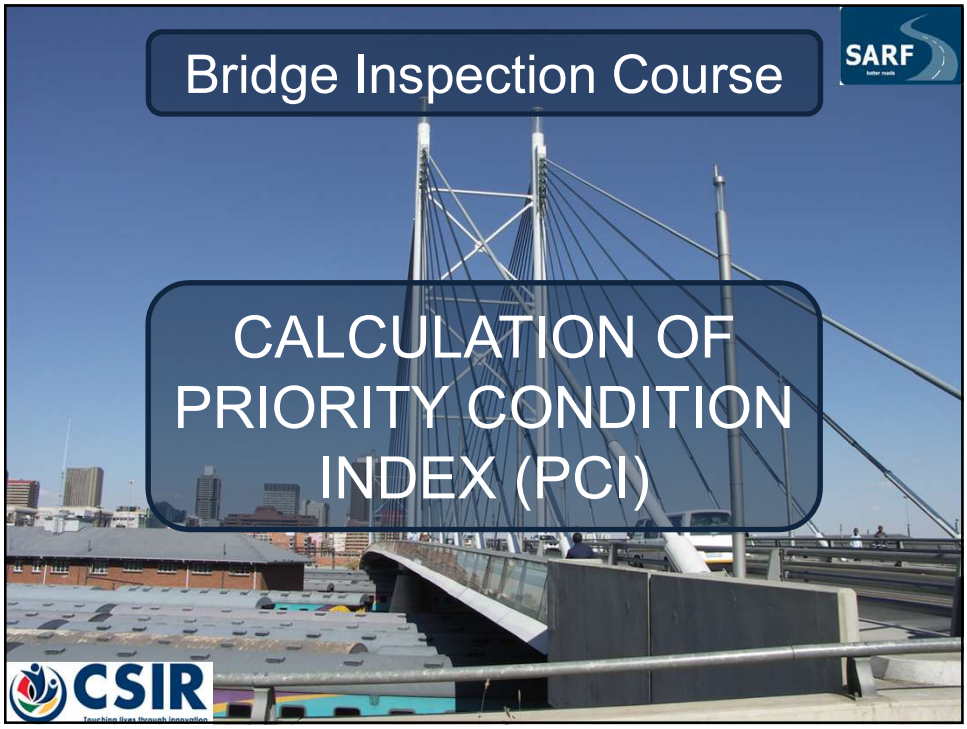


A. Priority Condition Index (PCI)

- The PCI value is intended to identify those structures with the highest priority for maintenance or repairs by ensuring that structures with significant defects on vital structural elements are allocated a low PCI value ("get to the top of the list")
- The PCI is calculated using a **Deduct Points Method**
- PCI values can range from 2.5 (worst condition) to 100 (best condition)

Deduct-points Method

DER ratings are used to calculate a Priority Condition Index (PCI) value for the structure following the following steps:

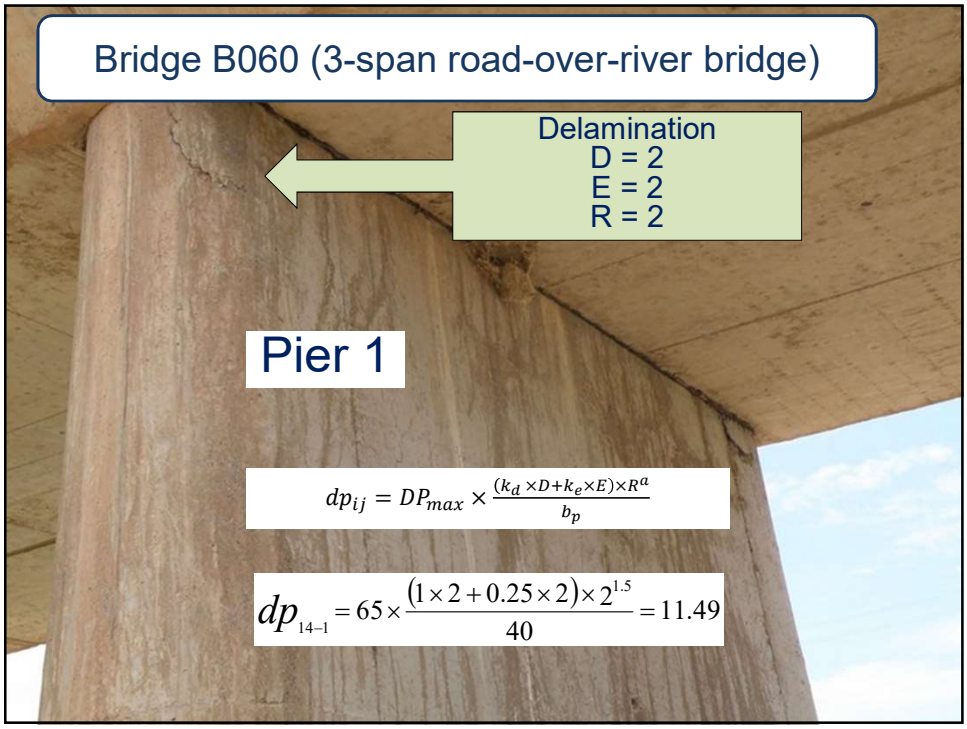
1. Calculate the deduct points for each inspection sub-item (or item for items with no sub-items)
2. Calculate the weighted deduct points for each sub-item (or item)
3. Combine the five highest weighted deduct points
4. Subtract the combined deduct points from 100 to arrive at the PCI for the structure

1. Calculation of Deduct Points for Sub-items/Items

$$dp_{ij} = DP_{max} \times \frac{(k_d \times D + k_e \times E) \times R^a}{b_p}$$

dp_{ij}	=	calculated deduct points for inspection sub-item j of item i;
DP_{max}	=	maximum deduct points per inspection sub-item 65 (agreed value)
D	=	degree rating for inspection sub-item j of item i;
E	=	extent rating for inspection sub-item j of item i;
R	=	relevancy rating for inspection sub-item j of item i;
k_d	=	degree factor = 1
k_e	=	extent factor = 0.25
a	=	relevancy exponent = 1.5
b_p	= = = =	$(k_d \times D_{max} + k_e \times E_{max}) \times R_{max}^a$ $(k_d \times 4 + k_e \times 4) \times 4^a$ $(1 \times 4 + 0.25 \times 4) \times 4^{1.5}$ 40

$0 \leq dp_{ij} \leq 65$



3. Calculate Weighted Deduct Points

$$\mathbf{wdp}_{ij} = \frac{w_i}{w_{max}} \times dp_{ij}$$

$\mathbf{wdp}_{ij}$	=	The weighted deduct points for sub-item j of inspection item i
$\mathbf{w}_i$	=	weight for inspection item i
$\mathbf{w}_{max}$	=	highest weight for the inspection items making up the structure type – typically 5
$\mathbf{dp}_{ij}$	=	deduct points for the inspection sub-item j of inspection item i

Inspection Items and Weights

No.	Inspection Item	Weight
01	Approach Embankment	2
02	Guardrail	1 (0)
03	Waterway	2
04	Approach Embankment Protection Works	2
05	Abutment Foundations	5
06	Abutments	5
07	Wing/ Retaining Walls	4
08	Surfacing	1
09	Super-structure Drainage	1
10	Kerbs / Sidewalks	1
11	Parapet	3
12	Pier Protection Works	1
13	Pier Foundations	5
14	Piers & Columns	5
15	Bearings	3
16	Support Drainage	1
17	Expansion Joints	2
18	Longitudinal Members	5
19	Transverse Members	3
20	Decks & Slabs	5
21	Miscellaneous Items	0

$$\mathrm{wdp}_{ij} = \frac{w_i}{w_{max}} \times dp_{ij}$$

$$wdp_{14-1} = \frac{5}{5} \times 11.49 = 11.49$$

If the DER = 2-2-2 defect was on a parapet (Item 11), wdp_{11} would be:

$$wdp_{11} = \frac{3}{5} \times 11.49 = 6.89$$

4. Calculation of Deduct Points for a Structure (DPS)

$$DP_S = wdp_1 + a \times wdp_2 + b \times wdp_3 + c \times wdp_4 + c \times wdp_5$$

DP_S	=	total deduct points for the structure;	
wdp_1	=	deduct points for the inspection sub-item with the highest value (primary inspection sub-item);	
wdp_2	=	deduct points for the inspection sub-item with the 2nd highest value (secondary inspection sub-item);	
wdp_3	=	deduct points for the inspection sub-item with the 3rd highest value (tertiary inspection sub-item);	
wdp_4	=	deduct points for the inspection sub-item with the 4th highest value (first other inspection sub-item);	
wdp_5	=	deduct points for the inspection sub-item with the 5th highest value (second other inspection sub-item);	
a	=	factor for the contribution of the secondary inspection sub-item	**= 0.3**
b	=	factor for the contribution of the tertiary inspection sub-item	**= 0.1**
c	=	factor for the contribution of the other inspection sub-items	**= 0.05**

Item No.	Item Description	Sub-item	D	E	R	dp_{ij}	$Weight_i$	wdp_{ij}	Rank
1	Approach Embankment	A1	1	3	1	2.84	2	1.14	15
		A2	1	4	1	3.25	2	1.30	13
2	Guardrail		0			0	1	0.00	
3	Waterway		0			0	2	0.00	
4	Approach Embankment Protection Works	A1	3	2	1	5.69	2	2.28	9
		A2	3	2	1	5.69	2	2.28	10
5	Abutment Foundations	A1	0			0	5	0.00	
		A2	0			0	5	0.00	
6	Abutments	A1	1	1	1	2.03	5	2.03	11
		A2	1	1	1	2.03	5	2.03	12
7	Wing/Retaining Walls	A1	0			0	4	0.00	
		A2	0			0	4	0.00	
8	Surfacing		0			0	1	0.00	
9	Super-Structure Drainage		0			0	1	0.00	
10	Kerbs/Sidewalks		0			0	1	0.00	
11	Parapet/Handrail		1	1	1	2.03	3	1.22	14

Item No.	Item Description	Sub-item	D	E	R	dpij	$Weight_i$	wdp_{ij}	Rank
12	Pier Protection Works	P1	X				1		
		P2	X				1		
13	Pier Foundations	P1	0			0	5	0.00	
		P2	0			0	5	0.00	
14	Piers & Columns	P1	2	2	2	11.49	5	11.49	1
		P2	1	2	1	2.44	5	2.44	8
15	Bearings	A1	0			0	3	0.00	
		A2	0			0	3	0.00	
		P1	0			0	3	0.00	
		P2	0			0	3	0.00	
16	Support Drainage	A1	0			0	1	0.00	
		A2	0			0	1	0.00	
		P1	0			0	1	0.00	
		P2	0			0	1	0.00	
17	Expansion Joints	A1	3	4	2	18.38	2	7.35	2
		A2	3	4	2	18.38	2	7.35	3
		P1	3	4	2	18.38	2	7.35	4
		P2	3	4	2	18.38	2	7.35	5
18	Longitudinal Member	S1	X				5		
		S2	X				5		
		S3	X				5		
19	Transverse Members	S1	X				3		
		S2	X				3		
		S3	X				3		
20	Deck Slab	S1	2	1	1	3.66	5	3.66	6
		S2	2	1	1	3.66	5	3.66	7
		S3	0			0	5	0.00	
21	Miscellaneous Items		X				0		

Rank	Sub-Item		DER	Weight	DP_{ij}
1	14-1	Piers & Columns	2-2-2	5	$wdp_{14-1} = 11.49$
2	17	Expansion Joints	3-4-2	2	$wdp_{17-1} = 7.35$
3	20	Expansion Joints	3-4-2	2	$wdp_{17-2} = 7.35$
4	4	Expansion Joints	3-4-2	2	$wdp_{17-3} = 7.35$
5	6	Expansion Joints	3-4-2	2	$wdp_{17-4} = 7.35$

$$DP_{B060} = 11.49 + 0.3x7.35 + 0.1x7.35 + 0.05x7.35 + 0.05x7.35$$

$$DP_{B060} = 15.17$$

5. Calculation of the PCI for the Structure

- $PCI_{structure} = 100 – DP_{structure}$
- $PCI_{B060} = 100 - 15.17 = 84.83$
- B060 is therefore in the “Good” category

$2.5 \leq PCI \leq 100$
PCI = 2.5 when DER = 4-4-4 defects are present on five inspection sub-items with a weight of 5

Thank you