

TNZ C26 NOTES: 2003

NOTES FOR THE CLEANING AND RECOATING OF STEELWORK COATED WITH LEAD BASED PAINT

*These notes are for the guidance of Transit New Zealand's consultants, and **must not be included** in the Contract Documents.*

1. SCOPE

Transit New Zealand Specification C/26 should be used for the maintenance painting of structural steelwork where existing coating system contains concentrations of lead greater than 1% by weight. These Notes discuss the additional specification clauses that need to be written to suit the particular structure and provide additional information for use by specifiers. The specification does not cover any traffic management requirements that will need to be referenced separately.

2. DESCRIPTION OF WORK

Additional specification clauses will be required that give a description and location of the highway structure and the extent of maintenance painting that is required. This may include appending a Locality Plan, together with as-built drawings and/or photographs. If only part of the structure requires repainting, the inclusion of marked-up drawings showing the exact extent of the refurbishment work will be necessary.

Also include in the Tender Documents any information known about the existing system from records or a site assessment.

3. CONTAINMENT (Clause 2.2.2)

The specifier should carry out a risk assessment for the project as set out in Transfund New Zealand Research Report 115 and specify the required level of emission control that is required.

Suggested wording for the relevant specification clause is given below.

“Using the criteria given in the Transfund New Zealand Research Report 115 *Guidelines for the Management of Lead-based Paints on Roading Structures*;
The public health risk for this project has been designated as,
(INSERT “HIGH”, “MODERATE”, “LOW”, OR “NIL”).

The environmental risk as (*INSERT "HIGH" OR "LOW"*).
The risk to adjacent workers as.....(*INSERT "HIGH", "LOW" OR "NIL"*).

The minimum project-specific emission control level required is therefore Level (*INSERT "A", "B", OR "C"*) which will govern the combination of paint removal methods and containment systems to be used on this project."

Refer to Appendix C of AS 4361.1 for additional guidance in assessing these risks and establishing the control level. Note that AS 4361.1 defines a "small project" as one where less than 10sqm of lead-based paint will be removed within a 12 month period, and that its requirements need not apply unless "in the immediate proximity of a sensitive receptor" (eg a kindergarten). However these small projects, eg bridge handrails, would still be subject to applicable regulatory requirements including worker protection and waste management.

4. WASTE DISPOSAL (Clause 2.2.3)

As the quantity of lead contaminated waste and hence the cost of its treatment and disposal may not be known at the time of tender; it is an option that this be treated as a Provisional Sum item. This will also ensure that the Contractor will not be tempted to cut corners in disposal of waste or build a large risk element into the tendered price. It is therefore recommended that Specifiers include an additional clause to cover payment of waste disposal as follows;

"The Principal will reimburse the Contractor, at cost, for:

- a. The cost of transporting the waste from the project to the treatment plant/disposal site, and
- b. The cost of treating and/or disposing of the waste, including payment of any disposal fees or special Consents."

On the other hand, if waste disposal is included as priced Scheduled Item, there is incentive for the Contractor to minimise waste and be more innovative regarding its treatment. Specifiers should determine which option is the most appropriate for their particular project.

5. ENVIRONMENTAL MONITORING (Section 4)

The Schedule of Rates in the Tender Document should include a suitable Provisional Sum Item to cover any soil and water testing and air monitoring where required by the Resource Consent. The Engineer will need to determine whether or not they wish to be directly responsible for the environmental monitoring or delegate this to the Third Party Inspector, and add amending clauses where appropriate.

6. THIRD PARTY INSPECTION (TPI) (Section 5)

This section will require amendment where the Consultant wishes to provide inspection by suitably qualified and experienced members of their own staff or hire the TPI directly. Where the Contractor is to provide the TPI payment should be made via a separate Scheduled Item or Provisional Sum. Where it is to be a via a Scheduled Item it will be necessary to specify the frequency of attendance as an addendum to Clause 5.1.2, ie. whether the TPI is to be on site continuously/daily/alternate days/ or weekly during surface preparation and coating application. Hold points listed in Clause 5.2 may be amended to suit the location and system being applied.

7. COATING SYSTEM (Clause 8.1)

7.1 Selection and Specification of Systems

Selection of the most suitable and cost effective coating system depends on;

- a. the proximity of the structure to the coast and wind-borne salts,
- b. whether encapsulation, a spot repair, or total replacement is required,
- c. the generic type and adhesion of the existing coating to be overcoated,
- d. the required time until next maintenance,
- e. aesthetic requirements (eg colour, gloss levels, anti-graffiti resistance),
- f. the prevailing weather conditions (eg temperature and humidity),
- g. the time available for recoating (eg rapid cure system or metal spray required),
- h. the presence of crevices (eg from riveted or bolted joints),
- i. the amount of pitting of the steelwork (found once abrasive blasting has been completed), and
- j. the degree of surface preparation (eg if abrasive blasting is not used)

The specifier should prepare a detailed specification for the coating system to be used on the work. This should be in a generic format to allow competitive tendering of different brands that can be shown to comply with the material specification. As a general rule, the better the standard of surface preparation, the longer the coating system will perform. However the higher standard of preparation may increase the quantity of hazardous material to be contained and disposed of. It is recommended that for major works, a detailed job specific coating specification be prepared by a reputable coating manufacturer or independent coating consultant after an assessment has been made of the existing coating condition (refer Appendix B of AS 4361.1). A useful checklist giving the steps involved in planning for maintenance painting is presented as Appendix A3 in AS/NZS 2312.

Typical systems used for the maintenance painting of highway structures are summarised in the Table on page 7, and may be specified where appropriate for minor works as discussed below. In some situations it may be desirable to invite tenders for more than one of the following outline specifications to obtain comparative prices. Where available their **system designation** in accordance with AS/NZS 2312:2002 has also been included. For major structures, expert advice should be sought. Note that NCHRP Synthesis 251: *Lead-Based Paint Removal for Steel Highway Bridges* reported in 1997 that US roading authorities “had a strong preference for moisture-cured urethane systems” and FHWA-RD-96-058 *Environmentally Acceptable Materials for the Corrosion Protection of Steel Bridges* found thermal metal spray systems had the lowest Life Cycle Cost.

7.2 Outline Coating System Specifications

- No.1 Power tool clean rusted areas to St 2 and prime with a zinc phosphate alkyd applied by brush to give a minimum dry film thickness (DFT) of 40µm. Apply one spot coat and one full finish coat of micaceous iron oxide (MIO) pigmented alkyd enamel to give a minimum total dry film thickness (TDFT) of 120µm (**ALK6**).
- No.2 Power tool clean rusted areas to St 2 and prime with a 100% solids low viscosity epoxy penetrating sealer applied by brush to give a minimum DFT of 25µm. Apply one full finish coat of MIO pigmented epoxy mastic to give a minimum TDFT of 150µm.
- No.3 Power tool clean rusted areas to St 2 and prime with an aluminium pigmented aromatic moisture cured urethane (MCU) penetrating sealer applied by brush to give a minimum DFT of 50µm. Apply one full finish coat of MIO pigmented aliphatic MCU to give a minimum TDFT of 100µm.

These three coat spot repair systems may be suitable to extend the life of an existing lead-based system (5 - 10 years) in a medium corrosivity environment where the structure is to be replaced or existing coating system is to be fully removed in the future. They may also be suitable for use in low corrosivity environments as encapsulation systems, with water washing as the only preparation (ie minimal hazardous waste material generated).

- No.4 Clean rusted areas by wet slurry blasting to WAB-6 or water jetting to WJ-2 and prime with 50µm of brush applied zinc phosphate pigmented epoxy. Spot paint with 125µm of MIO epoxy mastic and apply a 50µm tie coat of epoxy mastic to remaining surfaces. Apply a 100µm finish coat of MIO pigmented epoxy.
- No.5 Clean rusted areas by wet slurry blasting to WAB-6 or water jetting to WJ-2 and prime with 50µm of brush applied zinc/MIO pigmented MCU. Spot paint with 75µm of MIO MCU and apply a 50µm tie coat of MIO aromatic MCU to remaining surfaces. Apply a 50µm finish coat of MIO aliphatic MCU.

Systems 4 & 5 may be suitable to extend the life of a generally sound existing lead-based coating system in a medium corrosivity environment where full removal is not warranted. Systems 2, 4 & 10 should be confirmed as suitable by applying a test patch one month (or ideally 12 months) prior to repainting and check for possible delamination.

- No.6 Remove all previous coating by abrasive blasting to Sa 2½. Prime with 75µm of zinc-rich epoxy and apply a 125µm build coat of MIO pigmented epoxy mastic (or high build epoxy). Apply a 125µm finish coat MIO high build epoxy (EHB6).
- No.7 Remove all previous coating by abrasive blasting to Sa 2½. Prime with 75µm of zinc rich MCU and apply a 75µm build coat of MIO pigmented aromatic MCU. Apply a 75µm finish coat of MIO aliphatic MCU (MCU2).
- No.8 Remove all previous coating by abrasive blasting to Sa 3. Apply a single 100µm coat of inorganic zinc silicate, or 125 µm of thermal zinc spray, or remove and hot-dip galvanize to AS/NZS 4680 (HDG600).
- No.9 Power tool clean rusted areas to St 2 and prime with 75µm of brush applied zinc/MIO pigmented MCU. Spot paint with 75µm of MIO MCU and apply a 50µm tie coat of MIO aromatic MCU to remaining surfaces. Apply a 75µm finish coat of MIO aliphatic MCU.
- No.10 Clean rusted areas by wet slurry blasting to WAB-6 or water jetting to WJ-2 and prime with 75µm of brush applied zinc phosphate pigmented epoxy. Spot paint with 125µm of MIO epoxy mastic and apply a 50µm tie coat of epoxy mastic to remaining surfaces. Apply a 125µm finish coat of MIO pigmented epoxy.
- No.11 Clean rusted areas by wet slurry blasting to WAB-6 or water jetting to WJ-2 and prime with 75µm of brush applied zinc/MIO pigmented MCU. Spot paint with 75µm of MIO MCU and apply a 50µm tie coat of MIO aromatic MCU to remaining surfaces. Apply a 75µm finish coat of MIO aliphatic MCU.

Systems 10 & 11 may be suitable to extend the life of a generally sound existing lead-based coating system where full removal is not warranted. System 10 should be confirmed as suitable by applying a test patch 12 months prior to repainting. MCU systems tend to apply less stress to aged coatings but a minimum adhesion strength of 1.5 MPa in the existing coating is preferred to prevent its delamination.

- No.12 Remove all previous coating by abrasive blasting to Sa 2½. Prime with 75µm of zinc-rich epoxy and apply a 175µm build coat of MIO pigmented high build epoxy. Apply a 150µm finish coat MIO high build epoxy.
- No.13 Remove all previous coating by abrasive blasting to Sa 2½. Prime with 75µm of inorganic zinc silicate. Apply a full 150µm intermediate coat and 150µm finish coat of MIO high build epoxy.

- No.14 Remove all previous coating by abrasive blasting to Sa 2½. Apply a single 125µm coat of inorganic zinc silicate (Type 6 to AS/NZS 3750.15) (IZS3).
- No.15 Remove all previous coating by abrasive blasting to Sa 3. Apply 150µm of thermal zinc spray (TSZ150).

Systems 7, 12, 13, 14 & 15 may be suitable for use in high corrosivity (eg. marine) environments where full removal and replacement of the existing lead-based system is required. Zinc metal spray thickness can be increased to give 40+ years life till next maintenance if required (Refer to AS/NZS 2312 Table 5.1).

7.3 Additional Notes

In very high corrosivity (severe marine) environments, Systems 12, 13, or 14 may be used but apply an additional intermediate coat to all surfaces sheltered from rain-washing. On other surfaces apply an additional intermediate coat to all edges, welds, fasteners and downward facing surfaces. Alternatively use thermal metal spray systems **TSZ200S** or **TSA150S**.

Where a colour finish and/or graffiti resistance is required, the MIO HBE finish coat in Systems 4, 6, 10, 12, & 13 should be replaced with a 75µm coat of catalysed two-pack polyurethane conforming to AS/NZS 3750.6. MCU is available in a limited range of colours, in flat with MIO or semi-gloss without MIO, and is now specified in AS 3750.18.

Systems 8, 14 & 15 should only be used where steel is in good condition (ie not badly pitted and on relatively smooth large sections (eg large I-beams and not riveted or bolted plates, or lattice steelwork) because of difficulties in obtaining uniform film thickness.

Surface preparation cleanliness standards are in terms of the widely known Swedish Standard SIS 05 5900 (which has been incorporated into ISO 8501-1 and NZS/AS 1627.9). Sa 2½ is a “near-white” abrasive cleaned surface, which is similar to SSPC SP10. Sa2 = SSPC SP6, and Sa 3 = SSPC SP5. St 2 is a “thoroughly tool cleaned” surface. Note that it is important not to burnish the surface when power wire brushing as this will reduce adhesion of the primer. Water Jetting and Wet Abrasive Blast cleanliness standards are given in SSPC-VIS 4 and SSPC-VIS 5 respectively. (WAB-6 = WJ-2 = Sa 2). Also note that many coating manufacturers do not endorse the use of corrosion inhibitors when wet abrasive blasting as these may compromise primer adhesion and also mask the presence of salt contaminants.

The job specification should include maximum as well as minimum DFT's permitted for each coat in the system. (This is particularly important when overcoating with epoxy material). Also check that the blast profile specified in clause 7.4 is appropriate and amend with an additional clause if necessary.

Further information on the Australian Paint Approvals Scheme referenced in Clause 6.1 may be obtained from the web site www.apas.gov.au. Note that APAS took over administration of the NZ Paint Approval Scheme (NZPASS) from Telarc on 1 January 2002.

BIBLIOGRAPHY

For additional information refer to the following publications;

AS/NZS 2312:2002, "Guide to the protection of structural steel work against atmospheric corrosion by the use of protective coatings".

AS 4361.1-1995: "Guide to Lead Paint Management Part 1: Industrial Applications".

AS/NZS 4680:1999, "Hot-dip galvanized (zinc) coatings on fabricated ferrous articles".

'After-Fabrication Hot Dip Galvanizing' (15th edition), published by the Galvanizers Association of Australia (1999)

APAS List of Approved Products (30th edition) published by Australian Government Analytical Laboratories (2000)

BS EN ISO 14713: 1999 'Protection against corrosion of iron and steel in structures – Zinc and aluminium coatings – Guidelines'

'Guide for Painting Steel Structures', published by AASHTO (1997)

Industrial Lead Paint Removal Handbook (2nd edition) by K A Trimber (SSPC 93-02)

NCHRP Synthesis 251: 'Lead-Based Paint Removal for Steel Highway Bridges'

Steel Structures Painting Manual, Volume 2 (8th edition), published by SSPC (2000) (in particular SSPC-Guide 6 on containment of hazardous debris & SSPC- Guide 7 on waste disposal).

SSPC-SP 12/NACE 5: 'Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating' (SSPC 96-05)

SSPC-VIS 4/NACE VIS 7 'Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting' (SSPC 01-05).

SSPC-VIS 5/NACE VIS 9 'Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning' (SSPC 01-06).

Szokolik & Rapattoni, (1998); "A Guide to the Use of Coatings for the Protection of New Steel Bridges Against Atmospheric Corrosion", BHP.

TABLE OF MAINTENANCE SYSTEMS

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Ref No.	Life	Environment	Prep. Std.	Primer Coat	DFT μ m	Build/Tie Coat	DFT μ m	Finish Coat	DFT μ m	TDFT μ m		
1	Short	Moderate	St 2	ZPA	50	MIOA	50	MIOA	50	150		
2				EPS	25	-		MIO EM	125	150		
3				Al MCU	50	-		MIO-MCU	50	100		
4	Medium		Sa 2	ZPE	50	MIOEM	125	MIO HBE	100	275		
5				Zn/MIO MCU	50	MIO MCU	75	MCU	50	175		
6	Long		Sa 2½	ZnE	75	MIOEM	125	MIO HBE	100	300		
7				Zn MCU	75	MIO MCU	75	MIO MCU	75	225		
8				Sa 3	TSZ	125	-	-	-	-	125	
					IZS	100	-	-	-	-	100	
	Pickle		Hot-dip Galvanize	85 min.					85 min.			
9	Medium		Marine	St 2	Zn/MIO MCU	75	MIO MCU	75	MIO MCU	75	225	
10					Sa 2	ZPE	75	MIO EM	125	MIO HBE	125	325
11						Zn/MIO MCU	75	MIO MCU	75	MIO MCU	75	225
12	Long			Sa 2½	ZnE	75	MIO HBE	175	MIO HBE	150	400	
7					Zn MCU	75	MIO MCU	75	MIO MCU	75	225	
13		IZS			75	MIO HBE	150	MIO HBE	150	375		
14		Sa 3		TSZ	150	-	-	-	-	150		
15				IZS-HR	125	-	-	-	-	125		

EM = Epoxy mastic
 IZS-HR = "High-ratio" IZS
 ZnE = Zinc epoxy

EPS = Epoxy penetrating sealer
 MIO = Micaceous iron oxide
 ZPA = Zinc phosphate alkyd

HBE = High build epoxy
 MCU = Moisture cured urethane
 ZPE = Zinc phosphate epoxy.

IZS = Inorganic Zinc Silicate
 TSZ = Thermal Sprayed Zinc