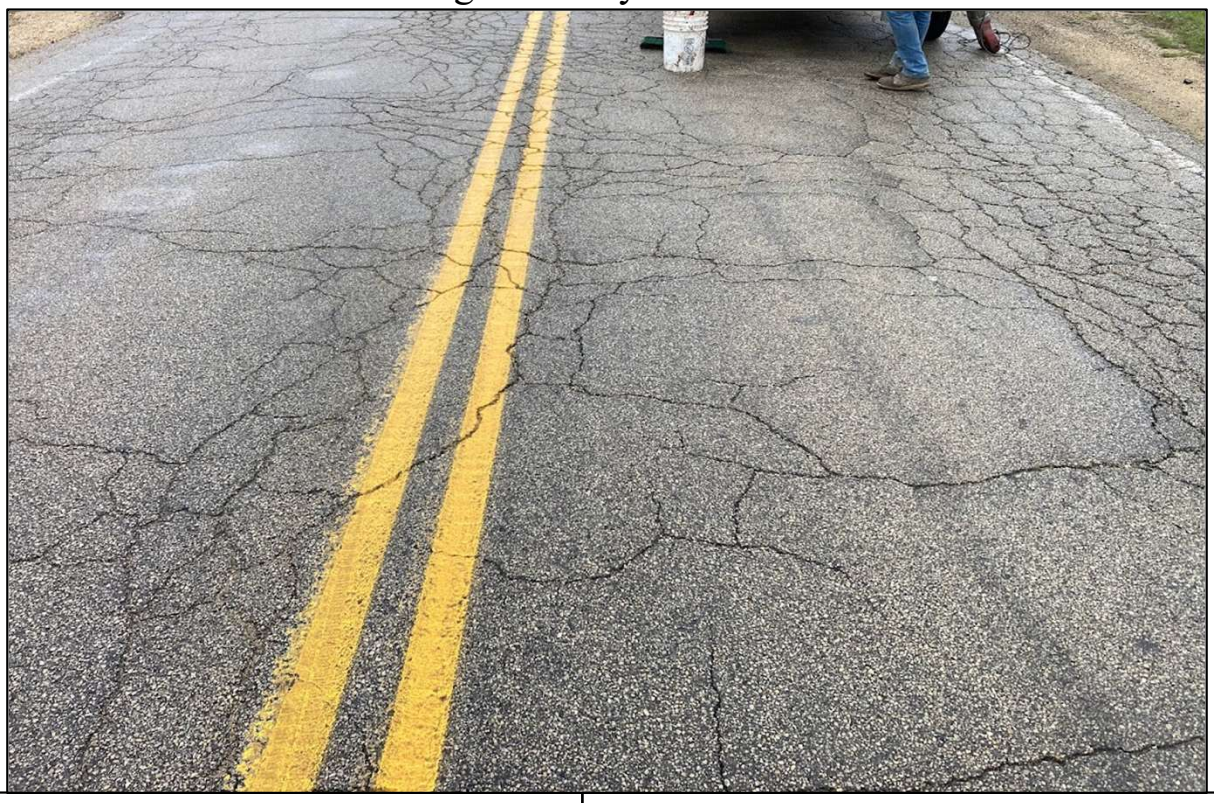


East River Road – Stephenson Co, IL

Sampling and Testing

Location 8: Eastbound Lane

Existing Roadway Condition

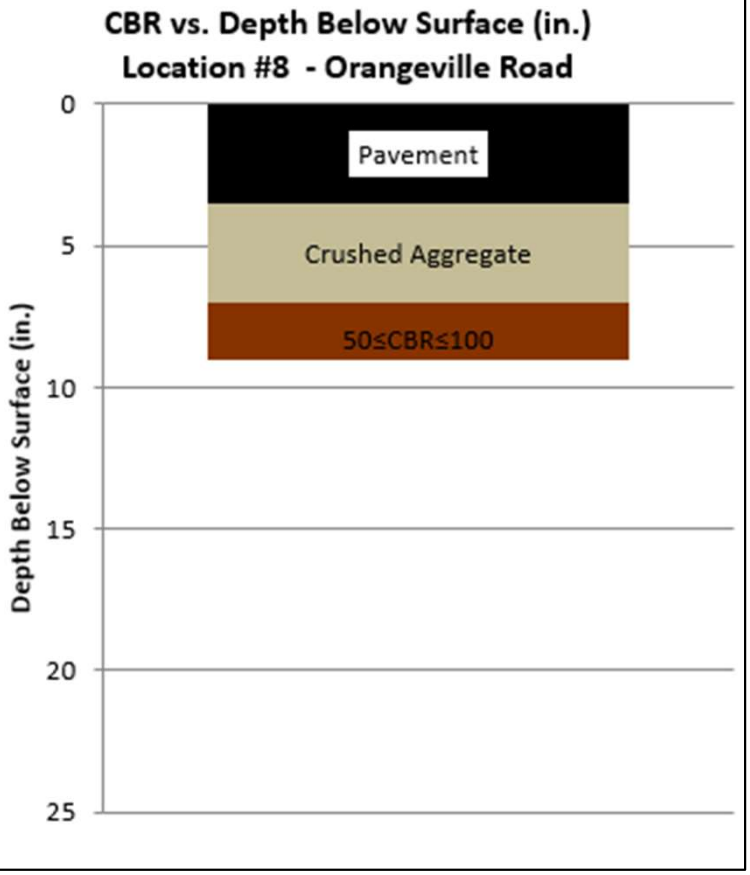


Sampling Observations:

- Alligator cracking was observed
- A total of 3.5 inches of bituminous material was observed at this location
- Full depth cracking was observed in core #1 and 2
- A crushed aggregate base was observed directly below the bituminous material past a depth of 7.0 inches

Pictured Bituminous Thickness

#1-3.5” #2-3.5” #3-3.5”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 9: Eastbound Lane

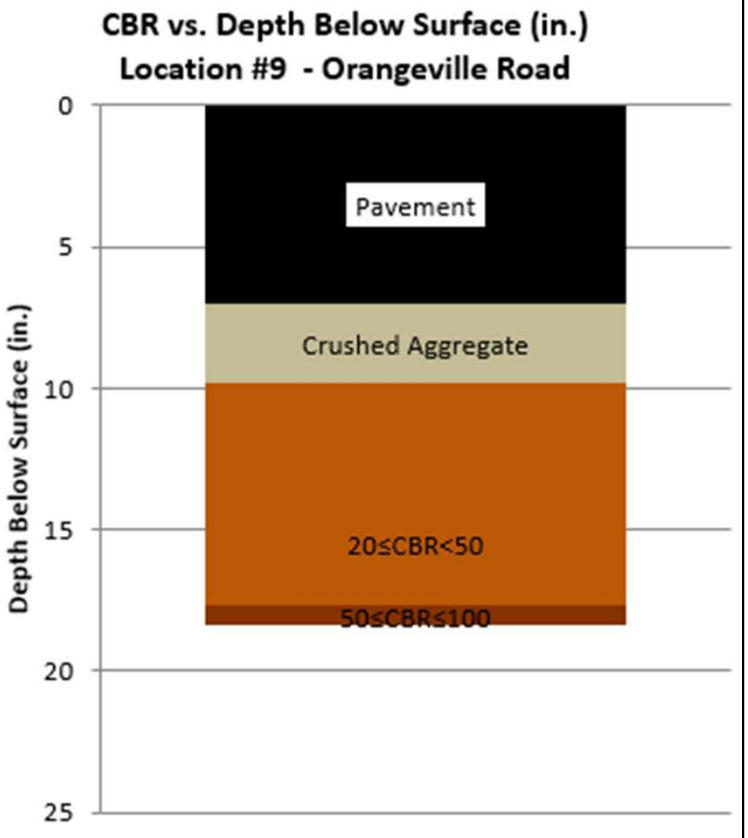
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- A total of 7.0 inches of bituminous material was observed at this location
- A crushed aggregate base was observed directly below the bituminous material past a depth of 9.8 inches

Pictured Bituminous Thickness

#1-7.0” #2-7.0” #3-7.0”

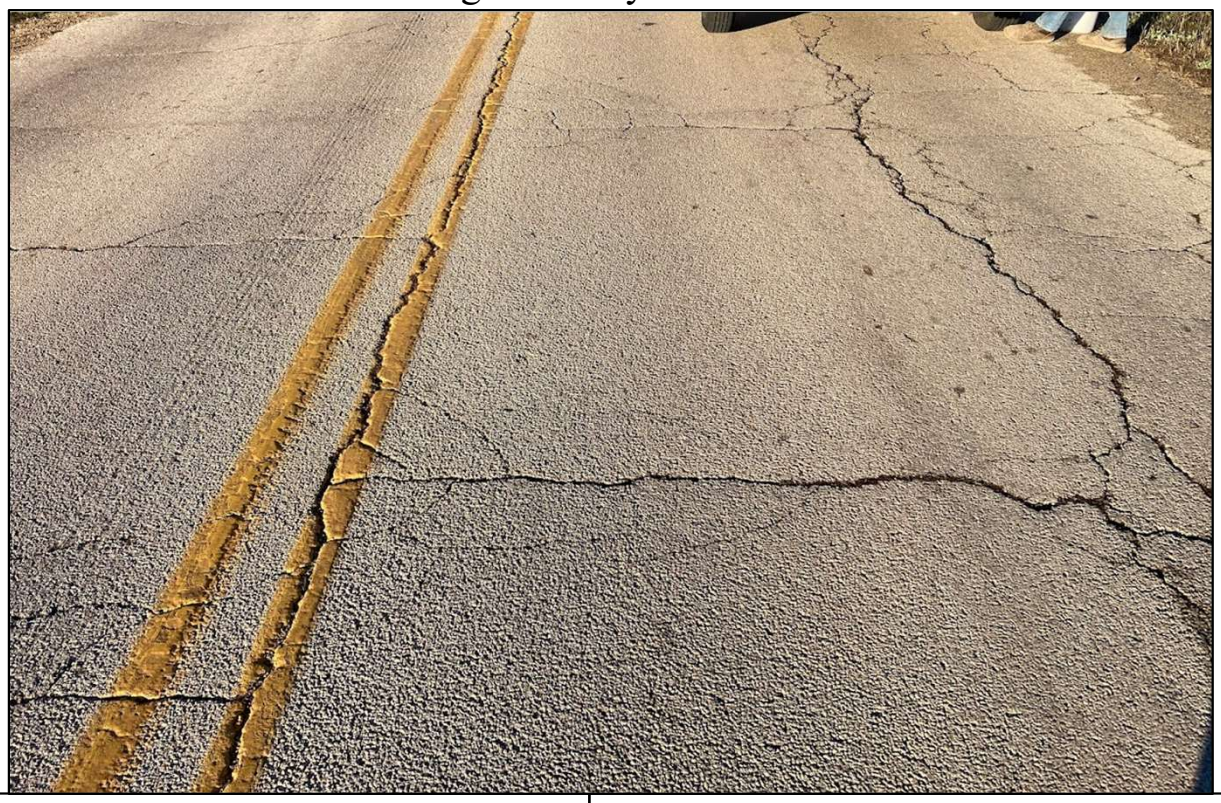


Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 10: Eastbound Lane

Existing Roadway Condition

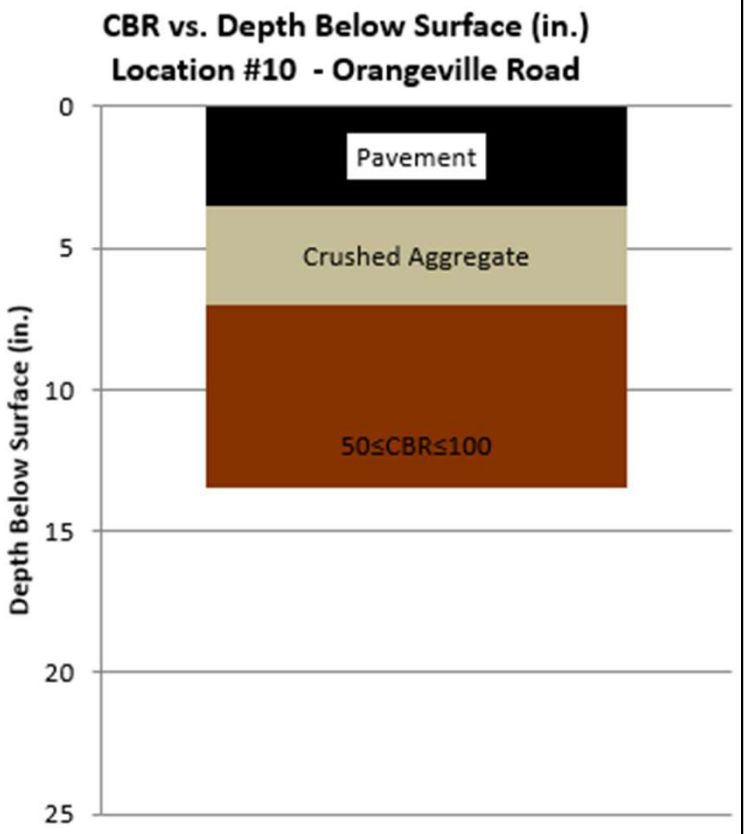


Sampling Observations:

- Longitudinal and transverse cracking was observed
- A total of 3.5 inches of bituminous material was observed at this location
- Top-down cracking was observed to a depth of 1.0 inches
- A crushed aggregate base was observed below the bituminous material past a depth of 7.0 inches

Pictured Bituminous Thickness

#1-3.5” #2-3.5” #3-3.5”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 11: Eastbound Lane

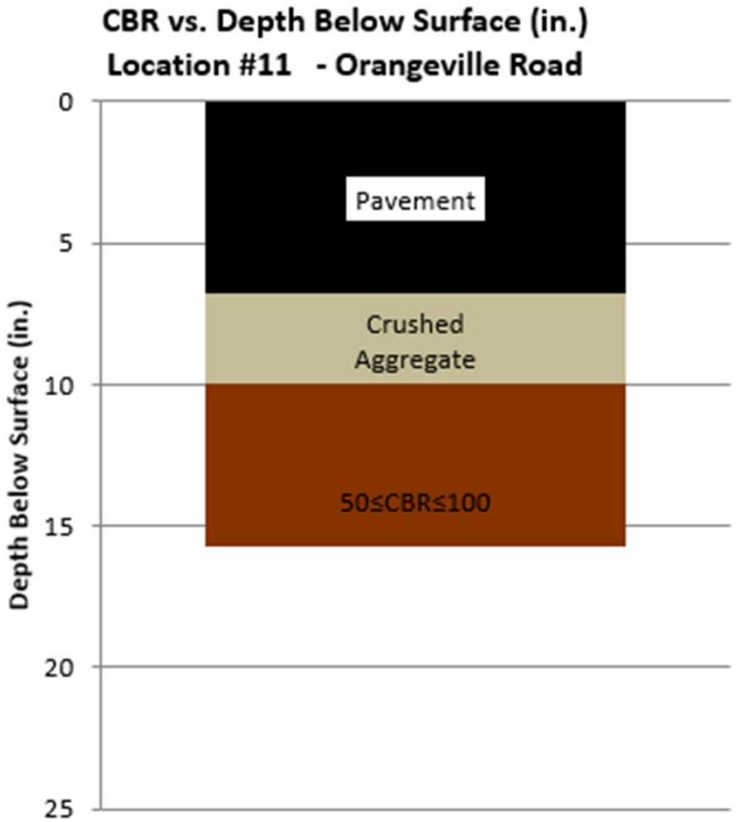
Existing Roadway Condition

Sampling Observations:

- Loss of surface material was observed in the westbound lane
- A total of 6.8 inches of bituminous material was observed at this location
- Stripping and cracking was observed below 4.0 inches in the cores
- A crushed aggregate base was observed directly below the bituminous material past a depth of 10.0 inches

Pictured Bituminous Thickness

#1-4.0” #2-6.8”

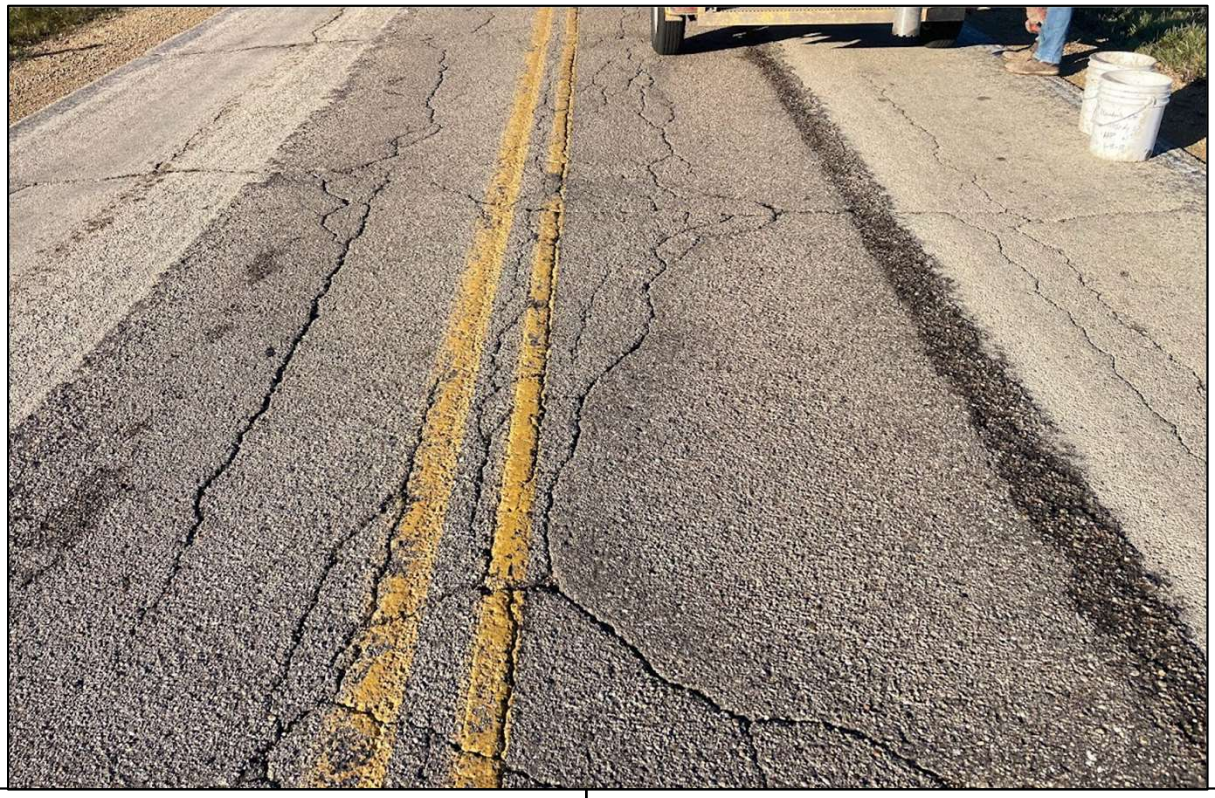


Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 12: Eastbound Lane

Existing Roadway Condition

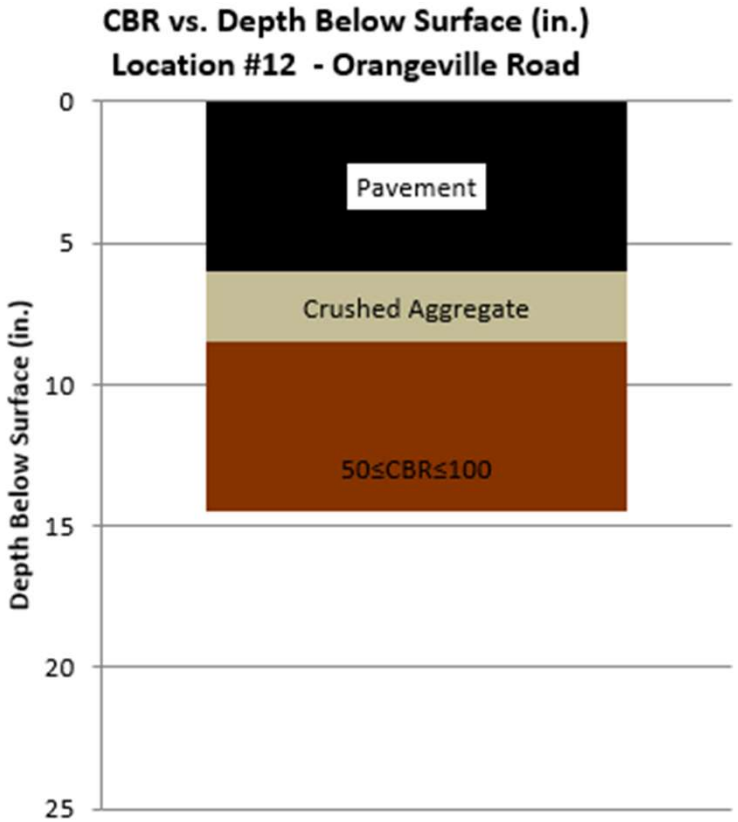


Sampling Observations:

- Longitudinal and transverse cracking was observed
- An average of 6.0 inches of bituminous material was observed at this location
- Full depth samples unable to be extracted intact
- Full depth cracking was observed in core #3
- A crushed aggregate was observed directly below the bituminous material past a depth of 8.5 inches

Pictured Bituminous Thickness

#1-5.0” #2-5.5” #3-5.5”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 13: Southbound Lane

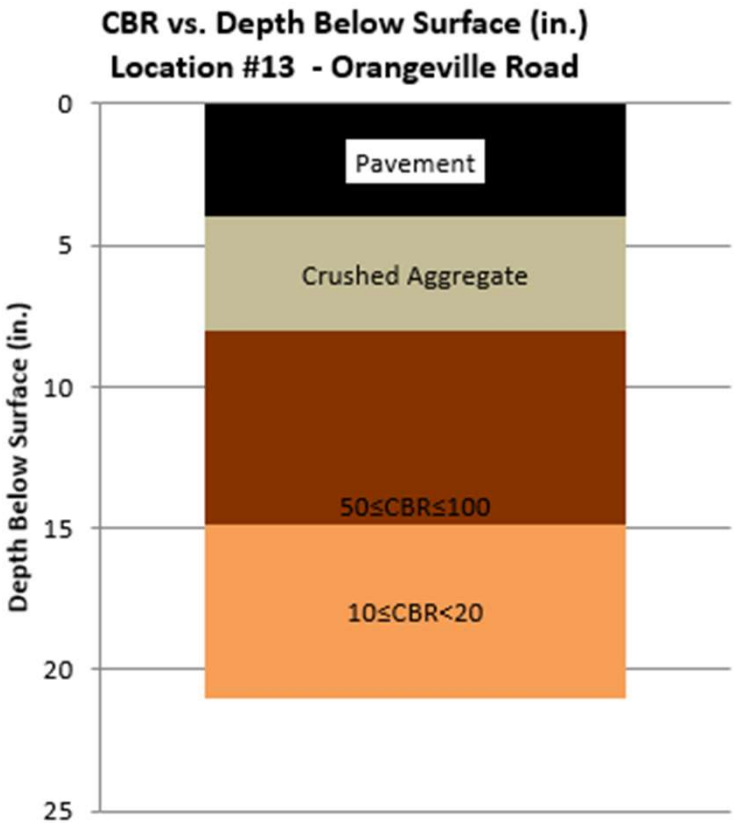
Existing Roadway Condition

Sampling Observations:

- Alligator cracking was observed
- An average of 4.0 inches of bituminous material was observed at this location
- Full depth samples unable to be extracted intact due to stripping past a depth of 2.0 inches in core #1 and 2
- A crushed aggregate was observed directly below the bituminous material past a depth of 8.0 inches

Pictured Bituminous Thickness

#1-2.8” #2-4.0” #3-4.0”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 14: Southbound Lane

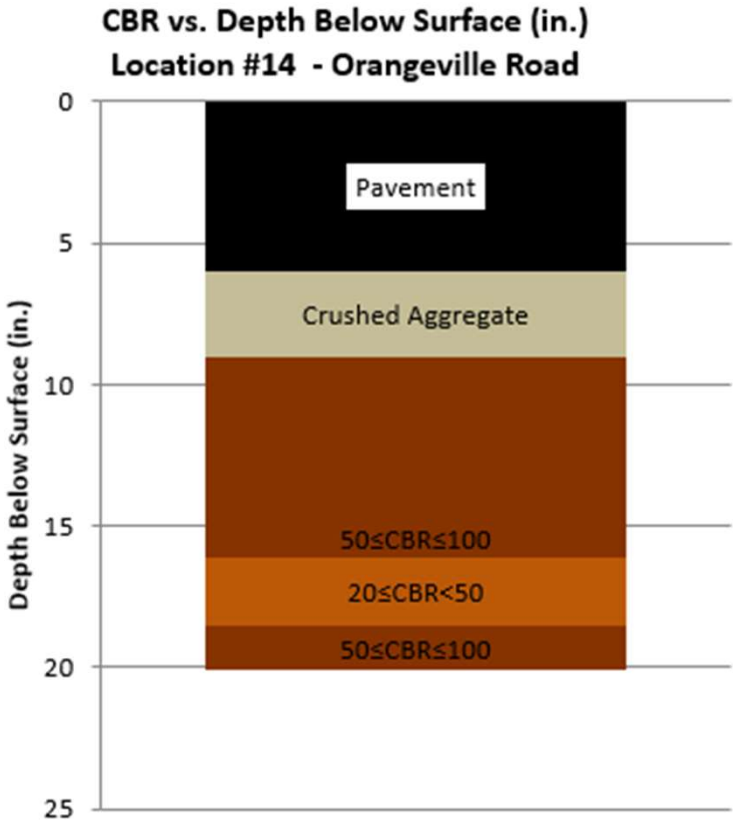
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- Alligator cracking was observed
- An average of 6.0 inches of bituminous material was observed at this location
- Stripping was observed at a depth of 4.0 inches in core #3
- Bottom-up cracking was observed in core #2
- A crushed aggregate was observed directly below the bituminous material past a depth of 9.0 inches

Pictured Bituminous Thickness

#1-6.0” #2-6.0” #3-6.0”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 15: Eastbound Lane

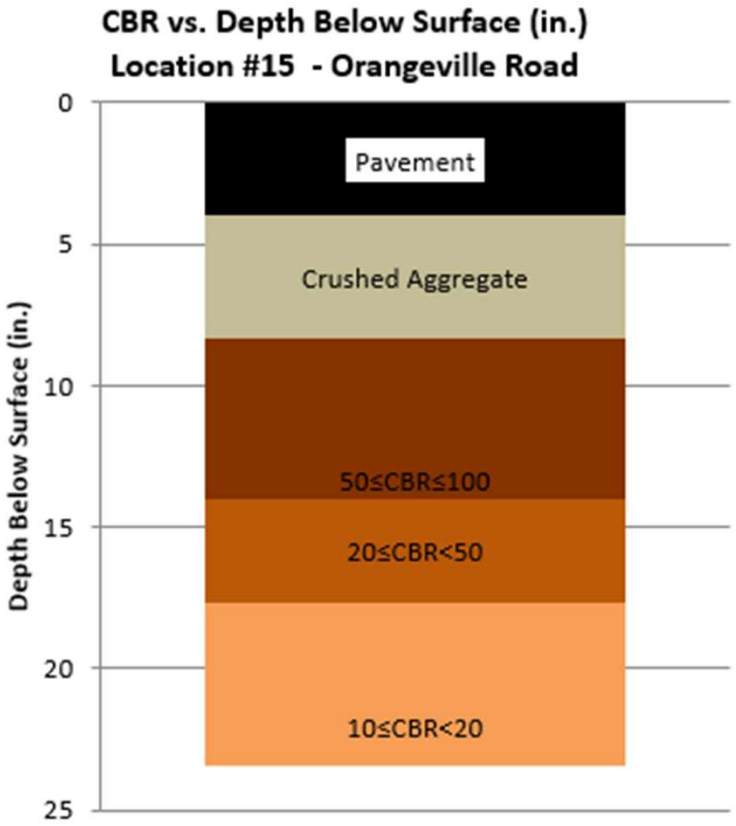
Existing Roadway Condition

Sampling Observations:

- Longitudinal and transverse cracking was observed
- An average of 4.8 inches of bituminous material was observed at this location
- Bottom-up cracking was observed in core #3
- A crushed aggregate was observed directly below the bituminous material past a depth of 8.3 inches

Pictured Bituminous Thickness

#1-4.5” #2-5.0” #3-5.0”



Orangeville Road – Stephenson Co, IL

Sampling and Testing

Location 16: Eastbound Lane

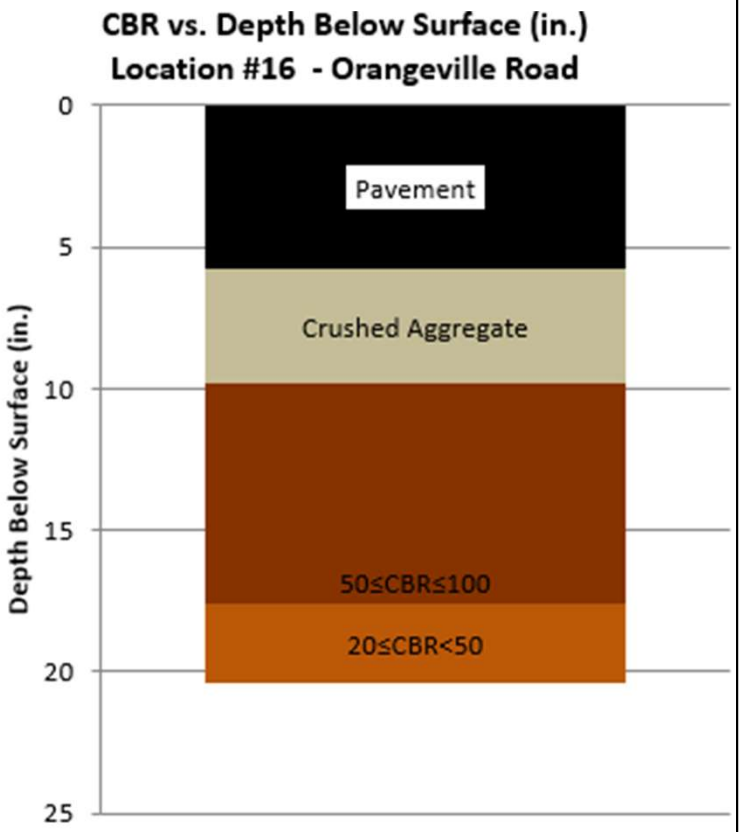
Existing Roadway Condition

Sampling Observations:

- Alligator cracking was observed
- An average of 5.6 inches of bituminous material was observed at this location
- Full depth cracking was observed
- A crushed aggregate was observed directly below the bituminous material past a depth of 9.8 inches

Pictured Bituminous Thickness

#1-5.8” #2-5.5”



Appendix A

Dynamic Cone Penetrometer Testing

- Dynamic Cone Penetrometer testing (ASTM 6951) involves the penetration rate of an 8 kg hammer through undisturbed soil and/or compacted materials.
- The penetration rate is then correlated to an estimated CBR value as shown in ASTM D6951, which in turn can be related to the more common resilient modulus for pavement design applications.
- As the hammer penetrates the natural subgrade beneath the layers of HMA, the penetration rate will vary depending on the strength of the subgrade materials.
- Typical CBR Values for reference purposes:
  - Aggregate Base: CBR > 50
  - Gravel and Gravelly Soils: 60 > CBR > 20
  - Sand and Sandy Soils: 20 > CBR > 10
  - Silts and Clays with low plasticity: CBR < 15
  - Silts and Clays with high moisture and plasticity: CBR < 5
- Test results are depicted in charts which show CBR values versus depth below the pavement surface.