ROAD PAVEMENTS FORUM
TWENTY-FIFTH MEETING

7 May 2013

OVERVIEW OF TMH19: DRAFT STANDARD FOR THE VISUAL ASSESSMENT OF ROAD STRUCTURES

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(CSIR Built Environment)

Acknowledgements

- SANRAL
- Team Members:
  - Paul Nordengen (CSIR Built Environment)
  - Stephen Humphries (Nyeleti Consulting)
  - Frans Kromhout (AECOM)
  - William Martin (SMEC)
  - Raimund Miller (ARQ)
  - Michael Roux (CSIR Built Environment)

Background

- New TMH document for assessment of road structures
- It is based on the DER rating methodology
- The DER rating methodology was accepted by COTO as the national standard for rating of road structures in 2012
- Document consist of:
  - Part A – General Information
  - Part B – Visual Assessment Guide

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Committee of Transport Officials

Draft TMH 19

MANUAL FOR THE VISUAL ASSESSMENT OF ROAD STRUCTURES

May 2013

Committee of Transport Officials

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Part A: General Information

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Road Structures Covered by Manual

- Bridges
- Culverts
- Low Level Structures
- Retaining Walls
- Gantries
- Road Tunnels
- Light Masts

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Structure Types Included in Manual

- Bridges
  - Bridge (General)
  - Bridge (Arch)
  - Bridge (Cable)
  - Bridge (Cellular)
- Culverts
  - Major Culvert
  - Lesser Culvert
- Retaining Wall
- Gantry
- Road Tunnel
- Light Masts

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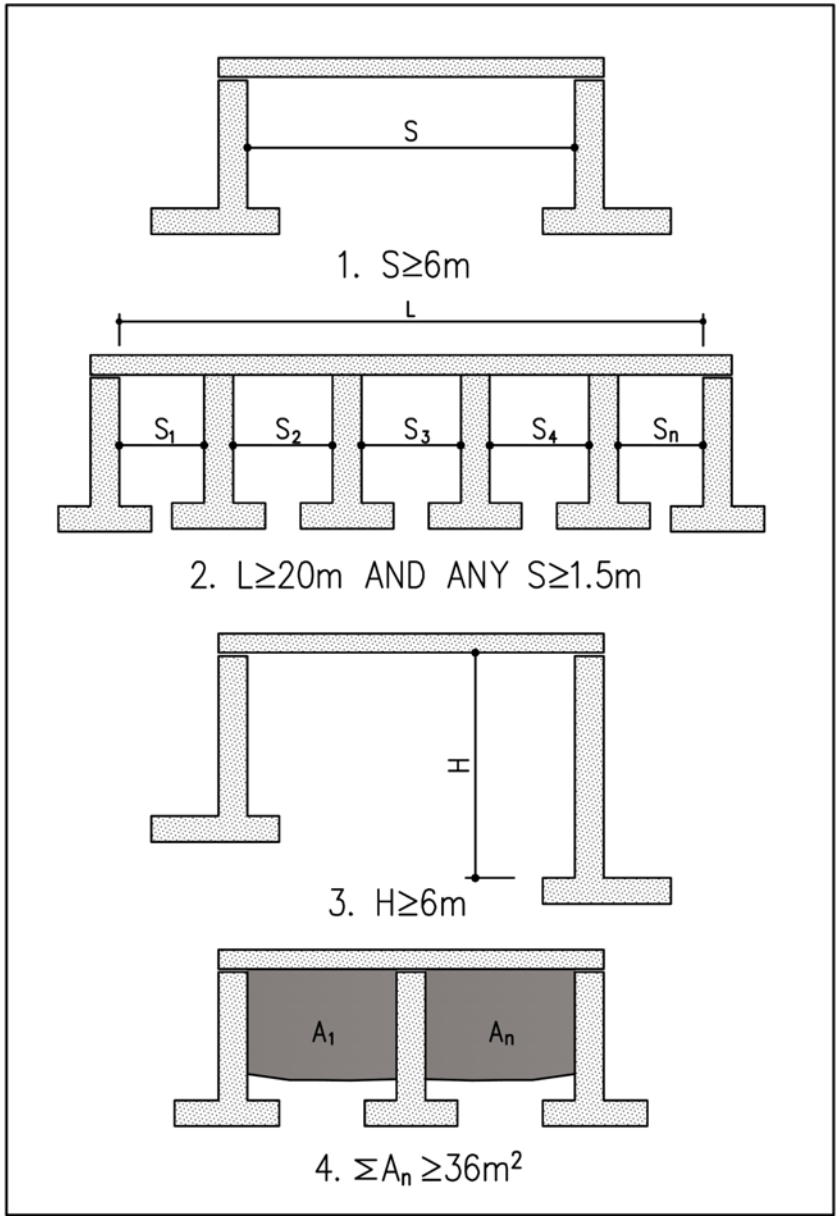
Definition of a Bridge



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Bridge Types

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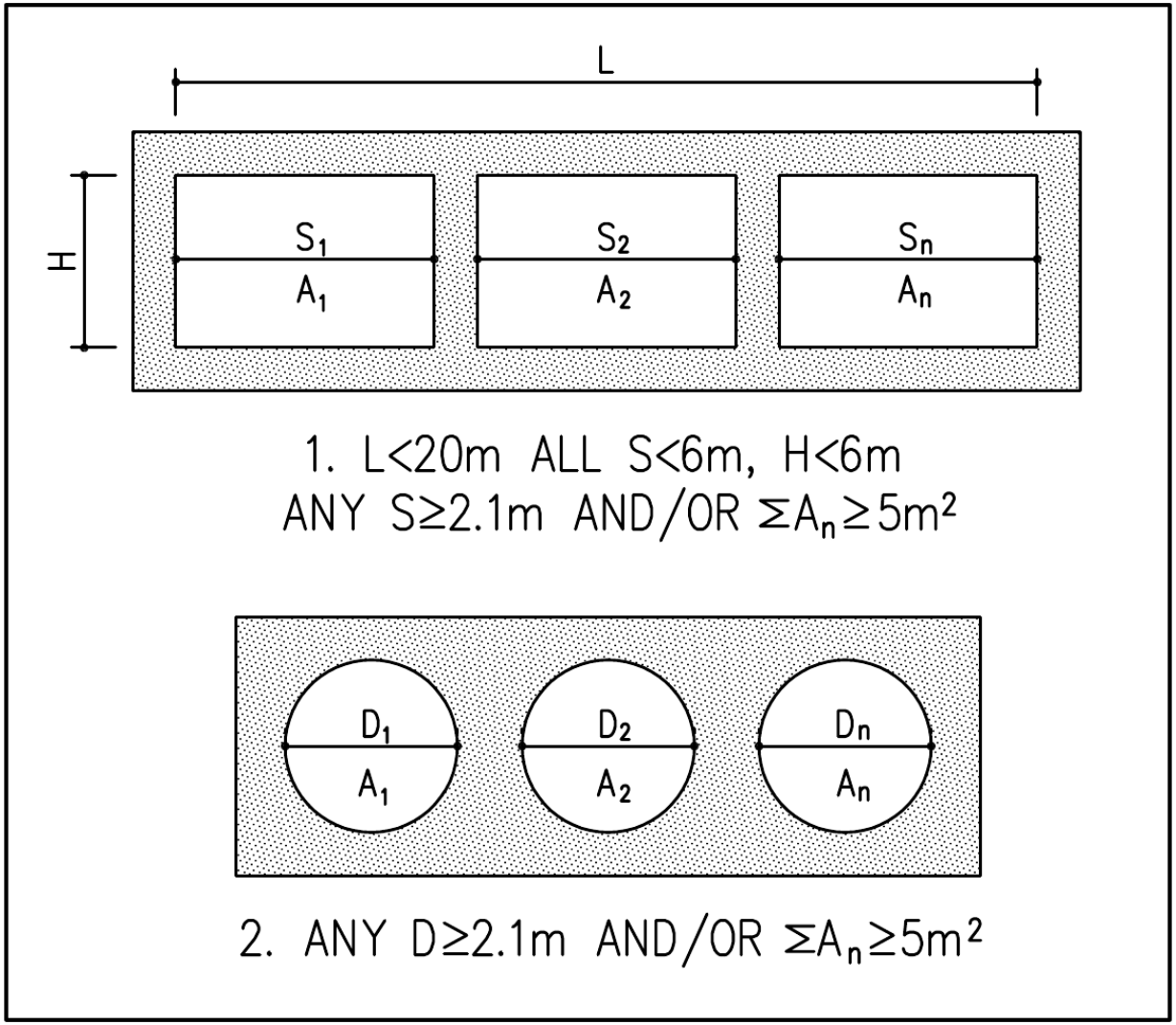
Definition of a Major Culvert



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Culvert Types

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Other Structure Types

Minimum height > 2 m

Gantry

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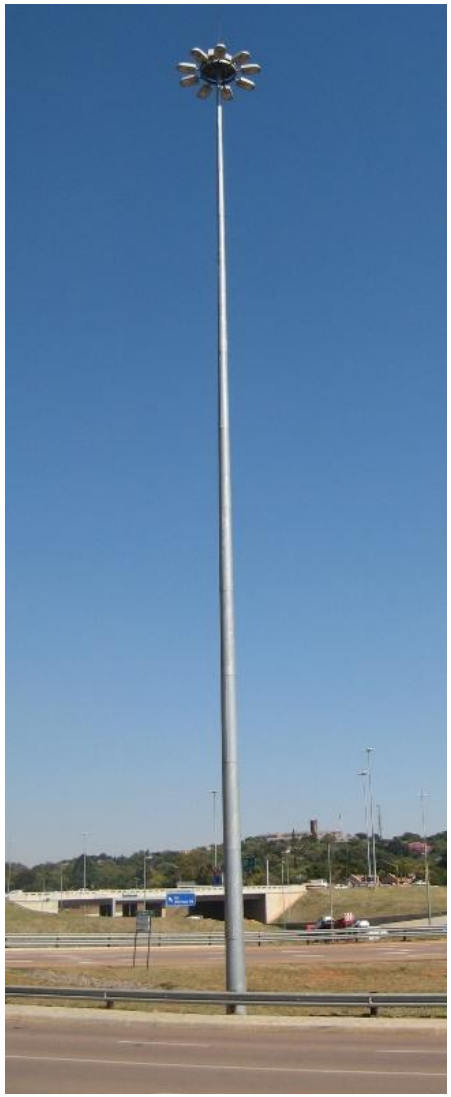
Other Structure Types



Light Mast

Road Tunnel

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Overview of a Structures Management System

- Inventory Data
- Inspection Data
- Condition Analysis
- Repair Costs
- Validation

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Inventory Information

- Numbering of Structures
- Location Details
- Inventory Data Required for Structures
- Additional Inventory Data for Structures
- Recommended Inventory Photos
  - Bridges
  - Major Culverts
  - Lesser Culverts
  - Retaining Walls
  - Gantries
  - Road Tunnels
  - Light Masts

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The DER Rating System

- Defects based system
- Defects are rated using the DER rating methodology

D	• **D**egree of defect
E	• **E**xtent of defect
R	• **R**elevancy of defect

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Summary of DER values

Rating	Degree	Extent	Relevancy
X	Not applicable		
U	Unable to inspect		
0	None		
1	Minor	Local	Minimum
2	Moderate	More than local	Moderate
3	Warning	Less than general	Major
4	Severe	General	Critical

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Overview of Structure Defects

- Defects
  - Design defects
  - Construction defects
  - Material performance defects
  - Damage
  - Deterioration
    - Delamination and Spalling
    - Cracking
    - Carbonation
    - Chloride penetration
    - Efflorescence and discolouration
    - Alkali-aggregate reaction
    - Chemical attack
    - Corrosion and fatigue of steel

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Overview of Structure Defects

- Ancillary bridge elements
  - Typical expansion joint defects
  - Typical bearing defects
  - Typical parapet and end block defects
  - Typical drainage defects
  - Typical embankment protection defects
  - Typical surfacing defects
- Typical Retaining Wall Defects
- Typical Gantry Defects
- Typical Road Tunnel Defects
- Typical Light Mast Defects

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Inspection Items

Number of Inspection Items per Structure Type	
• Bridge (General, Arch, Cable & Cellular)	21
• Major Culvert	14
• Lesser Culvert	5
• Retaining Wall	7
• Gantry	8
• Road Tunnel	8
• Light Mast	8

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Inspection Sheets

ROAD AUTHORITY	STRUCTURE TYPE	BRIDGE NUMBER	LOCATION SKETCH
	BRIDGE - GENERAL	BRIDGE NAME	

INSPECTION INFORMATION

Inspection Type	Inspector Name	Firm	Date (dd/mm/yyyy)

GPS COORDINATES

Longitude (East)			Latitude (South)		
DD	MM	SS.s	DD	MM	SS.s

VERTICAL CLEARANCES (road-over-road bridges only)

Position/Span No						
Min height (m)						

LOCATION DETAIL

Road No.	Road km	Road Name	Feature Crossed	Feature Name/Road No.	Region/Depot

STRUCTURE INFORMATION

No. of Spans	Structure Orientation	Overall Length	Overall Width	Year Constructed	Bridge Type	

INSPECTION RATINGS

INSPECTION ITEM	1. APPROACH EMBANKMENT			2. GUARDRAIL			3. WATERWAY			4. APPROACH EMB. PROT WORKS			5. ABUTMENT FOUNDATIONS			6. ABUTMENTS			7. WING / RETAINING WALLS			8. SURFACING			9. SUPER-STRUCT. DRAINAGE		
POSITION	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R
Abut																											
Abut																											

INSPECTION ITEM	10. KERBS / SIDEWALKS			11. PARAPET / HANDRAIL			21. MISC. ITEMS		
	D	E	R	D	E	R	D	E	R

INSPECTION ITEM	12. PIER PROTECTION WORKS			13. PIER FOUNDATIONS			14. PIERS & COLUMNS			15. BEARINGS			16. SUPPORT DRAINAGE			17. EXPANSION JOINTS			INSPECTION ITEM	18. LONGITUDINAL MEMBER			19. TRANSVERSAL MEMBERS			20. DECK SLAB		
POSITION	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	POSITION	D	E	R	D	E	R	D	E	R
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ITEM	POSITION	ACTIVITY CODE or DESCRIPTION	QTY	Unit	U	Make safe	REMARKS	Rpt. Photo	Mon freq

Inspector's assessment and further comments:

FURTHER INSPECTION REQUIRED ? Y/N		IF FURTHER INSPECTION REQUIRED IS "Y" Then please indicate any special requirements ie. 6m Ladder, Bush cutting, UBIU, better weather etc. If nothing please state "none"
Was UBIU used ? Y/N		
Is the UBIU needed for future inspections? Y/N		

D - DEGREE							E - EXTENT				R - RELEVANCY				U - URGENCY					
Not Applic-able	Unable to inspect	None	Minor	Mode-rate	Warning	Severe	Local	More than local	Less then general	General	Min	Moderate	Major	Critical	Record only	Monitor only	Routine	< 10 yrs	< 5 yrs	ASAP
X	U	0	1	2	3	4	1	2	3	4	1	2	3	4	R	0	1	2	3	4

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INSPECTION RATINGS

INSPECTION ITEM		1. APPROACH EMBANKMENT			2. GUARDRAIL			3. WATERWAY			4. APPROACH EMB. PROT WORKS			5. ABUTMENT FOUNDATIONS			6. ABUTMENTS			7. WING / RETAINING WALLS			8. SURFACING			9. SUPER-STRUCT. DRAINAGE		
POSITION		D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R
Abut																												
Abut																												

INSPECTION ITEM	10. KERBS / SIDEWALKS			11. PARAPET / HANDRAIL			21. MISC. ITEMS		
	D	E	R	D	E	R	D	E	R

INSPECTION ITEM		12. PIER PROTECTION WORKS			13. PIER FOUNDATIONS			14. PIERS & COLUMNS			15. BEARINGS			16. SUPPORT DRAINAGE			17. EXPANSION JOINTS			INSPECTION ITEM		18. LONGITUDINAL MEMBER			19. TRANSVERSAL MEMBERS			20. DECK SLAB		
POSITION		D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	POSITION		D	E	R	D	E	R	D	E	R
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ITEM	POSITION	ACTIVITY CODE or DESCRIPTION	QTY	Unit	U	Make safe	REMARKS	Rpt. Photo	Mon freq

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Inspection Procedure and Quality Assurance

- Types of Inspections
  - Principal Inspections
  - Partial Inspections
  - Completion inspections
  - Waterway inspections
- Qualifications and Experience of Inspectors
  - Bridge Inspector
  - Senior Bridge Inspector
  - Major Culvert Inspector
  - Lesser Culvert Inspector
  - Retaining Wall Inspector
  - Gantry and Light Mast Inspector
  - Tunnel Inspector

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Inspection Procedure and Quality Assurance

- Training of Inspectors
- Accreditation of Inspectors
- Procedure for Visual Inspections
- Quality Control
- OHS Requirements
- Inspection Photos

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Remedial Activities & Costs

- Defects that are identified are recorded
- At least one remedial activity must be associated with a defect
- Remedial activities are selected from a remedial activity list
  - *Remedial activity list per structure type*
- Estimated quantity of remedial activity is recorded
- Urgency of the remedial activity is recorded

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Urgency Rating of Remedial Activity

R = Record only	• No remedial work on the defect is envisaged • D will be 1 or 2 and R will be 1
0 = Monitor only	• Remedial work on the identified defect is not envisaged for the foreseeable future • Monitoring frequency must be indicated (e.g. 12, 24, 36 months) • Should not be used frequently
1 = Routine	• Use for remedial activities identified as routine activities in the remedial activity list • Do not use for routine defects with a high Relevancy (3 or 4)
2 = Within 10 years	• After the next round of principle inspections
3 = Within 5 years	• Before the next round of principle inspections
4 = As soon as possible	• Would usually be within 2 years

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Part B: Visual Assessment Guide

- Illustration of the extent rating
- Descriptions of defects including the applicable remedial activities and the range of relevancy and urgency ratings
- A photographic guide of defects
  - Main purpose is to illustrate the Degree rating, but extent, relevancy and urgency ratings are also included
  - Defects with a D-rating of 1 to 4 are illustrated per inspection item per structure type

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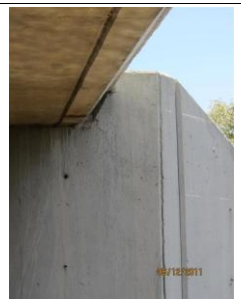
Item 6 Abutment Defect Photos		
D = 1 Left DER-U 111-2 Right DER-U 111-2		
	Crack in abutment wall	Local spall in abutment wall
D = 2 Left DER-U 211-2 Right DER-U 222-3		
	Vertical crack in abutment wall	AAR cracking in return wall
D = 3 Left DER-U 311-2 Right DER-U 312-3		
	Vertical crack in abutment return wall	Spalling at abutment return wall
D = 4 Left DER-U 413-3 Right DER-U 433-3		
	Vertical crack in abutment wall	AAR in abutment wall

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Bridge (General)

Item 6	**Abutment Defects**	
Defects	**Observations**	**D**
Spalling (All loose concrete must be broken away to expose extent of spall)	Spalling is shallow and reinforcement is not visible. Spalling is shallow. Reinforcement is partly exposed. Minor signs of corrosion. Thus spalling not attributable to corrosion. Reinforcement is partially or fully exposed and corrosion is a problem Reinforcement is exposed and significantly corroded. Prestress duct is exposed. Section loss.	1 2 3 4
Shrinkage and restraint cracks including AAR (Crack should be cleaned. Its width and if possible its depth ascertained)	Crack is of the order of 0.3 mm with no signs of water leakage or corrosion of reinforcement. Crack is greater than 0.3 mm but smaller or equal to 0.6 mm with no signs of water leakage or corrosion of reinforcement. Crack is of the order of 0.6 mm and there are signs of water passing through crack and evidence of corrosion of reinforcement. Crack is greater than 0.6 mm	1 2 3 4

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Structure Condition Analysis

- This is covered in the TMH 22 manual
- The inspection data collected during the visual inspection of structures is used to calculate various indices for each structure.
- The indices that can be calculated are:
  - Structure Average Condition Index;
  - Structure Priority Condition Index;
  - Structure Functional Index; and
  - Structure Combined Condition Index.

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Thank You

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