

mark kaler

To: Connie Lightcap (connie@jcsupply.us)
Subject: Epoxy Presentation

I put this together by slides for a power point – have someone put it into the JC format and headings

Im around tomorrow if you want to talk through – preparing for our Thursday board meeting so I will be busy the rest of the week.

Slide 1

Problem statement

- Significant increased usage of steel dowels for load transfer over the last 10 years
- Epoxy coated dowels with 15-30 + years of service in some cases have demonstrated some degree of degradation (could reference the Larson- Smith report – not sure we want to bring this to the forefront)
- State DOT's have inconstant epoxy coating specifications for dowels – specifically fusion bonded coating of the ends of dowels
- AASHTO M-254 specification doesn't address the epoxy coating of the dowel ends

Slide 2

Hypothesis

- Bare ends of steel dowels are a significant break in the fusion bonded epoxy coating quality
- Immediate anode - corrosion current initiates day thus corrosion activity is accelerated
- Patched ends have poor adhesion and long term performance
- Sharp edges on dowel ends create holidays for the sprayed applied patch typically used

Slide 3

Testing Program

- Testing was performed to ASTM A955
- Testing was performed on three types of dowel ends – Fusion bonded epoxy coated dowel ends, spray applied epoxy patch and bare ends
- 4 sets of 18 bars were tested for each test group
- Dowels from test group 1 and 3 were epoxy coated to ASTM 934 and group 2 was coated to ASTM A775 – all bars passed the CALTRANS specification
- No holidays we detected on the lateral surfaces of any of the test bars – holidays were found on some bars on the dowel ends

Slide 4

Test Results

- The positive voltage was measured per ASTM A955 – the corrosion rate was determined for each bar in each test group
- Per ASTM A955 - The average corrosion rate for a minimum of 5 specimens shall at no time during the test exceed 0.25um per year, with no specimen exceeding a corrosion rate of 0.50um

Add Corrosion Rate equation for report here

Slide 5

Test results – Test Group 1 - Fusion bonded epoxy ends

- The average corrosion rate for the set ranged between 0 and 0.1 um per year for the test duration.
- No disbondment of the coating was observed
- Figure 1 has the corrosion rate over time plotted for each sample set – performance requirements form ASTM A955 Annex A1 for stainless steel are plotted on this graph for reference.
- Performance results for this test group approached that of stainless steel

Slide 6

Graph in figure 5

Slide 7

Test Results – Test group 2 – sprayed applied epoxy patch ends

- The corrosion rate started below 0.1 per year but steadily increased to 0.4um
- Average corrosion rates exceeded 0.25um per year for approximately the first half of the test duration and exceeded 0.50um per year for 3 of the test groups
- Disbondment of the coating was observed on 90% of the bars with the coating actually peeling off the bar – Figure 2
- The anode bars exhibited corrosion staining
- Figure 3 has the corrosion rate over time plotted for each sample set – performance requirements form ASTM A955 Annex A1 for stainless steel are plotted on this graph for reference

Slide 8

Figure 12 from report

Slide 9

Figure 7 from report

Slide 10

Test results – test group 3- bare ends

- The average corrosion rate ranged from 3-14um per year for the duration of test with a peak rate of 47um per year
- Corrosion staining and pitting was observed on each bar Figure 4
- Average corrosion rates exceeded 0.25 um per year and 0.50um for a single specimen for the entire duration of the test

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Figure 14 from report

Slide 12

Figure 8 from report

Slide 13

Conclusion

- Lower corrosion rates provided significantly better protection from corrosion
- Fusion bonded epoxy ends with the ASTM A934 coated bar performance approached that of Stainless steel
- The quality of the epoxy coating of the dowels likely will have a significant impact on the long term performance of the epoxy coated dowel and the long term load transfer effectiveness of the concrete pavement joint

Slide 14

Recommendation

- Fusion bonded epoxy coated dowel ends should be specified wherever epoxy coated dowels are specified.

- Dowel ends preparation for fusion bonded epoxy coating should require a beveling of the edges to reduce holiday on dowel ends due to sharp edges.
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