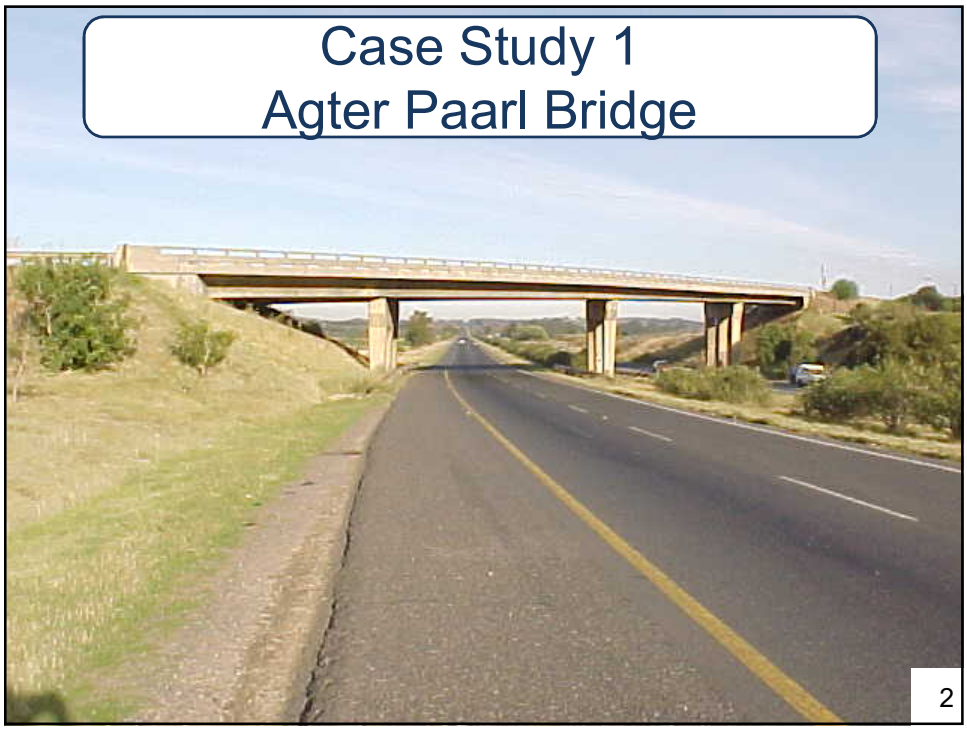
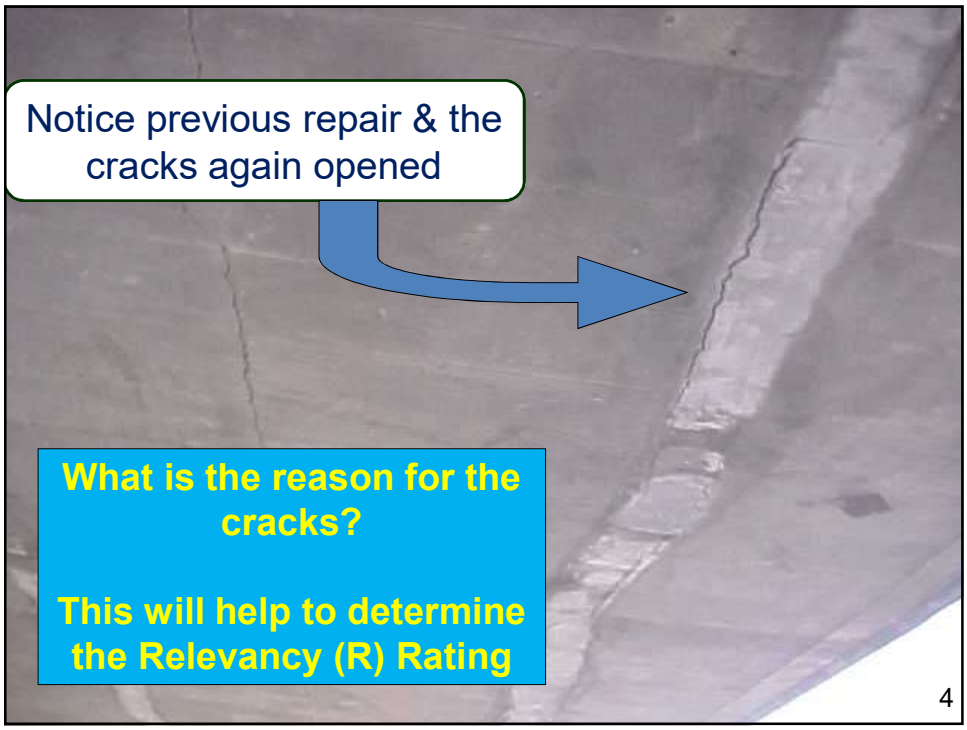
Bridge Inspection Course
SARF
CASE STUDIES:
RATING OF DEFECTS
CSIR
Touching lives through innovation


Case Study 1
Agter Paarl Bridge
2

Severe crack in deck slab
5 mm to 10 mm
3


Notice previous repair & the cracks again opened
What is the reason for the cracks?
This will help to determine the Relevancy (R) Rating
4

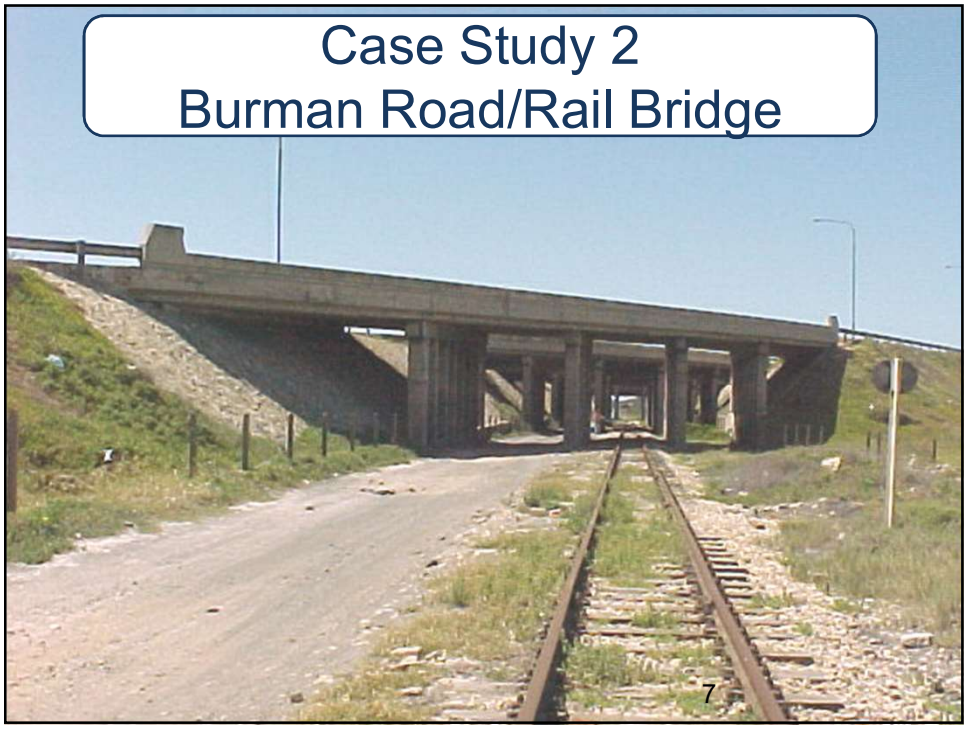
How do we rate this deck?

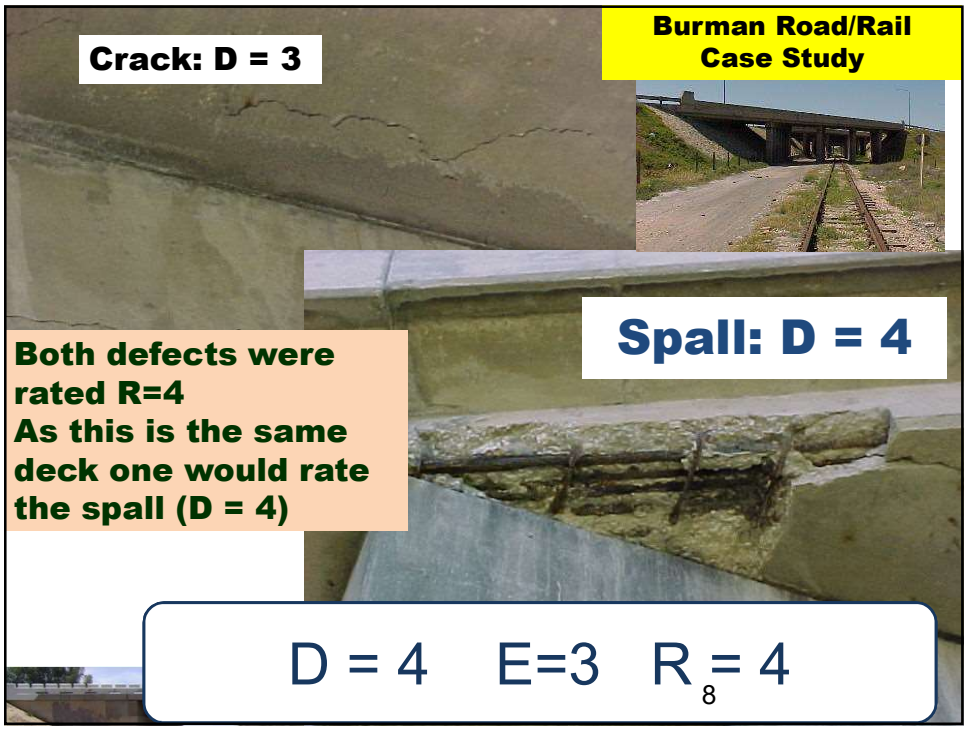
- Do we use item 18, 19 or 20?
- Program takes the worst of all three so don't be too concerned
- D = 4 (4) E = 3 (3) R = 4 (3)
- Bridge was No 6 on the priority list out of 2 000 structures
- Has been repaired – detail investigations revealed virtually no transverse steel. Edge of deck could only take 30% Live Load. Although ASR was present it was not the main problem.

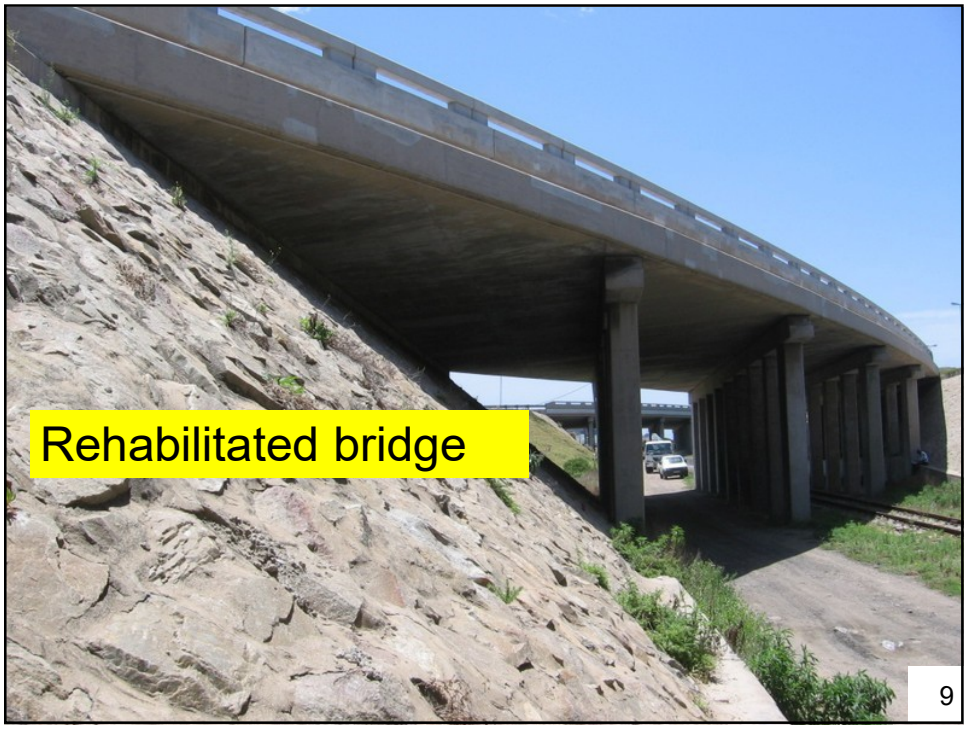
5

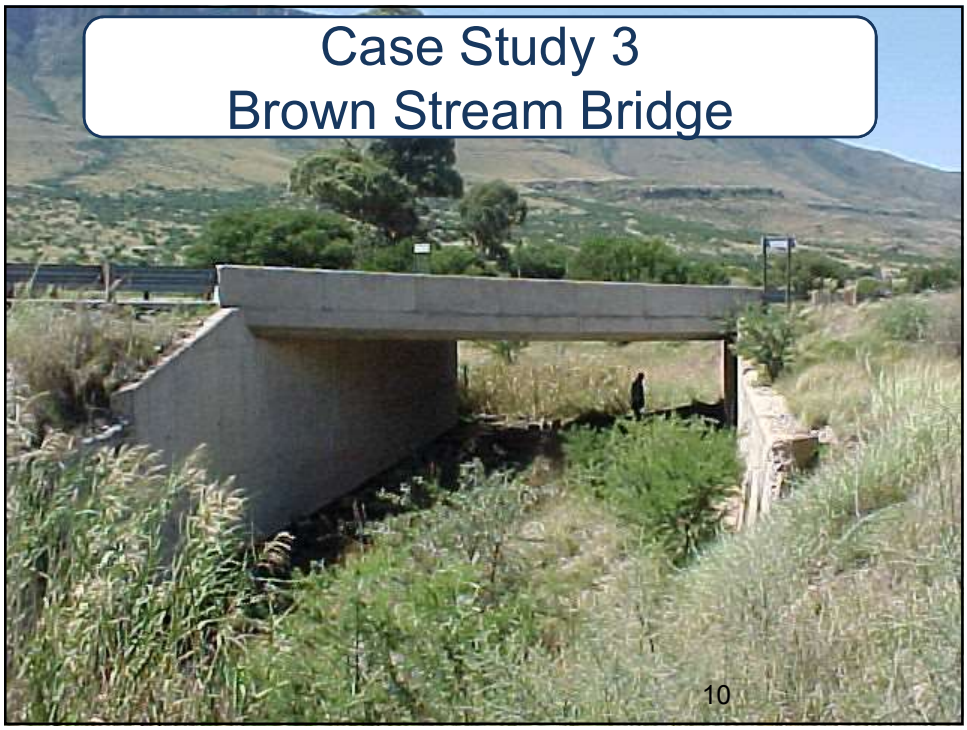
Repaired bridge deck

6

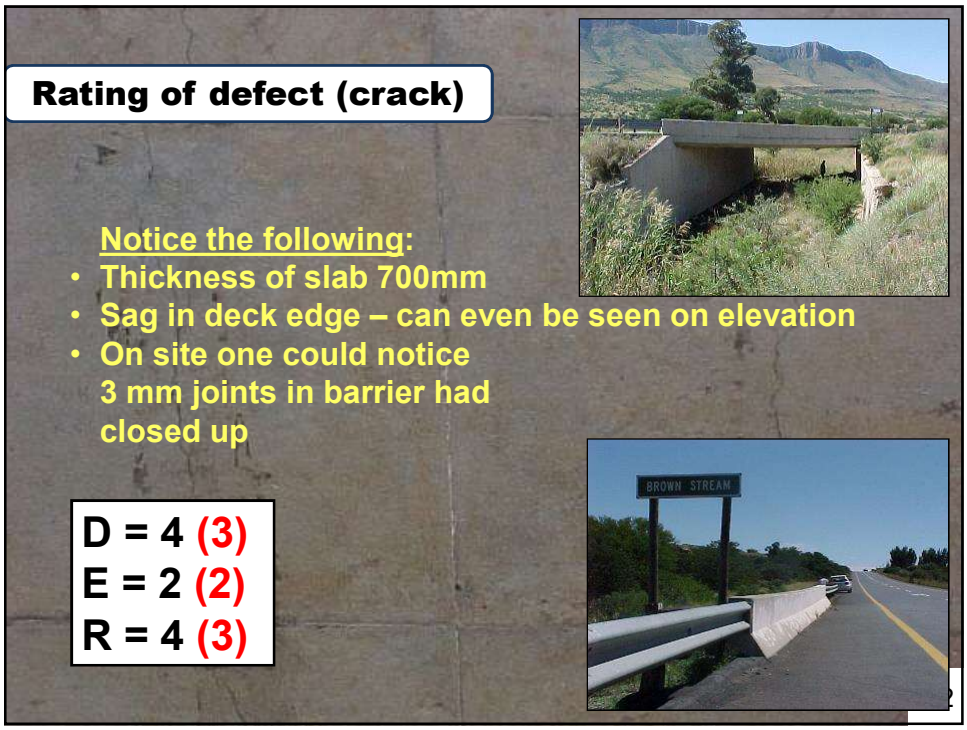

Case Study 2
Burman Road/Rail Bridge
7


Crack: D = 3
Burman Road/Rail Case Study
Spall: D = 4
Both defects were rated R=4
As this is the same deck one would rate the spall (D = 4)
D = 4 E=3 R = 4
8

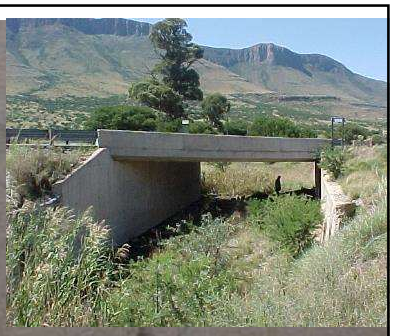

Rehabilitated bridge
9


Case Study 3
Brown Stream Bridge
10

1 to 2 mm transverse cracks in deck slab soffit (main bending)
11


Rating of defect (crack)
Notice the following:
• Thickness of slab 700mm
• Sag in deck edge – can even be seen on elevation
• On site one could notice 3 mm joints in barrier had closed up
D = 4 (3)
E = 2 (2)
R = 4 (3)
BROWN STREAM

Repairs done



OPI was No 52 out of 2 000

- A design check was done & deck found to have only 30% of LL Capacity
- Strengthening not feasible due to steel stressed beyond yield
- Could hear crunching of concrete when vehicles crossed
- Deck was demolished and replaced
- During demolition when deck had been demolished half way it collapsed under own weight!!!

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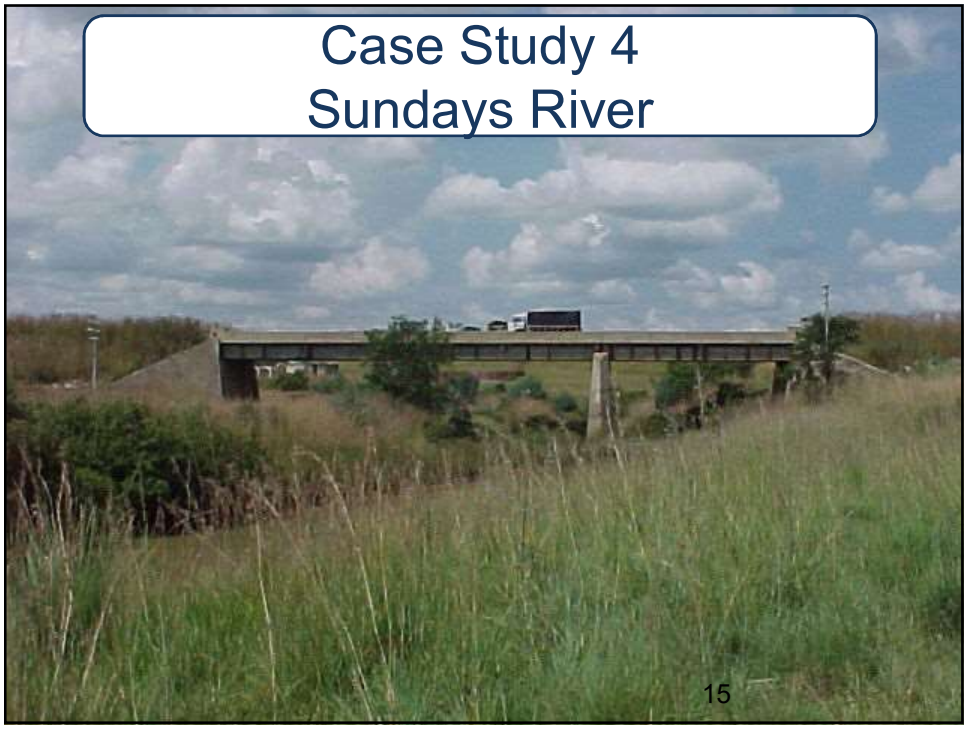
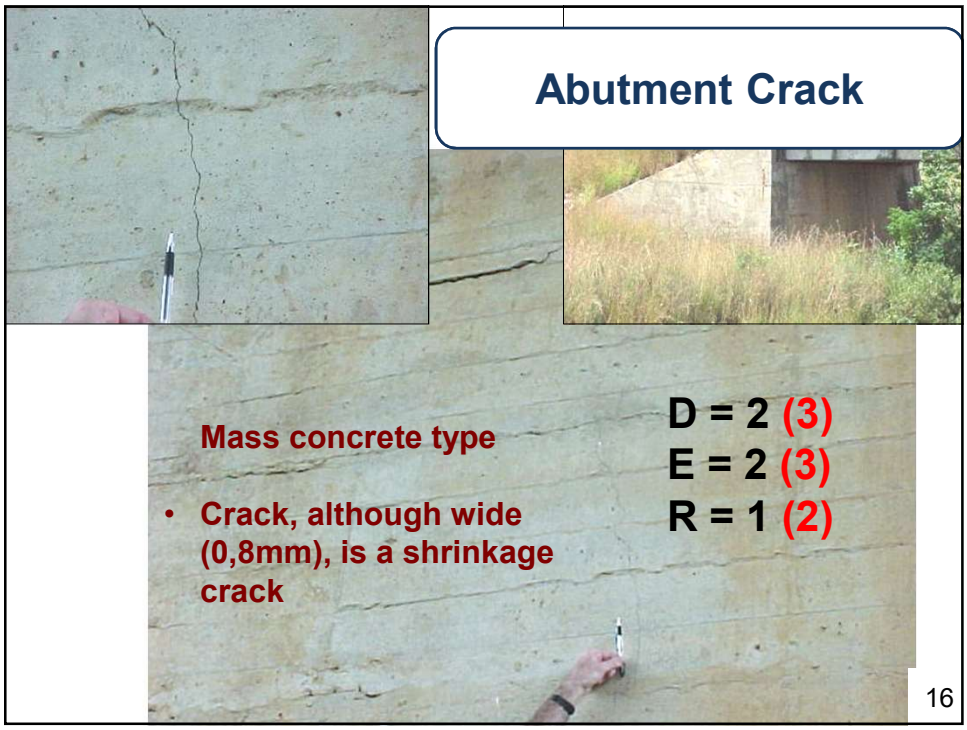
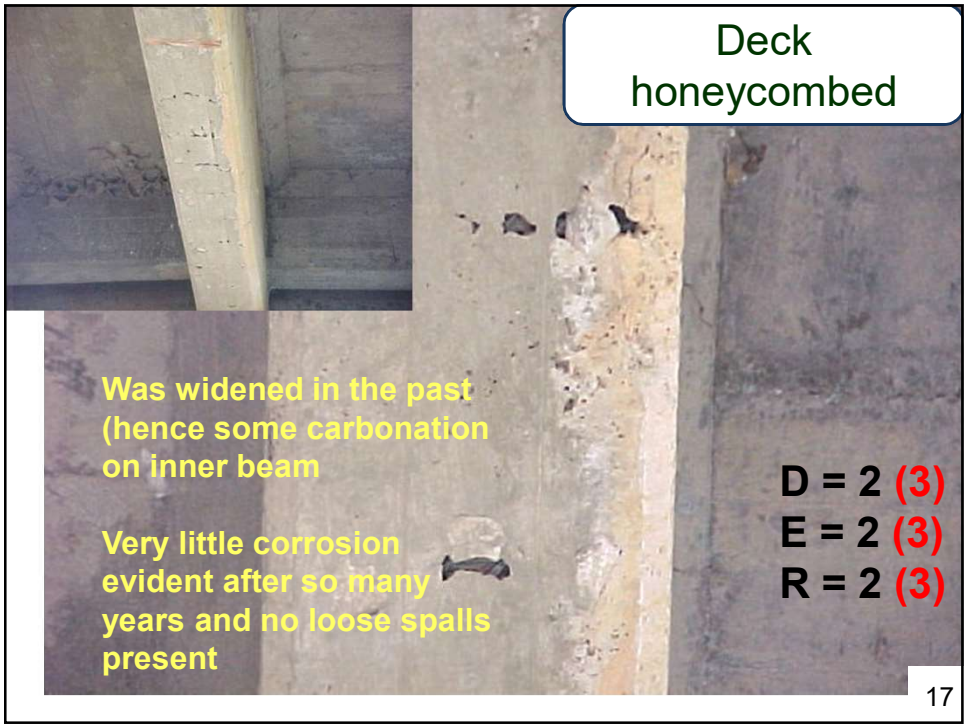
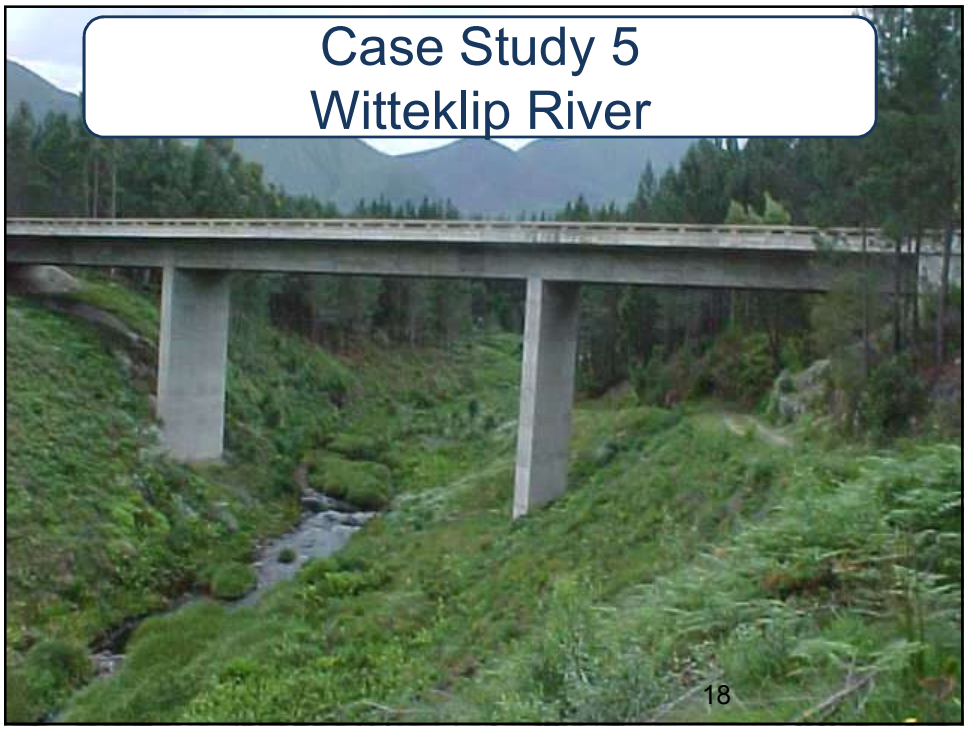
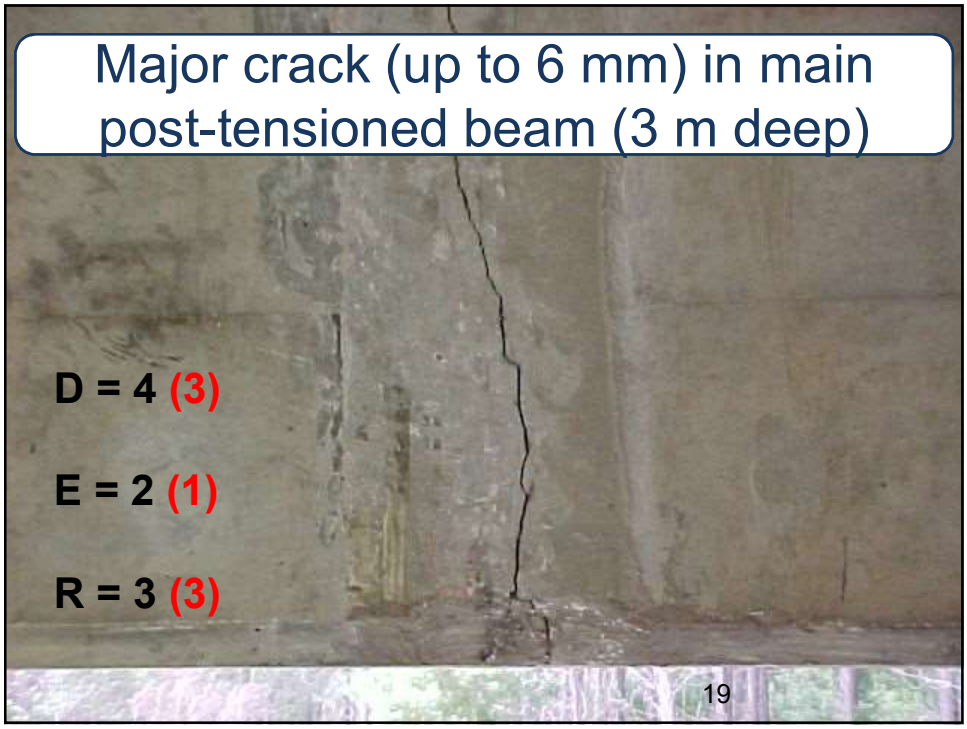
14


Case Study 4
Sundays River
15

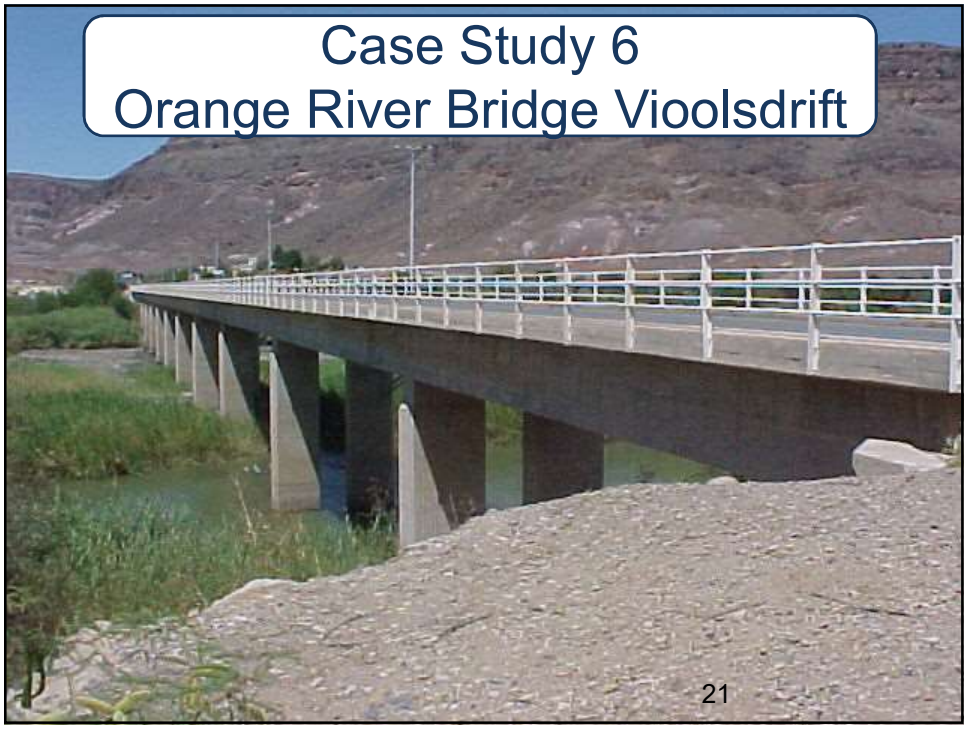

Abutment Crack
Mass concrete type
• Crack, although wide (0,8mm), is a shrinkage crack
D = 2 (3)
E = 2 (3)
R = 1 (2)
16

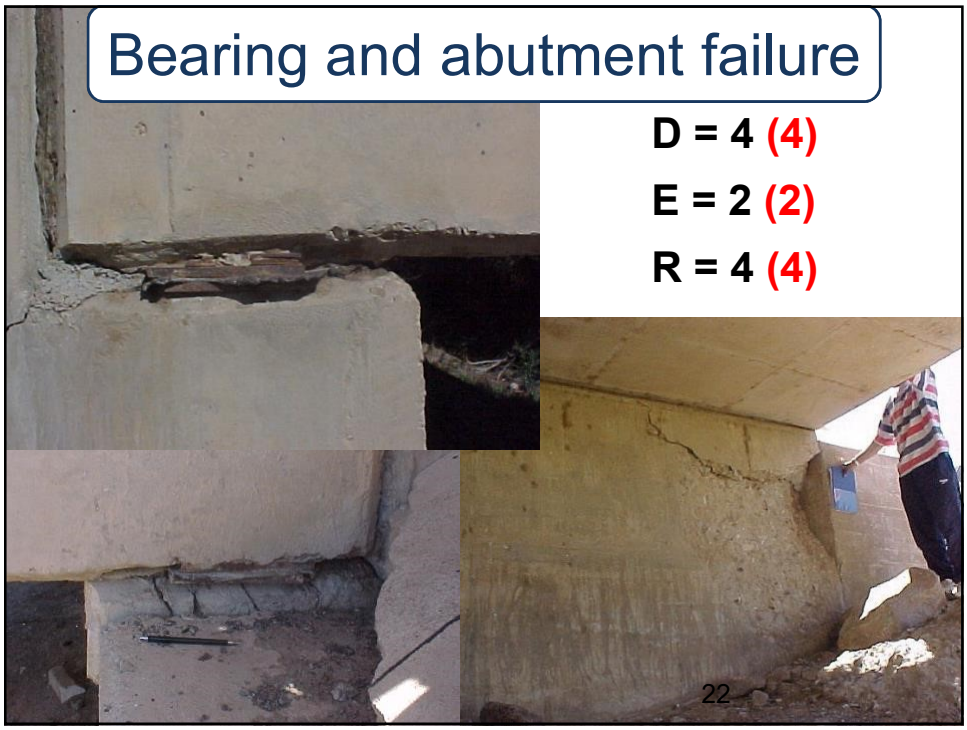

Deck
honeycombed
Was widened in the past
(hence some carbonation
on inner beam
Very little corrosion
evident after so many
years and no loose spalls
present
D = 2 (3)
E = 2 (3)
R = 2 (3)
17


Case Study 5
Witteklip River
18

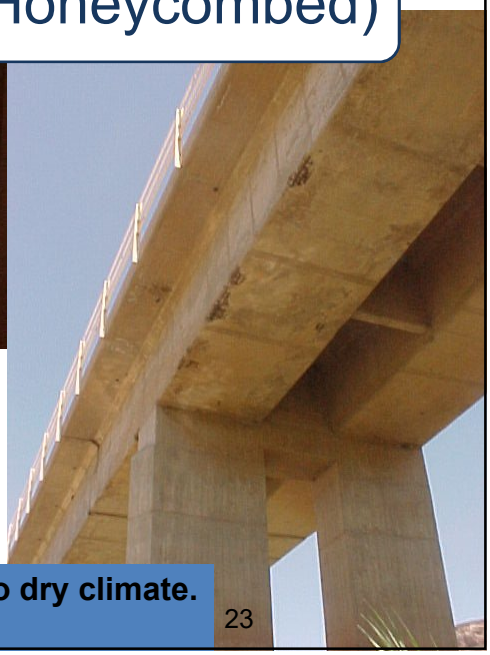

Major crack (up to 6 mm) in main post-tensioned beam (3 m deep)
D = 4 (3)
E = 2 (1)
R = 3 (3)
19

20


Case Study 6
Orange River Bridge Vioolsdrift
21


Bearing and abutment failure
D = 4 (4)
E = 2 (2)
R = 4 (4)
22

Deck Rating (Honeycombed)



D = 3 (3)

E = 2 (2)

R = 2 (3)

NB: Notice no corrosion due to dry climate.
Hence R = 2 and not 3

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Case Study 7
Kareebosch Poort Rail Bridge

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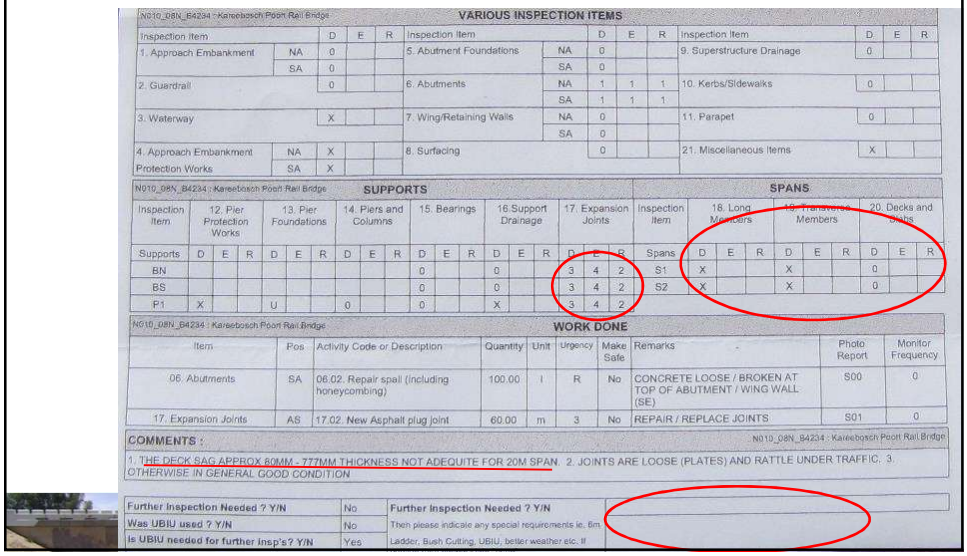
Actual inspection form



N010_08N_84234 : Kareebosch Poort Rail Bridge — VARIOUS INSPECTION ITEMS

Inspection Item		D	E	R	Inspection Item		D	E	R	Inspection Item	D	E	R
1. Approach Embankment	NA	0			5. Abutment Foundations	NA	0			9. Superstructure Drainage	0		
	SA	0				SA	0						
2. Guardrail		0			6. Abutments	NA	1	1	1	10. Kerbs/Sidewalks	0		
						SA	1	1	1				
3. Waterway		X			7. Wing/Retaining Walls	NA	0			11. Parapet	0		
						SA	0						
4. Approach Embankment Protection Works	NA	X			8. Surfacing		0			21. Miscellaneous Items	X		
	SA	X											

N010_08N_84234 : Kareebosch Poort Rail Bridge — SUPPORTS / SPANS

Inspection Item	12. Pier Protection Works			13. Pier Foundations			14. Piers and Columns			15. Bearings			16.Support Drainage			17. Expansion Joints		
Supports	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R
BN										0			0			3	4	2
BS										0			0			3	4	2
P1	X			U			0			0			X			3	4	2

Inspection Item	18. Long Members			19. Transverse Members			20. Decks and Slabs		
Spans	D	E	R	D	E	R	D	E	R
S1	X			X			0		
S2	X			X			0		

N010_08N_84234 : Kareebosch Poort Rail Bridge — WORK DONE

Item	Pos	Activity Code or Description	Quantity	Unit	Urgency	Make Safe	Remarks	Photo Report	Monitor Frequency
06. Abutments	SA	06.02. Repair spall (including honeycombing)	100.00	l	R	No	CONCRETE LOOSE / BROKEN AT TOP OF ABUTMENT / WING WALL (SE)	S00	0
17. Expansion Joints	AS	17.02. New Asphalt plug joint	60.00	m	3	No	REPAIR / REPLACE JOINTS	S01	0

COMMENTS : N010_08N_84234 : Kareebosch Poort Rail Bridge

1. THE DECK SAG APPROX 80MM - 777MM THICKNESS NOT ADEQUITE FOR 20M SPAN. 2. JOINTS ARE LOOSE (PLATES) AND RATTLE UNDER TRAFFIC. 3. OTHERWISE IN GENERAL GOOD CONDITION

Further Inspection Needed ? Y/N	No	Further Inspection Needed ? Y/N	
Was UBIU used ? Y/N	No	Then please indicate any special requirements ie. Bm	
Is UBIU needed for further Insp's? Y/N	Yes	Ladder, Bush Cutting, UBIU, better weather etc. If	

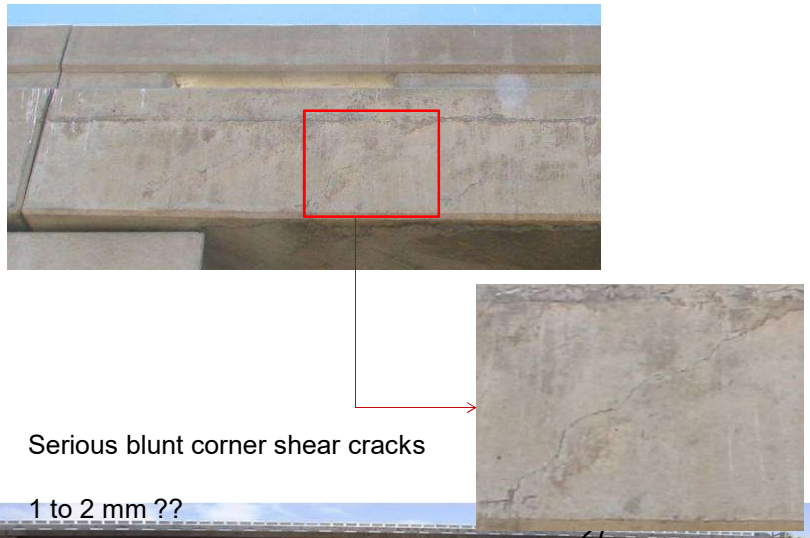
Joints

17. Expansion Joints			
D	E	R	
3	4	2	3
3	4	2	3
3	4	2	4

Remember to rate the element and how it fulfils its function and not the element in relation to the bridge

2. JOINTS ARE LOOSE (PLATES) AND RATTLE UNDER TRAFFIC. 3. ← G26d comment

However at pier!



Serious blunt corner shear cracks

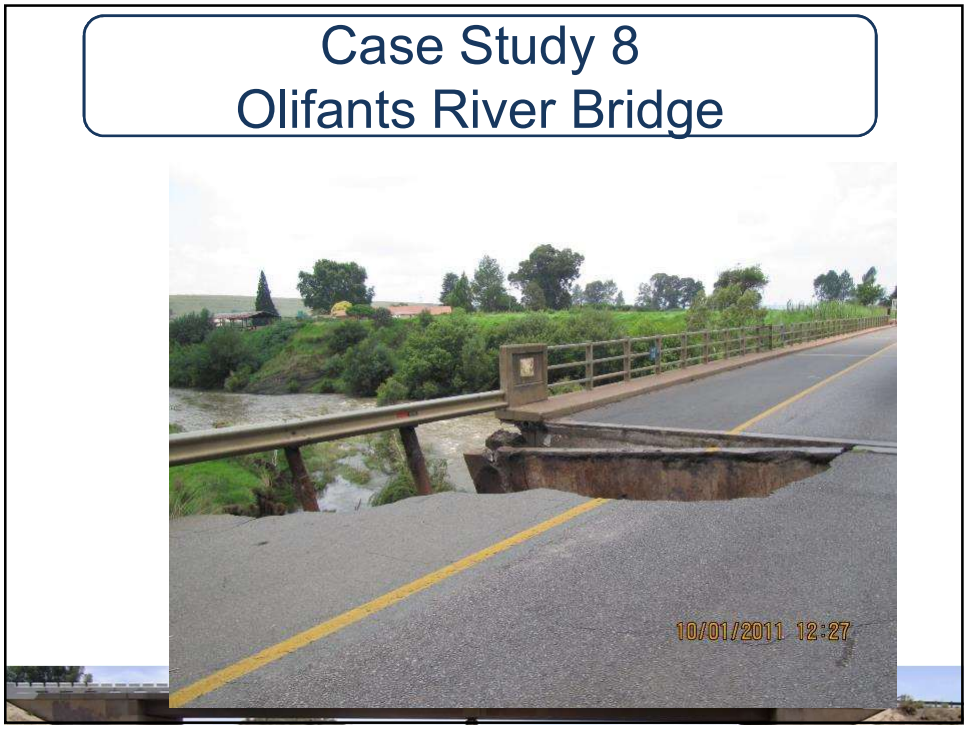
1 to 2 mm ??

However at abutment!

SPANS									
Inspection Item	18. Long Members			19. Transverse Members			20. Decks and Slabs		
Spans	D	E	R	D	E	R	D	E	R
S1	X			X			0		
S2	X			X			0		

SPANS									
Inspection Item	18. Long Members			19. Transverse Members			20. Decks and Slabs		
Spans	D	E	R	D	E	R	D	E	R
S1	X			X			0 3	3	4
S2	X			X			0 3	3	4

Case Study 8
Olifants River Bridge



Actual Inspection Form

R555_01E_B421 : Olifants River

VARIOUS INSPECTION ITEMS

Inspection Item		D	E	R	Inspection Item		D	E	R	Inspection Item	D	E	R
1. Approach Embankment	NA	0			5. Abutment Foundations	NA	0			9. Superstructure Drainage	1	1	1
	SA	0				SA	0						
2. Guardrail		1	1	1	6. Abutments	NA	0			10. Kerbs/Sidewalks	0		
						SA	0						
3. Waterway		1	1	1	7. Wing/Retaining Walls	NA	1	1	1	11. Parapet	1	1	1
						SA	0						
4. Approach Embankment	NA	3	4	3	8. Surfacing		1	1	1	21. Miscellaneous Items	1	1	1
Protection Works	SA	3	4	3									

R555_01E_B421 : Olifants River

SUPPORTS

Inspection Item	12. Pier Protection Works			13. Pier Foundations			14. Piers and Columns			15. Bearings			16.Support Drainage			17. Expansion Joints		
Supports	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R	D	E	R
P1	0			0			0			0			0			3	2	2
P2	0			0			0			0			0			3	2	2
P3	0			0			0			0			0			3	2	2
U1										0			0			3	2	2
U2										0			0			3	2	2

SPANS

Inspection Item	18. Long Members			19. Transverse Members			20. Decks and Slabs		
Spans	D	E	R	D	E	R	D	E	R
S1	0			0			0		
S2	0			0			0		
S3	0			0			0		
S4	0			0			0		

30

R555_01E_B421 : Olifants River

WORK DONE

Item	Pos	Activity Code or Description	Quantity	Unit	Urgency	Make Safe	Remarks	Photo Report	Monitor Frequency
02. Guardrail	AP	02.04. Replace posts (steel or timber)	4.00	No	1	No		S04	6
02. Guardrail	BA	02.03. Attach guardrail to endblock	4.00	No	1	No		S04	12
03. Waterway	AS	03.06. Remove trees girth < 500mm	10.00	No	1	No		S02	12
04. Approach Embankment Protection Works	BA	04.03. Gabion (matresses & boxes)	150.00	m3	1	No		S00,S07	3
07. Wing/ Retaining Walls	EA	07.04. Repair spall (including honeycombing)	20.00	l	1	No		S01	12
08. Surfacing	AS	08.01. Resurface or patch	10.00	m2	1	No		S11	12
09. Superstructure Drainage	AS	09.05. Extend scupper below deck soffit	30.00	No	1	No		S12	12
11. Parapet	AP	11.03. Paint steel rails	90.00	m2	1	No		S05	12
17. Expansion Joints	AP	17.06. Replace neoprene glands	70.00	m	1	No		S09	12
17. Expansion Joints	BA	17.01. Repair concrete nosing	28.00	m	1	No		S03	12
21. Miscellaneous Items	BE	21.08. Replace road signs	2.00	m2	0	No		S08	12
21. Miscellaneous Items	BE	21.06. Bridge number plates	2.00	No	1	No		S10	12

COMMENTS : R555_01E_B421 : Olifants River

BRIDGE IN GOOD OVERALL CONDITION.

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S00 - 296_Abutment founding conditions.JPG

S07 - 3257_Scour damage.JPG

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33

10/01/2011 11:46

10/01/2011 12:44
35

Case Study 9 - Culvert

R033_14N_IDC3316 : Blinkwater

VARIOUS INSPECTION ITEMS

Inspection Item		D	E	R	Inspection Item		D	E	R	Inspection Item		D	E	R
1. A/Slabs & C/Off Walls	EE	X			5. Waterway	G	1	1	1	9. Parapet/Handrails	G	X		
	WE	X												
2. Wing/Ret/Head Walls	EE	3	2	2	6. Road Slabs	G	X			14. Miscellaneous Items	G	X		
	WE	3	2	2										
3. Scour Protection Works	EE	3	2	2	7. Roadway Joints	G	X							
	WE	3	2	2										
4. Embankment Prot. Works	EE	3	2	2	8. Guardrails	G	X							
	WE	3	2	2										

Inspection Ratings (Specific Positions) R033_14N_IDC3316 : Blinkwater

Inspection Item	10. Walls			11. Top Slab			12. Invert Slab			13.Cell Displacement		
	D	E	R	D	E	R	D	E	R	D	E	R
CD1	0			0			0			0		
CD2	0			0			0			0		

R033_14N_IDC3316 : Blinkwater

WORK DONE

Item	Pos	Activity Code or Description	Quantity	Unit	Urgency	Make Safe	Remarks	Photo Report	Monitor Frequency
02. Wing / Ret / Head Walls	EE,WE	02.158. Rock backfill	10.00	m3	4	No	Stone pitched head wall damged by water erosion shoiuld be repairee ASAP	S1,S1	0
03. Scour Protection Works	EE,WE	03.156. Gabion (mattresses and boxes)	10.00	m3	4	No	The scoured area bacfill and compact, use 300mm thick gabion mattress (20m2), to pervent further scour.	S1,S1	0
04. Embankment/s	EE,WE	04.156. Gabion (mattresses and boxes)	10.00	m3	4	No	No protaection to embankments erosion, Provide 1mx1mx1m gabion with mattress of 300mm thick to retain/support river channel.	S1,S1	0
05. Waterway	C1,C2	05.151. Backfill scour damage (earth)	30.00	m3	4	No		S1,S1,S1	0

COMMENTS : R033_14N_IDC3316 : Blinkwater

Inventory Photos

V01 - P1000284.JPG

V02 - P1000283.JPG

V03 - P1000286.JPG

V05 - P1000287.JPG

V06 - P1000288.JPG

V07 - P1000289.JPG

Inspection Photos

S01 - P1000291.JPG

S02 - P1000292.JPG-Scour down stream

S03 - P1000293.JPG-Scour down stream

S05 - P1000295.JPG-Scour down

S06 - P1000296.JPG-Scour down

Inspection Ratings (Specific Positions)

Inspection Item	10. Walls			11. Top Slab			12. Invert Slab			13.Cell Displacement		
	D	E	R	D	E	R	D	E	R	D	E	R
C01	0			0			0			0		
C02	0			0			0			0		

R013_1/N_ID03316 : Rintwater

Inspection Ratings (Specific Positions)

Inspection Item	10. Walls			11. Top Slab			12. Invert Slab			13.Cell Displacement		
	D	E	R	D	E	R	D	E	R	D	E	R
C01	0			0			0			0		
C02	0			0			0			0		

4 4 4
2 4 3

R013_1/N_ID03316 : Rintwater

Where does the responsibility lie if a bridge collapses?

ANSWER

????????

Depends on the laywers

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Summary of Case Studies

- Some inspectors are too conservative especially if they have no bad bridges.
- Insufficient thought and observation resulted in some items not being rated important enough
- Experience is critical for this BMS system

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