

Bridge Degradation Modelling



Background

A bridge is made up of several components which degrade at different rates. There is no variable which can be measured to obtain the condition of the elements of a bridge.



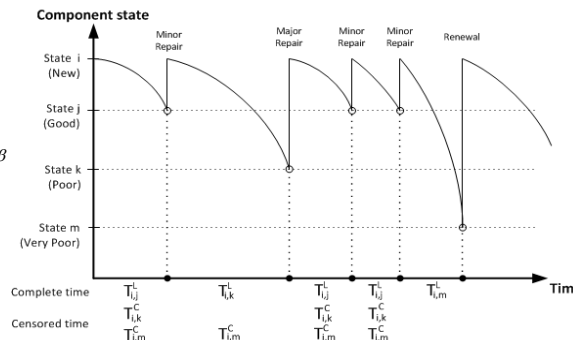
Objective

- (i) To define condition states for a bridge which can be used in predict maintenance requirements.
- (ii) To establish a distribution for the times to degrade to any condition state.

Weibull Distribution

$$F(t) = 1 - e^{-\left(\frac{t}{\eta}\right)^\beta}$$

$$f(t) = \frac{\beta}{\eta} \left(\frac{t}{\eta}\right)^{\beta-1} e^{-\left(\frac{t}{\eta}\right)^\beta}$$



Severity rating	Definition
A	No visible defects to metal
B	Corrosion/loss of section < 1mm deep
C	Corrosion/loss of section 1mm up to 5mm deep
D	Corrosion/loss of section > 5mm up to 10mm deep
E	Corrosion/loss of section > 10mm but not through section
F	Corrosion/loss of section to full thickness of section
G	Choose most extensive from: Tears, fracture, cracked welds Buckling, permanent distortion or displacement

Severity rating G relates to a condition that would normally merit immediate notification to Network Rail if known to be a new defect.

Extent	Definition
1	No visible defects
2	Localised defect due to local circumstances (such as isolated damage caused by a single bridge strike or isolated water leakage)
3	< 5%
4	Percentage of surface of the element occupied by defect 5% up to 10%
5	>10% up to 50%
6	> 50%

Table 2C.14: Severity and extent ratings for metal

METAL						
Severity	Extent					
	1	2	3	4	5	6
A	0					
B		1	2	2.5	3	3.5
C		2	3.5	4	5	6
D		3	4	5	6.5	8.5
E		4	5	7	8.5	9
F		5	7	9	9.5	10
G		5	8.5	9	9.5	10

Defect Level
Minor or no defect
Minor corrosion, tear
Major corrosion, loss of section, fracture, crack welds
Major loss of section, buckling, permanent distortion

Metal Bridge Elements

