BRIDGES AND STRUCTURES STRATEGY

INTRODUCTION

1. Bridges are one of the key elements of the highway network. The majority of bridges were built prior to 1953 and were not designed to current loading standards. Many years of natural deterioration, frequently requires that temporary weight restrictions are imposed where current standards are not met. This usually needs to be followed by strengthening or reconstruction.

2. The hilly topography of West Yorkshire requires regular application of road de-icing salts to permit traffic to flow unhindered by frost, ice and snow. De-icing causes structural deterioration from the penetration of salt into steel and reinforced concrete structures. Bridges built after 1965, often of steel or concrete, have been subject to 'wear and tear' from the effects of traffic and road de-icing salts, exacerbated by failing movement joints. Without adequate waterproofing systems, masonry arch bridges suffer from material breakdown arising from sulphate attack from de-icing salts. Measures are often required to prevent further deterioration and to maintain carrying capacity.

3. Because of the topography of West Yorkshire, burr walls and retaining walls form a major part of the highway structures stock. There are several hundred kilometres of structural highway walling (greater than 1.2 m high). A high proportion of walls are of dry stone construction, over 100 years old and are reaching the end of their useful life. The use of large HGVs is imposing increased loading on many walls at a time when their condition has deteriorated due to weathering, pollution and other factors.

4. The maintenance and strengthening of bridges at critical locations is a pre-requisite to the continued effective implementation of the Local Transport Plan. The highway structures stock is summarised in Table 1.

	Bridges	Cul-verts	Foot-bridges and Subways	Structural Retaining Walls (Estimate)	Sign Gant-ries	High Mast Lighting Columns	Signal Mast Arms	Total No. of Structures
Bradford	179	171	148	100 km	12	N/A	10	520
Calderdale	179	104	141	275 km	4	0	0	428
Kirklees	209	209	247	400 km	4	0	0	669
Leeds	208	135	179	120 km	44	118	30	714
Wakefield	64	86	50	20 km	8	18	1	227
Total	839	741	765	915 km	72	136	41	2,558

Table 1: Local Authority Highway Structures Stock in West Yorkshire

5. In addition to having responsibility for the assessment, strengthening and maintenance of their own bridge stock, the districts are also carrying our bridge assessments on bridges owned by other authorities as shown in Table 2.

	Railtrack	BRPB	British Waterways	Other Private Owners	Total
Bradford	28	14	8	40	90
Calderdale	25	6	2	16	49
Kirklees	25	23	11	12	71
Leeds	41	14	3	76	134
Wakefield	41	7	3	3	54
Total	160	64	27	147	398

Table 2: Non-District Bridges

6. The five districts have adopted a joint strategy for their programmes of Bridge Assessment, Strengthening and Maintenance. However because of varying topography, each district places emphasis on different aspects of the strategy.

7. The assessment programme is almost complete with exceptions relating primarily to bridges on non-PRN routes and bridges owned by Railtrack and other Private Owners principally Yorkshire Water. Further details are shown in the Assessment Section.

8. We have been able to address the key needs with regard to bridge strengthening by targeting available resources at those bridges with the greatest need. The remaining resources have been used in providing interim measures such as weight restrictions on weak bridges or further assessment work to improve the capacity of bridges that failed the initial assessment.

OBJECTIVES

9. Our aim is to provide a bridge and highway structure stock of suitable standard to allow the safe and efficient movement of people and goods with minimum adverse effect on the environment. In line with achieving our primary objective of maintaining a safe and efficient transport infrastructure for all users, the specific objectives for bridges and highway structures maintenance and strengthening are:

- all highway structures must be able to safely carry appropriate traffic including pedestrians and cyclists and where required, abnormal loads;
- all highway structures must be visually acceptable to the community;
- user disruption should be kept to the minimum;
- preventative maintenance should be carried out adequately and rigorously so that backlogs of sub-standard bridges and structures will not build up;
- materials used should be chosen so that they minimise the depletion of natural resources, maximise the use of waste materials, and minimise the emission of harmful gases and their by-products to the environment;
- structures and their components should be designed in such a way that they may be easily maintained and provide flexibility for future generations to modify them for modes of use that cannot yet be envisaged;

- to plan and manage available resources to ensure their economic, efficient, and effective use.

STRATEGY

10. The achievement of the objectives will be progressed through:

- completion of the Bridge Assessment Programme;
- assessment of the risks associated with undertaking monitoring of a structure prior to the introduction of other interim measures;
- provision, where possible, of interim measures to permit the passage of 40 tonne vehicles across Principal road bridges;
- assessment of the risks associated with diverting traffic elsewhere when weight restrictions are under consideration;
- prioritising the strengthening of highway structures with emphasis on Primary Route Network bridges which carry the heaviest flows of HGV traffic;
- liaison with other disciplines to ensure co-ordinated approach to route management;
- giving appropriate consideration in prioritisation of strengthening to important public transport routes which if closed or restricted would cause serious disruption to passengers and operators;
- ensuring that bridges on other routes that provide essential access routes to industrial and commercial premises, which without HGV access could not function, are given appropriate priority;
- liaison and co-ordination of strengthening programmes locally and regionally with other bridge owners to ensure a consistent approach to the assessment and strengthening of Primary Route Network and key secondary route bridges.

Assessments and Strengthening

Liaison with Other Authorities

11. Liaison and the co-ordination of strengthening programmes locally and regionally with other bridge owners have been and will be maintained within West Yorkshire and the surrounding highway authorities. This ensures a consistent approach to the assessment and strengthening of Primary Route Network and key secondary route bridges.

12. Liaison has also been ongoing with the Highways Agency with regard to assessment and strengthening of bridges on trunk roads and bridges over the motorway network, and with Yorkshire Water, a major owner of private bridges. In addition liaison continues countywide with Railtrack, British Rail Property Board and British Waterways.

General Consultations

13. The Local Transport Plan has been produced with the collaboration of representatives from all the Districts through a Core Group. The work of the Core Group included extensive consultation and participation exercises, on all aspects of the Plan, with individuals and representative groups across West Yorkshire.

14. Consultations with organisations representing the transport industry and the West Yorkshire Passenger Transport Executive, on behalf of bus companies, have formed a fundamental part of the development of the bridge strengthening strategy within Leeds. As part of the 'Leeds Bridge Strengthening Strategy and Programme Study' the following bodies were contacted by letter, informing them of the study and its objectives. Their comments were discussed and taken on-board:

- Freight Transport Association
- Road Haulage Association
- Heavy Transport Association
- National Grid (through their transport consultants)
- West Yorkshire Passenger Transport Executive

15. In all Districts the programmes of Capital Works for Carriageway and Highway Structure schemes are only implemented following receipt of approval from elected members through appropriate committees or boards.

Specific Consultations (prior to project implementation)

16. Consultation with local residents and businesses anticipated to be affected by the work takes the form of a circular letter, delivered to businesses potentially affected by the works. The consultation contains brief details of the scheme and how the work is expected to affect local activities. Where appropriate, advice as to how to mitigate adverse effects is offered and in every case, a contact for discussion of anticipated problems is offered. Consultation takes the form of a similar circular letter to the above, delivered to affected residences. The letter gives details of the extent, scope and timing of the work and invites contact with officers involved to discuss details, concerns or misgivings. Feedback from residents and community groups is taken into account through Neighbourhood Forums and local Ward Members.

17. Consultation in respect of all bridgework which has the potential for interruption of normal traffic flows is always undertaken and takes the form of a meeting with the emergency services, traffic managers, New Roads and Street Works Act officers and West Yorkshire Passenger Transport Executive (Metro).

18. Where projects affect routes with cross-boundary implications, liaison with neighbouring authorities' traffic managers is undertaken and measures (i.e. advance and advisory route signing) are implemented collaboratively.

Prioritisation

19. We have developed a criteria based approach to selecting priorities for the bridge assessment and strengthening programme. Essentially they give priority to bridges on the Primary Route Network with emphasis on those routes which carry the heaviest flows of HGV traffic.

20. The strategy also recognises that there are bridges on other roads that form essential access routes to industrial and commercial premises that could not function without direct HGV access. Similarly, there are also bridges on important public transport routes that, if closed, would cause serious disruption to passengers and operators. This would undermine the role of public transport that the Local Transport Plan is seeking to develop.

21. We are also seeking to provide interim measures, where appropriate, to permit the passage of the 40 tonne EU vehicles across all Principal Road bridges where it has not been possible to strengthen because of limited funding.

22. A strategy has been developed which seeks to address the issues in a logical and pragmatic manner. This strategy ensures that those bridges that are essential to the economic well being and movement of goods and people by public transport around the district and region are given the appropriate priority.

23. The bridges strengthening criteria are shown in Table 3. Priority for strengthening is a function of the primary selection criteria, supported by the broad bands of HGV traffic flow given in the secondary criteria. The criteria are applied with flexibility because every bridge is unique, with factors specific to its location. The application of these criteria is subject to the provisions of BA79/98. In Leeds, these criteria have been endorsed by the recommendations of an independent consultant's report.

Primary Selection Criteria					
Priority Rating	Priority Criteria				
1	Primary Route Network				
	Any route used by HGVs and PCVs where no alternative route exists				
2	All other A roads - except where for environmental reasons an HGV restriction has or is to be introduced where adequate alternative routes exist				
	Cross boundary routes other than the PRN used by significant HGV traffic where agreement is reached with the neighbouring authorities on the need to give works priority for strategic reasons				
3	B roads and other roads which give access to significant generators of HGV traffic				
	Other roads where the diversion to alternative routes would cause a net environmental disbenefit to local communities or a weight restriction would have severe effects on local industry and commerce				
4	Other routes used daily by HGVs where it is desirable that the bridge be strengthened rather than a restriction imposed and the traffic diverted to another route less suitable for such traffic				
Secondary Selection Criteria					
Criticality rating	A	B	C	D	E
Daily HGV flow	>3,000	1,500 – 2,999	750 – 1,499	250 - 749	<250

Table 3: Selection Criteria for Priority of Assessment and Bridge Strengthening

24. All the districts recognise that it may not be economically viable, environmentally acceptable or necessary for all weak bridges to be capable of carrying 40 tonne vehicles. However, the question of the adequate policing of weight-restricted bridges is a prime concern and in some cases physical measures such as width restrictions are adopted to prevent unauthorised use. The needs of public transport, emergency services and winter maintenance have also to be taken into account. Additionally, the routeing requirements for abnormal load movements within West Yorkshire are taken into account when determining which weak bridges should be strengthened and to what level i.e. in excess of 40 tonnes, HA or 30 units HB.

25. The strategic nature or access role of the route carried by a particular bridge and the urgency of strengthening works as shown by the result of the assessment is taken into account where appropriate. The importance of feeder routes to the Primary Route Network, particularly in the steep sided valleys of the Pennines where suitable diversion routes are unavailable, is also an important factor.

26. The question of whether maintenance expenditure is required is relevant in establishing strengthening priorities in all districts. Some maintenance expenditure is necessary to maintain the assessed loading capacity in specific bridges and to prevent further deterioration.

27. An assessment of the risks associated with postponing the introduction of formal interim measures (e.g. the introduction of weight restriction) whilst setting up a monitoring regime are also taken into account, as are the risks associated with diverting traffic elsewhere when weight restrictions are under consideration.

28. Access to major industrial sites including the effect of low headroom bridges on potential diversion routes is a prime concern in all districts.

29. The strengthening strategy for Railtrack bridges whose assessments are incomplete is dependent on the outcome of those assessments and their relationship to Railtrack's load bearing obligations.

30. The poor condition of retaining walls supporting the highway is of concern across the county and is of particular importance within the Pennine areas of Bradford, Calderdale and Kirklees Here the nature of the road network constructed along steep-sided valleys along sidelong ground has created a need for large retaining walls, many of which are reaching the end of their lives. Bradford has an ongoing programme of assessment of walls supporting principal roads whilst other Districts are setting up similar programmes. Three points are worthy of note:

- because of the inherent difficulties of assessing the strength of walls, their maintenance need is unpredictable, usually following a collapse. This can occur on any class of road and be as disruptive as a bridge closure;
- it is impossible to impose meaningful and effective weight restrictions along lengths of highway supported by walls;
- diversion routes are extremely problematic often forcing traffic onto even less suitable routes.

Programme

31. All the districts had been working to meet the national target of assessing all the districts' bridge stock on Principal Roads by 31 December 1998. However, delays have

been experienced due in part to the late start of the Railtrack part of the programme and to the poor condition of many of the Railtrack-owned bridges, and also to the lack of agreement with BRPB regarding the assessment of Property Board bridges.

32. Additional slippage in the programme for district-owned bridges has been caused by implementing revised standards that have become available during the course of the programme. These have enabled further assessment work or testing to fully establish the hidden strength of the bridges, whilst managing their weaknesses in accordance with BA79 'The Management of Sub-standard Bridges'.

33. The identification of additional structures in the Other Private Owners category has required an extension of the programme.

Structural Maintenance

34. Structural maintenance schemes are often combined with strengthening schemes, to preserve the condition of the bridge such that further deterioration is avoided and the load carrying capacity of the bridge is maintained, thus minimising disruption to the network.

35. We have identified programmes of structural maintenance, which have been interrupted by the bridge strengthening programme. These programmes rely on information drawn from Principal Inspections carried out as part of the bridge assessment process. It is proposed to include further Principal Inspections during the course of the Plan period on those structures that have been excluded from the assessment programme or are due to be repeated.

36. Programmes of structural rehabilitation and upgrading have been developed following the example of the Highways Agency's 15-year Rehabilitation Programme. These programmes address issues such as the replacement of waterproofing membranes before failure, the upgrading of sub-standard parapets and the replacement of life-expired bearings and joints.

37. The hilly topography of West Yorkshire coupled with the density of traffic requires regular application of road de-icing salts to permit traffic to flow unhindered by frost, ice and snow. All the districts have identified the need to overcome the effects of structural deterioration due to the penetration of de-icing salts into steel and reinforced concrete structures. It is also apparent that, without adequate waterproofing systems, masonry arch bridges suffer from material breakdown arising from sulphate attack from de-icing salts. Measures are often required to masonry arches to prevent further deterioration and to maintain the assessed capacity.

38. It is anticipated that after the bridge strengthening programme is completed, the substantial backlog of work in the areas described above will be addressed. This process will begin during this 5-year programme, as the majority of the funding required is diverted from strengthening to structural maintenance. However it is expected that in future years there will be even greater demands on funds for structural maintenance.

ASSESSMENT OF STRUCTURES

Bridges

39. Bridge assessment programmes have been prepared using the priority criteria described above. Progress to 31 March 2000 is summarised in Table 4.

	Bridges in Programme	Bridges Assessed		Strength-ened	Bridges to be Strengthened			Outstanding Assessments
		40 tonne Capacity	< 40 tonne Capacity		Primary Route	Principal Roads	Other Routes	
BRADFORD								
Council > 1.8m	200	117	63	24	2	3	32	20
Council 1.5 to 1.8m	49	0	0	0	0	0	0	49
Railtrack	28	14	8	2	1	0	5	6
BRPB	14	0	0	0	0	0	0	14
BWB	8	4	4	1	0	0	3	0
Other Private	40	3	8	0	0	0	8	29
Totals	339	138	83	27	3	3	48	118
CALDERDALE								
Council > 1.8m	183	113	66	38	0	3	25	4
Council 1.5 to 1.8m	5	0	0	0	0	0	0	5
Railtrack	25	1	4	1	0	0	3	20
BRPB	6	0	0	0	0	0	0	6
BWB	2	1	1	0	0	0	1	0
Other Private	17	9	8	1	0	0	7	0
Totals	238	124	79	40	0	3	36	35
KIRKLEES								
Council > 1.8m	244	152	79	60	0	4	15	13
Council 1.5 to 1.8m	44	0	0	0	0	0	0	44
Railtrack	25	13	4	0	0	0	4	8
BRPB	23	9	3	0	0	0	3	11
BWB	11	10	1	0	0	0	1	0
Other Private	12	5	1	0	0	0	1	6
Totals	359	189	88	60	0	4	24	82
LEEDS								
Council > 1.8m	206	98	53	13	14	4	22	55
Council 1.5 to 1.8m	36	0	0	0	0	0	0	36
Railtrack	41	3	6	0	2	2	2	32
BRPB	14	3	5	3	1	0	1	6
BWB	3	2	0	0	0	0	0	1
Other Private	76	4	4	0	2	0	2	68
Totals	376	110	68	16	19	6	27	198

WAKEFIELD								
Council > 1.8m	72	50	21	11	1	2	6	1
Council 1.5 to 1.8m	10	0	0	0	0	0	0	10
Railtrack	41	24	15	2	1	0	10	2
BRPB	7	4	3	0	0	1	2	0
BWB	3	0	3	0	0	0	1	0
Other Private	3	0	0	0	0	0	0	3
Totals	126	78	42	13	2	3	19	6
GRAND TOTAL	1,438	639	360	156	24	19	154	439

Table 4: Bridge Assessment Programme - Position at 31 March 2000

40. All bridge assessments in the five Districts are programmed for completion by March 2001 except for the following:

- BRPB bridges in Bradford and Calderdale,
- Railtrack bridges in Calderdale and Leeds,
- Other Private Structures in Leeds,
- Council owned bridges between 1.5m and 1.8m span.

Council Owned Bridges

41. All council owned bridges across West Yorkshire of span greater than 1.8m carrying the PRN and principal roads had been assessed by the end of March 1999. Assessments of council owned bridges on other routes were substantially completed in Calderdale, Kirklees and Wakefield during 1999/2000 and will be completed in all Districts during 2000/2001. Bridges with spans between 1.5m and 1.8m will be programmed for assessment in 2001/2.

Railtrack Bridges

42. Bradford, Kirklees, Leeds and Wakefield have entered Joint Venture agreements with Railtrack for the assessment of Railtrack owned bridges carrying public roads. Bradford, Kirklees and Wakefield expect to complete their programmes in 2000/2001. Leeds' programme extends to 2001/2002.

43. The assessments of Railtrack owned bridges in Calderdale are being carried out by the bridge owner and are ongoing. Information on the timescale for completion is awaited from Railtrack.

British Rail Property Board Bridges

44. Kirklees and Wakefield have signed agreements with BRPB to carry out assessments of their bridges which carry public roads. Wakefield has completed the assessments and Kirklees will complete its programme in 2000/2001. Leeds has assessed BRPB bridges on high priority routes prior to entering a formal agreement and proposes to sign an agreement with BRPB in the near future that will allow the assessments to be completed in 2000/2001. Bradford and Calderdale have yet to conclude an agreement with BRPB and do not expect to complete the assessment of these bridges before the end of 2001/2002.

British Waterways Board Bridges

45. British Waterways has completed assessments of all its bridges in West Yorkshire carrying public roads except for one bridge in Leeds for which the assessment result is under discussion.

Other Private Structures

46. Lists of privately owned structures of span greater than 1.8m and programmes for their assessment have been prepared. This has involved liaison with British Coal, Environment Agency, Rochdale Canal Company, Yorkshire Water and other private owners. Further liaison will be required following recent guidance on the span limit applied to council owned structures.

47. Progress on the programme varies across the county:

- Calderdale has completed its programme;
- Kirklees and Bradford carried out some assessments during 1999/2000 giving priority to bridges carrying principal roads and will complete the programmes in 2000/2001;
- the private structures in Wakefield are all on minor roads and will be assessed during 2000/2001;
- Leeds has identified a large number of private structures. Many are owned by Yorkshire Water and are confined spaces that have incurred high inspection costs. A start has been made on assessing these structures giving priority to principal roads, but the assessment of structures on non-principal routes will extend into 2002/2003.

Retaining Walls

48. In West Yorkshire there are numerous burr and retaining walls built for highway purposes which come within the scope for assessment. These walls require identification prior to the preparation of assessment programmes. This exercise has begun in some Districts and will begin in other Districts during 2000/2001.

Assessment Costs

49. The current bridge assessment programme will be substantially complete by the end of 2000/2001 except as described above. The assessment bids reflect this and also take account of the following**:**

- the recent reduction in the span limit for assessment from 1.8m to 1.5m;
- the bids include the ongoing costs of identifying and assessing highway retaining walls in all the Districts;
- the four Districts that have Joint Venture Agreements with Railtrack have paid Railtrack's costs to date but work is ongoing. The bids cover anticipated outstanding payments which will have to be made under the Agreements but final accounts have still to be agreed;
- Calderdale has paid Railtrack in advance to assess their bridges and do not anticipate any further payment;
- in Leeds, the completion of the assessment programme has been delayed because of the large number of private structures, the issue of revised assessment standards

during 1996/1997, the general poor condition of Railtrack bridges where extensive examination and subsequent appraisal has been found to require additional resources;

- the result of a bridge assessment is valid only so long as the condition of the structure remains unchanged. There is a need, which has been recognised by the Highways Agency, to have an ongoing programme of assessments following the current programme. This will cover those bridges not included in the current programme and reviews of previous assessments where changes in condition or use of the structure are identified.

50. Within our objective to keep road user disruption to a minimum the aim has been to limit the number of lane and weight restrictions on bridges by using all the available assessment techniques to the full. This has required more time, resources and funding than originally envisaged.

Effect of Sub- Standard Bridges and Structures

51. The sub-standard bridges and structures on principal roads which have been identified through the assessment programmes of the five Districts up to the 31 March 2000 are listed in Table 5. The effects on the principal road network and on other routes are currently being minimised by management of the sub-standard bridges through the application of the principles contained in Departmental Advice Note BA79.

District	Structure Name	Owner	Route	Substandard Elements	Assessed Capacity (tonnes)	Interim Measures
Bradford	Ivestone	Bradford	A629	Spandrel Walls Abutments	12.5	Monitoring
Bradford	Weston Hill	Bradford	A6038	Masonry Arch	10	Monitoring
Bradford	Valley Road Br	Bradford	A6037	Piers	7.5	Weight Restriction
Bradford	Queens Rd (B171)	Bradford	A6177	Masonry Arch	17.5	Monitoring
Bradford	Canal Rd (B165)	Bradford	A6037	Masonry Arch	25	Monitoring
Bradford	Retaining Walls	Bradford	A644	138 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A629	741 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A65	373 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A6038	550 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A657	45 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A641	95 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A644	197 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A647	504 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A6033	262 lin. m of wall	Various	Monitoring
Bradford	Retaining Walls	Bradford	A6034	653 lin. m of wall	Various	Monitoring
Calderdale	County	Calderdale	A58	Wrought iron widening under footpath	7.5	Footway protection proposed
Calderdale	Golden Lion	Calderdale	A6033	Cast iron widening under footpath		Footway protection

District	Structure Name	Owner	Route	Substandard Elements	Assessed Capacity (tonnes)	Interim Measures
Calderdale	Brighouse Canal	Calderdale	A641	Concrete widening under footpath		Handrail between carriageway and footway
Kirklees	Victoria Bridge, Holmfirth	Kirklees	A635	Concrete extension – beams and columns	3	Traffic measures - kerbs
Kirklees	Leeds Road Railway	Kirklees	A62	Steel beams encased in concrete under kerbs	25	Monitoring
Kirklees	Woodsome Mills	Kirklees	A62	Footway extension – steel beams encased in concrete and slab over	3	Monitoring
Kirklees	Cook Lane	British Rail Property	A651	Wrought iron beams	0	Monitoring
Leeds	Wharfe	Leeds	A58	Reinforced concrete anchor arms and cantilevers	17	Monitoring
Leeds	Pool	Leeds	A658	Muti-span arches. Downstream arch capacity	7.5	Monitoring
Leeds	Croft	Leeds	A642	RC box	17	Monitoring Weight Restriction.
Leeds	Swillington	Leeds Council	A642	Spandrel walls	7.5	Monitoring
Leeds	Bangor Terrace	Leeds	A6110	Weak footways	7.5	Footway Protection
Leeds	Gelderd Road	Leeds	A62	Weak webs to RC box	3	Monitoring
Leeds	Waddington's Railway	Leeds	A61	Weak footways Pier suffers from extensive cracking	3	Monitoring Footway protection
Leeds	Clay Pit Lane Junction	Leeds	A58/ A64 (M)	Weak cover slabs to services under verge	3	Monitoring Verge protection
Leeds	Hough End	Leeds	A647/ A6110	Weak half joints		Monitoring
Leeds	Ivy Street	Leeds	A64	Pier problems	17	Monitoring
Leeds	New Wellington River	Leeds	A58	Weak service bay slabs in footway	0	Monitoring Footway protection
Leeds	Wellington Canal	Leeds	A58	Weak service bay slabs in footway	0	Monitoring Footway protection

District	Structure Name	Owner	Route	Substandard Elements	Assessed Capacity (tonnes)	Interim Measures
Leeds	Blenheim Subway	Leeds	A58	Roof slab	38	Monitoring Strengthen-ing in progress
Leeds	Portland Subway	Leeds	A660	Roof slab	17	Monitoring
Leeds	Wetherby	Leeds	A661	Weak multispan arches	7.5	Monitoring
Leeds	Harewood	Leeds	A61	Spandrel walls	7.5	Monitoring
Leeds	Queens Square Subway	Leeds	A58 (M)	Roof slab	17	Monitoring
Leeds	Calverley River	Leeds	A6120	Weak footway	7.5	Monitoring Footway protection
Leeds	Town End	Railtrack	A642	Arch ring	7.5 (to be confirmed)	None currently
Leeds	Roman Ridge	Railtrack	A656	Arch ring	7.5 (to be confirmed)	None currently
Leeds	Dewsbury Road	Railtrack	A653	Longitudinal beams	17 (to confirm)	None currently
Leeds	Dragons Bridge	Railtrack	A58	Carriageway Cast iron edge beam next to footway	40 (to be confirmed) Group 2 FE (to be confirmed)	None currently
Leeds	Pool Bank Bridge	British Rail Property	A658	Transverse girders	Less than 40 (to be confirmed)	None currently
Leeds	CSO Dewsbury Rd	Yorkshire Water	A653	Steel beams in roof slab under verge	Less than 3 (to be confirmed)	None currently
Leeds	CSO Harrogate Rd	Yorkshire Water	A61	Steel beams in roof slab	7.5 (to be confirmed)	None currently
Wakefield	Doncaster Road Canal	Wakefield	A638	Service bay cover slabs Edge beams	Zero 7.5	Footway protection planned
Wakefield	Tanshelf	Wakefield	A639	Service bay cover slabs Central reserve slabs	3 0	Footway protection planned
Wakefield	Newmiller Railway	Wakefield	A61	Edge girders	7.5	Verge restrictions
Wakefield	Bridge Road	Railtrack	A642	Service bay floor plates under the carriageway Edge girder	Zero 3	Monitoring Footway protection planned
Wakefield	Warmfield	British Rail Property	A655	Edge girders Floor plates under footway and carriageway	7.5 7.5	Footway protection planned Monitoring

Table 5: Substandard Structures on Principal Roads – Position at 31 March 2000

52. If funding is provided at the level of the bids included in the plan it is envisaged that restrictions on principal roads in West Yorkshire can be maintained at an acceptable level. Whilst monitoring is being widely used across the County it must be recognised that this can only be used as a short-term measure. A reduction in funding would lead to the imposition of more restrictions and to the restrictions being in place for extended periods resulting in increased traffic disruption and inconvenience.

53. As part of the management of sub-standard bridges Leeds is currently assembling data relating to the potential effect on the network of the application of further interim measures.

54. Bradford has recorded long lengths of sub-standard retaining walls on principal roads. This will be reflected in other Districts and on other routes as the identification and assessment of walls proceeds.

STRENGTHENING OF STRUCTURES

Bridges

55. Strengthening schemes have been prioritised in accordance with the strategy on a County wide basis for the years 2001/2 and 2002/3 and on a District wide basis for the years 2003/4 to 2005/6. It is intended that the priority lists will be reviewed year on year in order to maintain 2 years forward programming on a Countywide basis. The scheme justifications are included in the Programmes Appendix . Where the estimated cost of schemes is in excess of £1million, the programming of the required work has, where possible been spread across more than one financial year in an effort to achieve a more even level of spend year on year.

56. In determining the required carrying capacity of bridges it is accepted that it may not be economically viable, environmentally acceptable or necessary for all structures to be capable of carrying 40 tonne vehicles. Each structure has been critically examined in accordance with the Strategy to ascertain:

- whether it is essential to carry out the strengthening;
- if suitable interim measures can be applied
- if a weight limit can be applied either short term or long term;
- if necessary, the bridge can be closed and a suitable alternative route found either short term or long term.
- the load carrying capacity to which the bridge is required to be strengthened

57. To date 148 bridges have been strengthened in West Yorkshire. The focus of this has been to ensure that the Primary and Principal Route network is capable of carrying 40T vehicles. However, there are many weak structures which are not on the PRN or on Principal roads but which have a very low assessed load carrying capacity and which require strengthening.

58. Problems are experienced when load carrying capacities of less than 17 tonnes are identified; as this precludes use by most fire engines, buses, refuse vehicles etc. In the majority of cases the imposition of permanent or even temporary weight restrictions would prevent reasonable access and delivery of essential services to sections of the

community and to local industry and for this reason these restrictions have been avoided wherever possible.

59. It is accepted that priority should be given to strengthening structures on the PRN however, there is little merit providing a network capable of carrying 40 tonne vehicles if these vehicles cannot reach the required destination due to weight restrictions elsewhere.

60. Strengthening of Railtrack bridges requires significant expenditure. An agreement between Railtrack and the CSS, representing Local Authorities nationally, has been reached over the level of contribution to the costs of strengthening bridges.

61. Slow progress in the processing of assessments through Railtrack's approval systems has made it difficult to programme and budget for strengthening works to sub-standard Railtrack owned bridges. Railtrack is also engaged in a programme of works to its rail over-road bridges. The timing of these works has implications on both road bridge strengthening and other highway works through conflicting requirements for traffic diversions.

62. Estimates of the likely contributions to strengthening costs by the districts have been made and included in the programme. However, because the level of contribution is dependent on Railtrack's load bearing obligations, the level of bid for individual structures may be subject to change in future submissions.

63. A significant number of Railtrack owned bridges are in traffic sensitive areas. Restrictions on the use of these bridges has resulted in major disruption and in some cases, the need to divert HGVs through built up areas containing residential properties and schools as well as business and retail premises.

64. It is important that as finance is made available, responsibilities for each element of the strengthening cost and its phasing are planned and programmed to enable the works to progress. As strengthening works require integration of the budgets of both Railtrack and the councils it may be necessary in some cases to depart from the prioritisation strategy to ensure council contributions tie in with Railtrack's commitment to scheme finance.

Retaining Walls

65. Burr walls and retaining walls form a major part of the County's highway structures stock. There are several hundred kilometres of structural highway walling (greater than 1.2 m high). A high proportion are of dry stone construction, over 100 years old and reaching the end of their useful life. The regular use of HGVs both within urban and rural areas has imposed increased loading on many of these walls at a time when their condition has deteriorated due to weathering, pollution and the effects of heavy traffic.

66. The location of many walls in steep-sided valleys means that measures such as road closures, traffic diversions and carriageway restrictions are often not appropriate because of the length of required diversions and insufficient carriageway widths. Interim measures such as propping or traffic signal control can only be considered as short-term solutions. The result of this is that at present much of the expenditure is demand driven to deal with walls that have already collapsed or are showing significant signs of failure.

67. The exercise in identification and assessment of walls is ongoing and is expected to identify the requirement for significant expenditure on strengthening over the coming years.

Monitoring and Interim Measures

68. The introduction to Advice Note BA79/98 'The Management of Sub-standard Highway Bridges' recognises that residual work arising from the Bridge Assessment and Strengthening programme will continue for some time after the target completion date of 1 January 1999. Strict application of the interim measures described in BD21 would lead to 'widespread traffic disruption and considerable expenditure of scarce public funds.'

69. The assessment failure of a highway structure will result in the requirement for immediate expenditure in the form of one or more of the following:

- the introduction of appropriate traffic management measures;
- the implementation of a structural monitoring regime to ensure the safety of highway and other users;
- where appropriate, further more rigorous assessment of the structure.

70. As the assessment programme nears completion the number of structures requiring such measures is likely to increase. In recognition of this, realistic projections of expenditure on these items have been made over the 5-year Plan period. However, should the allocation for bridge strengthening fall short of the bid, expenditure will be required for interim measures and monitoring will increase. Further, this expenditure will not achieve an overall improvement in the condition of the highway structure stock.

MAINTENANCE OF STRUCTURES

71. In addition to the programme for strengthening highway structures there is also an increasing need for structural maintenance works in order to sustain the structures stock. The importance of structural maintenance work has been highlighted in both the Highways Agency paper 'Performance Objectives, Indicators and Targets for the Maintenance of Highway Structures' and the CSS Bridges Group report ' Funding for Bridge Maintenance'. In particular the latent problems associated with under funding of structural maintenance work are stressed.

72. Broadly in line with the recommendations of the above two documents, the estimated required annual expenditure on structural maintenance is 0.85% of the Gross Replacement Cost of the structures stock.

73. This is split into 0.35% spent on preventative work and the remaining 0.5% spent on essential work.

74. The programmed structural maintenance workload for the next 5 years is shown in Table 6 below, together with the target expenditure on structural maintenance of structures and retaining walls in Table 7.

	2001/02 £000s	2002/03 £000s	2003/04 £000s	2004/05 £000s	2005/06 £000s

Bradford	60	355	977	1,250	1,291
Calderdale	330	179	173	163	619
Kirklees	800	650	1,200	990	900
Leeds	585	1,417	1,372	938	1,796
Wakefield	87	119	290	476	163
TOTALS	1,862	2,720	4,012	3,817	4,769

Table 6: Programmed Structural Maintenance Work

	No. of Structures	Km of Retaining wall > 1.2m	Yearly Grand Total
Bradford	520	100	
Calderdale	428	275	
Kirklees	669	400	
Leeds	714	120	
Wakefield	227	20	
TOTALS	2445	815	
Estimated Replacement cost (£000)	549,970	823,500	
Yearly Structural Maintenance Expenditure Requirement at 0.85% of Replacement Cost (£000)	4,675	7,000	11,675

Table 7: Structures Replacement and Maintenance Requirements

75. It can be seen that as the bulk of the strengthening programme is completed, the available funds are being directed at structural maintenance works.

76. Preventative work is seen as the most effective way of keeping the costs of replacement and rehabilitation of the structures stock at a manageable and steady level.

77. A substantial part of the current and planned structural maintenance workload is represented by those structures that have been affected by chlorides originating from the use of de-icing salts and a lack of effective waterproofing. As such preventative works to ensure the integrity of waterproofing systems represent an excellent opportunity to minimise the remaining whole life costs of structures.

78. A good example of this is the refurbishment of Hebble Viaduct in Halifax, where rectifying waterproofing faults now will drastically reduce the predicted remaining whole life costs of the structure (Hebble Viaduct Impact Study Report).

79. General Inspections are carried out at least every two years in order that routine and preventative maintenance can be identified before the problem develops to require more costly essential maintenance.

80. Principal Inspections, which involve a detailed examination of all surfaces of the structure, are being carried out every six years. These often recommend further Special Inspections to look at specific areas of concern, which in turn lead to preventative or essential maintenance. Funding for this activity is included in the programme.

COMPLEMENTARY FUNDING

Local Authority

81. In addition to the Local Transport Plan settlement, all the authorities continue to invest funding of their own towards the general maintenance of highway structures. Over the last 3 years a total of £3.9m of the authorities' funding has been invested in structural repairs and improvements across West Yorkshire (Table 8).

82. This investment has been spread throughout all five districts and has been targeted in the main towards works, but also towards regular and effective inspection regimes.

	1997/1998 (£000s)		1998/1999 (£000s)		1999/2000 (£000s)		Total (£000s)
	Works	Insp.	Works	Insp.	Works	Insp.	
Bradford	103	1	285	12	146	51	
Calderdale	418	13	500	26	444	24	
Kirklees	350	54	218	123	38	60	
Leeds	157	106	157	106	232	31	
Wakefield	73	6	73	6	81	7	
TOTAL WORKS	1,101		1,233		941		3,275
TOTAL INSPECTIONS		180		273		173	626

Table 8: Complementary Funding by Local Authorities

83. Local Authority funding (revenue and capital) is anticipated to continue at levels comparable to those shown in Table 8.

Works

84. The £3.3m spend on structural maintenance and repair works has included items such as deck waterproofing, repairs to joints, re-building collapsed retaining walls, repainting of steel work, pressure pointing and many other minor repair works.

85. It is hoped that in the future these structural maintenance works can be funded through capital allocation, with the districts' own funds then being available to be targeted to essential routine maintenance works.

Inspections

86. General and special inspections are regularly being undertaken. Over the past three years this has amounted to a cost of £626,000. This commitment to inspections is a key element in ensuring that resources are targeted towards the most needy areas and that value for money is achieved with respect to whole-life maintenance costs. It should be noted that the sum mentioned does not include the cost of undertaking Principal Inspections which it is hoped the capital allocation will cover.

Private Sector

87. Efforts will continue to be made to secure contributions from the private sector towards both structural maintenance and strengthening works. For example where assessment failures are identified on structures owned by Railtrack, BRPB, Yorkshire Water, etc negotiations will be undertaken to secure the appropriate contributions towards strengthening costs.

88. Recent successes include:

Calderdale

- £254,000 contribution (Railtrack) for Huddersfield Road Railway Bridge, Brighouse.

Kirklees

- £35,000 contribution (Private Developers) for retaining wall works at Crackenedge Lane, Dewsbury and Station Street, Meltham, Huddersfield.
- £600,000 from Millennium Commission/English Partnerships to replace two existing highway bridges as part of the Huddersfield Narrow Canal re-opening scheme.

Wakefield

- £800,000 full cost (Railtrack) Lumley Hill Bridge
- £210,000 full cost (Private Develop/Land Receipts) Denby Dale Road Bridge

Bradford

- £800,000 full cost (Railtrack) for New Lane Railway Bridge, Bradford
- £1 million full cost (Railtrack) for Cleckheaton Road Railway Bridge, Bradford

Leeds

- £17,000 contribution (British Rail Property Board), Arkwright Street Bridge.
- £1.4 million (approx) full cost (Railtrack) for Nineveh Road Railway Bridge.

Commitment of Partners

89. It is anticipated that the major and most likely partner in strengthening work will be Ralitrack. The level of their contribution to any scheme will be negotiated in accordance with the national agreement between Railtrack and the CSS on behalf of Local Authorities.