

Report No. **06153**

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 Government
 of South Australia

 Department for Transport,
 Energy and Infrastructure

LABORATORY REPORT

Report To: Manager Technical Support
 Subject: Evaluation of coatings, Superior Hi-Tech
 Information Required: Adhesion and corrosion protection over existing painted steel on bridges

1.0 BACKGROUND

DTEI was first approached by Superior Hi-tech Coatings Australasia (SHC) in 2000 to evaluate a range of coatings and products for use on a range of infrastructure. Subsequent testing was carried out on a number of products on the Birkenhead Bridge on 19th December 2006. This report provides a summary of test data and observations from all tests.

2.0 PRODUCTS TESTED

The following materials were used or evaluated in this investigation:

Rust Grip	Moisture cure single pack polyurethane, volume solids 51%
Enamo Grip	Two-pack aliphatic polyurethane, volume solids 46%
Graffiti Cleaner	Water reducible graffiti remover with active ingredients N-Methylpirrolidinone (NMO) and Gamma-Butyrolactone (BLO)
SPS Cleaner	Solvent based surface cleaner
Chlor Rid	Surface soluble salt remover

3.0 PROCEDURE

Initial testing carried out in March 2000 involved the application of SHC coatings to the external girder (North Facing) of a bridge over a watercourse on the Magill – Lobethal Road, 2.59km east of RN 4496 (Gumeracha – Lobethal), Bridge Plan Number 747. Three separate patches were applied, as shown in Table 1.

Section (From Left)	Surface Preparation	Coating	No. of Coats
1	None	Rust Grip	2
2	None	Rust Grip	2
		Enamo Grip	2
3	Cleaned with SPS Cleaner	Rust Grip	2
		Enamo Grip	2

Table 1 – Coating Details, Bridge PN 747

A visual inspection was carried out, together with pull-off adhesion testing to AS1580.408.5, on Monday 18th December 2006. Adhesion testing was also carried out on the existing coatings on Tuesday 2nd January 2007, as a control.

Further testing was carried out on a number of products on the Birkenhead Bridge (Plan Number 1229) on 19th December 2006, with the coatings tested as detailed in Table 2.

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Test Location	Test surface	Surface Preparation	Coating	No. of Coats
1 Western stiffener	Steel, red lead primer/ Alkyd MIO	Chlor Rid	Rust Grip	2
			Enamo Grip	2
2 Abutment web	Steel, red lead primer/ Alkyd MIO	Chlor Rid	Rust Grip	2
			Enamo Grip	2
3 Abutment web		Graffiti Cleaner	Rust Grip	2
			Enamo Grip	2
4 Underside of deck	Rebar/ concrete	None	Rust Grip	2
5 Cast Concrete guardrail end	Concrete	None	Enamo Grip Clear	2

Table 2 – Coating Details, Bridge PN 1229

Initial testing consisted of adhesion testing to AS1580.408.5, with test dollies adhered to test surfaces on Thursday 21st December 2006, 45 hours after completion of coating application. Pull-off tests were conducted on Friday 22nd December 2006. Adhesion testing was also carried out on the existing coatings on Tuesday 2nd January 2007, as a control.

4.0 RESULTS AND DISCUSSION

Coatings on Bridge Plan Number 747 were inspected and found to exhibit no integrity failure. No cracking, checking, flaking, peeling, erosion, rusting or blistering was observed. The Enamo Grip finish also exhibited high gloss, comparable to the pre-exposure level. The adhesion test results are detailed in Appendix 1, and summarised in Table 3.

Existing Coatings	Surface Preparation	Coating System	Average Adhesion, Mpa
Iron oxide-zinc chromate primer, alkyd MIO	None	2 coats Rust Grip	0.5
	None	2 coats Rust Grip/ 2 coats Enamo Grip	1.25
	SPS Cleaner	2 coats Rust Grip/ 2 coats Enamo Grip	1.81
			2.0

Table 3 – Adhesion Results, Bridge PN 747

The pull-off adhesion test identifies the weakest point within any coating system, which in the case of all tests was identified as a cohesive failure within the existing coatings. No failure occurred at the junction between the old and new coatings, or within the new coating layers. Given that the adhesion figures for red oxide zinc chromate primer are typically low, in the range of 0.5 to 2.0 MPa, the test results can be considered as normal for this coating system. There was no evidence of any negative effect of the over-coating system on the adhesion of the existing coatings.

The adhesion test results for the coatings applied to the Birkenhead Bridge are detailed in Appendix 2, and summarised in Table 4.



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Test Substrate	Surface Preparation	Coating System	Average Adhesion, Mpa
Steel, red lead primer, alkyd MIO	Chlor Rid	2 coats Rust Grip/ 2 coats Enamo Grip	1.9
	Graffiti Cleaner	2 coats Rust Grip/ 2 coats Enamo Grip	2.1
Concrete	None	2 coats Rust Grip	3.5
	None	2 coats Enamo Grip Clear	2.25
Steel, red lead primer, alkyd MIO			2.0

Table 4 – Adhesion Results, Bridge PN 1229

The pull-off adhesion test identifies the weakest point within any coating system, which, in the case of the tests conducted over existing coatings, was identified as a cohesive failure within the red lead primer. No failure occurred at the junction between the old and new coatings, or within the new coating layers. Given that the adhesion figures for red lead primer are typically low, in the range of 0.5 to 2.0 MPa, the test results can be considered as normal for this coating system. There was no evidence of any negative effect of the over-coating system on the adhesion of the existing coatings.

Both the Rust Grip and Enamo Grip provided good adhesion levels over the concrete substrate.

5.0 CONCLUSIONS

The conclusions drawn from this investigation were as follows:

- Both the Rust Grip and Rust Grip/ Enamo Grip coating systems provided almost 7 years exposure performance, with no integrity failure, over a structure exposed in a Category C environment.
- Pull-off adhesion testing indicated that the Rust Grip and Rust Grip/ Enamo Grip coating systems provided adequate adhesion over existing weathered coating systems, both initially and after almost 7 years of exposure.
- Pull-off adhesion testing indicated that the Rust Grip and Rust Grip/ Enamo Grip coating systems had no negative effect on the adhesion of existing coating systems.
- Both the Rust Grip and Enamo Grip provided good adhesion levels over the concrete substrate.

Date: 10 / 01 /2007

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Round spots mark the area where pull dollies were attached to perform pull tests.

