

# ALBERTA TRANSPORTATION CLASS A BRIDGE INSPECTION COURSE

Level II Inspection of Concrete Bridge Elements



## Overview

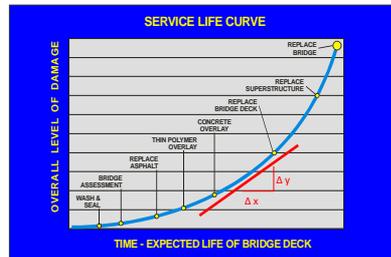
- Function of Level II Inspections for Concrete Bridge Elements
- Level II Concrete Inspection/Test Methods
  - Equipment
  - What does test data indicate
  - How is the data used



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## This Didn't Happen Overnight

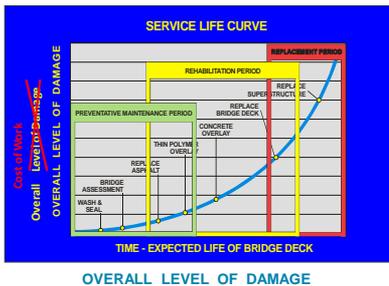


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OVERALL LEVEL OF DAMAGE



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Alberta Transportation Level II Inspections of Concrete Elements

Level II BIM Manual

- Chapter 2 - Concrete Deck Inspection
- Chapter 3 - Copper Sulfate Electrode Testing
- Chapter 4 - Chloride Testing

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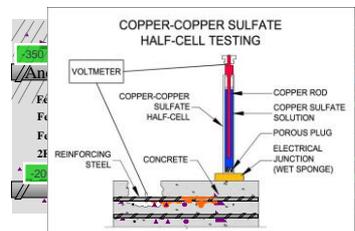
Chapter 3 - Copper Sulfate Electrode (CSE) Testing



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Chapter 3 - Copper Sulfate Electrode (CSE) Testing



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### Chapter 3 - Copper Sulfate Electrode (CSE) Testing

ASTM C876 Interpretation of Results

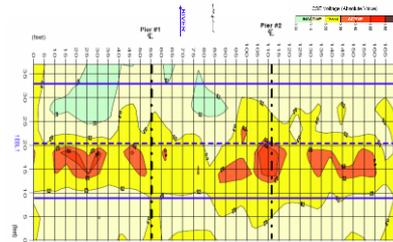
	Half-Cell Potential (Absolute Value)	Percent of Test Area	
<b>Inactive Area (0 to -0.2 V)</b> 90% Probability that active corrosion is not occurring.	0.000 to 0.099 V	0.0	1.4
	0.100 to 0.199 V		
<b>Transition Area (-0.2 V to -0.35 V)</b> Potential for active corrosion is indeterminate.	0.200 to 0.299 V	20.8	33.6
	0.300 to 0.349 V	12.7	
	0.350 to 0.399 V	14.7	
<b>Active Area (-0.35 V to -0.8 V)</b> Potential for active corrosion is indeterminate.	0.400 to 0.499 V	30.8	65.0
	0.500 to 0.599 V	19.5	
	0.600 to 0.699 V	0.5	
	0.700 to 0.799 V	0.5	

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### Chapter 3 - Copper Sulfate Electrode (CSE) Testing

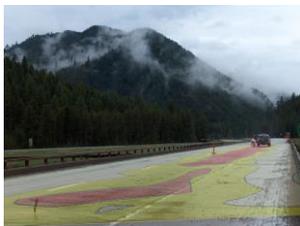


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### Chapter 3 - Copper Sulfate Electrode (CSE) Testing



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### Chapter 3 - Copper Sulfate Electrode (CSE) Testing

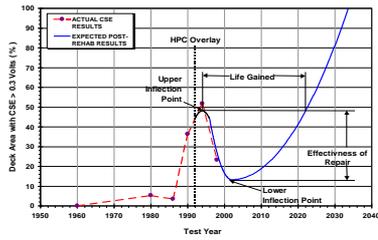


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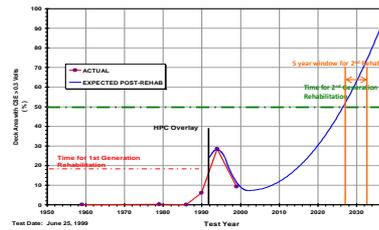
### CSE Prediction Model



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### Alberta Transportation Guidelines for Using CSE to Determine Timing of Repairs



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### Chapter 4 – Chloride Content Testing

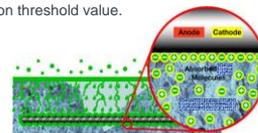


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### Chapter 4 – Chloride Content Testing

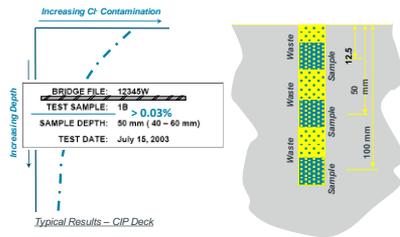
0.03 % Chloride per unit weight of concrete is known as the corrosion threshold value.



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### Chapter 4 – Chloride Content Testing



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### Chapter 4 – Chloride Content Testing

#### Rapid Chloride Test Method

- Advantages
- Speed of testing
  - Economical
  - Tests completed on site

- Disadvantages
- Testing completed on site
  - Not to be taken on decks with waterproofing membranes in good condition



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### Chapter 4 – Chloride Content Testing

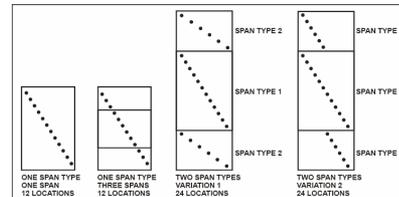


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### Chapter 4 – Chloride Content Testing

#### Selection of Test Locations:



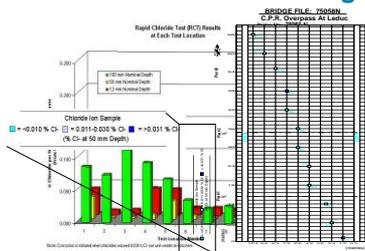
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## Chapter 4 – Chloride Content Testing

### Typical Results:

- Bar Chart
- Plan View of Bridge Deck



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## Chapter 4 – Chloride Content Testing

- **Quantitative**
  - Rating Methodology Different than Level I
- **Programmed**
  - Cyclic Basis to Monitor Condition
- **Specialized tools**
  - For Portions of the Inspection



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## Chapter 4 – Chloride Content Testing

### Rating Methodology:

Rating	Condition	Criteria
5	Very Good	Wearing Surface: 100% Sound, No Cracks, No Spalls, No Delamination
4	Good	Wearing Surface: 90% Sound, No Cracks, No Spalls, No Delamination
3	Fair	Wearing Surface: 75% Sound, No Cracks, No Spalls, No Delamination
2	Poor	Wearing Surface: 50% Sound, No Cracks, No Spalls, No Delamination
1	Unsatisfactory	Wearing Surface: 25% Sound, No Cracks, No Spalls, No Delamination

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## Chapter 2 – Concrete Deck Inspection

- Level II Concrete Deck Inspection Form Sections:
  - Wearing Surface
  - Concrete Overlay
  - Concrete Deck
  - Edge Elements (curbs/barriers/ medians/sidewalks)
  - Deck Joints

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## Chapter 2 – Concrete Deck Inspection

		Last	New	Explanation of Condition		
<b>Wearing Surface</b>						
Pavement (Y/N)						
ACP (Y/N)						
Chip Seal Coat (Y/N)						
Seal Coat						
Type		Year Installed	Avg. Total Thickness (mm)	Area (m <sup>2</sup> )		
CONVENTIONAL CHIP SEAL COAT		2008	180(2)			
<b>Polymer Rating (% Area)</b>						
Y1	Y2	4	3	2(1)	N(1)	Covered by seal coat.
Last						
New						
ACP Rating (% Area)						
Y1	Y2	4	3	2(1)	N(1)	100
Last						
New						
<b>Chip Seal Coat Rating (% Area)</b>						
Y1	Y2	4	3	2(1)	N(1)	100
Last						
New						
Polymer Total Delimited Lost Area (m <sup>2</sup> )					225	
ACP Total Delimited Lost Area (m <sup>2</sup> )					X	
ACP Average Measured Depth (mm)					X	
ACP Crack Frequency (mm/m <sup>2</sup> )					X	
Chip Seal Coat Total Lost Area (m <sup>2</sup> )					45	

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## Chapter 2 – Concrete Deck Inspection

Deck Delamination Survey

- ASTM D4580



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## Chapter 2 – Concrete Deck Inspection

Measured Damage:



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## Chapter 2 – Concrete Deck Inspection - Concrete Overlay

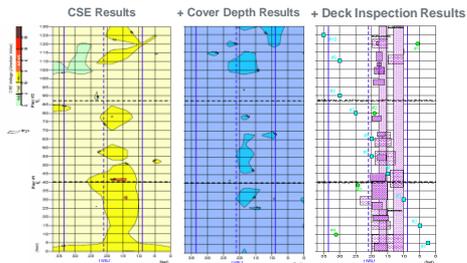
		Last	New	Explanation of Condition			
<b>Concrete Overlay</b>							
Overlay? (Y/N)							
Slabs Type (C)							
Slab Numbers (1, 2, 3, 4)							
<b>Overlay Type: CONCRETE (HIGH DENSITY)</b>							
Pavement (Y/N)							
Year Installed (Y/N)							
Thickness (mm) (M)							
Average Cracks (mm/m <sup>2</sup> ) (1)							
<b>Overlay Rating (% Area)</b>							
Y1	Y2	4	3	2(1)	N(1)	Partially covered by chip seal coat.	
Last							
New							
Total Crack Length - Measured/Visible (m)					35	25	There is widespread cracking along the overlay. Several core
Total Sealed Area - Light (m <sup>2</sup> )					0	0	0
Total Sealed Area - Measured/Visible (m <sup>2</sup> )					0	0	0
Delimited Area (m <sup>2</sup> )					84	25	
Spalled Area (m <sup>2</sup> )					1	2.4	
Patched Area (m <sup>2</sup> )					0	11	
Average Measured Cover Depth (mm)					100	200	
Standard Deviation of Measured Cover Depth (mm)					14	15	

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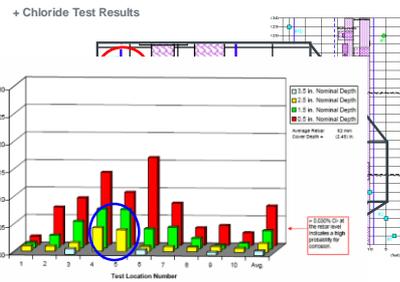




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**Other Level II Inspection/ Testing Methods for Concrete Bridge Elements:**

- Thermography
- Ground Penetrating Radar (GPR)
- Schmidt Hammer
- Coring
- Linear Polarization

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**Thermography Data Collection:**

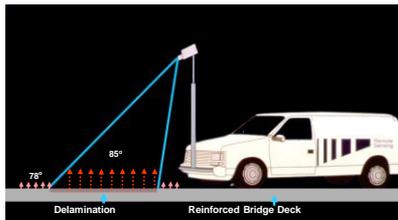


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### Thermography



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### Ground Penetrating Radar Data Collection:

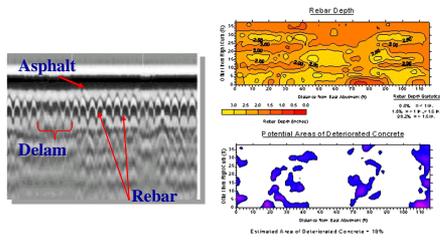


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### Ground Penetrating Radar Data



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### Schmidt Hammer



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### Coring



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### Linear Polarization Testing



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Questions?

Two speech bubbles, one containing a question mark. The background is a solid blue color.

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