

PROJECT 1: CAUSES OF FAILURE
PROPOSAL FOR A RESEARCH PROJECT TO APPRAISE THE RESULTS
OF THE ASSESSMENT AND STRENGTHENING PROGRAMME.

1.0 Background.

1.1 The requirement to accommodate the EU 40 tonne family of vehicles on UK highways as from 1/1/99 prompted the assessment and Strengthening Programme in 1988.

1.2. It was presumed that the main reason for inadequacy would be the shear deficiency of structures built before the introduction of new shear rules in 1973. To allow for a two-year “lead in” time to construction, all bridges with loaded lengths less than 50 metres and retaining walls built after 1975 were deemed to be adequate.

1.3 The assessment of structures accommodating trunk roads in the UK is now complete and the results reveal the following:

- (i) A significant %age was assessed as substandard for reasons other than shear deficiency or deterioration in condition;
- (ii) Very few of the assessment failures were adequate for the pre-40 tonne Construction and Use limit of 38 tonnes; this means that those substandard strength structures had been in full, unrestricted, use service prior to the Assessment and Strengthening Programme;
- (iii) Many of the structures that passed their assessments had little reserve of strength above the current requirements: and again, shear deficiency or deterioration in condition did not appear to be the reasons;
- (iv) A significant %age of bridges built since the early 1960’s were assessed as substandard.

1.4 These revelations prompted the following observations:

- (i) If the introduction of the 1973 shear rules is not the prime reason for structures failing their assessments, then the 1975 referenced scope of the Assessment and Strengthening Programme may be deficient;
- (ii) The residual lives of structures that passed their assessments with little reserve of strength above current requirements are probably considerably less than the remainder of their 120-year design lives;
- (iii) The current, and historic, “steady state” maintenance policy does not include any provision for assessing the strength or residual lives of the structural stock;
- (iv) If the interim precautionary measures required by the technical standards had been applied to the substandard structures, the function of the trunk road network would have been severely compromised by weight and lane restrictions or temporary

propping; the disruption was only avoided by the actions of pragmatic bridge managers and the rapid introduction of a risk based approach to the management of substandard structures in 1998;

- (v) There needs to be a properly researched means of estimating the residual life of the existing bridge stock; the philosophy governing the design standards needs to be critically examined in the light of the experience gained from the Assessment and Strengthening Programme; structures built only 25 years ago should not be failing to meet current standards.

2.0 Description of the Research Project.

2.1 Scope

2.1.1 General

It would be sensible to focus attention on structures built since the start of the rapid expansion of the trunk road network in the early 1960's i.e. to set the start date at 1960.

It would also be sensible to restrict the scope to trunk road structures because the required volume of information is known to be available from central government departments; and if the 1960 limit is acceptable, then it is unlikely that the information available from the local authority element of the Programme would significantly enhance the validity of the conclusions.

2.1.2 Categories

The appraisal should examine statistically representative samples of the various structural forms within the span ranges 3 to 9 metres, 10 to 19 metres, 20 to 29 metres, 30 to 39 metres and greater than 40 metres; and these should be randomly selected from the stock in England, Scotland, Wales and Northern Ireland.

The examination should appraise the inspection reports and the supporting calculations, when appropriate, all on a non-attributable basis.

2.2 Aims and Objectives

- (i) To identify common reasons for substandard strength with reference to the requirements of current standards i.e. shear, bending, torsion, global or local effects or deterioration in condition;
- (ii) To appraise the reasons for the failures with reference to the original design requirements, subsequent changes in the design standards, deficiencies in analysis techniques and design errors;

- (iii) To propose means of estimating the residual lives of those structures that have passed their assessments using the knowledge gained from this Project.