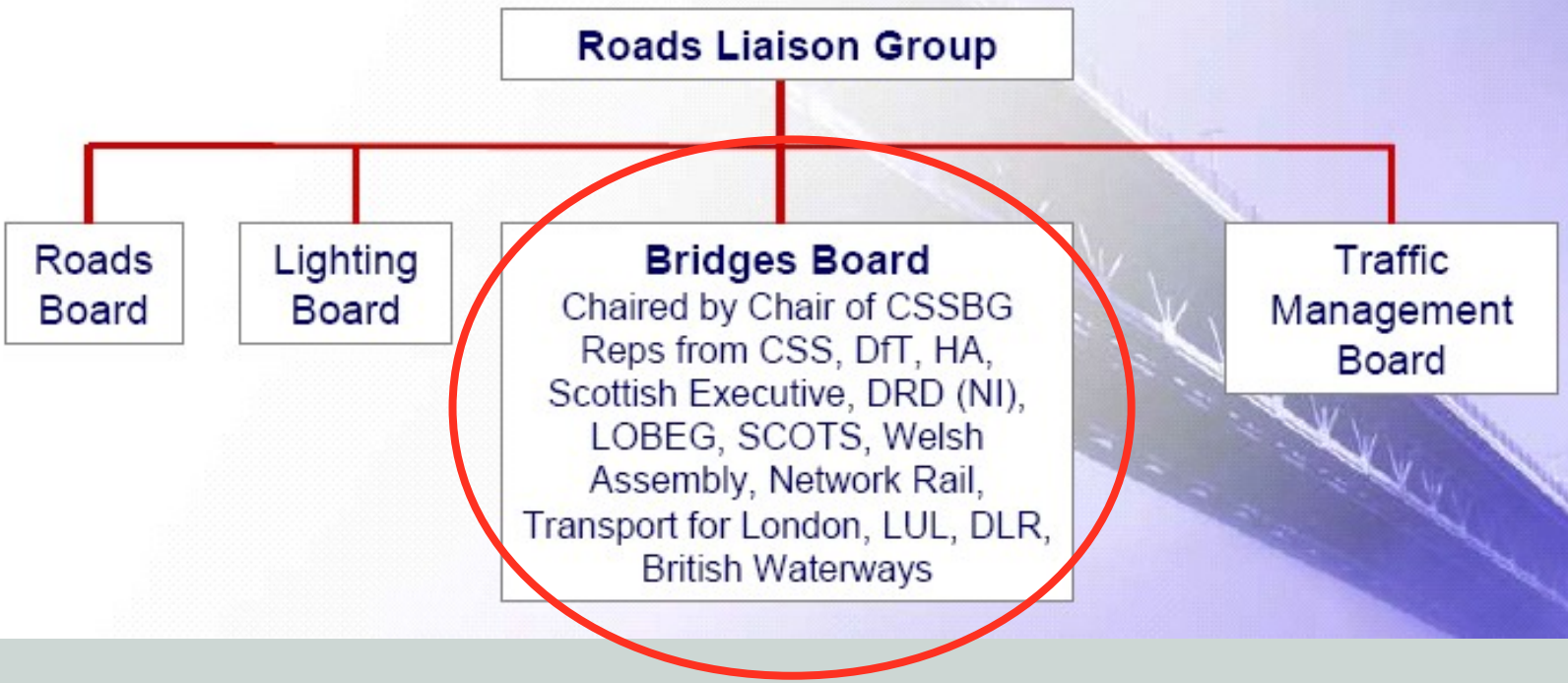
International Bridge Forum
September 2009

Inspection, Testing and Monitoring

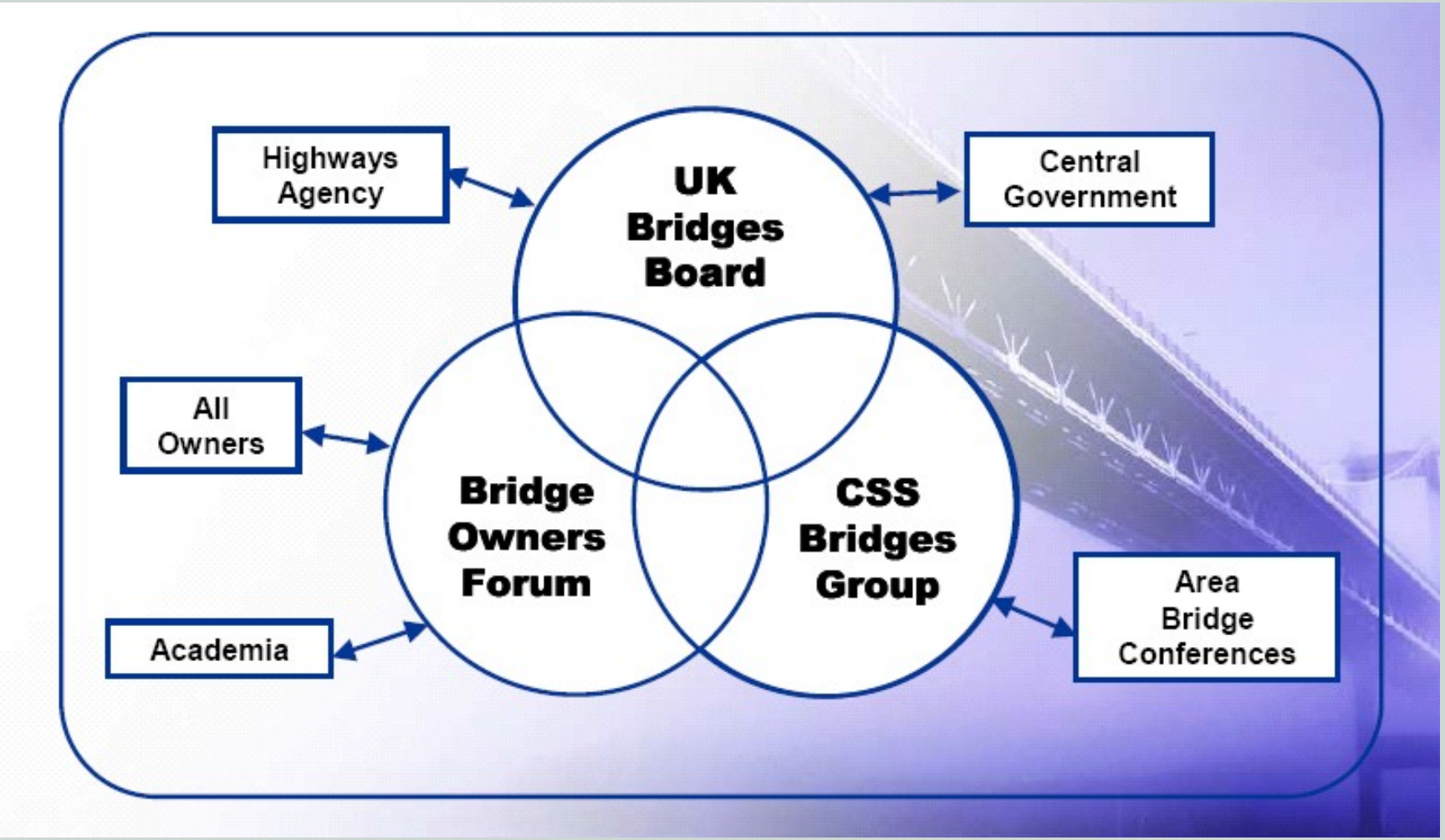
Condition Evaluation

Graham Cole

UK Bridges Board



CSS Bridges Group


Highways Agency
UK Bridges Board
Central Government
All Owners
Bridge Owners Forum
CSS Bridges Group
Academia
Area Bridge Conferences

Structure of Session

- Chairman's Introduction
- Presentations
- Contributions and Discussion
  - Inspections
  - Testing
  - Monitoring
- Summary

Chairman's Introduction

CONDITION EVALUATION

SAFE FOR USE

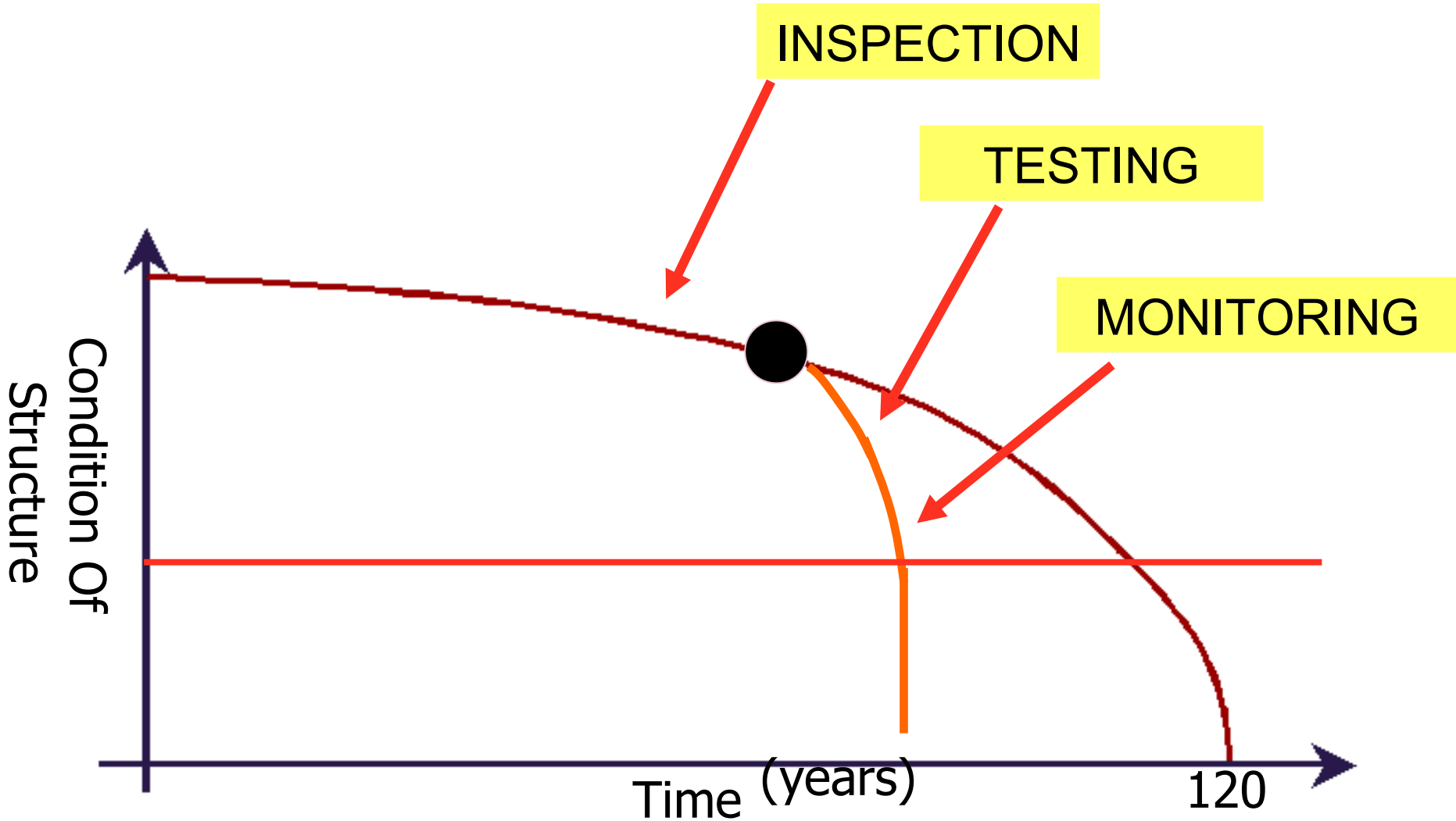
FIT FOR PURPOSE

WELL MANAGED

INSPECTIONS

TESTING

MONITORING


INSPECTION
TESTING
MONITORING
Condition Of Structure
Time (years)
120

INSPECTIONS: 'FUNDAMENTAL TASK'

- The Purpose of Inspection is to:
  - Provide data on current condition and performance

    SAFE FOR USE
  - Inform management planning by noting change of condition, deterioration etc.

    FIT FOR PURPOSE
  - Compile, verify and maintain inventory data

    WELL MANAGED

Minnesota I35W

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COUNTY COUNCIL

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This photo from June 12, 2003, shows a bent gusset plate on the I-35W bridge that is visible to the eye. (Photo courtesy of NTSB)

CLOSE ☒

Montreal

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Incident on 30 September 2006

killed 5 people and injured 6 others.

Commission of Inquiry reported on 12 October 2007

Negligence during Construction

Lapses in the management of the structure during its life

AP / Ryan Remiorz

AP / Ryan Remiorz

‘To the Victims of their Incompetence’


CEVC 011175 p2
CEVC 011176

Malahide

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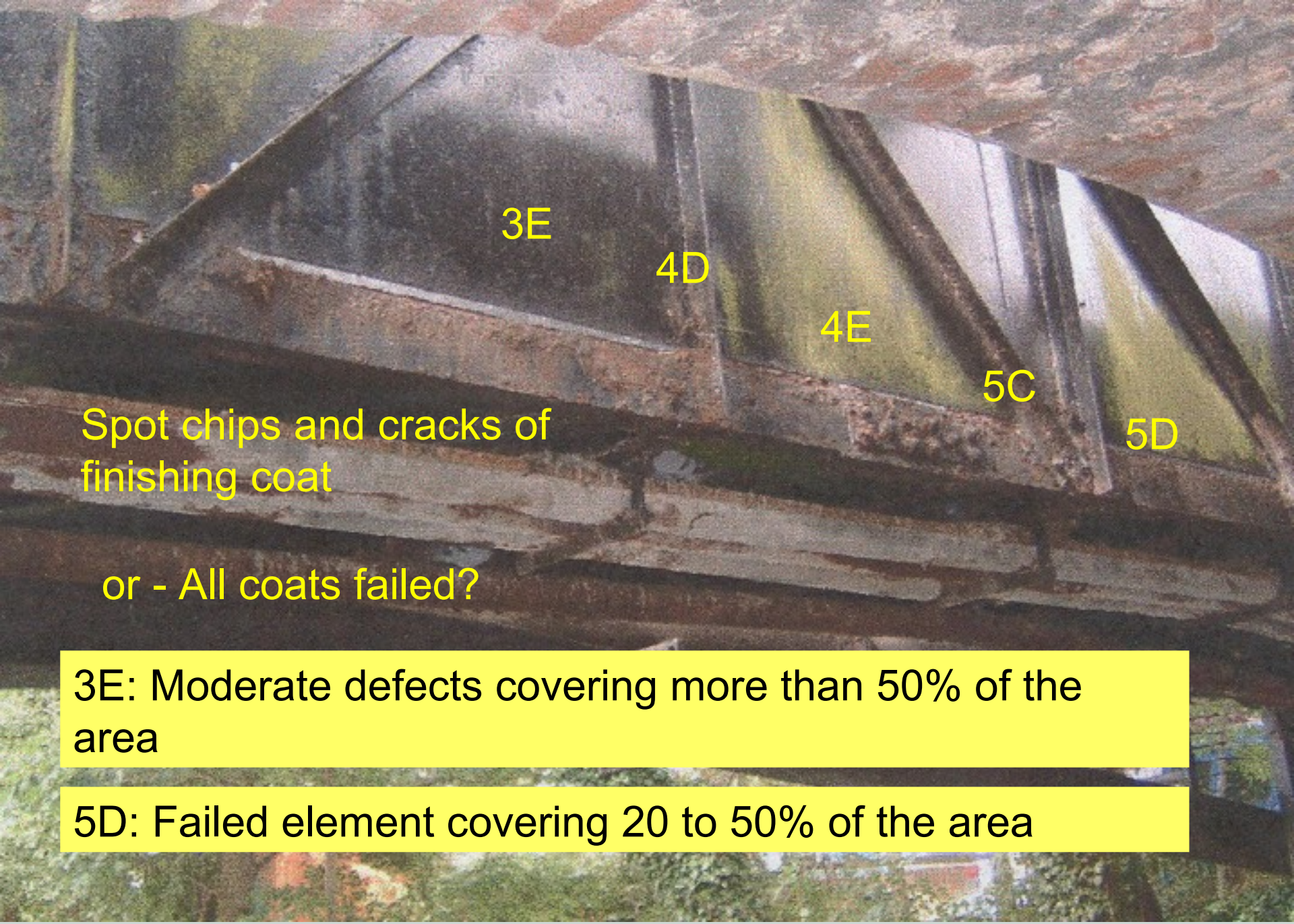
Woking Inspection Trial August 2005



3E: Moderate defects covering more than 50% of the area

5D: Failed element covering 20 to 50% of the area

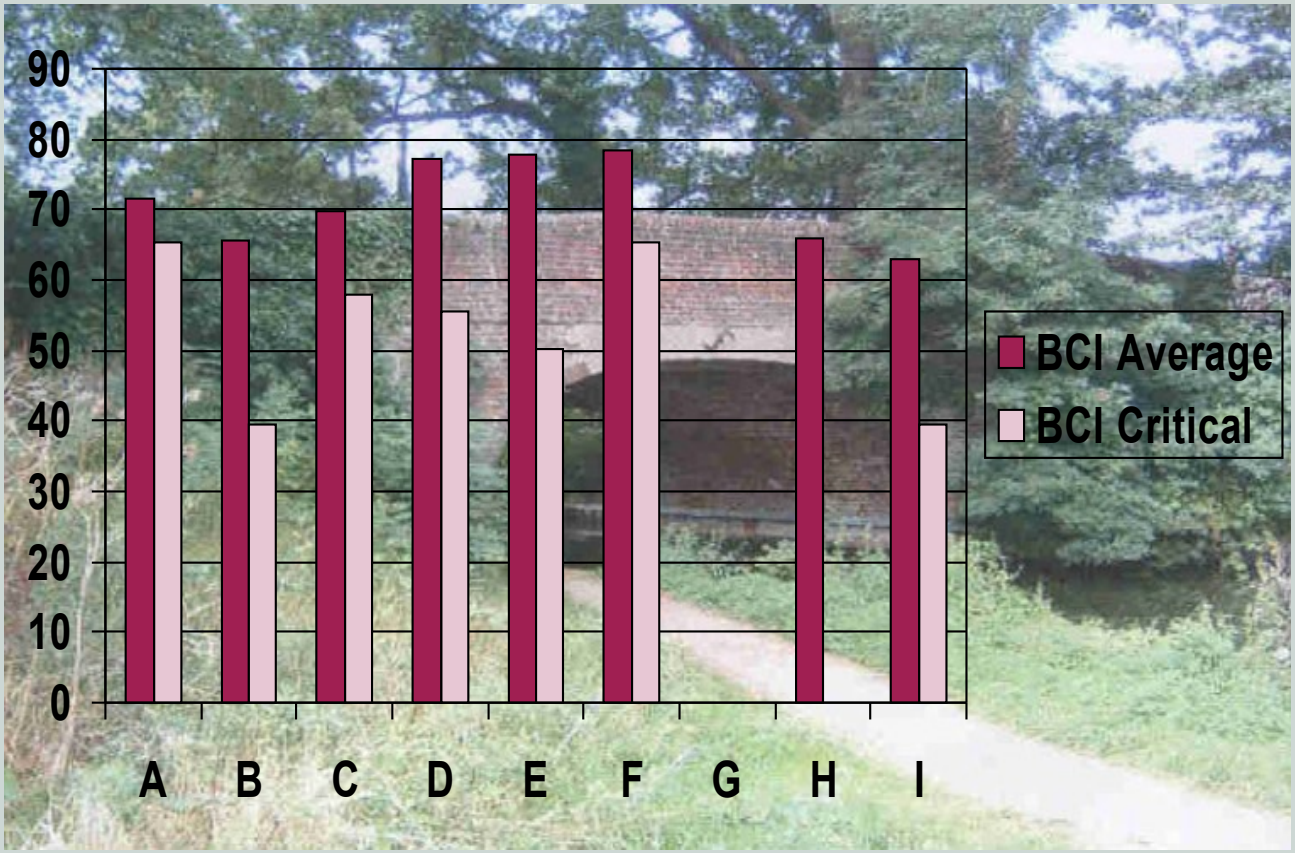
Four different dominant defect types

Severity varies from 2 to 5 and Extent from B to E

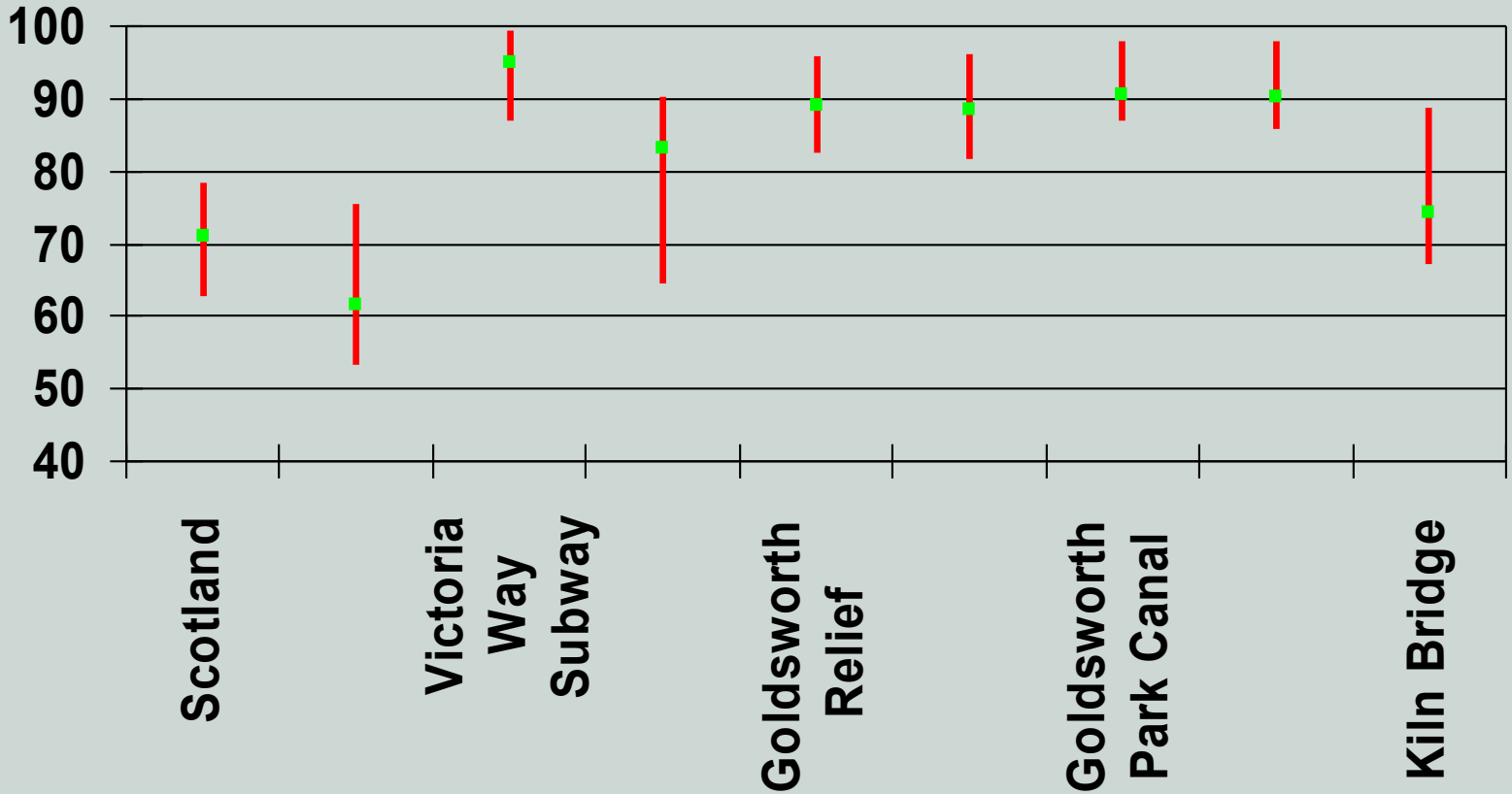
Scotland Bridge Primary Deck Element

Severity	Extent	Defect	Description
3	D	3.7	Moderate bulging, leaning or displacement
5	E	3.1	Major deformation
3	D	3.1	Minor deformation
3	B	3.2	Moderate pointing loss …..
3	C	3.1	Minor deformation
2	E	3.2	Minor depth of pointing deteriorated
3	D	3.4	Diagonal cracks, longitudinal cracks > 3mm
2	E	3.7	Minor bulging, leaning or displacement

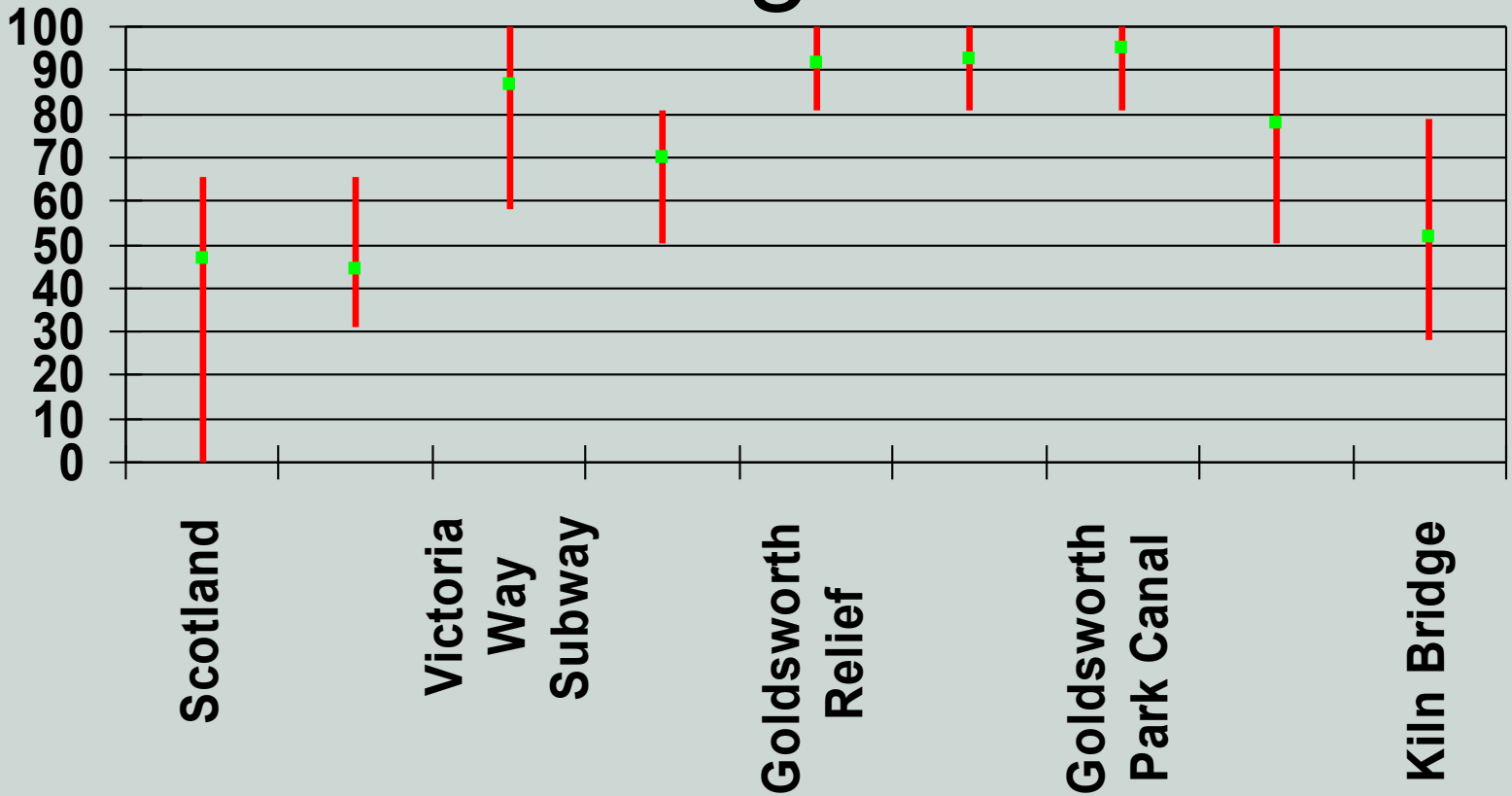
BCI for Scotland Bridge



BCI Average Range



BCI Critical Range



Variations in BCI can create problems for safety, valuation and maintenance planning.

The trial shows that this is reality!

What have we done about this?

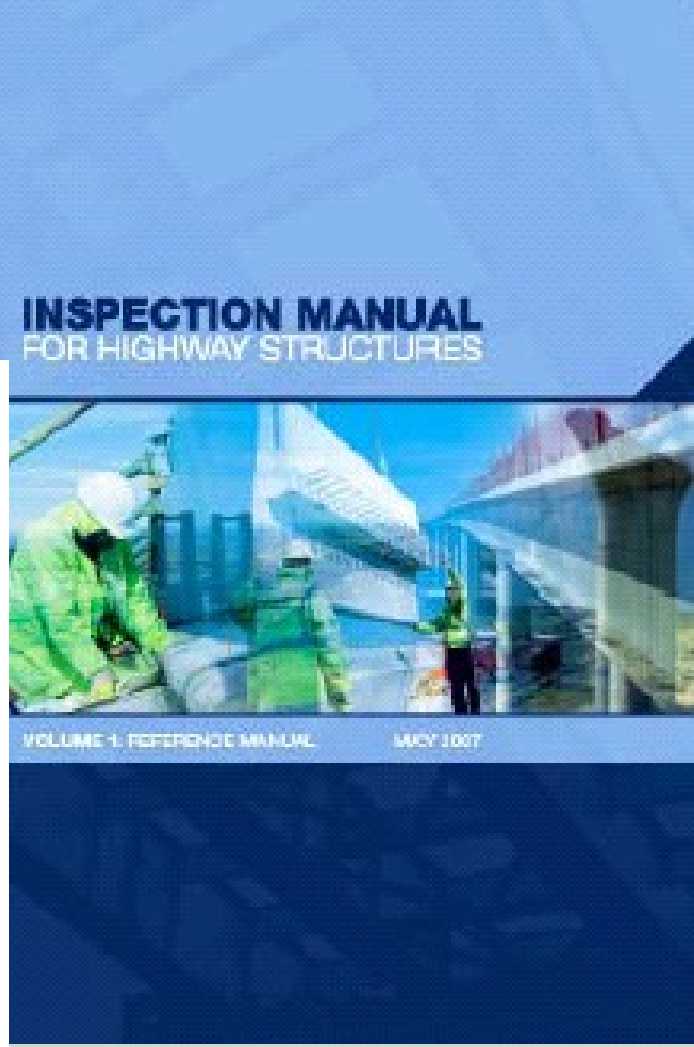
‘The Simplicity of the Solution belies the Complexity of the Problem.’

Advice and Training

Management of Highway Structures

A Code of Practice

September 2005



Task No: YY86731

Guidance Document for Performance Measurement of Highway Structures

Part B1: Condition Performance Indicator

Report prepared by:

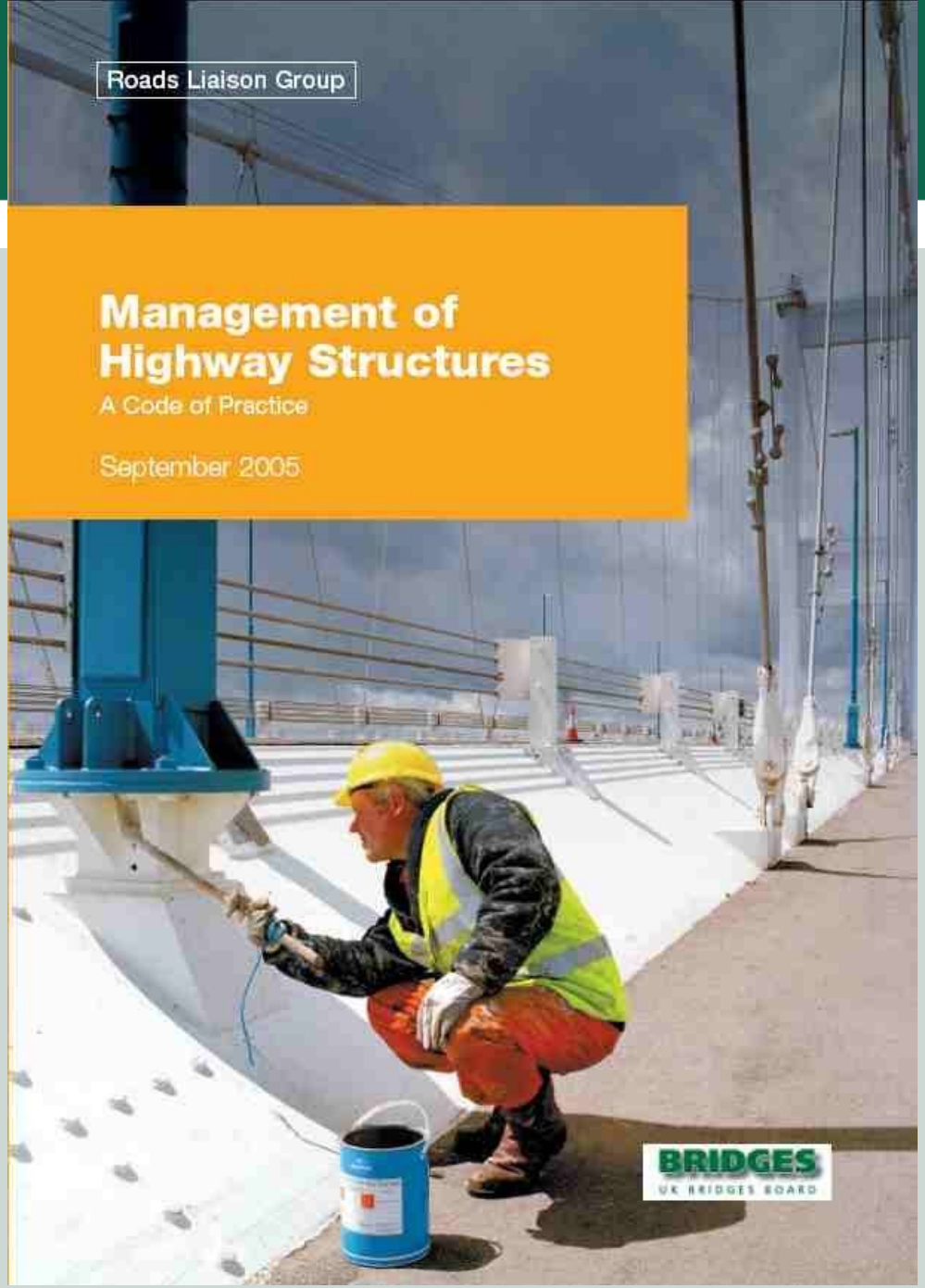
ATKINS

Report prepared on behalf of:

Highways Agency

CSS Bridges Group

2007



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COUNTY COUNCIL

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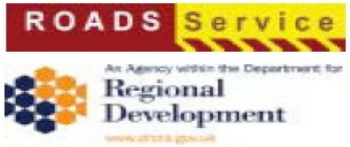
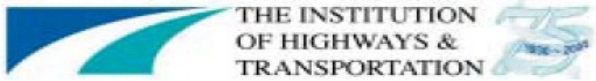
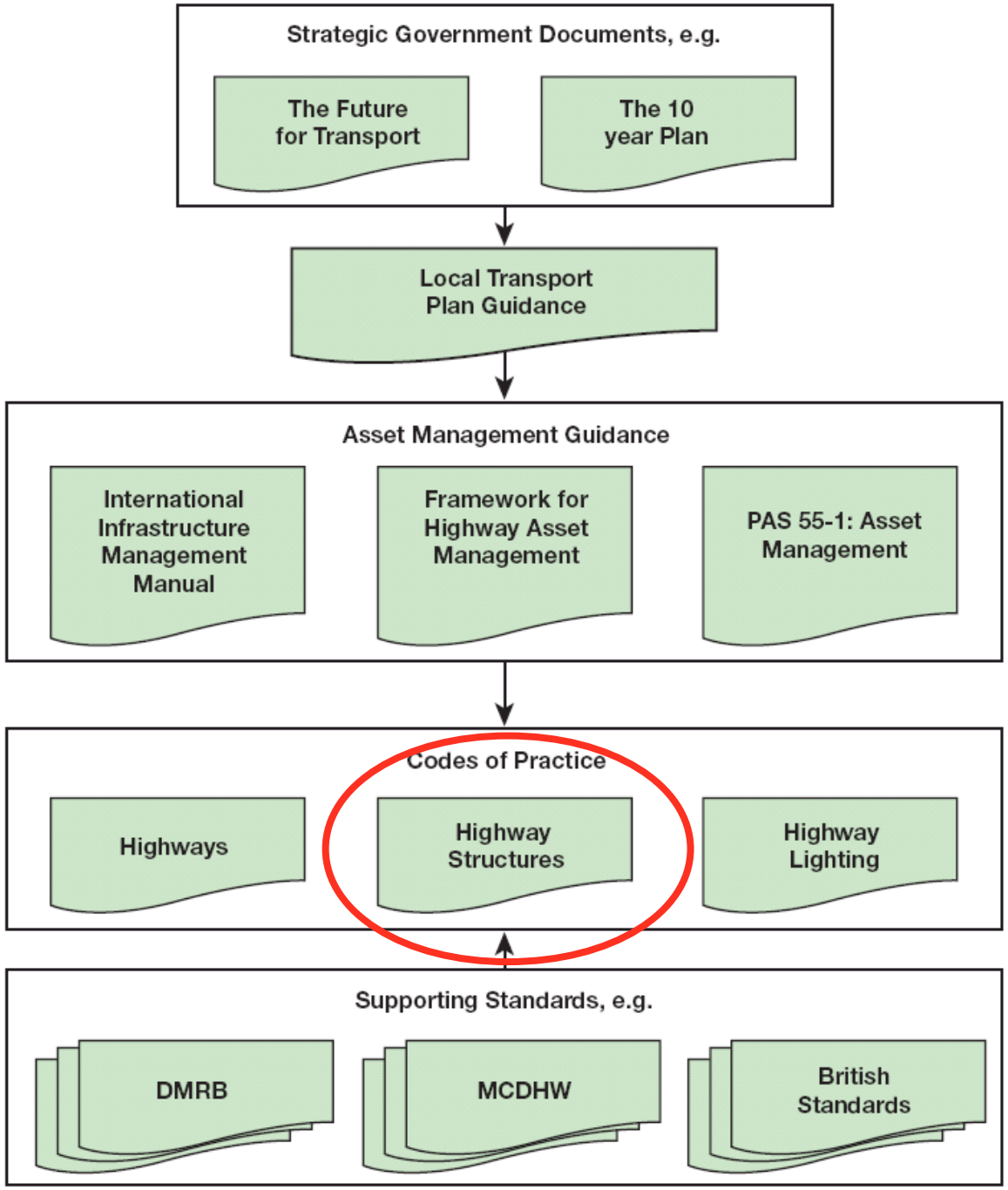
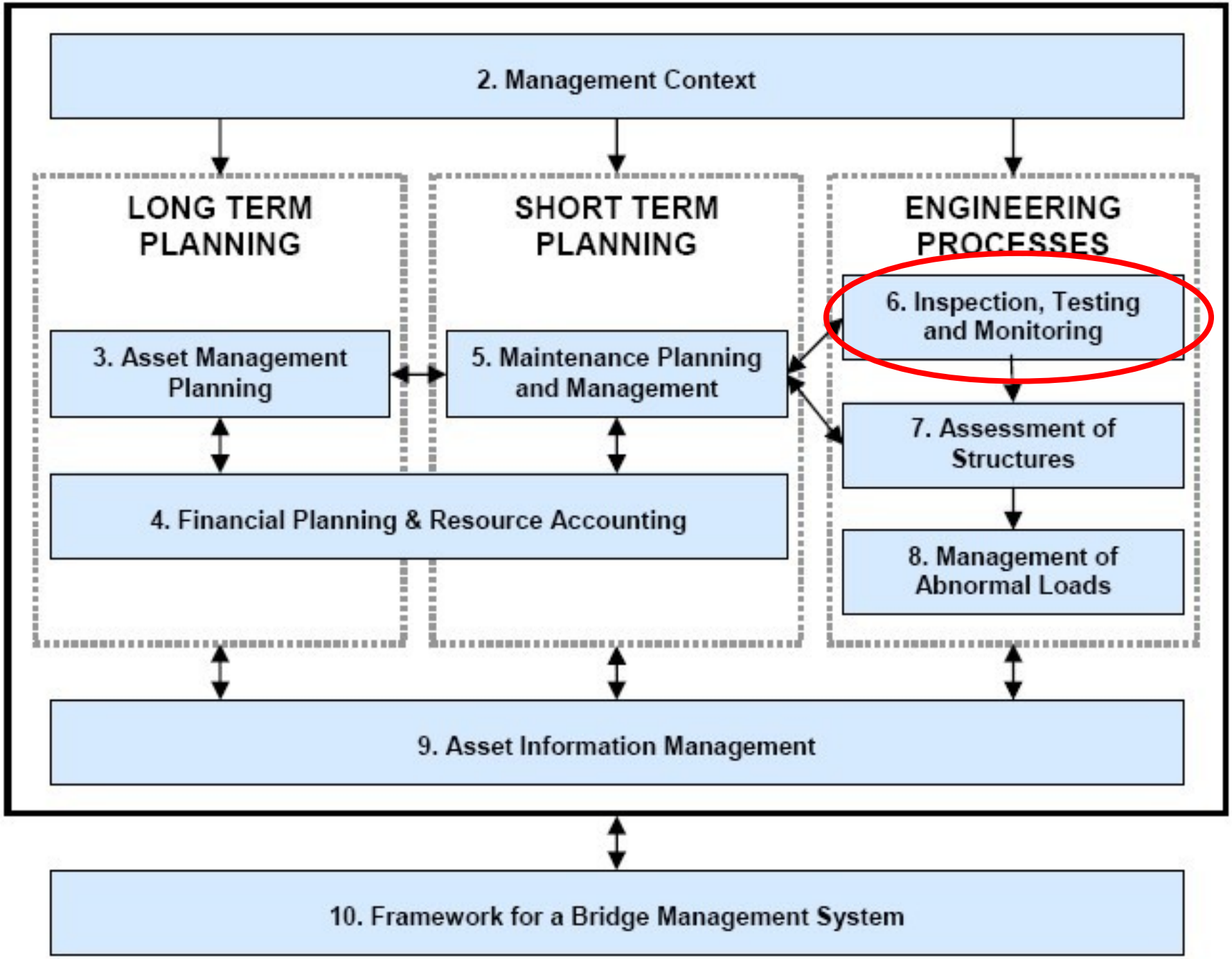
This Code is supported, endorsed and recommended by

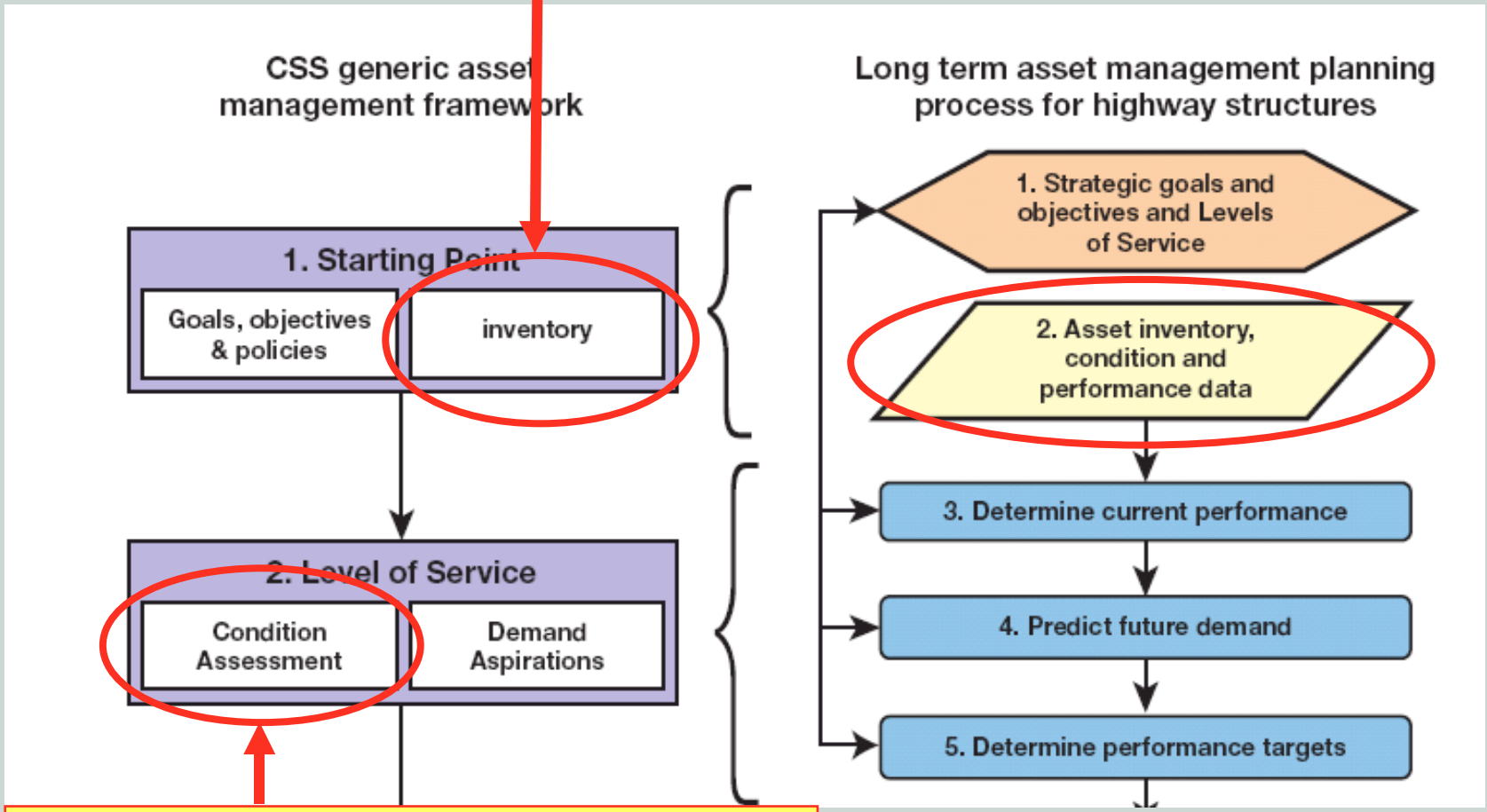





Strategic Government Documents, e.g.
The Future for Transport
The 10 year Plan
Local Transport Plan Guidance
Asset Management Guidance
International Infrastructure Management Manual
Framework for Highway Asset Management
PAS 55-1: Asset Management
Codes of Practice
Highways
Highway Structures
Highway Lighting
Supporting Standards, e.g.
DMRB
MCDHW
British Standards


2. Management Context
LONG TERM PLANNING
SHORT TERM PLANNING
ENGINEERING PROCESSES
3. Asset Management Planning
5. Maintenance Planning and Management
6. Inspection, Testing and Monitoring
7. Assessment of Structures
8. Management of Abnormal Loads
4. Financial Planning & Resource Accounting
9. Asset Information Management
10. Framework for a Bridge Management System

WHAT HAVE WE GOT?



WHAT CONDITION IS IT IN?

SURREY COUNTY COUNCIL

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Milestone	Actions
ONE	• Implement a regime of Routine, Safety, Special and Acceptance Inspections covering all highway structures and any necessary testing and monitoring (Section 6.4). • Implement a regime of General Inspections at an interval of not more than two years covering all highway structures (Section 6.4). • Implement a process whereby the inspector has a clearly defined duty to inform the bridge manager, at the earliest possible opportunity, of any defects that may represent an immediate risk to public safety (Section 6.5). • Implement a monitoring regime for all sub-standard structures (Section 6.7).
TWO	• Implement a regime of Principal Inspections at an interval of not more than six years covering all highway structures except those where a Principal Inspection would not add significantly to the defects picked up by a General Inspection (Section 6.4). • Record the severity and extent of defects during General and Principal Inspections. It is recommended that the CSS Inspection Guidance, or a similar approach, is used (Section 6.5). • Produce a full report for each Principal Inspection (Section 6.5). • Carry out regular in-house inspection meetings to assess the consistency and competence of inspectors **OR** check that external contractors have suitably qualified/experienced inspectors who are also reviewed on a regular basis (Section 6.5).
THREE	• Implement a regime of Principal Inspections covering all highway structures. Where appropriate, use risk assessment to determine the inspection interval (Section 6.4). • Produce an inspection, testing and monitoring manual that clearly defines the inspection requirements for the authority with H&S, Environmental and Conservation information recorded for each structure (Sections 2 and 6).

www.surreycc.gov.uk

INSPECTION MANUAL
FOR HIGHWAY STRUCTURES

VOLUME 1: REFERENCE MANUAL MAY 2007

Bridge Inspection Manual

Volume One – A4

Volume Two – A5

2.1 PURPOSE OF THE MANUAL

2.1.1 The purpose of this Inspection Manual is to provide guidance on the inspection process for all staff involved in the management of highway structures. It is also considered that this Manual provides a sound basis for the development of formal inspector training courses.

2.1.2 This Manual aims to ensure that inspections are carried out efficiently, uniformly and to a high standard. The Manual is intended for use as guidance, outlining typical procedures and defining the normal requirements for the various categories of inspection. It is not intended to provide the definitive solution in all situations, as the party best able to decide on the appropriate course of action is the inspector or engineer undertaking the work.

2.1.3 This Manual supersedes the *Bridge Inspection Guide* [5] and is endorsed by the Highways Agency, Transport Wales, Transport Scotland, Department for Regional Development Northern Ireland (DRDNI) Roads Service, CSS Bridges Group and the London Bridges Engineering Group (LoBEG). To be agreed.

INSPECTOR

The most important part of any inspection regime is the inspector, who is relied upon to perform their duties accurately, consistently, thoroughly and safely. At least one experienced inspector, who should give due consideration to the inspection requirements set down by the authority, should always be present on site during an inspection. The qualities of this experienced inspector should include, but should not be limited to the following:

- knowledge of the safe working practices and methods of access required for inspection;
- ability to recognise and evaluate defects on highway structures;
- an understanding of the behaviour of highway structures;
- knowledge of the construction methods and materials used in the construction of highway structures;
- knowledge of the causes of defects and suitable testing methods to identify, confirm or investigate these; and
- ability to record defects accurately, clearly and consistently.

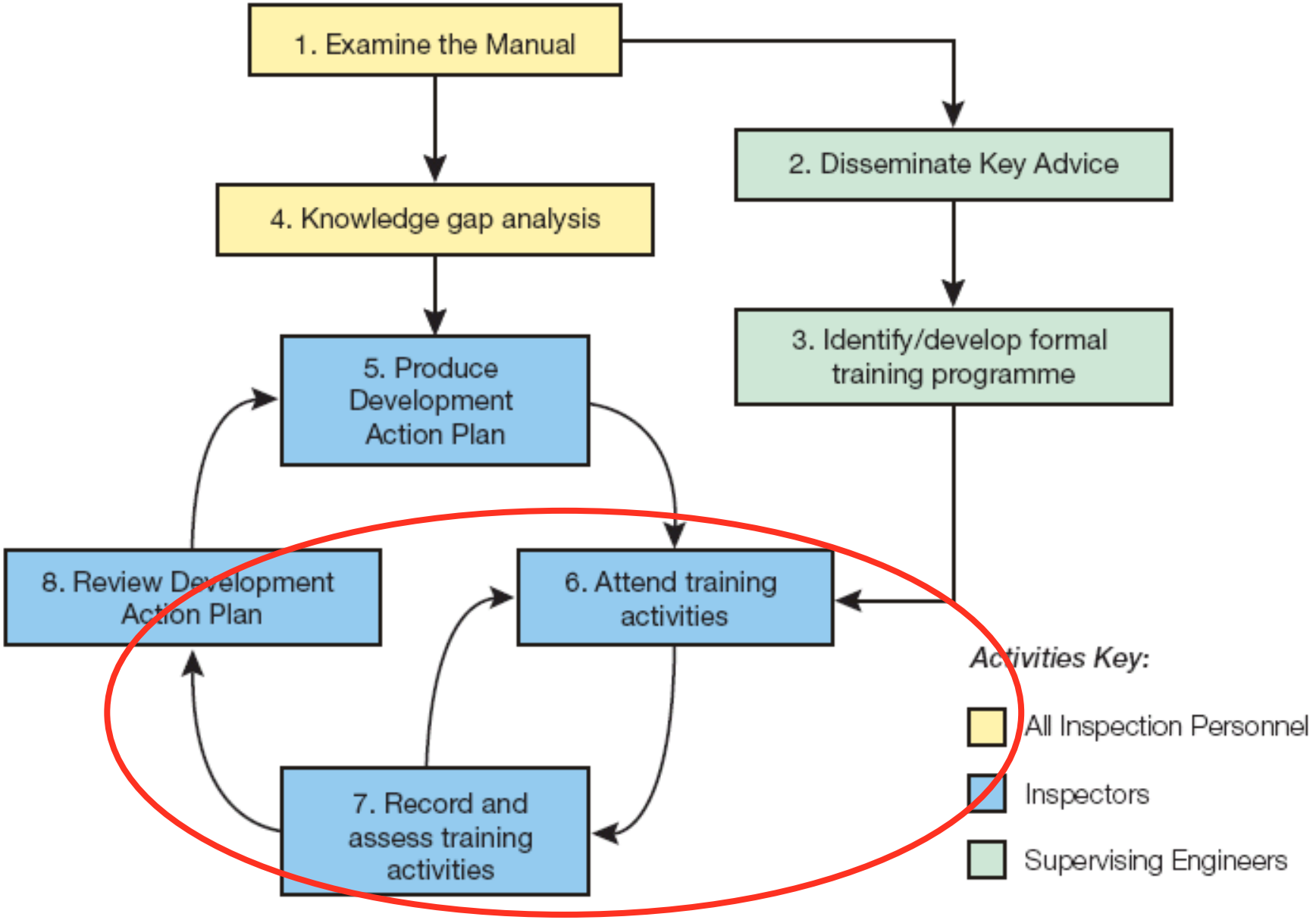

Figure A.1 – Process for the implementation of the Inspection Manual

- Inspections are a critical bridge management activity
- Significant variations in bridge condition reporting have been recorded during trials
- Adverse impact on effective management of the bridge stock
- Review and implement Code of Practice and the Bridge Inspection Manual
- Provide training – leading to qualifications
- Inspectors to be able to demonstrate competence

Trained, competent inspectors with sufficient resources appropriately procured

Transport for London
London Streets

Risk Based Inspections of Highway Structures – (Study)

Project Report

June 2009

MAYOR OF LONDON

Framework Number: TfL 01501

Call-Off Contract Number: 460001464/90

Transport for London

Risk Based Inspections of Highway Structures

Project Report: Final

Report Prepared by:

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Version	Purpose	Originated	Reviewed	Authorised	Date
5	Final	Megha Garia	Vicky Vassou	Garry Sterritt	25/06/09
4	Final Draft	Megha Garia	Vicky Vassou	Garry Sterritt	11/06/09
3	Third Draft	Vicky Vassou	Garry Sterritt	Navil Shetty	20/05/09
2	Second Draft	Vicky Vassou	Garry Sterritt	Navil Shetty	06/04/09
1	First Draft	Vicky Vassou	Garry Sterritt	Navil Shetty	04/03/09
ATKINS			REF: TfL_RBI_Project Report_v5_Final		

Bridge Inspector Competency Trials

TESTING

‘Guide to testing and monitoring the durability of concrete structures’

Condition Monitoring Phase

Diagnosis Phase

Solution Development Phase

Condition Monitoring Phase

- Inspections
- Periodic condition testing
- Routine automated monitoring

Diagnosis Phase

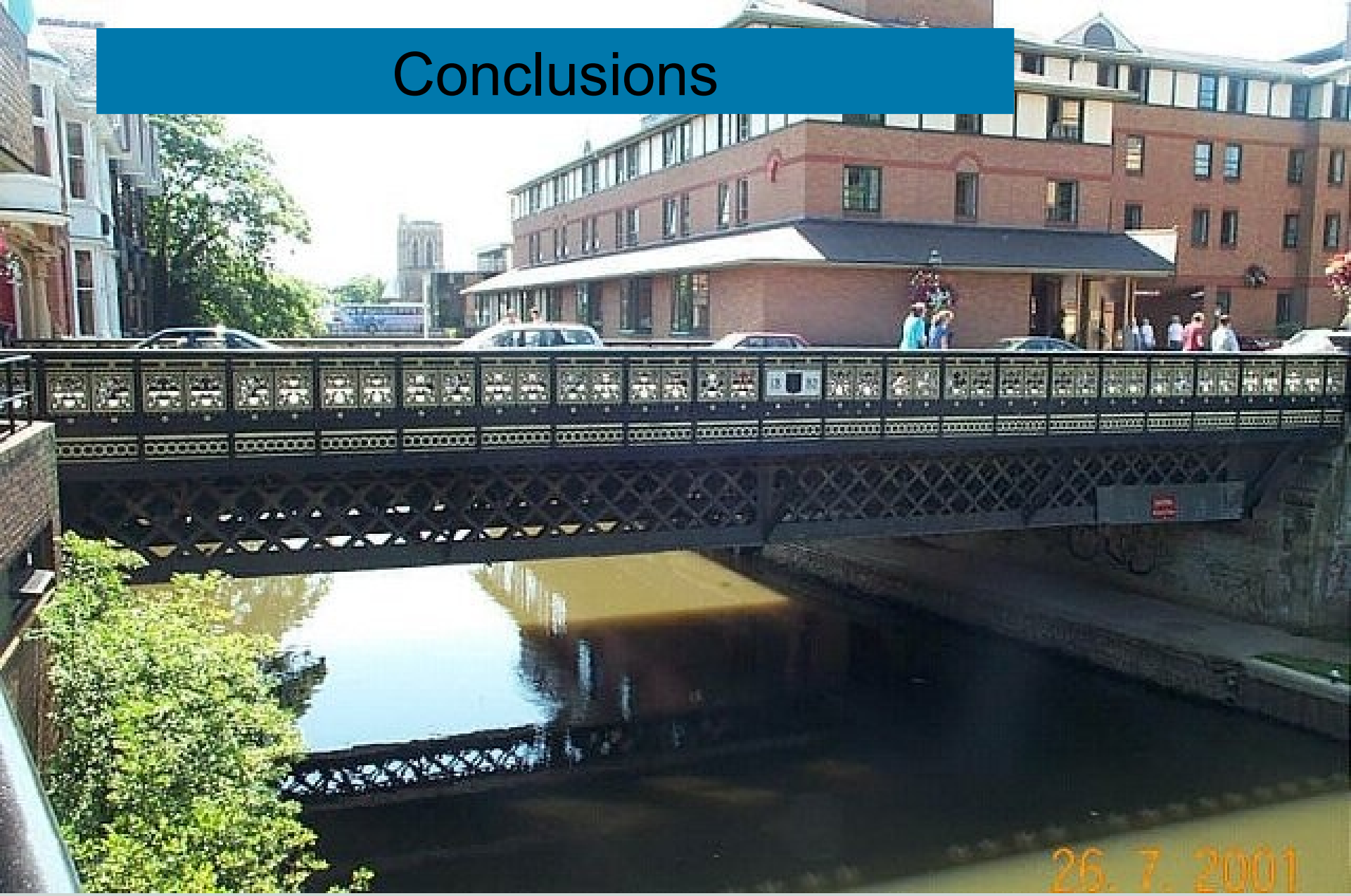
- Diagnosis testing

Solution Development Phase

- Solution development testing

- Special automated monitoring

Conclusions



Montreal

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‘The fact that the physical causes were not detailed raises two questions: could the collapse, or at the very least, the existence of a major structural defect, have been foreseen, and was it avoidable?’

‘At play were both organisational and human causes that include failure to fulfill obligations and to comply with procedures, incomplete files, lack of team work, missed evaluation opportunities, and an approach that did not take into account the special character of this overpass’

‘Quebec did not rigorously and effectively deploy all the means at its disposal to properly evaluate the condition of the overpass despite numerous signs of deterioration; it also failed to maintain adequate records that could have better guided its inspection and maintenance work’

‘To the Victims of their Incompetence’

If we do CONDITION EVALUATION effectively through competent inspection, testing and monitoring then ……

SAFE FOR USE

FIT FOR PURPOSE

WELL MANAGED


The end & thank you !
SURREY
COUNTY COUNCIL