1. INTRODUCTION

1.1 This Interim Advice Note (IAN) implements an Interim Management Strategy for *reinforced concrete and steel/concrete composite half-joint* deck detailing in suspended span and propped-cantilever bridges. (It does not include steel to steel half-joint deck details). Agents are requested to check their stock of bridges to determine if this IAN applies, then consult with Highways Agency TOD Project Sponsors to implement the guidance. The risk based strategy is necessary to ensure that all structures of this type, which are particularly vulnerable to deterioration and difficult to inspect, are recorded, specially inspected, and remedial works planned, and to allow the future maintenance funding requirements to be identified.

1.2 This is a framework document, offering advice to Managing Agents on the performance and management of bridges with half-joints. Agents are responsible for the appraisal of the bridges with half-joints within the scope of this framework, until such a time that the Future Management Strategy is implemented. It is in a similar format to the strategy adopted for managing hinge deck bridges (IAN 51/03 – this only directly affected a limited number of Agents).

1.3 The opportunity has been taken to manage this strategy using the National Structures Programme (NSP) Module for the Structures Management Information System (SMIS). This is detailed in Annex E. The structures listed at Annex C have already been assigned to the half-joint NSP on SMIS.

1.4 Agents are requested to implement the guidance in consultation with Highways Agency TOD Project Sponsors and local SSR TAG engineers. This guidance is also being provided for DBFO Companies.

2 BACKGROUND

2.1 Half-joints were introduced into bridge decks as a means of simplifying design and construction operations. This form of joint is vulnerable to deterioration in the event of deck expansion joint failure, where chloride rich seepage through the joint can cause concrete deterioration and corrosion of the reinforcement. Loss of reinforcement section through corrosion, or associated concrete spalling can induce higher stresses and significantly reduce the safety margins expected of serviceable structures. Half-joints are a particular concern because they are not easily accessible for inspection or maintenance and they are mostly located over or under live traffic lanes.

2.2 Bridges owned by the Highways Agency incorporating half-joints are well distributed in England. Many have already been subject to visual inspection, and will have been prioritised for maintenance by the Agent on the basis of their external condition. Some may already have been repaired and/or strengthened. This IAN sets out an Interim Management Strategy for all structures of this type, and the actions are indicated in flow chart format in Annex A, and described below.

3 INTERIM MANAGEMENT STRATEGY

Data validation check

3.1 A preliminary data collection exercise has already been undertaken in 2002, by means of a circulated questionnaire sent by Consultants employed by the Highways Agency, to identify all Trunk road and Motorway bridges with half-joints – the results are contained in Annex C. However it is essential to ensure that this information is correct, as a basis for the ongoing management of the half-joint programme. As a priority Agents shall confirm the identity of all Trunk Road and Motorway bridges with half-joints, for which they are currently responsible, **within the next 2 months**. Details should be sent by email to all three contacts at paragraphs 5.1, 5.2 and 5.3, to allow assigned structures on half-joint NSP on SMIS to be amended as necessary.

Initial Special Inspection (SMIS Activities 1.1 and 1.2)

3.2 Bridges with half-joints which have not had a special inspection of the half-joints, **shall be inspected within the next six months**. Where special inspections have been carried out within the last 3 years (or principal inspections have examined the half-joint and its internal surfaces closely, Agents should consider if the requirements in paragraph3.3 and 3.4 are met, and if necessary undertake further inspection within the next six months, from the underside of the deck.

3.3 Initial special inspections should determine whether there is evidence of failure of the expansion joint over the half-joint and consequent leakage of water and chlorides on to the bearing shelf of the half-joint. It should also determine whether there is cracking at the re-entrant corners of the half-joint (shown at Annex B), and if present and possible, the width of the crack. The measurements should be averaged to ensure that a true value for the crack width is reported. Care should be taken in the measurement of cracks to avoid overestimation by recording surface effects such as fretting of the concrete surface adjacent to the crack. Bridge temperature should also be recorded since crack width may be influenced by seasonal temperature variation. The severity and location of any other defects such as leaching, or corrosion products should also be recorded, and any relevant concrete delamination and spalling in the vicinity of the half-joint. Whilst carrying out the special inspection, consideration should be given to install monitoring demec pips across the re-entrant corner cracking where there is evidence of significant cracking, to enable periodic monitoring of future changes to crack width.

Further Special Inspection (SMIS Activities 1.3)

3.4 Where the half-joints have ***significantly*** cracked (defined as crack widths >2mm), or where there is evidence of current or past significant seepage, or serious delamination of concrete in the vicinity of the joint, the opportunity should be taken to determine the condition of the reinforcement (if practical). One method of doing this without significant intrusion is to carefully drill small holes to the reinforcement and inspect bars using a borescope, however this will only produce limited information. At the same time if there is significant seepage, limited concrete condition testing (chloride content, cement content, half-cell measurement etc) should be carried out at the half-joint, if required to supplement existing data already available from earlier principal or special inspections.

3.5 Agents should report this inspection information as soon as possible to the Highways Agency regional office (TOD and SSR TAG contacts), with recommendations for further investigation work if necessary.

3.6 Where there is no indication of significant cracking of the half-joints, seepage, or other defects observed, no immediate action is required, pending further advice that may be issued in due course. However, normal inspection and maintenance arrangements will apply, and Agents should ensure that information relating to the half-joints is reported.

Monitoring (SMIS Activity 1.6)

3.7 Where significant cracks have been observed, and there may be other deterioration, a regime of periodic monitoring and inspection should be instigated. This should generally be based on a visual approach that will target the key factors affecting half-joint performance, such as changing condition, material deterioration or bridge movements. In some cases it may be appropriate to utilise technical monitoring using strain or other movement gauges. The intervals for monitoring should be appropriate for the structure (eg. 3 months to 1 year), depending on the nature and severity of the deterioration, and the potential risk to the network. The objective of the monitoring is to determine if there is any:

i) progressive horizontal and vertical movement at the joint,
ii) movement due to traffic loading and,
iii) ongoing material deterioration.

3.8. Depending on the ease of access, monitoring of cracks at the re-entrant corner of half-joints can be undertaken on site using a demountable strain gauge to measure manually between demec pips bonded either side of the crack. Manual monitoring is perhaps best used as part of an initial investigation into structural performance. To enable prior warning of structural problems, automatic or remote monitoring using vibrating wire strain gauges is also possible. Embedded silver/silver chloride/potassium chloride half-cells may be used to monitor for potential corrosion risk of reinforced concrete elements.

Agents should discuss and agree proposals for monitoring with their respective Highways Agency regional office contacts.

Invasive Inspection and Non-destructive Testing (SMIS Activity 1.5)

3.9 Detailed structural assessment requires accurate information on the condition and geometry of half-joints – this can only be obtained by detailed measurements, invasive inspection, testing and non-destructive methods. Full advantage should be taken of NDT techniques, although most are still in development (refer to paragraph 3.12 below). If it is considered that there is still insufficient information about the condition of the half-joint and its reinforcement for assessment purposes, further invasive testing to expose the reinforcement may be necessary. Such investigations will be subject to technical approval procedures and must be supported by a full technical appraisal, to safeguard the structure during the course of the work, and to set down the type of investigation proposed, and details of the expected outputs.

3.10 Consideration should be given to selecting the most appropriate bridges for invasive testing, and the most suitable test location(s) on the bridge. Where invasive testing involves de-stressing the half-joint reinforcement, the additional loading carried by the adjacent bar sets should be assessed, and the necessity and effects of propping the bridge during the work considered. In determining testing locations, concentration of half-joint loading, drainage paths and the severity of defects should be considered, together with safety, access and traffic management issues.

3.11 Agents should submit detailed proposals for invasive testing to their respective Highways Agency regional office contacts for discussion and agreement, including the method, timescale, cost, materials tests and inspection, reinstatement procedures, traffic management, noise control and contingency measures etc. Particular attention should be given to planning reinstatement of test areas, and the selection of materials, method of reinstatement, given the time constraints, weather and engineering requirements. Contingency measures should be planned to take into account difficulties encountered during the invasive testing process, including the condition of the exposed half-joint reinforcement, unexpected delays and weather conditions.

3.12 Non-destructive testing methods such as impact echo, radiography, acoustic emission, and thermography etc. may be considered to minimise the need for invasive inspection of half-joints. Whilst NDT methods alone are unlikely to give definitive indications of defects and overall condition, they can be used to assist determination of the variations in condition along joints, and may also allow coverage of large areas in a relatively short time. The results, properly interpreted and compared to known conditions at one or more locations derived by invasive inspection, should give a good indication of the relative condition elsewhere, or point to where further invasive inspection may be necessary. However some care is required in selection of the NDT technique, as the difficulty in access, health and safety issues, and unsuitability of application to half-joints may prevent their widespread adoption, and the production of meaningful data. However most of the NDT techniques are either still under development in terms of robust and reliable site equipment, and/or have not been used on half-joint decks, so there will be little in the way of comparative site data available.

Structural Assessment (SMIS Activity 1.4)

3.13 For those bridges which have already been identified as substandard through the Stage II Assessment Programme, strengthening schemes should be either completed or well advanced. However, for some structures with half-joints, which have previously passed the 40tonne assessment, and are now exhibiting significant deterioration (refer to paragraph 3.4), it is possible that their capacity may have been further reduced. Where half-joint structures are exhibiting significant deterioration, Agents shall review existing structural assessment reports as part of the Steady State Assessment programme, and carry out new assessments as appropriate.

3.14 Particular attention should be paid to the method of analysis previously adopted, and whether it is still considered appropriate: any assumptions made about the condition of the half-joint in the assessment, and the continued appropriateness of any departures from standards previously granted. It is recognised that previous assessments concentrated on the effects of the 40tonne assessment live load, and it may be necessary to reassess the structure in its present (i.e. deteriorated and cracked) condition, taking account of construction defects such as poor concrete compaction,

curing and reinforcement misalignment, where known, and particularly the condition of the half-joint.

3.15 Assessment should be carried out in two parts:

i) To determine the range of load effects on the half-joint;
ii) To calculate the capacity of the joint in its deteriorated condition, Agents should use their judgement as to the deteriorated condition of the joint taking account of the likely loss of reinforcement section and the effects of delamination of cover concrete. Reference should be made to BA39/93 'Assessment of reinforced concrete half-joints' as necessary to assist – in due course it is expected that this document will be updated.

3.16 One of the objectives of the assessment should be to identify a deterioration trigger point to feed into a monitoring and inspection regime, and to assist in determining when interim safeguarding measures are required. To facilitate this, a 'sensitivity' analysis should be carried out to determine the influence of variations in the condition of the structure. Defects can be categorised under reinforcement yielding, concrete debonding, and loss of link reinforcement. A range of severity of each defect (and any other factors) should be considered, and the position of the structure within this range determined. For the sake of consistency of reporting, sensitivity should be expressed in terms of 'usage factor': the ratio of load effect to assessed joint capacity. Technical Approval procedures in accordance with BD 2 will apply to this assessment work.

Risk Management (SMIS Activity1.7)

3.17 In order to develop a strategy for the repair and maintenance of bridges with half-joints a method of prioritisation is required to focus resources appropriately. Initial prioritisation should be on the basis of external condition only, in terms of the need for further detailed investigations. This is provided at Annex E. However a more detailed qualitative assessment has also been appended to assess the likelihood of a structure with half-joints becoming substandard in the future. This can be used to establish a priority ranking once more detailed information about the condition and assessed capacity of the half-joint is known. The likelihood factor ranges from 1 to 9, where 5 is considered to be the median likelihood. Example and blank proformas for the qualitative risk assessment are given in Annex D, together with detailed guidance on the methodology adopted.

Interim Measures (SMIS Activity 1.8)

3.18 Risks should be assessed considering joint configuration and access, current usage factor, current condition, rate of deterioration, and network factors such as traffic volume and HGV loading over the bridge. If the results of the investigations indicate a potentially unacceptable level of risk to the integrity of the structure, interim measures should be implemented to safeguard the road network, such as temporary propping and/or load reduction, or permanent repair/renewal. Structures with half-joints with a likelihood factor of 6 or higher are likely to require management effort in the near future to ensure they will not become substandard. The higher the likelihood factor the more urgent the need for remedial action is likely to be. The procedures outlined in BA 79 'Management of Sub-standard Highway Structures' shall be instigated, and Technical Approval procedures for the temporary / permanent works will apply.

Maintenance

3.19 For all half-joint bridges, high priority should be given to preventing further deterioration of half-joints, by maintaining drainage in working order and the integrity of deck waterproofing and expansion joints, including pipe bays where appropriate. Bids for remedial works should be prioritised as essential maintenance, and submitted as part of the normal funding arrangements. Advantage should also be taken during any planned rewaterproofing or resurfacing work to undertake inspection and concrete condition testing of half-joints, and reinforcement inspection from above.

3.20 Expansion joint replacement and renewal of waterproofing (where they have shown to have failed) are the most important preventative remedial actions to safeguard against further deterioration of a half-joint.

Repair

3.21 The repair of half-joints is made particularly difficult due to poor access, generally congested reinforcement and traffic management issues. Advice is given below on possible repair methods and further guidance will be provided in the Future Management Strategy.

3.22 Concrete replacement is an option for repairing deteriorated concrete. Information on concrete replacement is provided in BD27 'The repair of concrete highway structures'. The HA/CSS/TRL publication, 'Best Practice Guidance for Concrete Repair' details current thinking on best practice to be adopted for concrete repair. Unless such practices are adopted, it is likely that concrete repairs will be only partially effective in minimising future corrosion of reinforced concrete.

3.23 Information on cathodic protection (CP) is available as an Advice Note BA83 'Cathodic protection for use in reinforced concrete highway structures'. This can be an effective technique for minimising future corrosion in reinforced concrete, usually in combination with some concrete repair work. However it is essential that specialist advice is sought if cathodic protection is to be considered. It is also important that the condition of the half-joint and in particular the reinforcement is known with certainty. CP is an active corrosion control method, but it must be managed and monitored to ensure continued effective operation. If it is, then there should be no further deterioration to effect the load capacity of the half-joint.

3.24 Where half-joints have deteriorated so badly that it is practically or economically beyond repair, such as the reinforcement is so badly corroded that it cannot be satisfactorily reinstated, then replacement of a whole element may be a cost effective option.

3.25 There are a number of alternative commercial repair systems available to manage deteriorating reinforced concrete such as, chloride extraction, galvanic protection, and active moisture reduction systems. The effectiveness of these particular remedial methods for use on half-joints is not yet proven and as such they are not considered appropriate at this time.

Data management

3.26 As part of this Interim Strategy, the Structures Management Information System (SMIS) is to be utilised to manage the programme of work on half-joint structures. To assist the Highways Agency in developing a Future Management Strategy, it is important that Agents input the required data (refer to Annex F) when required. This will assist Agents in managing their own programmes as well as allowing the Agency to produce and assess national progress reports. It will be necessary for Agents to populate SMIS with 'historic' data, for any work already completed.

4 FUTURE MANAGEMENT STRATEGY (SMIS Activities 2.1, 2.2 and 2.3)

4.1 A Future Management Strategy is to be developed for half-joint structures, which will supersede this interim advice. This will include specific information on the whole-life assessment of half-joints, ongoing monitoring, interim measures and full-scale repairs and renewal. Consideration will be given the identification and management of risks taking account of the present condition of the structure, the rate of deterioration, the vulnerability of the half-joints to further deterioration, the present use and location of the structure, any planned works, and any other strategic factors. The timescale for issue of this Strategy is expected to be 2 to 3 years.

5 FURTHER INFORMATION

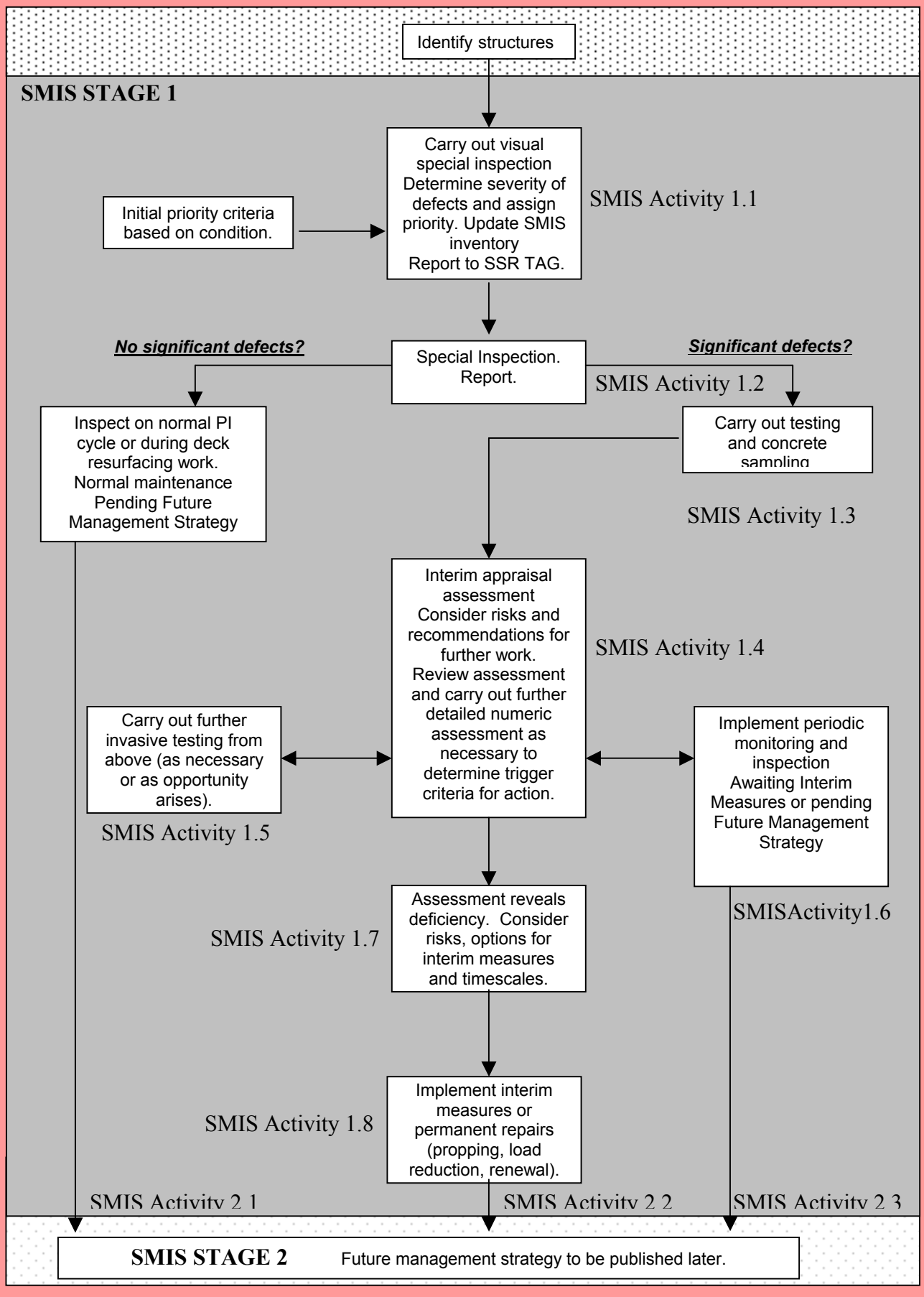
5.1 If you have any questions on this document please contact:

Neil Loudon, Tel. 01234 796107
E-mail: neil.loudon@highways.gsi.gov.uk

5.2 If you have any queries about individual structures with half-joints please contact SSR TAG local contacts.

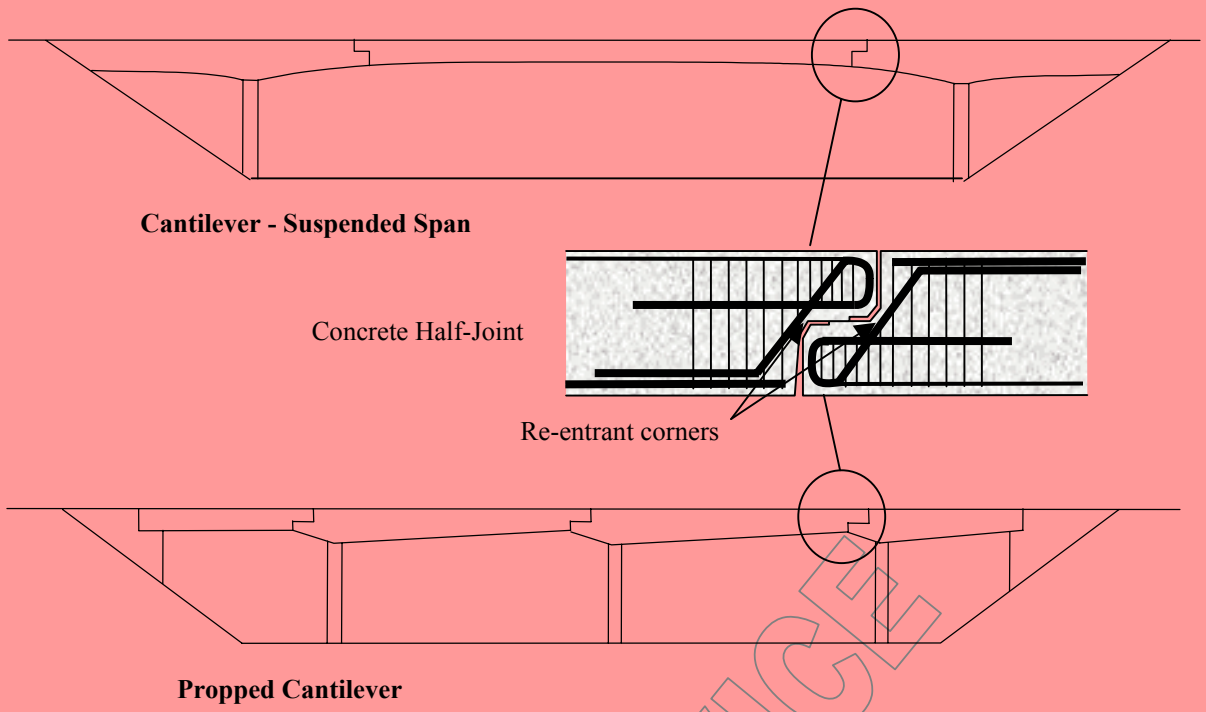
5.3 If you have any queries about project management issues please contact TOD local contacts.

INTERIM MANAGEMENT STRATEGY ANNEX A

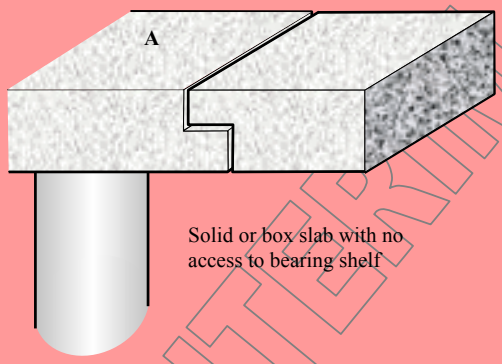


TYPICAL HALF-JOINT DETAIL

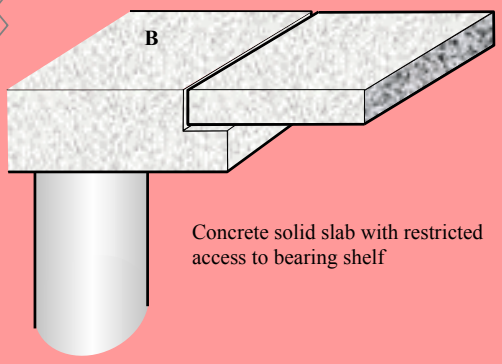
ANNEX B



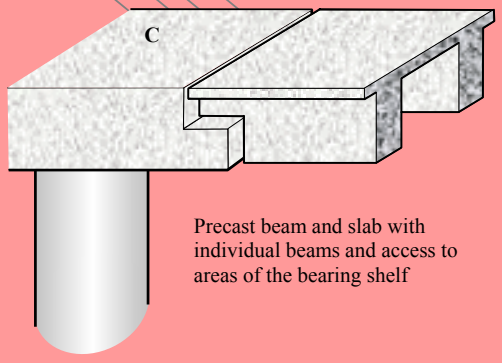
TYPES OF HALF-JOINT CATEGORISED BY ACCESS TO BEARING SHELF



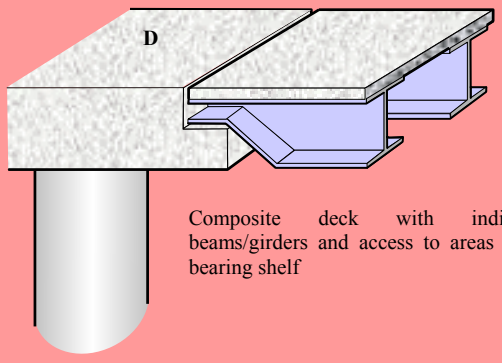
Solid or box slab with no access to bearing shelf



Concrete solid slab with restricted access to bearing shelf



Precast beam and slab with individual beams and access to areas of the bearing shelf



Composite deck with individual beams/girders and access to areas of the bearing shelf

TABLE 1 HALF-JOINT INVENTORY

ANNEX C

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
6310	Telegraph Hill	1	A38	108.4	29097	8425	1972	OB	1	2	SN	D2
6349	River Dart	1	A38	82.2	27459	6660	1975	UB	3	2	D2	RV
1100	Hodson Footbridge	2	M4	124.8	41792	18120	1971	OB	36	2	FB	M3
1105	Blackhorse Footbridge	2	M4	128.4	41450	18233	1971	OB	3	2	FB	M3
1130	Leafy Lane Footbridge	2	M4	145.5	39870	18134	1971	OB	3	2	FB	M3
1156	Burbarrow Lane	2	M4	173.6	37162	17774	1966	OB	1	2	SA	M3
1157	Parkfield	2	M4	175.1	37018	17774	1966	OB	1	2	SN	M3
1161	Folly Lane	2	M4	178.1	36726	17850	1966	OB	1	2	SN	M3
1163	Church Lane	2	M4	179.9	36555	17858	1966	OB	1	2	SN	M3
1173	Trench Lane	2	M4	185.7	36226	18287	1966	OB	1	2	SN	M3
3520	Parkway (Stoke Lane)	2	M32	7.6	36375	17913	1966	OB	1	2	SN	M3
3521	Old Gloucester Road	2	M32	7.9	36397	17933	1966	OB	1	2	SN	M3
795	Chertsey Road B386	3	M3	38.9	49778	16522	1972	OB	3	2	SN	M3
797	Chobham Road B383	3	M3	40.4	49651	16453	1972	OB	3	2	SN	M3
798	Brickhill Footbridge	3	M3	40.9	49610	16432	1974	OB	3	2	FB	M3
803	Strandways Footbridge	3	M3	44.1	49304	16305	1974	OB	3	2	FB	M3
806	Lightwater I/C (East)	3	M3	45.4	49196	16290	1970	OB	3	2	SW	M3
807	Lightwater I/C (West)	3	M3	45.5	49186	16262	1970	OB	3	2	SW	M3
813	Brackendale Road F/B	3	M3	50.8	48802	15913	1970	OB	3	2	FB	M3
827	Broomhill Footbridge	3	M3	54.3	48512	15703	1971	OB	5	2	FB	M3
850	Scotland Farm Bridle	3	M3	67	47324	15320	1971	OB	11	2	FB	M3
859	Hatch Footbridge	3	M3	72.7	46770	15197	1971	OB	3	2	FB	M3
867	Cliddesden Road F/B	3	M3	77.4	46363	15012	1971	OB	9	2	FB	M3
3444	Rookery Farm	3	M27	30.6	45105	10909	1973	OB	6	6	SA	M3
3447	Dodwell Lane	3	M27	27.9	44880	11055	1973	OB	3	2	SN	M3
3448	Blundell Lane	3	M27	28.2	44910	11033	1973	OB	3	2	SN	M3
3452	Coal Park Lane	3	M27	29.2	44996	11000	1974	OB	3	2	SN	M3
3455	Swanwick Lane	3	M27	29.7	45031	10957	1974	OB	3	2	SN	M3
3458	Botley Road	3	M27	31.2	45159	10890	1973	OB	3	2	SN	M3
3466	Whitley Lane	3	M27	33.4	45361	10812	1973	OB	4	4	SL	M3
3470	Redbarns Farm	3	M27	35.7	45591	10790	1975	OB	3	2	SA	M3
3475	North Fareham Farm	3	M27	38.3	45835	10752	1975	OB	3	2	FB	M3
3481	Upper Cornaway Lane F/B	3	M27	40.8	46068	10664	1975	OB	3	2	FB	M3
3483	High Tor F/B	3	M27	42.2	46200	10661	1975	OB	3	2	FB	M3
3485	Bude Close F/B	3	M27	43	46297	10627	1975	OB	7	2	FB	M3
3511	Portsmouth Road North	3	M27	46.1	46530	10467	1975	UB	3	2	SW	D2
3513	Portsmouth Road South	3	M27	46.1	46528	10462	1975	UB	3	2	SW	D2
3515	Portsbridge Viaduct	3	M27	46.3	46549	10462	1975	UB	7	2	M3	D2
3534	St Johns Road	3	M27	26.5	44824	11182	1977	OB	4	3	SN	M3
6184	Picket Twenty	3	A303	133.9	43852	14476	1969	UB	3	2	D2	D2
6187	Winchester Road	3	A303	131.3	43632	14406	1969	OB	2	1	SN	D2
6192	Abbotts Ann	3	A303	129.7	43452	14476	1969	OB	3	2	SN	D2
7282	Kingsworthy Flyover	3	A34	0.6	44920	13199	1969	UB	3	2	D2	SW
7290	Three Maids Hill Flyover	3	A34	3.6	44630	13377	1969	OB	3	2	SN	D2
8296	Manor Court	3	M3	87.5	55260	43947	1984	OB	2	2	FB	M3
9399	Fitzalan Arundel	3	A27	71	50145	10680	1973	UB	5	2	SN	RV
13784	Wooden Bridge Footbridge	3	A3	51.7	49887	15082	1979	OB	3	2	FB	D2
692	Medway River	4	M2	47.3	57234	16711	1963	UB	3	2	M3	RV
3257	East Street F/B	4	M20	46.7	56594	15932	1971	OB	7	2	FB	M3
3268	Teapot Lane Footbridge	4	M20	53	58181	15548	1971	OB	9	2	FB	M3
3269	Hall Road	4	M20	53.6	57261	15850	1971	UB	2	1	M3	SW
3273	Medway	4	M20	55.4	57428	15828	1960	UB	3	3	M3	RV
3286	Chrismill Railway	4	M20	64	58181	15548	1959*	OB	5	2	M3	RL
7687	Morants Court	4	M25	24.6	55020	15820	1966	OB	3	2	SN	M3
7689	Brickfield Lane	4	M25(S)	26.2	54960	15630	1966	OB	3	2	FB	SW
7692	Moat Farm	4	M25(S)	26.2	54980	15590	1966	OB	3	2	SA	D2
9110	Littledale Viaduct	4	A2	29.1	55641	17222	1970	UB	9	16	D2	RV
9122	Thong Lane	4	A2	41	56739	16984	1966	OB	3	2	SA	D2

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
9123	Cobham Flyover	4	A2	41.9	56827	16966	1966	OB	6	4	SN	D2
9128	Poplar View Footbridge	4	A2	80.1	60558	15934	1975	OB	3	2	FB	SW
9375	River Ouse	4	A27	25.6	54227	10915	1977	UB	3	2	D2	RV
9384	Falmer Overbridge	4	A27	32.8	53519	10885	1980	OB	2	1	SN	D2
12271	Morley Road I/C North	4	A21	34.2	55422	15137	1967	OB	3	2	SW	D2
12272	Morley Road I/C South	4	A21	34.3	55427	15126	1967	OB	3	2	SW	D2
12274	Old Cock Footbridge	4	A21	36	55512	14986	1971	OB	3	2	FB	SW
12279	Leigh Road	4	A21	38	55557	14781	1971	UB	3	2	D2	SW
12281	Barnetts Wood Footbridge	4	A21	39.1	55594	14682	1971	OB	3	2	FB	SW
12283	Medway Viaduct Sth Bound	4	A21	40.1A	55618	14615	1970	UB	15	26	D2	RV
12284	Medway Viaduct Nth Bound	4	A21	39.8	55618	14615	1970	UB	15	26	D2	RL
12290	Quarry Hill Viaduct	4	A21	42.4	55822	14496	1971	OB	10	14	D2	D2
12292	Deakin Leas Footbridge	4	A21	43.3	55910	14483	1971	OB	1	2	FB	SW
12422	Ford Lane	4	M26	15.1	56361	15874	1971	UB	2	2	M3	SW
12472	Morants Court Accomm A	4	M25	25.2	54979	15791	1966	OB	3	2	SA	M3
985	Windsor Rd	5	M4	43.6	49006	17864	1961	UB	3	2	M3	SN
1024	River Loddon	5	M4	61.3	47578	16956	1971	UB	5	6	M3	RV
1028	Shinfield Footbridge	5	M4	64.7	47258	16866	1971	OB	1	2	FB	M3
1046	Theale Footbridge	5	M4	73.2	46487	17170	1971	OB	3	6	FB	M3
1049	Malpas Footbridge	5	M4	74.8	46412	17296	1971	OB	3	2	FB	M3
1068	Bussock Wood Footbridge	5	M4	92.8	44691	17292	1971	OB	3	2	FB	M3
4953	Cecil Road Flyover	5	A1(M)	24.4	52285	20153	1961	OB	5	2	SN	M3
7366	Lodge Hill	5	A34	75.3	45070	20022	1973	OB	3	2	SW	D2
9184	Tring Park Footbridge	5	A41(M)	51.6	49261	21085	1975	OB	9	2	FB	D2
12128	Park Avenue Footbridge	5	M25	112.1	50404	19589	1975	OB	1	2	FB	M3
13048	Bentley Heath F/B	5	M25	136.4	52484	20010	1975	OB	5	4	FB	M3
19653	Marlow Northbound	5	A404	10.1	48591	18598	1972	UB	3	2	D2	RV
19658	Marlow Southbound	5	A404	10.1	48592	18598	1972	UB	3	2	D2	RV
7592	Longthorpe Footbridge	6	A47	162.5	51624	29907	1971	OB	3	2	FB	SW
7593	Bretton Footbridge	6	A47	161.6	51655	29984	1971	OB	3	2	FB	SW
7604	Fulbridge Footbridge	6	A47	158.5	51858	30181	1974	OB	9	2	FB	SW
7627	Elms Farm Access	6	A47	107.4	56066	31860	1975	OB	3	2	SA	SW
7628	Great Ouse	6	A47	106.8	56114	31844	1975	UB	7	4	D2	RV
7647	Wendling	6	A47	69.2	59380	31294	1978	OB	3	2	SN	D2
7648	Abbey Farm Overpass	6	A47	68.8	59416	31289	1978	OB	3	2	SA	SW
7649	Podmore Farm Overbridge	6	A47	67.5	59546	31270	1978	OB	3	2	SA	SW
7655	Hall Lane Farm Overpass	6	A47	62.4	60036	31281	1978	OB	3	2	SA	SW
8993	Brandon Creek	6	A10	129.5	56076	29177	1969	UB	9	2	SN	RV
9938	Kirton Road Footbridge	6	A14	205.3	62758	23807	1972	OB	3	2	FB	D2
10061	River Cam	6	A14	104.3	54862	26156	1978	UB	3	2	D2	RV
5327	Nene Bridge Wansford	7	A1	137.2	50760	29935	1973	UB	3	4	D2	RV
5414	Twyford Bridge Elkesley	7	A1	229.2	46983	37524	1973	OB	3	2	SN	D2
5419	Blyth Flyover	7	A1	244.2	46295	38625	1966	OB	3	2	SN	D2
6975	Bridge Over Railway	7	A453	63.8	44972	32925	1966	UB	3	2	SN	RL
7758	Woodhouse Inn Viaduct	7	A57	143.8	45660	38020	1986	UB	5	4	SW	SW
10340	Clifton Stage 1 North Bound	7	A52	107.0	45617	33671	1958	OB	6	2	SW	RV
253	River Nene Viaduct	8	M1	108.7	46807	25930	1959	UB	11	2	M3	RV
307	River Avon Viaduct	8	M1	131.6	45637	27777	1965	UB	9	8	M4	RL
10131	Railway Viaduct	8	A14	76.2	52329	27171	1975	UB	6	2	D2	RL
3637	Ripple Brook Viaduct	9	M50	3.8	38779	23720	1960	UB	13	8	M2	RV
3641	Queenhill East Approach	9	M50	5.4	38675	23689	1960	UB	15	28	M2	RV
3643	Queenhill West Approach	9	M50	5.4	38657	23684	1960	UB	9	16	M2	RV
3645	Bushley Brook Viaduct	9	M50	6.1	38582	23627	1960	UB	11	8	M2	RV
3649	Hillcourt	9	M50	9.2	38342	23431	1960	OB	3	2	SA	M2
3677	Revells Farm	9	M50	29.8	36608	22584	1960	UB	3	2	M2	SA
6694	Churchdown Footbridge	9	A40	163.8	38764	22052	1968	OB	3	2	FB	D2
11706	Bridstow	9	A40(S)	199.1	35928	22450	1960	UB	3	2	D2	RV
13369	Walham Viaduct	9	A40	171.4	38215	21973	1983	UB	6	2	SN	RV
2485	Moss Farm	10	M6	264.6	37717	35568	1963	OB	3	2	SA	M3
2510	Whitening House	10	M6	274.2	37562	36475	1963	OB	3	2	SA	M3
2524	Northwich Road	10	M6	280.6	37353	37070	1963	OB	4	2	SN	M3

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
2529	Fields Farm	10	M6	284	37330	37408	1963	OB	3	2	SA	M3
2532	Bucklow Farm	10	M6	285.4	37356	37544	1963	OB	3	2	SA	M3
2544	Gore Farm	10	M6	292.7	36998	38097	1963	OB	3	2	SA	M3
2551	Crowley Hall	10	M6	295.2	36785	38233	1963	OB	3	2	SA	M3
2553	Moss Oaks Farm	10	M6	296.2	36723	38314	1963	OB	3	2	SA	M3
2582	Sandsfields South	10	M62	29.4	36279	39263	1972	UB	4	4	SW	M3
2583	Sandsfields North	10	M62	29.4	36274	39269	1972	UB	4	4	SW	SN
3695	Moreton North	10	M53	10.5	32770	38960	1970	OB	3	2	SW	M2
3699	Moreton South	10	M53	10.6	32772	38947	1970	OB	3	2	SW	M2
3701	Moreton East	10	M53	10.5	37283	38955	1972	UB	3	2	SW	M2
3718	Woodchurch North	10	M53	13.8	32880	38660	1970	OB	1	2	SW	M2
3725	Woodchurch South	10	M53	14.2	32883	38640	1970	OB	1	2	SW	M2
3733	Storeton Hall Farm Acces	10	M53	16.2	32997	38454	1971	OB	3	2	SA	M2
3736	Clatterbridge North	10	M53	18.9	33200	38293	1972	OB	3	2	SW	M2
3738	Clatterbridge South	10	M53	19	33211	38282	1972	OB	3	2	SW	M2
3741	Clatterbridge Farm	10	M53	19.5	33237	38242	1969	OB	3	2	SA	M2
3749	Raby Hall Road	10	M53	21.6	33287	38041	1970	OB	3	2	SN	M2
3751	Eastham Viaduct South	10	M53	23.8	33478	37910	1972	UB	10	20	M2	RL
3752	Eastham Viaduct North	10	M53	23.9	33481	37909	1972	UB	9	18	M2	RL
3930	Mosswood Hall (Accom)	10	M56	32	36331	38271	1974	OB	3	2	SA	M2
3946	Wood Lane	10	M56	42.3	35398	37976	1971	OB	3	2	SN	M2
3950	Weaver Viaduct	10	M56	43.5	35290	37942	1970	OB	33	2	SW	M2
4161	Johnson'S Tenement	10	M62	29.4	36396	39258	1970	OB	4	4	SN	M3
8212	Chester Road	10	A55	5	34244	36426	1976	OB	3	2	SN	D2
8216	Eaton Road	10	A55	6.8	34114	36307	1976	OB	3	2	SN	D2
8223	Common Lane	10	A55	10.8	33714	36279	1976	OB	3	2	SA	D2
12847	Poplar Hall	10	M56	58.3	34019	37298	1980	OB	3	2	SA	M2
15012	Upton Road	10	M53	11.8	32792	38830	1970	OB	3	2	D2	M2
15610	Little Stanney Viaduct	10	M53	33.7	34165	37432	1981	OB	6	10	M2	SW
348	River Soar Viaduct	11	M1	151.7	45475	29737	1965	UB	5	4	M3	RV
374	Desford Brook Viduct	11	M1	160.3	45246	30538	1963	UB	7	6	M3	RV
375	Flood Viaduct	11	M1	160.5	45237	30553	1963	UB	5	4	M3	RV
413	Black Brook Viaduct	11	M1	178	44847	32083	1965	UB	5	4	M3	RV
420	West Meadow Viaduct	11	M1	181.4	44689	32386	1963	UB	5	4	M3	RV
1961	Mkt Harboro	11	M6	132.8	45583	27885	1971	UB	5	2	SW	SW
1962	Mkt Harboro	11	M6	132.9	45580	27882	1971	UB	5	2	SW	SW
1985	Nettlehill Viaduct	11	M6	147.2	44214	28220	1971	UB	7	6	M3	RV
1986	Ansty Brinklow Road	11	M6	148.1	44112	28228	1971	UB	5	2	M3	SN
2006	Aldermans Green	11	M6	153.4	43624	28385	1971	UB	5	4	M3	SN
2011	Longford Viaduct West	11	M6	154.7	43512	28469	1971	OB	13	2	M3	SN
2025	Fillongley-Meriden Road	11	M6	163.1	42710	28557	1971	UB	5	2	M3	SN
2412	Cresswell Home Farm	11	M6	228.9	39036	32600	1962	OB	3	2	SA	M3
2428	Lodge Covert	11	M6	239.7	38642	33584	1962	OB	3	2	SA	M3
2431	Beech House Farm	11	M6	241.6	38659	33757	1962	OB	3	2	SA	M3
2434	Knowl Wall Farm	11	M6	243.4	38541	33939	1962	OB	3	2	SA	M3
2455	Hungerford House Farm	11	M6	252.9	37886	34450	1963	OB	3	2	SA	M3
2465	Craddocks Moss Farm	11	M6	257	37820	34814	1963	OB	3	2	SA	M3
7786	Outwoods Footbridge	11	A38	428.7	42330	32411	1967	OB	4	2	FB	SW
7796	Eggington - Northbound	11	A38	433.6	42684	32710	1967	UB	15	2	D2	RV
9701	Cliff Vale Footbridge	11	A500	6.7	38670	34650	1978	OB	6	4	FB	D2
13699	M6/M54 Junction Overbridge	11	M6	204.5	39650	30430	1983	OB	2	4	SW	M3
13707	Wolverhampton-Stafford Rail	11	M54	5.1	39214	30448	1983	UB	3	2	M3	RL
1480	Oldbury Viaduct (24/6A-19)	12	M5	6.8	40023	28978	1970	UB	12	2	M3	RL
1556	Quinton I/C North	12	M5	14	39912	28354	1965	UB	3	2	M3	SW
1557	Quinton I/C South	12	M5	14.1	39905	28339	1965	UB	3	2	M3	SW
1559	Lapal East	12	M5	14.7	39889	28279	1965	OB	3	2	SN	M3
1564	Frankley Hill	12	M5	18.2	39829	27943	1965	OB	3	2	SN	M3
1566	Gannon Green	12	M5	19.5	39740	27852	1965	OB	3	2	FB	M3
1567	Gannow Road	12	M5	19.9	39705	27836	1965	OB	3	2	SN	M3
1568	Chapmans Hill	12	M5	20.6	39652	27790	1965	OB	3	2	SL	M3
2112	Gravelly Hill (AC/5-AC/7)	12	M6	183.4	40934	29022	1970	UB	2	3	SW	SW

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
2161	Gravelly Hill (AC/7AE/13)	12	M6	183.6	40928	29028	1970	UB	11	11	SN	SW
2224	Aldridge Rd/College Rd	12	M6	186.5	40717	29231	1969	UB	3	2	M3	D2
2226	Perry Barr Locks Canal	12	M6	187	40689	29278	1969	UB	3	2	M3	RV
2246	A34 Interchange Viaduct	12	M6	190.4	40456	29500	1971	OB	8	3	D2	M3
2315	Pleck Loop Railway Bents	12	M6	196.3	39934	29696	1968	UB	7	2	M3	RL
3601	Wheeley Moor Accomm	12	M42	36.8	41970	28746	1977	OB	3	2	SA	M3
3602	Hall Walk Accomodation	12	M42	37.3	41960	28797	1977	OB	3	2	SA	M3
4910	Shirley Fields Accomm	12	M42	30.9	41940	28167	1976	OB	3	2	SA	M3
433	R Trent S Floodplain 4	14	M1	188	44680	33025	1966	UB	5	4	M3	RV
436	R Trent N Floodplain 1	14	M1	189.1	44649	33131	1966	UB	15	12	M3	RV
437	R Trent N Floodplain 3	14	M1	189.4	44650	33164	1966	UB	13	1	M3	RV
7177	R Trent N Floodplain 2	14	M1	189.3	44650	33160	1966	UB	9	8	M3	RV
7833	Derwent	14	A38	449.7	43586	33994	1968	UB	3	2	D2	RV
7846	Hill Top Farm Access	14	A38	457.7	43751	34732	1976	OB	3	2	SA	D2
7847	Fp 42 Ripley & Knob Farm	14	A38	458.9	43768	34860	1976	OB	3	2	SA	D2
7849	B6374 Heage Road	14	A38	461.3	43849	35007	1977	OB	3	2	SN	D2
7856	Pentrich Road (B6016)	14	A38	464.2	43972	35301	1977	OB	3	2	SN	D2
7859	Fp 6 Alfreton	14	A38	468	44228	35509	1969	OB	3	2	FB	D2
7884	Hilltop	14	A61	46.5	43502	37764	1977	UB	2	1	SN	D2
7885	Gosforth Footbridge	14	A61	47	43477	37797	1975	OB	3	2	FB	D2
7887	Stubley Lane	14	A61	47.7	43471	37871	1977	UB	2	1	SN	D2
4137	Manor Farm F/B	15	M62	15.7	34973	38967	1973	OB	4	4	FB	M3
4143	Ladies Walk Footbridge	15	M62	20.4	35422	39084	1971	OB	5	2	FB	M3
4144	Bold Hall	15	M62	21	35486	39090	1973	OB	3	2	SA	M3
4155	Peel Hall Footbridge	15	M62	27.7	36140	39190	1973	OB	5	2	FB	M3
4159	Houghton Green	15	M62	28.6	36230	39218	1973	OB	5	6	SN	M3
4164	Lilbourne Footbridge	15	M62	31.2	36472	39298	1973	OB	3	2	FB	M3
4166	Risley Manse	15	M62	31.6	36510	39308	1973	OB	3	2	SW	M3
4170	Holcroft Moss	15	M62	34.1	36756	39332	1974	OB	3	2	SA	M3
4173	Keepers Cottage	15	M62	35.8	36924	39375	1972	OB	3	2	SA	M3
4277	Hill Top Footbridge	15	M62	65.4	39038	41040	1970	OB	3	3	FB	M3
4292	Pennine Way F/B	15	M62	75	9835	1475	1970	OB	3	4	FB	M3
4650	Bolton Road North	15	M66	0.1	37960	41864	1978	OB	3	2	SW	M3
4651	Bolton Road South	15	M66	0.2	37962	41855	1978	OB	3	2	SW	M2
4652	Edenwood	15	M66	0.5	37973	41830	1975	UB	3	3	M2	SA
4653	Old Hall Lane Foot Bridge	15	M60	33.3	38379	40527	1970	OB	8	4	FB	M3
4656	Well Bank	15	M66	1.4	37983	41737	1978	OB	3	2	SA	M2
4658	Peel Brow	15	M66	2	37983	41680	1978	OB	3	3	SN	M2
4659	Fletcher Bank	15	M66	2.2	37985	41660	1977	OB	3	2	SN	M2
4663	Walmersley Old Road	15	M66	4.8	38086	41436	1975	OB	3	3	SN	M2
4668	Top O'Th Hill	15	M66	6	38155	41336	1978	OB	3	2	SA	M2
4669	Bradshaw Hill	15	M66	6.6	38163	41278	1978	OB	3	2	SA	M2
4696	Hills Lane	15	M66	12.7	38236	40683	1975	OB	3	2	SA	M2
4718	King Street Footbridge	15	M67	4.8	39473	39516	1978	OB	3	2	FB	M2
4720	Clarendon Street Footbridge	15	M67	4.90	39486	39515	1978	OB	3	2	FB	M2
4723	Hoviley Footbridge	15	M67	5.1	39508	39513	1978	OB	8	2	FB	M2
7948	Stakehill Lane (Spur Rd)	15	A627(M)	2.7	38888	40860	1971	OB	3	2	SN	M2
7954	Thornham Lane	15	A627(M)	3.2	38949	40909	1971	OB	3	2	SN	M2
12326	Yew Tree Lane Footbridge	15	A5103	1.3	38240	39052	1974	OB	4	2	FB	D2
12967	Boundary F/B	15	M60	1.7	38668	38907	1979	OB	9	6	FB	M3
16570	River Tame	15	M60	51.2	39141	39363	1989	UB	3	2	M3	RV
555	Penny Brampton	16	M18	250.4	44807	38789	1967	UB	2	4	SW	M3
582	Droppingwell Footbridge	16	M1	261.9	43890	39250	1967	OB	7	2	FB	M3
590	Rainsworth Bridge	16	M1	264.7	43720	39460	1968	OB	3	3	SN	M3
591	Hesley Bar South	16	M1	265.7	43680	39550	1968	OB	4	3	SW	M3
592	Hesley Bar North	16	M1	265.8	43680	39560	1968	OB	4	3	SW	M3
605	Cock Inn	16	M1	271.9	43421	40108	1968	OB	2	1	SN	M3
608	Doe Lane	16	M1	273.9	43390	40290	1968	OB	3	2	SN	M3
637	Wooley Low Moor	16	M1	287.4	43047	41487	1968	OB	3	2	SN	M3
649	Snapethorpe Accomm	16	M1	292.2	43032	41915	1967	OB	3	2	SA	M3
665	Carr Gate Beck Accom	16	M1	298.9	43123	42484	1967	OB	3	2	SA	M3

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
672	Lofthouse Ne Slip Road	16	M1(S)	300.7	43239	42628	1967	UB	2	1	SW	SN
673	Lofthouse Nw Slip Road	16	M1(S)	300.7	42327	42630	1967	UB	2	1	SW	SN
3207	New Farm Accommodation	16	M18	282.2	46730	41040	1972	OB	3	2	SA	M2
3225	Dikesmarsh	16	M18	287.9	46843	41567	1975	OB	4	2	SN	M2
3227	Hadds Farm	16	M18	289.1	46843	41668	1975	OB	4	2	SA	M2
3230	Crown Farm	16	M18	290	46849	41770	1975	OB	4	2	SA	M2
3231	Greenland Lane	16	M18	292	46850	41975	1975	OB	4	2	SN	M2
4371	Whitechapel Road	16	M62	99.6	41771	42583	1972	OB	4	3	SN	M3
4383	Bluehills	16	M62	102.8	41992	42760	1972	OB	4	3	SW	M3
4384	Oxford Road	16	M62	103.5	42046	42730	1972	OB	3	2	SW	M3
4389	Field Head Lane	16	M62	105.4	42234	42759	1971	OB	4	3	SN	M3
4395	Birkby Brow	16	M62	108.1	42474	42744	1969	OB	2	1	SN	M3
4396	Scott Lane Accommodation	16	M62	109	42521	42671	1970	OB	3	2	SA	M3
4432	Hepron Wood	16	M62	127.8	44268	42330	1974	OB	3	2	SA	M3
4442	Holmfield Lane Accomm	16	M62	132	44672	42412	1973	OB	2	1	SA	M3
4465	Flyboat	16	M62	142.7	45656	42230	1974	UB	2	1	M3	RV
4466	High Eggborough	16	M62	143.3	45714	42236	1974	OB	4	2	SN	M3
4477	Finnleys Lane	16	M62	151.2	46478	42092	1975	OB	4	2	SN	M3
4479	Cowick Hall	16	M62	152.6	46610	42083	1975	OB	4	2	SA	M3
4794	Dale Mount	16	M180	3.1	46992	40989	1978	OB	3	2	SA	M2
4798	Plains Lane	16	M180	6.7	47346	40890	1978	OB	3	2	SL	M2
4802	Woodcarr Farm Accom	16	M180	9.6	47624	40885	1978	OB	3	2	SA	M2
4810	Bellwood Farm Accom	16	M180	13.3	47972	40790	1978	OB	3	2	SA	M2
4847	River Ancholme	16	M180	33.9	49920	40788	1977	UB	3	2	M3	RV
4887	Asquith Avenue	16	M621	2.7	42550	42868	1972	OB	4	3	SN	M3
4888	Rooms Lane	16	M621	3.6	42610	42929	1972	OB	3	2	SL	M3
5074	Sprotbrough Footbridge	16	A1(M)	252	45480	40212	1961	OB	3	2	FB	M2
5082	Brodsworth F/B	16	A1(M)	261	45190	40760	1961	OB	3	2	FB	M2
5435	Jossey Lane Footbridge	16	A638	40.5	45471	40589	1968	OB	3	2	FB	D2
5468	Church Road Footbridge	16	A1	288.6	44854	42560	1961	OB	3	2	FB	D2
5472	Fairburn Footbridge	16	A1	291.3	44734	42787	1962	OB	3	2	FB	D2
8488	Elloughton Footbridge	16	A63	68.4	49468	42822	1971	OB	3	2	FB	D2
2652	Lydiate Farm F/B	17	M6	342.2	35540	42265	1962	OB	3	2	FB	M3
2694	Bamfords Farm F/B	17	M6	356.9	35374	43529	1963	OB	3	2	FB	M3
2699	Three Stiles F/B	17	M6	358.6	35288	43669	1964	OB	3	2	FB	M3
2702	Jepps Lane	17	M6	359.9	35259	43803	1964	OB	3	2	SN	M3
2707	Ducketts Farm Footbridge	17	M6	363.4	35126	44126	1964	OB	3	2	FB	M3
2710	Hardmans Wood F/B	17	M6	365.6	35115	44345	1964	OB	3	2	FB	M3
2718	Keepers Footbridge	17	M6	368.6	35057	44633	1964	OB	3	2	FB	M3
2721	Woodacre Great Wood	17	M6	370.1	35029	44781	1964	OB	3	2	FB	M3
2761	Carnforth I/C South	17	M6	394	35107	47053	1970	OB	4	2	SW	M3
2762	Carnforth I/C North	17	M6	394.1	35114	47061	1970	OB	4	2	SW	M3
2771	Borwick Lane	17	M6	396.5	35186	47297	1970	OB	4	4	SN	M3
2774	Tewitfield	17	M6	397.2	35188	47363	1970	OB	4	4	SN	M3
2778	Cinderbarrow	17	M6	398.6	35193	47507	1970	OB	3	2	SN	M3
2780	Deerslack	17	M6	399.4	35210	47585	1970	OB	3	2	SN	M3
2781	Station	17	M6	400.5	35259	47673	1970	OB	4	4	SN	m3
2783	Clawthorpe	17	M6	401.4	35284	47767	1970	OB	4	2	SN	M3
2784	Green Bank	17	M6	402.1	35288	47837	1970	OB	4	2	SN	M3
2787	Chapel	17	M6	404.5	35309	48076	1970	OB	4	4	SN	m3
2792	Moss End Lane	17	M6	405.9	35317	48214	1970	OB	3	2	SN	M3
2793	Farleton Int S	17	M6	406.3	35335	48248	1970	OB	4	4	SW	M3
2794	Farleton Int N	17	M6	406.4	35342	48259	1970	OB	4	4	SW	M3
3801	Marton Circle West	17	M55	6.2	33510	43350	1975	OB	3	2	SW	M3
3802	Marton Circle East	17	M55	6.3	33528	43350	1975	OB	3	2	SW	M3
3809	Pheasant Wood	17	M55	12.1	34084	43488	1975	OB	3	2	SA	M3
3812	Pasture Barn	17	M55	13.7	34246	43481	1975	OB	3	2	SA	m3
3813	White Carr Lane	17	M55	14.5	34328	43482	1975	OB	3	2	SA	m3
3814	Moorside Lane	17	M55	14.9	34370	43485	1975	OB	3	2	SN	M3
3815	Boggart Pits	17	M55	15.8	34460	43478	1974	OB	3	2	SN	M3
3823	Crow Trees	17	M55	21.1	34976	43384	1975	OB	3	2	SN	M3

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
3831	Broughton Circle	17	M55	24.2	35289	43408	1974	UB	5	6	M3	SW
4076	Park Hall Footbridge	17	M61	16.1	36351	40938	1969	OB	6	2	FB	M3
12703	Syke Side East	17	A56	88.8	37943	42199	1981	OB	1	2	SN	D2
12704	Syke Side West	17	A56	88.9	37935	42197	1981	OB	1	2	SN	D2
12707	Helmshore Road	17	A56	89.8	37850	42231	1981	OB	3	3	SN	D2
12708	Grane Road	17	A56	90.2	37818	42262	1982	UB	3	2	D2	SW
13472	Cheslin North	17	M58	10.4	33718	40040	1979	OB	3	2	SN	M3
13481	Leatherbarrows Lane	17	M58	12.5	33892	40122	1981	OB	3	2	SN	M3
13482	Moss Nook	17	M58	13.1	33941	40170	1979	OB	3	2	SA	M3
13483	Maghull Lane West	17	M58	13.8	33990	40221	1979	OB	3	2	SW	M3
13484	Maghull Lane East	17	M58	13.9	33997	40229	1979	OB	3	2	SW	M3
13485	Prescot Road	17	M58	14.5	34043	40259	1980	OB	4	2	SN	M3
13486	Cunscough Hall	17	M58	15.2	34112	40284	1980	OB	3	2	SA	m3
13488	Simonswood Lane	17	M58	16.1	34199	40325	1980	OB	3	2	SN	M3
13489	Mercers Lane	17	M58	16.9	34258	40375	1980	OB	3	2	SA	M3
13490	Oxhey Footbridge	17	M58	18.3	34377	40433	1980	OB	6	4	FB	M3
13492	Intake Footbridge	17	M58	19.3	34478	40469	1980	OB	3	2	FB	M3
13792	Gannow Green Canal South	17	10/M65	31.8	38234	43257	1983	UB	3	2	M3	RV
13794	Gannow Green Canal North	17	10/M65	31.7	38233	43256	1983	UB	3	2	SW	RV
8393	Moortown Footbridge	18	A6120	11.1	42973	43887	1980	OB	3	2	FB	D2
11181	Broughton Road	18	A64	70.1	47780	47243	1978	OB	3	2	SN	D2
11182	Outgang Road	18	A64	70.7	47838	47268	1978	OB	3	2	SA	D2
11183	Rainbow	18	A64	71.7	47918	47310	1978	OB	3	2	SL	D2
11184	Pickering Road West	18	A64	72.5	48012	47334	1978	OB	3	2	SN	D2
11185	Pickering Road East	18	A64	72.6	48011	47335	1978	OB	3	2	SN	D2
11186	Derwent	18	A64	73.7	48112	47303	1978	UB	3	2	D2	RV
2800	Lupton	19	M6	409.1	35510	48465	1970	OB	3	2	SN	M3
2802	Sillfield	19	M6	409.9	35550	48540	1970	OB	4	4	SN	M3
2807	Brunthwaite	19	M6	413.2	35705	48828	1970	OB	4	4	SN	M3
2813	Bull Coppy	19	M6	415.4	35805	49018	1970	OB	4	4	SN	M3
2815	Hoghouse	19	M6	417.3	35880	49190	1970	OB	3	2	SN	M3
2822	Powson	19	M6	421.2	35987	49542	1970	OB	3	2	SN	M3
2826	Cowperthwaite	19	M6	422.6	36080	49637	1970	OB	3	2	SN	M3
2840	Borrowbeck Viaduct	19	M6	428.8	36086	50145	1970	UB	3	2	M3	RV
2844	Lawtland House Viaduct	19	M6	430.1	36125	50291	1970	OB	5	1	SN	D2
2845	Jeffreys	19	M6	430.3	36119	50293	1970	UB	3	2	M3	RV
2850	Tebay	19	M6	431.9	36129	50448	1969	UB	5	4	M3	RV
2859	Lowmoor	19	M6	434.5	36038	50653	1970	OB	3	2	SN	M3
2860	Selsmire	19	M6	434.5	36054	50668	1970	OB	3	2	SN	M3
2881	Shap Int	19	M6	441.2	35803	51273	1970	OB	4	2	SN	M3
2883	Colvilles	19	M6	442	35785	51347	1970	OB	4	2	SN	M3
2887	Kirkbank	19	M6	444.1	35741	51551	1970	OB	3	2	SN	M3
2888	Trainrigg	19	M6	444.2	35749	51552	1970	OB	3	2	SN	M3
2889	Crayston	19	M6	445.8	35677	51707	1970	OB	3	2	SN	M3
2891	Capplerigg	19	M6	447.3	35626	51855	1970	OB	4	4	SN	M3
2895	Greenriggs	19	M6	449	35533	52003	1970	OB	3	2	SA	M3
7275	Mossband Viaduct Railway	19	A74	7.8	33450	56565	1964	UB	8	3	D2	RL
8607	Kentigern	19	A66	32.1	32508	52412	1975	UB	3	2	SW	RV
8609	Spoonygreen	19	A66	33	32691	52424	1975	OB	3	2	SL	SW
8611	Brundholme	19	A66	34.9	32788	52410	1975	OB	2	1	SL	SW
11258	Moss End Farm	19	A590	37.8	34081	48146	1977	OB	3	2	SA	D2
13215	Woodlands	19	A590	55	35250	48335	1974	OB	3	2	SN	D2
13220	Hincaster	19	A590	52.7	35119	48526	1974	OB	3	2	SA	D2
13221	Summerhouse	19	A590	51.5	35075	48627	1974	OB	3	2	SN	D2
9326	Equestrian	22	A406	31.5	53918	19055	1970	OB	3	2	SA	D2
5937	Trunks Alley F/B	23	A20	17.3	55020	16900	1965	OB	3	2	FB	SW
6052	Lovelace School F/B	23	A3	27.4	51712	16434	1976	OB	3	2	FB	D2
6055	Coverts Road	23	A3	29.9	51580	16246	1976	OB	3	2	SA	D2
6064	Black Pond Bridleway	23	A3	32.7	51304	16198	1976	OB	3	2	SA	D2
6067	Norwood Farm Accommod	23	A3	34.7	51112	16150	1976	OB	3	2	SA	D2
9084	Radnor Avenue Footbridge	23	A2	17.6	54681	17456	1966	OB	9	2	FB	SW

Structure Key	Structure Name	Area Code (in 2001)	Road	Chainage	Easting	Northing	Year Open	Under or Over Bridge	No. of spans	No. Half joints	Carrying Type	Crossing Type
9087	Bexley Golf Course F/B	23	A2	19.1	54828	17430	1966	OB	3	2	FB	SW
9089	Midhurst Hill Footbridge	23	A2	20.2	54931	17434	1966	OB	3	2	FB	SW
9096	Denton Road Footbridge	23	A2	23.7	55124	17327	1970	OB	3	2	FB	SW
8774	Constantius River	25	A69	57.5	39213	56551	1977	UB	3	2	D2	RV
10478	River Dove Old	28	A50	111.5	41057	33444	1976	UB	3	2	SW	RV
11120	Foxcover Lane	26	A19	173.6	43500	55455	1972	OB	2	1	SN	D2
3537	Windsor End F/B	NK	M40	40.6	49476	18943	1970	OB	4	6	FB	M3
8880	Allerdene Railway Bridge	NK	A1	442.9	25400	58500	1974	UB	3	2	D2	RL
9777	Larkhay Road	NK	A417	84.2	38728	21814	1965	OB	1	2	SA	D2

QUALITATIVE RISK ASSESSMENT ANNEX D

Based on the initial data collection exercise (refer paragraph 3.1) there are 372 trunk road bridges with half-joints, of varying forms of construction and usage. When considering risks, clearly those associated with a substandard footbridge spanning a single carriageway road in a rural location are likely to be significantly easier to manage than that of a road bridge carrying a dual carriageway over a 3 lane motorway in an urban setting. In order to develop a strategy for the repair and maintenance of such a significant number of bridges, a methodology is required to rationally assess the comparative risks that may arise from the deterioration process.

Although there is no single set methodology for qualitative risk assessment, the practice is well established in a number of industries. Qualitative risk assessment is being used increasingly by managers of infrastructure assets and some published guidelines are available. The guidance within CIRIA Report SP125 'Control of risk: a guide to the systematic management of risk from construction' has generally been adopted in this particular methodology. It should be noted that there are no right or wrong answers in qualitative assessment only relative opinion. The principal value of qualitative risk assessment is not necessarily in the final ranking outcome but in the process of risk identification. It is a formalised process enabling work to be reported objectively and open to scrutiny.

The definition of risk is widely accepted as being the product of the probability or likelihood of an event occurring and the consequences arising from the event.

Risk = Likelihood of occurrence x Consequence

In the method adopted in this study a simple numerical scale is used for the likelihood and consequence. It is important to stress that the indicator may have no numerical significance, other than to show qualitatively that one asset is likely to require more management effort than another.

1.1 OUTLINE METHODOLOGY

A number of factors have been identified which may increase or decrease the likelihood of a bridge with half-joints becoming substandard, as follows:-

(P1) Configuration and Access;
(P2) Current Capacity;
(P3) Current Condition;
(P4) Rate of Deterioration;
(P5) Future Loading.

It is important to establish a numerical scale that may be used objectively. The scale adopted for the likelihood is based on CIRIA SP125 five point scale:

Very Low	1
Low	3
Medium	5
High	7
Very High	9

Not all factors should be given equal weighting and therefore a significance factor has been applied to further enhance the assessment. A distorted numerical scale has been adopted to take account of the potential difference between very high and very low significance as follows:

Very Low	0.5
Low	1
Medium	2
High	4
Very High	8

The significance factors are used to weight the relative likelihood factors.

The consequences arising from a bridge collapse due to the failure of a half-joint, in terms of potential loss of life and/or confidence in this form of bridge construction would be so great as to totally dominate any qualitative risk assessment. The safety of the road user is paramount and it is a primary objective that all bridges with half-

joints be managed so that safety is assured. Given this policy statement, consequences in this study have been considered solely in terms of the financial costs of investigation, assessment, repair and traffic delay costs.

To enable the future management effort to be identified and readily grouped, a continuous numerical scale of 1 to 9 has been established for the cost consequence. Unlike the likelihood of failure, the indicator for consequence does have a meaningful relationship to actual cost.

	Consequence Factor	Cost	
Very Low	1	£25,000	1
	2	£50,000	2
Low	3	£100,000	4
	4	£200,000	8
Medium	5	£400,000	16
	6	£800,000	32
High	7	£1,600,000	64
	8	£3,200,000	128
Very High	9	£6,400,000	256

A distorted scale of costs has been adopted with each increase in consequence of 1 unit representing a doubling of cost. The consequence factor may be determined directly from the cost by the equation:

$(\text{Log}_n (\text{Cost} / £25{,}000) / \text{Log}_n 2) + 1$

Or the cost may be determined from the consequence factor by the equation:

$£25{,}000 \times 2^{(\text{Consequence factor} - 1)}$

For example, a cost of £235,700 would have a consequence factor of:

$(\text{Log}_n (£235{,}700/£25{,}000) / 0.301) + 1 = 4.2$

Values up to £25,000 will have a consequence score of less than 1.

1.2 LIKELIHOOD OF OCCURRENCE

The qualitative assessment of the likelihood of the half-joints becoming substandard is determined by considering the five factors P1 to P5.

1.2.1 (P1) JOINT CONFIGURATION

The four generic arrangements of half-joint identified during the initial data collection process are illustrated in Annex B. Ease of access to the bearing shelf for inspection is influenced by the joint arrangement. Joint type A is the most difficult to inspect due to the half-joint spanning the full width of the deck and therefore no access to the bearing shelf. Joint type B is easier to inspect than type A with limited access to the bearing shelf. Joint types C and D have some access to the bearing shelf. The values were assigned as follows:

Type A or unknown	High	7
Type B	Medium	5
Type C	Low	3
Type D	Low	2

Where physical access to the joints from below is particularly difficult factor P1 may be increased by up to two units. The adjustments to be applied for ease of access are as follows:

Difficult access to more than one joint	+2
Difficult access to one joint	+1
Moderate	0

1.2.2 (P2) CURRENT CAPACITY

Structural assessment results are generally reported for the bridge as a whole and do not necessarily relate to the capacity of the joint. Nevertheless, a comparison of the current assessed capacity with the original design capacity would indicate whether the overall design was more or less robust.

A median value of 5 is initially assigned to P2. It is reasonable to assume that where the current capacity is less than the design capacity, loading restrictions will be in place. However, the probability of failure is increased by 4 units for structures with current capacity less than 50% of the original design capacity. The adjustments to be applied for assessed capacity are as follows:

Current capacity < ½ design capacity	+4
Current capacity < design capacity	+2
Current capacity is not known	0
Current capacity = design capacity	-2
Current capacity > design capacity	-4

Where comparisons are borderline, i.e. current capacity is just less than or just greater than the design capacity, the age of the assessment and the availability of calculations should be considered. Assessments that are recent and available should be considered more accurate and reliable than older calculations.

1.2.3 (P3) CURRENT CONDITION

Information of current condition should be based on the latest inspection report (or special inspection report carried out as part of this strategy) and where possible in relation to the Stage II Assessment condition factor. For half-joints in a fair condition a median value of 5 is assumed with the following adjustment made for good and poor condition:

Poor	+2
Fair	0
Good	-2

If particular concerns or defects have been identified which may affect the performance of the joints a further +2 adjustment may be warranted. If repairs have been undertaken a negative adjustment may be appropriate to reflect the long- term improvement in condition. If repairs are only cosmetic then no adjustment is warranted.

Specific defects	+2
Cosmetic or no repairs	0
Structural repair	-2

1.2.4 (P4) RATE OF DETERIORATION

Direct measurements of concrete properties such as concrete permeability, chloride contamination, cover etc are not currently widely available for the majority of half-joints. However, there are other indicators which can give an insight as to whether the likely rate of deterioration will be greater or lesser than the average half-joint to which a median value of 5 is assigned.

The type and condition of the road joint above the half-joint will influence how much salt is likely to penetrate through to the half-joint. The service life of elastomeric joints is of the order of 20 years. The expected service life of modern buried joints is 10 years and 5 years for asphaltic plug type joints.
Due to poor maintenance in the past, joints with a shorter service life are more likely to result in contamination of the half-joint. For half-joints with asphaltic plug joints in a fair condition on a average salted road have a median value of 5 is assumed.

The following adjustments have been adopted:

Open joint (irrespective of condition)	+3
All other joints	0
Buried joints	-1
Elastomeric	-2

A road joint in a poor condition is likely to allow chloride contamination of the half-joint. Depending on road joint condition the following adjustments are appropriate:

Poor	+1
Fair	0
Good	-1

The level of salt use on a route is an important consideration as this is a major contributor for the deterioration of reinforced concrete structures. The following adjustments are adopted depending on the salt usage:

High	+1
Medium	0
Low	-1

1.2.5 (P5) FUTURE LOADING

Increased usage and congestion on a route will increase the probability of a joint becoming substandard and so increase the rate of deterioration of road joints. Routes which are likely to experience unchanged and average traffic growth are assigned a median value of 5. Urban and strategic routes, which are being carried by the structure, are likely to see greater increases in future loading and traffic volume than rural routes. Access roads are less likely to see any increase in loading. As a guide the following factors are appropriate, however, local knowledge should prevail.

Motorway	+2
Dual A P Trunk Road	+1
Single Carriageway Trunk Road	0
Lane / Local Road	-2
Access Road / Footway	-4

1.2.6 SIGNIFICANCE FACTORS

Not all contributing factors should be given equal weighting. The significance factor applies a weighting to the likelihood. The relative significance given to each factor is as follows:

(P1)	Configuration and Access	2
(P2)	Current Capacity	4
(P3)	Current Condition	4
(P4)	Rate of Deterioration	2
(P5)	Future Loading	1

Management effort will be greatest for those bridges deemed to be imminently substandard. The current capacity (P2) and current condition (P3) of a joint will be the primary factors affecting whether or not a joint is likely to be substandard at the present time and are given a “high” significance score of 4. For those bridges deemed to be of adequate capacity but actively deteriorating, management effort will be required to prevent further deterioration but this may be spread over a number of years. Factors (P1) joint configuration and access, and (P4) rate of deterioration, are factors which generally indicate the potential for a half-joint to become substandard in the future and are assigned a significance factor of 2. Future loading (P5) is considered to be of low significance as future increases in loading can be planned for well in advance of any potential problems arising and is assigned a significance score of 1.

1.3 COST CONSEQUENCE

The overall costs of repair comprise the design costs, the actual costs of undertaking repairs and the cost to the road user in terms of traffic delays. Traffic delay costs are often many times greater than the actual cost of repair and should be taken into consideration when considering the impact of a structure becoming substandard. For structures with a calculated likelihood factor of 6 or greater, the Agent is required to estimate the costs of undertaking repairs to the half-joints. These estimates may initially be based on the provision of discrete anode cathodic protection. However, if the Agent already has a clear understanding of the remedial measures to be adopted a detailed estimate of repair is available (inclusive of user delay costs) these costs shall be reported.

1.3.1 REPAIR COSTS

The total works costs includes an allowance for access and traffic management costs. If a half-joint requires repair then replacement of the deck expansion joint above will also be required. The repair techniques which are suitable for half-joints are limited. The most promising technique is likely to be discrete anode cathodic protection for those joints which require long-term repair. The cost estimate may assumes the implementation of this particular repair technique to assess the relative consequences of a structure becoming substandard. It is important to note that this is a comparative exercise using limited data. Should repair be required for an individual structure, the Maintenance Agent will be responsible for determining the actual scope of repair and a more thorough budget estimate for submittal through the annual bidding process.

For bridges crossing a river or other watercourse access for repair by scaffolding off the deck may be assumed. For bridges over roads, access may be assumed to be via scaffolding from the road below.

Generally traffic management will be required for repair from both above and below deck. The nature of repairs is such that 2 running lanes are likely to be closed with contraflow running. The length of traffic management for contraflow may be assumed to be 5km for motorways and dual all purpose trunk roads, to accommodate cross-over points at an assumed distance of 3km. For single carriageway roads, traffic signalling with shuttle flow may be assumed. The time to undertake repairs is likely to be split say 75% from below deck and 25% from above deck and this would be reflected in the relative access and traffic delay costs incurred from above and below deck working.

For underbridges over rail, access may be assumed to be by scaffold access tower and additional rail protection staff will also be required. Gaining access to a railway is always difficult and requires careful planning and liaison with the rail authorities to obtain track possessions. This will limit the time available to undertake repairs and every opportunity should made to limit the works duration undertaken from below deck. In this case the time to undertake repairs is more likely to be split 25% from below deck and 75% from above deck.

For specialist repair techniques the ratio of design and contract preparation costs to works costs will be relatively high and may be assumed to be as high as 50% of the contract value for each bridge (which includes traffic management and access costs).

1.3.2 TRAFFIC DELAY COSTS

Traffic user delay costs can be calculated using the computer program QUADRO (QUeues And Delays at ROadworks). Tables contained in the Trunk Road Maintenance Manual (TRMM) - Volume 1 have been derived from QUADRO to estimate traffic delay costs for different scenarios of traffic management restriction. These tables have been used as the basis for deriving the traffic delay costs per day.

The traffic delay costs are related to the type of road, the degree of the restriction, the daily traffic flow, the percentage of Heavy Goods Vehicles (HGV) and the physical length of the works on site.

The duration of the works above and below deck needs to be considered to obtain the total traffic delay costs. To evaluate traffic delay costs it is generally necessary to obtain the following information:

- Road classification;
- The likely lane restriction;
- Annual average daily traffic (AADT) flows;
- Percentage of HGVs using the structure;
- Alternative routes for diversion if appropriate;
- Whether or not works are undertaken off-peak.

Road classification codes have been assigned to each bridge with half-joints for the carriageway carried and carriageway or obstacle crossed in Annex C (although these should be confirmed by the Agent). The type of repair or investigation will dictate the nature of the lane restrictions for each road classification.

In the absence of more local knowledge Table 4 presents typical traffic delay costs per 8 hour working day for repair. The percentage of HGVs which use the road influence the traffic user delay costs. Motorways are assumed to have 30% HGVs, dual all purpose trunk roads 20% HGVs and single carriageway roads are assumed to have 10% HGVs. Motorway slip roads are classified as wide single carriageways and particularly where two motorways join, the percentage HGVs is more likely to be 30%. However, there is only a few £100 per day between 10% and 30% HGVs and therefore the assumption of 10% for all situations is considered acceptable for the level of accuracy required.

For minor roads with 2 marked lanes of 5.5m width up to 7.3m width the maximum traffic flow is assumed to be 5,000 AADT. For access roads the costs are assumed to be half those given for single carriage ways.

For repairs 2 running lanes are assumed to be closed with contraflow running. The length of traffic management for contraflow is assumed to be 5km. For single carriageway roads, traffic signalling with shuttle flow is assumed. The traffic management proposed is such that traffic is unlikely to divert on to alternative roads and therefore no additional factors have been applied to the TRMM tables.

Off-peak or night working is considered practical for most short duration repair work. The traffic delay costs presented in the Table may be factored by 0.25 if off-peak working is a practical option to reflect the reduced volume of traffic.

1.3.3 COST CONSEQUENCE FACTOR

The estimated costs shall be identified as:

- design costs;
- works costs including access and traffic management;
- traffic delay costs.

The sum of the estimated costs shall be used to calculate the consequence factor, determined directly from the cost by the equation:

$(\text{Log}_n (\text{Cost} / £25{,}000) / \text{Log}_n 2) + 1$

UNIT RATES FOR COST ESTIMATE

Activity	Unit rate	Unit	Works Rate
Access costs			
Scaffolding for repair *(for 35m deck width)*	£75	per day	
Mobile elevated platform	£300	per day	
Under bridge unit	£750	per day	
Mobile Scaffold + Rail Protection Staff	£1,000	per day	
Traffic Management			
2 Lanes closed in contraflow	£1,400	per day	
1 Lane closed	£300	per day	
Traffic light control	£900	per day	
Joint Replacement			
Asphaltic	£120	per m	14 m/day
Buried	£75	per m	17 m/day
Elastomeric	£575	per m	7 m/day
Comb	£2,500	per m	3 m/day
Other or unknown	£200	per m	11 m/day
Repair			
Discrete anode CP per m width of joint	£360	per m	6 m/day
Control & monitoring equipment. *(assumes one control cabinet per 4 joints)*	£6,000 £4,000	Dual Carriageway Single Carriageway	

DAILY TRAFFIC DELAY COSTS FOR HALF-JOINT REPAIR

AADT (1000)	M4	M3	M2	D2	SW	SN	SL	SA
TRMM. Table Ref	5	17	32	38	41	42	42	42/2
2								£140
5						£280	£280	
6						£350	£350	
7						£430	£430	
8						£510		
10					£250	£690		
12					£320	£1,360		
14					£390			
16					£460			
18					£530			
20			£6,100	£7,200	£610			
30			£11,000	£20,000				
40		£9,200	£36,000	£62,000				
50		£13,100	£90,000	£129,000				
60	£13,000	£17,000	£112,000	£148,000				
80	£18,000	£41,000	£214,000	£233,000				
100	£23,000	£194,000						
120	£57,000	£308,000						
140	£275,000	£532,000						

Note: Costs at 1998 prices
See Table 1 for key to road codes

EXAMPLE PROFORMA FOR QUALITATIVE RISK ASSESSMENT

Structure Key	555	**Structure Name**	Penny Brampton
Area Reference	16	**Maintaining Agent**	WSP Group

Ref	Median Factor	Factor Adjustments	Likelihood (A)	Significance (B)	AxB
		PROBABILITY OF FAILURE			
P1	Joint configuration and Access Type A 7 Type B 5 Types C 3 Type D 2	Access Difficult +2 Difficult & Moderate +1 Moderate 0	5	2	10
P2	Current Capacity at Joint 5	Current capacity < ½ Design capacity +4 Current capacity < Design capacity +2 Current capacity = Not known 0 Current capacity = Design capacity -2 Current Capacity > Design Capacity -4	7	4	28
P3	Current Condition Poor 7 Fair 5 Good 3	Particular Defects: Yes +2; Yes +1 Repairs: Specific Defects +2; Cosmetic/no repairs 0; Structural repairs -2	3	4	12
P4	Rate of Deterioration 5	Type of road joint: Elastomeric -2; Buried joints -1; All other joint 0; Open joint +3 Condition: Poor +1; Fair 0; Good -1 Salt Use: High +1; Med 0; Low -1	4	2	8
P5	Future Loading 5	Route Carried Motorway +2 Dual A P Trunk Road +1 Single Carriageway Trunk Road 0 Lane / Local Road -2 Access Road / Footway -4	9	1	9
		Average Relative Probability of Failure, P = Σ (A x B) / 13 = 67/ 13			**5.2**

Estimated Works Costs	Estimated Traffic Delay Costs	GRAND TOTAL COSTS
£65,964	£515,014	£580,978

Consequence Factor, C = (Log_n (Cost / £25,000) / Log_n2) + 1 **5.5**

PROFORMA FOR QUALITATIVE RISK ASSESSMENT

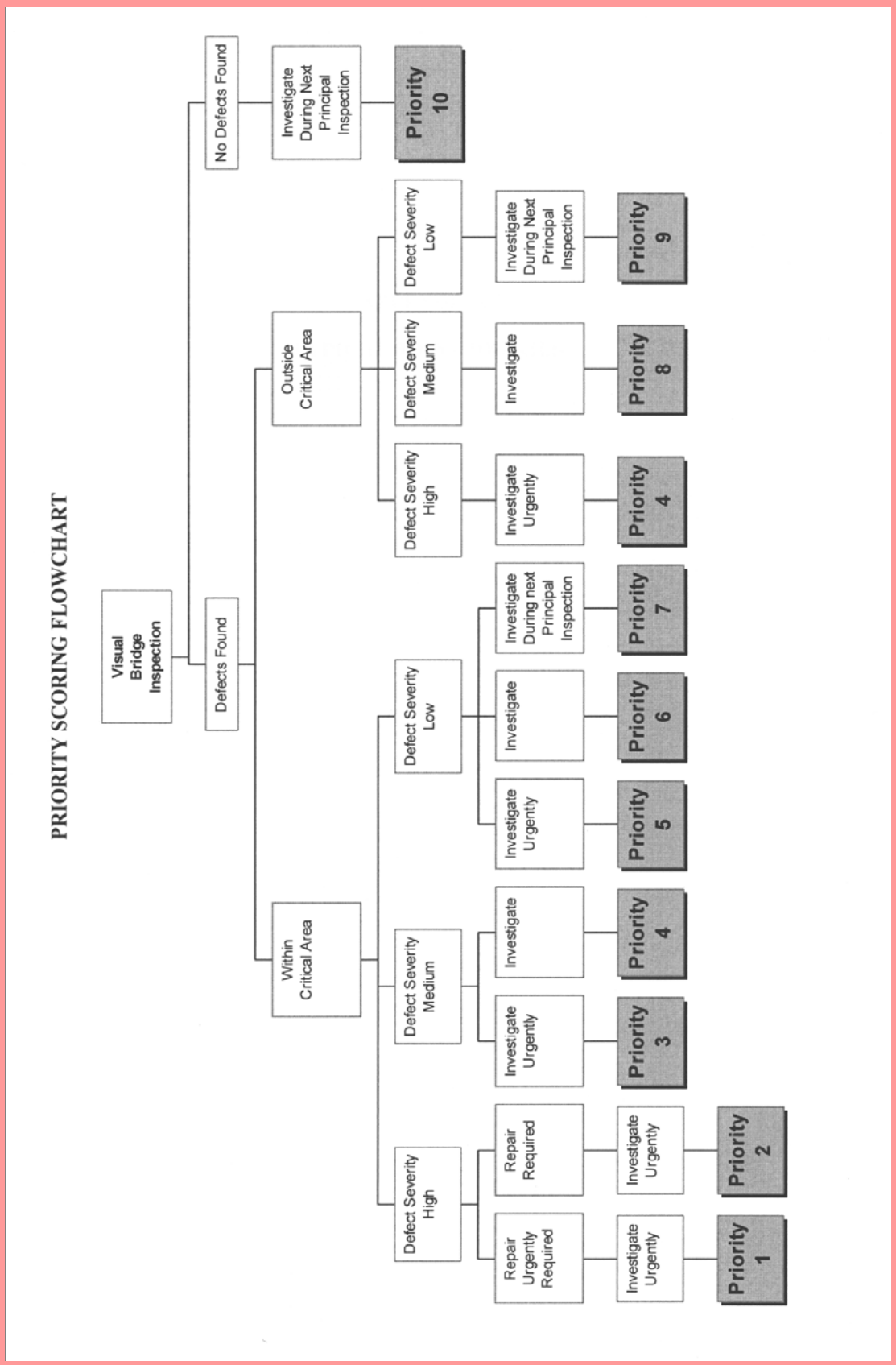
Structure Key		**Structure Name**	
Area Reference		**Maintaining Agent**	

Ref	Median Factor	Factor Adjustments	Likelihood (A)	Significance (B)	AxB
		PROBABILITY OF FAILURE			
P1	Joint configuration and Access Type A 7 Type B 5 Types C 3 Type D 2	Access Difficult +2 Difficult & Moderate +1 Moderate 0			
P2	Current Capacity at Joint 5	Current capacity < ½ Design capacity +4 Current capacity < Design capacity +2 Current capacity = Not known 0 Current capacity = Design capacity -2 Current Capacity > Design Capacity -4			
P3	Current Condition Poor 7 Fair 5 Good 3	Particular Defects Yes +2 Yes +1 Repairs Specific Defects +2 Cosmetic/no repairs 0 Structural repairs -2			
P4	Rate of Deterioration 5	Type of road joint Elastomeric -2 Buried joints -1 All other joint 0 Open joint +3 Condition Poor +1 Fair 0 Good -1 Salt Use High +1 Med 0 Low -1			
P5	Future Loading 5	Route Carried Motorway +2 Dual A P Trunk Road +1 Single Carriageway Trunk Road 0 Lane / Local Road -2 Access Road / Footway -4			
		Average Relative Probability of Failure, P = Σ (A x B) / 13 =			

Estimated Works Costs	Estimated Traffic Delay Costs	GRAND TOTAL COSTS
£	£	£

Consequence Factor, C = (Log_n (Cost / £25,000) / Log_n2) + 1

PRIORITISATION ANNEX E



SMIS REQUIREMENTS ANNEX F

F.1 INTRODUCTION

This annex provides guidance on how to use SMIS (Structures Management Information System) when inputting data or viewing progress reports for the Half joint Deck Strategy. It gives a summary of what is required by SMIS for each activity in the flowchart in annex A.

The annex is primarily aimed at those who will be inputting data, and it assumes a working knowledge of SMIS. The screens used adopt the general use and format of other screens in SMIS. Hence detailed instructions of how to logon, and how to use the screens are *not* included here. Instead, the annex refers to the relevant part of the online user guide. The SMIS user is recommended to read through this annex in conjunction with annex A, and the relevant parts of the SMIS online guide *before* embarking on using the system to input data.

For those who have an interest in the progress of the programme, your attention is drawn to the Progress Reporting paragraph in D.2 below.

F.2 GENERAL

Background

SMIS is a tool for managing the HA structures asset. One area of the system provides a means to capture data and organise a series of actions for programmes that are beyond the usual scope of structures renewals work. The half joint deck programme is one such example, where each structure within the programme goes through a series of steps in order to establish what needs to be done in a coordinated manner. The series of steps are given in annex A.

The advantages of such an approach is of a consistent method adopted for the problem across the network, and additionally data is captured centrally so an overview of the problem can be more easily gained.

SMIS uses the term NSP (National Structures Programme) to describe these programmes of work.

Contacts

If experiencing difficulties, use the following channels of support:

- BIS ServiceDirect, for support for accessing the system. Contact on 0113 254 1140 or email servicedirect@highways.gsi.gov.uk.
- The SMIS administrator, for support in using the system and queries on the data. Contact by email on SMIS@highways.gsi.gov.uk.

Progress Reporting

Several reports are available. They can be accessed using the NSP Reports icon, which is found by clicking on the Programmes menu.

- **Structures by Stage Report.** This shows a summary snapshot, giving the numbers of structures that are currently in each stage of the programme. Currently, only stage one is defined in SMIS. Stage 2 (a future management strategy may be issued if required at a later date). A further breakdown of each activity in each stage is given in the Current Progression Report.

- **Current Progression Report.** This gives a detailed view, showing the current position of structures for each activity in the programme. It shows the current position for those activities that are not completed.

- **Programme Activity Report.** This shows a history of activities that have been assigned to structures, whether currently outstanding or completed. It shows the dates of when each activity was 'created' in the system and when it was completed.

- **Structures Added Report.** This shows the pattern of how structures have been added to the programme over time.

Reviewing Outstanding Activities

Use the Activity Find screen to produce a list of structures in the programme. The screen can also list the status of structures for specific activities (as per the flowchart in Annex A). This is described in the online help, in section Activities. If you have an MA/MAC user profile, then the listing will be restricted to structures in your area.

Update and input of data for these activities is done through a screen for that specific type of activity. E.g. the Inspection Schedule Find screen has the appropriate buttons for scheduling, inputting and authorising inspection findings. The appropriate screen to use is given with the descriptions for each activity below.

Note: some find screens return a maximum of 100 lines. When this happens, either use the Excel button on the screen to view the entire list, or refine your filter settings to show the information you are interested in.

Adding / Removing Structures in the Programme

You are asked to verify the list of structures as correct. To add or remove structures from this list, contact the SMIS Administrator, by email on SMIS@Highways.gsi.gov.uk. An email reply will inform you when the structures have been added or removed.

F.3 IMPLEMENTATION

At the time of issue of this document, a number of structures are already some way into the Half joint Deck programme. These structures require data to be input to SMIS retrospectively.

A suggested approach is to identify where the structure best sits in the flowchart in Annex A. Then identify relevant inspection findings etc that best support each of the previous activities, and input the data as outlined in D.4 below.

Where there is no known information for an activity, then input the appropriate details for the activity with a comment that there is no known information. The next activity will then be scheduled. Call your HA TAG office for advice if necessary.

F.4 USING SMIS FOR EACH ACTIVITY

This section looks in turn at each activity in the flowchart in Annex A.

SMIS Activity 1.1: Initial Visual Inspection

This inspection results in an initial visual evaluation of the condition of the half joints on the bridge. In addition, details of the half joints are input to SMIS and the overall priority of the structure within the half joint deck programme is set.

What you need to do	How to do it	Where to find help
Locate the structure requiring this activity (if the structure key is not known)	• Open the Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.1" and NSP as "Half joint Deck Stage 1 programme". • The structure(s) should be listed.	Online Guide, section Activities, topic Activity Find.
Locate the structure and activity in SMIS	• Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key and click find and the structure should be listed. (If it does not appear, try again with the years in the date fields set to blank.) • Click on the appropriate inspection line. • Click on the SMIS Insp button and the Enter Observations / Defects screen appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Input inspection details	• Input inspection details in the top area of the screen and click save.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Input half joint deck details	• Half joint deck details need to be input before any defects can be assigned to them. • Click the Go to Inventory button, and the inventory screen will appear. • Rename components to correct names if appropriate. • Add half joint deck components to the relevant decks. • Click the Save button after inputting details.	Online Guide, section Maintaining Structures Inventory, topic New/Edit Component.
Input observations / defects	• Input any observations / defects specifically relating to half joint decks. • Assign the observations / defects to the appropriate components. • Other defects from previous inspections may be carried forward to this inspection. Only Click the confirmed check-box if you are confirming / updating the severity and extent for those defects. • Click the Close button when finished. • On the Inspection Schedule Find screen, click the Complete button, so the inspection is ready to be authorised.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Authorise the inspection	• A person with access rights to authorise inspection will need to do this. • Locate the structure in using the Inspection Schedule Find screen, as described above. • Click the Authorise button. • The next activity will be created for the structure.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Set the priority	• Open the Programme Find screen, the icon for this is found in the 'Programmes Menu' • Set the Programme Name filter to "half joint" and click find. • The half joint deck programme should be listed and highlighted in blue. Click the Structure Ranking button and the Structure Ranking List screen will be	Annex E. Online Guide, section Progressing and Tracking an NSP, topic Structure Ranking List.

What you need to do	How to do it	Where to find help
	displayed. • Find the appropriate structure, and key in the priority. • Click the Save Structure Ranking button. (If not done so, your input will be lost.) • Click the close button on the Structure Ranking List screen, and then on the Programme Find screen.	

Continue at activity 1.2.

SMIS Activity 1.2: Detailed Inspection

This Inspection is to determine the condition of the half joint ~~crack width and extent of seepage.~~
The target date for this may depend on the priority set and other access opportunities, and the agent may prefer to set an appropriate target date to assist with inspection planning. (See the Online Guide, section Inspection Menu, topic Set Target Date.)

What you need to do	How to do it	Where to find help
Locate the structure requiring this activity (if the structure key is not known)	• Open the Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.2" and NSP as "Half joint Deck Stage 1 programme". • The structure(s) should be listed.	Online Guide, section Activities, topic Activity Find.
Locate the structure and activity in SMIS	• Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key and click find and the structure should be listed. • Click on the appropriate inspection line. • Click on the SMIS Insp button and the Enter Observations / Defects screen appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Input inspection details	• Input inspection details in the top area of the screen and click save. • Add or update observations as appropriate for the condition ~~crack width and seepage (note measurements may be recorded in the comments field).~~ • Other defects from previous inspections may be carried forward to this inspection. Only Click the confirmed check-box if you are confirming / updating the severity and extent for those defects. • Click the Close button when finished. • On the Inspection Schedule Find screen, click the Complete button, so the inspection is ready to be authorised.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Authorise the inspection	• A person with access rights to authorise inspection will need to do this. • Locate the structure in using the Inspection Schedule Find screen, as described above. • Click the Authorise button.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Choose the branch in the flowchart	• As the activity is set to complete, you will be asked which activity is to follow. • Select step 1.3 or 2.1 as appropriate. • DO NOT select both steps. • The next activity will be created for the structure.	Online Guide, section Progressing and Tracking an NSP, topic Choose Next Activities. (Note an incorrect choice can be corrected – see Online Guide, section Activities *before* proceeding further.)

If activity 1.3 was selected, then continue with activity 1.3 below.
If activity 2.1 was selected, then no further action is required until the future management strategy is issued.

SMIS Activity 1.3: Invasive Testing

Testing and concrete sampling results are input to SMIS as observations, and input in the form of an inspection. Again, the target date for this may depend on the priority set and other access opportunities, and the agent may prefer to set an appropriate target date.

What you need to do	How to do it	Where to find help
Locate the structure requiring this activity (if the structure key is not known)	• Open the Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.3" and NSP as "Half joint Deck Stage 1 programme". • The structure(s) should be listed.	Online Guide, section Activities, topic Activity Find.
Locate the structure and activity in SMIS	• Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key and click find and the structure should be listed. • Click on the appropriate inspection line. • Click on the SMIS Insp button and the Enter Observations / Defects screen appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Input inspection details	• Input inspection details in the top area of the screen and click save. • Add or update observations as appropriate for the testing (use the comments field to record salient facts). • Click the Close button when finished. • On the Inspection Schedule Find screen, click the Complete button, so the inspection is ready to be authorised.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Authorise the inspection	• A person with access rights to authorise inspection will need to do this. • Locate the structure in using the Inspection Schedule Find screen, as described above. • Click the Authorise button. • The next activity will be created for the structure	Online Guide, section Inspection Menu, topic Inspection Schedule Find.

Continue at activity 1.4.

SMIS Activity 1.4: Interim Appraisal

An interim appraisal assessment is to consider risks and recommendations for further work.

What you need to do	How to do it	Where to find help
Locate the structure and activity in SMIS	• Open the Appraisal Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.4"; NSP as "Half joint Deck Stage 1 programme" and structure key if known. • The activity for the structure(s) should appear.	Online Guide, section Appraisals, topic Appraisal Activity Find.
Input general details of the assessment	• Select the activity click the Edit button. The appraisal screen should appear. • Read the guidance. • Input your name, the date and the appraisal result. • Click Save and then the Close buttons.	Online Guide, section Appraisals, topic Edit Activity.
Complete the assessment input	• Click Save and then the Close buttons.	Online Guide, section Appraisals, topic Edit Activity.
Choose the branch in the flowchart	• As the activity is set to complete, you will be asked which step to follow. • The activities to select depend on the result that has been input. Follow the activity selection table below. • The next activities will be created for the structure.	Online Guide, section Progressing and Tracking an NSP, topic Choose Next Activities. (Note an incorrect choice can be corrected – see Online Guide, section Activities *before* proceeding further.)
Set the target date for the first monitoring inspection	If 1.6 was selected, the target date for the first monitoring inspection will need to be set as follows: • Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key and click find and the structure should be listed. • Click on the appropriate inspection line. • Click on the Target Date button and the Enter the Target Date for the 1st monitoring inspection in the screen that appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.

Activity selection table

Result		Activities to select		
		1.5 (testing)	1.6 (monitoring)	1.7 (interim measures)
Monitoring	either	-	yes	-
	or	Yes	yes	-
	or	-	yes	yes
Further Investigation		Yes	-	-
Interim Measures		-	-	yes

Note, activities 1.5 and 1.7 **must not** be selected at the same time.

Continue with activities 1.5, 1.6 or 1.7 as appropriate.

SMIS Activity 1.5: Further Invasive Testing

This records further invasive testing that is conducted as necessary, or as an opportunity arises.

What you need to do	How to do it	Where to find help
Locate the structure requiring this activity (if the structure key is not known)	• Open the Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.5" and NSP as "Half joint Deck Stage 1 programme". • The structure(s) should be listed.	Online Guide, section Activities, topic Activity Find.
Locate the structure and activity in SMIS	• Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key and click find and the structure should be listed. • Click on the appropriate inspection line. • Click on the SMIS Insp button and the Enter Observations / Defects screen appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Input inspection details	• Input inspection details in the top area of the screen and click save. • Add or update observations as appropriate for the testing (use the comments field to record salient facts). • Click the Close button when finished. • On the Inspection Schedule Find screen, click the Complete button, so the inspection is ready to be authorised.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Authorise the inspection	• A person with access rights to authorise inspection will need to do this. • Locate the structure in using the Inspection Schedule Find screen, as described above. • Click the Authorise button. • The next activity (1.4) will be created for the structure	Online Guide, section Inspection Menu, topic Inspection Schedule Find.

Continue with activity 1.4.

SMIS Activity 1.6: Monitoring

If periodic monitoring and inspections are required, a record of each monitoring "visit" or inspection is recorded in SMIS.

What you need to do	How to do it	Where to find help
Locate the structure and activity in SMIS	• Open the Inspection Schedule Find screen, the icon for this is found in the 'Inspection Menu' • Input the structure key (if known), and/ or Inspection Type of Monitoring. Click find and the structure should be listed. • Click on the appropriate inspection line. • Click on the SMIS Insp button and the Enter Observations / Defects screen appears.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Input inspection details	• Input inspection details in the top area of the screen and click save. • Add or update observations as appropriate for the observation / defect being monitored (note measurements may be recorded in the comments field). • Click the Close button when finished. • On the Inspection Schedule Find screen, click the Complete button, so the inspection is ready to be authorised.	Online Guide, section Inspection Menu, topic Edit Observations / Defects.
Authorise the inspection	• A person with access rights to authorise inspection will need to do this. • Locate the structure in using the Inspection Schedule Find screen, as described above. • Click the Authorise button.	Online Guide, section Inspection Menu, topic Inspection Schedule Find.
Set the target date for the next monitoring inspection	• The Schedule Monitoring window will appear, complete the details and press the Save or End Monitoring buttons as appropriate.	Online Guide, section Monitoring, topic Schedule Monitoring.
Choose the branch in the flowchart	• The Choose next Activity window will now appear. • If the Save was clicked on the previous window, a further monitoring inspection will have been scheduled. In this case, select option 1.4 if the monitoring has resulted in further consideration being needed. DO NOT select 2.3. • If the End Monitoring was clicked on the previous window, no further monitoring inspection will have been scheduled. In this case, select option 1.4 or 2.3 as appropriate. DO NOT select both steps. • The next activity will be created for the structure.	Online Guide, section Progressing and Tracking an NSP, topic Choose Next Activities. (Note an incorrect choice can be corrected – see Online Guide, section Activities *before* proceeding further.)

Continue with further monitoring (activity 1.6) and/ or a further interim appraisal (activity 1.4) as appropriate.
If activity 2.3 was selected, then no further action is required until the future management strategy is issued.

SMIS Activity 1.7: Interim Measure Appraisal

When the assessment reveals a deficiency, recommended interim measures and/ or maintenance actions (i.e. works) are input to SMIS. An appraisal activity is used to record this.

What you need to do	How to do it	Where to find help
Locate the structure and activity in SMIS	• Open the Appraisal Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.7"; NSP as "Half joint Deck Stage 1 programme" and structure key if known. • The activity for the structure(s) should appear.	Online Guide, section Appraisals, topic Appraisal Activity Find.
Input general details of the appraisal	• Select the activity click the Edit button. The appraisal screen should appear. • Read the guidance. • Input your name, the date and the appraisal result. • Click Save and then the Close buttons.	Online Guide, section Appraisals, topic Edit Activity.
Input a maintenance action	If a maintenance action is to be added then: • Click the Inventory button, and the inventory screen will appear. • Click the defects tab at the bottom left of the screen, and the defects / maintenance action summary will be displayed. • Click the Add button in the maintenance action part of the screen, and the New Maintenance Action screen will appear. • Input the fields as appropriate. Note that Origin of Work should be set to Half joint Deck Stage 1, and the Activity as this one (1.7). • When complete, click the Save and then the Close buttons.	Online Guide, section Maintenance Actions & Projects, topic New/Edit Maintenance Action.
Complete the appraisal input	• Click Save and then the Close buttons.	Online Guide, section Appraisals, topic Edit Activity.
Complete the activity	• On the Appraisal Activity Find screen, click Complete. • The next activity step will be created for the structure.	Online Guide, section Appraisals, topic Edit Activity.

Continue with activity 1.8.

SMIS Activity 1.8: Confirm Interim Measure is Implemented

This is to confirm that an interim measure or maintenance action has been implemented. There may be instances were an interim measure is put in place until the maintenance action is complete. In such cases, the interim measure being implemented is recorded against this activity.

What you need to do	How to do it	Where to find help
Locate the structure requiring this activity (if the structure key is not known)	• Open the Activity Find screen, the icon for this is found in the 'Main Menu' • Set the filter to activity name to "1.8" and NSP as "Half joint Deck Stage 1 programme". • The structure(s) should be listed.	Online Guide, section Activities, topic Activity Find.
Locate the structure	• Open the Structure Find screen, the icon for this is found in the 'Main Menu' • Input the structure key and click find and the structure should be listed. • Click Inventory and the structure details should be shown.	Online Guide, section Maintaining Structures Inventory, topic Structure Find.
Confirm an interim measure or maintenance action has been implemented	• Click Open Event and the New Event window will appear. • Complete the fields in the window and be sure to check the '1.8' activity in the list at the bottom. • Then click Open New Event.	Online Guide, section Maintaining Structures Inventory, topic New Event.
Input an interim measure	If an interim measure has been implemented: • Click the appropriate part of the component hierarchy of where the interim measure has been put in place (e.g. bridge, span or structural joint). • Click the Add button and select an interim measure. • Complete the details for the interim measure and then click the Save button.	Online Guide, section Maintaining Structures Inventory, topic New/Edit Component.
Reviewing interim measures	• The agent is to ensure that interim measures are reviewed and updated in SMIS when they have exceeded their expected end date.	The Main Menu, icon Interim Measures Find allows interim measures that have expired to be located. Set the End Date, To field to today and click the Find button.
Complete the activity	• Click Close Event. The system will validate and save your updates. (Note the checking the 1.8 activity on the Open Event is an update that is saved at this point.)	Online Guide, section Maintaining Structures Inventory, topic Inventory – Event Status Open.
Complete a maintenance action	If a maintenance action has been completed: • Open the Project Find screen, the icon for this is found in the 'Projects Menu' • Find and select the appropriate project using this screen, and click the Open button. (If the project name is not known, this can be found in the inventory details for the structure as described above, and clicking on the Projects item, when all projects associated with the structure will be listed.) • Click the Set as Complete button. • Confirm which maintenance actions in the project have been completed and click the Close button.	Online Guide, section Link to HAMIS for Bidding and Doing Works, topic Complete Project.

No further activity related input is required until the future management strategy is issued.
However monitoring (activity 1.6) continues if applicable, and maintenance actions are set as completed as and when projects are completed.