

HEALTH & SAFETY FILE

Operation & Maintenance

Foot / Cycle Bridge over A379
Apple Lane to Sandy Park
Exeter

Produced by:
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Section One

THE PROJECT

INTRODUCTION

1. The contents of this Health & Safety File deal specifically with those works and only those works carried out under the contract scheme.
2. The principal contractor undertaking the works has been Dean & Dyball Construction Limited.
3. The following publications have been considered in selecting material for this file.
 - Construction (Design and Management) Regulations 1994 Approved Code of Practice L54
 - A Guide to Managing Health & Safety in Construction, HSE Books 1995
 - Guide to Designing for Health & Safety in Construction.
4. The content of the File is specified in CDM Regulation 14 (d to f) and its purpose can be inferred from item (e) as to provide appropriate information to ensure the safety of all those engaged in constructions or cleaning work (as defined in Regulation 2) or any person who may be affected by that work. Contributions have come from designers and contractors with the intention that any such feature of the structure which will involve significant risks to health and safety during the structure's lifetime, has been included in the File.
5. It is important that the limited purpose of the information requirements are fully understood. CDM Regulation 13 (2) (b), specified in Regulation 14 (d), only requires designers to provide information about aspects of the project, structure or materials and NOT about how to safely carry out ANY construction work. Thus this File is not intended as a handbook of construction work. It is a site specific guide to alert those who are expected to carry out such work and provide them with information on the risks inherent in the design which they cannot reasonably be expected to know.
6. The Client must be aware of his duty under Regulation 12 to ensure that the information within the File is available for inspection by any person who may need it. Should the Client dispose of his interest in the property he must deliver the File to the person who acquires his interest and ensure such person is aware of the nature and purpose of the File.

BRIEF DESCRIPTION OF PROJECT

This project consists of the construction of a non-segregated footpath and cycleway from the Apple Lane footpath to Old Rydon Lane.

A 108.5m long asymmetric cable stay bridge has been provided to cross the A379 dual carriageway.

PROJECT DATES

- Project commencement date: 7 November 2005
- Project completion date: 15 September 2006

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Section Two

THE DESIGN

Pre-Construction Health & Safety Plan

PRE-CONSTRUCTION PHASE HEALTH AND SAFETY PLAN

EXETER RUGBY GROUP

STADIUM CONSTRUCTION

SEPTEMBER 2005

EXETER RUGBY GROUP – SANDY PARK FARM
PRE-CONSTRUCTION PHASE HEALTH AND SAFETY PLAN
STADIUM WORKS

Prepared by: [REDACTED] (Emailed).....
Principal Engineer

Approved by: [REDACTED] (Emailed)
Associate Director
SW Health and Safety

Rev No	Comments	Date
1	General Update and reference to named contractor removed	6 Sept 2005
2	General Update and reference to named contractor	1 Nov 2005

Job No: 41538WXY
Reference: TDG
Date created: April 2005

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Introduction

This Pre-Construction Health and Safety Plan has been prepared in accordance with the Construction (Design and Management) Regulations 1994.

The Pre-Construction Health and Safety Plan provides the basis from which the Principal Contractor will prepare the Construction Phase Health and Safety Plan, developing the issues raised to the extent, that, so far as reasonably practicable, employees working on the site, visitors or any person who may be affected by the works are protected against injury and risks to their health.

The Construction Phase Health and Safety Plan must be sufficiently developed to the satisfaction of the Client prior to commencement of construction works.

As collator of relevant information provided by the Client and the Design Team, FaberMaunsell as Planning Supervisor:

Do not accept any responsibility for the accuracy of the documents provided by others.

Do not have any liability or responsibility for the design of the project or the specification or choice of materials or methods of construction used in the construction of the project.

The Health and Safety File will be provided to the Client at the issue of the Certificate of Practical Completion for the benefit of themselves, future owners and occupiers, and any parties required to make use of the knowledge gained in the development of the project.

1 DESCRIPTION OF THE PROJECT



1. Description of the Project

1.1. Description of the Project

The proposed scheme comprises a new Rugby Stadium and training pitches for the Exeter Rugby Club. The work involves the construction of piled foundations, ground beams and ground floor slab, erection of a steel frame with pre-cast terracing units together with the erection of steel, masonry, rainscreen cladding and rendered exterior finishes. The project also includes provision for mechanical and electrical services for the internal building facilities and the whole site.

The work also includes the construction of a new access from the service road constructed under the enabling works contract, the construction of a main pitch, second pitch and a level training area to the north of the main pitch. The main stadium foul drainage will be connected to an on site foul pumping station, which convey flows to the public foul sewer located in Old Rydon Lane. The surface water will connect to an on-site sustainable urban drainage system, which drains to underground attenuation tanks feeding deep boreholes.

There are also several ancillary elements on the site including provision for portable toilet blocks, control box, garage storage and scoreboard.

A combined pedestrian footbridge/ cycleway will be constructed over both carriageways of the A379 as part of the stadium works contract. The proposed bridge scheme has only recently achieved planning approval and site topographical survey and geotechnical investigation works are due to be undertaken now that access has been granted to third party land. It is intended that this element of the scheme will be included as a further revision of this Health and Safety Plan as the design is developed by the Principal Contractor's Designer.

During the construction of the Rugby Club Stadium and adjacent to the site boundary, it is likely that a separately managed project to construct a new David Lloyd Tennis Centre (DLTC) will also be under construction at the same time as the stadium work.

1.2. Location of Site

The site is located on the land situated between the M5 motorway and the A379 trunk road into Exeter. Access is currently via an existing entrance from Old Rydon Lane serving Sandy Park Farm. The enabling works to create a site with level plateaus to enable the construction of various buildings and pitches on the site are currently near completion. The enabling works is programmed to be completed by early November 2005 and access onto the stadium site is due to be permitted in early November 2005.

1.3. Approximate Programme

Construction Start	:	7 November 2005 (anticipated)
Duration	:	45 weeks
Construction Completion	:	11 September 2006
Phased / Sectional Completion	:	To be advised

1.4. F10 Notification

The Initial notification for the enabling works project was issued to the HSE on 1 March 2005. An Additional Notification will be issued when further details of the project are finalised.

1.5. Project Directory

1.5.1. The Client

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2 CLIENT'S CONSIDERATIONS AND MANAGEMENT REQUIREMENTS



2. Client's Considerations and Management Requirements

2.1. Details of the Structure and Organisation of the Client's Team for the project

Client	Exeter Rugby Group
The Design Team	Faber Maunsell : Civil/Infrastructure, Structural, Mechanical and Electrical Services and Bridge Engineering Consultants (Checking Consultants – TBA)
	Kensington Taylor - Project Architect
Lead Consultant	Faber Maunsell
Planning Supervisor	Faber Maunsell
Principal Contractor	Dean and Dyball

2.2. Safety Goals and arrangements for monitoring and review

The Client is keen to minimise the occurrence of health and safety incidents on the site. It will be necessary for the Principal Contractor to undertake safety monitoring of the site and the provision of information on monitoring e.g. by the use of external consultants or submission of Contractor's safety reports at site meetings.

2.3. Management Requirements

None identified.

2.3.1. Permits and authorisation procedures

None identified.

2.3.2. Emergency procedures

Site emergency procedures are to be established on the site. The Stadium Contractor is to ensure that daily co-ordination meetings with the Project Managers of adjacent construction projects are held to ensure that each Contractor is aware of the construction activities of the other. It will be incumbent on both Contractors to liaise with one another regarding the implementation of emergency procedures for the Stadium and the DLTC sites.

2.3.3. Site rules and other restrictions on contractors, suppliers and others (interaction with client operatives or operations on the site)

The Principal Contractor shall incorporate these rules into his Health and Safety Plan. These and any additional site rules implemented by the Principal Contractor should be displayed prominently on the site and brought to the attention of all persons working on the project and strictly enforced.

- (1) The Site is to be a hard-hat area and safety helmets must be worn by **everyone at all times** unless specifically agreed in writing with the Principal Contractor for particular activities.
- (2) Safety footwear must be worn by all persons whilst on site, unless specifically agreed in writing by the Principal Contractor for particular activities.
- (3) No alcohol or drugs (unless prescribed) are to be allowed on site.

Any persons considered to be under the influence of drugs or alcohol on arrival must not be permitted on site.
- (4) The site is to be kept clear of rubbish, which is to be stored in designated areas.

- (5) Materials are to be stored in designated areas only.
- (6) Any opening or hole through which people could fall or trip must be securely covered or guarded.
- (7) Smoking on site will not be permitted except in designated safe areas.
- (8) Radios, CD players and the like will not be permitted.

2.3.4. Activities on or adjacent to the site during the works

The site is adjacent to a turf-growing establishment and tenants occupy the farm buildings located on the edge of the site adjacent to the proposed coach parking area. During the construction of the stadium project, the DLTC will also be under construction on an adjacent site. As such there are areas of the site where there will be shared access rights. The paved access between the Tennis Centre and the stadium retaining wall is one of the areas identified.

2.3.5. Arrangements for liaison between parties

Health and Safety liaison on site is to be through the Site Manager.

2.3.6. Security arrangements

The contractor is to provide a secure compound around the excavation works and any storage or Contractor's compound.

2.3.7. Client enforced site rules

All visitors to the Site are to report to the site office.

2.4. Provision and management of site facilities

It is the Principal Contractor's responsibility to ensure that adequate provision is made on site for all the facilities necessary for the safe execution of the works. Proposals should be included in the Principal Contractors Health and Safety Plan for the provision of all the necessary facilities and their management.

In addition to the items noted in Appendix A of this plan the Health and Safety Plan should also include but not be limited to:

- Signage
- Site security, isolation provisions and lighting. **Reasonable measures must be taken to ensure no unauthorised persons enter the work area – Regulation 16(1)(c).**
- Site accommodation and welfare facilities. All welfare facilities must be in accordance with **The Construction (Health, Safety and Welfare) Regulations 1996.**
- Fire precautions
- Emergency procedures

2.5. Traffic Systems and Restrictions

The Principal Contractor shall at all times ensure that the carrying out of the Works does not impede public, staff and/or private rights of way across or around any adjoining premises, property or the public highway.

The Principal Contractor shall conform to the further requests of the Client in respect of vehicular movements, delivery of materials, access and escape routes, health and safety matters and response to fire or other emergency alarms.

It is a requirement of the Planning Conditions to restrict the Contractor vehicle movements in Old Rydon Lane. **Access to the site will be via the new link road from the A379.**

2.6. Restrictions on Noise, Vibration and other Environmental Issues

The Principal Contractor is expected to use his best endeavours to limit the amount of noise and dust emanating from his works.

Vibration, noise and dust pollution must be kept to a minimum taking into account the residential properties nearby. All reasonable steps must be taken to reduce noise and dust pollution to levels acceptable to the Local Authority Environmental Health Department under the Environmental Protection Act 1990. e.g. by noise attenuation measures if necessary, noise monitoring etc.

Any restrictions regarding working hours and noise levels that are stipulated by the Local Authority and/or Planning Conditions must be adhered to at all times.

3 ENVIRONMENTAL RESTRICTIONS AND EXISTING ON-SITE RISKS



3. Environmental Restrictions and Existing On-Site Risks

3.1. Safety Hazards

The safety hazards relevant to this project are detailed below.

3.1.1. Boundaries and access, including temporary access

Entry to the site will be from the new access road from the A379 and each Contractor on the site shall liaise with the Principal Contractor to manage the shared access to the site for deliveries, staff, workers and site visitors.

3.1.2. Adjacent land uses

There is a turf growing establishment to the west of the site. A small caravan park and several tenant occupied properties are also located near to the site, adjacent to the proposed coach park area.

3.1.3. Existing storage of hazardous materials

During the course of the enabling works contract, areas of fly tipping were encountered. The material in one of the areas in the north slope between the main and artificial pitches was found to be contaminated with blue, brown and white asbestos bound in a cement material. The strategy for this contaminated material is to leave the material in-situ, being capped off and sealed with a layer suitable material. A risk assessment has been produced, which has been approved by the Environment Agency.

An additional area of fly tipping has been discovered at the northern end of the proposed artificial pitch. The strategy is to leave the material in place and provide a gabion wall and seal the top of the contaminated material with suitable material. A risk assessment has been produced, which has been approved by the Environment Agency.

3.1.4. Location of existing services – water, electricity, gas etc

The location and status of any buried on and off site services laid as part of the enabling work are indicated on the combined services drawing number 40671/WXB/ME101 and drainage drawing 40671/ITK/120 produced for the enabling works project. Note these drawing are based on the last construction issue. The location and status of existing overhead and buried services are also shown on this drawing.

3.1.5. Ground conditions

A ground investigation has been carried out, covering both the David Lloyd Tennis Centre and the Rugby Club Stadium sites. See Faber Maunsell Site Investigation Report dated January 2005 and subsequent report produced for the various incidences of contamination discovery. See Appendix C.

3.1.6. Existing structures – stability, or fragile materials

The enabling works project includes the construction of a reinforced concrete retaining wall adjacent to the DLTC and the Stadium. A length of this wall is to be used to support the steelwork for an undercroft structure linking the first floor of the Stadium to the raised roadway situated between the tennis centre and the Stadium.

3.1.7. Anti-social behaviour

It is anticipated that the area may be attractive for off road cyclist and skateboards users. Although there is limited evidence of this type of activity occurring during the enabling works.

3.1.8. Interface safety hazards

The Stadium will be constructed simultaneously with the DLTC and will overlap with some elements of the enabling works which have not been completed and as a consequence it will be necessary to

ensure that co-ordination between all Contractors on the site is established with agreed reporting and liaison procedures.

3.2. Health Hazards

The health hazards relevant to this project are detailed below. Appendices B and C include the design hazard identification sheets and information on significant risks.

3.2.1. Asbestos, including details of surveys and management plans

During the course of the enabling works contract areas of fly tipping was encountered, in which material contaminated with blue, brown and white bound asbestos cement material and hydrocarbons was uncovered. Agreement has been reached with the Environment Agency to leave the fly tip material in-situ in the area to the north of the artificial pitch and also in the north bank of the main pitch. Risk assessment have been produced and agreed with the EA and Environmental Health. (See Appendix C)

3.2.2. Existing storage of hazardous materials

The initial geotechnical investigations and evidence encountered during the onsite excavation works under the enabling works package has identified that a large area to the north of the site has been previously used as a tip. Several areas of contamination have been identified during the course of the works and the strategy to deal with the material encountered has been developed in conjunction with the appropriate authorities. However, further areas not currently identified may exist within the site.

3.2.3. Contaminated land, including details of environmental investigations

Contaminated land has been encountered on the site throughout the course of the enabling works Contract and several strategies for dealing with the material have been developed and as noted above.

3.2.4. Existing structures including hazardous materials

None are present on the site.

3.3. Environmental Considerations

FaberMaunsell are externally accredited to ISO 14001: 1996, a requirement of which is that we raise awareness of and try to influence the impact of environmental issues wherever possible. We have therefore included below examples of some Environmental matters that may be considered for this project:

3.3.1. Emissions to Air

Ozone depletion from refrigerants and insulants (*global impact*)
 NO_x emissions from burners e.g. temporary heaters (*global – leading to acid rain*)
 Indoor environment (*local*)
 Release of hazardous materials to air (*global and local*)
 Emissions from vehicles (*local*)
 Epoxy resin (*local*)

3.3.2. Releases to water

Contamination of ground water e.g. diesel spillages, site surface water run-off (*global and local*)
 Contamination of surface water e.g. diesel spillages site surface water run-off (*global and local*)
 Discharges to controlled waters and sewers e.g. diesel spillages (*global and local*)

3.3.3. Waste Management

Impacts associated with waste disposal – land use, transport etc (*global and local*)

3.3.4. Contamination of land (global and local)

Chemical e.g. diesel or other hydro carbon spillage etc

3.3.5. Use of Raw Materials

Transport of road stone, bitumen, concrete etc (*local*)
 Recycled materials (*local*)

3.3.6. Local Environmental and Community Issues

Nuisance to neighbours (*local impact*) e.g.

Noise
 Vibration
 Dust
 Light and other Visual Intrusion
 Transport/Traffic Management
 Footpaths/Designated Rights of Way
 Degradation of Habitats and biodiversity
 Other
 Effect on Local Ecology (*Global and Local*)

3.3.7. Ecology

Flora (*e.g. hedgerow removal, mature trees*)
 Fauna (*nesting birds, protected species*)
 Site of Special Scientific Interest (SSSI)
 Historical Site

4 SIGNIFICANT DESIGN AND CONSTRUCTION HAZARDS



4. Significant Design and Construction Hazards

4.1. Foreseeable Risks

The following hazards cannot be avoided and may involve a risk to the health and safety of those carrying out construction activities and others who may be affected by such activities. These hazards must be covered in detail in the Health and Safety Plan produced by the Principal Contractor. These hazards are in addition to any other activity, of which the Principal Contractor is aware and that involves more than an insignificant risk to health and safety.

4.1.1. General Health and Safety Hazards

The construction work is to be carried out on a “developed site” and there is the potential for conflict in the area between the construction operations and local residents on Sandy Park Farm and Old Rydon Lane.

The following list of health and safety risks, have been identified by the Design Team and the Planning Supervisor. Refer to Designer Risk Assessments and design review documents in Appendix B

4.1.2. Architectural Hazards

- Site Access and conflict with moving vehicles. See Section 3.1.1. The Principal Contractor shall liaise and co-ordinate with other Contractor working on adjacent sites.
- Unauthorised access onto site. The Principal Contractor will need to establish site wide or discrete hazard security areas to prevent unauthorised access in areas of construction activity.
- Emergency evacuation procedures – During the stadium construction the Principal Contractor will make due consideration for the establishment of a fire/evacuation procedure to account for the compartmentalisation of the building.
- Residual ground contamination – Enabling works Contract is dealing with on site. The fly tip area to north of the stadium construction contains hydrocarbon and asbestos (Blue, Brown and White asbestos cement bound material) contamination. PCB contamination has been encountered in the north bank adjacent to the main pitch.
- Live services – Both new and existing (recently laid) services are to be identified by the Enabling works Contractor.
- Falls from height – significant risks from working on undercroft, 1st and 2nd floors and roof. Until the undercroft steelwork is erected there will be a period of time where there is no provision for flooring between the undercroft and the retaining wall.
- Falling Objects - significant risks from working on undercroft, 1st and 2nd floors, roof

4.1.3. Structural Hazards

- Structural Stability – The stability of the roof structure is reliant upon the dead load of the first and second floor planks.
- Access onto Steelwork Frame – Permanent staircases to be fully installed to provide means of access on to building floors.
- Stability of steel frame – steelwork erection sequence to commence from stair cores (see Design Intent Summary Sheets in Appendix B).
- Collapse from temporary instability and structural loadings

- Large structural components – steel beams, steel columns, precast flooring and terracing units.

4.1.4. Mechanical and Electrical Hazards

- Manual handling of Sub-Station Transformer into pre-constructed space.
- Construction and installation of flood light columns - Falling columns.
- Installation of pipework, ductwork, cooling plant, testing & commissioning - Working on open Roof Area. A suitable number of barriers of sufficient type are to be installed to prevent access onto areas of the roof. Unauthorised access is to be prevented at all times.
- Installation of pipework, ductwork, cooling plant, testing & commissioning - Refrigerant Leakage.

4.1.5. Civil Engineering and Geotechnical Hazards

- Flooding and ground water hazards.
- Contaminated Land – areas of known hydrocarbon and other hazardous contamination are present on the site in specific areas. See Contamination strategy risk assessments in Appendix
- Contaminated Land – presence of unknown contamination (site previously a tip site) in the area of the artificial pitch. Contamination is located at a depth of approximately 500mm below the ground surface.
- Ground stability of open cut and trenches – some excavation could collapse in some areas of the site (See Geotechnical Investigation Report).
- Potential build – up of fumes from hydrocarbon contamination in trenches and excavations.

5 THE HEALTH & SAFETY FILE



5. The Health and Safety File

The Health and Safety File shall be a project specific document containing all necessary information to enable correct maintenance procedures to be followed and future modification or demolition of the structure undertaken safely.

The scope of the Health and Safety File will be restricted to the work undertaken within the defined area of the project and any services serving the area.

5.1. Format and Content

The Health and Safety File shall include as appropriate, but not limited to, items detailed:

5.1.1. Record Drawings

The Health and Safety File should include a comprehensive compilation of record drawings from the Design Team, Contractors and any others with a design input relevant to the project with health and safety implications.

5.1.2. Existing Details

- Architectural, structural and services record drawings
- Site survey drawings showing levels and relevant local authority records
- Services drawings – Gas, Electricity, Water, Drainage, Telecommunications etc.

5.1.3. As Built/As Installed Details

- Architectural – all general arrangement drawings
- Structural – all general arrangement drawings and relevant Contractor or Specialist Contractor drawings
- Engineering Services – Contractors as fitted drawings showing any new or additional services
- Principal Contractor's design package information – in particular where the Principal Contractor has had a major input to the design process
- Contractor's Design – all subcontracts or specialist equipment suppliers (*lifts, escalators, cleaning gantries, piling, roof glazing etc*).

A master list of all existing and construction drawings, schedules etc. produced by the Client, Designers and Principal Contractor, along with names, address and telephone numbers of the relevant parties shall be included as an index to the above section.

5.1.4. Documentation

Certificates including:

- Planning Permission
- Building Warranties
- Fire Certificate
- Electrical Test Certificates
- Final Completion Certificate

Design Criteria/Specifications including:

- Description of building design
- Construction/Demolition Methodology
- List of materials used in construction
- List of any hazardous materials remaining on site and working practices associated with this material
- Structural design philosophy/loadings etc. Presence of prestressed concrete – prohibition in drilling, cutting or removal
- Specification for all specialist equipment supplied under the contract
- Building services design and safety requirements

Reports carried out as part of the design/construction phase of the works including:

- Archeological
- Site Survey
- Environmental Survey
- Structural Surveys
- Asbestos Reports

Maintenance Procedures:

- Structure of Building
- Life cycle maintenance of facilities
- Window Cleaning
- Strategy for cleaning of roof cladding from Architect and roof supplier
- Equipment Operation and Maintenance Manuals and Procedures
- Mechanical Equipment – Legionnaire Considerations
- Electrical Equipment
- Fire/Security Equipment
- Details of all maintenance procedures to be followed are to be included with planned maintenance schedules

Details of Emergency Systems

Include all details of emergency systems:

- Means of Escape
- Location of Call Points
- Location of Fighting Equipment – Hose Reels and Fire Extinguishers
- Location of Fire Alarms
- Location of Smoke Detectors

- Location of Dry/Wet Risers
- Location of Control Panels
- Fire Brigade Access, Turning Area
- Signage Drawing Attention to Any of the Above

The Health and Safety File should be handed over to the client at the issue of the Certificate of Practical Completion or within three weeks after this date.

6 MATERIALS



6. Materials

6.1. Materials

Certain construction materials used cannot be avoided and are potentially hazardous to health. Some construction activities create hazards to health by giving off dusts, vapours or fumes. Examples of the above include:

- welding/soldering fumes
- silica and quartz from concrete cutting, scrubbing, Terrazzo, etc
- isocyanates (eg varnishes, adhesives)
- solvents (eg paints, glues, lacquer)
- cement, plaster

Where such materials are to be used or specified where no alternative exists, then the risk must be assessed to determine any required action in accordance with the COSHH Regulations. The requirements of these regulations must then be adhered to and in particular, information, instruction and training of employees must be undertaken.

7 CONTINUING LIAISON



7. Continuing Liaison

7.1. Health and Safety Plan

The nature of the works are such that:

- 1) The Principal Contractor and other Contractors may not be able to complete fully the Construction Phase Health and Safety Plan prior to commencement of construction. However, the Principal Contractor should always provide a Health and Safety Plan for each element of the work before it commences;

Design changes may require the Construction Health and Safety Plan to be altered or amended;

The Principal Contractor will have directly, or indirectly through other Contractors, design responsibilities for certain elements of the project e.g. cold rolled steel work, hot rolled steelwork connections, piling, plunge pool design, precast staircases and terracing units, plant enclosure and combined pedestrian and cycleway bridge across the A379.

In any of the above the Principal Contractor should identify the procedure he will follow for updating the Construction Health and Safety Plan. As appropriate he should also provide information on designs to the Planning Supervisor so that compliance with the Construction (Design and Management) Regulations requirements can be monitored.

7.2. Health & Safety File

The Principal Contractor should indicate his procedures for providing information to the Planning Supervisor, which may require inclusion in the Health and Safety File.

7.3. Unplanned Events

The Principal Contractor shall inform the relevant authorities by telephone and subsequently confirm in writing to the Planning Supervisor on behalf of the Client any event resulting in:

- an incident requiring to be reported under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR);
- enforcement action by the Health and Safety Executive or any other body whether in relation to health and safety or otherwise;
- a major change of the design and/or to the resources required to complete the work.

7.4. Names of Principal Contractor, other Contractors and Nominated Suppliers with Design Input

The Principal Contractor shall add the names and details of all contractors with a design input to the Construction Phase Health and Safety Plan.

7.5. Procedures for Dealing with Design Changes/Unforeseen Eventualities During Construction

The following procedures must be observed where unforeseen eventualities during project execution result in substantial design changes, which might affect the allocation of health and safety resources.

- a) Any substantial design changes shall be examined by the Designers for health and safety implications using the same procedures described above.
- b) Details of proposed substantial design changes must be submitted to the Planning Supervisor to ensure compliance with the regulations.

- c) The Principal Contractor and, where applicable, the other Contractors, shall re-examine changes and implement all necessary Health and Safety measures to deal with those changes.
- d) Non-design generated works/site developments, which had not or could not have been envisaged, necessitating a revised approach, must be evaluated by the Designer(s) from a health and safety risk assessment before implementation.
- e) The Designer's resolution of any such unforeseen circumstances must be submitted to the Planning Supervisor to ensure compliance with the regulations before implementation.

APPENDIX A CONSTRUCTION PHASE AND SAFETY PLAN REQUIREMENTS



Appendix A – Construction Phase Health & Safety Plan Requirements

Construction Phase Health and Safety Plan Requirements

The Construction Phase Health & Safety Plan is required to be sufficiently developed by the Principal Contractor prior to the Construction Work commencing, and then, to be fully developed through the construction phase of the project, so that it:

- incorporates the approach to be adopted for managing health and safety by everyone involved in the construction phase;
- includes the assessments prepared by Contractors under the Management of Health and Safety at Work Regulations 1999 (see Regulation 19(1)(b)) and other legislation);
- incorporates the common arrangements (including emergency procedures and welfare); these may be imposed by the Client or developed by the Principal Contractor;
- includes arrangements for fulfilling the Principal Contractor's duties under Regulations 16 to 18;
- includes reasonable arrangements for monitoring compliance with health and safety law;
- Includes specific Information to ensure that all induction procedures cover in full the requirements set down in Paragraphs 204 and 205 of the CDM ACOP.
- includes, where appropriate, rules for the management of the work for health and safety; and
- can be modified as work proceeds according to experience and information received from the Contractors (Regulation 19(1)(b) and (e)).

The following sections give an outline/guidance on the elements, which are required to be developed by the Principal Contractor prior to commencement on site and during the construction phase. These are only indicative and the Principal Contractor may wish to use part of their own Safety Management System to develop the Health and Safety Plan.

Contents - Summary

1. Principles - Project Description, Objectives and Restrictions
2. Management Arrangements
3. Risk Assessment Procedures
4. Common Arrangements – Emergency
 - Welfare
 - Security
 - Site Rules
 - Reporting RIDDOR Information
 - Display Notification
5. Information and Training Procedures
6. Communication and Co-operation Procedures
7. Health and Safety File Information
8. Monitoring Arrangements

9. Contractor Selection Procedures

10. Project Review Procedures

Safe Systems of Work

To comply with the Health and Safety at Work etc Act 1974 (Section 2(2) - provision of a safe system of work) method statements are necessary for all construction activities involving more than an insignificant risk. These method statements should be prepared by the Principal Contractor and other Contractors and derived from risk assessments (which must be in writing to comply with the Management of Health and Safety at Work Regulations 1999). These method statements should be incorporated in the Construction Phase Health and Safety Plan before each construction activity commences.

This section sets out to identify the significant hazards, which need to be taken into consideration by the Principal Contractor and other Contractors.

The items are not exhaustive and do not relieve the Principal Contractor or other Contractors of their responsibilities or requirements under the Health and Safety legislation.

The Principal Contractor has a requirement to examine the Pre-Construction Health and Safety Plan and the risk assessments of other Contractors to confirm that the seriousness of the risks has been properly evaluated, to ensure that the assessments are applicable to the Works and to identify where any inter-relationship problems may exist. The results of this examination are to be incorporated, by the Principal Contractor, into the Construction Phase Health and Safety Plan.

The method statements/risk assessments should:

- be drawn up before work starts;
- identify the work activity, and the hazard or hazards involved;
- quantify the risks to those carrying out, or who may be affected by the carrying out of, that activity;
- identify the controls to be implemented to eliminate, reduce or control the risk;
- be easily understood;
- be communicated to those in control and those carrying out the activity prior to it being carried out;
- be monitored.

APPENDIX B DESIGNER RISK ASSESSMENTS



Appendix B – Designer Risk Assessments

Designer Risk Assessment

APPENDIX C – CONTAMINATION INFORMATION



Appendix C – Contamination Information

APPENDIX D – SERVICES DRAWINGS



Appendix D - Services Drawings

APPENDIX E – HSE PRIORITIES/INITIATIVES



Appendix E – HSE Priorities/Initiatives

In recognizing the various initiatives run by the HSE, the designers have set out to reduce the risks during construction by way of the following:

- Vibration White Finger - By specifying isolation reinforcement bars for pile cages.
- Vibration White Finger – By specifying dovetail channels to be incorporated into the precast terracing units to avoid the need to drill and fix anchors for fixing of grandstand seats.
- Lifting of Steel Members – Specification requirement for the steelwork fabricator to provide specific lifting points and lifting cleats to facilitate easier erection.

'Agreement in Principle' Document

CLIENT:

Devon County Council

PROJECT:

B0302 Exeter Chiefs Rugby Club

**Name of Bridge
or Structure :**

Section 106 – Cable Stay Footbridge

Approval in Principle

Document Reference:

LN00905/NE/AIP

Revision: 0

Status: For Approval

APPROVED
DOCUMENT

HYDER CONSULTING LIMITED
29 Bressenden Place
LONDON
SW1E 5DZ

1. HIGHWAY DETAILS

1.1 **Type of Highway**
Footway/Cycleway

1.2 **Permitted Traffic Speed**
Not applicable

1.3 **Existing restrictions**
Not applicable

2. SITE DETAILS

2.1 **Obstacle Crossed**
A379 dual carriageway

3. PROPOSED STRUCTURE

3.1 **Description of Structure**
Two span cable stay bridge.

3.2 **Structure Type**
The foot/cycle bridge is a two span asymmetric cable stayed structure with foot/cycle inclined approaches at the north and south embankments. The structure comprises a single steel tower supported on a reinforced concrete foundation positioned at approximately 1/3 span. The tower is an 'A' frame type structure formed by fabricated steel box sections and it supports a reinforced concrete deck on steel stringer beams via two rows of spiral strand cables, attached to the deck, outside the line of the parapets. The deck is also supported at either end by concrete bankseats.

3.3 **Foundation Type**
The tower support is to be founded on a reinforced concrete pad foundation on a suitable supporting substructure. The ends of the bridge deck are supported at the north and south bankseats on reinforced concrete pad foundations. At the north end the foundation structure will incorporate an anchor system which will resist the tensile load from the two anchor cables and the horizontal forces from the north bearing.

3.4 **Span Arrangements**
Overall span between centrelines of bearings = 108.5m

3.5 Articulation Arrangements

The tower base will be fully fixed against translation and rotation. The top will be anchored back to the north bank via the upper cable strands of the back span to a mass concrete anchor block. Guided bearings will be used at the south bankseat end of the deck to restrain lateral movement and to permit longitudinal translation and rotation. Bearings at the north bankseat end of the deck will be fixed to restrain lateral and longitudinal translation but will allow longitudinal rotation. The deck support at the tower will be a sliding rocker arrangement with lateral translation restraint.

3.6 Types of Road Restraint System

Pedestrian parapets are formed from curved profile steel plate posts with steel circular hollow section horizontal top rails. Below the top rails, the horizontal infill will comprise a single stainless steel tensioned wire above steel circular hollow section rails. The bottom third height of infill will be steel plate fins angled to help prevent light spill on to the A379. The parapet height will be 1.4m.

3.7 Proposed Arrangements for Maintenance and Inspection

3.7.1 Traffic management

It will be possible to maintain traffic flow along the A379 whilst applying individual lane closures as necessary for inspection periods and maintenance operations.

3.7.2 Access

Securing points will be attached to the south elevation of each leg of the tower at 3m centres vertically. These will enable the access equipment to be secured during inspection and maintenance of the tower and cable anchorage points. The cables may also be inspected by use of a mobile access platform. The bridge deck soffit can be inspected using a mobile access platform. The bankseat bearings and cable anchorages can be inspected from steps and platform formed by extending the bankseat foundation. Access to this extension will be from the top of the embankment. The north bankseat bearings are stainless steel pins in dry bearing bushes. A temporary bolt support system will be provided adjacent to each pin to be used when withdrawing the pins for inspection or replacement. Other bearings will be permanent integral parts of the superstructure and will require no maintenance.

3.8 Sustainability Issues considered – Materials and Finishes:

In situ Concrete	- blinding layers ST1
	- all structural elements reinforced concrete grade 50 ($f_{cu} = 50\text{N/mm}$)
Precast Concrete	- reinforced concrete grade 50 ($f_{cu} = 50\text{N/mm}$)

- Finishes - (i) Formed - Class F3 to exposed concrete surfaces
- Class F1 to buried concrete surfaces
- (ii) Unformed - U3 to top surfaces of parapet plinths
- U1 to top surfaces of foundations
- Top surface of precast deck units shall be prepared by
shotblasting or mechanical abrasion after 28 days
- Reinforcement - High yield type 2 deformed bars grade 460 to BS4449 and BS4461
throughout
- Surfacing - Combined wearing course and waterproof membrane comprising methyl
methacrylate resin based binder with aggregate overscatter and a clear resin sealer.
- Structural Steel - (i) Hollow Sections -Grade S355 J2 H in accordance with
BS EN10210-1:1994
(ii) Other Sections – Grade S355 J2 G3 in accordance with
BS EN10025:1993
Steel protective treatment system shall be a 3 coat epoxy glass flake paint system to
satisfy Inland Environment and Difficult Access criteria requiring no maintenance up
to 12 years, minor maintenance after 12 years and major maintenance after 20
years. Final coat colour to be White RAL 9003 (gloss).
- Cable Stays - Coated galvanised spiral strand cable assemblies
- Cable Nominal Tensile Grade 1770 N/mm²

3.9 Risks and hazards considered

Risks and hazards particular to this type of construction shall be identified and minimised. The design of permanent works shall take account of assembly and erection methods. A designer risk assessment shall be produced demonstrating consideration of risks and hazards.

Traffic management to be set up in accordance with Chapter 8 of the Traffic Signs Manual.

3.10 Estimated Cost of Proposed Structure together with other Structural Forms considered including where appropriate proprietary manufactured structures, and the Reasons for their Rejection including Comparative Whole Life Costs with Date of Estimates

The estimated cost of proposed structure is £600 000 (2005)

3.11 Proposed arrangements for construction

3.11.1 Traffic management

It is envisaged that the bankseats will be constructed with access from the top of the embankments and will not disturb the traffic flow on the A379. Roadside protection barriers will be provided at the foot of the embankment as necessary.

The tower base will be constructed in the central area between carriageways. The tower will be located a minimum of 4.5m from the edge of carriageway. To allow site access for plant and workforce, it is envisaged that the outside lane of the eastbound carriageway will need to be coned off during daylight site access hours. This will provide an acceleration/deceleration lane enabling safer site access and egress. It is likely to take approximately one week to install the foundation for the tower.

The erection of the bridge superstructure will necessitate closure of the A379. An example of duration of closure would be 5 number 12 hour overnight closures. Actual closure periods will depend on permissions and final erection methodology.

3.11.2 Service diversions

None anticipated.

3.11.3 Interface with existing structures

Bankseat supports constructed in existing embankments.

4 DESIGN CRITERIA

4.1 Live loading, Headroom

4.1.1 Loading relating to normal traffic under AW regulations and C&U regulations

Not applicable

4.1.2 Loading relating to General Order Traffic under STGO regulations

Not applicable

4.1.3 Footway or footbridge live loading

5kN/m² to BD37/01. Bollards shall be placed off the structure to ensure no vehicular access

4.1.4 Loading relating to Special Order Traffic, provision for exceptional abnormal loads, indivisible loads including location of vehicle track on deck cross-section

Not applicable

4.1.5 Any special loading not covered above

It is considered that there is severe potential risk of vehicular impact on the tower support. BD 60/04 gives guidance that the values of design collision loads should be taken from BD 60/04 Table 3 and not BD 37/01 under these circumstances and requires that this be recorded in the AIP.

4.1.6 **Heavy or high load route requirements and arrangements being made to preserve the route, including any provision for future heavier loads or future widening**
Not applicable

4.1.7 **Minimum headroom provided**
Will exceed 6m

4.1.8 **Authorities consulted and any special conditions required**
Devon County Council
Others to be confirmed

4.2 **List of relevant documents from TAS**
See Appendix A

4.2.1 **Additional relevant standards**
None

4.3 **Proposed departures from Standards given in 4.2 and 4.2.1**
Provision of safety barriers in accordance with IRRRS and IAN 44/05.

4.4 **Proposed methods of dealing with aspects not covered by Standards in 4.2 and 4.2.1**
Specialist advice will be sought for consideration of the dynamic effects of live loads and wind

5 **STRUCTURAL ANALYSIS**

5.1 **Methods of Analysis Proposed for Superstructure, Substructure and Foundations**

The superstructure will be analysed as a finite element model using the LUSAS computer program. The substructures and foundations will generally be analysed by hand calculation methods. The longitudinal deck members shall be designed in accordance with Clause 10 of BS5400 Part 3 with effective lengths being derived as follows.

Buckling of the longitudinal members in an upwards direction will not be considered because of the restraint to movement in this direction afforded by the dead loads of the structure deck. For the purposes of design, the effective length for vertical buckling shall be conservatively taken as 16.250m.

5.2 Description and Diagram of Idealised Structure to be used for Analysis

Refer to Fig 1 in Appendix B

5.3 Assumptions intended for Calculation of Structural Element Stiffness

For the purpose of analysis, gross uncracked concrete section properties will be used.

5.4 Proposed Earth Pressure Coefficients (k_a , k_o or k_p) to be used in Design of Earth Retaining Elements

There are no significant earth retaining structures proposed.

6 GEOTECHNICAL CONDITIONS

6.1 Acceptance of recommendations of Section 8 of the Geotechnical Report to be used in the design and reasons for any proposed changes

Design parameters are presented on the Form C which will be confirmed after the Geotechnical Report is available.

6.2 Geotechnical Report Highway Structure Summary Information (Form C)

Refer to Appendix C

6.3 Differential settlement to be allowed for in the design of the structure

The maximum differential settlement between adjacent foundations will be less than 10mm

6.4 If the Geotechnical Report is not yet available, state when the results are expected and list the sources of information used to justify the preliminary choice of foundations.

Not applicable

7 CHECKING

7.1 Proposed Category of Structure
Category III

7.2 If Category III, Name of Proposed Independent Checkers
Tony Gee and Partners

7.3 Erection Proposals or Temporary Works for which the Contractor will be Required to Arrange an Independent Check Listing the Parts of the Structure Affected with Reasons for Recommending an Independent Check


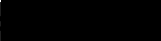
It is envisaged that the superstructure will be erected in stages. An independent check will be required to ensure structural stability at all stages of the erection sequence and to ensure that there are no detrimental effects on the permanent works resulting from the erection proposals.

8 DRAWINGS AND DOCUMENTS

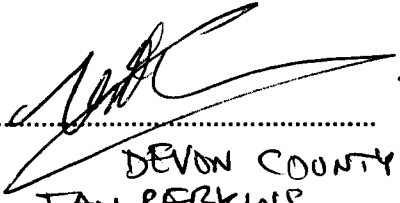
8.1 List of drawings (including numbers) and documents accompanying the submission

<u>Drq No.</u>	<u>Title</u>
2001 – LN00905	General Arrangement
2002 – LN00905	Cable Profile Length and Loads
2003 – LN00905	Parapet Details
2004 – LN00905	Structural Steelwork Deck Details Sheet 1 of 2
2005 – LN00905	Structural Steelwork Deck Details Sheet 2 of 2
2006 – LN00905	Tower Details Sheet 1 of 3
2007 – LN00905	Tower Details Sheet 2 of 3
2008 – LN00905	Tower Details Sheet 3 of 3

9 THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed:  (Hold) CEES MISTRUSTE.
Name: 
Technical Director
Hyder Consulting Limited
Date: 20th March 2006.

10 THE ABOVE IS AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW

Signed:  BY CEES MICE
TAA DEVON COUNTY COUNCIL
Name: IAN PERKINS
Date: 3 APRIL 06

APPENDIX A

Schedule of Documents Relating to Design or Assessment of Highway Bridges and Structures

British Standards

BS 5268: Part 2: 2002	Structural Use of Timber
BS 5400	Steel concrete and composite bridges
Part 1; 1988	General Statement (see BD 15 (DMRB 1.3.2))
Part 2; 1978	Specification for loads (as implemented by BD 37 (DMRB 1.3))
Part 3; 2000	CP for design of steel bridges (see BD 13 (DMRB 1.3))
Part 4; 1990	CP for design of concrete bridges (see BD 24 (DMRB 1.3.1))
Part 5; 2005	CP for design of composite bridges (see BD 16 (DMRB 1.3))
Part 9; 1983	Bridge bearings (see BD 20 (DMRB 2.3.1))
Part 10; 1980	CP for fatigue (see BD 9 (DMRB 1.3))
BS 5628: Part 1; 1992	Unreinforced Masonry
BS 5930: 1999	Site investigation
BS 6031: 1984	Earthworks
BS 7818: 1995 Incorporating Corrigendum No. 1	Specification for pedestrian restraint systems in metal
BS 8002: 1994	Earth retaining structures
BS 8004: 1986	Foundations
BS 8118: 1991	The structural use of aluminium
BS EN 1317-1-1998 Road Restraint Systems Part 1	Terminology and general criteria for test methods
BS EN 1317-2-1998 Road Restraint Systems Part 2	Performance classes, impact test acceptance criteria and test methods for safety barriers
BS EN 1317-3-2000 Road Restraint Systems Part 3	Performance classes, impact test acceptance criteria and test methods for crash cushions
ENV 1317-4-2002 Road Restraint Systems Part 4	Terminals and Transitions
BS EN 14388—2005	Road Traffic Noise Reducing Devices—Specification

Miscellaneous

Circular Roads No. 61/72 – Routes for heavy and high abnormal loads

Railway Group Approved Code of Practice GC/RC5510: Recommendations for the Design of Bridges (2000)

Railway Group Approved Code of Practice GC/RT5204: Structure Gauging and Clearances

Simplified Tables of External Loads on Buried Pipelines (1986)

Traffic Management Act 2004

The Manual of Contract Documents for Highway Works (MCDHW)

Volume 1: Specification for Highway Works March 1998, including Amendments dated May 2001 and May 2002

Volume 2: Notes for Guidance on the Specification for Highway Works March 1998, including Amendments dated May 2001 and May 2002

Volume 3: Highway Construction Details December 1991 including subsequent amendments.

The Design Manual for Roads and Bridges (DMRB)

Bridges and Structures, Advice Notes (BA Series)

Document Reference	Title	Date of Issue	Decimal References
BA 9/81	The use of BS 5400: Part 10: Code of Practice for Fatigue	Dec 1981	1.3
	Amendment No. 1	Nov 1983	
BA 16/97	The Assessment of Highway Bridges and Structures.	May 1997	3.4.4
	Amendment No.1	Nov 1997	
	Amendment No.2	Nov 2001	
BA 19/85	The use of BS 5400: Part 3: 1982	Jan 1985	1.3
BA 24/87	Early Thermal Cracking of Concrete	Jul 1987	1.3
	Amendment No. 1	Aug 1989	
BA 26/94	Expansion Joints for Use in Highway Bridge Decks	Nov 1994	2.3.7
BA 28-92	Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures	Aug 1992	1.2.2
BA 30/94	Strengthening of Concrete Highway Structures Using Externally Bonded Plates	Feb 1994	3.3.1

Document Reference	Title	Date of Issue	Decimal References
BA 34/90	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures. Stage 1 – Older Short Span Bridges and Retaining Structures	Sep 1990	3.4
BA 35/90	Inspection and Repair of Concrete Highway Structures	Jun 1990	3.3
BA 36/90	The Use of Permanent Formwork	Feb 1991	2.3
BA 37/92	Priority Ranking of Existing Parapets	Oct 1992	2.3.2
BA 38/93	Assessment of the Fatigue Life of Corroded or Damaged Reinforcing Bars	Oct 1990	3.4.5
BA 39/93	Assessment of Reinforced Concrete Half Joints	Apr 1993	3.4.6
BA 40/93	Tack Welding of Reinforcing Bars	Apr 1993	1.3.4
BA 41/98	The Design and Appearance of Bridges	Feb 1998	1.3.11
BA 42/96	The Design of Integral Bridges	Nov 1996	1.3.12
BA 43/94	Strengthening, Repair and Monitoring of Post-tensioned Concrete Bridge Decks	Dec 1994	3.3.2
BA 44/96	Assessment of Concrete Highway Bridge and Structures	Nov 1996	3.4.15
BA 47/99	Waterproofing and Surfacing of Concrete Bridge Decks	Aug 1999	2.3.5
BA 48/93	Pedestrian Protection at Head Walls, Wing Walls and Retaining Walls	Dec 1993	2.2.2
BA 50/93	Post-tensioned Concrete Bridges, Planning, Organisation and Methods for Carrying Out Special Inspections	Jul 1993	3.1.3
BA 51/95	The Assessment of Concrete Structures Affected by Steel Corrosion	Feb 1995	3.4.13
BA 52/94	The Assessment of Concrete Highway Structures Affected by Alkali Silica Reaction	Nov 1994	3.4.10
BA 53/94	Bracing Systems and the Use of U-Frames in Steel Highway Bridges	Dec 1994	1.3.13
BA 54/94	Load Testing for Bridge Assessment	Apr 1994	3.4.8
BA 55/00	The Assessment of Bridge Substructures and Foundations, Retaining Walls and Buried Structures	May 2000	3.4.9
BA 56/96	The Assessment of Steel Highway Bridges and Structures	Nov 1996	3.4.12
BA 57/01	Design for Durability	Aug 2001	1.3.8
BA 58/94	Design of Bridges and Concrete Structures with External Unbonded Prestressing	Nov 1994	1.3.10
BA 59/94	Design of Highway Bridges for Hydraulic Action	May 1994	1.3.6
BA 61/96	The Assessment of Composite Highway Bridges	Nov 1996	3.4.17
BA 63/94	Inspection of Highway Structures	Oct 1994	3.1.5
BA 67/96	Enclosure of Bridges	Aug 1996	2.2.8
BA 68/97	Crib Retaining Walls	Feb 1997	2.1.4
BA72/03	Maintenance of Road Tunnels	May 2003	3.2.3

Document Reference	Title	Date of Issue	Decimal References
BA 79/98	The Management of Sub-Standard Highways Structures	Aug 1998	3.4.18
	Amendment No.1	Aug 2001	
BA 80/99	Use of Rockbolts	Feb 1999	2.1.7
BA 82/00	Formation of Continuity Joints in Bridge Decks	Nov 2000	2.3.7
BA 83/02	Cathodic Protection for Use in Reinforced Concrete Highway Structures	Feb 2002	3.3.3
BA 84/02	Use of Stainless Steel Reinforcement in Highway Structures	Feb 2002	1.3.15
BA 85/04	Coatings for Concrete Highway Structures & Ancillary Structures	May 2004	2.4.3
BA86/04	Advice Notes on the Non-Destructive Testing of Highway Structures	May 2004	3.1.7
BA 87/04	Management of Corrugated Steel Buried Structures	Aug 2004	3.3.4
BA 88/04	Management of Buried Concrete Box Structures	Aug 2004	3.3.5

Bridges and Structures, Standards (BD Series)

Document Reference	Title	Date of Issue	Decimal References
BD 2/05	Technical Approval of Highway Structures	Aug 2002	1.1.1
BD 7/04	Weathering Steel for Highway Structures	Nov 2001	2.3.8
BD 9/81	Implementation of BS 5400: Part 10: 1980. Code of Practice for Fatigue	Dec 1981	1.3
BD 10/97	Design of Highway Structures in Areas of Mining Subsidence	May 1997	1.3.14
BD 12/01	Design of Corrugated Steel Buried Structures with Spans Greater than 0.9 Metres and up to 8 Metres	Nov 2001	2.2.6
BD 13/04	Design of Steel Bridges. Use of BS 5400: Part 3: 2000	Nov 2004	1.3
BD 15/92	General Principles for the Design and Construction of Bridges. Use of BS 5400: Part 1: 1988	Dec 1992	1.3.2
BD 16/82	Design of Composite Bridges. Use of BS5400: Part 5: 1979	Nov 1982	1.3
	Amendment No. 1	Dec 1987	
BD 20/92	Bridge Bearings. Use of BS 5400: Part 9: 1983	Oct 1992	2.3.1
BD 21/01	The Assessment of Highway Bridges and Structures	May 2001	3.4.3
BD 24/92	Design of Concrete Bridges. Use of BS 5400: Part 4: 1990	Nov 1992	1.3.1
BD 26/04	Design of Lighting Columns	Nov 2004	2.2.1
BD 27/86	Materials for the Repair of Concrete Highway Structures	Nov 1986	3.3
BD 28/87	Early Thermal Cracking of Concrete	Jul 1987	1.3
	Amendment No. 1	Aug 1989	

Document Reference	Title	Date of Issue	Decimal References
BD 29/04	Design Criteria for Footbridges	Aug 2004	2.8
BD 30/87	Backfilled Retaining Walls and Bridge Abutments	Aug 1987	2.1
BD 31/01	The Design of Buried Concrete Box and Portal Frame Structures	Nov 2001	2.2.12
BD 33/94	Expansion Joints for Use in Highway Bridge Decks	Nov 1994	2.3.6
BD 34/90	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures Stage 1 – Older Short Span Bridges and Retaining Structures	Sep 1990	3.4
BD 35/05	Quality Assurance Scheme for Paints and Similar Protective Coatings	May 2005	2.4.1
	Errata Sheet	Feb 2000	
BD 36/92	Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures	Aug 1992	1.2.1
BD 37/01	Loads for Highway Bridges	Aug 2001	1.3.14
BD 41/97	Reinforced Clay Brickwork Retaining Walls of Pocket Type and Grouted Cavity Type Construction	May 1997	2.1.1
BD 42/00	Design of Embedded Retaining Walls and Bridge Abutments	May 2000	2.1.2
BD 43/03	The impregnation of Reinforced and Prestressed Concrete Highway and Structures using Hydrophobic Pore – Lining Impregnants	Feb 2003	2.4.2
BD 44/95	The Assessment of Concrete Highway Bridges and Structures	Jan 1995	3.4.14
BD 45/93	Identification Marking of Highway Structures	Aug 199	3 3.1.1
BD 46/92	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures. Stage 2 – Modern Short Span Bridges	Aug 1992	3.4.1
BD 47/99	Waterproofing and Surfacing of Concrete Bridge Decks	Aug 1999	2.3.4
BD 48/93	The Assessment and Strengthening of Highway Bridge Supports	Jun 1993	3.4.7
BD 49/01	Design Rules for Aerodynamic Effects on Bridges	May 2001	1.3.3
BD 50/92	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures Stage 3 – Long Span Bridges	Dec 1992	3.4.2
BD 51/98	Design Criteria for Portal and Cantilever Sign/Signal Gantries	May 1998	2.2.4
BD 52/93	The Design of Highway Bridge Parapets	Apr 1993	2.3.3
BD 53/95	Inspection and Records for Road Tunnels	Jul 1995	3.1.6
BD 54/93	Post-tensioned Concrete Bridges. Prioritization of Special Inspections	Apr 1993	3.1.2

Document Reference	Title	Date of Issue	Decimal References
BD 56/96	The Assessment of Steel Highway Bridges and Structures	Nov 1996	3.4.11
BD 57/01	Design for Durability	Aug 2001	1.3.7
BD 58/94	The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing Design of Highway Bridges for Vehicle Collision	Nov 1994	1.3.9
BD60/04	Design of Highway Bridges for Vehicle Collision Loads	May 2004	1.3.5
BD 61/96	The Assessment of Composite Highway Bridges	Nov 1996	3.4.16
BD 62/94	As Built, Operational and Maintenance Records for Highway Structures	Oct 1994	3.2.1
BD 63/94	Inspection of Highway Structures	Oct 1994	3.1.4
BD 65/97	Design Criteria for Collision Protector Beams	Feb 1997	2.2.5
BD 67/96	Enclosures of Bridges	Aug 1996	2.2.7
BD 68/97	Crib Retaining Walls	Feb 1997	2.1.3
BD 70/03	Strengthened/Reinforced Soils and Other Fills for Retaining Walls and Bridge Abutments. Use of BS8006: 1995, incorporating Amendment No 1. (Issue 2 March 1999)	May 2003	2.1.5
BD 74/00	Foundations	May 2000	2.1.8
BD 78/99	Design of Road Tunnels	Aug 1999	2.2.9
BD 81/02	Use of Compressive Membrane Action in Bridge Decks	May 2002	3.4.20
BD 82/00	Design of Buried Rigid Pipes	Aug 2000	2.2.10
BD 83/01	Design of CCTV Masts	Aug 2001	2.2.11
BD 84/02	Strengthening of Concrete Bridge supports Vehicle Impact Using Fibre Reinforced Polymers	Aug 2002	1.3.16
BD86/04	The Assessment of Highway Bridges and Structures for the Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles	Nov 2004	3.4.19
BD87/05	Maintenance Painting of Steelwork	May 2005	3.2.2
BD88/05	Design of Cantilever Masts for Traffic Signals and/or Speed Cameras	May 2005	3.2.2
BD89/03	The Conservation of Highway Structures	May 2005	2.2.13
BD90/05	Design of FRP Bridges and Highway Structures	May 2005	1.3.17
BD91/04	Unreinforced Masonry Arch Bridges	Nov 2004	2.2.14

Bridges and Structures, Technical Memoranda (BE Series)

Document Reference	Title	Date of Issue	Decimal Reference
BE 13	Fatigue Risk in Bailey Bridges	Apr 1968	3.4
BE 23	Shear Deck Decks	Nov 1970	1.3
	Amendment No. 1 to Annex	Jun 1971	
BE 5/75	Rules for the Design and Use of Freyssinet Concrete Hinges in Highway Structures	Mar 1975	1.3
BE 7/04	Departmental Standard (Interim) Motorway Sign/Signal Gantries	Aug 2004	2.2

Traffic Engineering and Control, Standards (TD Series)

TD 9/93	Road layout and geometry. Highway link design.
TD 19/85	Safety fences and barriers
TD 27/05	Cross Sections and Headroom
TD 36/93	Subways for pedestrians and cyclists, layout and dimensions
IRRRS / IAN 44/05 rev4	Interim Requirements for Road Restraint Systems

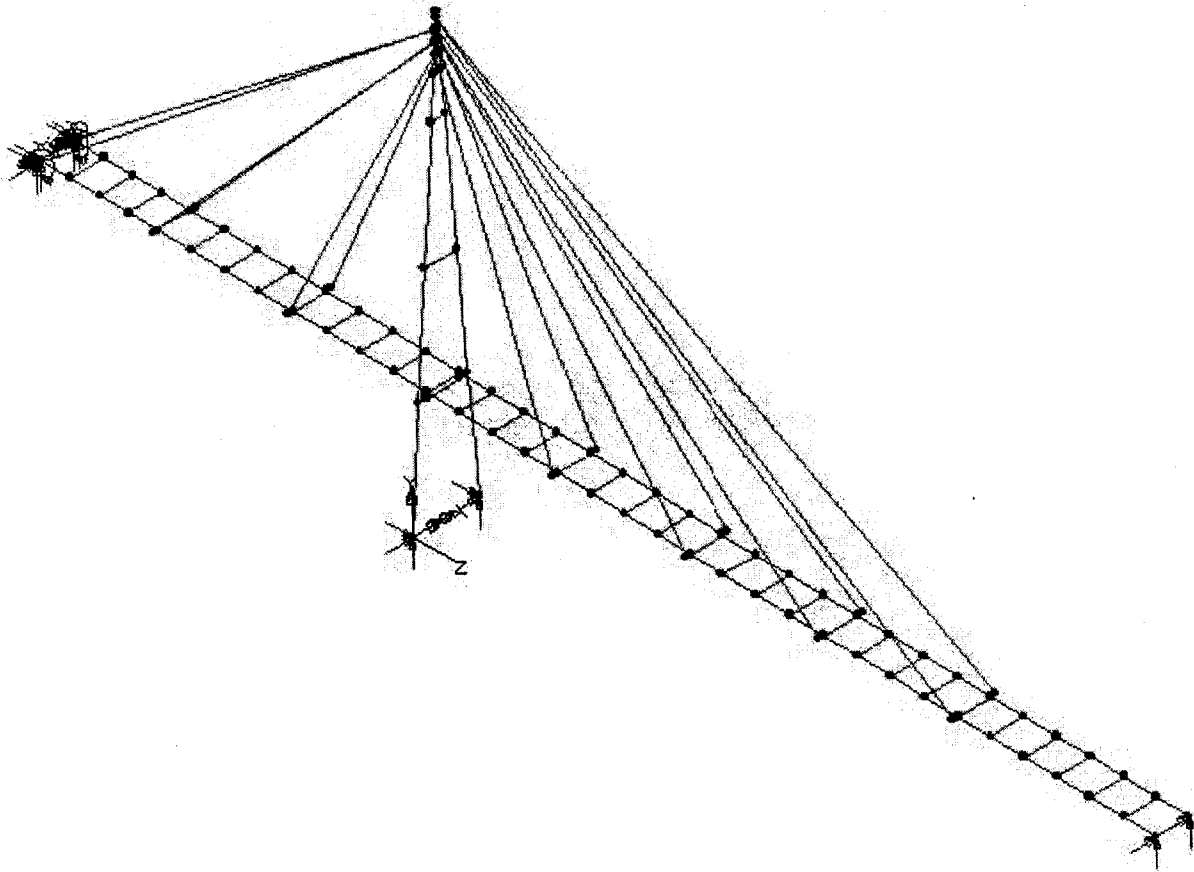
Highways, Advice Notes (HA Series)

Document Reference	Title
HA 66/95	Environmental Barriers – Technical Requirements
H84/02	Nature Conservation and Biodiversity
HA 59/92	Mitigating Against Effects on Badgers.
HA 80/99	Nature Conservation Advice in Relation to Bats
HA 81/99	Nature Conversation Advice in Relation to Otters
HA 97/01	Nature Conservation Management Advice in Relation to Dormice
HA 98/01	Nature Conservation Management Advice in Relation to Amphibians

Highways, Standards (HD Series)

HD 22/02	Managing Geotechnical Risk
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APPENDIX B
IDEALISED STRUCTURE DIAGRAM



APPENDIX C

GEOTECHNICAL REPORT HIGHWAY STRUCTURE SUMMARY INFORMATION (FORM C)

**GEOTECHNICAL REPORT
HIGHWAY STRUCTURE SUMMARY INFORMATION**

**FORM C
STRUCTURE DESIGN SUMMARY**

SCHEME: B0302 Exeter Chiefs Rugby Club	CHAINAGE: -
STRUCTURE NAME: Cable Stay Footbridge	Structure Type: Central Pier & Bankseats

SOILS/GEOLOGY

Strata	Typical depth (m)		Soil Design Parameters									
			ϕ'	ϕ'_{des}	C'	Cu	Ka	Ko	Kp	γ_{bulk}		
Made Ground	from	to										
	EGL	0	1.65	28	24	-	-	0.37	0.59	3.19	15	
Medium dense silty & clayey sand	0	1.65	0	5.00	32	28	-	-	0.32	0.54	3.86	18
Weathered sandstone (very dense sand)	0	5.00	1.00	6.55	37	32	-	-	0.26	0.47	5.13	20
Moderately weak Sandstone	1.00	6.55	-	-	39	34	5	-	0.24	0.44	5.85	22

Exploratory holes used in above assessment:
BH 1, 2 & Tp1

BEARING CAPACITY – spread footings

Structure element	Founding stratum	M (AOD)	Footing size (m)	Safe net bearing pressure (kN/m ²)	Reference / Comments
North bankseat	Medium dense sand	TBA	5 x 4	75	All pressures quoted are in order to limit max settlement to 10mm ∴ max differential will be < 10mm
Central pier	Bedrock	TBA	2no. 4 x 4	500	
South bankseat	Bedrock	TBA	5 x 2	500	

NB precise levels still to be confirmed

PILE DESIGN

Structure element	Founding stratum	Toe level (m AOD)	Diameter (mm)	Length (m)	Caisson working load (kN)	Reference / Comments
Not used						

SETTLEMENT/DEFLECTIONS

Structure element	Founding level (m AOD)	Diameter (mm)	Immediate settlement (mm)	Total settlement (mm)	Settlement after deck construction	Reference / Comments
North bankseat	TBA	-	-	5 - 10	5 - 10	Max differential 10mm
Central pier	TBA	-	-	5 - 10	5 - 10	
South bankseat	TBA	-	-	0 - 5	0 - 5	

GROUND MOVEMENTS

Cause of movement	Abutment settlement due to emb't loading	Heave due to cutting excavation	Subsidence due to mineral extraction	Flowing water	Other	Reference / Comments
						None anticipated

CHEMICAL ANALYSIS

Type of test/sample	Soil SO ₄ – total (%)	Soil SO ₄ – water sol. (g/l)	Water SO ₄ (g/l)	Other	Reference/ Comments
TBA					

GROUND WATER

Water level readings	Highest level recorded	Level	No water encountered
	Maximum design level (uplift)		
	Maximum design level (sliding)		

NOTES

1. The foundations will be designed so that the maximum differential settlement between adjacent elements is less than 10mm
2. Precise levels at present art not known and will be provided later
3. Concrete class to be confirmed once all lab data is available
4. Ground water was not encountered during the investigation

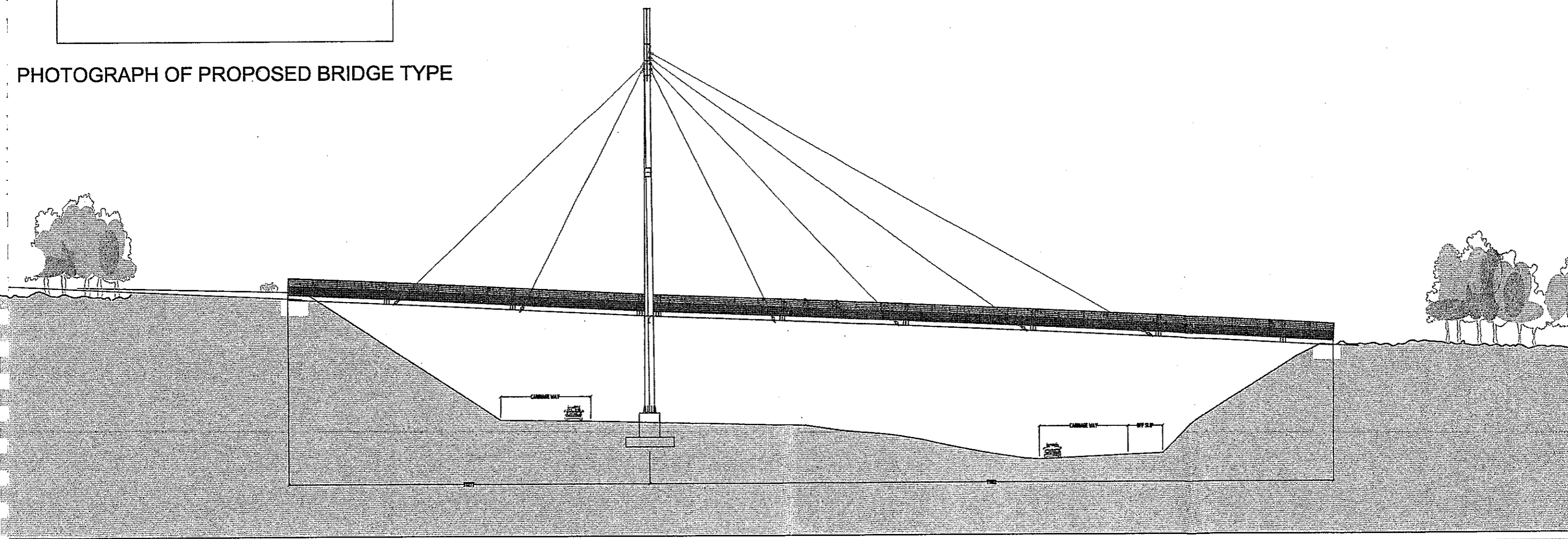
APPENDIX D

REFERENCE DRAWING

Drawing Number 0088 PL 23 - Proposed Cablestay Bridge Over A379

S:\0088--exeter_rugby_club\images\0088-CABLE STAY BRIDGE.jpg

PHOTOGRAPH OF PROPOSED BRIDGE TYPE



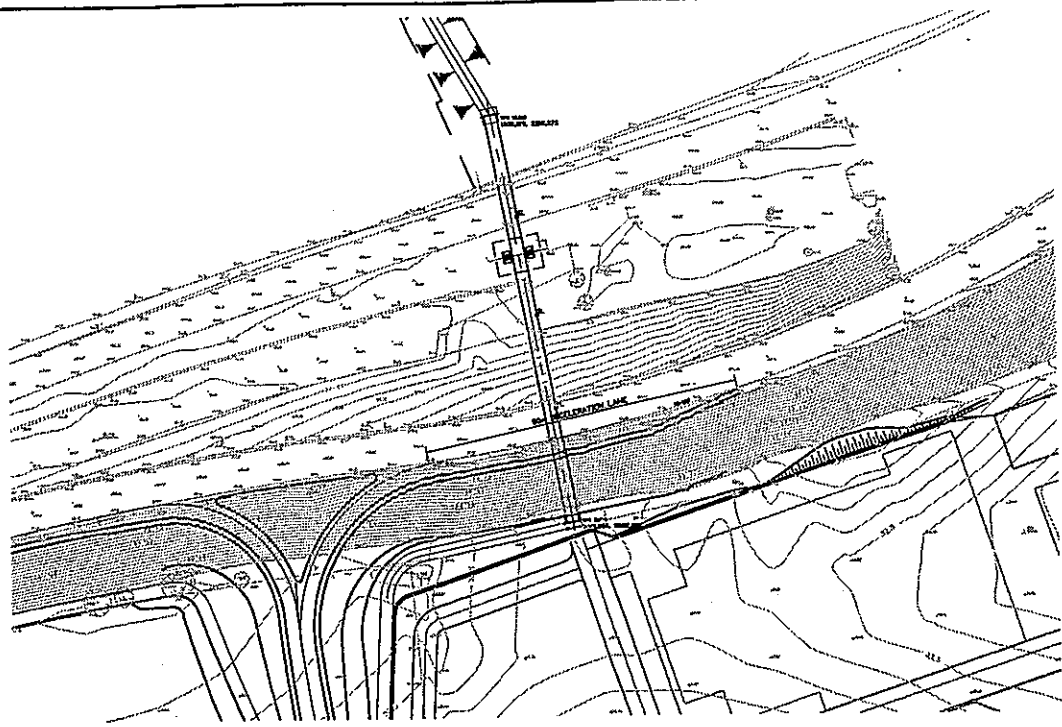
ELEVATION OF PROPOSED CYCLE / FOOTBRIDGE OVER THE A379 CARRIAGE WAY

EXETER RUGBY CLUB
EXETER RUGBY GROUP LTD

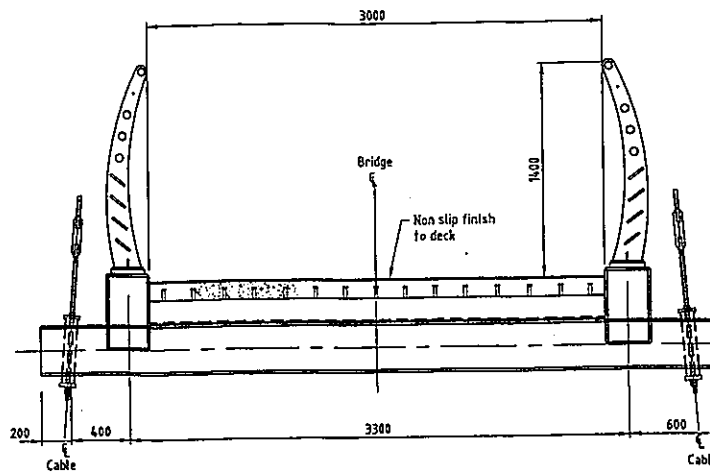
PROPOSED CABLE STAY BRIDGE OVER A379

1:200 JUNE 2005 SJH

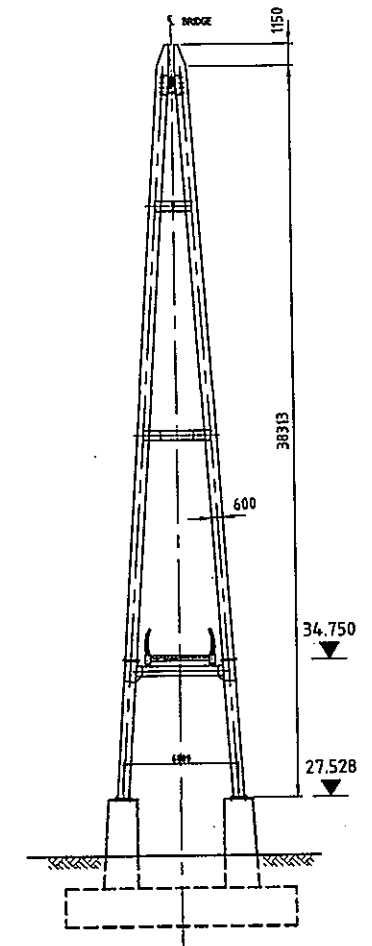
0088 PI 23



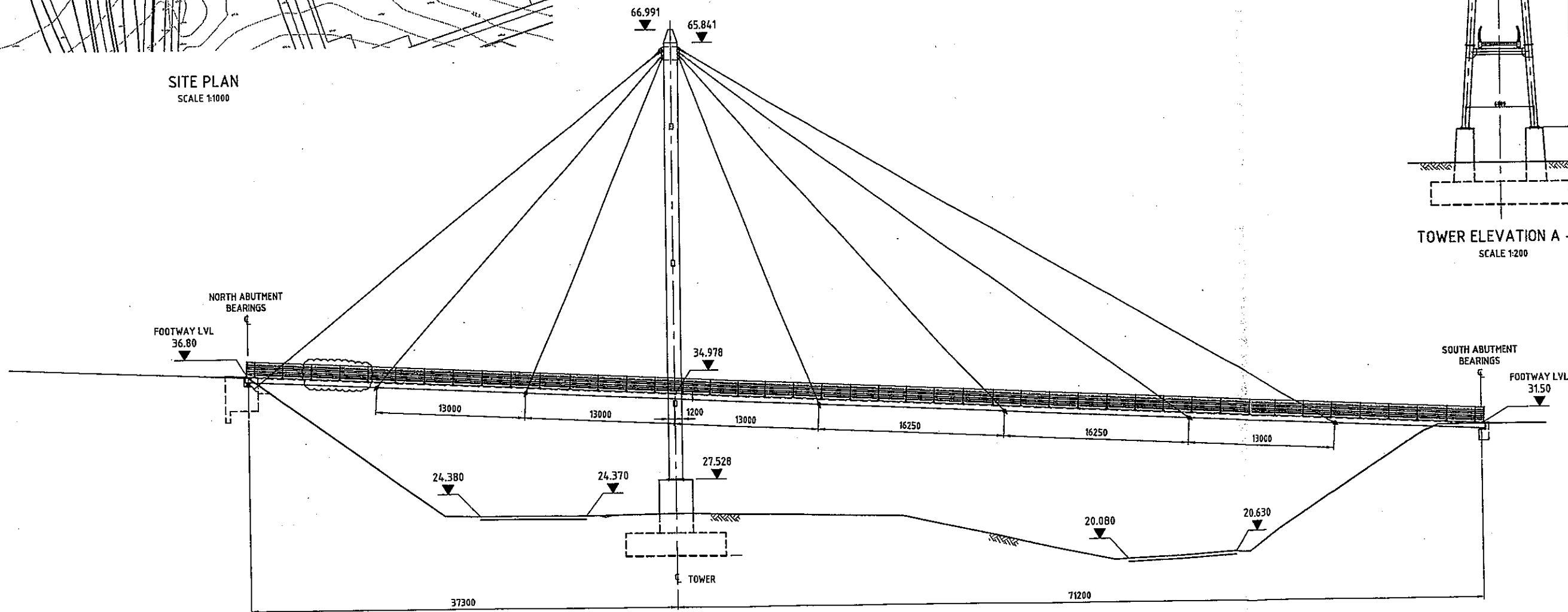
SITE PLAN
SCALE 1:1000



TYPICAL DECK SECTION
SCALE 1:25



TOWER ELEVATION A - A
SCALE 1:200



ELEVATION OF PROPOSED CYCLE / FOOTBRIDGE OVER A379 CARRIAGEWAY
SCALE 1:200

Issue	Description	Date
02	PARAPEY POST, TOWER DETAILS AMENDED	22.02.06
01	INITIAL ISSUE	01.02.06

Notes
 1. DO NOT SCALE FROM DRAWING, USE FIGURED DIMENSIONS ONLY
 2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
 3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.

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DEAN DYBALL
 CONSTRUCTION

Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION	
Scales	1:200 1:20	Current Issue Signatures
Original Size	A1	Author P. GORDHAN
Datum	DATUM	Checker P. BAILEY
Grid	GRID	Approver P. BAILEY
Filename:	2001-LN00905-LND-02.DWG	

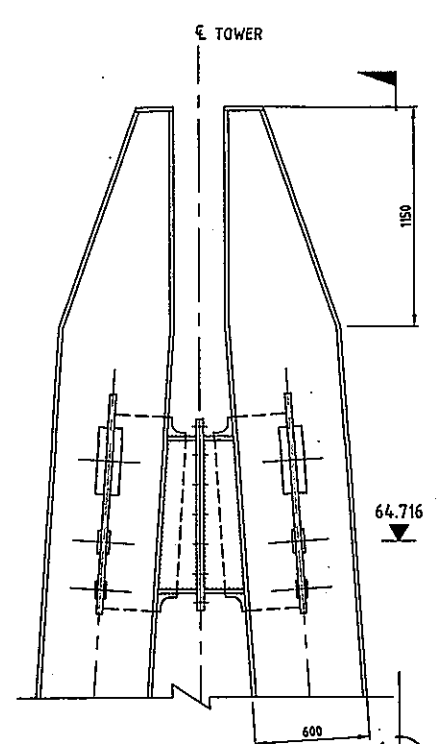
Project
**PROPOSED CABLE STAY BRIDGE
 OVER A379**

Title
GENERAL ARRANGEMENT

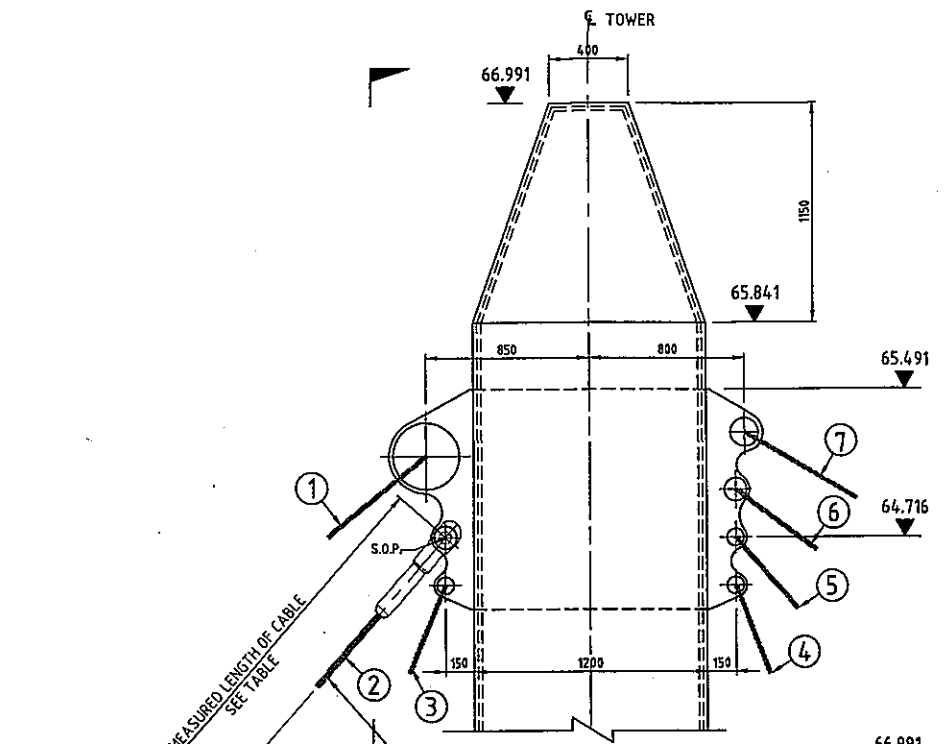
Hyder Consulting

HYDER CONSULTING (UK) LTD
 29 Bressenden Place
 London
 SW1E 5DZ
 Tel: +44 (0)1870 000 3005
 Fax: +44 (0)1870 000 3906

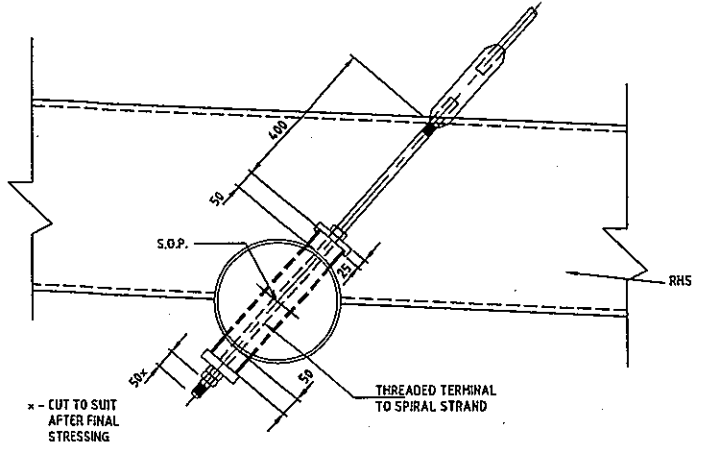
Drawing No. 2001 - LN00905 - 02
 Project No. LN00905
 Issue



ELEVATION A - A
SCALE 1:20



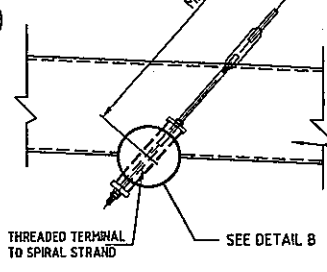
DETAIL 1
ELEVATION B - B
SCALE 1:20



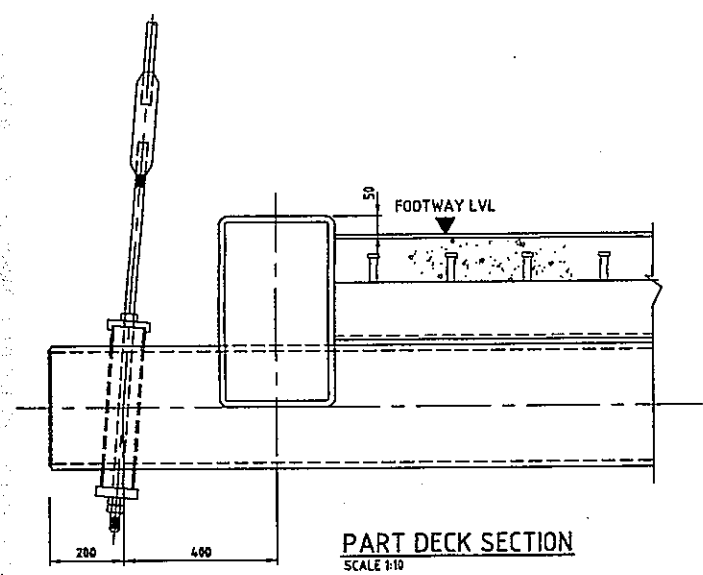
DETAIL B
SCALE 1:10

CABLE PROFILE				
Cable No. (2 Nos of each)	Diameter	Length in millimetres	Final Dead Load in Cable (kN)	Min. Breaking Load (kN)
1	65mm	45480	545	2600
2	30mm	38337	142	670
3	25mm	31713	110	570
4	25mm	32885	130	570
5	30mm	42507	196	840
6	30mm	55328	207	864
7	35mm	66701	255	1028

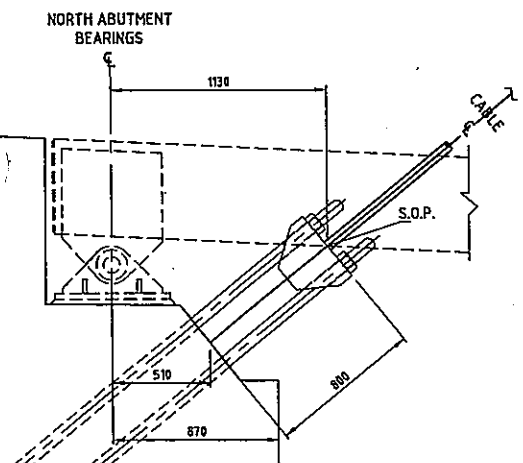
CHS Centre to Pin Centre



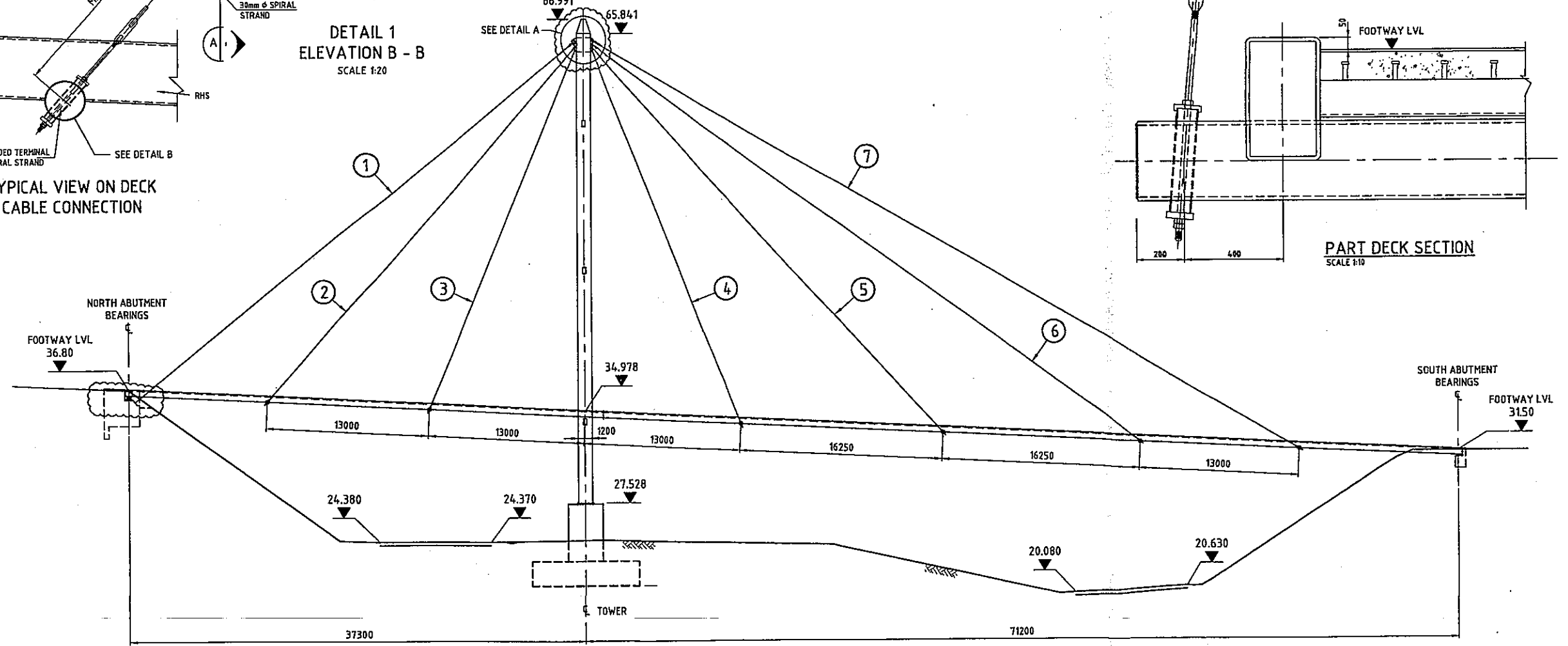
TYPICAL VIEW ON DECK
CABLE CONNECTION



PART DECK SECTION
SCALE 1:10



ANCHORAGE DETAILS AT
NORTH ABUTMENT
SCALE 1:20



ELEVATION OF PROPOSED CYCLE / FOOTBRIDGE OVER A379 CARRIAGEWAY
SCALE 1:200

Notes

- LOADS HAVE BEEN CALCULATED USING
- DO NOT SCALE FROM THE DRAWING, USE FIGURED DIMENSIONS ONLY.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
- ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.

GALVANISED SPIRAL STRAND				
	65ø	35ø	30ø	25ø
CSA =	2501 mm ²	731 mm ²	530 mm ²	377 mm ²
EA =	400 MN	124 MN	93 MN	66 MN
E =	165 kN/mm ²	170 kN/mm ²	175 kN/mm ²	175 kN/mm ²

Client
**EXETER RUGBY CLUB
EXETER RUGBY GROUP LTD**

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Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION	
Scales	1:200 1:20	Current Issue Signatures
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Datum	DATUM	Checker P. BAILEY
Grid	GRID	Approver P. BAILEY
Filename	2002-LN00905-LND-02.DWG	

Project
**PROPOSED CABLE STAY BRIDGE
OVER A379**

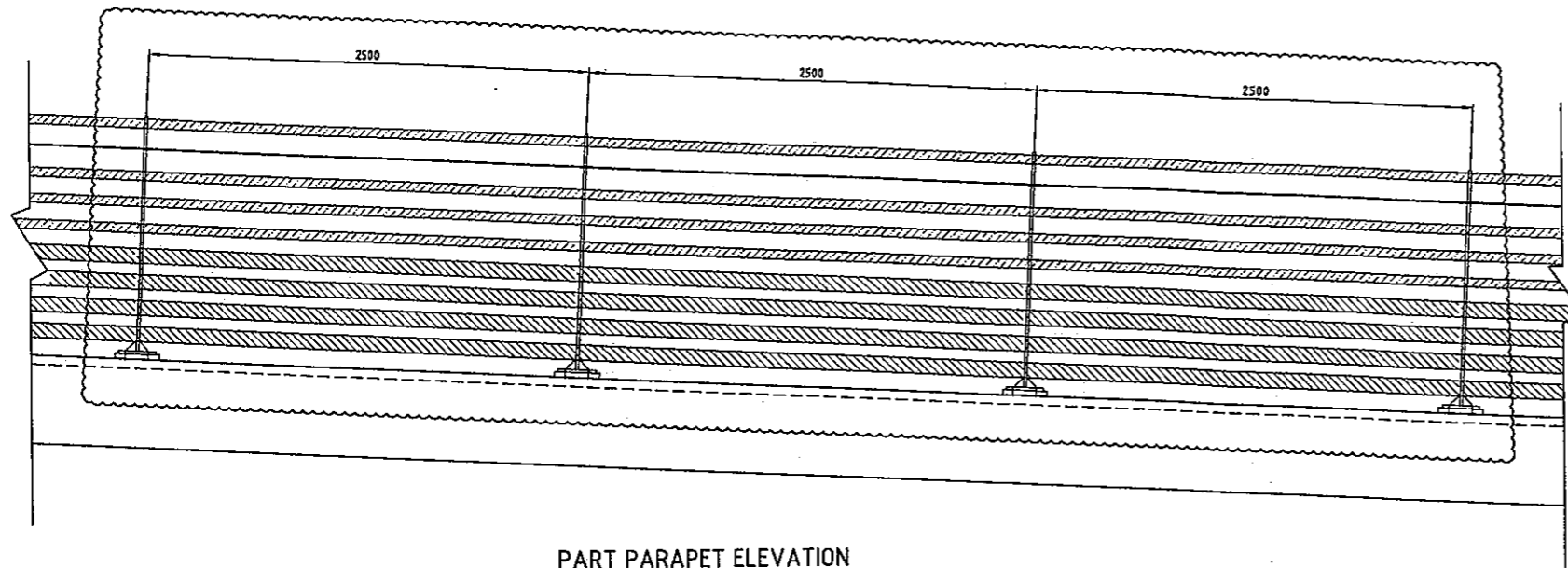
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**CABLE PROFILE, LENGTHS
AND LOADS**

Hyder Consulting

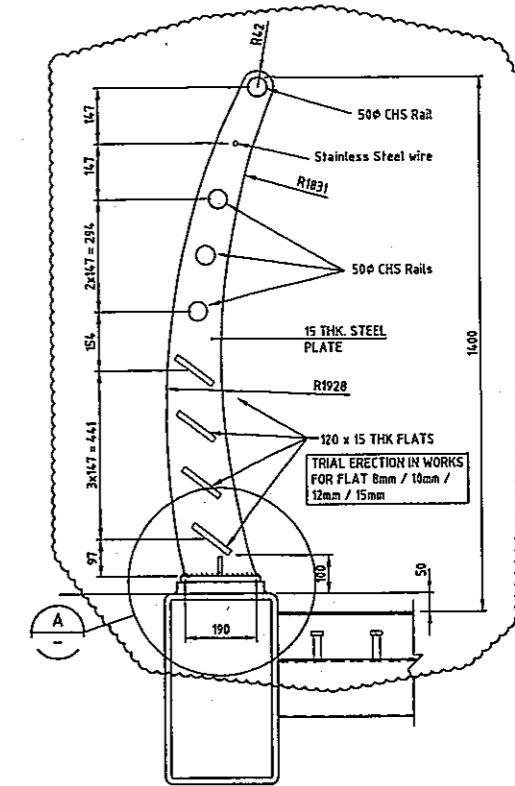
HYDER CONSULTING (UK) LTD
29 Bressenden Place
London
SW1E 5DZ
Tel: +44 (0)20 600 3905
Fax: +44 (0)20 600 3906

Drawing No.	Project No.	Issue
2002 -	LN00905	02

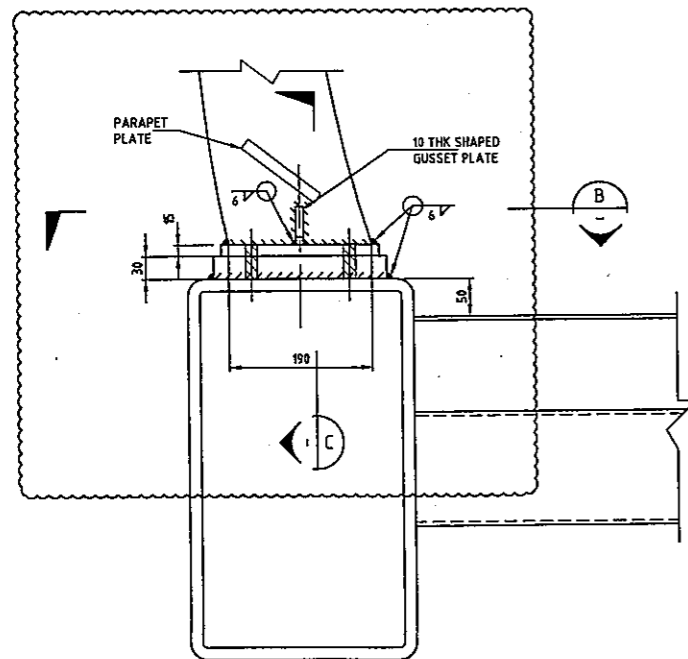
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02	DETAIL A, B, ELEVATION, TABLE AND NOTES AMENDED	22.02.06
01	INITIAL ISSUE	01.02.06



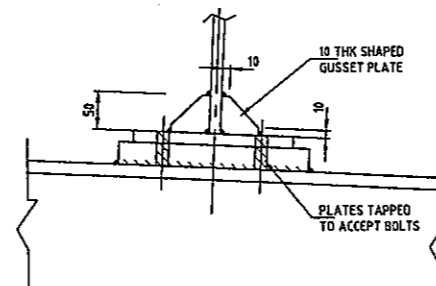
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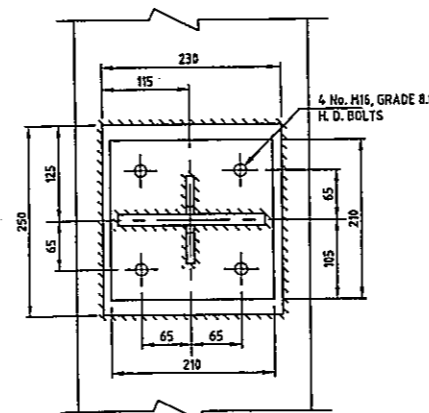
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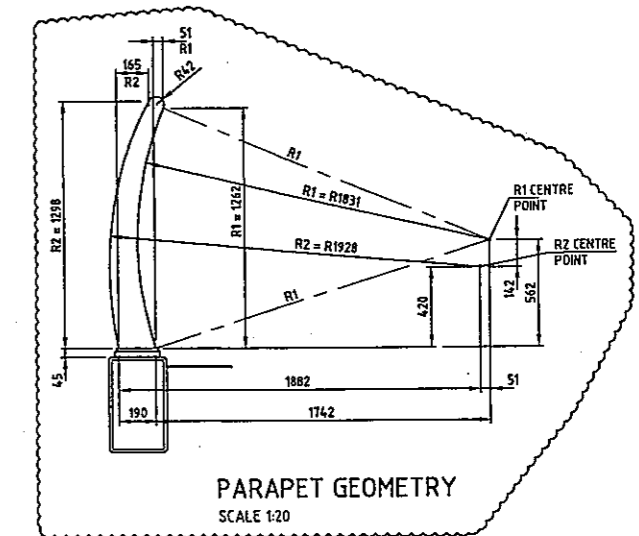
DETAIL A
SCALE 1:5



SECTION C - C
SCALE 1:5



SECTION B - B
PLAN ON BASE PLATE
SCALE 1:5



PARAPET GEOMETRY
SCALE 1:20

Issue	Description	Date
04	PARAPET DETAILS AMENDED, GEOMETRY DETAILS ADDED	24.02.06
03	NOTES AMENDED	22.02.06
02	PARAPET POST DRAWN PERPENDICULAR TO DECK AND SECTIONS ADDED	15.02.06
01	INITIAL ISSUE	31.01.06

- Notes
- ALL PLATES, FLATS AND SECTIONS (OTHER THAN HOLLOW SECTIONS) SHALL BE GRADE S355 J2 G3 IN ACCORDANCE WITH BS EN10025-1:1993.
 - ALL STRUCTURAL STEEL HOLLOW SECTIONS SHALL BE GRADE S355 J2 H IN ACCORDANCE WITH BS EN10210-1:1994.
 - ALL WELDING SHALL BE IN ACCORDANCE WITH BS 5135:1994, ALL WELDS TO BE 6mm FILLET WELD UNLESS OTHERWISE NOTED.
 - STEEL PROTECTOR TREATMENT - 3 COAT EPOXY GLASS FLAKE PAINT SYSTEM TO SATISFY INLAND ENVIRONMENTAL AND DIFFICULT ACCESS. FINAL COAT COLOUR WHITE.

- DO NOT SCALE FROM THE DRAWING, USE FIGURED DIMENSIONS ONLY.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ORG. No. 2001.

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Original Size: A1

Datum: DATUM

Grid: GRID

Filename: 2003-LN00905-LND-02.DWG

Current Issue Signatures
Author: P. GORDHAN
Checker: P. BAILEY
Approver: P. BAILEY

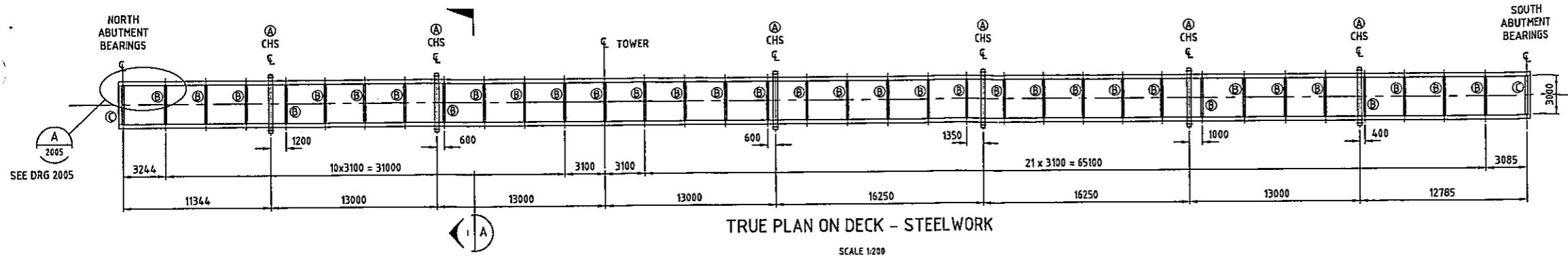
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Title: **PARAPET DETAILS**

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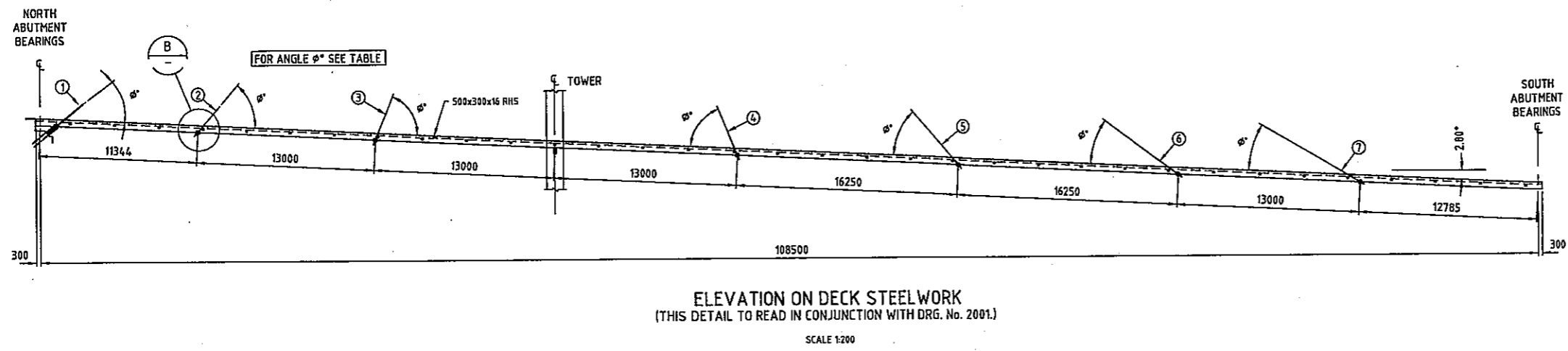
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29 Bressenden Place
London
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Tel: +44 (0)1870 000 3006
Fax: +44 (0)1870 000 3906

Drawing No: 2003
Project No: LN00905
Issue: 04



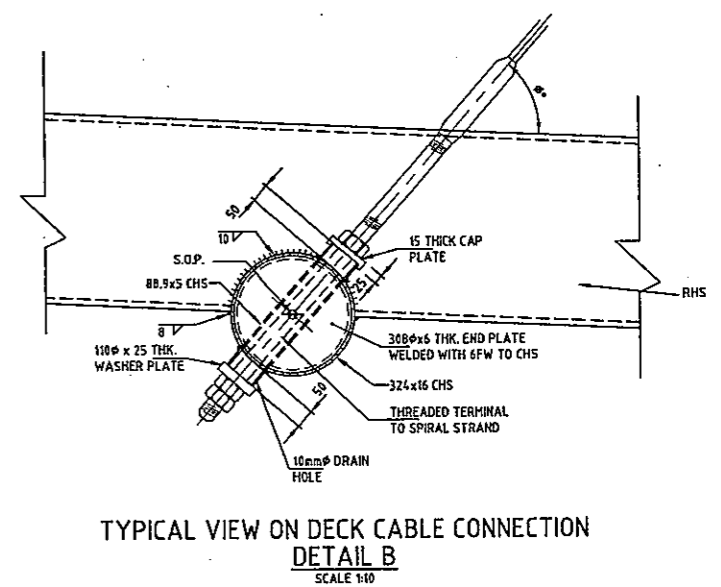
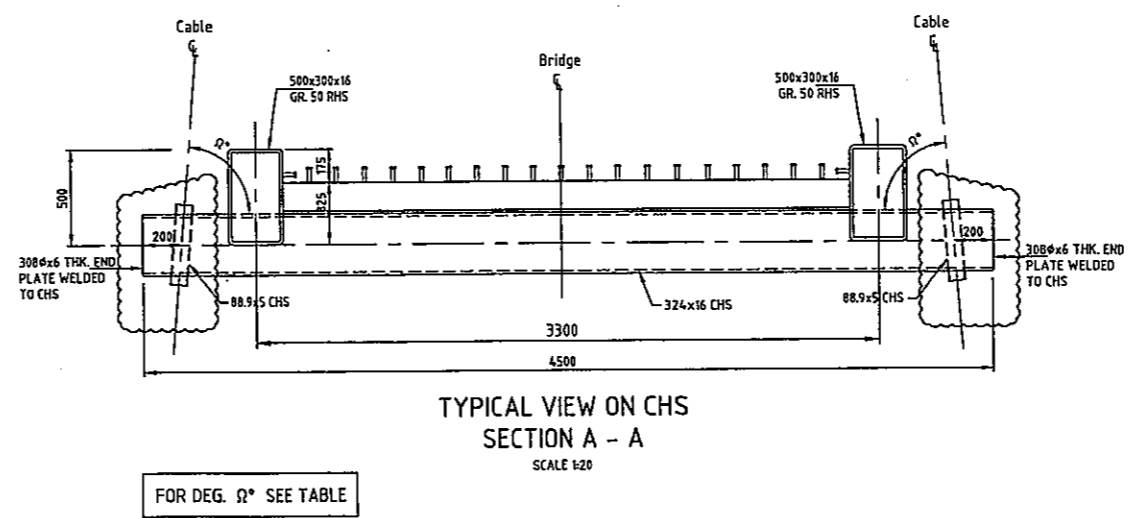
MEMBER SIZES

Member No.	SIZES
A	324 x 16 CHS
B	150 x 150 x 5 SHS
C	200 x 200 x 8 SHS



CABLE PROFILE

Cable No.	Angle = ϕ°	Angle = ω°
1	41.995°	88.000°
2	51.66°	87.600°
3	70.11°	87.110°
4	65.37°	87.210°
5	45.17°	87.840°
6	33.32°	88.340°
7	27.41°	88.630°



Issue	Description	Date
02	CABLE PROFILE TABLE, SECTION A-A AND DETAIL B AMENDED	22.02.06
01	INITIAL ISSUE	08.02.06

Notes

- ALL PLATES, FLATS AND SECTIONS (OTHER THAN HOLLOW SECTIONS) SHALL BE GRADE S355 J2 G3 IN ACCORDANCE WITH BS EN10025-1:1993.
- ALL STRUCTURAL STEEL HOLLOW SECTIONS SHALL BE GRADE S355 J2 H IN ACCORDANCE WITH BS EN10210-1:1994.
- ALL WELDING SHALL BE IN ACCORDANCE WITH BS 5135:1984, ALL WELDS TO BE 6mm FILLET WELD UNLESS OTHERWISE NOTED.
- STEEL PROTECTOR TREATMENT - 3 COAT EPOXY GLASS FLAKE PAINT SYSTEM TO SATISFY INLAND ENVIRONMENTAL AND DIFFICULT ACCESS. FINAL COAT COLOUR WHITE.

Notes

- DO NOT SCALE FROM THE DRAWING, USE FIGURED DIMENSIONS ONLY.
- ALL DIMENSIONS ARE IN MILLEMETRES UNLESS OTHERWISE NOTED.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH DRG. No. 2001.

Client
EXETER RUGBY CLUB
EXETER RUGBY GROUP LTD

DEAN DYBALL
CONSTRUCTION

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales
1:200
1:20, 1:10

Original Size
A1

Datum
DATUM

Grid
GRID

Filename
2004-LN00905-LND-02.DWG

Current Issue Signatures
Author
P. GORDMAN
Checker
P. BAILEY
Approver
P. BAILEY

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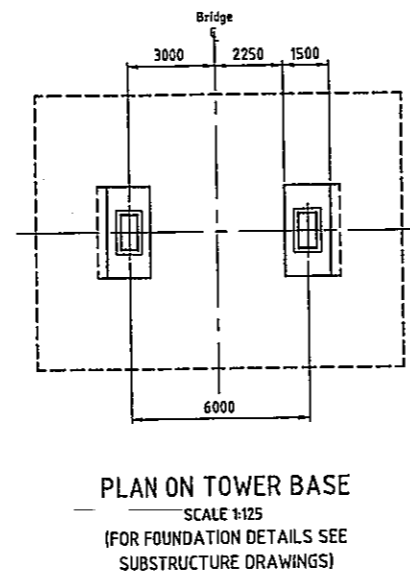
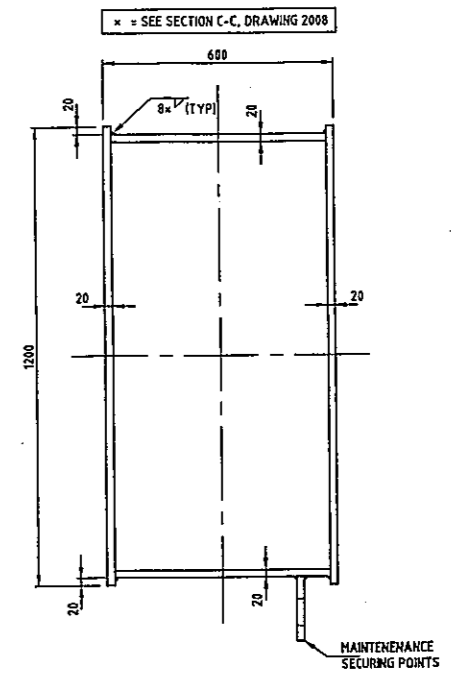
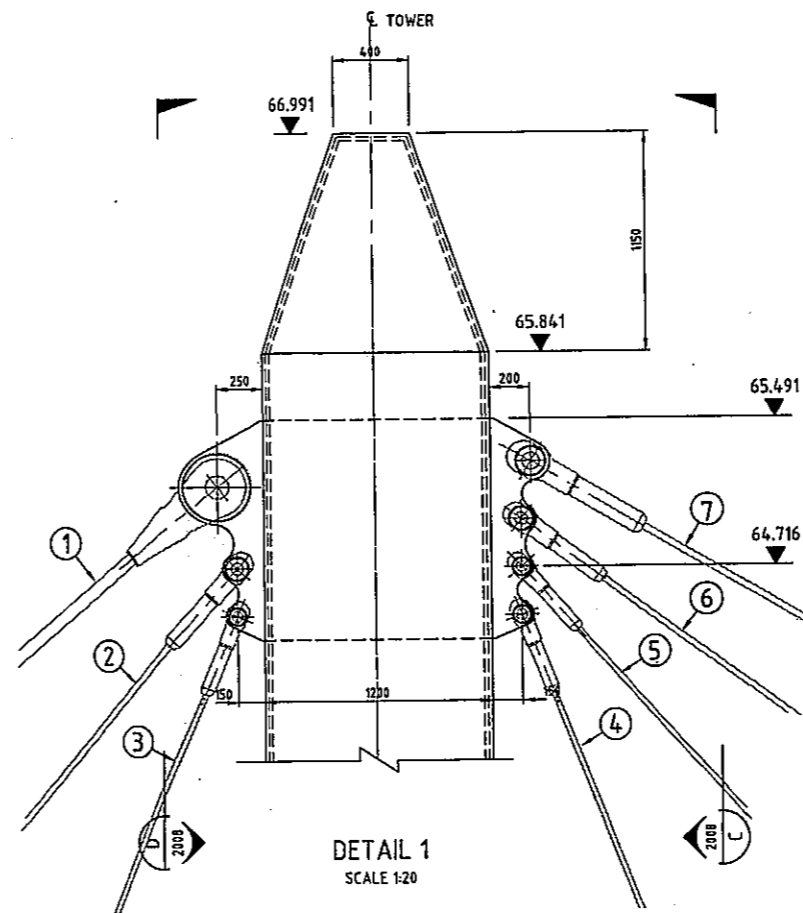
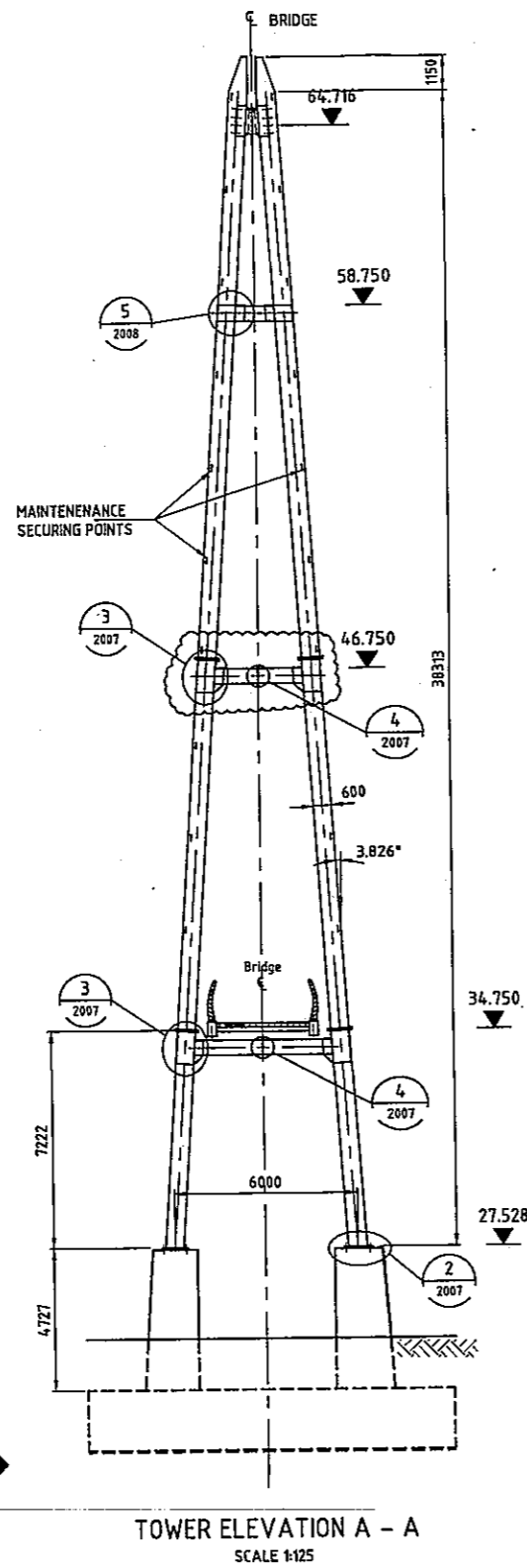
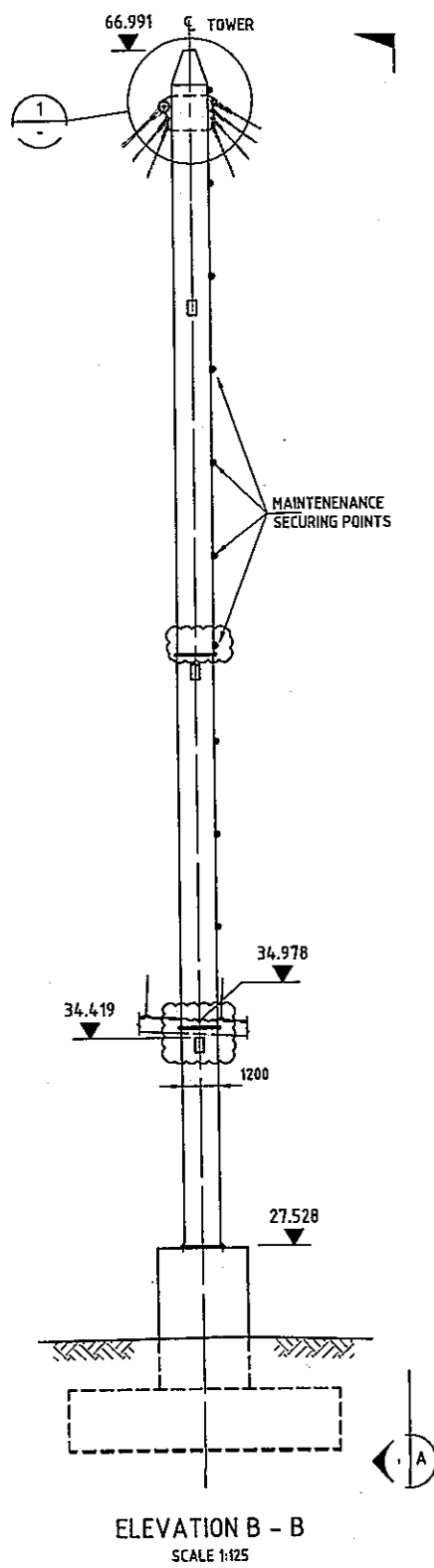
Project
PROPOSED CABLE STAY BRIDGE
OVER A379

Title
STRUCTURAL STEELWORK
DECK DETAILS
SHEET 1 OF 2

Hyder Consulting

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Drawing No. 2004
Project No. LN00905
Issue 02



Issue	Description	Date
03	DETAIL 3, 4 AND NOTES AMENDED	03.03.06
02	TOWER LEG ANGLE ADDED, LEVEL ADDED	28.02.06
01	INITIAL ISSUE	22.02.06

Notes

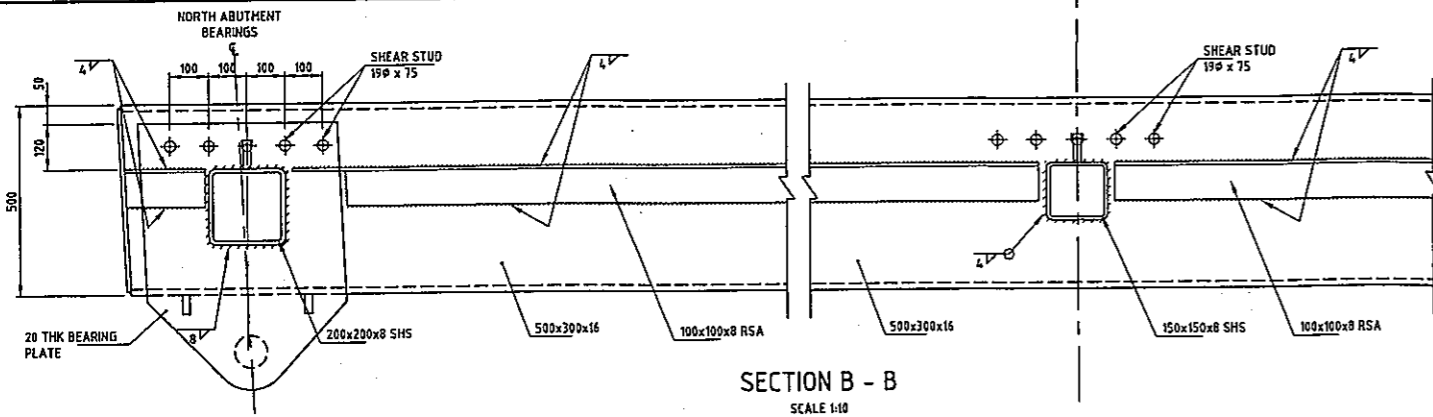
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- THIS DRAWING TO BE READ IN CONJUNCTION WITH DRG. No. 2001

Client EXETER RUGBY CLUB EXETER RUGBY GROUP LTD		Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION		Project PROPOSED CABLE STAY BRIDGE OVER A379	
DEAN DYBALL CONSTRUCTION		Scales 1:200 1:25, 1:10		Current Issue Signatures	
Original Size A1		Author P. GORDHAN		Checker P. BAILEY	
Datum DATUM		Approver P. BAREY		Title TOWER DETAILS SHEET 1 OF 3	
Grid GRID		Copyright reserved		Drawing No. 2006	
Filename: 2006-LN00905-LND-02.DWG				Project No. LN00905	
				Issue 03	

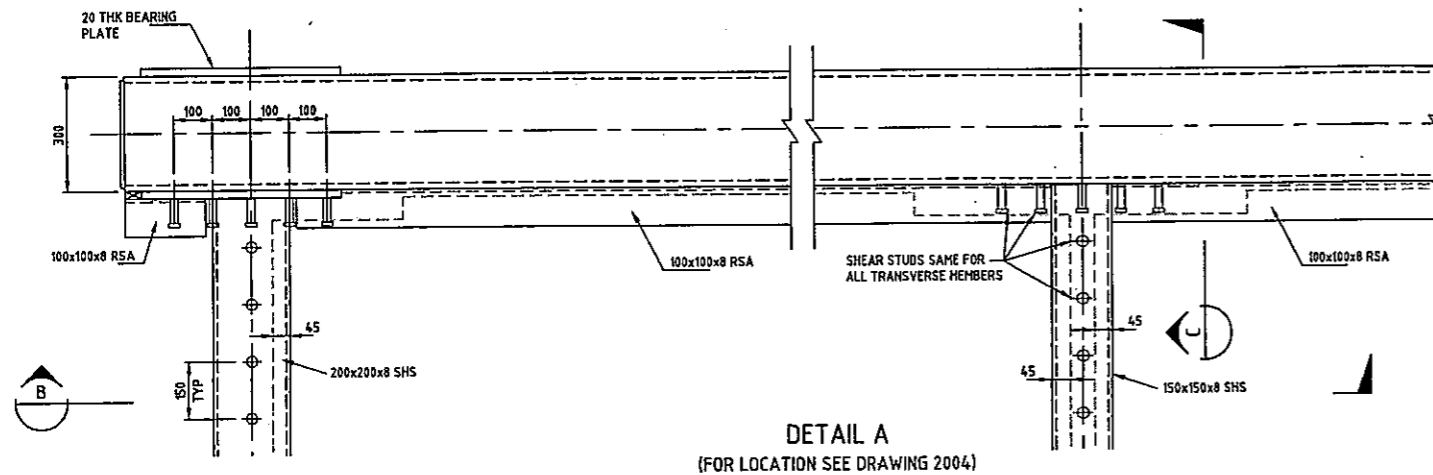
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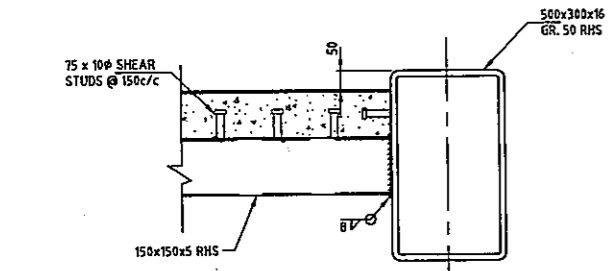
Drawing No. 2006
Project No. LN00905
Issue 03



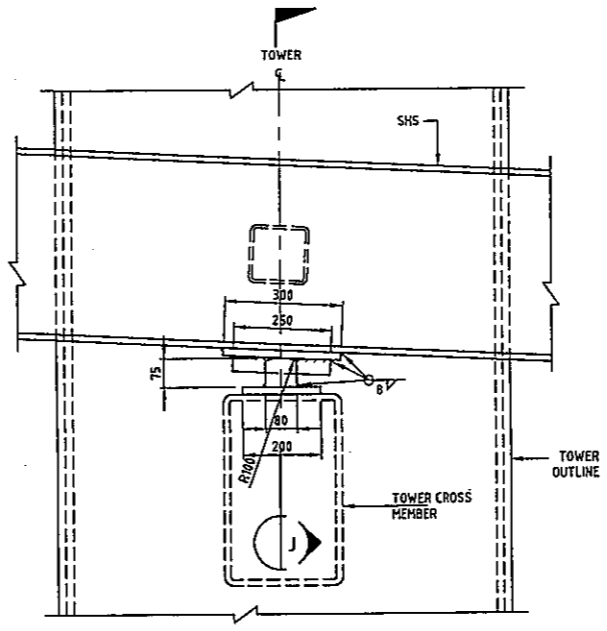
SECTION B - B
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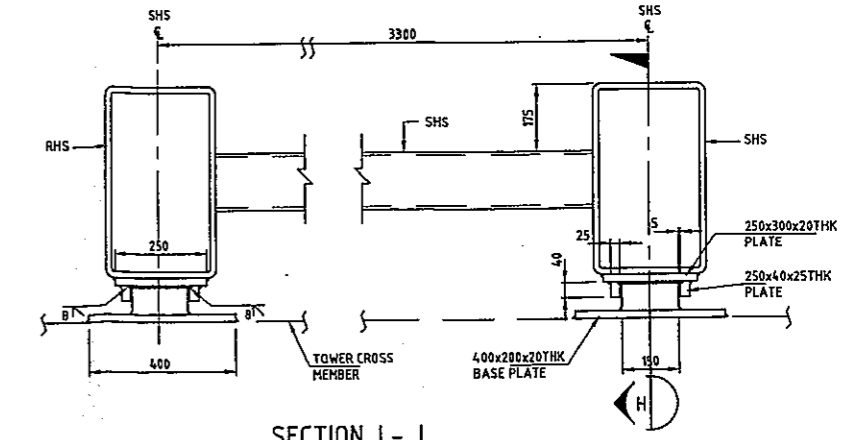
DETAIL A
(FOR LOCATION SEE DRAWING 2004)
SCALE 1:10



SECTION C - C
TYPICAL DETAIL
SCALE 1:10

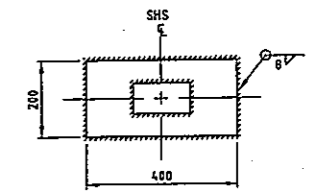


SECTION H - H
SCALE 1:10

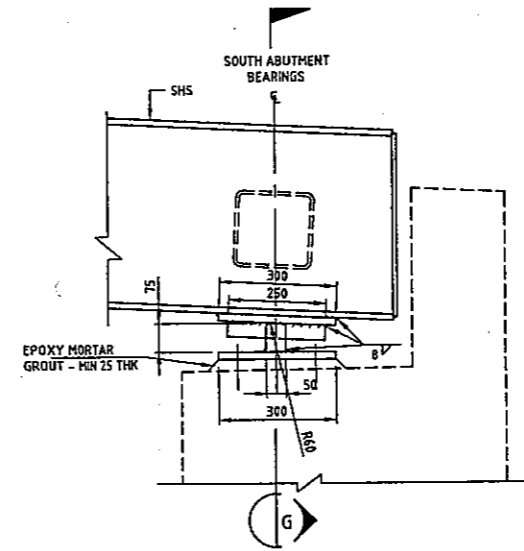


SECTION J - J
SCALE 1:10

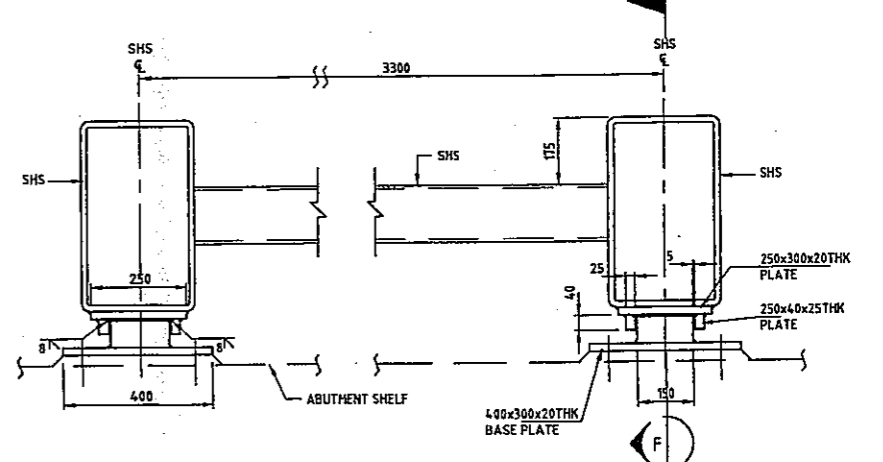
TOWER BEARING DETAILS



PLAN ON TOWER BEARING
BASE PLATE
SCALE 1:10

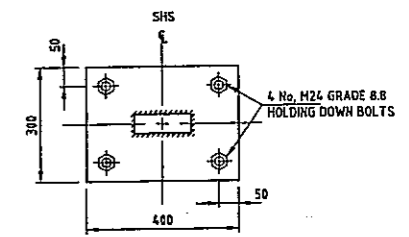


SECTION F - F
SCALE 1:10



SECTION G - G
SCALE 1:10

SOUTH ABUTMENT BEARING DETAILS



PLAN ON BASE PLATE
SCALE 1:10

Issue	Description	Date
03	NORTH ABUTMENT DETAILS OMITTED, NOTE 8 ADDED.	03.03.06
02	WELD DETAILS AND NOTES AMENDED	22.02.06
01	INITIAL ISSUE	09.02.06

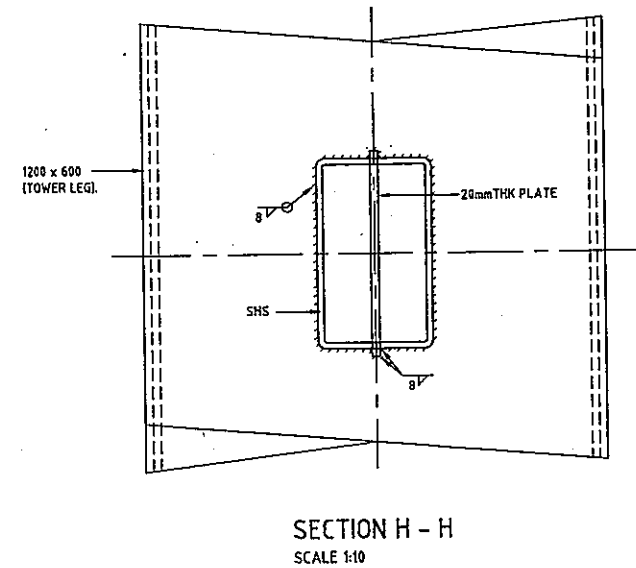
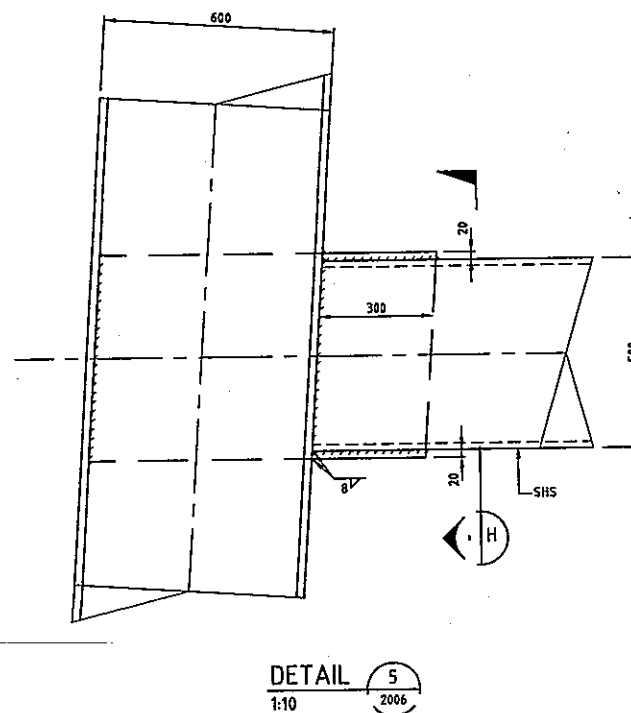
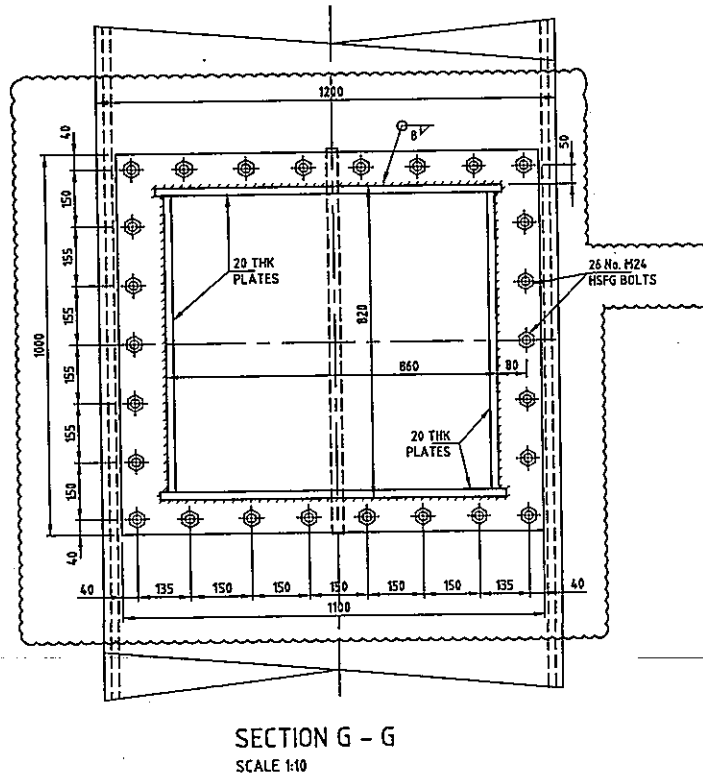
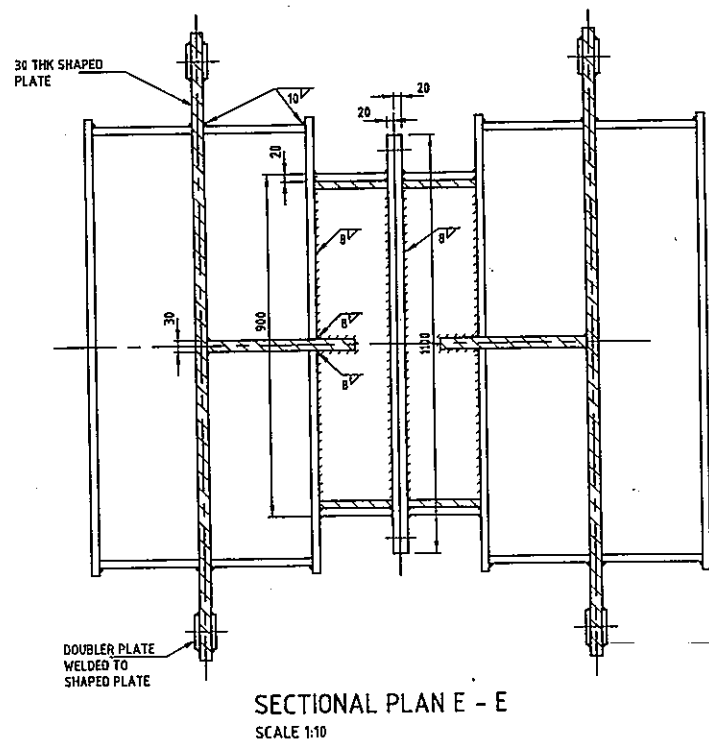
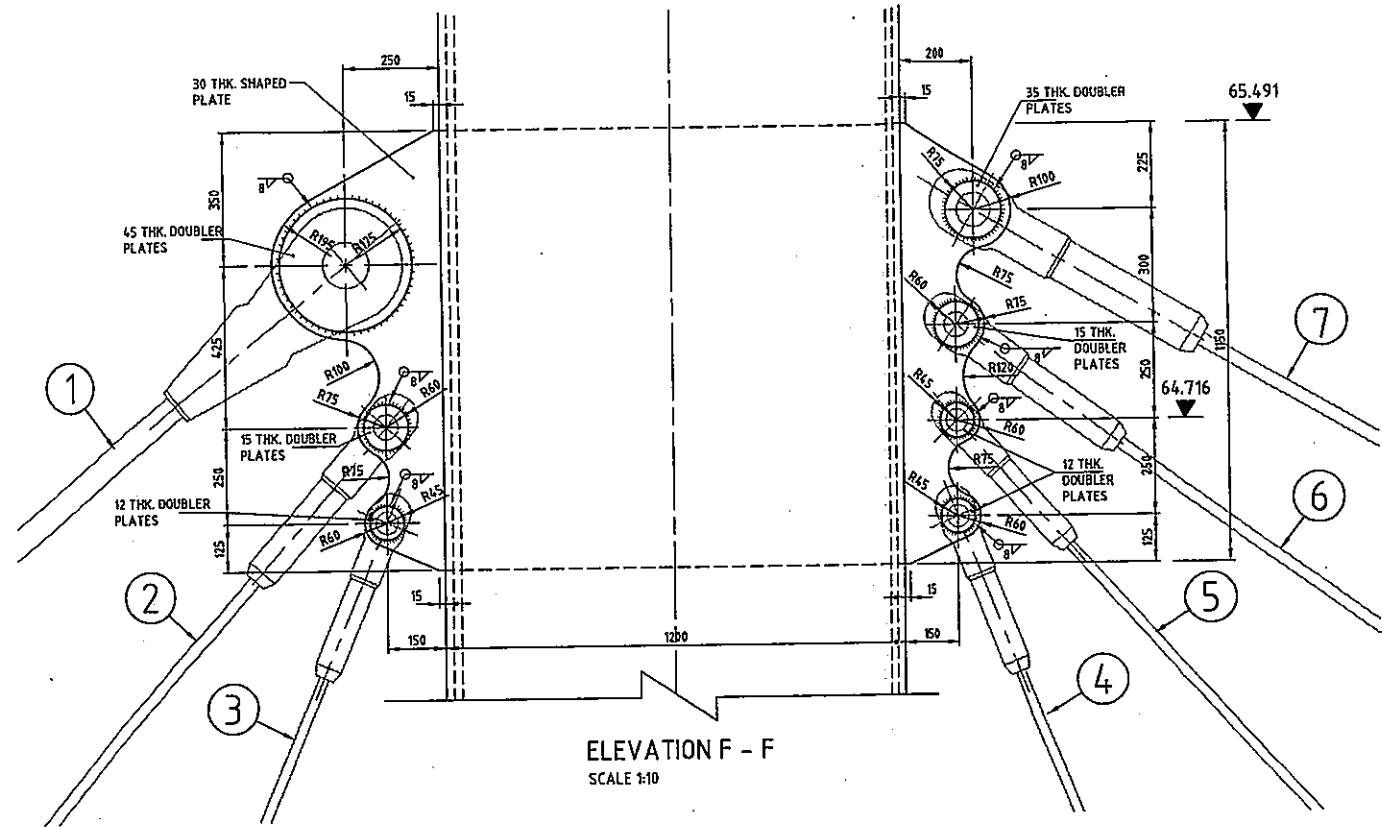
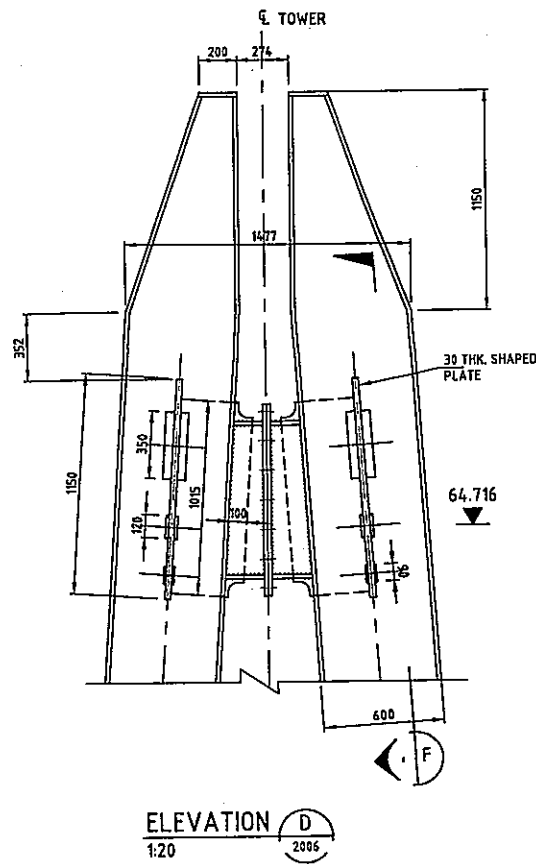
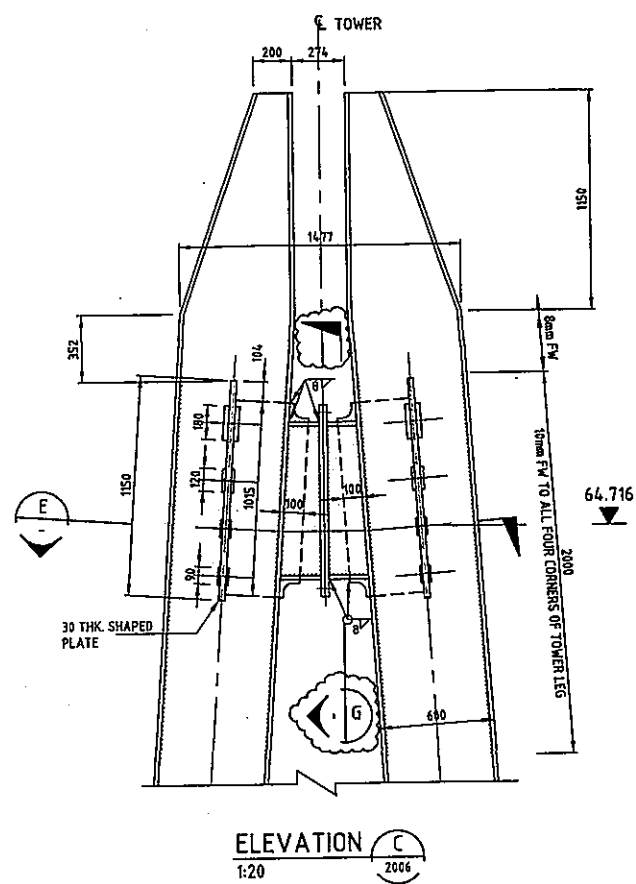
Notes

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- ALL DIMENSIONS ARE IN MILLEMETRES UNLESS OTHERWISE NOTED.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH DRG. No. 2001
- FOR NORTH ABUTMENT BEARING DETAILS SEE DRG No. 2009.

Client EXETER RUGBY CLUB EXETER RUGBY GROUP LTD		Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION	Project PROPOSED CABLE STAY BRIDGE OVER A379
		Scales: 1:10 Original Size: A1 Datum: DATUM Grid: GRID Filename: 2005-LN00905-LND-03.DWG	Current Issue Signatures: Author: P. GORDHAN Checker: P. BAILEY Approver: P. BAILEY © Copyright reserved
Title: STRUCTURAL STEELWORK DECK DETAILS SHEET 2 OF 2		Drawing No.: 2005 - LN00905 Project No.: LN00905 Issue: 03	

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Drawing No.: 2005 - LN00905 Project No.: LN00905 Issue: 03	



- Notes**
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 - THIS DRAWING TO BE READ IN CONJUNCTION WITH ORG. No. 2001 AND 2006.

Client

EXETER RUGBY CLUB
EXETER RUGBY GROUP LTD

DEAN DYBALL
CONSTRUCTION

Status		PRELIMINARY NOT TO BE USED FOR CONSTRUCTION					
Scales		1:20, 1:10					
Original Size		A1					
Datum		DATUM					
Grid		GRID					
Filename:		2008-LN00905-LND-02.DWG					
Current Issue Signatures		<table border="1"> <tr> <td>Author P. GORDHAN</td> <td>Checker P. BAILEY</td> </tr> <tr> <td>Approver P. BAILEY</td> <td>© Copyright reserved</td> </tr> </table>		Author P. GORDHAN	Checker P. BAILEY	Approver P. BAILEY	© Copyright reserved
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Project

PROPOSED CABLE STAY BRIDGE
OVER A379

Title

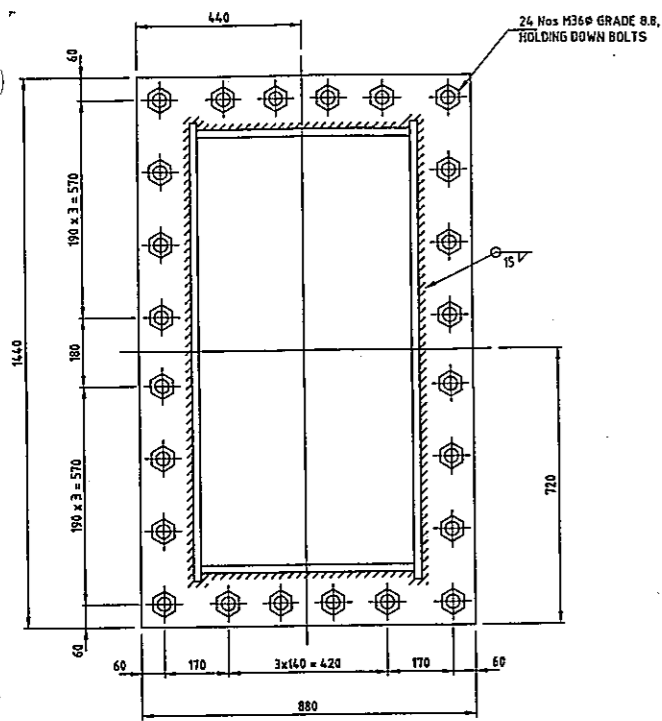
TOWER DETAILS
SHEET 3 OF 3

Hyder
Consulting

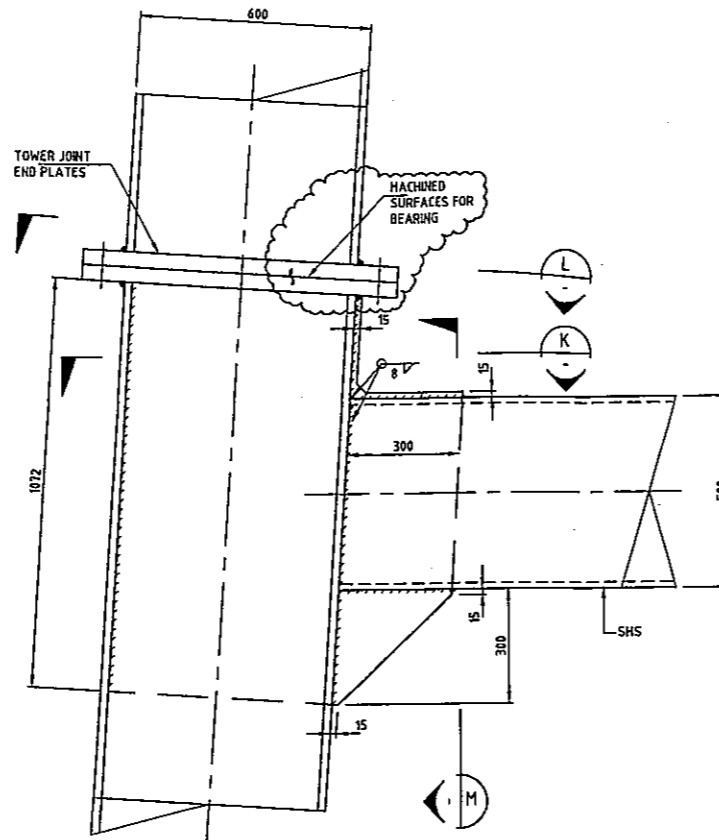
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Drawing No.	Project No.	Issue
2008	LN00905	02

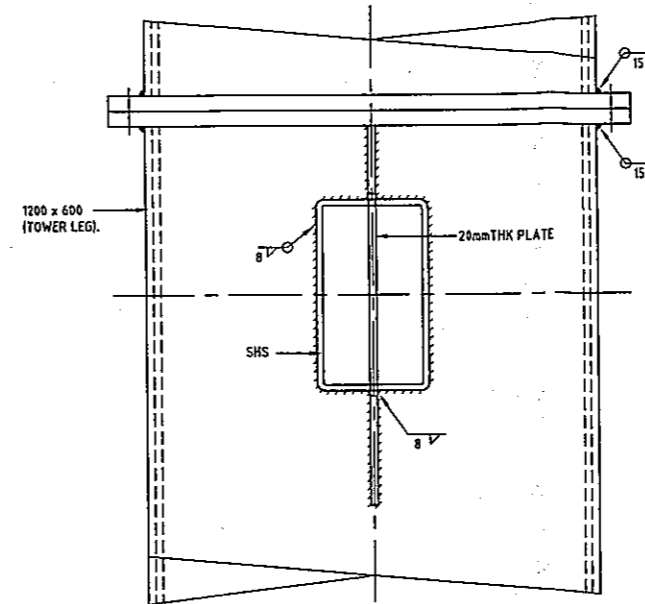
Issue	Description	Date
02	NOTES AND SECTION G-G AMENDED	03.03.06
01	INITIAL ISSUE	22.02.06



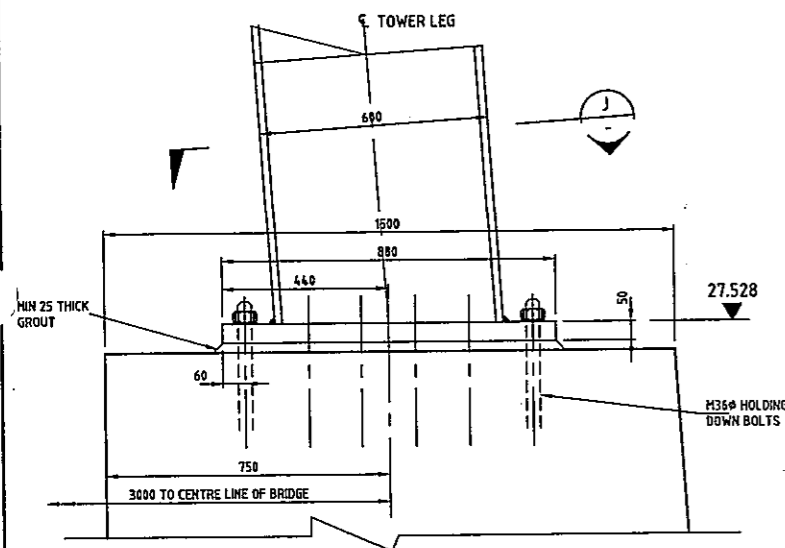
SECTIONAL PLAN J - J ON BASE PLATE
SCALE 1:10



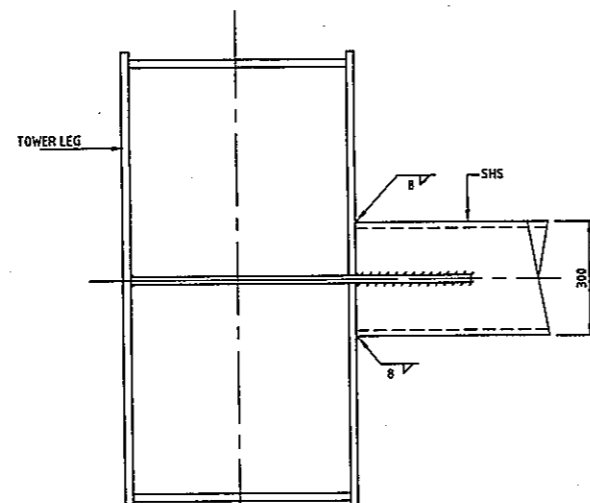
DETAIL 3
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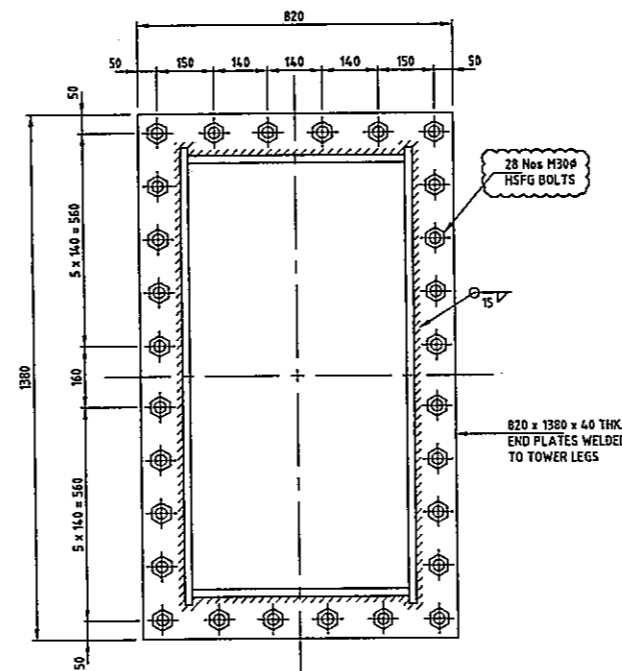
SECTION M - M
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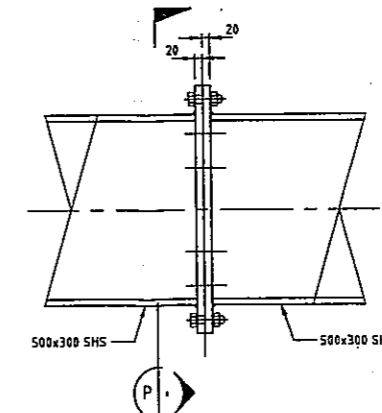
DETAIL 2
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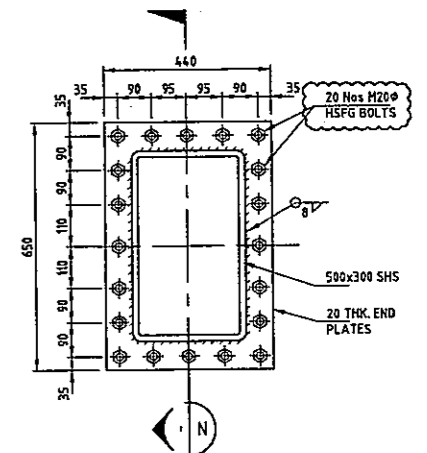
SECTIONAL PLAN K - K
SCALE 1:10



SECTIONAL PLAN L - L
TOWER JOINT DETAILS
SCALE 1:10



SECTION N - N
SCALE 1:10



SECTION P - P
SCALE 1:10

DETAIL 4
1:10

Notes	
1. ALL PLATES, FLATS AND SECTIONS (OTHER THAN HOLLOW SECTIONS) SHALL BE GRADE S355 J2 G3 IN ACCORDANCE WITH BS EN10025:1993.	5. DO NOT SCALE FROM THE DRAWING, USE FIGURED DIMENSIONS ONLY.
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3. ALL WELDING SHALL BE IN ACCORDANCE WITH BS 5135:1984, ALL WELDS TO BE 6mm FILLET WELD UNLESS OTHERWISE NOTED.	7. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRG. No. 2004 AND 2006.
4. STEEL PROTECTOR TREATMENT - 3 COAT EPOXY GLASS FLAKE PAINT SYSTEM TO SATISFY INLAND ENVIRONMENTAL AND DIFFICULT ACCESS. FINAL COAT COLOUR WHITE.	

Issue	Description	Date
02	DETAIL 1 AND NOTES AMENDED	03.03.06
01	INITIAL ISSUE	22.02.06

Client
EXETER RUGBY CLUB
EXETER RUGBY GROUP LTD

DEAN DYBALL
CONSTRUCTION

Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION	
Scales	1:200 1:20, 1:10	Current Issue Signatures
Original Size	A1	Author P. GORDHAN
Datum	DATUM	Checker P. BAILEY
Grid	GRID	Approver P. BAILEY
Filename:	2007-LN0095-LND-02.DWG	

Project
**PROPOSED CABLE STAY BRIDGE
OVER A379**

Title
**TOWER DETAILS
SHEET 2 OF 3**

Hyder Consulting

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Drawing No. 2007 - LN0095 - 02
Project No. LN0095
Issue 02

Site Investigation Report

CONTAMINATION STRATEGY / ASSESSMENT

For information on the Contamination Strategy / Assessment please refer to the following document:

Exeter Rugby Club, Sandy Park Farm
Health & Safety File
Enabling Works for Maple Oak Developments
January 2006
Volumes 1-3.



KEY TO EXPLORATORY HOLE LOGS

Sample type

D	Small disturbed sample	D*	Contamination sample
B	Large disturbed sample	W	Water sample
U	Undisturbed sample	P	Piston sample
X	Dynamic sample	C	Core sample

Test type

SPT

S	Split spoon sampler followed by SPT 'N' value
C	Solid cone followed by SPT 'N' value
*250	Where full test drive not completed, linearly extrapolated N value reported
**	No effective penetration

H	Hand vane – direct reading in kPa – not corrected for BS1377 (1990). Re* denotes refusal.
M	Mackintosh probe result – number of blows to achieve 100mm penetration
PP	Pocket penetrometer result – direct reading in kg/sq.cm.

Sample/core range/ I_f









|	Dynamic sample
█	Undisturbed sample
— x	X = Total Core Recovery (TCR) as percentage of core run. Where value significantly exceeds 100%, a note is given in Remarks on log.
y	Y = Solid Core Recovery (SCR) as percentage of core run. Note: assessment of solid core is based on full diameter.
z	Z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

I_f - fracture spacing – the average fracture spacing (in millimetres) over the indicated length of core. Where spacing varies significantly, the minimum, average and maximum values are given.

NI = non-intact core
NA = not applicable

Instrumentation

	Porous tip		Granular response zone		Cement/bentonite grout
	Perforated standpipe		Bentonite seal		Soil backfill
	Gas monitoring standpipe		Concrete		

Stratum boundaries

-----	Estimated boundary
-----	Grading boundary

BOREHOLE LOG



CLIENT FABER MAUNSELL

BH01

SITE EXETER FOOTBRIDGE

Sheet 1 of 3

Start Date 01 December 2005

Scale 1 : 50

End Date 07 December 2005

Depth 19.11 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
01/12/05 1330hrs	1D 2X	1.20 - 1.65 1.20 - 2.20	nil	S 4				MADE GROUND: Grass over orange slightly silty sand with a little subrounded fine and medium gravel sized fragments of clinker. 1.20 - 1.65m: Very loose.	1.65		
01/12/05 1700hrs dry	3D 4X	2.20 - 2.50 2.20 - 3.20	nil	S 18				Orange locally mottled off-white fine to coarse SAND with occasional coarse gravel sized pockets weakly cemented. (Possibly reworked.)	2.15		
02/12/05 0800hrs dry	5D 6X	3.20 - 3.65 3.20 - 4.20	2.20	S 10				Medium dense red fine to coarse SAND with occasional coarse gravel sized pockets of firm red clay. (Possibly reworked.) 2.50 - 2.60m: Locally firm slightly sandy red clay.	3.00		
	7D 8X	4.20 - 4.65 4.20 - 5.00	3.20	S 18				Orange slightly silty SAND with a little subangular and subrounded fine to coarse sandstone gravel. Possibly reworked. Medium dense grey-brown silty fine to coarse silty SAND. Locally sandy silt with occasional fine rootlets. Feint organic odour.	3.40 3.65		
	9D C	5.00 - 5.32 5.00 - 6.00	4.20	S *79	80 0 0	NI		Medium dense red-brown locally brown very clayey fine to coarse SAND with occasional fine rootlets. 3.80m: 30mm stiff red clay with occasional fine rootlets. 3.90 - 4.00m: Locally mottled light grey. 4.00m: Becomes with a little subangular coarse tabular sandstone gravel. 4.10m: Locally weakly cemented 4.25 - 6.00m: With occasional thin veins and gravel size pockets of green-grey clay/silt.	5.00		
02/12/05 1500hrs 2.50m	10C	6.00 - 6.30 6.00 - 7.00	4.20	C *88	100 3 0	NI		Very dense red-brown locally brown very clayey fine to coarse SAND. Rare subrounded gravel size sandstone lithorelicts and frequent fine rootlets.	6.00		
05/12/05 0800hrs 2.30m	11C	7.00 - 7.15 7.00 - 8.00	5.00	C *214	100 9 9	NI		Very dense red-brown locally brown clayey fine to coarse SAND with occasional subangular medium gravel size sandstone lithorelicts. Locally tending to a very weak sandstone. 6.30 - 6.55m: Stiff and very stiff indistinctly structured red-brown slightly sandy clay with a little subangular blocky mudstone gravel. Occasional fine veins and gravel size pockets of green clay. 6.40m: 1No. coarse gravel size pocket of orange-brown stained sand.	6.55		
		8.00 - 8.11	6.00	C *300				Very weak becoming weak thinly laminated slightly micaceous fine and medium grained SANDSTONE. Predominantly NI, recovered as sand. Discontinuity above	8.00 (8.00)		

EQUIPMENT: Geotechnical Pioneer rig.
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-2.20m, (113mm) 2.20-5.00m. Waterflush rotary core drilled (116mm) 5.00-19.00m.
 CASING: 140m diam to 6.00m.
 BACKFILL: On completion hole backfilled with bentonite pellets on 07/12/05.
 REMARKS: Lost drilling flush at 15.80m.

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.	18332	

Geotechnical Engineering Ltd, Tel. 01452 527743 18332.GPJ TRIAL.JHPJ GEOTECH.GLB 02/02/06

BOREHOLE LOG



CLIENT FABER MAUNSELL

BH01

SITE EXETER FOOTBRIDGE

Sheet 2 of 3

Start Date 01 December 2005

Scale 1 : 50

End Date 07 December 2005

Depth 19.11 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	ly	instru -ment	description	depth (m)	reduced level (m)	legend
	12C	8.00 - 9.00			80 17 17		NI	is discoloured yellow-brown and green with much mica. 7.00 - 8.00m: Drilling disturbed, recovered as sand. 7.95m: Tending to a very weak sandstone with 1No. 15mm thick bed of yellow-grey sandstone.	8.90		.....
	13C	9.00 - 9.11 9.00 - 10.00	6.00	C *300	110 13 13			Weak to moderately weak indistinctly thin and thickly laminated red-brown predominantly fine and medium grained SANDSTONE with occasional 15mm thick bed of stiff clay. Predominantly NI.			.....
	14C	10.00 - 10.09 10.00 - 11.00	6.00	C *500	100 0 0			8.65m: 45mm thick bed of stiff indistinctly structured clay. Moderately weak red-brown fine to coarse grained SANDSTONE with occasional gravel size mudstone clasts. Predominantly NI, recovered as sand. 9.10m: 130mm thick bed of weak fine and medium grained sandstone. 9.55m: 15mm thick bed of stiff red clay. 10.00 - 11.00m: With frequent rounded gravel size quartz fragments.			.....
	15C	11.00 - 11.09 11.00 - 12.00	6.00	C *375	90 50 0	NI 45 65		11.00 - 12.00m: Predominantly intact with very closely to closely spaced planar rough tight fractures.			.....
	16C	12.00 - 12.06 12.00 - 13.00	6.00	C *750	100 80 80	35 121 480		Moderately weak to moderately strong indistinctly thickly laminated red-brown slightly micaceous fine to coarse grained SANDSTONE. Locally NI. 12.00 - 13.00: Fractures are indistinct, drilling induced?	12.00		.....
	17C	13.00 - 13.06 13.00 - 14.00	6.00	C *750	100 100 75			13.00 - 15.00m: With very closely to medium spaced planar tight occasionally open fractures.			.....
	18C	14.00 - 14.05 14.00 - 15.00	6.00	C *750	100 95 31			14.00m: Becoming distinctly thickly laminated.			.....
	19C	15.00 - 15.07 15.00 - 16.00	6.00	C **	105 90 75			15.00 - 16.00m: Locally fine and medium grained. Fractures are inclined at 0-5° and occasionally discoloured black.			.....
05/12/05 1700hrs 2.30m	20C	16.00 - 16.09 16.00 - 17.00	6.00	C *500	88 65 10	NI 55 140		Moderately weak becoming moderately strong red-brown occasionally speckled black SANDSTONE. 16.00 - 16.20m: Recovered as slightly silty sand. 16.20 - 16.40m: With extremely closely spaced 20° incipient planar clean smooth discontinuities. 16.40 - 16.90m: 3 No. closely spaced 60° tight and incipient undulating discontinuities with black surface stain. 16.66 - 16.78m: Subvertical curvilinear rough tight discontinuity with black surface stain. 16.85 - 17.26m: Recovered as sand. 17.26 - 17.35m: With extremely closely spaced 20° incipient planar discontinuities. Possibly drilling induced.	16.00		.....
06/12/05 0800hrs dry	22C	17.00 - 17.08 17.00 - 18.00	6.00	C *750	116 82 51						.....
		18.00 - 18.07	6.00	C *750							.....

Continued Next Page

{18.00}

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks	CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.	18332	

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BOREHOLE LOG



CLIENT FABER MAUNSELL

BH01

SITE EXETER FOOTBRIDGE

Sheet 3 of 3

Start Date 01 December 2005

Scale 1 : 50

End Date 07 December 2005

Depth 19.11 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend	
06/12/05 1700hrs 16.60m	35C	18.00 19.00			86 74 66		17.46 - 17.87m: With very closely spaced 20° incipient planar smooth and rough clean discontinuities. 17.85m: 20° open smooth planar discontinuity. 17.89m: 20° open smooth planar discontinuity. 18.00 - 18.09m: Recovered as sand. 18.09 - 19.00m: With very and extremely closely spaced 20-30° incipient smooth and rough planar discontinuities. 18.10m: Subhorizontal tight undulating rough clean discontinuity. 18.31m: Subhorizontal tight undulating rough clean discontinuity. 18.50 - 18.52m: 30° tight planar smooth clean discontinuity, terminates on discontinuity. 18.52m: Subhorizontal tight planar smooth clean discontinuity. 18.70m: Subhorizontal tight planar smooth clean discontinuity. Borehole completed at 19.11m.	19.11		.....
		19.00 - 19.11	6.00	C *750							
								(28.00)			
water strike (m) casing (m) rose to (m) time to rise (m) remarks							CONTRACT	CHECKED			
Groundwater not encountered prior to use of water flush.							18332				

BOREHOLE LOG



CLIENT FABER MAUNSELL

BH02

SITE EXETER FOOTBRIDGE

Sheet 1 of 2

Start Date 08 December 2005

Scale 1 : 50

End Date 09 December 2005

Depth 10.06 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
08/12/05 0800hrs	1X	0.60 - 0.70						Red-brown slightly silty SAND with some subangular fine to coarse sandstone gravel. 0.90m: Becoming weakly cemented. Moderately weak red-brown fine to coarse grained SANDSTONE. 1.00 - 1.35m: Recovered as silty sand. 2.00 - 3.00m: With medium spaced subhorizontal planar rough clean tight and incipient discontinuities with occasional dark brown surface stain. 2.52m: 40mm band dark brown stain with occasional coarse gravel sized nodules of weak coarse grained sandstone. Moderately weak indistinctly laminated red-brown fine to coarse grained SANDSTONE with closely to medium spaced horizontal irregular rough tight fractures. Locally NI, recovered as sand. 3.70 - 4.00m: With occasional mottled black discoloration and frequent gravel size fragments of chert and granite. Moderately weak red-brown predominantly fine and medium grained SANDSTONE with very closely to closely spaced 10° planar rough tight fractures. 4.00 - 4.30m: NI, recovered as sand and gravel size fragments. 5.50m: Becoming indistinctly laminated and locally coarse grained. Moderately strong thinly and thickly laminated red-brown fine and medium grained SANDSTONE with extremely closely to closely spaced 0-5° irregular rough tight fractures. Discontinuities are occasionally discoloured black. 6.00 - 6.30m: NI. Moderately weak red-brown predominantly fine and medium grained SANDSTONE with closely occasionally very closely spaced 0-10° planar and irregular rough tight			
	2C	0.70 - 1.00	0.70		100 0				1.00		
	3C	1.00 - 1.14 1.00 - 2.00	0.70	C *300	100 40 40	NI 140 220					
	4C	2.00 - 2.08 2.00 - 3.00	0.70	C *500	100 80 77						
	5C	3.00 - 3.09 3.00 - 4.00	1.50	C *375	92 52 52	NI 173 300				3.00	
	6C	4.00 - 4.10 4.00 - 5.00	1.50	C *500	100 68 24	NI 75 130				4.00	
	7C	5.00 - 5.05 5.00 - 6.00	1.50	C *500	87 50 23						
	8C	6.00 - 6.04 6.00 - 7.00	1.50	C *750	96 60 0	NI 39 90				6.00	
	9C	7.00 - 7.05 7.00 - 8.00	1.50	C *500	98 98 36					7.40	
08/12/05 1700hrs 2.80m		8.00 - 8.07	1.50	C *500	50 98 140				8.00		
09/12/05 0800hrs 1.50m											

EQUIPMENT: Geotechnical Pioneer rig.
 METHOD: Hand dug inspection pit 0.00-0.60m. Dynamic sampled (128mm) 0.60-0.70m. Waterflush rotary core drilled (116mm) 0.70-10.00m.
 CASING: 140m diam to 1.50m.
 BACKFILL: On completion hole backfilled with bentonite pellets.

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.	18332	

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BOREHOLE LOG



CLIENT FABER MAUNSELL

BH02

SITE EXETER FOOTBRIDGE

Sheet 2 of 2

Start Date 08 December 2005

Scale 1 : 50

End Date 09 December 2005

Depth 10.06 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend	
09/12/05 1230hrs 3.40m	10C	8.00 - 8.50			50 17 0	50 96 140		fractures. 8.00 - 8.25m: NI, recovered as sand.	8.40		.....
	11C	8.50 - 9.00			50 32 0			8.30m: 100mm thick bed of very stiff closely fissured red clay.			.....
	12C	9.00 - 9.07	1.50	C *750		100 100 0	20 55 90		Weak locally very weak slightly micaceous fine grained SANDSTONE.	9.00	
		9.00 - 10.00							8.80m: 100mm thick bed of very weak closely fissured red mottled green mudstone.		
		10.00 - 10.06	1.50	C *500				Moderately strong becoming moderately weak red-brown fine to coarse grained SANDSTONE with very closely to closely spaced 0-10° irregular rough tight fractures occasionally stained black.	10.06		.....
								Borehole completed at 10.06m.				

{18.00}

water strike (m) casing (m) rose to (m) time to rise (m) remarks
 Groundwater not encountered prior to use of water flush.

CONTRACT 18332 CHECKED

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STANDARD PENETRATION TEST



CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole no.	borehole depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	remarks
				blows	pen (mm)	blows	pen (mm)	blows	pen (mm)			
BH01	1.20	nil	dry	1 0	75 75	0 1 0 3	75 75 75 75	S	4			
BH01	2.20	nil	dry	2 2	75 75	4 4 4 6	75 75 75 75	S	18			
BH01	3.20	2.20	2.30	1 2	75 75	1 2 3 4	75 75 75 75	S	10			
BH01	4.20	3.20	2.30	1 3	75 75	4 4 4 6	75 75 75 75	S	18			
BH01	5.00	4.20	2.30	6 13	75 75	13 20 17	75 75 40	S	79			
BH01	6.00	5.00	2.30	10 13	75 75	15 23 12	75 75 20	S	88			
BH01	7.00	6.00	2.10	10 15	75 10	50	70	S	214			
BH01	8.00	6.00	2.10	25	60	50	50	S	300			
BH01	9.00	6.00	1.80	25	60	50	50	S	300			
BH01	10.00	6.00	2.10	25	60	50	30	S	500			
BH01	11.00	6.00	2.10	25	50	50	40	S	375			
BH01	12.00	6.00	2.30	25	40	50	20	S	750			
BH01	13.00	6.00	2.30	25	40	50	20	S	750			
BH01	14.00	6.00	2.40	25	30	50	20	S	750			
BH01	15.00	6.00	2.30	25	60	50	10	S	1500	No effective penetration		
BH01	16.00	6.00	14.80	25	60	50	30	S	500			
BH01	17.00	6.00	dry	25	60	50	20	S	750			
BH01	18.00	6.00	dry	25	50	50	20	S	750			
BH01	19.00	6.00	16.60	25	20	50	20	S	750			
BH02	1.00	nil	0.00	15 10	75 20	50	50	S	300			
BH02	2.00	0.70	0.80	25	50	50	30	S	500			
BH02	3.00	1.50	1.30	25	50	50	40	S	375			
BH02	4.00	1.50	1.50	25	75	50	30	S	500			
BH02	5.00	1.50	2.10	25	20	50	30	S	500			

notes:

1. Test carried out in general accordance with BS.1377 : Part 9 : 3.3
2. Test carried out using split spoon S, solid cone C.
3. Where full test drive not completed, linearly extrapolated N value reported.

CONTRACT 18332	CHECKED
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STANDARD PENETRATION TEST



CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole no.	borehole depth (m)	casing depth (m)	water level (m)	seating drive		test drive		test type	N	remarks
				blows	pen (mm)	blows	pen (mm)			
BH02	6.00	1.50	2.50	25	20	50	20	S	750	
BH02	7.00	1.50	2.80	25	20	50	30	S	500	
BH02	8.00	1.50	2.00	25	40	50	30	S	500	
BH02	9.00	1.50	2.60	25	50	50	20	S	750	
BH02	10.00	1.50	3.40	25	40	50	30	S	500	

notes:

1. Test carried out in general accordance with BS.1377 : Part 9 : 3.3
2. Test carried out using split spoon S, solid cone C.
3. Where full test drive not completed, linearly extrapolated N value reported.

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TRIAL PIT LOG



CLIENT FABER MAUNSELL

TP01

SITE EXETER FOOTBRIDGE

Sheet 1 of 1

Start Date 05 December 2005

Scale 1 : 25

End Date 05 December 2005

Depth (m) 1.60

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
1.00m: Seepage.	1B		0.20	MADE GROUND: Grass over dark brown slightly clayey sand with some subangular and subrounded fine to coarse gravel of various lithologies.	0.10		
				MADE GROUND: Brown clayey sand with rare gravel sized ceramic fragments and occasional fine rootlets	0.30		
	2B		0.40	Red-brown clayey SAND with a little subangular fine to coarse sandstone gravel.			
					0.65		
	3B				0.70		
				1.00			
Dry.	4B		1.10	Red-brown slightly clayey slightly sandy angular fine to coarse sandstone GRAVEL.			
					1.60		
				Trial pit completed at 1.60m.			

Notes

Trial pit excavated by JCB 3CX mechanical excavator.
 Groundwater seepage from 1.00m. On completion, trial pit was dry.
 At 0.80m; partial end wall collapse from 0.40m.
 From 1.00m slow excavation.
 Trial pit terminated at 1.60m due to bedrock.
 Trial pit dimensions 2.80x0.60x1.60m.
 On completion, the trial pit was backfilled with materials arising.

Sketch of Foundation - Not to scale. All dimensions in metres.

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KEY TO EXPLORATORY HOLE LOGS

Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:1999

For mixed soils the proportions of secondary constituents have been described using the following terms:

Description before SOIL NAME	SAND or GRAVEL	CLAY or SILT	Description after SOIL NAME
Slightly *	< 5%	< 35%	with a little
*	5 – 20%	35 – 65%	with some
very *	> 20%	> 65%	with much

* clayey, silty, sandy or gravelly as appropriate

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of the fracture state. Where doubt exists, a note has been made in the descriptions.

General Comments

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

Indicated water levels are those recorded during the progress of drilling in open or cased boreholes and may not represent standing water levels.

Legends are drawn in accordance with BS 5930:1999.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry.

LIQUID AND PLASTIC LIMITS



BS.1377 : Part 2 : 1990 : 4 and 5

CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole / trial pit no.	sample		specimen depth (m)	natural moisture content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
BH01	2X	1.20	1.20	12						Orange-brown slightly silty SAND with a little f-m gravel
BH01	7D	4.20	4.20	17	BX	12	19	NP		Red-brown sandy SILT with a little fine gravel
TP01	1B	0.20	0.20	22	BX	21	32	22	10	Brown sandy CLAY with a little f-m gravel
TP01	3B	1.10	1.10	9.3						Red-brown silty SAND with some f-c gravel

general remarks:

natural moisture content determined in accordance with BS1377 : Part 2 : 1990 : 3.2 (unless specified)
 NP denotes non-plastic

specimen preparation:

A - as received
 B - washed on 0.425mm sieve
 C - air dried
 D - oven dried (50°C)
 E - not known

test method:

X - cone penetrometer (test 4.3)
 Y - one point cone penetrometer (test 4.4)
 Z - Casagrande apparatus (test 4.5)

CONTRACT
18332

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PARTICLE SIZE DISTRIBUTION

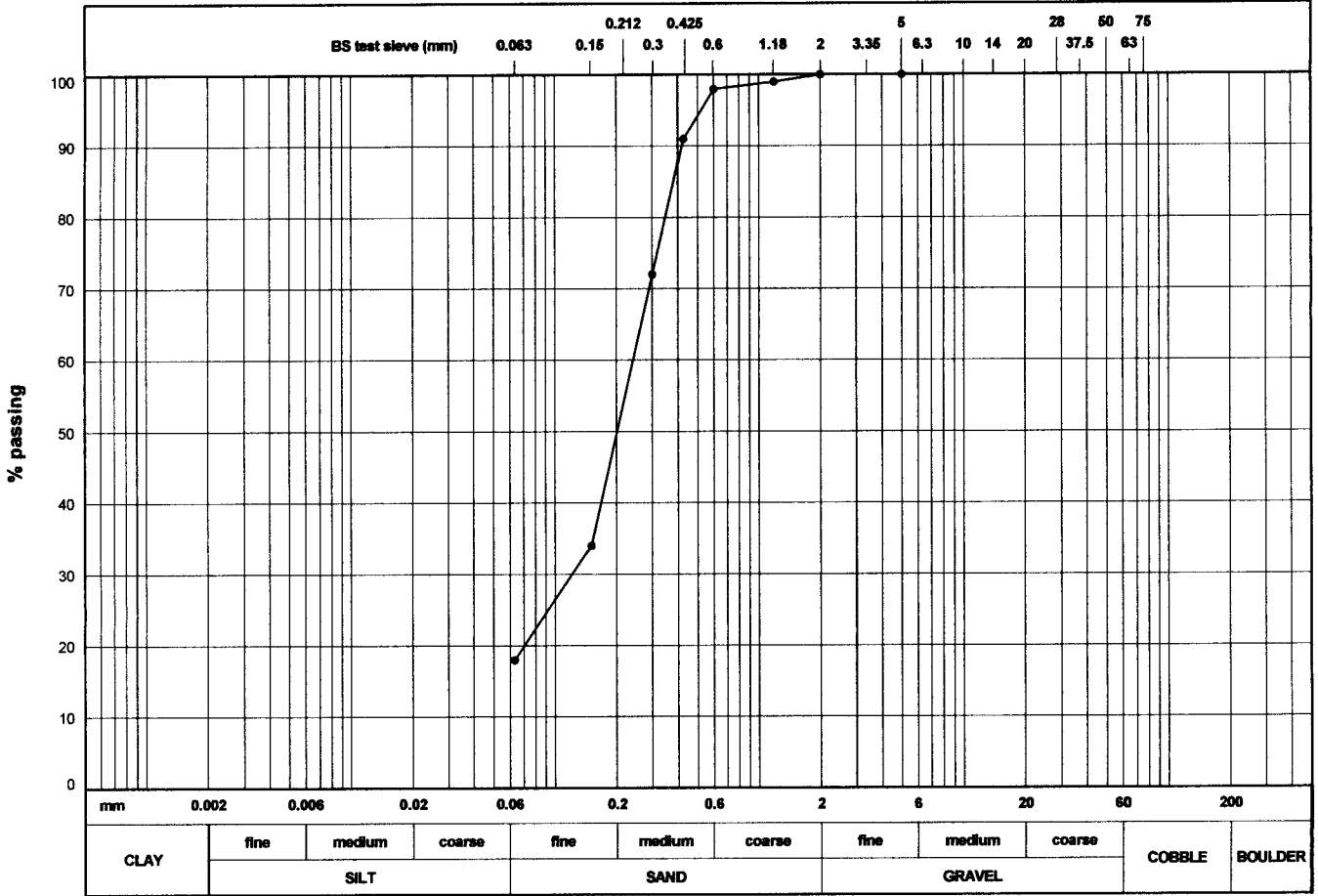


BS.1377 : Part 2 : 1990 : 9

CLIENT FABER MAUNSELL
SITE EXETER FOOTBRIDGE

BH/TP No. BH01
SAMPLE No./TYPE 8X
SAMPLE DEPTH (m) 4.20
SPECIMEN DEPTH (m) 4.30

DESCRIPTION Red-brown silty SAND



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	100	20	
SILT		75		3.35		6	
SILT & CLAY	18	63		2	100	2	
SAND	82	50		1.18	99		
GRAVEL	0	37.5		0.6	98		
COBBLE & BOULDER	0	28		0.425	91		
test method(s)	9.2	20		0.3	72		
test method:		14		0.212			
9.2 - wet sieving		10		0.15	34		
9.3 - dry sieving		6.3		0.063	18		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:						CONTRACT	CHECKED
						18332	

PARTICLE SIZE DISTRIBUTION

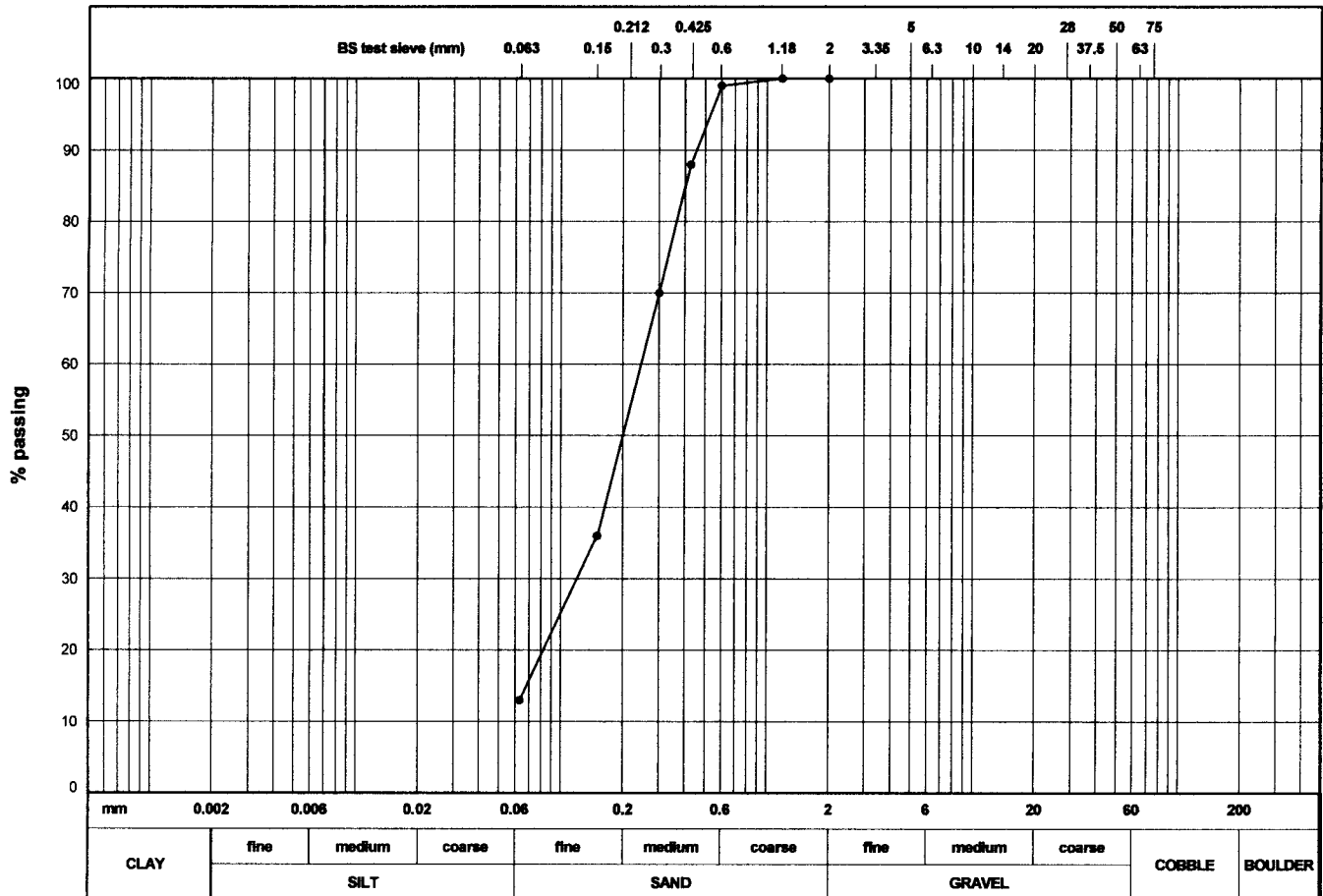


BS.1377 : Part 2 : 1990 : 9

CLIENT FABER MAUNSELL
SITE EXETER FOOTBRIDGE

BH/TP No. BH02
SAMPLE No./TYPE 1X
SAMPLE DEPTH (m) 0.60
SPECIMEN DEPTH (m) 0.60

DESCRIPTION Red-brown silty SAND



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY				5		20	
SILT		150		5		20	
SILT & CLAY	13	75		3.35		6	
SAND	87			2	100	2	
GRAVEL	0	63		2	100	2	
COBBLE & BOULDER	0	50		1.18	100		
test method(s)	9.2	37.5		0.6	99		
test method:		28		0.425	88		
9.2 - wet sieving		20		0.3	70		
9.3 - dry sieving		14		0.212			
9.4 - sedimentation by pipette		10		0.15	36		
9.5 - sedimentation by hydrometer		6.3		0.063	13		
remarks:						CONTRACT	CHECKED
						18332	

PARTICLE SIZE DISTRIBUTION

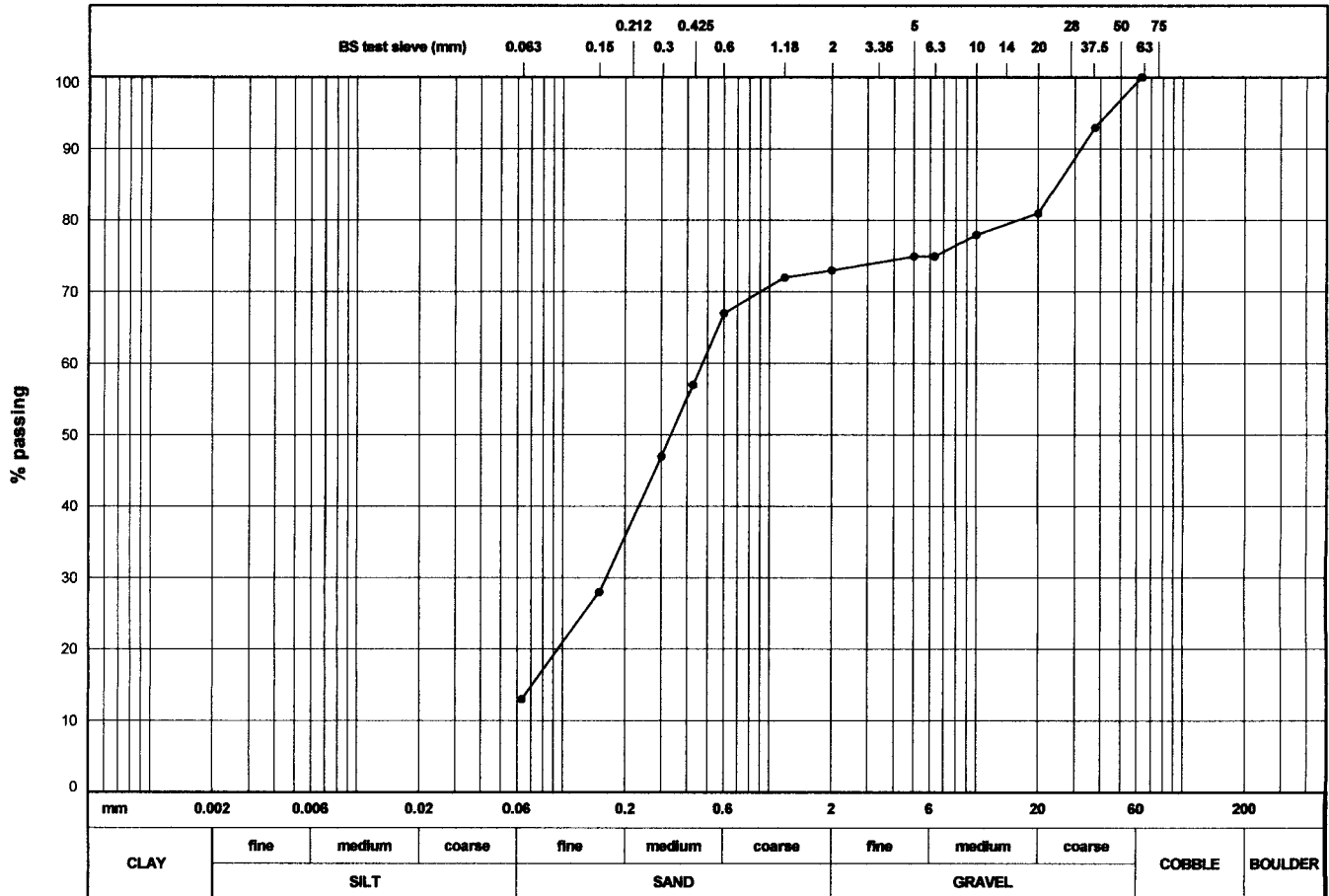


BS.1377 : Part 2 : 1990 : 9

CLIENT FABER MAUNSELL
SITE EXETER FOOTBRIDGE

BH/TP No. TP01
SAMPLE No./TYPE 2B
SAMPLE DEPTH (m) 0.40
SPECIMEN DEPTH (m) 0.40

DESCRIPTION Red-brown silty SAND with much f-c gravel and occasional cobbles



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	75	20	
SILT		75		3.35		6	
SILT & CLAY	13						
SAND	60	63	100	2	73	2	
GRAVEL	26						
COBBLE & BOULDER	1	50		1.18	72		
test method(s)	9.2	37.5	93	0.6	67		
test method:		28		0.425	57		
9.2 - wet sieving		20	81	0.3	47		
9.3 - dry sieving		14		0.212			
9.4 - sedimentation by pipette		10	78	0.15	28		
9.5 - sedimentation by hydrometer		6.3	75	0.063	13		
remarks:						CONTRACT	CHECKED
						18332	



SULPHATE CONTENT AND pH VALUE

BS.1377 : Part 3 : 1990 : 5 and 9

CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole /trial pit no.	sample		specimen depth (m)	fraction <2mm (%)	average sulphate content - SO ₃			pH	description and remarks
	no./type	depth (m)			in soil		in ground-water (g/l)		
					total (%)	2:1 water extract (g/l)			
BH01	3D	2.20	2.20	100		<0.1 (<0.1)	6.6	Orange-brown silty SAND	
BH01	9D	5.00	5.00	100		<0.1 (<0.1)	7.6	Red-brown silty SAND	
BH02	1X	0.60	0.60	100		<0.1 (<0.1)	7.5	Red-brown silty SAND	
BH02	4C	2.00	2.00	100		<0.1 (<0.1)	7.3	Red-brown silty SAND	
TP01	4B	1.60	1.60	85		<0.1 (<0.1)	8.7	Red-brown silty SAND with some f-c sandstone gravel	

general remarks:

the bracketed values above give the sulphate contents in terms of SO₄ for direct comparison with BRE Special Digest 1 (2001).
sulphate content determined by gravimetric method (test 5.5).

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POINT LOAD STRENGTH TEST RESULTS



I.S.R.M. 1985

CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole / trial pit no.	sample depth (m)	test type	test orientation	moisture condition	width W (mm)	length L (mm)	platen sep. D (mm)	failure load P (kN)	equiv. dia. De (mm)	Is (MPa)	size factor F	Is(50) (MPa)	rock type
BH01	13.85	D		N		30	90	0.10	90.00	0.01	1.30	0.02	Red-brown SANDSTONE
BH01	13.85	A		N	70		45	0.10	63.33	0.02	1.11	0.03	Red-brown SANDSTONE
BH01	14.30	D		N		45	88	0.05	88.00	0.01	1.29	0.01	Orange-brown SANDSTONE
BH01	14.30	A		N	90		51	0.15	76.45	0.03	1.21	0.03	Orange-brown SANDSTONE
BH01	15.80	D		N		105	89	0.20	89.00	0.03	1.30	0.03	Red-brown SANDSTONE
BH01	15.80	A		N	89		75	0.30	92.19	0.04	1.32	0.05	Red-brown SANDSTONE
BH01	16.50	D		N		65	69	0.05	69.00	0.01	1.16	0.01	Orange-brown SANDSTONE
BH01	16.50	A		N	67		60	0.15	71.54	0.03	1.17	0.03	Orange-brown SANDSTONE
BH01	17.55	D		N		50	90	0.05	90.00	0.01	1.30	0.01	Red-brown SANDSTONE
BH01	17.55	A		N	90		35	0.05	63.33	0.01	1.11	0.01	Red-brown SANDSTONE
BH01	18.50	D		N		30	93	0.00	93.00	0.00	1.32	0.00	Orange-brown SANDSTONE
BH01	18.50	A		N	90		38	0.05	65.99	0.01	1.13	0.01	Orange-brown SANDSTONE
BH02	4.60	D		N		75	90	0.20	90.00	0.02	1.30	0.03	Red-brown SANDSTONE
BH02	4.60	A		N	88		60	0.25	81.99	0.04	1.25	0.05	Red-brown SANDSTONE
BH02	5.75	D		N		55	90	0.10	90.00	0.01	1.30	0.02	Red-brown SANDSTONE
BH02	5.75	A		N	90		42	0.30	69.37	0.06	1.16	0.07	Red-brown SANDSTONE
BH02	6.80	D		N		40	90	0.05	90.00	0.01	1.30	0.01	Red-brown SANDSTONE
BH02	6.80	A		N	90		55	0.10	79.39	0.02	1.23	0.02	Red-brown SANDSTONE
BH02	7.88	D		N		100	90	0.20	90.00	0.02	1.30	0.03	Red-brown SANDSTONE
BH02	7.88	A		N	90		92	0.65	102.68	0.06	1.38	0.09	Red-brown SANDSTONE

remarks: Tests carried out in accordance with I.S.R.M.(1985): Suggested Methods for Determining Point Load Strength.
 Int. J. Rock Mech. Min. Sci. and Geotech. Abstr. Vol.22 No. 2.
 * test orientation given relative to discontinuities

test type: D - diametral A - axial I - Irregular lump	test orientation: X - perpendicular Y - parallel Z - oblique	moisture condition: N - natural moisture content P - partially air dried S - soaked
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CONTRACT 18332	CHECKED
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POINT LOAD STRENGTH TEST RESULTS



I.S.R.M. 1985

CLIENT FABER MAUNSELL

SITE EXETER FOOTBRIDGE

borehole / trial pit no.	sample depth (m)	test type	test orientation	moisture condition	width W (mm)	length L (mm)	platen sep. D (mm)	failure load P (kN)	equiv. dia. De (mm)	Is (MPa)	size factor F	Is(50) (MPa)	rock type
BH02	8.40	D		N		75	90	0.30	90.00	0.04	1.30	0.05	Red-brown SANDSTONE
BH02	8.40	A		N	90		71	0.40	90.20	0.05	1.30	0.06	Red-brown SANDSTONE
BH02	8.50	D		N		90	89	0.20	89.00	0.03	1.30	0.03	Red-brown SANDSTONE
BH02	8.50	A		N	89		70	0.40	89.06	0.05	1.30	0.07	Red-brown SANDSTONE
BH02	9.00	D		N		80	90	0.02	90.00	0.00	1.30	0.00	Orange-brown SANDSTONE
BH02	9.00	A		N	90		55	0.10	79.39	0.02	1.23	0.02	Orange-brown SANDSTONE

remarks: Tests carried out in accordance with I.S.R.M.(1985): Suggested Methods for Determining Point Load Strength.
 Int. J. Rock Mech. Min. Sci. and Geotech. Abstr. Vol.22 No. 2.
 * test orientation given relative to discontinuities

test type: D - diametral A - axial I - Irregular lump	test orientation: X - perpendicular Y - parallel Z - oblique	moisture condition: N - natural moisture content P - partially air dried S - soaked
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CONTRACT 18332	CHECKED
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ALcontrol Geochem Analytical Services

Table Of Results - Appendix

Job Number: 06/00266/02/01
Client: Geotechnical Eng. Ltd
Client Ref. No.: 18322

Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10⁻⁷

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
PFD	Possible Fibres Detected	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample ¹	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture content and description			WET	
TM061	Method for the Determination of EPH, Massachusetts Dept. of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)	✓		DRY	
TM061	Method for the Determination of EPH, Massachusetts Dept. of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)	✓	✓	DRY	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection	✓		WET	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection	✓	✓	WET	
TM074	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS	✓		DRY	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water	✓		NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓		NA	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser	✓		NA	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser	✓	✓	DRY	
TM101	Method 4500B & C, AWWA/APHA, 20th Ed., 1999	Determination of Sulphide in soil and water samples using the Kone Analyser	✓		WET	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser	✓		NA	
TM123	BS 2690: Part 121:1981	The Determination of Total dissolved Solids in Water	✓		NA	
TM127	Method 3112B, AWWA/APHA, 20th Ed., 1999	The Determination of Trace Level Mercury in Aqueous Media and Soil Extracts by Atomic Absorption Spectroscopy	✓		NA	

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

Validated
 Preliminary

ALcontrol Geochem Analytical Services

Table Of Results

ISO 17025 accredited
 M MCERTS accredited
 * Subcontracted test
 » Shown on prev. report

Job Number: 06/00266/02/01
Client: Geotechnical Eng. Ltd
Client Ref. No.: 18322

Matrix: LEACHATE
Location: EXETER FOOTBRIDGE
Client Contact: Lyndon Barton

Sample Identity	BH01	BH02	TP01							Method Code	Lod/Units
Depth (m)	6.00-7.00	2.00-3.00	1.10								
Sample Type	SOIL	SOIL	SOIL								
Sampled Date											
Sample Received Date	07.01.06	07.01.06	07.01.06								
Batch	1	1	1								
Sample Number(s)	5	8	9								
Antimony Dissolved (CEN 2:1) (ICP-MS)	<5	<5	<5							TM152 [#]	<5 ug/l
Antimony Dissolved (CEN 8:1) (ICP-MS)	<5	<5	<5							TM152 [#]	<5 ug/l
Antimony Dissolved (CEN 10:1C) (ICP-MS)	<0.04	<0.04	<0.04							TM152 [#]	mg/kg
Arsenic Dissolved (CEN 2:1) (ICP-MS)	<1	4	2							TM152 [#]	<1 ug/l
Arsenic Dissolved (CEN 8:1) (ICP-MS)	<1	2	5							TM152 [#]	<1 ug/l
Arsenic Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.024	0.044							TM152 [#]	mg/kg
Barium Dissolved (CEN 2:1) (ICP-MS)	160	236	226							TM152 [#]	<1 ug/l
Barium Dissolved (CEN 8:1) (ICP-MS)	20	41	115							TM152 [#]	<1 ug/l
Barium Dissolved (CEN 10:1C) (ICP-MS)	0.480	0.800	1.372							TM152 [#]	mg/kg
Boron Dissolved (CEN 2:1) (ICP-MS)	349	166	97							TM152 [#]	<10 ug/l
Boron Dissolved (CEN 8:1) (ICP-MS)	230	153	116							TM152 [#]	<10 ug/l
Boron Dissolved (CEN 10:1C) (ICP-MS)	2.54	1.56	1.12							TM152 [#]	mg/kg
Cadmium Dissolved (CEN 2:1) (ICP-MS)	<0.4	<0.4	<0.4							TM152 [#]	<0.4 ug/l
Cadmium Dissolved (CEN 8:1) (ICP-MS)	<0.4	<0.4	<0.4							TM152 [#]	<0.4 ug/l
Cadmium Dissolved (CEN 10:1C) (ICP-MS)	<0.0032	<0.0032	<0.0032							TM152 [#]	mg/kg
Chromium Dissolved (CEN 2:1) (ICP-MS)	28	5	3							TM152 [#]	<1 ug/l
Chromium Dissolved (CEN 8:1) (ICP-MS)	4	4	2							TM152 [#]	<1 ug/l
Chromium Dissolved (CEN 10:1C) (ICP-MS)	0.088	0.042	0.022							TM152 [#]	mg/kg
Copper Dissolved (CEN 2:1) (ICP-MS)	24	16	11							TM152 [#]	<1 ug/l
Copper Dissolved (CEN 8:1) (ICP-MS)	14	10	6							TM152 [#]	<1 ug/l
Copper Dissolved (CEN 10:1C) (ICP-MS)	0.160	0.112	0.070							TM152 [#]	mg/kg
Lead Dissolved (CEN 2:1) (ICP-MS)	5	6	4							TM152 [#]	<1 ug/l
Lead Dissolved (CEN 8:1) (ICP-MS)	5	6	4							TM152 [#]	<1 ug/l
Lead Dissolved (CEN 10:1C) (ICP-MS)	0.050	0.060	0.040							TM152 [#]	mg/kg
Molybdenum Dissolved (CEN 2:1) (ICP-MS)	1	7	4							TM152 [#]	<1 ug/l
Molybdenum Dissolved (CEN 8:1) (ICP-MS)	<1	3	1							TM152 [#]	<1 ug/l
Molybdenum Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.038	0.016							TM152 [#]	mg/kg
Nickel Dissolved (CEN 2:1) (ICP-MS)	2	3	<1							TM152 [#]	<1 ug/l
Nickel Dissolved (CEN 8:1) (ICP-MS)	<1	2	4							TM152 [#]	<1 ug/l
Nickel Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.022	0.032							TM152 [#]	mg/kg
Selenium Dissolved (CEN 2:1) (ICP-MS)	<1	<1	<1							TM152 [#]	<1 ug/l

Supplemental Report

Date 23.01.2006

Validated
 Preliminary

ALcontrol Geochem Analytical Services

Table Of Results

ISO 17025 accredited
 M MCERTS accredited
 * Subcontracted test
 » Shown on prev. report

Job Number: 06/00266/02/01
 Client: Geotechnical Eng. Ltd
 Client Ref. No.: 18322

Matrix: LEACHATE
 Location: EXETER FOOTBRIDGE
 Client Contact: Lyndon Barton

Sample Identity	BH01	BH02	TP01							Method Code	LoD/Units
Depth (m)	6.00-7.00	2.00-3.00	1.10								
Sample Type	SOIL	SOIL	SOIL								
Sampled Date											
Sample Received Date	07.01.06	07.01.06	07.01.06								
Batch	1	1	1								
Sample Number(s)	5	8	9								
Selenium Dissolved (CEN 8:1) (ICP-MS)	<1	<1	<1							TM152 [#]	<1 ug/l
Selenium Dissolved (CEN 10:1C) (ICP-MS)	<0.008	<0.008	<0.008							TM152 [#]	mg/kg
Zinc Dissolved (CEN 2:1) (ICP-MS)	81	118	54							TM152 [#]	<3 ug/l
Zinc Dissolved (CEN 8:1) (ICP-MS)	52	61	40							TM152 [#]	<3 ug/l
Zinc Dissolved (CEN 10:1C) (ICP-MS)	0.578	0.724	0.428							TM152 [#]	mg/kg
Mercury Dissolved (CEN 2:1) (CVAA)	<0.05	<0.05	<0.05							TM127 [#]	<0.05 ug/l
Mercury Dissolved (CEN 8:1) (CVAA)	<0.05	<0.05	<0.05							TM127 [#]	<0.05 ug/l
Mercury Dissolved (CEN 10:1C) (CVAA)	<0.0004	<0.0004	<0.0004							TM127 [#]	mg/kg
Chloride (CEN 2:1)	8	5	6							TM097 [#]	<1 mg/l
Chloride (CEN 8:1)	2	1	1							TM097 [#]	<1 mg/l
Chloride (CEN 10:1C)	32	18	20							TM097 [#]	mg/kg
Fluoride (CEN 2:1)	<0.5	<0.5	0.8							TM104 [#]	<0.5 mg/l
Fluoride (CEN 8:1)	<0.5	<0.5	<0.5							TM104 [#]	<0.5 mg/l
Fluoride (CEN 10:1C)	<4	<4	<4							TM104 [#]	mg/kg
Sulphate (CEN 2:1)	10	4	<3							TM098 [#]	<3 mg/l
Sulphate (CEN 8:1)	<3	<3	<3							TM098 [#]	<3 mg/l
Sulphate (CEN 10:1C)	<24	<24	<24							TM098 [#]	mg/kg
Dissolved Organic Carbon (CEN 2:1)	9	4	3							TM090 [#]	<1 mg/l
Dissolved Organic Carbon (CEN 8:1)	3	2	1							TM090 [#]	<1 mg/l
Dissolved Organic Carbon (CEN 10:1C)	42	24	14							TM090 [#]	mg/kg
Total Dissolved Solids (CEN 2:1)	36	20	57							TM123 [#]	<5 mg/l
Total Dissolved Solids (CEN 8:1)	9	7	26							TM123 [#]	<5 mg/l
Total Dissolved Solids (CEN 10:1C)	144	96	322							TM123 [#]	mg/kg
Phenols Total Monohydric (CEN 2:1)	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/l
Phenols Total Monohydric (CEN 8:1)	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/l
Phenols Total Monohydric (CEN 10:1C)	<0.08	<0.08	<0.08							TM062 [#]	mg/kg

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Date 23.01.2006

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ALcontrol Geochem Analytical Services

Table Of Results

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Job Number: 06/00266/02/01
Client: Geotechnical Eng. Ltd
Client Ref. No.: 18322

Matrix: LEACHATE
Location: EXETER FOOTBRIDGE
Client Contact: Lyndon Barton

Sample Identity	BH01	BH02	TP01							Method Code	Lot/Units
Depth (m)	6.00-7.00	2.00-3.00	1.10								
Sample Type	SOIL	SOIL	SOIL								
Sampled Date											
Sample Received Date	07.01.06	07.01.06	07.01.06								
Batch	1	1	1								
Sample Number(s)	5	8	9								
Antimony Dissolved (CEN 10:1C) (ICP-MS)	<0.04	<0.04	<0.04							TM152 [#]	mg/kg
Arsenic Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.024	0.044							TM152 [#]	mg/kg
Barium Dissolved (CEN 10:1C) (ICP-MS)	0.480	0.800	1.372							TM152 [#]	mg/kg
Boron Dissolved (CEN 10:1C) (ICP-MS)	2.54	1.56	1.12							TM152 [#]	mg/kg
Cadmium Dissolved (CEN 10:1C) (ICP-MS)	<0.0032	<0.0032	<0.0032							TM152 [#]	mg/kg
Chromium Dissolved (CEN 10:1C) (ICP-MS)	0.088	0.042	0.022							TM152 [#]	mg/kg
Copper Dissolved (CEN 10:1C) (ICP-MS)	0.160	0.112	0.070							TM152 [#]	mg/kg
Lead Dissolved (CEN 10:1C) (ICP-MS)	0.050	0.060	0.040							TM152 [#]	mg/kg
Molybdenum Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.038	0.016							TM152 [#]	mg/kg
Nickel Dissolved (CEN 10:1C) (ICP-MS)	<0.008	0.022	0.032							TM152 [#]	mg/kg
Selenium Dissolved (CEN 10:1C) (ICP-MS)	<0.008	<0.008	<0.008							TM152 [#]	mg/kg
Zinc Dissolved (CEN 10:1C) (ICP-MS)	0.578	0.724	0.428							TM152 [#]	mg/kg
Mercury Dissolved (CEN 10:1C) (CVAA)	<0.0004	<0.0004	<0.0004							TM127 [#]	mg/kg
Chloride (CEN 10:1C)	32	18	20							TM097 [#]	mg/kg
Fluoride (CEN 10:1C)	<4	<4	<4							TM104 [#]	mg/kg
Sulphate (CEN 10:1C)	<24	<24	<24							TM098 [#]	mg/kg
Dissolved Organic Carbon (CEN 10:1C)	42	24	14							TM090 [#]	mg/kg
Total Dissolved Solids (CEN 10:1C)	144	96	322							TM123 [#]	mg/kg
Phenols Total Monohydric (CEN 10:1C)	<0.08	<0.08	<0.08							TM062 [#]	mg/kg

Date 23.01.2006

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ALcontrol Geochem Analytical Services

Table Of Results

ISO 17025 accredited
 M MCERTS accredited
 * Subcontracted test
 » Shown on prev. report

Job Number: 06/00266/02/01
 Client: Geotechnical Eng. Ltd
 Client Ref. No.: 18322

Matrix: SOLID
 Location: EXETER FOOTBRIDGE
 Client Contact: Lyndon Barton

Sample Identity	BH01	BH01	BH02							Method Code	Lod/Units
Depth (m)	1.20-1.65	3.20-3.60	0.60-0.70								
Sample Type	SOIL	SOIL	SOIL								
Sampled Date											
Sample Received Date	07.01.06	07.01.06	07.01.06								
Batch	1	1	1								
Sample Number(s)	1-2	3-4	6-7								
Boron Water Soluble	<1	<1	1							TM129 [#] _M	<1 mg/kg
Arsenic	7	5	3							TM129 [#] _M	<1 mg/kg
Cadmium	<1	<1	<1							TM129 [#] _M	<1 mg/kg
Chromium	32	13	13							TM129 [#] _M	<1 mg/kg
Copper	15	8	10							TM129 [#] _M	<1 mg/kg
Lead	14	10	4							TM129 [#] _M	<1 mg/kg
Mercury	<1	<1	<1							TM129 [#]	<1 mg/kg
Nickel	5	4	4							TM129 [#] _M	<1 mg/kg
Selenium	<3	<3	<3							TM129 [#] _M	<3 mg/kg
Zinc	28	15	7							TM129 [#] _M	<1 mg/kg
Water Soluble Sulphate as SO4 2:1 Extract	0.010	0.038	0.005							TM098 [#] _M	<0.003 g/l
Acid Soluble Sulphide	<50	<50	<50							TM101 [#]	<50 mg/kg
Resorcinol	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
Catechol	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
Phenol	<0.01	<0.01	<0.01							TM062 [#] _M	<0.01 mg/kg
Total Cresols	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
Total Xylenols	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
1 Napthol	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
2,3,5 Trimethyl-Phenol	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
4-Isopropyl Phenol	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
Phenols Total of 8 Speciated	<0.01	<0.01	<0.01							TM062 [#]	<0.01 mg/kg
Total Cyanide	<1	<1	<1							TM153 [#] _M	<1 mg/kg
pH Value	7.56	5.93	7.24							TM133 [#] _M	<1.00 pH Units
EPH (DRO) (C10-C40)	<1	99	<1							TM061 [#] _M	<1 mg/kg
EPH C10-20	<1	6	<1							TM061 [#]	<1 mg/kg
EPH >C20-30	<1	38	<1							TM061 [#]	<1 mg/kg
EPH >C30-40	<1	55	<1							TM061 [#]	<1 mg/kg

All results expressed on a dry weight basis.

Date 23.01.2006

Validated
 Preliminary

ALcontrol Geochem Analytical Services

Table Of Results

ISO 17025 accredited
 M MCERTS accredited
 * Subcontracted test
 » Shown on prev. report

Job Number: 06/00266/02/01
Client: Geotechnical Eng. Ltd
Client Ref. No.: 18322


Matrix: SOLID
Location: EXETER FOOTBRIDGE
Client Contact: Lyndon Barton

Sample Identity	BH01	BH01	BH02							Method Code	Lod/Units
Depth (m)	1.20-1.65	3.20-3.60	0.60-0.70								
Sample Type	SOIL	SOIL	SOIL								
Sampled Date											
Sample Received Date	07.01.06	07.01.06	07.01.06								
Batch	1	1	1								
Sample Number(s)	1-2	3-4	6-7								
PAH by GCMS											
Naphthalene	<10	<10	<10							TM074#	<10 ug/kg
Acenaphthylene	<5	<5	<5							TM074#	<5 ug/kg
Acenaphthene	<14	<14	<14							TM074#	<14 ug/kg
Fluorene	<12	<12	<12							TM074#	<12 ug/kg
Phenanthrene	<21	<21	<21							TM074#	<21 ug/kg
Anthracene	<9	<9	<9							TM074#	<9 ug/kg
Fluoranthene	<25	<25	<25							TM074#	<25 ug/kg
Pyrene	<22	<22	<22							TM074#	<22 ug/kg
Benz(a)anthracene	<12	<12	<12							TM074#	<12 ug/kg
Chrysene	<10	<10	<10							TM074#	<10 ug/kg
Benzo(b)fluoranthene	<16	<16	<16							TM074#	<16 ug/kg
Benzo(k)fluoranthene	<25	<25	<25							TM074#	<25 ug/kg
Benzo(a)pyrene	<12	<12	<12							TM074#	<12 ug/kg
Indeno(123cd)pyrene	<11	<11	<11							TM074#	<11 ug/kg
Dibenzo(ah)anthracene	<8	<8	<8							TM074#	<8 ug/kg
Benzo(ghi)perylene	<10	<10	<10							TM074#	<10 ug/kg
PAH 16 Total	<25	<25	<25							TM074#	<25 ug/kg

All results expressed on a dry weight basis.

Date 23.01.2006

Residual Risks

	HEALTH & SAFETY HAZARD RECORD	
	Project title Exeter Rugby Club Footbridge	Project Code LN00905
Assessment Coverage: Complete Project		
<p>1. Scope of Commission and Assessment of Coverage:</p> <p>Design Superstructure and Substructure for new 110m cable stayed footbridge for access to a new rugby stadium across the A379. Provide all drawings to enable all works to be constructed, also consider method of erection and effects on permanent structure.</p> <p>2. Brief Description of the Works:</p> <p>New cable stayed cycleway/ footbridge with spans of 38m and 72m, over twin carriageways of the A379.</p> <p>The bridge will be constructed from High Yield steel rectangular hollow sections forming the main longitudinal members and tower legs, with a cast insitu concrete deck. It will span the roadway below with a clearance of approximately 11m, and provide a 3m wide walkway/cycleway.</p> <p>The main tower will be approximately 43m tall and founded at least 4m clear of the adjoining carriageway. At each end of the bridge will be supported on reinforced concrete abutments at the top of the embankments.</p> <p>3. Key Risk Reduction measures taken during design process:</p> <p>Prior to detail design, the erection methodology was agreed between all parties. – see erection sequence sketch and initial erection method statement.</p> <p>The Design enabled all components fabricated off site, this ensured minimal work on site or at height was required. The design allowed for long unsupported spans (3No) in the temporary condition, using one temp trestle, prior to the cables being fitted. Permanent formwork was fitted during the erection of the three spans which provided safe access for erection personnel,</p> <p>Erection of all the bridge elements was undertaken using carnage.</p> <p>Consideration of the size and weight of all the bridge elements that were fabricated off site was considered, enabling them to be of sufficient size to be transported by road haulage. This was agreed with fabricator before detailed design started.</p> <p>An assembly yard was established adjacent to bridge final position, this allowed the smaller sections to be assembled and the permanent formwork secured. The bottom section of tower was erected first and the moment connection established, prior to releasing from crane.</p> <p>Main tower and temporary tower were located greater than 4m away from adjacent carriageway.</p> <p>The steel deck of the bridge was fabricated in six sections approx 20m each. Two sections were welded together in assembly yard adjacent to the final bridge position. The temporary trestle was placed to break longitudinal span into approximately three equal spans, this allowed three simple lifts of approx 40m length sections to be placed onto secure supports. The design was checked to allow for this temporary loadcase.</p> <p>Cables were attached to tower top at ground level and tied back accordingly, prior to erecting tower, this reduced the work required at 43m above the road level.</p> <p>Temporary shuttering was used and placed onto the steel framework in assembly yard. This provided a temporary walkway for steel erectors to fix cables and access end sockets. In accordance with the</p>		



HEALTH & SAFETY HAZARD RECORD

Project title

Exeter Rugby Club Footbridge

Project Code

LN00905

Contractors safe system of work.

The cables were attached to the steel deck and tensioned to the required line and level.

Reinforcement for concrete deck was placed insitu, and concrete deck cast in an agreed sequence. Once the concrete had cured the cables were re-tensioned to the satisfaction of the engineer.

The formwork was then removed and the temporary parapets replaced with the permanent parapets. The cables were re-tensioned and the bridge line and level checked.

All steelwork painted off site and any connections made in the assembly yard, to be fully painted prior to erection. Final touch of the paintwork was carried out once the erection was complete.

4. Significant Project Specific Hazards Remaining – Construction Phase:

Working at heights – contractor to establish safe system of work, e.g. harness to be worn clipped to safety wire.

Working adjacent to carriageway – Contractor to liaise with County Council on safe system of work, closure of one lane to allow access and egress to site.

Tensioning of cables – Contractor to develop safe Access system, as jacks to be connected to bottom of cable which is outside the deck area.

Possibility of falling objects – as much work as possible carried out prior to erection. All access platforms fully boarded and toe boards provided. Toolbox talks before carrying out work with personnel to ensure scope and danger of operation are fully understood.

Excavations at the top of steep embankments adjacent to live carriageways. Discussion with County Council to enable adjacent lane to be closed. Contractor to ensure excavation machinery will have adequate reach and stability to carry out work.

5. Specific Construction Requirements:

Construction of the steel frame of the bridge will be in a manner agreed with the engineer. As detailed on the preliminary erection sequence.

The Concreting sequence of the deck to be agreed with the Engineer . This most probably will start at the main pier and work out towards the abutments.

Loading and sequence of loading the cables both before concreting the deck and after the concrete has set, will be in accordance with the Engineers instructions.

All the above requirements were followed during the erection process.

6. Means by which significant hazards were conveyed to contractors and others:

Numerous meetings took place and all methods of working and sequence of erection were agreed before any site operations.

Appropriate notes were put on Engineers drawings.

Method statements that affect any issues of the permanent works were agreed with the Engineer.

	HEALTH & SAFETY HAZARD RECORD	
	Project title Exeter Rugby Club Footbridge	Project Code LN00905

7. Residual Risks:Cables

All cables have loads as indicated on the as built drawings. These loads are 'actual loads' put into the cables during the final erection tensioning.

Re-tensioning of any of the cables will require a fully approved method statement and sequence of works. As the lower threaded bar has been cut after the final tensioning, an alternative method of holding the load in the cable to that used for erection will have to be devised. This may take the form of a 'Yoke' around the bottom cable termination, with attachments to a hollow ram jack attached to the remaining threaded bar.

The re-tensioning of the back stay cables can be carried out using similar method to that used to install the initial loads.

A single cable can be replaced at any one time, providing there is no live loading on the bridge. Replacement of the two 65mm diameter back stay cables has not been checked, and would require further analysis to determine a safe method to replace these cables.

Tower

The tower has been designed to take all dead and live load in accordance with the Approval in Principle, however, it was essential that the initial 'locked in stresses' that may take place during construction were minimised. This could take the form of the tower not being vertical and imposing bending stresses that may exceed the allowable.

A limit of 150mm out of vertical was used during the erection process, for the tower. The tower is at its most vulnerable when there is no restraint to the tower top, and also even when secured having only minimal vertical loading.

Should any of the cables need to be replaced (except the two large back stay cables) the verticality of the tower should be considered during the process.

Deck

The steel deck is fully welded and fairly simple construction. The concrete deck is simply supported on all four sides at every cross member. The north end of the deck is connected to the abutment via a large steel pin under each longitudinal member. This pin has substantial shear load, even in the unloaded 'live' load state. This arises due to the resultant horizontal load from the inclined cables. The two holes either side of the pin have been designed to accept two M36 8.8 grade bolts, these bolts have been designed to take the shear force due to the dead load, should the existing pin need to be removed or replaced. It must be remembered that the M36 bolts will take the load providing the deck is not taking Live pedestrian loading.

Date of Review

Assessed by:

Name Signature Date



HEALTH & SAFETY HAZARD RECORD

Project title

Exeter Rugby Club Footbridge

Project Code

LN00905

Reviewed by:

Name

Signature

Date

Design & Check Certificates

COPY

DESIGN CERTIFICATE

SHEET 1 OF 3

Name of Project: Exeter Chiefs Rugby Club
Name of Structure(s): Cable Stay Bridge
Design Certificate No: 001

1. We certify that we have used reasonable skill, care and diligence in the preparation of the design of the above named structure with a view to securing that:-
 - a. The design has been carried out taking account of existing factual information provided by the Employer and any additional factual information obtained by the Contractor as shown on Sheet 2 of this Design Certificate;
 - b. The design has been carried out in accordance with the Standards listed and details contained within the Approval in Principle ref LN00905/NE/AIP.
 - c. We have used reasonable professional skill and care in translating into the construction drawings, and specifications shown on Sheet 3 of this Design Certificate.

Signed:  on behalf of Hyder Consulting (UK) Ltd

Name:  Technical Director Structural Solutions

Date: 12th September 2006

Signed: _____ on behalf of Dean & Dyball Construction Ltd

Name: _____ (Director)

Date: _____

Signed: _____ on behalf of TAA

Name: _____

Date: _____

COPY

DESIGN CERTIFICATE

SHEET 2 OF 3

Name of Project: Exeter Chiefs Rugby Club
Name of Structure(s): Cable Stay Bridge
Design Certificate No: 001

SUPPLIED DESIGN INFORMATION

Drawing Proposed Cable stay Bridge over A379 – 0088PL23
Xaccess – a dwg
New bridge Location 18-1-06.dwg
Planning elevation – CL(9)407.dwg
Planning footpath SA(2)408.dwg
Planning Plan CL(9)408.dwg
Survey -2005-11-22.dwg-11-01-06.dwg
Architects Bridge handrail detail.pdf
ERFC footbridge location plan 41538/IBRG/1
Geotechnical Report 17/2/06
Trial Pit TP01 (Contract 18332)
Bore Hole Log BH02 (Contract 18332)
Bore Hole Log BH01 (Contract 18332)
Bore Hole Log WS06 (Contract 16865)

DESIGN CERTIFICATE

SHEET 3 OF 3

Name of Project: Exeter Chiefs Rugby Club

Name of Structure(s): Cable Stay Bridge

Design Certificate No: 001

LIST OF DESIGN OUTPUT

2001-LN00905	General Arrangement
2002-LN00905	Cable Profile, lengths and Loads
2003-LN00905	Parapet Details
2004-LN00905	Structural Steelwork Details Sheet 1 of 2
2005-LN00905	Structural Steelwork Details Sheet 2 of 2
2006-LN00905	Tower Details – Sheet 1 of 3
2007-LN00905	Tower Details – Sheet 2 of 3
2008-LN00905	Tower Details – Sheet 3 of 3
2009-LN00905	Structural Steelwork North Abutment – Bearing Details
2010-LN00905	Structural Concrete – Deck Details
2011-LN00905	Structural Concrete - RC Details of Precast Panels
2012-LN00905	Top of Tower Anchorage details
2020-LN00905	Intermediate Pier and Foundation GA
2021-LN00905	Intermediate Pier and Foundation reinforcement details
2022-LN00905	North Abutment GA
2023-LN00905	North Abutment Details
2024-LN00905	North Abutment Reinforcement Details
2025-LN00905	South Abutment GA
2026-LN00905	South Abutment Reinforcement Details
2027-LN00905	Proposed Arrangement of Safety Barriers
3001-LN00905	Construction Sequence

Hyder Consulting
Design Information





BMT FLUID MECHANICS Limited



COMMERCIAL - IN - CONFIDENCE

BMT Fluid Mechanics Limited

Project No. 43664/10

**Exeter Bridge
Aerodynamic Stability Assessment**

(13 July 2006)

for

Hyder Consulting

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EXECUTIVE SUMMARY

This document has been prepared by BMT Fluid Mechanics Limited (BMT) for Hyder Consulting Engineers (Hyder) to summarise the main results of a programme of wind studies commissioned to assess the aerodynamic stability of the proposed Exeter Footbridge, in Exeter, UK.

The first phase (Phase I) of the work consisted of desk studies to investigate the potential for aerodynamic instabilities to occur within the design wind speed range. These studies, which are based on the UK Highways Agency standard BD49/01 and on BMT's considerable experience in the assessment of wind effects on long span bridges, concluded that the critical wind speed for the onset of torsional divergent vibrations could potentially be within the design wind speed range.

Phase II studies have been carried out to derive a detailed quantification of the dynamic response of the bridge deck to wind effects by way of section model wind tunnel testing, in accordance with the requirements of BD49/01.

The Exeter Footbridge wind tunnel tests were carried out in BMT's aeronautical wind tunnel using a 2-dimensional, 1:10 scale section model of the bridge deck. The main results of the wind tunnel testing are as follows:

Divergent Amplitude Response

- Divergent amplitude responses were measured up and above the design wind speed of 42.3m/s for a range of wind angles of attack.
- The Exeter bridge is stable within the design wind speed range.

Vortex Shedding Response

- Vortex shedding response was measured for a range of wind angles and structural damping of 0.03 logdec in accordance with the requirements of BD49/01.
- The peak amplitude response in bending for 0° wind incidence is 10mm and occurs for a wind speed of 5.7m/s.
- No vortex shedding response was observed in torsion.

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43664/10
Exeter Bridge
Aerodynamic Stability Assessment
(13 July 2006)

1. INTRODUCTION

1.1. BACKGROUND

This document has been prepared by BMT Fluid Mechanics Limited for Hyder Consulting Engineers (Hyder) to summarise the main results of a programme of wind studies commissioned to assess the aerodynamic stability of the proposed Exeter Footbridge, in Exeter, UK.

The first phase (Phase I) of the work consisted of desk studies to investigate the potential for aerodynamic instabilities to occur within the design wind speed range. These studies, which are based on the UK Highways Agency standard BD49/01 and on BMT's considerable experience in the assessment of wind effect on long span bridges, concluded that the critical wind speed for the onset of torsional divergent vibrations could potentially be within the design wind speed range.

Phase 2 studies have been carried out to derive a detailed quantification of the dynamic response of the bridge deck to wind effects by way of section model wind tunnel testing, in accordance with the requirements of BD49/01.

Exeter Bridge wind tunnel tests were carried out in BMT's aeronautical wind tunnel using a 2-dimensional, 1:10 scale section model of the bridge deck. The tests were carried out for a range of wind angles.

1.2. BASES FOR STUDIES

The studies have been conducted in accordance with the scope of the work described in BMT's email proposal Q73011 (ref Q73011/ab/001) for desk studies and email proposal (ref 43664/ab/007) for wind-tunnel studies.

1.3. PROPOSED STRUCTURE

Exeter Bridge is a pedestrian cable-stayed bridge located in Exeter, UK, with a total length of ~110 m comprising a main span of ~75 m. The single A-shape tower is 40m high and supports a 3.6 m wide deck. The deck is characterised by rectangular leading edge beams, which support a plate-like deck and includes a porous barrier arrangement.

The layout of the bridge are shown in Figures 1.1 and 1.2

1.4. REQUIREMENTS OF THE STUDY

The main requirements of the studies are as follows:

- Provide an assessment of the aerodynamic stability of the Exeter bridge deck with respect to vortex shedding and divergent responses

1.5. SCOPE OF WORK [APPENDIX A]

The scope of work agreed between Hyder and BMT to achieve the main requirements of the studies is detailed in Appendix A.

1.6. METHODOLOGY

1.6.1. *Specification of Wind Regime [Appendix B]*

A detailed wind analysis was carried out to define the wind regime at the site in accordance with the methodology described in the UK Highways Agency standards BD37/01⁽¹⁾ and BD49/01⁽²⁾. Details of the analysis are provided in Appendix B.

The design wind speed up to which the deck is required to be stable is 42.3 m/s.

1.6.2. *Structural and Dynamic Properties [Appendix C]*

The structural properties of the proposed Exeter Bridge for the current studies were supplied by Hyder and are detailed in Appendix C.

1.6.3. *Phase I Studies - Aerodynamic Stability Assessment [Appendix D]*

This study is based on the UK Highways Agency standard BD49/01⁽²⁾ and BMT's considerable experience in the assessment of wind effects on long span bridges.

1.6.4. *Phase II Studies*

The following methodology has been adopted for the section model studies.

1.6.4.1. **BMT's Aeronautical Wind Tunnel & Flow Conditions**

The section model tests have been conducted in BMT's aeronautical wind tunnel facility.

The tunnel has an octagonal cross section test section, which is 2.74 m wide x 2.14 m high. The controllable wind speed range is between 0.2 m/s - 65 m/s.

All wind tunnel tests were conducted in smooth flow. The maximum level of turbulence inherent in smooth flow in the wind tunnel is below 0.5%.

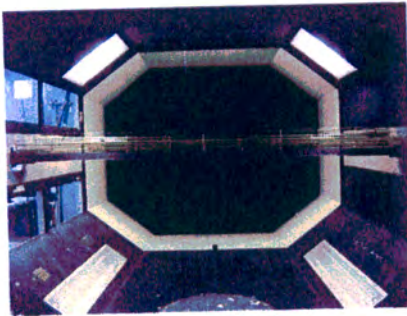
1.6.4.2. Wind Tunnel Model [Appendix E]

A rigid model of the bridge deck was designed and constructed at a scale of 1:10, based on drawing information supplied by Hyder.

The governing criteria for section model design and dynamic rig were as follows:

- Geometric representation of all aerodynamically active features at a scale of 1:10
- Conservation of non-dimensional inertia parameters as defined in Appendix F
- Compatibility between controllable wind speed range of the wind tunnel facility and the full scale design wind speed range in smooth flow

The following photographs show the wind tunnel model and a close up view of the barrier arrangement. Further details on the model design and construction are provided in Appendix E and F.



1.6.4.3. Test Matrix

The test matrix is as follows:

Test Number	Wind incidence [deg]	Damping
1	0.0	0.008
2	-2.5	0.008
3	-5.0	0.008
4	2.5	0.008
5	5.0	0.008
6	0.0	0.030
7	-2.5	0.030
8	-5.0	0.030
9	2.5	0.030
10	5.0	0.030

1.6.4.4. Dynamic Response Measurements [Appendix F]

Details of the experimental set-up and instrumentation used for the measurement of the dynamic response are included in Appendix F.

2. PHASE I – DESK STUDIES

2.1. GENERAL

The desk study has focused on two main mechanisms of divergent amplitude response, galloping and flutter. These phenomena consist of self-excited aerodynamic instabilities, which may involve vertical, torsional motions or coupled torsion, and vertical motions and arise from the interaction between the relative motion of the deck moving in the wind and the wind-flow itself. These motion-induced forces are sensitive to the deck cross-section and barrier arrangement and are the most serious form of instability as they result in potential structural failure. Therefore, the critical wind speed for the onset of instability is required to be well above the design wind speed for the bridge location.

In accordance with BD 49/01, Exeter Bridge has the potential to be susceptible to aerodynamic instabilities (see Appendix D section D.1). However, Exeter Bridge is beyond the scope of the code due to the high solidity of the barrier arrangement (see Appendix D section D.2).

In this assessment, information from previous wind tunnel tests results and available data in the open literature of other bridges with similar geometry has been used to estimate the critical wind speeds at which these instabilities are likely to occur for the proposed Exeter Bridge.

From an aerodynamic point of view, the barrier arrangement is an important feature of the proposed scheme. It has been demonstrated that the stability of typical bridge deck sections, which are in general characterized by a low aspect ratio (width to depth) compared to road bridges, is sensitive to the barrier arrangement, and this can drive the development of different divergent phenomena.

2.2. GALLOPING

2.2.1. *Vertical motion*

The onset of vertical galloping is observed at the speed at which the aerodynamic forces cause the vertical damping, comprising components of structural and aerodynamic damping, to be negative. When this condition is reached, the motion can diverge to levels that will cause the collapse of the bridge. As the vertical aerodynamic damping is a function of the wind speed and the rate of change of the force normal to the deck section with wind incidence, the necessary condition for galloping to occur is established by the Den Hartog Criterion, applied as follows:

$$\begin{cases} C_D + \frac{\partial C_L}{\partial \alpha} > 0 \text{ the structure is stable} \\ C_D + \frac{\partial C_L}{\partial \alpha} < 0 \text{ the structure may be unstable} \end{cases}$$

where C_D and C_L are the drag and lift force coefficients of the deck section and α is the wind incidence.

Pure vertical instabilities are generally typical for bluff cross sections of aspect ratio (width to depth) in the region of 2:1 to 3:1 (references [3], [4] and [5]). Typically, footbridges with solid parapets will tend to experience vertical galloping instabilities.

The cross section of the Exeter bridge deck has an aspect ratio of 7:1 and the parapets are regarded as sufficiently porous to marginally decrease this aspect ratio, as a result the aerodynamic damping of the bridge is expected to be positive preventing galloping instabilities to occur.

In addition, following the rather conservative approach of BD49, which assumes that negative aerodynamic damping could be development for any given section, the onset of vertical galloping can be estimated at a wind speed in excess of 60m/s, well above the design wind speed.

2.2.2. Torsional Motion

The onset of torsional instabilities is regarded as the speed at which the torsional damping becomes negative. Generally, bluff cross-sections with low width to depth ratio tend to be prone to this phenomena.

An index of the aerodynamic stability of a deck cross-section is the non-dimensional critical speed $V/f_t \cdot b$ (where V is the critical wind speed, f_t is the torsional frequency and b is the deck width). Experience suggests that the reduced wind speed is likely to be in the range of 3 to 6 for bridge decks of similar geometry. As f_t is 3.1 Hz and b is 3.6 m, the predicted critical speed for torsional instabilities is likely to be within 30m/s to 60 m/s.

It is noted that the critical wind speed is a strong function of the leading edge arrangement, and therefore a more accurate estimate is achievable only through further detailed study (e.g. section model wind tunnel tests).

In addition, BD49/01 methodology would suggest a critical wind speed of the order of 35m/s

2.3. CLASSICAL FLUTTER

Classical flutter instabilities are characterised by strong vertical and torsional motion. Generally, decks with streamlined cross-sections or high width/depth ratios have the potential to experience flutter. Given that the torsion and vertical motions need to

couple, the ratio of the vertical to torsional frequency is a driving parameter for the critical wind speeds at which these phenomena could occur.

The critical wind speeds for the onset of flutter can be estimated based on data available in the open literature (see Wyatt & Scruton [6]) as a function of frequency ratio, cross section dimensions, mass, and radius of gyration.

The predicted flutter wind speed is in excess of 100m/s.

It is noted that for Exeter Bridge, the separation between the vertical and torsion frequencies and the effective mass can be regarded as “high”, which is beneficial in increasing the critical wind speed for flutter.

3. PHASE II – WIND TUNNEL STUDIES

3.1. DIVERGENT AMPLITUDE RESPONSE

3.1.1. *Details of Measurements*

The objective of these tests was to investigate the bridge deck dynamic response up to the following design wind speed based on the UK Highways Agency standards BD37/01 and BD49/01.

-5°	35	6.61	3.12
-2.5°	35	6.61	3.12
0°	43.2	8.04	3.79
+2.5°	35	6.61	3.12
+5°	35	6.61	3.12

The reduced wind speeds for bending ($U/f_b B$) and torsion ($U/f_t B$) responses are based on the first vertical bending mode with frequency f_b of 0.91Hz and the first torsion mode with frequency f_t of 3.1Hz and the width of the bridge B taken as 3.6m. Tests were carried out for damping levels of 0.008 and 0.03 logdec.

3.1.2. *Results*

The results of the stability measurements are presented in form of:

- Variation of the bending full scale RMS displacement with reduced wind speed ($U/f_b B$) (*Figure 2.1*)

- Variation of the torsion full scale RMS response with reduced wind speed ($U/f_t B$) (*Figure 2.2*)

A flutter type of instability (pure torsion) was observed for all configurations. The critical wind speed was defined from the plots by extrapolating the region of rapid response growth back to the wind speed axis. The value where the line crosses the wind speed axis is defined as the critical wind speed.

On the basis of the design wind speed given above, the bridge is stable within the design wind speed range for all wind incidences

3.2. VORTEX SHEDDING RESPONSE

The vortex shedding responses were measured in terms of accelerations in bending and torsion. No vortex shedding in torsion was found.

Results in terms of variation of the full-scale bending RMS response with reduced wind speed are presented in Figures 2.1 and 2.2.

The peak vibration amplitudes, calculated as described in Appendix F, and corresponding critical reduced wind speeds are summarised below:

Vortex Shedding – Damping (~0.03) logdec

Wind Angle [deg]	BENDING		
	Full Scale Wind Speed [m/s]	Reduced Wind Speed V/tB [t]	Full Scale Displacement Amplitude [mm]
-5°	N/A	N/A	N/A
-2.5°	6.55	1.86	2
0°	5.67	1.61	10
2.5°	5.86	1.66	4
5°	7.07	2.00	19

No vortex shedding resonant responses were recorded in torsion.

4. CONCLUSION

The following conclusions have been drawn from the wind tunnel study carried on to assess the dynamic response on the proposed Exeter bridge deck:

Divergent Amplitude Response

- Divergent amplitude responses were measured up and above the design wind speed of 42.3m/s for a range of wind angles of attack.
- The Exeter bridge is stable within the design wind speed range.

Vortex Shedding Response

- Vortex shedding response was measured for a range of wind angles and structural damping of 0.03 logdec in accordance with the requirements of BD49/01.
- The peak amplitude response in bending for 0° wind incidence is 10mm and occurs at the critical wind speed of 5.7m/s.
- No vortex shedding response was observed in torsion

5. REFERENCES

- (1) Uk Highway Agency, Loads for highway Bridges. BD37/01- Part 3.
- (2) UK Highway Agency, Design Rules for Aerodynamic Effects on Bridges. BD49/01- Part 3.
- (3) Blevins, Robert D. - Flow-Induced Vibration, 1977
- (4) ESDU, Response of structures to galloping excitation. Item 91010, ESDU International, London, 1993.
- (5) ESDU, 'Lift-curve slope' for structural response calculations. Item 91013, ESDU International, London, 1993.
- (6) Wyatt, T.A. Scruton, C., A brief survey of the aerodynamic stability problems of bridges" Proceedings of the Institution of Civil Engineers, London, 1981

FIGURES

Figure 1.1: Exeter Bridge – Layout

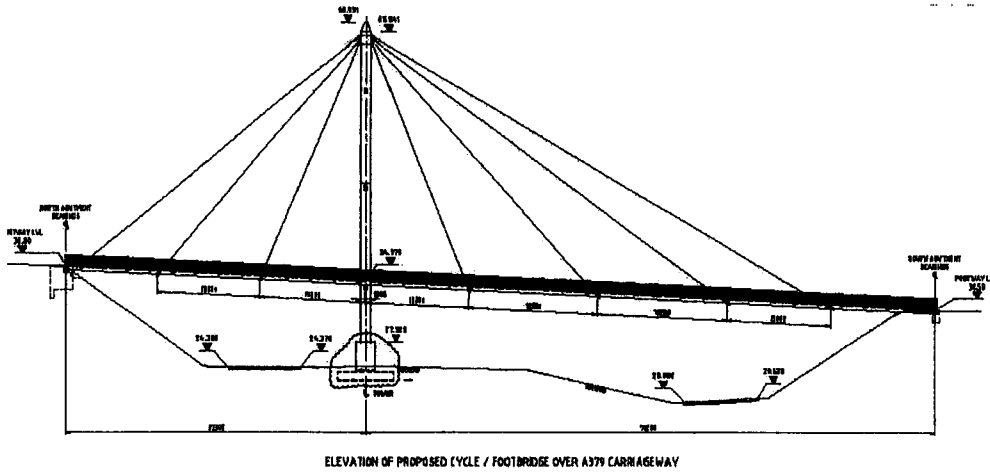


Figure 1.2: Exeter Bridge – Typical Cross Section

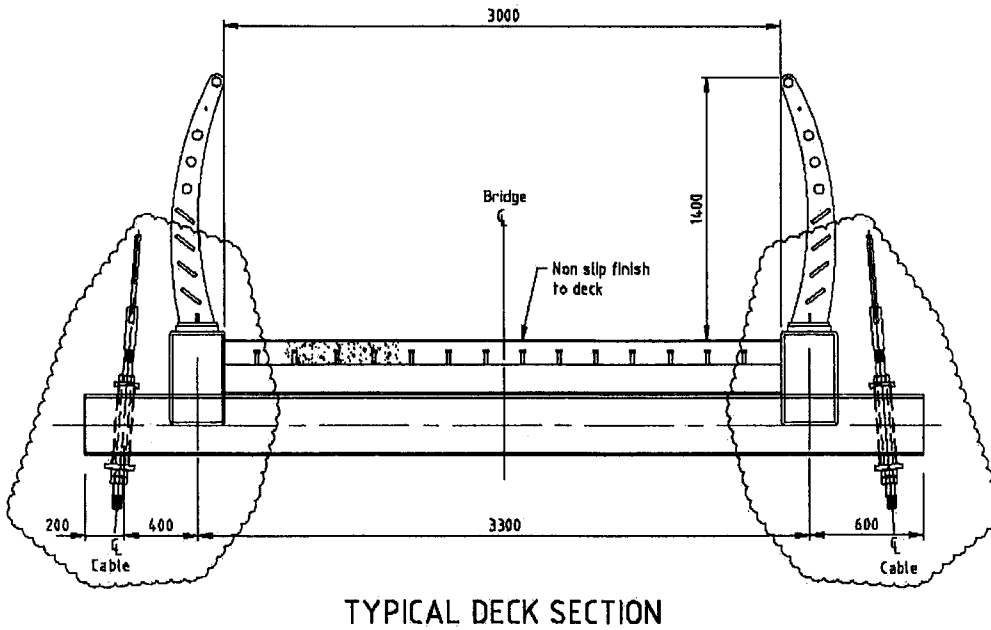


Figure 2.1 Dynamic Response - Variation of Bending Responses with Reduced Wind Speeds

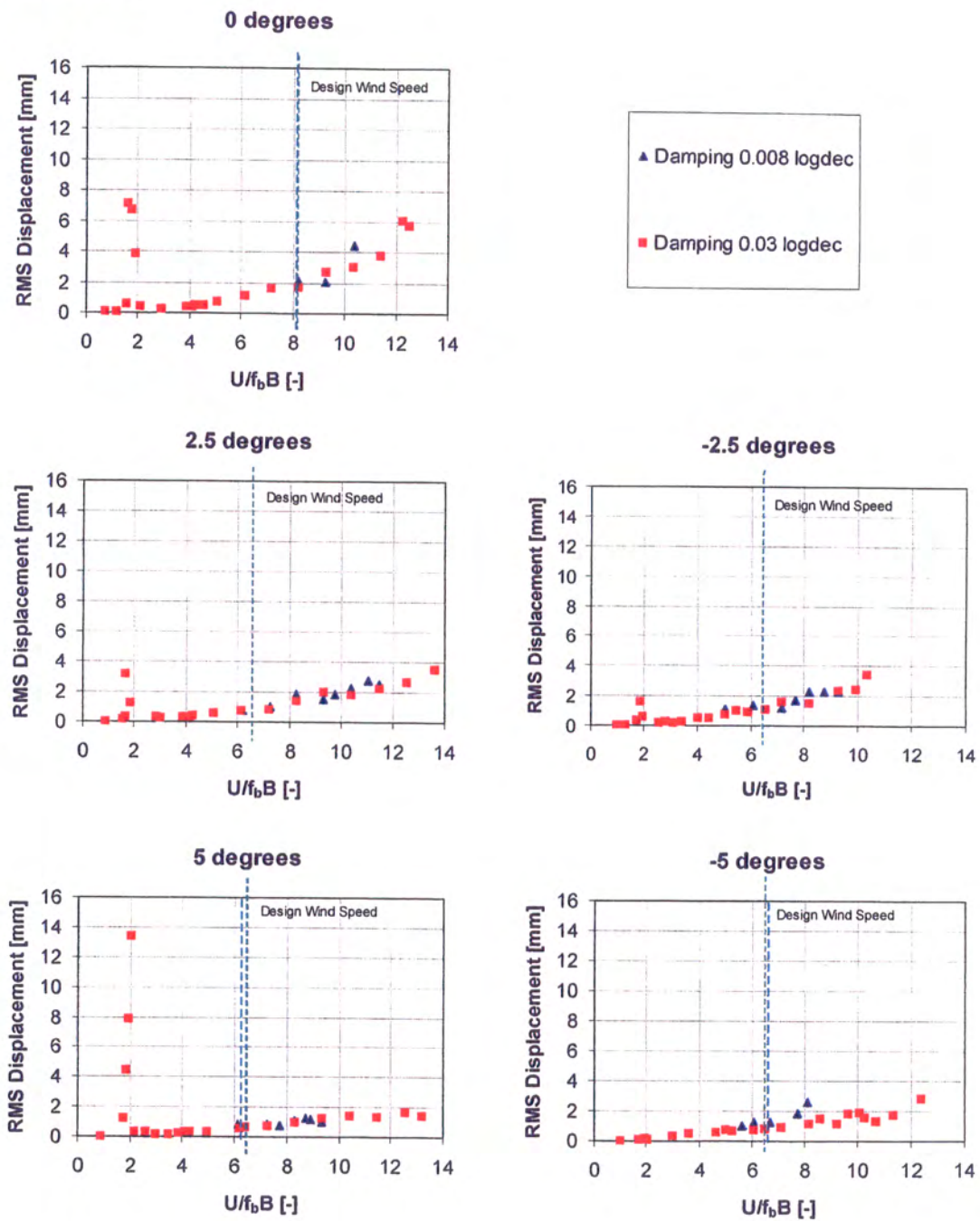
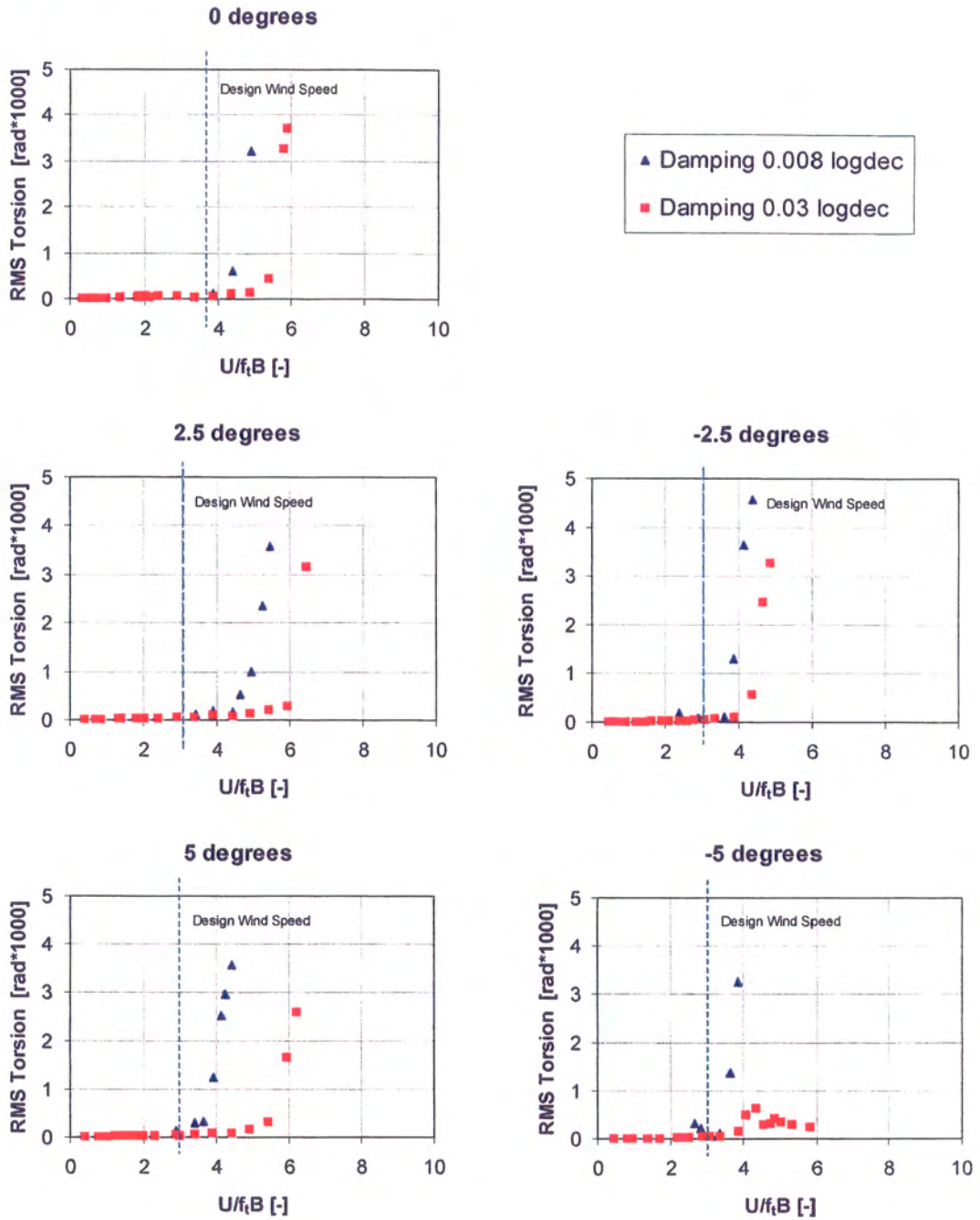


Figure 2.2 Dynamic Response – Variation of Torsion Responses with Reduced Wind Speeds



APPENDIX A. SCOPE OF WORK

The scope of work agreed between Hyder and BMT is detailed in the sections below.

A.1. Desk Studies

- Conduct desk studies to assess the potential for aerodynamic instabilities - with respect to vortex shedding and to divergent amplitude responses - to occur within the design wind speed range. The study will be carried out in accordance with the requirements of BD49/01 and will also be based on BMT's considerable experience on wind effects on long span bridges

A.2. Wind Tunnel Studies

A.2.1. *Wind Tunnel Models*

- Design, construct, and instrument a detailed carbon fibre constant section model at a model scale of 1:10 suitable for the purpose of conducting model scale section model wind tunnel tests using dynamic model rigs

A.2.2. *Wind Tunnel Tests*

- Conduct dynamic section model wind tunnel tests to determine the critical speeds and amplitudes for the onset of vortex shedding oscillations and galloping/flutter instability in bending and in torsion at wind incidences in the range $\pm 5.0^\circ$ in increments of $\pm 2.5^\circ$ in smooth flow for 2 level of damping for a series of bridge deck configurations

A.3. Reporting

- On completion of all studies provide a detailed final technical report for client review and approval

APPENDIX B. SPECIFICATION OF WIND REGIME

B.1. General

The design wind speed for divergent instabilities were calculated in accordance with UK Highways Agency standards BD37/01⁽¹⁾ and BD49/01⁽²⁾.

B.2. Aerodynamic Stability - Design Wind Speeds

According to BD49/01⁽²⁾, the stability of the proposed bridge is required to be demonstrated up to the wind speed V_{wo} given by:

$$V_{wo} = \frac{1.1}{2} (V_r + V_d) \cdot K_{1A}$$

where:

V_r is the mean hourly design wind speed at reference height (section D.1.7)

V_d is the maximum wind gust speed at reference height (BD37/01 clause 5.3.2.1)

K_{1A} is a coefficient to give an appropriate low probability of occurrence of severe oscillation taken as 1.25 (BD49 clause 2.1.3.4)

For the proposed bridge site the design wind speed V_{wo} is 42.3 m/s and has been calculated based on the parameters defined in the following sections.

B.2.1. Mean Hourly Design Wind Speeds (V_r)

The mean hourly design wind speed V_r is defined as follows:

$$V_r = V_s \cdot S_m$$

Where V_s and S_m are calculated as follows:

$$V_s = V_b \cdot S_a \cdot S_d \cdot S_p$$

$$S_m = S'_c \cdot K_F \cdot T_c \cdot S'_h$$

where:

V_b is the basic wind speed for the site taken as 22m/s (BD37/01 clause 5.3.2.2)

S_a is the altitude factor taken as 1.02 (BD37/01 clause 5.3.2.2.3)

S_d is the direction factor taken as 1 (BD37/01 clause 5.3.2.2.4)

S_p is the probability factor taken as 1.05 (BD37/01 clause 5.3.2.2.2)

S'_c is the hourly wind speed factor, taken as 1.25 (BD37/01 clause 5.3.2.3.1)

K_F is the fetch correction factor, taken as 1 (BD37/01 clause 5.3.2.4.1)

T_c is the hourly mean town reduction factor, taken as 0.88 (BD37/01 clause 5.3.2.4.2)

S'_h is the topography factor, taken as 1 (BD37/01 clause 5.3.2.3.3)

The hourly mean wind speed (V_r) is then 25.9 m/s at deck level.

B.2.2. Maximum Gust Speed (V_d)

The maximum wind gust speed is defined as follows:

$$V_d = V_s \cdot S_g$$

where S_g is the gust factor defined as:

$$S_g = S'_b K_F T_g S'_h$$

where:

S'_b is the bridge and terrain factor taken as 1.6 (BD37/01 clause 5.3.2.3.1)

T_g is the town reduction factor taken as 1 (BD37/01 clause 5.3.2.3.2)

The wind gust speed V_D at reference height is 33.2 m/s.

APPENDIX C. STRUCTURAL AND DYNAMIC PROPERTIES

Drawing Information

The following drawing information were provided by Hyder for the purpose of the current study:

Drawing Name	Received by BMT
2001-LN00905-LND-04.dwg	06/04/2006
2002-LN00905-LND-03.dwg	06/04/2006
2003-LN00905-LND-04.dwg	06/04/2006
2004-LN00905-LND-03.dwg	06/04/2006
2006-LN00905-LND-04.dwg	06/04/2006
X003-LN00905-A1H-00.dwg	06/04/2006

Structural and Dynamic Properties

The following properties were provided by Hyder for the purpose of the current study:

Bridge deck mass	~1500kg/m
First vertical frequency	0.91Hz
First torsional frequency	3.1Hz

The modeshapes for the above frequencies were also provided by Hyder in electronic format and shown in Figures C.1 and C.2 below.

Figure C.1 First Vertical Modeshape

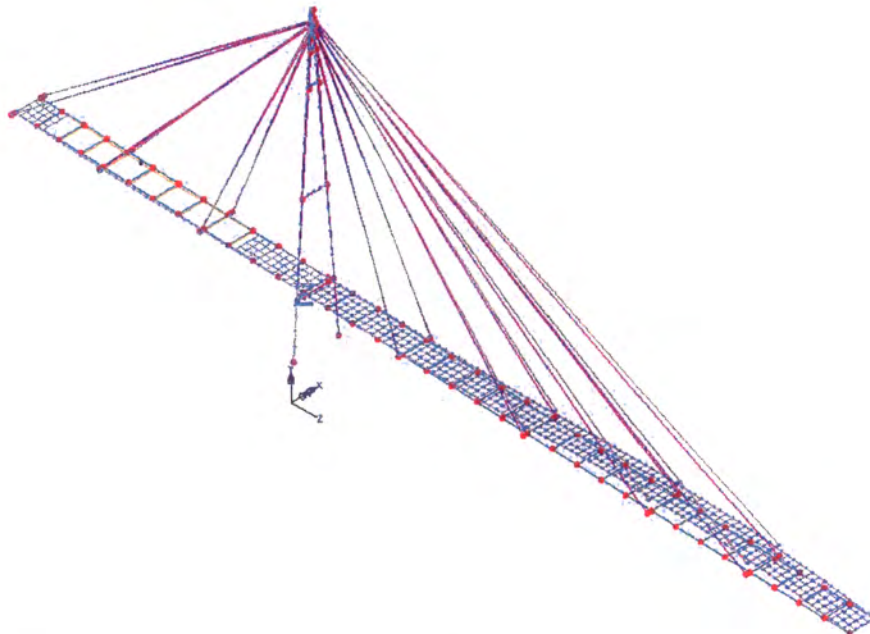
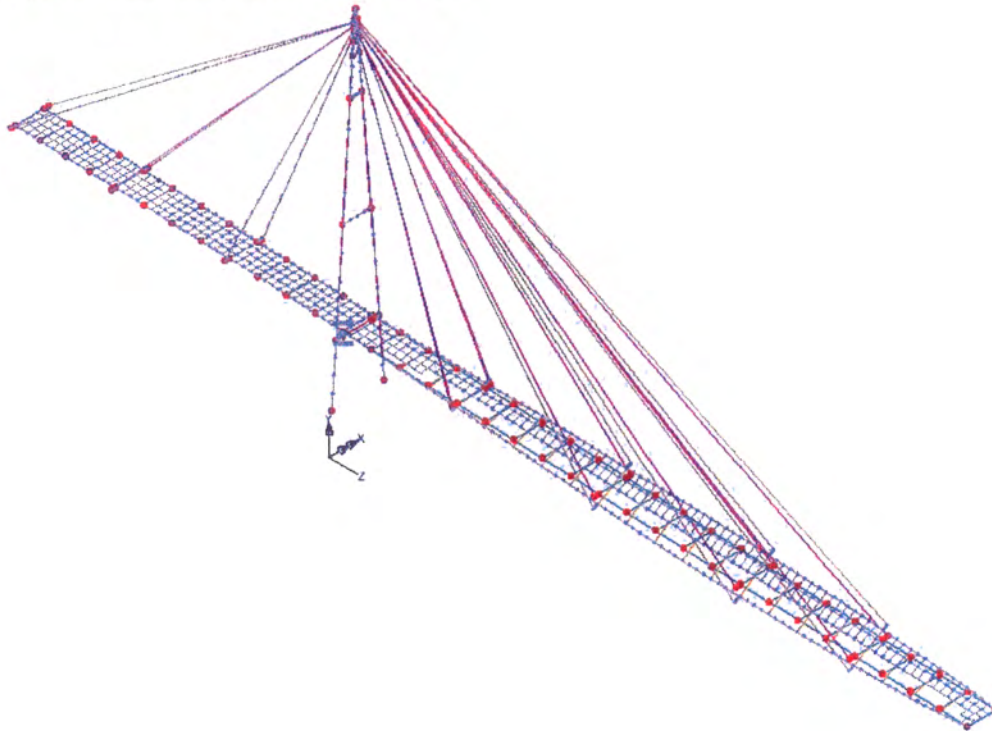


Figure C.2 First Torsion Modeshape



APPENDIX D. AERODYNAMIC STABILITY ASSESSMENT

D.1. Aerodynamic Susceptibility Parameter

The susceptibility to aerodynamic excitation of the proposed Exeter Bridge has been estimated as follows:

$$P_b = \left(\frac{\rho \cdot b^2}{m} \right) \cdot \left(\frac{16 \cdot V_r^2}{b L f_B^2} \right) \text{ ((BD49/01 clause 2.1)}$$

where

ρ is the air density = 1.23 kg/m³

b is the bridge deck width = 3.6 m

m is the mass per unit length = 1552 kg/m

V_r is the hourly mean wind speed = 25m/s

L is the main span of the deck = 71 m

f_B is the first vertical bending frequency = 0.91 Hz

The aerodynamic susceptibility coefficient is ~0.5, therefore the proposed bridge is within has the potential to be sensitive to wind action

D.2. Geometric Constrains

For bridges with porous parapets, the following geometric constrain is require to be satisfied in order to ensure that the bridge is within the scope of BD49/01:

$$\phi \leq 0.5$$

$$\phi \cdot h \leq 0.35 \cdot d_4$$

where

ϕ solidity ratio of parapet

d_4 depth of the bridge deck

The above constrain is not satisfied, therefore the Exeter bridge is outside the scope of BD49/01.

APPENDIX E. MODEL DESIGN AND CONSTRUCTION

E.1. Basis for Design and Construction

The model was designed and constructed based on drawing information of the bridge deck supplied by Hyder. Table E.1 summarises the drawings used for the model design and construction.

Table E.1 - Drawing Information

Drawing Name	Received by BMT
2001-LN00905-LND-04.dwg	06/04/2006
2002-LN00905-LND-03.dwg	06/04/2006
2003-LN00905-LND-04.dwg	06/04/2006
2004-LN00905-LND-03.dwg	06/04/2006
2006-LN00905-LND-04.dwg	06/04/2006
X003-LN00905-A1H-00.dwg	06/04/2006

E.2. Model Design & Construction

The section model, as designed, was suitable for dynamic wind tunnel testing.

The model was constructed at a linear model scale of 1:10. At this scale the model allows detailed representation of all geometric features of the bridge deck that are expected to affect the wind flows around the bridge at full scale.

In order to achieve the model scale target mass and high bending frequency, a hollow carbon fibre construction was adopted. Each bridge deck component was constructed independently in carbon fibre and bounded together. Figures E.1 and E.2 show a general view of the model in the wind tunnel and a close up of the lower surface of the deck.

The model was equipped with removable barriers constructed in brass. The louvers were fabricated using photo-etching techniques brass and bent manually. Figure E.3 shows a close up view of the barrier arrangement.

The model also comprised two 6 mm thick carbon fibre end plates suitable for model installation within BMT's Aeronautical Wind Tunnel.

Figure E.1 – Wind Tunnel Model – General View

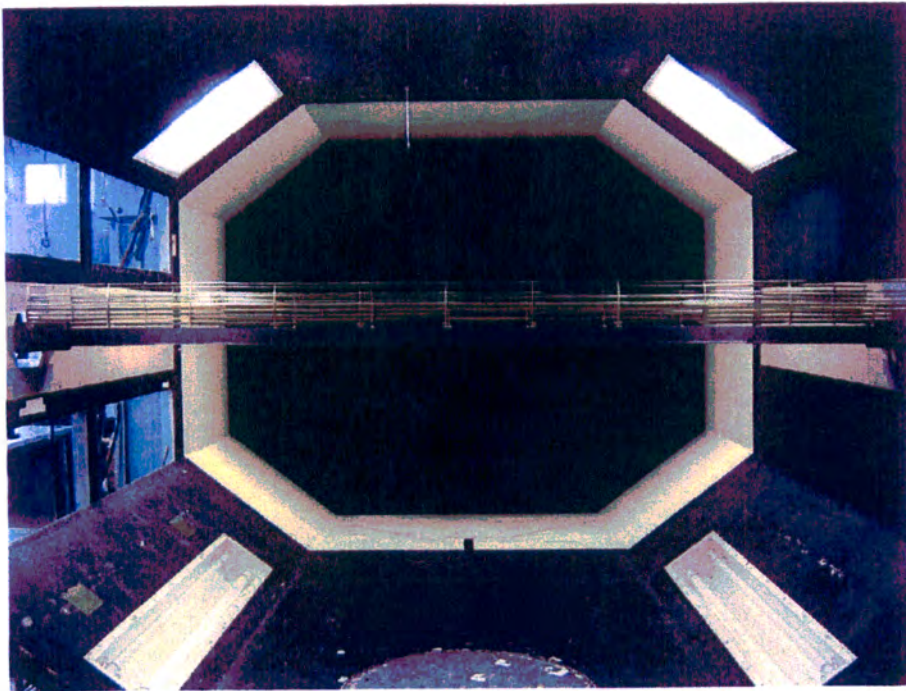


Figure E.2 – Wind Tunnel Model – Transverse Stiffeners – Close up view

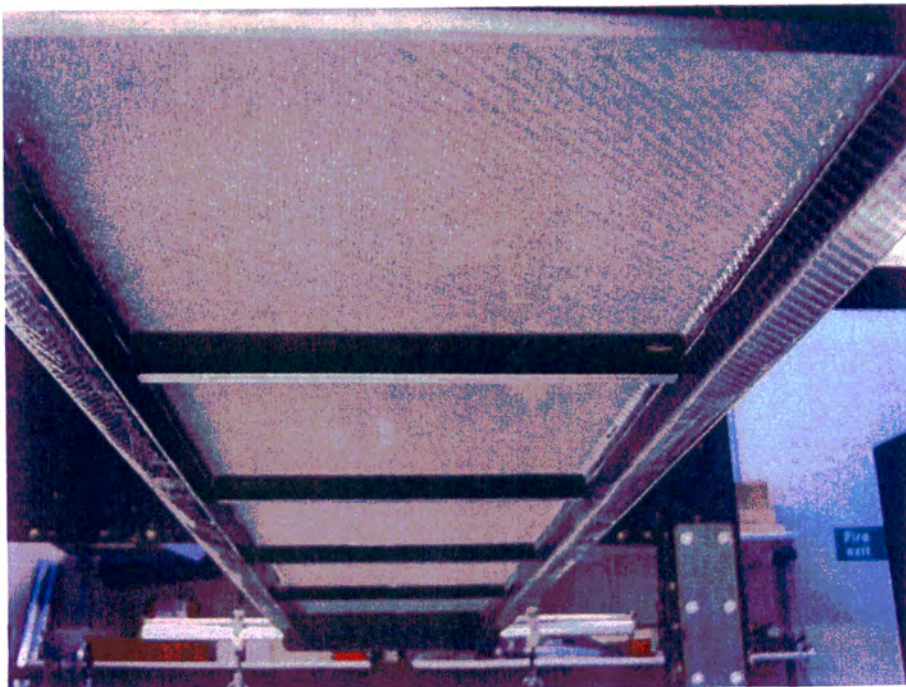
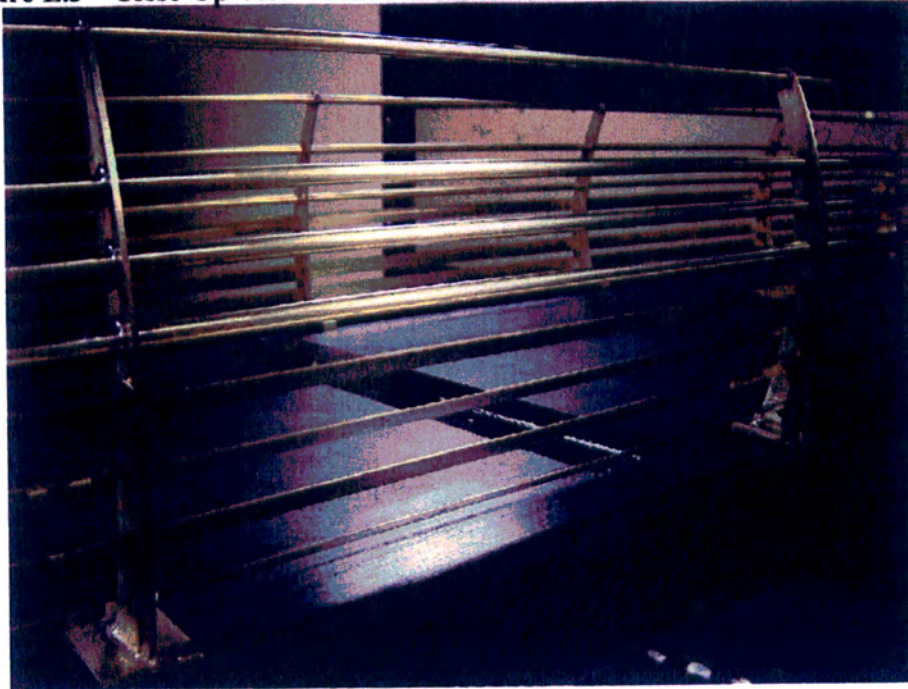


Figure E.3 – Close-Up View of the Pedestrian Handrails



E.3. Model Approval

The wind tunnel model was reviewed and approved by Hyder on 26th May 2006 prior to testing.

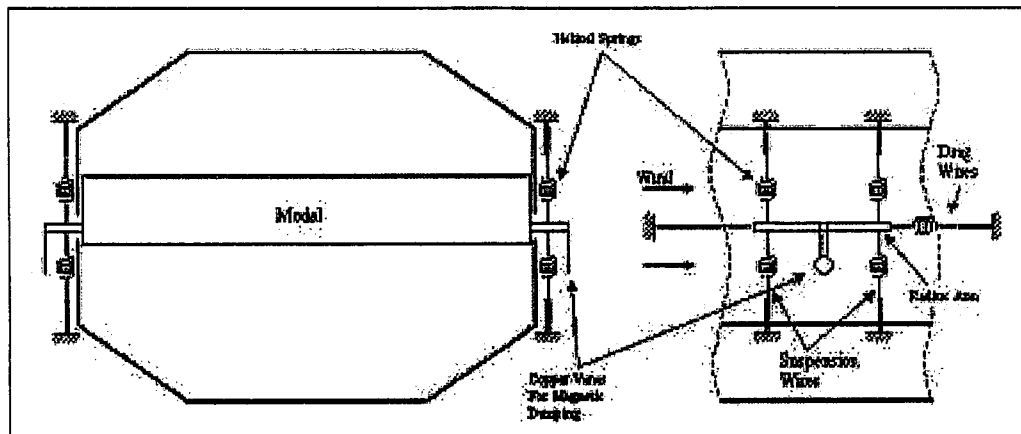
APPENDIX F. DYNAMIC RESPONSE STUDIES

F.1. Model Mounting & Instrumentation

For the dynamic response tests the model was mounted across the 2.74 m width of the wind tunnel on a dynamic rig consisting of a system of springs allowing 2 degrees of freedom (vertical bending and torsional motion). The model was restrained from moving in the other directions by a combination of light steel wires.

The layout of the dynamic rig for this configuration is shown in Figure F.1 below.

Figure F.1 – Layout of Dynamic Rig



For dynamic response measurements, the test rig was instrumented with four small accelerometers mounted on the suspension arm external to the wind tunnel and positioned to resolve the vertical bending and rotational motion through the sum and the difference of the signals digitized simultaneously. From the accelerations time histories the amplitude response of the model was determined.

F.2. Experimental Conditioning

F.2.1. Scaling Requirements

For the dynamic rig tests it was required to reproduce the full-scale behaviour of the bridge deck by imposing the correct structural properties on the wind tunnel model subject to scaling laws detailed below.

For dynamic similarity, equality of the following non-dimension parameters is required between model-scale and full-scale:

$$i) \frac{I_z}{\rho B^2} \quad ii) \frac{I_g}{\rho B^4}$$

$$\begin{array}{ll} \text{iii)} \frac{U}{f_b B} & \text{iv)} \frac{U}{f_t B} \\ \text{v)} \delta_z & \text{vi)} \delta_\theta \end{array}$$

Where:

I_z is the mass per unit length of the bridge deck

I_θ is the mass moment of inertia of the bridge deck

B is the reference dimension taken as the bridge deck width

ρ is the density of air

U is the mean hourly wind speed

f_b is the bending natural frequency

f_t is the torsional natural frequency

δ_z is the logarithmic decrement of the structural damping corresponding to the bending frequency

δ_θ is the logarithmic decrement of the structural damping corresponding to the torsional frequency

The combined damping and inertial parameters for single degree of freedom sinusoidal motions are as follows:

$$\begin{array}{ll} \text{vii)} \frac{I_z \delta_z}{\rho B^2} & \text{viii)} \frac{I_\theta \delta_\theta}{\rho B^4} \end{array}$$

A departure from the correct frequency ratio can be obtained for single degree of freedom motions providing different values of U and hence different wind speed scales for vertical bending and torsional motion.

With the above parameters correctly modelled, values of U/fB obtained from wind tunnel measurements will be directly applicable to full scale. The responses measured in the wind tunnel can be related via the model scale.

F.2.2. Dynamic Response

The full-scale and model scale dynamic properties of the deck are compared in Table F.1. Table F.2 contains target and achieved values of non-dimensional inertia for each mode considered for the dynamic tests. The target parameters were based on the full-scale data supplied by Hyder.

Table F.1 Full Scale and Model Scale Parameters

Bending frequency (f_b) [Hz]	0.91	4.83
Torsion frequency (f_t) [Hz]	3.10	10.25
Mass [kg/m]	1500	16.20
Damping -bending [Logdec]	N/A	0.03
Damping -torsion [Logdec]	N/A	0.03

Table F.2 Target & Achieved Non-Dimensional Quantities

$\frac{I_z}{\rho B^2}$	$\frac{I_\theta}{\rho B^4}$	$\frac{f_t}{f_b}$	$\frac{I_z}{\rho B^2}$	$\frac{I_\theta}{\rho B^4}$	$\frac{f_t}{f_b}$
94	13-18	3.41	94	18	2.12

F.3. Model Calibration

The model dynamic properties in terms of natural bending and torsional frequencies and structural damping were measured prior to each set of tests.

The dynamic properties of the model were measured by resonating the model in a natural mode via the deck using a vibrator through a light spring or by hand.

The bending and torsional frequencies were measured by oscillating the model at constant amplitude.

The structural damping associated with the rig system was measured in amplitude decay tests.

F.4. Derivation of Full-Scale Displacements

The full-scale bending and torsion RMS displacements are determined from the RMS model acceleration as follows:

$$y_{FS} = 10 \frac{\ddot{y}_{MS}}{(2\pi f_b)^2}, \theta_{FS} = \frac{\ddot{\theta}_{MS}}{(2\pi f_t)^2}$$

Where y_{FS} and θ_{FS} are the full-scale RMS bending displacement and torsion, \ddot{y}_{MS} and $\ddot{\theta}_{MS}$ are the bending and torsion RMS model accelerations and f_b and f_t are the bending and torsion frequencies.

The full-scale bending and torsion vibration amplitudes are defined as follows:

$$y_{AMP-FS} = \sqrt{2} \cdot y_{FS}, \theta_{AMP-FS} = \sqrt{2} \cdot \theta_{MS}$$

Where y_{AMP-FS} and θ_{AMP-FS} are the full-scale bending and torsion vibration amplitude, y_{MS} and θ_{MS} are the bending and torsion RMS displacements.

BMT Fluid Mechanics Limited is a wholly owned subsidiary of BMT Limited. BMT is an international design, engineering and risk management consultancy, working principally in the defence, energy marine technical services and transport sectors. BMT invests significantly in research. Its customers are served through a network of international subsidiary companies. The assets are held in beneficial ownership of its staff.

BMT Fluid Mechanics is internationally recognised as a leading independent specialist in the field of wind engineering and offshore marine consultancy. The Company uses its key skills in fluid dynamics, naval architecture, physical modelling and numeral modelling to help designers and operators optimise design, minimise commercial risk and maximise safety.

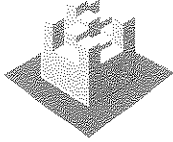


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Section Three

PLANNING

Planning Correspondence



John Rigby
Director Economy and Development

Richard Short
Head of Planning Services

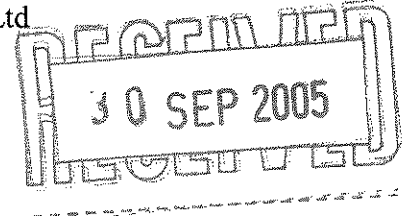
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Civic Centre
Paris Street
Exeter EX1 1NN

Tel: 01392 277888
Fax: 01392 265431
Email: planning@exeter.gov.uk
Website: www.exeter.gov.uk

Exeter City Council

Kensington Taylor
Kensington Court
Pynes Hill
EXETER
EX2 5TY

Exeter Rugby Group Ltd
County Ground
Church Road
Exeter
EX2 9BQ



Town and Country Planning Act 1990
Town and Country Planning (General Development Procedure) Order 1995
FULL PLANNING PERMISSION GRANTED

Part I - Particulars of Application

DATE RECEIVED: 18 April 2005

APPLICATION NUMBER: 05/0629/03

PROPOSAL: Provision of cycle/footpath link including bridge over A379

LOCATION: Land East of Railway Line from Apple Lane to Old Rydon Lane, Exeter, EX2

Part II - Particulars of decision

The Local Planning Authority grants permission for the carrying out of the development referred to in Part 1 hereof in accordance with the application and the plans submitted subject to the following conditions:-

- 1 Samples of the materials it is intended to use externally in the construction of the development shall be submitted to the Local Planning Authority and the development shall not be started before their approval is obtained in writing and the materials used in the construction of the development shall correspond with the approved samples in all respects.
Reason: To ensure that the materials conform with the visual amenity requirements of the area.
- 2 The landscaping shall be carried out in full accordance with the scheme of landscaping shown on drawing No. 0088 PL 24 Rev A, received on 26th September 2005, unless otherwise agreed in writing by the Local Planning Authority. The landscaping shall be carried out within the first planting season following completion of the development hereby approved or in accordance with a programme agreed in writing by the Local Planning Authority.
Reason: In the interests of the visual amenities of the area.



- 3 Prior to the commencement of the development hereby approved full details of the proposed means of lighting of the footpath/cycleway, including type and intensity of individual lights, and their position, shall be submitted to, and be approved in writing by, the Local Planning Authority. Thereafter the development shall be completed strictly in accordance with the approved details.
Reason: To ensure that the details of the development are visually and environmentally acceptable.
- 4 Prior to the commencement of the development hereby approved details of the proposed boundary treatments, including their elevational appearance and materials, shall be submitted to, and be approved in writing by, the Local Planning Authority. Thereafter the development shall be completed strictly in accordance with the approved details.
Reason: In the interests of the visual amenities of the area.
- 5 No development shall take place within the site until a written scheme of archaeological work has been submitted and approved in writing by the Local Planning Authority. This scheme shall include on-site work, and off-site work such as the analysis, publication, and archiving of the results. All works shall be carried out and completed as approved, unless otherwise agreed in writing by the Local Planning Authority.
Reason: To ensure the appropriate identification, recording and publication of archaeological and historic remains affected by the development.

Reason for Decision

This application is determined having regard to Exeter Local Plan First Review Policies (.....) taking particular account of:-

Hierarchy of Modes

Encouraging Use of Sustainable Modes

Objectives of Urban Design

Signed 
Head of Planning Services

Dated: 27 September 2005

Section Four

THE CONSTRUCTION

Subcontractors / Material Suppliers

SUBCONTRACTOR / MATERIAL SUPPLIERS DIRECTORY

SERVICE / SUPPLY	SUBCONTRACTOR / SUPPLIER	CONTACT DETAILS
Crash Barriers	Barrier Services Ltd	The Elms Caerwent Brook Caldicot Monmouthshire NP26 5BB Tel: 01291 430161 Fax: 01291 430158
Aerodynamic Assessment	BMT Fluid Mechanics Ltd <i>(Subcontract to Hyder)</i>	67 Stanton Avenue Teddington Middlesex TW11 0JY Tel: 0208 6144400 Fax: 0208 9433224
Installation & Tensioning of Cables	Bridon Ropes <i>(Subcontract to Taylor & Sons)</i>	Sheephouse Wood Stocksbridge Sheffield S36 4GS Tel: 01302 344010 Fax: 01302 382263
Fencing	JP Douglas Ltd	PO Box 2 Nuneaton Warwickshire CV11 6AF Tel: 024 7674 2491 Fax: 024 7674 2492

SERVICE / SUPPLY	SUBCONTRACTOR / SUPPLIER	CONTACT DETAILS
Footpath / Paving	E & JW Glendinning Ltd	Exhibition Way Pinhoe Exeter Devon EX4 8HT Tel: 01364 652601 Fax: 01364 651119
Reinforcing Bars	KB Reinforcements	Roundhead Road Heathfield Industrial Estate Newton Abbot Devon TQ12 6RY Tel: 01626 833861 Fax: 01626 832825
Concrete	Proform	Quay Road Brunel Industrial Estate Newton Abbot Devon TQ12 2BU Tel: 01626 333026 Fax: 01626 330250
Street Lighting <i>(please refer to Section 5 – Mechanical & Electrical)</i>	Southern Electric Contracting (SEC)	2 Mallard Road Sowton Exeter EX2 7LD Tel: 01392 353033 Fax: 01392 209199

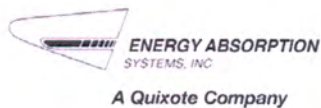
SERVICE / SUPPLY	SUBCONTRACTOR / SUPPLIER	CONTACT DETAILS
Expansion Joints & Split Resistant Coating System	Stirling Lloyd Contracts Ltd	Union Bank King Street Knutsford Cheshire WA16 6EF Tel: 01565 633111 Fax: 01565 650770
Metalwork Fabrication & Painting	Taylor & Sons	5-6 Curran Road Cardiff CF10 5DF Contact: Steve Lloyd Tel: 029 2034 4556 Fax: 029 2066 8183

Barrier Services Ltd

ABC Terminal



*Terminating your Safety Barrier
is as Simple as ABC*



Highway Care

Product & Installation Manual

Product Description

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Important Introductory Notes

Correct design, installation, maintenance, and repair of the ABC Terminal system is essential to assure maximum performance. Take the time to review this manual thoroughly before performing any necessary work.

Do not attempt to install any safety system without proper instructions.

CAUTION

It is not advisable to install two ABC Terminals side by side as occupants of an errant vehicle impacting both terminals head on will be subject to twice the deceleration forces which could potentially lead to serious injury. Increasing the distance between the P4 Terminals so that it is only possible to hit one system will provide an opportunity for errant vehicles to impact the protected object or the reverse side of the adjacent P4 Terminal. Staggering P4 Terminals may also allow vehicles to impact the reverse side of a terminal. When two adjacent barrier runs must be terminated, an alternative such as a crash cushion should be considered.

The ABC Terminal is a crash worthy steel-post, energy absorbing terminal designed to enhance safety at the beginning and end of highway safety barrier.

The ABC Terminal has been successfully tested to 110 km/h using the CEN criteria described in ENV 1317-4.

The ABC Terminal uses a new steel 'directional' breakaway post concept. The Lower Post, having an 'H' section is driven into the ground. The Upper Post, with its 'U' section, slides into the Lower Post and is secured using a stainless steel Shear Pin.

During a head-on impact, longitudinal forces break the Shear Pin, releasing the Upper Post. Energy absorption is achieved through friction and deformation as the rail sections slide rearwards.

During a side impact along the ABC Terminal the Upper and Lower Posts are designed to remain together, laterally supporting the rail sections, so that the impacting vehicle is smoothly redirected.

The 110 km/h system has an overall length of 12.36 metres. Shorter versions, for 100 km/h and 80 km/h protection are available.

The 100 km/h system (P3) has an overall length of 9.70 metres and is a shortened version of the P4 system. (Reduced by 2 post assemblies and 2 intermediate rails). Available as a P3 kit.

The 80 km/h system (P2) has an overall length of 7.03 metres and is a shortened version of the P4 system. (Reduced by 4 post assemblies and 4 intermediate rails). Available as a P2 kit.

The ABC Terminal

Component Description

PART	Engineering Reference	Quantity
End Rail and Head Assembly	ABC-1	1
Intermediate Rail	ABC-2	7
Rear Rail Section	ABC-3	1
Support Plate	ABC-4	16
Hex Bolt M16x35 Assembly, complete	ABC-5	10
Hex Bolt M10x40 Assembly, complete	ABC-5A	1
Dome Head M16x35 Assembly, complete	ABC-5B	52
Guardrail Spacer (posts 2-9)	ABC-6	8
Guardrail Spacer (1st post)	ABC-7	1
Cable Assembly	ABC-8	1
Breaking Plate	ABC-9	1
Cable Attachment Plate	ABC-10	1
Upper Post	ABC-11	8
Lower Post	ABC-12	8
Shear Pin	ABC-13	8
U-Bolt	ABC-14	1
Large Diameter Washer	ABC-15	10

Note:

The End Rail and Head Assembly is asymmetrical. Left and right hand versions are available. Check that the End Rail and Head Assembly supplied is the correct version for your application.

IMPORTANT

Positioning of the posts is critical. Measure each post centre and relevant distance back from the road carefully. Double check all measurements before driving the Lower Posts into the ground.

Check Shipping List

Check the component parts against parts received to verify that all items were received.

Tools Required for Installation

- Traffic control equipment
- 10mm Allen Key or Hex Insert Socket
- 16mm Hex Socket Drive
- Chalk Line
- Tape Measure
- Marking Paint
- Shovel
- 2 x Alignment tools ("Podgers")
- Torque Wrench

CAUTION

Read and understand all instructions before beginning installation.

Installation

Procedure

1) Positioning of the First (front) Post of the ABC Terminal

From the centre-line of the central slotted hole at the end of the installed safety barrier ("**W**" profile beams) or central slotted hole of the SF 11 Connection Piece (OBB applications) measure 12029mm. This marks the centre-line for the first lower post of the ABC Terminal (See page 12 for full setting out dimensions)

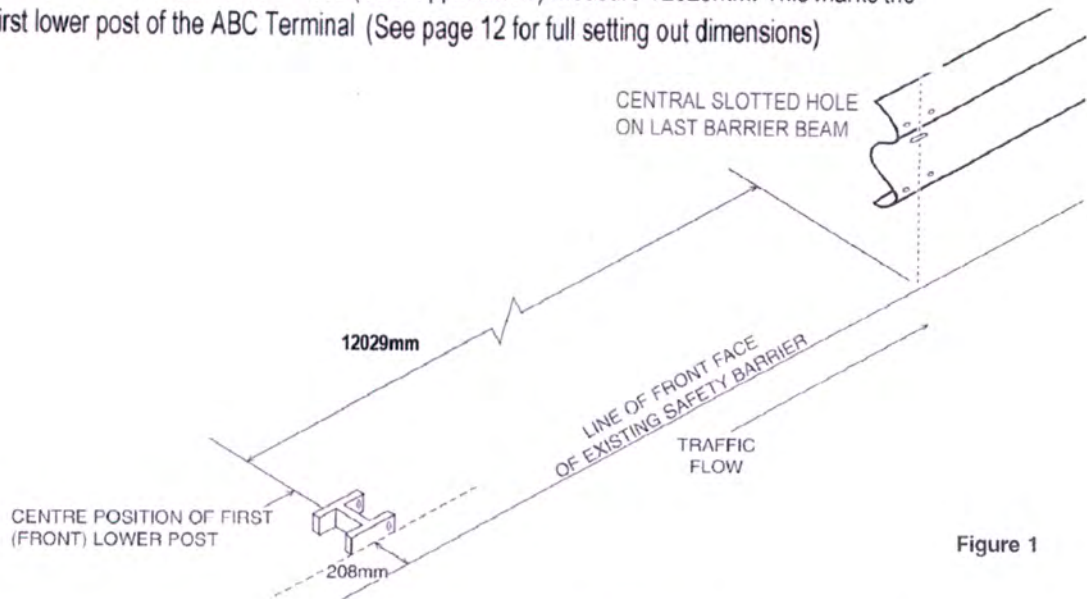


Figure 1

The front face of the ABC Terminal's rail sections will continue along the line of the front face of the installed safety barrier. The first Lower Post is set back 208mm from the line of front face of existing safety barrier (see Figure 1).

Make sure that the Lower Post is positioned with the shear pin holes to the rear.

Mark and drive the front Lower Post, leaving the top 55mm exposed. (See table in Notes)

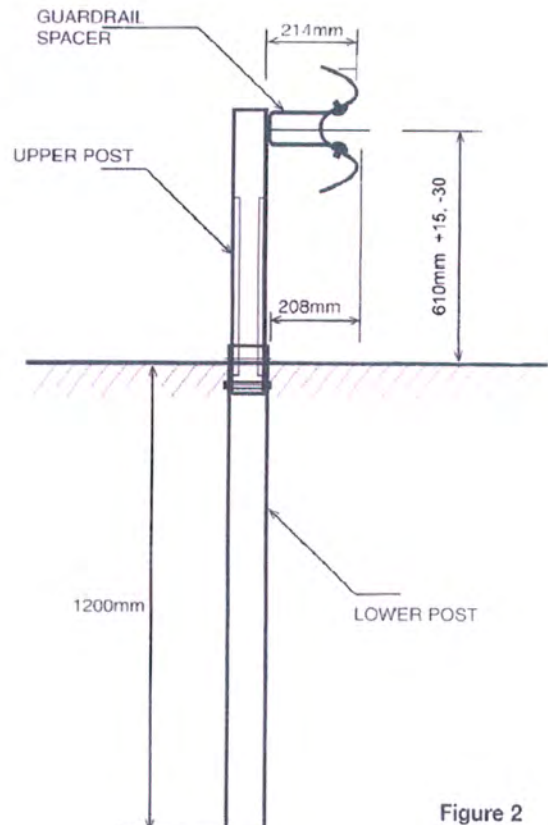
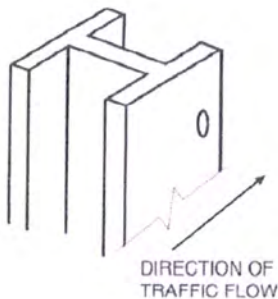


Figure 2

The ABC Terminal

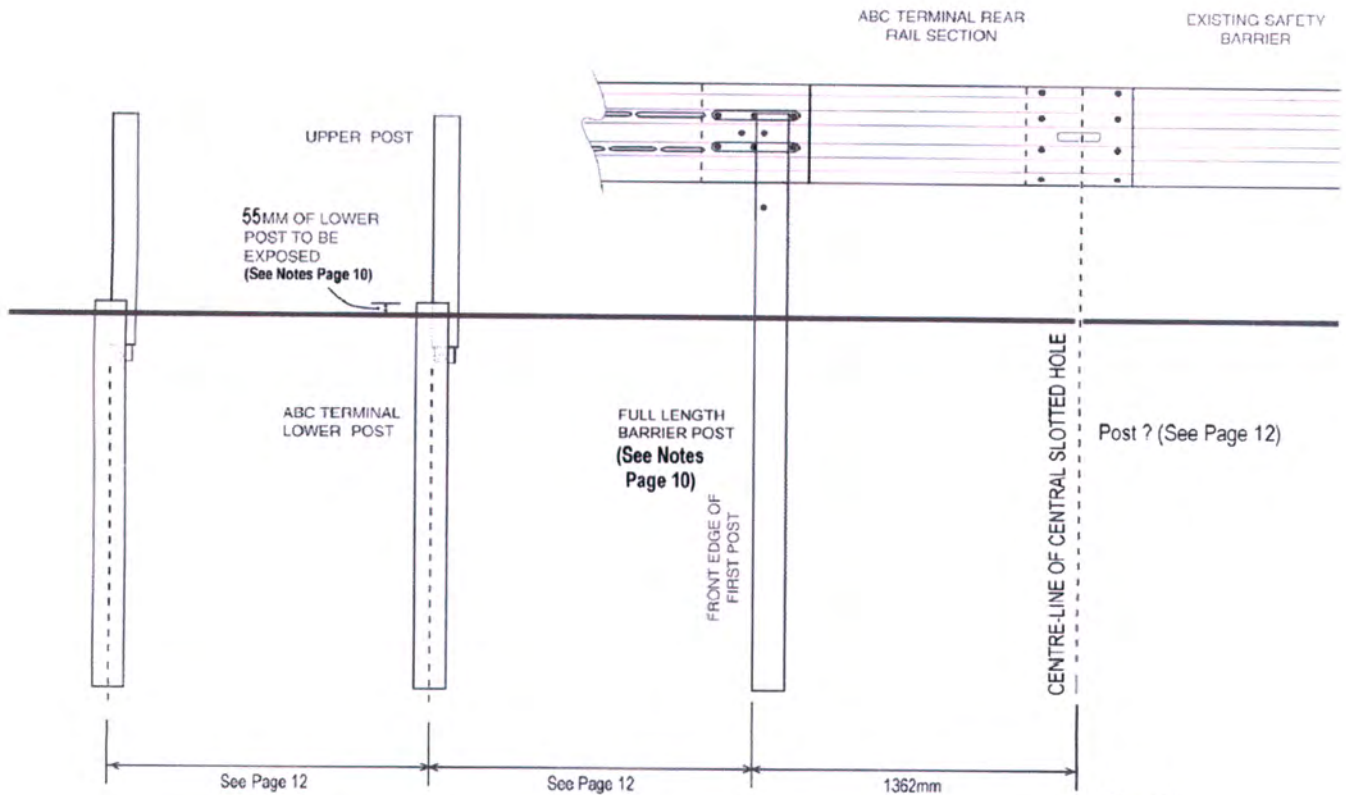


Figure 3

2) Positioning of the Rear Post

From the centre-line of the central slotted hole in the existing installed safety barrier measure 1362 mm. This marks the front edge of the Full Length Barrier Post (see Figure 3). The Full Length Barrier Post is set back 214mm from the front face of the existing safety barrier. (see Figure 4).

Mark and drive the Full Length Barrier Post into the ground.

3) Positioning the Remaining Posts

Stretch a line between the first and last posts. Measure out intervals as indicated on Page 12. These intervals mark the centres of where the remaining Lower Posts should be positioned.

The Lower Posts should be driven into the ground, leaving the top 55mm exposed. As with the first (front) Lower Post, the remaining Lower Posts are set back 208mm from the front face of the safety barrier.

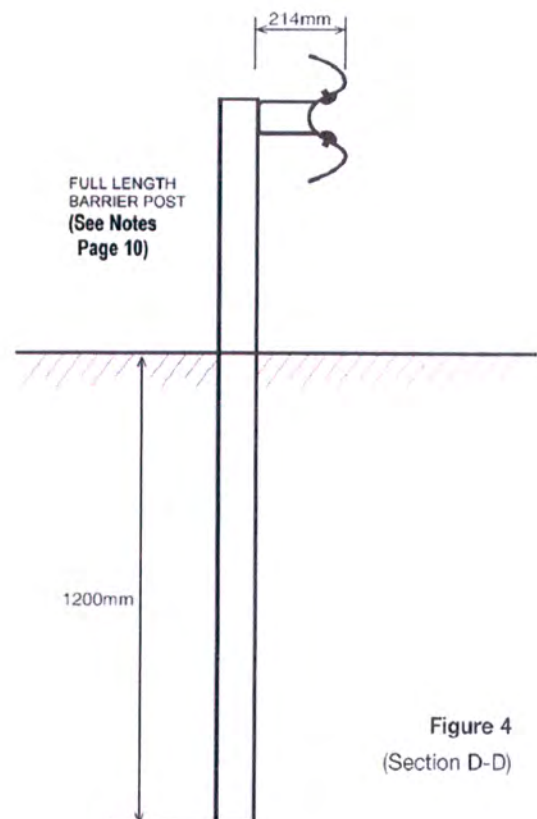


Figure 4
(Section D-D)

Installation

4) Installing the Upper Posts

Insert the Upper Posts into the Lower Posts, then secure each Upper Post to its Lower Post using the stainless steel Shear Pins provided.

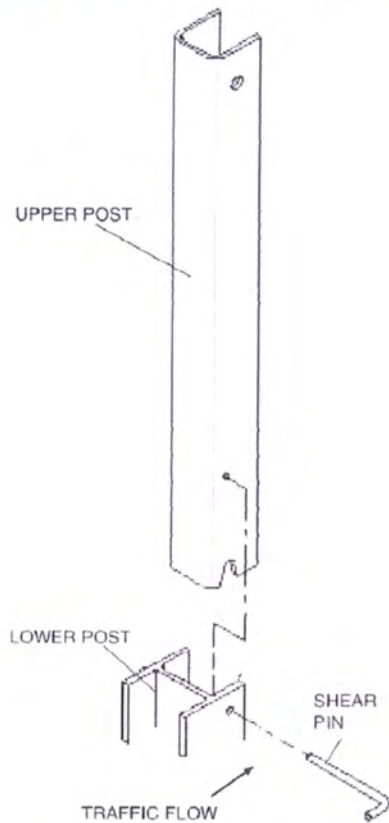


Figure 5

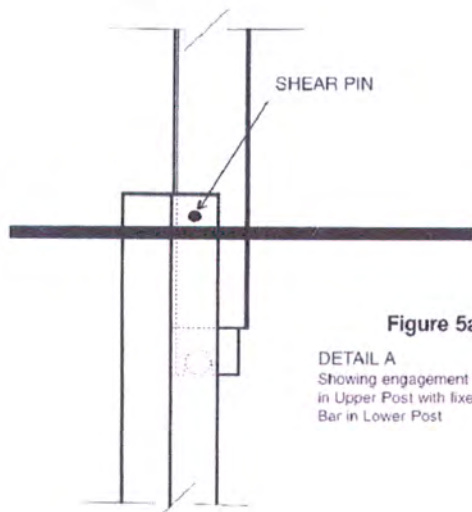


Figure 5a
DETAIL A
Showing engagement of notch in Upper Post with fixed round Bar in Lower Post

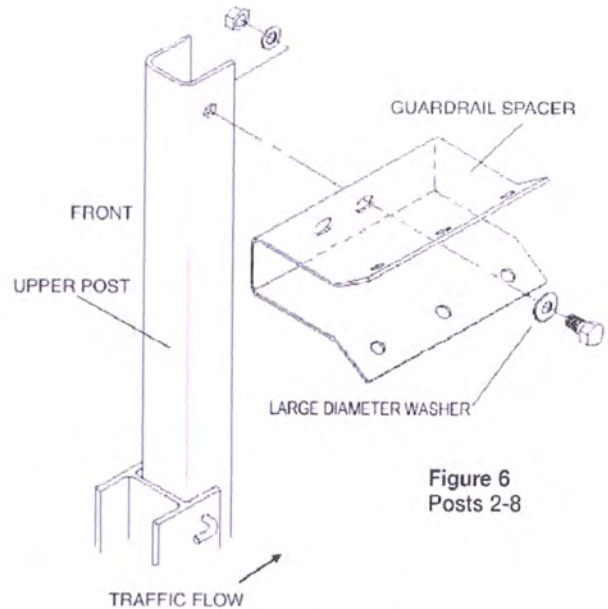


Figure 6
Posts 2-8

5) Installing the Guardrail Spacers

Use one 16mm x 35mm Hex Head Bolt, one Large Diameter flat Washer, one 16mm Flat washer, and one 16mm Hex Nut to attach the Guardrail Spacer to the Upper Post (see Figure 6).

Use one 16mm x 35mm Hex Head Bolt, one Large Diameter flat Washer, one 16mm Flat washer, and one 16mm Hex Nut to attach the shorter Guardrail Spacer to the front (first) Upper Post. This Guardrail Spacer supports the main End Rail and Head Assembly for the ABC Terminal (see Figure 7).

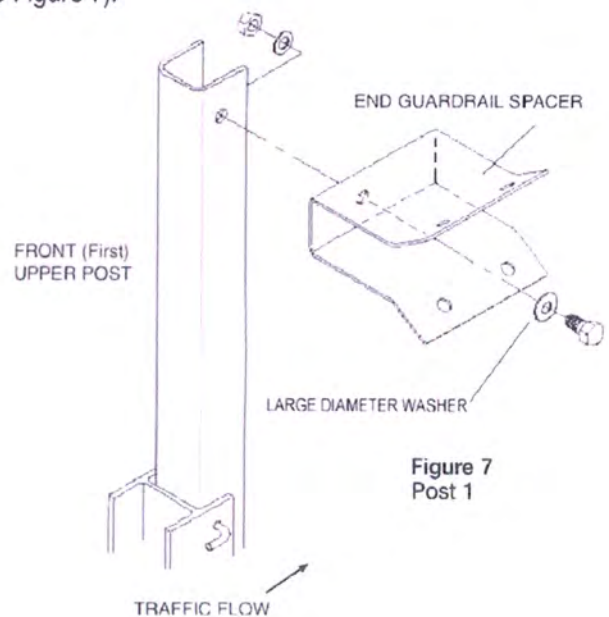


Figure 7
Post 1

The ABC Terminal

6) Installing the Rear Rail and Intermediate Rail Sections

Begin with the Rear Rail Section. Attach the Rear Rail Section over the first existing safety barrier panel. You may have to use the alignment tool to aid in aligning the holes.

Working from the Rear Rail Section, attach the 7 Intermediate Rails to the system as shown (see Figure 9) until you reach the post for the End Rail and Head Assembly.

The Rail Sections are secured to the Guardrail Spacers using 6x Dome Head Tear-drop 16mm x 35mm bolts and 2x Support Plates (see Figure 9).

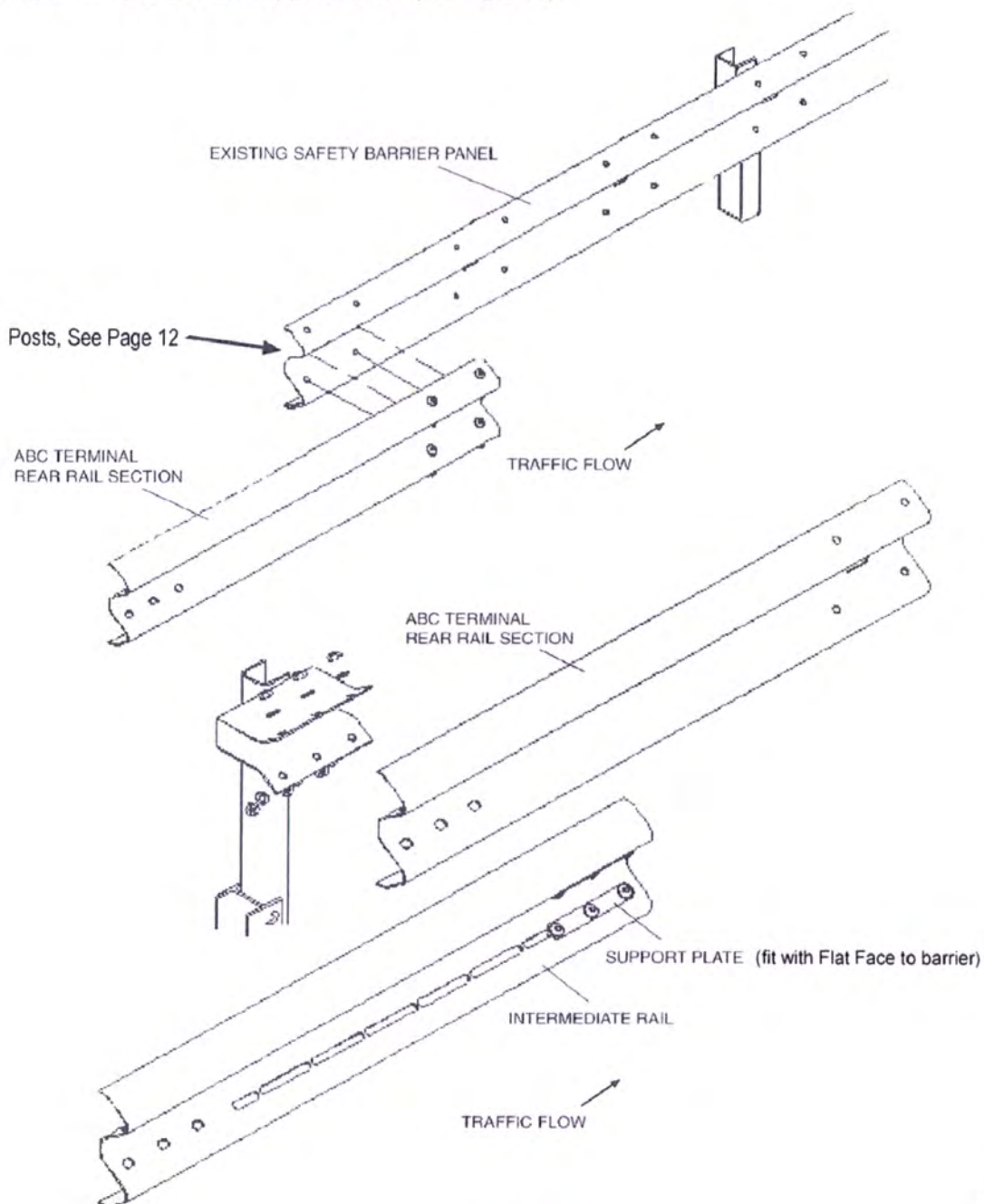


Figure 8

Figure 9

Installation

7) Installing the End Rail and Head Assembly

Attach the Cable Assembly to the Guardrail Spacer, positioned on the second Upper Post, using the U-Bolt and Breaking Plate. Attach the front end of the Cable Assembly to the first Lower Post using the Cable Attachment Plate. (Already linked to the Cable Assembly). The Cable Assembly and Breaking Plate are attached with 16mm Hex Head bolts and nuts.

Using either a forklift or three men, position the End Rail and Head Assembly.

Attach the End Rail and Head Assembly to the Guardrail Spacers using the enclosed hardware, (see figure 10).

Tighten all hardware throughout the entire system.

Tighten the slack out of the cable at the U-bolt.

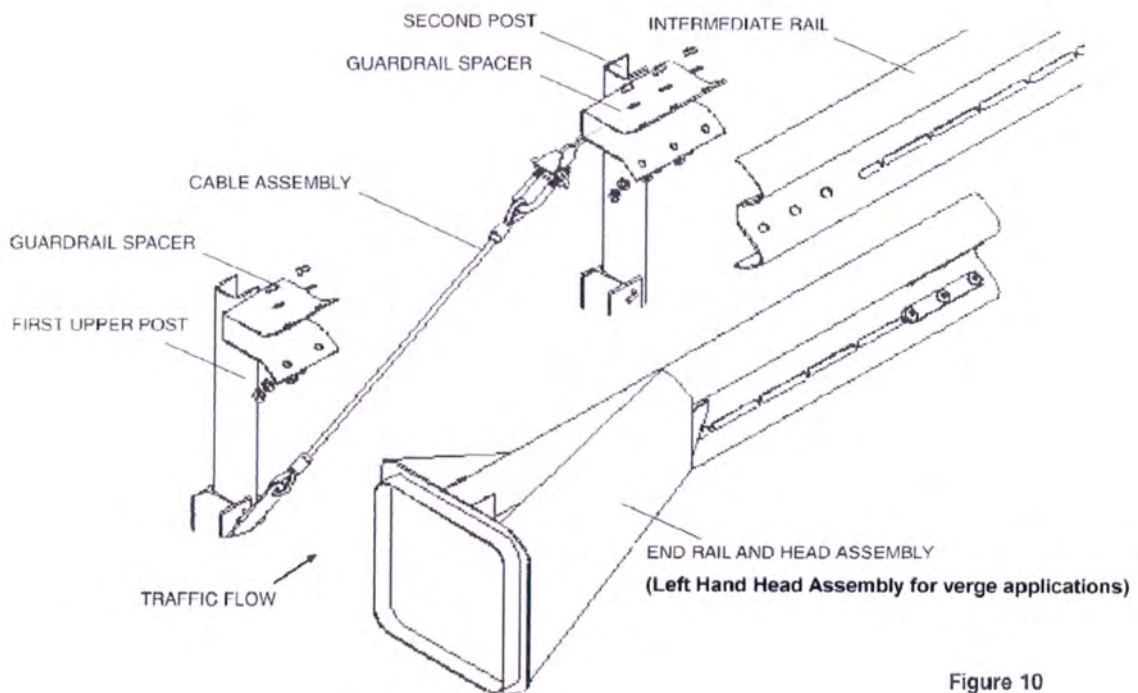


Figure 10

Torque Settings

All of the bolt assemblies should be tightened to a torque of **160Nm**.

The ABC Terminal

Maintenance

Visual Inspection - Weekly

The purpose of the visual inspection is to spot any conditions that would prevent the system from functioning as designed. These conditions may include an unrecorded impact, misalignment, loose fasteners, cable damage corrosion, vandalism, etc.

Check for any build up of silt or debris around the system that could interfere with proper operation.

Physical Inspection - Annually

Limitations and Warnings

The ABC Terminal has been tested and evaluated per the European document ENV 1317-4 (Terminals and Transitions).

The ABC Terminal is designed to safely decelerate and direct light and heavy weight vehicles using the following test criteria:

Tested in Europe - Using CEN Criteria

Test 1	Head-on $\frac{1}{4}$ offset;	900kg vehicle	100km/h
Test 2	Head-on centre;	1500kg vehicle	110km/h
Test 3	15° side $\frac{2}{3}$ L;	1500kg vehicle	110km/h
Test 4	165° side $\frac{1}{2}$ L;	900kg vehicle	100km/h

All test criteria satisfied

The ABC Terminal

Notes

- 1) The ABC Terminal should be installed at a height of 610mm above ground / channel level to centre of safety barrier beam.
At this height the **Top** of the lower post will be 55mm above ground / channel level. If the ABC Terminal height is to be adjusted to suit permitted roadside barrier tolerances, the range of permissible heights that the lower post will be above ground / channel level is as follows:

Height of ABC Terminal - ground/channel level to centre of safety barrier beam	Top of Lower Post above ground / channel level
610mm	55mm
610mm + 15mm	70mm
610mm - 30mm	25mm

- 2) The full length barrier post referred to on page 5 **is not** supplied with the ABC Terminal Kit. The installer must provide and use a barrier post appropriate to the barrier system being used and the prevailing ground conditions. The fastener to attach the Guard Rail Spacer to the post **is** included in the kit and is a M10 x 40mm 8.8 grade hexagonal bolt & nut, one large diameter washer between bolt head and Guard Rail Spacer and one standard washer between post and nut.
- 3) When connecting to "W" profile beams, the ABC Rear Rail section bolts directly to the safety barrier beam. When connecting to OBB, Item No A06 from Drawing No. SF / 11 is required. Should the barrier layout require it, this may be mounted on a post as detailed in 2) above.
- 4) The Support Plate fasteners are Domed Head Tear Drop Bolts. All remaining components are fixed with Hexagonal Headed bolt fastenings.
- 5) The ABC Terminal **must** be installed in a straight line, any change of alignment must be applied to the barrier system.
- 6) When installing an ABC Terminal on the departure end of a barrier run, the ABC Terminal must be set out from the departure end of the barrier run as though you are setting out at the approach end.
This means the following:
The beams of the ABC Terminal on the departure end must lap in the opposite direction to those of the longitudinal barrier.
The lower posts of the ABC Terminal on the departure end will be closer to the head on the departure end than the upper posts. Therefore the open edge of the "C" shaped upper posts will face away from the head on the departure end.
The head on the departure end will be of the opposite orientation to the head on the approach end.
- 7) Sign Plates (if required) must be attached in accordance with TSRGD 2002, Diagram 528.1. such that the diagonal lines are orientated from bottom right to top left to approaching traffic on verge side (Left Hand) applications, and from bottom left to top right on central reserve, (Right Hand) and departure end applications.



Correct for verge
(Left Hand) applications



Correct for central
reserve (Right Hand)
and departure end
applications

Alternative Lower Post installations

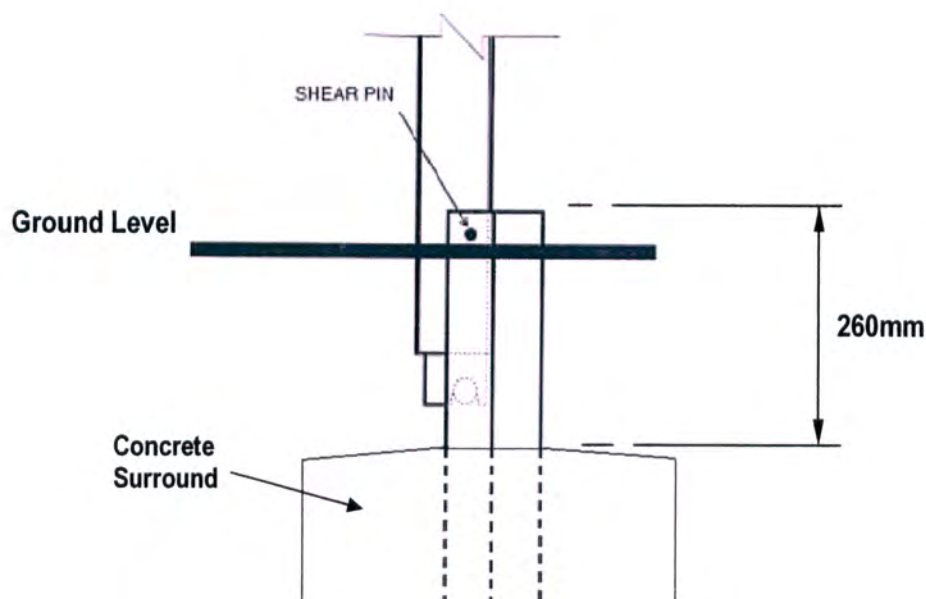
Ground Conditions - When ground conditions dictate, the alternative to a driven Lower Post is a concrete foundation, or a socketed concrete foundation. The dimensions and concrete mix should be the same as those required for the permanent safety barrier being installed. As the ABC system utilises a break away post system, it is important to ensure that the top of concrete / socket does not impede the collapsing post during impact. **The top of any surround / socket must be no higher than 260mm below top of Lower Post.**

Roadside Filter Drains - When the ABC Terminal is to be installed to an area where filter drains are present, "short" 940mm length posts are available which must be used with concrete foundations. (Alternatively the lower post can be trimmed to a minimum length of 940mm (From 1240mm)). Trimmed ends must be treated with "Galvafruid" or similar. When using shorter socketed posts, the hole will be approximately 940mm deep from ground level and embedment will be approximately 680mm.

Sockets - A 680mm socket is available for the 940mm "short" posts for roadside filter drain and general concrete post foundation applications. When using shorter socketed posts, the hole will be approximately 940mm deep from ground level and embedment will be approximately 680mm.

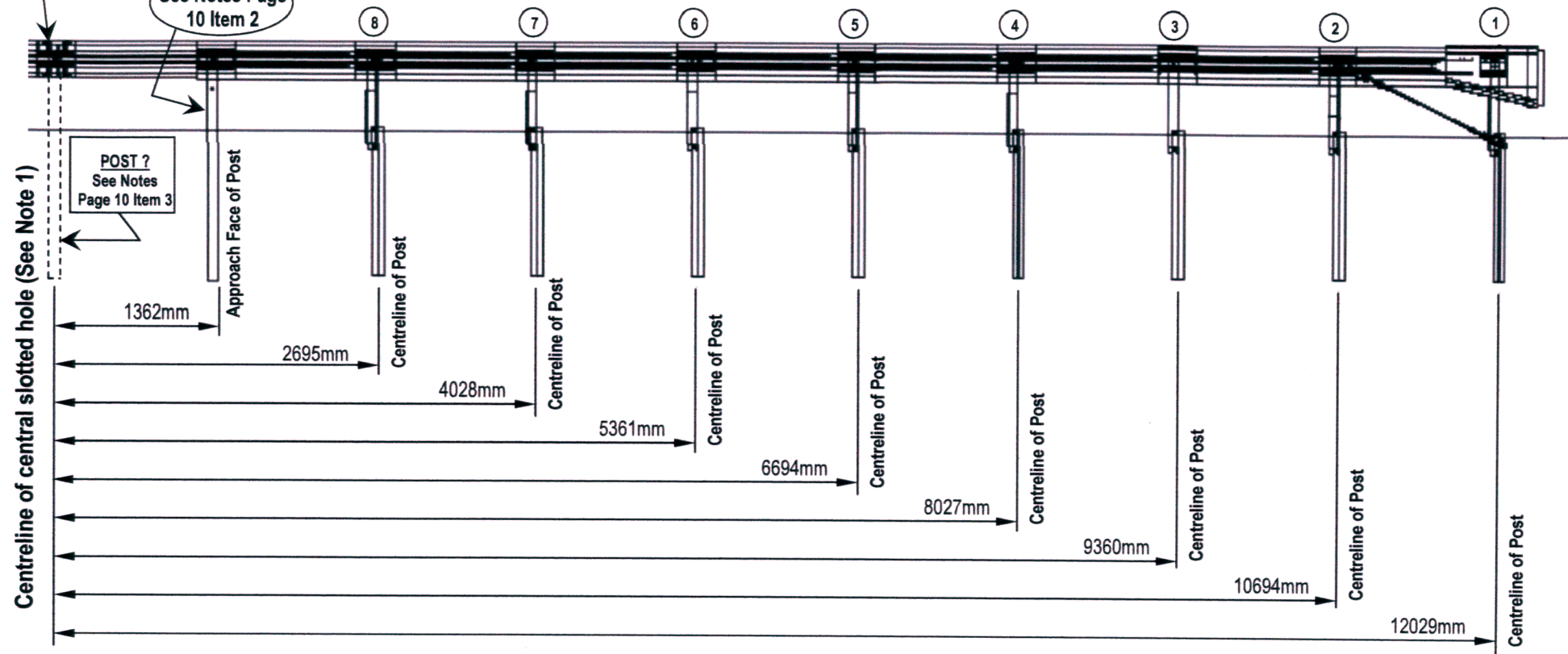
Concrete Foundations - Should be designed to withstand a 9000Nm push test.

Surface Finish - When an ABC Terminal is to be installed with concrete foundations in soft fill areas, the post can be backfilled to the proposed surface level with topsoil or non cohesive / soft cohesive materials. When installed in paved areas it is necessary to backfill around the post, from ground level to the top of the concrete foundation with a granular material such as "pea gravel" which will allow the post to rotate and lift upon impact. This gravel can be retained with a 225mm plastic drain pipe "collar" if required.



Existing Barrier End or SF 11
(See Notes Page 10 Item 3)

See Notes Page
10 Item 2



POST ?
See Notes
Page 10 Item 3

Centreline of central slotted hole (See Note 1)

Approach Face of Post

Centreline of Post

Centreline of Post

Centreline of Post

Centreline of Post

Centreline of Post

Centreline of Post

Centreline of Post

Centreline of Post

Notes

1. When installing an ABC Terminal to "W" profile beams, the dimensions above will apply from the centre of the central slotted hole on the existing barrier end.
When installing to OBB barrier systems the dimensions will apply from the centre of the slotted hole on the SF 11 Connection Piece.
2. Where an SF 11 Connection Piece is used, it may be necessary to install a post to the SF 11 due to post spacing of the existing Barrier. (See Notes Page 10 Item 2 & 3)

Highway Care

Highway Care Limited
The Highlands Detling Hill Detling Maidstone Kent ME14 3HT
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ABC TERMINAL (P4) - INSTALLATION LAYOUT DRAWINGS
SETTING OUT DIMENSIONS

DATE	Feb 2006
ISSUE	B
DRG. NO.	ABC / 100

NEXT ASSEMBLY:

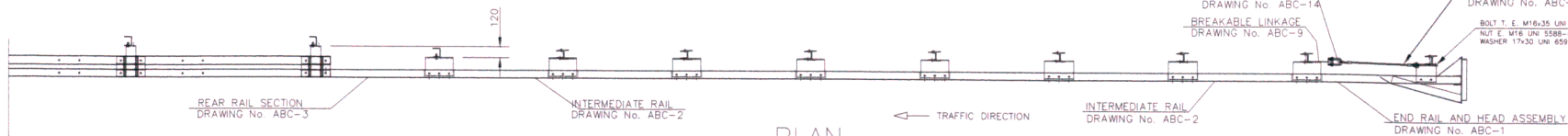
MATERIAL:

TOL ANGULAR:
TOL LINEAR:
UNLESS OTHERWISE NOTED

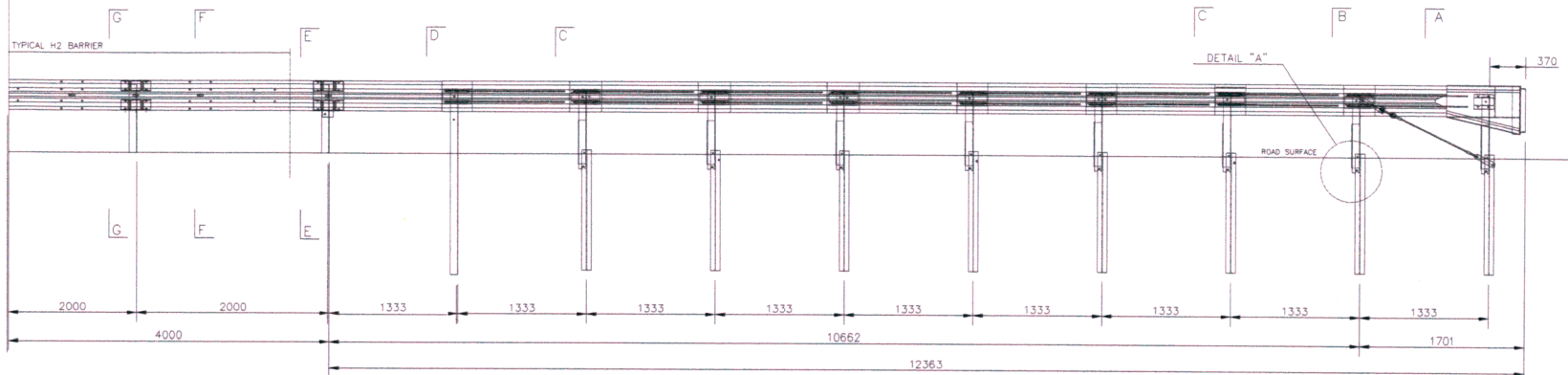
PARTS LIST

ITEM	STOCK NO.	DESCRIPTION	REQ'D
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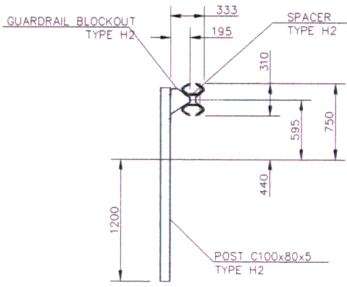
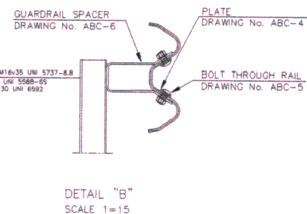
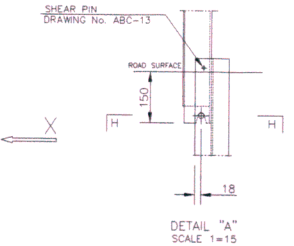
- U-BOLT
NUT E. M16 UNI 5588-65
WASHER 17x30 UNI 6592
DRAWING No. ABC-14
- BREAKABLE LINKAGE
DRAWING No. ABC-9
- CABLE $\phi 12$
DRAWING No. ABC-8
- BOLT T. E. M16x35 UNI 5737-8.8
NUT E. M16 UNI 5588-65
WASHER 17x30 UNI 6592



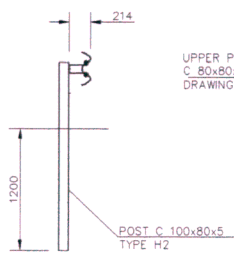
PLAN



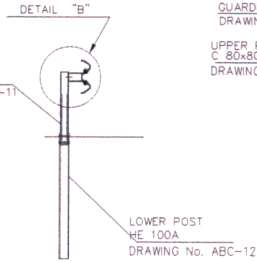
ELEVATION



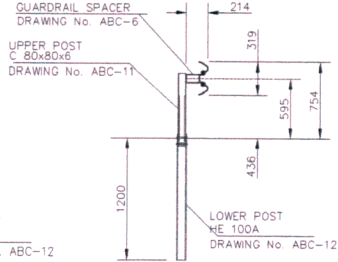
SECTION E-E



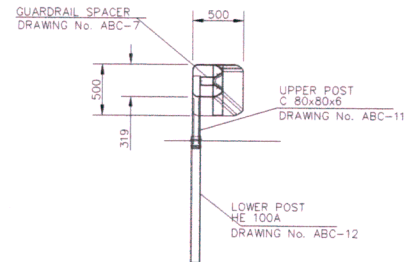
SECTION D-D



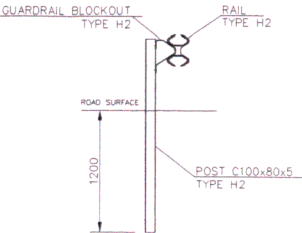
SECTION C-C



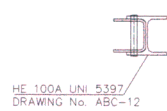
SECTION B-B



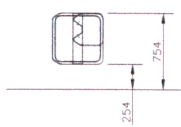
SECTION A-A



SECTION G-G



SECTION H-H



NOTES:
UNLESS OTHERWISE INDICATED, ALL COMPONENTS TO BE HOT DIP GALVANIZED PER LOCAL REQUIREMENTS.

-EUROPE: ZINC WEIGHT 300 GM/SO. M., ON ALL SURFACES PER UNI 5744/66

-U.S.A.: AASHTO M-180, TYPE II, (ZINC WEIGHT -- 3.6 OZ/SO. FT. [1,100 GM/SO. M.] TOTAL BOTH SIDES).

DRAWN:	KUSSAVAGE	DATE:	12/08/98
DESIGNED:		DATE:	
CHECKED:		DATE:	
APPROVED:		DATE:	
O.C.		DATE:	
CAD FILE:	ABC.dwg	SCALE:	1=50

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

ABC TERMINAL
GENERAL DESIGN

SCALE: 1=50 DWG: ABC SHEET: 1 of 1 REV:



ENERGY ABSORPTION
SYSTEMS, INC.

A Quixote Company

For further information contact:

Energy Absorption Systems, Inc
One East Wacker Drive, Chicago, Illinois 60601-2076
Telephone: (312) 467-6750 Fax: (312) 467-1356

European Office:

Tel: +44 1473 221105 Fax: +44 1473 221106
Internet: www.energyabsorption.com
E-mail: abc@energyabsorption.com

UK Distributor:

Highway Care Ltd., Tel: +44 (0) 1622 734 215
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E-mail: info@highwaycare.co.uk

Highway Care

Highway Care Limited

The Highlands • Detling Hill • Maidstone • Kent • ME14 3HT

e.mail - info@highwaycare.co.uk

website - www.Highwaycare.co.uk

Tel: 01622 734215 * Fax: 01622 735106

9th January 2006

To whom it may concern

P4 Terminals & Static Roadside Crash Cushions

Due to recent changes in requirements for permanent roadside barrier installations, the designer or specifier will have to consider whether they will use a P4 Terminal or a Crash Cushion on approach ends of barrier.

The P4 Terminals currently approved and in use in the UK are only suitable for single-sided situations where the reverse of the system cannot be impacted by an errant vehicle. This means that on verge installations they are almost always suitable, but in central reserves they will often not be suitable. They are, however designed to be impacted from traffic travelling in the opposite direction, as this is a requirement under EN1317 Part 4 for P4 Terminals; this means they are suitable for use on departure ends on all classes of roads.

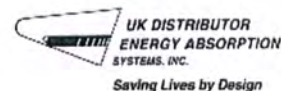
If a double sided or two single barriers into a double sided barrier need to be terminated and if the end treatment can be impacted from both sides, then a crash cushion* is the only safe solution. It is also not possible to place two P4 Terminals side by side as in the event of an errant vehicle impacting both terminals head on, the occupants would be subject to twice the deceleration forces, which could potentially lead to serious injury. Increasing the distance between the P4 Terminals so that it is only possible to hit one system head on will provide an opportunity for an errant vehicle to impact the protected object, or impact the reverse side of the adjacent P4 Terminal. Staggering P4 Terminals will also allow vehicles to impact the reverse side of these systems.

Full technical information and assistance is available for P4 Terminals and Static Roadside Crash Cushions – Please discuss with the presenter of this document, or contact **Highway Care Limited**

*Only Crash Cushions which are bi-directional are suitable for central reserve applications.



Registered Office: Abbey Gate Place, Tovil, Maidstone, Kent ME15 0PP
Registered in England No. 2506334 VAT Reg. No 619 0621 53



ABC Terminal – Lateral Displacement Class Details

TERMINALS

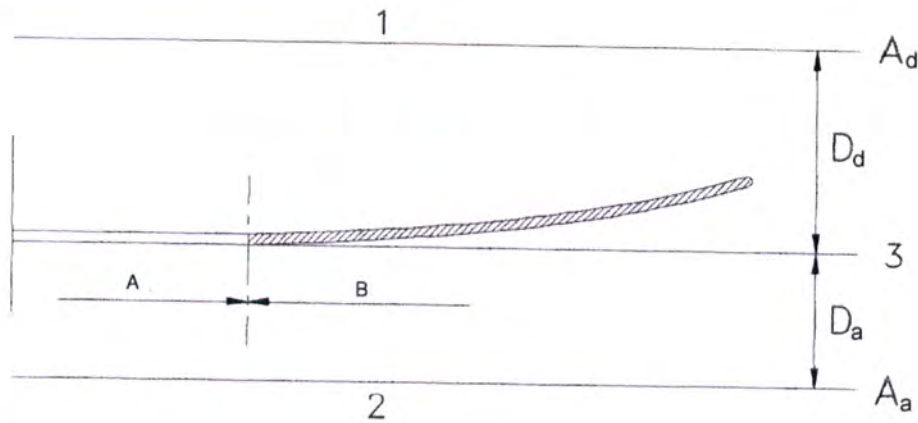
The following Terminals for safety barriers have been successfully tested to meet the requirements of DD EN1317 - 4 and have been approved for use on the Highways Agency Trunk Road Network for the Performance Class and Class Code stated below. The Terminals shall comply with the manufacturers Specification, component descriptions and Installation Standard. Copies of documents and drawings can be obtained from the Promoter.

Terminal Type	Performance Class	Class Code	Name and Address of Promoter	Comments
ABC Terminal	P4	D.1.1	Highway Care Ltd The Highlands Detling Hill Detling Hill Maidstone Kent ME14 3HT Tel: 01622 734215 Fax: 01622 735106 e mail: info@highwaycare.co.uk Web site: www.highwaycare.co.uk	For use in the Verge and Central Reserve for single sided applications only

Table 6 – Permanent lateral displacement zones for terminals

Class code		Displacement (m)	
x	1	D_a	0,5
	2		1,5
	3		3,0
y	1	D_d	1,0
	2		2,0
	3		3,5
	4		>3,5

The distances D_a and D_d are shown by lines A_a and A_d in Figure 4.



Key

- 1 Departure side
- 2 Approach side
- 3 Traffic face of barrier
- A Barrier
- B Terminal

Figure 4 – Terminal permanent displacement zones

ABC Terminal



Highway Care Ltd

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Unit D • Wharton Court
 Leominster • Herefordshire • HR6 0NX
 Tel: +44 (0) 1568 610909 • Fax: +44 (0) 1568 620007
 E-mail: enquiry@highwaycare.co.uk • www.highwaycare.co.uk



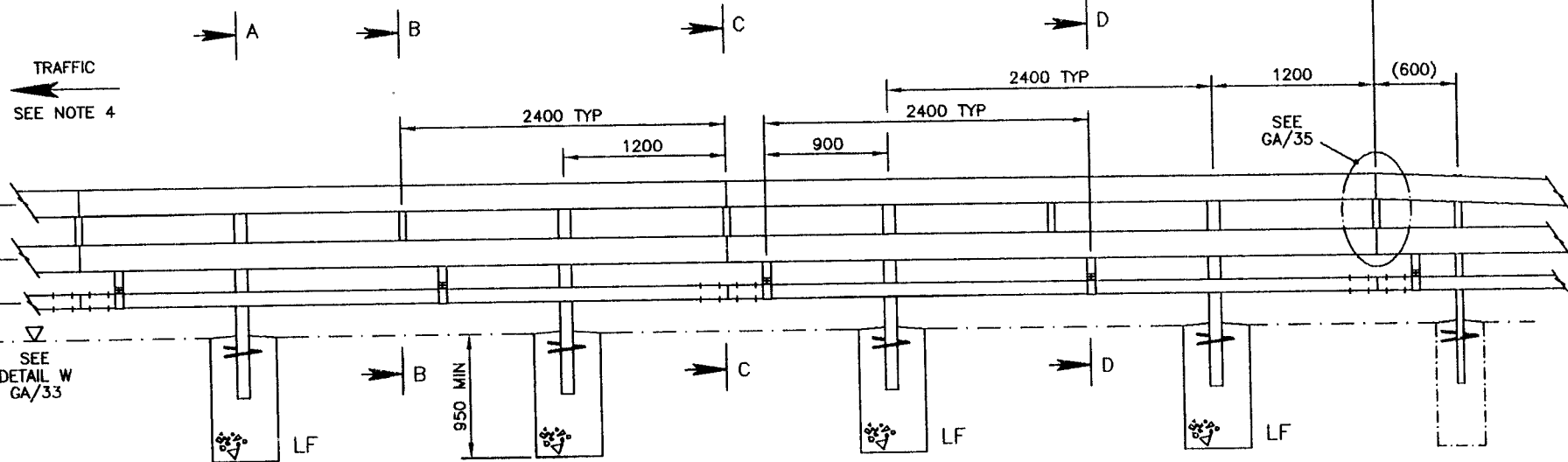
Highway Care



PLAN VIEW OF SAFETY FENCE

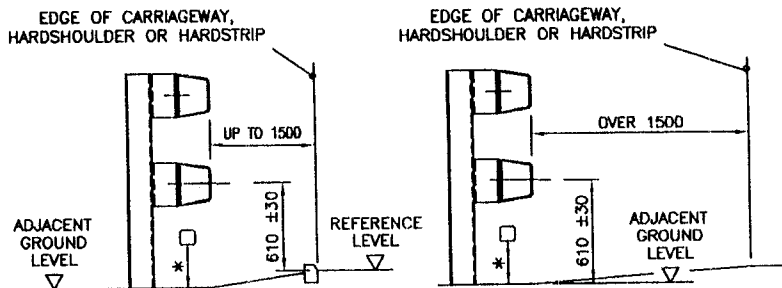
DOUBLE RAIL OPEN BOX BEAM SAFETY FENCE

TRANSITION TO STD
OPEN BOX BEAM
SAFETY FENCE
SEE DRG GA/35



VIEW ON TRAFFIC
FACE OF SAFETY FENCE

POST IN LARGE CONCRETE FOUNDATION
#500 MIN. OR 500 SQ. MIN.
140 MIN. COVER TO POSTS OR SOCKETS
(SEE NOTE 3)

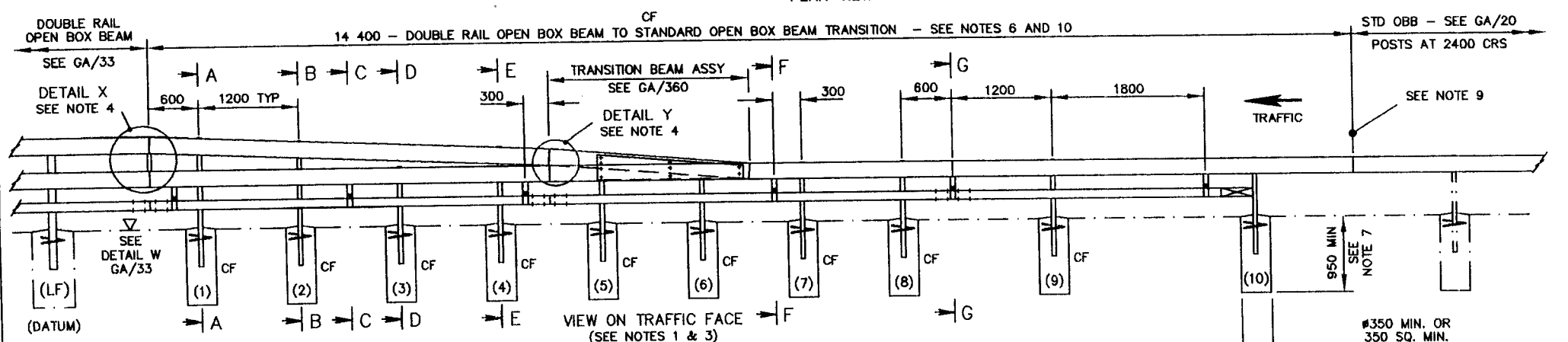
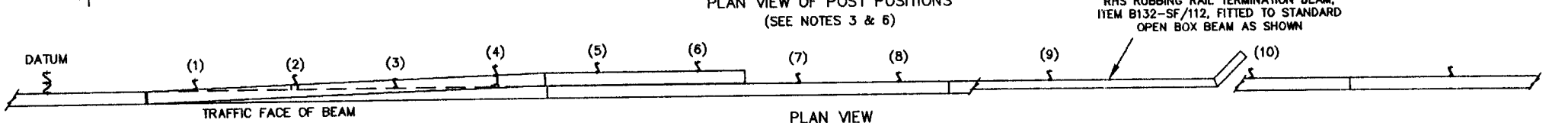
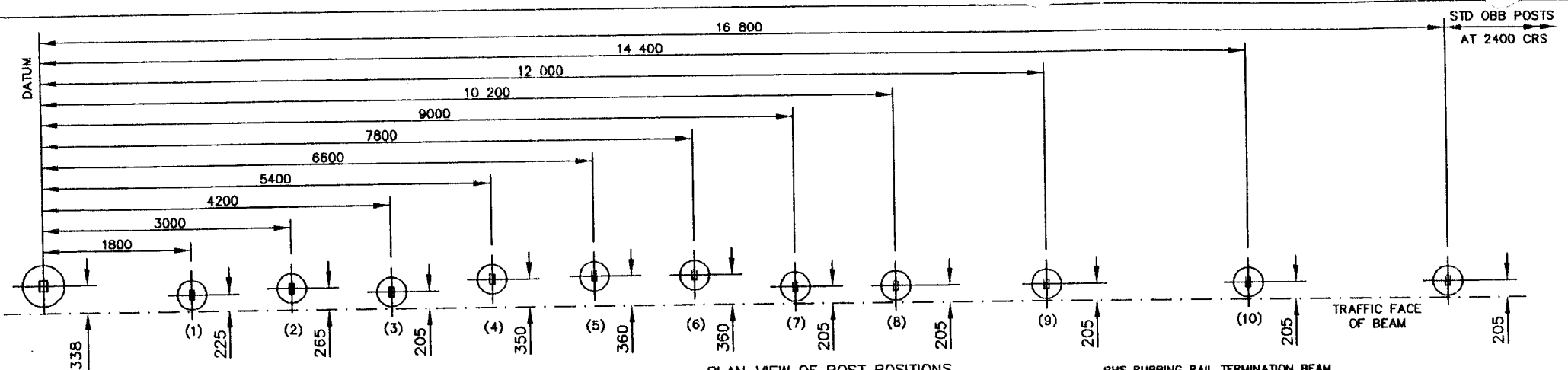


DETAIL W
* SEE NOTES 6 AND 7

- NOTES
1. WHEN SAFETY FENCE IS ERECTED ON CURVES USE ITEMS AS LISTED IN TABULATION.
 2. FOR SECTIONAL VIEWS SEE DRAWING GA/34.
 3. FOR ALTERNATIVE POST AND FOUNDATION OPTIONS SEE DRAWING GA/340.
 4. SAFETY FENCE ASSEMBLY SHOWN IS FOR USE IN CENTRAL RESERVE - VERGE ASSEMBLY IS SIMILAR BUT HAS REVERSED POST ORIENTATION.
 5. CONCRETE TO BE MIX C25 OR ST5.
 6. CONTRACTOR TO LEVEL GROUND BENEATH SAFETY FENCE BEFORE ERECTION IS COMMENCED TO ALLOW ACCESS TO UNDERSIDE OF LOWER RAIL.
 7. WHERE A KERB IS REQUIRED PREFERRED HEIGHT IS 75mm. MAXIMUM KERB HEIGHT IS 100mm.
 8. FOR EXPANSION JOINT POSITIONS SEE GA/341.

RADIUS OF CURVE (m)	BEAM	FISH PLATE	RUBBING RAIL	CONNECTOR PLATE
>50 ≤110	B04 - SF/09	B13 - SF/22	B134 - SF/112	B135A - SF/113
>110 ≤335	B03 - SF/08	B13 - SF/22	B175 - SF/112	B135A - SF/113
>335	B03 - SF/08	B12 - SF/22	B175 - SF/112	RHS 47/1/8

HIGHWAY CONSTRUCTION DETAILS	SAFETY BARRIER GENERAL ARRANGEMENT DRAWINGS			DOUBLE RAIL SINGLE SIDED OPEN BOX BEAM SAFETY FENCE - GENERAL ARRANGEMENT (SHEET 1 OF 4)	Drawing No.
		C3	31.7.03		GA/33
		Issue	Date		



- NOTES**
1. DRAWING SHOWS APPROACH END - CENTRAL RESERVE. DEPARTURE END IS SIMILAR. ERECTION FOR VERGE LOCATIONS IDENTICAL BUT HAS REVERSED POST ORIENTATION.
 2. RUBBING RAIL SUPPORT STRAP ASSEMBLIES TO BE FITTED AT APPROX POSNS SHOWN.
 3. FOR TRANSITION ASSEMBLY USING SURFACE MOUNTED POSTS SEE DRAWING GA/370.
 4. FOR SECTIONAL VIEWS AND DETAILS X AND Y SEE DRAWING GA/36.
 5. FOR TRANSITION BEAM ASSEMBLY SEE DRAWING GA/360.
 6. DRIVEN POSTS ARE NOT TO BE USED OVER LENGTH OF TRANSITION.

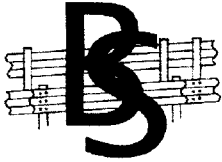
7. DEPTH OF FOUNDATIONS TO BE 950 mm MINIMUM MEASURED FROM FROM ADJACENT GROUND LEVEL AS SHOWN AT DETAIL W - GA/33.
8. CONCRETE TO BE MIX C25 OR ST5.
9. OPEN BOX BEAM TERMINATION AS SHOWN ON DRAWING GA/21 MAY COMMENCE AT THIS POINT IF REQUIRED.
10. EXPANSION JOINTS ARE NOT PERMITTED WITHIN THE LENGTH OF THE TRANSITION - SEE GA/341.

CF
POST IN STANDARD CONCRETE FOOTING
SEE NOTE 3

950 MIN SEE NOTE 7

Ø350 MIN. OR 350 SQ. MIN. 75 MIN COVER TO POST OR SOCKET SEE NOTES 3, 6, 7 & 8

HIGHWAY CONSTRUCTION DETAILS	SAFETY FENCE GENERAL ARRANGEMENT DRAWINGS			DOUBLE RAIL OPEN BOX BEAM SAFETY FENCE TRANSITION TO OPEN BOX BEAM SAFETY FENCE (SHEET 1 OF 3)	Drawing No.
		C2	30.6.01		GA/35
		Issue	Date		



FINAL INSPECTION CERTIFICATE

CONTRACT NO.: Sw938

CONTRACT NAME: A379 Sandy Gate, Exeter Rugby Club

DATE: 24th August 2006

DETAILS OF WORKS:- To Construct Safety Barrier in Accordance with Highways
Construction Manual & Design

DROBB To Structure with GA35 Transitions, P4 Approach Terminal, Tie in
Departure to Existing TCB

The above contract works are substantially completed to my satisfaction:-

SIGNED: _____
(for BARRIER SERVICES LIMITED)

NAME: _____

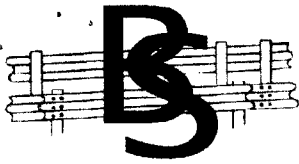
POSITION HELD: Contracts Manager

SIGNED: _____
(for Client)

NAME: _____

POSITION HELD: _____

NOTE: Notwithstanding the above BSL agree to carry out any outstanding remedials that the
Engineer deems necessary during the period of maintenance as detailed in the Contract.



QMS: INSPECTION REPORT

No:

(Begin each new contract with 1)

IN - PROGRESS *FINAL *

* Please tick as appropriate

Contract Name: A379 Exeter Rugby Club
 Client: Dean & Dyball
 Area / Location Inspected: A379 Footbridge Protection
 Date: 24th August 2006

No	Inspection Element	Requirement	Comment (Please use reverse of this form for additional space if necessary).	Conforms Yes or No	NCR No. (if any)
1	Method Statement and Risk assessment briefing	Required		Yes	
2	Permit to Dig issued	Required		Yes	
3	Setting out	Line and level from contract drawings		Yes	
4	Safety Fence Components	To BS EN 10 025 Grade S275	Hill and Smith	Yes	
5	Minimum Clearance and Post Centres	GA33 & GA35		Yes	
6	Height of Beam Centres	610mm from c/w		Yes	
7	Fence Post Footings	Concrete	Machine Excavated	Yes	
8	Footing Compaction	Hand Tamped Concrete Poker Unit	Poker Unit	Yes	
9	Push Over Tests Pull Tests	Tested to HCD Volume 3 Section 2 Drg No PTE/09 Tested to HCD Volume 1 Clause 404	N/A		
10	Tensioning	Tensioned to BS7669: Part 3 Section 2.1	N/A		

Number of NCR's raised on this report

FINAL INSPECTION ONLYTotal number of NCR's on this job

Have all NCR's been satisfactorily addressed and corrective actions successfully applied?

If no, please give details: YES

Inspected by:  (Sign) (Print)

Stirling Lloyd Contracts Ltd



sentinel™ emr expansion joint system

HIGHWAYS AGENCY TYPE 6

Nosing Mortar

Please refer to the separate datasheet for Sentinel™ Nosing Mortar PE (MA476) or for Sentinel™ Nosing Mortar FC (MA406).

APPLICATION

Primer

Prepared substrates should be primed with the appropriate primer depending on which Sentinel™ Nosing Mortar is to be used. Refer to relevant datasheet.

Nosing Mortar

Sentinel™ Nosing Mortar should be mixed and applied in accordance with the relevant Sentinel™ Nosing Mortar datasheet.

Steel Rail Corrosion Protection

The steel rails are provided with a corrosion protection finish. If this is damaged during installation and in areas around welds, the coating should be made good using a suitable corrosion resistant coating. Please contact our Customer Services department for advice.

Seals

Seals should be ordered in one continuous length suitable for the joint length. Butt joints in the seal must be avoided. Seals can be ordered by the linear metre. Ensure that the length ordered is at least 1 metre longer than the proposed joint length to allow for variations on site.

COVERAGE

Sentinel™ Nosing Mortar PE - Refer to datasheet MA476
Sentinel™ Nosing Mortar FC - Refer to datasheet MA406

PACKAGING & STORAGE

Sentinel™ EMR Seals	Supplied cut to length
Sentinel™ EMR Rail	3.75m standard length (7.5m length available by special order)

All components of the Sentinel™ EMR System should be stored off the ground in cool, dry, protected conditions, out of direct sunlight and in accordance with the relevant site Health & Safety regulations.

Sentinel™ Nosing Mortar PE should be stored between 5°C and exceed 25°C. Stored under these conditions the product has a shelf life of twelve months.

Sentinel™ Nosing Mortar FC should be stored below 25°C. Do not store near naked flames or foodstuffs. Stored under these conditions the product has a shelf life of six months.

HEALTH & SAFETY

The Material Safety Data Sheet for the relevant components must be read, understood and available on site before commencing work.

It is the Company's policy to take all reasonable steps to prevent injury to all property and personnel from foreseeable hazards. This extends to the public in so far as they come into contact with the Company or its products.

GENERAL INFORMATION

The Sentinel™ EMR Expansion Joint System is part of a wide range of specialist expansion joints, waterproofing, surfacing and repair materials manufactured and supplied by Stirling Lloyd. If you require any further information on this or any other of our products, please contact our Customer Services Department or www.stirlinglloyd.com



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The information presented herein is accurate to the best of our knowledge. We pursue a progressive research and development policy and reserve the right to alter any of the details herein without notice. The information given must not be taken in any way to form a specification. All technical properties quoted are from laboratory prepared samples. We will not accept liability whatsoever arising out of the use of the information contained herein.

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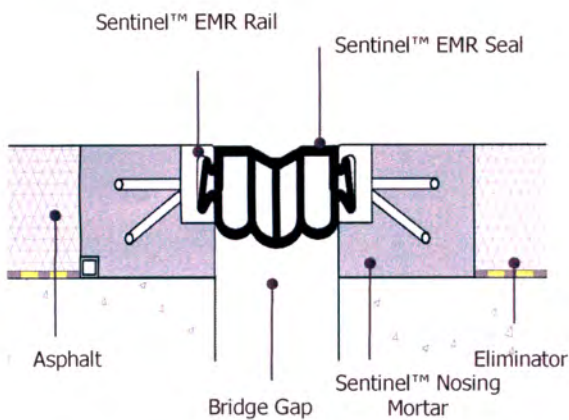
sentinel™ emr expansion joint system

HIGHWAYS AGENCY TYPE 6

DESCRIPTION

The Sentinel™ EMR Expansion Joint system is a Type 6 surface, mounted mechanical system that incorporates a central elastomeric seal inserted into two steel carrier rails. The carrier rails have special sinusoidal shaped reinforcements welded to the rear face, which locks the carrier rails into the Sentinel™ Nosing Mortar.

The expansion joint requires no mechanical fixing to the substrate.



The joint system is supplied in 5 sizes: Type 35, Type 50, Type 80, Type 100 and Type 150 (See Table 1 for movement capabilities).

USES

The Sentinel™ EMR Expansion Joint system has been developed to withstand heavy volume trafficking on bridges and viaducts.

FEATURES

- Highways Agency SA1 registered
- Rapid installation
- No mechanical fixings
- Can be installed onto both concrete and steel substrates
- Can be installed one lane at a time
- Suitable for expansion joint replacement or new works
- Allows horizontal movement of up to 150mm
- Load bearing multi-chambered seals
- Installed to the as built geometry of the structure
- Accepts horizontal and vertical movement.
- Waterproof
- Can be supplied with an in-joint drainage system and secondary membrane
- Installed only by authorised and trained contractors

TECHNICAL DATA

Table 1 - Movement Range

EMR35	EMR50	EMR80	EMR100	EMR150
Horizontal Movement				
35mm	50mm	80mm	100mm	150mm
Vertical Movement				
+/- 12mm	+/- 15mm	+/- 15mm	+/- 15mm	+/- 20mm
Joint gap at total Compression				
25mm	30mm	30mm	40mm	50mm
Joint gap at mid range				
45mm	55mm	70mm	90mm	125mm
Joint gap at total expansion				
60mm	80mm	110mm	140mm	200mm

Optimum gap dimensions are that selected at average design effective bridge deck temperatures and do not take into consideration movements other than thermal movement.

Joint gap dimensions are measured perpendicular to the inner face of the expansion gap. It should be noted that with joints that are set at a skew, the movement is not perpendicular and therefore a smaller joint seal may be used to accommodate thermal movement.

Table 2 - Standard Nosing Dimensions

EMR35	EMR50	EMR80	EMR100	EMR150
Minimum nosing width ¹				
100mm	120mm	140mm	160mm	200mm
Minimum nosing depth ²				
60mm	60mm	70mm	70mm	70mm

Central Elastomeric Seal

PROPERTY	VALUE
Working Temperature	-40 to +115°C
Specific gravity g/cm ³	1.16

¹ Nosing widths refer to each side of the expansion gap.

² For nosing depths greater than the above standards the nosing width should be calculated based upon a minimum 1:1.25mm (depth to width) ratio. For example depth of asphalt surfacing 100mm = minimum width of nosing 125mm. The exception to this is where vehicular traffic will not pass over the joint in such areas as central reserves and footways. In these locations the nosing material will not be subject to traffic loading.

sentinel™ nj expansion joint system

UK HIGHWAYS AGENCY TYPE 4

COVERAGE

PAR1 Primer	0.25kg/m ²
CW1 Adhesive 1	1.1kg/m ² /mm
Sentinel™ Nosing Mortar FC	2.26kg/litre (49.5kg kit=21.9ltrs)

Primer coverage is approximate and will vary depending on surface porosity and temperature.

PACKAGING & STORAGE

PAR1 Primer	5kg kit
Sentinel™ Nosing Mortar FC	49.5kg kit
CW1 Adhesive	5kg pack
Sentinel™ NJ Seals	Supplied cut to length
(Types 10, 12, 20 & 40)	

All components of the Sentinel™ NJ System should be stored off the ground in cool, dry, protected conditions, out of direct sunlight and in accordance with the relevant site Health & Safety regulations. Storage temperature must not exceed 25°C for the CW1 Adhesive or Nosing Mortar FC. These components should not be stored near naked flames or foodstuffs.

Stored under these conditions CW1 Adhesive and Sentinel™ Nosing Mortar FC have a shelf life of six months.

HEALTH & SAFETY

The Material Safety Data Sheet for the relevant components must be read, understood and available on site before commencing work.

It is the Company's policy to take all reasonable steps to prevent injury to all property and personnel from foreseeable hazards. This extends to the public in so far as they come into contact with the Company or its products.

GENERAL INFORMATION

The Sentinel™ NJ Expansion Joint System is part of a wide range of specialist expansion joints, waterproofing, surfacing and repair materials manufactured and supplied by Stirling Lloyd. If you require any further information on this or any other of our products, please contact our Customer Services Department or visit www.stirlinglloyd.com



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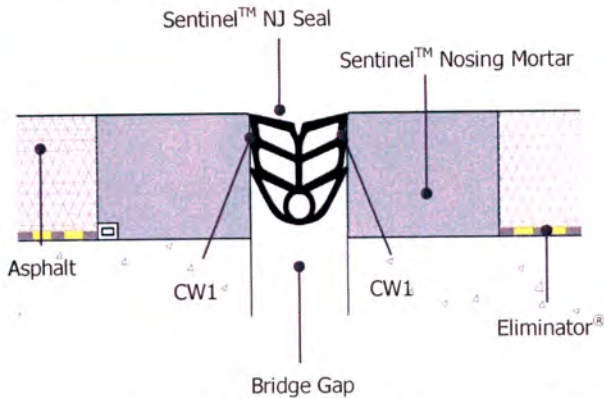
www.stirlinglloyd.com

sentinel™ nj expansion joint system

UK HIGHWAYS AGENCY TYPE 4

DESCRIPTION

The Sentinel™ NJ Nosing Joint system is a Type 4 surface mounted expansion joint, comprising a central preformed compression seal bonded between nosings of high performance, fast curing resin mortar.



The expansion joint is supplied with 4 seal sizes; type 10, 12, 20 and 40.

USES

The Sentinel™ NJ expansion joint has been developed as a small movement expansion joint system for highway bridges, car parks, footbridges and building applications.

FEATURES

- UK Highways Agency SA1 registered
- Rapid installation
- No mechanical fixings
- Can be installed one lane at a time
- Resists deformation from heavy traffic loading
- Installed to the 'as built' geometry of the structure
- Accepts horizontal and vertical movement
- Waterproof
- Installed only by authorised and trained contractors

TECHNICAL DATA

Table 1 - Movement Range

Type	Horizontal Movement	Minimum Gap Depth	Optimum Gap Width	Seal Width	
				Fully closed	Fully open
10	10 mm	40 mm	20 mm	15 mm	25 mm
12	12 mm	45 mm	25 mm	19 mm	31 mm
20	20 mm	70 mm	35 mm	25 mm	45 mm
40	40 mm	90 mm	50 mm	31 mm	71 mm

Note: Optimum gap dimensions are those selected at average 'design-effective' bridge deck temperatures. They only relate to thermal movements.

Joint gap dimensions are measured perpendicular to the inner face of the expansion gap. It should be noted that with joints that are set at a skew, the movement is not perpendicular and therefore a smaller joint seal may be used to accommodate thermal movement.

Table 2 - Standard Nosing Dimensions

Type	10	12	20	40
Minimum nosing width ¹	100mm	100mm	100mm	100mm
Minimum nosing depth ²	40mm	40mm	60mm ³	60mm ³

CW1 Adhesive Dark Grey

PROPERTY	VALUE
Application temperature range ⁴	0 - 30°C Tropical Grade 25 - 50°C
Cure time	15-40 minutes

Elastomeric Mortar

Please refer to the separate data sheet for Sentinel™ Nosing Mortar FC, MA406.

APPLICATION

Primer

Prepared substrates must be primed with PAR1 Primer in accordance with data sheet MA038.

Elastomeric Mortar

Sentinel™ Nosing Mortar should be mixed and applied in accordance with the Sentinel™ Nosing Mortar data sheet. Note: 2.26kg of mortar = 1 litre by volume.

Seals

Seals should be ordered in one continuous length suitable for the joint length. Butt joints in the seal must be avoided. Seals can be ordered by the linear metre. We recommend that the ordered length is at 1m longer than that proposed to allow for variations on site.

¹ Nosing widths refers to each side of the expansion joint.

² Where the nosing depths is greater than the above standard, the nosing width should be calculated based upon a minimum 1:1.25 depth to width ratio e.g. where the depth of asphalt surfacing is 100mm, width of nosing = 125mm minimum. The exception to this is where vehicular traffic will not pass over the joint and therefore the nosing material will not be subject to traffic loading.

³ The minimum depth of the gap required here is greater than the minimum nosing depth - see Table 1.

⁴ For temperatures outside this application range please contact our Customer Services Department.

bridgemaster®

COMBINED WATERPROOFING & SURFACING

DESCRIPTION

Bridgemaster® is a fast curing, Methyl Methacrylate (MMA) resin based screed combined with an aggregate overscatter and sealer to provide a waterproof, skid resistant wearing course all in one single layer.

Bridgemaster® is lightweight, flexible and durable and is superior to traditional systems.

USES

Bridgemaster® can be used to surface a wide diversity of structures subject to differing traffic conditions ranging from light duty pedestrian areas to those subjected to heavy vehicular traffic. It is suitable for application to concrete, steel and aluminium substrates.

Two standard grades are available:

- A 4mm screed plus aggregate for pedestrian applications.
- A 6mm screed plus aggregate for vehicular applications.

Specific areas of use include:

- Road Bridges
- Bascule bridges
- Swing bridges
- Roll-on/off ramps
- Marine structures
- Loading bays
- Footbridges
- Walkways
- Steps
- Stadium Spectator areas
- Subways

FEATURES

- Rapid cure even at low temperatures
- Economical and easily maintained
- Lightweight system
- Aids composite action
- High bond strength to substrate
- High mechanical strength
- Can be tailored to individual project requirements
- Trafficable within one hour
- Applied only by authorised and trained contractors

TECHNICAL DATA

PROPERTY	VALUE
Flexural Strength @ 23°C (BS6319 Part 3 1983)	6.9MPa
Flexural Modulus @ 23°C (BS6319 Part 3 1983)	170MPa
Fatigue Resistance @ -30°C (2 million cycles as a composite on steel)	No failure
Impact Resistance @ 20°C and @ -15°C	No failure No cracking No detachment

Application Temperature Range ⁽¹⁾ 0 to 35°C

Typical Working Life ⁽²⁾

Binder	
30°C	12 minutes
15°C	18 minutes
0°C	25 minutes

Sealer	
30°C	10 minutes
15°C	15 minutes
0°C	35 minutes

Typical Cure Time

Binder	
30°C	25 minutes
15°C	40 minutes
0°C	60 minutes

Typical Trafficking Time

30°C	1 hour
15°C	2 hours
0°C	3 hours

Fire Resistance (BS476:Pt 7: 1987) (BS476:Pt 6:1989 Fire Propagation Index)	Class 1 I = 5.6
---	--------------------

Complies with the requirements for a Class 0 surface as defined in paragraph A8(b) of Approved document B, 'Fire', to the Building Regulations 1985

London Underground Smoke Emission Test Pass

Wheel Tracking
(Transport Research Laboratory) No significant rutting observed

Tensile Adhesion Strength ⁽³⁾

Steel	> 2MPa
Concrete – Road Bridges	> 2MPa
Concrete – Foot Bridges	> 1.5MPa

Weight:

4mm system (PD)	approx 12.8 kg/m ²
6mm system (HD)	approx 20.3 kg/m ²

SURFACE PREPARATION

It should be stressed that the success of any surfacing system is dependent on the thoroughness of the surface preparation.

All substrates must be clean, dry and structurally sound. They must be free from laitance, oils and other surface contaminants.

¹ For temperatures outside this application range please contact our Customer Services Department.

² Assumes the correct grade is being used. Bridgemaster is supplied in winter, summer and tropical grades to allow an adequate working life across a wide range of temperatures. The winter grade is automatically supplied in the UK between October and March. The tropical grade is for tropical climates. Please contact our Customer Services Department for further information prior to ordering.

³ To enable Bridgemaster to perform correctly the tensile adhesion must exceed the figures stated. If tests show that failure occurs in the substrate at a lesser value the substrate is unsuitable for application.

bridgemaster®

COMBINED WATERPROOFING & SURFACING

Concrete

New concrete decks should be a minimum of fourteen days old. If additives, cement replacement or curing agents have been used please contact our Customer Services Department.

All concrete decks must be prepared by suitable mechanical means ⁽⁴⁾ such as vacuum blasting to provide a sound surface.

Repairs to damaged concrete can be made using Metaset® Rapid Repair Mortar. If other repair materials are to be used then the compatibility must be checked with our Customer Services Department first.

Steel

All surfaces must be free from rust, dirt, scale and other contaminants. The surface finish shall comply with Swedish Standard SIS 05 59 00 (1967) Sa 2.5.

APPLICATION

It is essential that good air circulation and ventilation is provided during application in enclosed spaces to allow full cure.

Primer

Concrete substrates must be primed using PAB1 Primer. Steel substrates must be primed with ZED S94 Primer. Please refer to the relevant datasheet for further information.

Bridgemaster®

Consists of a pre-packed binder resin (pigmented to the required colour), a bag of powder catalyst (BPO) and specially graded fillers in a bag. All three components are supplied pre-measured.

Ensure the job is prepared before starting the mixing operation. A pan mixer, such as a cretriangle is an ideal mixing vessel. Ensure that the vessel is clean and large enough to contain the pack size being mixed. Do not split the kits.

Shake the container of resin thoroughly and then pour it into the mixing vessel. Start to stir the resin and whilst continuing to stir, add the BPO hardener and mix for a few seconds. This then initiates the 'working life' during which time the Bridgemaster® must be used. So, without stopping, add the bag of fillers and mix thoroughly until all the fillers are wetted out.

(Additional catalyst is required at temperatures below 10°C. See the Application Guidelines for further information).

The mixed material must be placed and finished during the working life. Pour the material out onto the substrate and spread out using a toothed rake or trowel to the required thickness. Follow this up immediately by running a spiked roller over the screed to release any trapped air and to consolidate the screed.

Once rolled and before the screed starts to gel it should be completely 'blinded' with dry aggregate ensuring no bare patches of screed are visible. The aggregate must be applied in such a manner that individual particles are allowed to fall vertically onto the binder. Once the screed has cured the excess aggregate should be removed.

⁴ Water Jetting is not an acceptable method of mechanical preparation.

A coat of clear sealer is then applied to enhance aggregate retention and help maintain a clean surface. The system can be trafficked once the sealer has fully cured.

LIMITATIONS

Bridgemaster® is designed for use on gradients up to 1:12. For gradients greater than this please contact our Customer Services Department.

COVERAGE

Thickness	Binder	Aggregate	Sealer
6 mm	12.6 kg/m ²	4-7 kg/m ²	0.3-0.5 kg/m ²
4 mm	8.4 kg/m ²	4-7 kg/m ²	0.3-0.5 kg/m ²

The binder coverage rate will vary with surface texture. Aggregate and sealer consumption will vary depending upon the size of aggregate used.

AGGREGATES & COLOUR

The current aggregates acceptable for use are Chinese Bauxite, Guyanan Bauxite, Dynagrip and Criggion. Use of any other aggregate is prohibited unless approval has been granted by our Customer Services Department. Please see our Aggregate Price List for further details.

The Bridgemaster® resin is available in black and neutral colours. Please specify when ordering.

CLEANING

All tools and equipment should be cleaned with Stirling Lloyd Solvent No.1 (Acetone) before the material is allowed to cure.

PACKAGING & STORAGE

Primer	5 & 20kg kits
Screed	24kg kits
Aggregate	25kg bags (typically)
Sealer	5 & 20kg kits

All components of the Bridgemaster® system should be stored in cool, dry, protected conditions, out of direct sunlight and in accordance with the relevant Health & Safety regulations. Storage temperatures must not exceed 25°C. Do not store near naked flames or foodstuffs.

Stored in unopened containers, under these conditions, the components have a shelf life of six months.

ANCILLARIES

Stirling Lloyd produce a range of products to compliment the Bridgemaster® system. These include:

- SL Scratch Coat – a rapid cure, levelling screed.
- Metaset® – a range of resin based rapid repair mortars.
- Safetrack® LM – a flexible, bright, abrasion resistant line marking available in a range of colours.

bridgemaster®

COMBINED WATERPROOFING & SURFACING

- Sealants – a range of flexible sealants for all joints and cracks.
- A range of mechanical joints.

HEALTH & SAFETY

The Material Safety Data Sheet must be read, understood and available on site before commencing work.

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GENERAL INFORMATION

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[THE TECHNOLOGY OF PROTECTION]

SAFETY DATA SHEET

Bridgemaster

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY

PRODUCT NAME: Bridgemaster
PART No.: F60802
SUPPLIER: STIRLING LLOYD POLYCHEM LIMITED
 UNION BANK, KING STREET,
 KNUTSFORD,
 CHESHIRE, WA16 6EF.
TEL: +44(0)1565 633111
FAX: +44(0)1565 633555

2 COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	EINECS No.	CAS No.	CONTENTS	SYMBOL	RISK (R No.)
METHYL METHACRYLATE	201-297-1	80-62-6	10-30 %	F, Xi	11, 37/38, 43
BUTYL METHACRYLATE -norm	202-615-1	97-88-1	10-30 %	Xi	10, 36/37/38, 43
1,1'-(P-TOLYLIMINO)DIPROPANE-2-OL	254-075-1	38668-48-3	0-1 %	T	25, 52/53

The full text for all R-phrases are shown in section 16.

3 HAZARDS IDENTIFICATION

Highly flammable.
 Irritating to eyes, respiratory system and skin.
 May cause sensitisation by skin contact.

4 FIRST AID MEASURES

INHALATION: Remove victim immediately from source of exposure. Keep the affected person warm and at rest. Get prompt medical attention.
INGESTION: Do not induce vomiting. If vomiting occurs, the head should be kept low so that stomach vomit doesn't enter the lungs. Rinse mouth thoroughly. Immediately give a couple of glasses of water or milk, provided the victim is fully conscious. Get medical attention immediately!
SKIN: Promptly wash contaminated skin with water. Promptly remove clothing if soaked through and wash the skin with water. Get medical attention if any discomfort continues.
EYES: Promptly wash eyes with plenty of water while lifting the eye lids. Continue to rinse for at least 15 minutes and get medical attention.

5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Fire can be extinguished using: Water spray, fog or mist. Foam. Dry chemicals, sand, dolomite etc.
SPECIAL FIRE FIGHTING PROCEDURES: Cool containers exposed to flames with water until well after the fire is out. Use supplied air respirator if substance is involved in a fire.
UNUSUAL FIRE & EXPLOSION HAZARDS: May explode in a fire.

Bridgemaster

6 ACCIDENTAL RELEASE MEASURES

SPILL CLEANUP METHODS: Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate. Stop leak if possible without risk. DO NOT touch spilled material! Clean-up personnel should use respiratory and/or liquid contact protection. Inform Authorities if large amounts are involved. Absorb in vermiculite, dry sand or earth and place into containers.

7 HANDLING AND STORAGE

USAGE PRECAUTIONS: Keep away from heat, sparks and open flame. Avoid spilling, skin and eye contact. Do not use in confined spaces without adequate ventilation and/or respirator. Risk of vapour concentration on the floor and in low lying areas. Static electricity and formation of sparks must be prevented.

STORAGE PRECAUTIONS: Keep in cool, dry, ventilated storage and closed containers. Keep in original container. Keep away from heat, sparks and open flame. Protect from light, including direct sun rays.

STORAGE CRITERIA: Flammable liquid storage.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

INGREDIENT NAME	CAS No	STD	LT EXP	ST EXP
METHYL METHACRYLATE	80-62-6	OES	(8 hrs) 50 ppm	(15 min) 100 ppm

PROTECTIVE EQUIPMENT:



VENTILATION: Provide adequate general and local exhaust ventilation. Must not be handled in confined space without sufficient ventilation.

RESPIRATORS: No specific recommendation made, but respiratory protection must be used if the general level exceeds the Occupational Exposure Level (OEL). At work in confined or poorly ventilated spaces, respiratory protection with air supply must be used.

PROTECTIVE GLOVES: Use protective gloves made of: Glove manufacturers should be contacted for specific advice as to suitability and chemical contact life. Rubber, neoprene or PVC.

EYE PROTECTION: Wear splash-proof eye goggles to prevent any possibility of eye contact.

OTHER PROTECTION: Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK ROUTINES: DO NOT SMOKE IN WORK AREA! No eating or drinking while working with this material. Promptly remove any clothing that becomes contaminated. Wash promptly with soap & water if skin becomes contaminated. Wash at the end of each work shift and before eating, smoking and using the toilet.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Viscous. Liquid.		
COLOUR:	Varying. or Colour as described by Product Name.		
ODOUR/TASTE:	Acrylic		
SOLUBILITY DESCRIPTION:	Slightly soluble in water. Miscible with: Organic solvents (most).		
BOILING POINT (°C):	~100 @ 760mmHg		
SPECIFIC GRAVITY (Water=1):	~1.0 - 1.3 @ 20 °C		
VISCOSITY:	90 - 250 Ps @ 20 °C	FLASH POINT (°C):	~17
FLASH POINT METHOD:	CC (Closed cup).	FLAMMABILITY LIMIT (lower %):	2.0
AUTO IGNITION TEMPERATURE (°C):	~430		
FLAMMABILITY LIMIT (upper %):	13.0		

10 STABILITY AND REACTIVITY

STABILITY: Heat, sparks, flames. Light.

CONDITIONS TO AVOID: Avoid contact with strong oxidisers. Avoid heat, flames and other sources of ignition.

HAZARDOUS POLYMERIZATION: May polymerize violently.

POLYMERIZATION DESCRIPTION: Avoid contact with oxidizers, acids, aluminium, zinc, amines, peroxides, aluminium- and iron-chlorides. Avoid heat. Avoid light.

Bridgemaster

HAZARDOUS DECOMPOSITION PRODUCTS:

Irritating gases/vapours/fumes of: Carbon dioxide (CO₂). Carbon monoxide (CO).

11 TOXICOLOGICAL INFORMATION

ROUTE OF ENTRY: Inhalation. Skin and/or eye contact.
TARGET ORGANS: Respiratory system, lungs. Skin.
MEDICAL SYMPTOMS: Irritation of eyes and mucous membranes. Upper respiratory irritation. Skin irritation. Allergic rash. Gastrointestinal symptoms, including upset stomach. May cause sensitisation by skin contact.

12 ECOLOGICAL INFORMATION

MOBILITY: The product is predicted to have a high mobility in soil.
BIO ACCUMULATION: The product has a low potential for bioaccumulation.
DEGRADABILITY: Not readily biodegradable.
ACUTE FISH TOXICITY: Harmful to fish in static environment. Harmful to aquatic invertebrates.

13 DISPOSAL CONSIDERATIONS

DISPOSAL METHODS: Dispose of in accordance with Local Authority requirements. Contact specialist disposal companies.

14 TRANSPORT INFORMATION
LABEL FOR CONVEYANCE:

ROAD:

UN No:	1866		
HAZARD CLASS (ADR):	Class 3: Flammable liquids.	ADR CLASS No:	3
ADR PACK GR:	3b	MARGINAL:	2301
ADR LABEL No:	3	HAZCHEM CODE:	3(Y)E
PROPER SHIPPING NAME I:	Resin solution in flammable liquid.		
PROPER SHIPPING NAME II:	Resin solution in flammable liquid.		

RAIL:

RAIL TRANSPORT CLASS No:	3	RID PACK GR:	3b
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SEA:

UN SEA:	1866	SEA TRANSPORT CLASS No:	3.2
IMDG Page No:	3259	SEA PACK GR:	II
MARINE POLLUTANT:	No.		

AIR:

UN AIR:	1866	AIR TRANSPORT CLASS No:	3
AIR PACK GR:	II		

15 REGULATORY INFORMATION
LABEL FOR SUPPLY:

HIGHLY FLAMMABLE

IRRITANT

Bridgemaster

RISK PHRASES:	R-11 R-36/37/38 R-43	Highly flammable. Irritating to eyes, respiratory system and skin. May cause sensitisation by skin contact.
SAFETY PHRASES:	S-16 S-24/25 S-26 S-37 S-51 S-60	Keep away from sources of ignition - No Smoking. Avoid contact with skin and eyes. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable gloves. Use only in well ventilated areas. This material and its container must be disposed of as hazardous waste.
UK REGULATORY REFERENCES:	Chemicals (Hazard Information & Packaging) Regulations 1993. The Control of Substances Hazardous to Health Regulations 1988. Health and Safety at Work Act 1974. Highly Flammable Liquid Regulations 1972.	
UK ENVIRONMENTAL LISTINGS:	Environmental Protection Act 1990.	
GUIDANCE NOTES:	Spraying of Highly Flammable Liquids EH9. Occupational Exposure Limits EH40. Introduction to Local Exhaust Ventilation HS(G)37. CHIP for everyone HSG(108).	

16 OTHER INFORMATION

USER NOTES:	This product is intended for use for the application set out in the technical data sheet only. The information set out in this SAFETY DATA SHEET must be made available to all personnel who use or who may be exposed to this product. This SAFETY DATA SHEET refers to all variants of this product, EXCEPT TROPICAL GRADE - See SDS No. 10103.	
REVISION COMMENTS:	This SAFETY DATA SHEET supersedes all safety data sheets with issue dates previous to this one which have been issued and distributed in respect of this product. The Risk Phrases listed below are the full text for the individual ingredients shown in section 2. The relevant Risk Phrases for the overall product are only those shown in Section 15.	
REVISION DATE:	20.06.02	
REVISION No. /REPLACES SDS ISSUED:	03 / 12.11.96	
SDS No.:	10100	
R-PHRASES (Full Text):	R-10 R-11 R-25 R-43 R-36/37/38 R-37/38 R-52/53	Flammable. Highly flammable. Toxic if swallowed. May cause sensitisation by skin contact. Irritating to eyes, respiratory system and skin. Irritating to respiratory system and skin. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Authorised Contractor QA & Materials Site Record

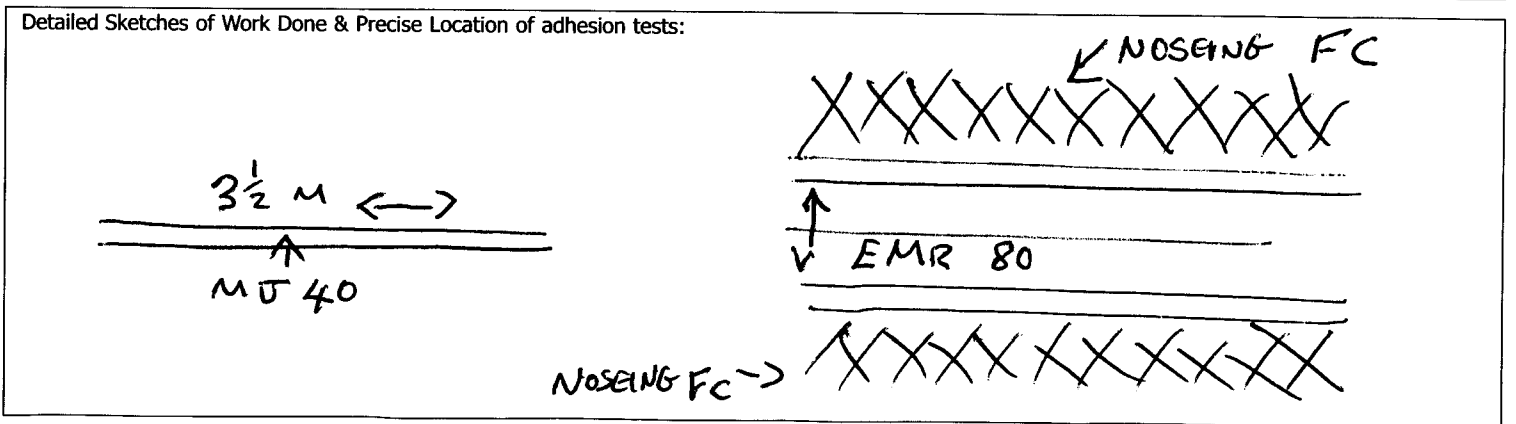
Weather Conditions:

Authorised Contractor STIRLING LLOYD Contract EXETER ROGGY CLUB Date 31/8/06

Substrate Type concrete Type of Surface Prep grinder Substrate Approved [Signature] System BRIDGE JOINT

Operation	Pt A or B	Batch Number(s)	Start Time	Finish Time	Material Usage			Application Method (i.e. spray or roller)	% RH	Air Temp (°C)	Deck Temp (°C)	Dew Point
					Area (m ²)	Qty (kg)	Coverage					
Primer (specify) <u>Summer</u>		<u>060804-024</u>			<u>7</u>	<u>1</u>		<u>BRUSH</u>				
Membrane 1 st Coat (specify) <u>NOSEING Mortar FC</u>		<u>060822-023</u>			<u>3½</u>	<u>3</u>		<u>Trowel</u>				
Membrane 2 nd Coat (specify) <u>MJ 40</u>					<u>3½</u>	<u>1</u>						
Binder (specify) <u>EMR 80</u>					<u>3½</u>	<u>1</u>						
Aggregate Overscatter (specify type & size) <u>CW 1</u>		<u>060622-005</u>			<u>3½</u>	<u>1</u>		<u>BRUSH</u>				
Tack Coat/Sealer (specify)												
Other (specify)												

Adhesion Tests -Location-	Failure Stress N/mm ²	Failure Mode



Signed: [Redacted]
 Print Name: [Redacted]
 On behalf of Authorised Contractor

Signed: [Redacted]
 Print Name: [Redacted]
 (Client) On behalf of _____

CS-21254

Additional Comments:

Taylor & Sons



SAFETY DATA SHEET

1. Identification of the preparation and of the company/undertaking

Product Name and/or Code : HEMPEL'S CURING AGENT 97050
9705000000

Company name and address : Hempel A/S
Lundtoftevej 150
DK-2800 Kgs. Lyngby
Denmark
Tel.: + 45 45 93 38 00

Emergency phone:
+45 45 93 38 00
See section 4 First aid measures.

Product Type : isocyanate curing agent

Field of application : used only as part of two- or multicomponent products.

Date of issue : 19-11-2004.

Date of Previous Issue : 21-01-2004.

2. Composition/information on ingredients

Ingredients presenting a hazard within the meaning of EU and National regulations.

Ingredient Name	CAS No.	%	EC Number	Classification
Prepolymer isocyanate HDI n-butylacetate	* 28182-81-2 123-86-4	75 - 100 2 - 5	500-060-2 204-658-1	R43 R10 R66, 67 R10
solvent naphtha (petroleum), light arom.	64742-95-6	2 - 5	265-199-0	Xn; R20, 65 Xi; R36/37/38 N; R51/53 T; R23 Xi; R36/37/38 R42/43
hexamethylene-di-isocyanate	822-06-0	0.15 - 0.2	212-485-8	

Notes

(*) See full text of phrases under section 16 and occupational Exposure Limit(s), if available, are listed in section 8

3. Hazards identification



Irritant

Flammable. May cause sensitization by skin contact. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

4. First aid measures

General : In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.

Inhalation : Move the person into fresh air and keep the person under surveillance. Keep person warm and at rest. If not breathing, if irregular breathing, or respiratory arrest occurs provide artificial respiration or oxygen by trained personnel. Give nothing by mouth. If unconscious, place in recovery position and seek medical advice.

Eye Contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. In all cases of doubt, or when symptoms persist, seek medical attention.

Skin Contact : Remove contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Do NOT use solvents or thinners.

- Ingestion** : If swallowed, seek medical advice immediately and show this document. Keep person warm and at rest. Do NOT induce vomiting unless directed to do so by medical personnel. Lower the head so that the vomit will not reenter the mouth and throat.
- Notes to physician** : If gasses have been inhaled, from the decomposition of the product, symptoms may be delayed.

5. Fire-fighting measures

Fire will produce dense black smoke. Exposure to decomposition products may cause a health hazard. Fire-fighters should wear proper protective equipment. Cool closed containers exposed to fire with water. Do not release runoff from fire to sewers or waterways.

- Extinguishing Media** : Recommended: alcohol resistant foam, CO₂, powders, water spray.
Not to be used : waterjet.
- Fire Degradation Products** : These products are carbon oxides (CO, CO₂), nitrogen oxides (NO, NO₂...).

6. Accidental release measures

Exclude sources of ignition and be aware of explosion hazard. Ventilate the area. Contain and collect spillage with non-combustible absorbent materials, e.g. sand, earth, vermiculite, diatomaceous earth, and place in container for disposal according to local regulations (see section 13). Do not allow to enter drains or watercourses. Clean preferably with a detergent; avoid use of solvents. If the product contaminates lakes, rivers, or sewers, inform the appropriate authorities in accordance with local regulation.

7. Handling and storage

Handling

Vapors are heavier than air and may spread along floors. Vapors may form explosive mixtures with air. Prevent the creation of flammable or explosive concentrations of vapors in air and avoid vapor concentrations higher than the occupational exposure limits. In addition, the product should be used only in areas from which all naked lights and other sources of ignition have been excluded. Electrical equipment should be protected to the appropriate standard. To dissipate static electricity during transfer, ground drum and connect to receiving container with bonding strap. No sparking tools should be used.

Care should be taken when re-opening partly used containers.

Avoid inhalation of vapour, dust and spray mist. Avoid contact with skin and eyes. Eating, drinking and smoking should be prohibited in area where this material is handled, stored and processed. Appropriate personal protective equipment: see Section 8. Always keep in containers made from the same material as the original one.

Storage

Store in accordance with local regulations for flammable liquids. Observe label precautions. Store in a cool, well-ventilated area away from incompatible materials and ignition sources. Keep out of the reach of children. Keep away from: Oxidizing agents, strong alkalis, strong acids as well as of amines, alcohols and water. No smoking. Prevent unauthorized access. Containers that are opened must be carefully resealed and kept upright to prevent leakage.

8. Exposure controls/personal protection

- Engineering measures** : Arrange sufficient ventilation by local exhaust ventilation and good general ventilation to keep the airborne concentrations of vapors or dust lowest possible and below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
- Hygiene measures** : Wash hands, forearms, and face thoroughly after handling the product and before eating, smoking, using lavatory, and at the end of day.

Ingredient Name

Occupational Exposure Limits

butylacetate

ACGIH TLV (United States, 2/2003). Notes: 1998 Adoption. 1998 Adoption.

STEL: 200 ppm 15 minute(s). Form: All forms

TWA: 150 ppm 8 hour(s). Form: All forms

hexamethylene-di-isocyanate

ACGIH TLV (United States, 2/2003).

TWA: 0.03 mg/m³ 8 hour(s). Form: All forms

TWA: 0.01 ppm 8 hour(s). Form: All forms

Personal protective equipment

- General** : Gloves must be worn for all work that may result in soiling. Apron/coveralls/protective clothing must be worn when soiling is so great that regular work clothes do not adequately protect skin against contact with the product. Safety eyewear should be used when there is a likelihood of exposure.

- Respiratory system** : If working areas have insufficient ventilation: For short durations wear half or totally covering mask equipped with gas filter of type A (Brown), when grinding use particle filter of type P2, when spraying wear combined filter AP. For continuous and prolonged work situation always wear an air-fed respirator (e.g. hood with supply of fresh or compressed air or a full face, powered air purifying filter). Be sure to use approved/certified filter, respirator or equivalent.
- Skin and body** : Wear suitable protective clothing. Always wear protective clothing when spraying.
- Hands** : Wear suitable gloves. Barrier creams may help to protect the exposed areas of the skin, but should not be applied once exposure has occurred. Barrier creams may not be used under or instead of gloves.
It is not possible to specify precise type of gloves, since the actual work situation is unknown. Supplier of gloves should be contacted in order to find the appropriate type.
- Eyes** : Use safety eyewear designed to protect against splash of liquids.

9. Physical and chemical properties

- Physical state** : Liquid.
- Melting Point** : -67.17°C based on data for: prepolymer isocyanate HDI
- Density** : The only known value is 1.13 g/cm³ (E143).
- Solubility** : Insoluble in cold water, hot water.
- Flash point** : Closed cup: 47°C (116.6°F).
- Explosion Limits** : 0.5 - 8 vol %
- % Solvent by Weight** : Weighted average: 10 %
- % Water by Weight** : Weighted average: 0 %
- VOC Content** : Weighted average: 115 g/l (CEPE)
- TOC Content** : Weighted average: 87 g/l (based on data for: Solvent.)
- Solvent Gas** : 0.024 m³/l

10. Stability and reactivity

Stable under recommended storage and handling conditions (see section 7).

Reactive with oxidizing agents.

Uncontrolled exothermic reactions occur with amines and alcohols. The product reacts slowly with water, resulting in the production of carbon dioxide. In closed containers, pressure buildup could result in distortion, expansion and, in extreme cases, bursting of the container..

When exposed to high temperatures (i.e. in case of fire) harmful decomposition products may be formed:

These products are carbon oxides (CO, CO₂), nitrogen oxides (NO, NO₂...).

11. Toxicological information

Effects and symptoms

Exposure to component solvent vapor concentrations may result in adverse health effects such as mucous membrane and respiratory system irritation and adverse effects on the kidneys, liver and central nervous system. Solvents may cause some of the above effects by absorption through the skin. Symptoms and signs include headaches, dizziness, fatigue, muscular weakness, drowsiness and, in extreme cases, loss of consciousness. Repeated or prolonged contact with the preparation may cause removal of natural fat from the skin, resulting in non-allergic contact dermatitis and absorption through the skin. If splashed in the eyes, the liquid may cause irritation and reversible damage. Accidental swallowing may cause stomach pain. Chemical lung inflammation may occur if the product is taken into the lungs via vomiting.

Isocyanate containing products have characteristics that include producing acute irritation and/or sensitisation when breathing, subsequent asthmatic problems and lung contractions. Sensitised people can, as a result from this, show asthmatic symptoms with exposure to atmospheric concentrations far below the TLV. Repeated exposures will lead to permanent damage to the respiratory system.

- Sensitization** : Contains (prepolymer isocyanate HDI, hexamethylene-di-isocyanate). May produce an allergic reaction.

Acute toxicity

Ingredient Name	Test	Result	Route	Species

prepolymer isocyanate HDI n-butylacetate	LD50	350 mg/kg	Oral	Mouse
	LD50	10768 mg/kg	Oral	Rat
	LD50	>17600 mg/kg	Dermal	Rabbit
solvent naphtha (petroleum), light arom.	LD50	8400 mg/kg	Oral	Rat
	LC50	2000 ppm (4 hour(s))	Inhalation	Rat
hexamethylene-di-isocyanate	LD50	738 mg/kg	Oral	Rat
	LD50	593 mg/kg	Dermal	Rabbit
	LC50	0.06 mg/l (4 hour(s))	Inhalation	Rat

12. Ecological information

The product must not be drained into water courses or drainage system.

The product is considered having hazardous effects in the aquatic environment following the method of the Dangerous Preparations Directive.

Ingredient Name	Species	Period	Result
butylacetate	Lepomis macrochirus (LC50)	96 hour(s)	100 mg/l
	Pimephales promelas (LC50)	96 hour(s)	18 mg/l

13. Disposal considerations

Residues of the product is listed as hazardous waste. Dispose of according to all state and local applicable regulations.

Spillage, remains, discarded clothes and similar should be discarded in a fireproof container.



European waste catalogue no. (EWC) and national waste group, catalogue, code or number is given below.

EWC no. : 08 01 11

14. Transport information

Transport may take place according to national regulation or ADR for transport by road, RID for transport by train, IMDG for transport by sea.

The transport classification is according to ADR 2003, IMDG edition 2002 (incl. Amdt. 31-02).

	UN-no.	Proper shipping name	Class	PGr.	Label	Additional information
ADR/RID Class	UN1263	PAINT	3	III		Remarks H-14
IMDG Class	UN1263	PAINT	3	III		EmS F-E, S-E

15. Regulatory information

Classification and labelling according to EU-Directives (the Preparations directive etc.).


Classification	: Irritant, Flammable
Contains	: - prepolymer isocyanate HDI
Risk Phrases	: R10- Flammable. R43- May cause sensitization by skin contact. R52/53- Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Phrases	: S23- Do not breathe vapor/spray. S24- Avoid contact with skin. S37- Wear suitable gloves. S51- Use only in well-ventilated areas.
Additional Warning Phrases	: Contains isocyanates. See information supplied by the manufacturer.

Other EU Regulations

Classification and labeling have been performed according to EU directives 67/548/EEC, 1999/45/EC including amendments and the intended use.

- Industrial applications, Used by Spraying.

16. Additional information

Full text of R phrases referred to in section 2 :  R10- Flammable.
R23- Toxic by inhalation.
R20- Harmful by inhalation.
R65- Harmful: may cause lung damage if swallowed.
R36/37/38- Irritating to eyes, respiratory system and skin.
R42/43- May cause sensitization by inhalation and skin contact.
R43- May cause sensitization by skin contact.
R66- Repeated exposure may cause skin dryness or cracking.
R67- Vapors may cause drowsiness and dizziness.
R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R52/53- Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Notice to Reader

Modified data or content compared with the previous version are marked with a triangular marker in the upper-left corner within the Safety Data Sheet.

The information contained in this safety data sheet is based on the present state of knowledge and EU and national legislation. It provides guidance on health, safety and environmental aspects for handling the product in a safe way and should not be construed as any guarantee of the technical performance or suitability for particular applications. It is always the duty of the user/employer to ascertain that the work is planned and carried out in accordance with the national regulations.



SAFETY DATA SHEET

1. Identification of the preparation and of the company/undertaking

Product Name and/or Code : HEMPEL'S CURING AGENT 98140
9814000000

Company name and address : Hempel A/S
Lundtoftevej 150
DK-2800 Kgs. Lyngby
Denmark
Tel.: + 45 45 93 38 00

Emergency phone:
+45 45 93 38 00
See section 4 First aid measures.

Product Type : Curing agent

Field of application : Metal industry

Ready for use mixture : 47140 4 LI / 98140 1 LI

Date of issue : 09-02-2006.

Date of Previous Issue : 12-12-2005.

2. Composition/information on ingredients

Substances presenting a health or environmental hazard within the meaning of the Dangerous Substances Directive 67/548/EEC.

Ingredient Name	CAS No.	%	EC Number	Classification
xylene	1330-20-7	15 - 20	215-535-7	R10 Xn; R20/21 Xi; R38
benzyl alcohol	100-51-6	15 - 20	202-859-9	Xn; R20/22
2,4,6-tris(dimethylaminomethyl)phenol	90-72-2	5 - 10	202-013-9	Xn; R22 Xi; R36/38
ethylbenzene	100-41-4	3 - 5	202-849-4	F; R11 Xn; R20
triethylenetetramine	112-24-3	0.2 - 0.5	203-950-6	Xn; R21 C; R34 R43 R52/53

Notes

(*) See full text of phrases under section 16 and occupational Exposure Limit(s), if available, are listed in section 8

3. Hazards identification



Harmful

Flammable. Harmful by inhalation and in contact with skin. Irritating to skin. Contains (triethylenetetramine). May produce an allergic reaction.

4. First aid measures

General : In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.

Inhalation : Move the person into fresh air and keep the person under surveillance. Keep person warm and at rest. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Give nothing by mouth. If unconscious, place in recovery position and seek medical advice.

Eye Contact	: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. In all cases of doubt, or when symptoms persist, seek medical attention.
Skin Contact	: Remove contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Do not use solvents or thinners.
Ingestion	: If swallowed, seek medical advice immediately and show this document. Keep person warm and at rest. Do NOT induce vomiting unless directed to do so by medical personnel. Lower the head so that the vomit will not reenter the mouth and throat.
Notes to physician	: If gasses have been inhaled, from the decomposition of the product, symptoms may be delayed.

5. Fire-fighting measures

Fire will produce dense black smoke. Exposure to decomposition products may cause a health hazard. Fire-fighters should wear appropriate protective equipment. Cool closed containers exposed to fire with water. Do not release runoff from fire to sewers or waterways.

Extinguishing Media	: Recommended: alcohol resistant foam, CO ₂ , powders, water spray. Not to be used : waterjet.
Fire Degradation Products	: These products are carbon oxides (CO, CO ₂), nitrogen oxides (NO, NO ₂ etc.).

6. Accidental release measures

Exclude sources of ignition and be aware of explosion hazard. Ventilate the area. Avoid all direct contact with the spilled material. Avoid breathing vapor or mist. Refer to protective measures listed in sections 7 and 8.

Contain and collect spillage with non-combustible absorbent materials, e.g. sand, earth, vermiculite, diatomaceous earth, and place in container for disposal according to local regulations (see section 13). Do not allow to enter drains or watercourses. Clean preferably with a detergent; avoid use of solvents. If the product contaminates lakes, rivers, or sewers, inform the appropriate authorities in accordance with local regulation.

7. Handling and storage

Handling

Vapors are heavier than air and may spread along floors. Vapors may form explosive mixtures with air. Prevent the creation of flammable or explosive concentrations of vapors in air and avoid vapor concentrations higher than the occupational exposure limits. In addition, the product should be used only in areas from which all naked lights and other sources of ignition have been excluded. Electrical equipment should be protected to the appropriate standard. To dissipate static electricity during transfer, ground drum and connect to receiving container with bonding strap. No sparking tools should be used.

Avoid inhalation of vapour, dust and spray mist. Avoid contact with skin and eyes. Eating, drinking and smoking should be prohibited in area where this material is handled, stored and processed. Appropriate personal protective equipment: see Section 8. Always keep in containers made from the same material as the original one.

Storage

Store in accordance with local regulations for flammable liquids. Observe label precautions. Store in a cool, well-ventilated area away from incompatible materials and ignition sources. Keep out of the reach of children.

Keep away from: Oxidizing agents, strong alkalis, strong acids. No smoking. Prevent unauthorized access. Containers that are opened must be carefully resealed and kept upright to prevent leakage.

8. Exposure controls/personal protection

Engineering measures	: Arrange sufficient ventilation by local exhaust ventilation and good general ventilation to keep the airborne concentrations of vapors or dust lowest possible and below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Hygiene measures	: Wash hands, forearms, and face thoroughly after handling the product and before eating, smoking, using lavatory, and at the end of day.

Ingredient Name	Occupational Exposure Limits
xylene	EU OEL (Europe, 4/2004). Skin STEL: 442 mg/m ³ 15 minute/minutes. Form: All forms STEL: 100 ppm 15 minute/minutes. Form: All forms TWA: 221 mg/m ³ 8 hour/hours. Form: All forms TWA: 50 ppm 8 hour/hours. Form: All forms
ethylbenzene	EU OEL (Europe, 4/2004). Skin STEL: 884 mg/m ³ 15 minute/minutes. Form: All forms STEL: 200 ppm 15 minute/minutes. Form: All forms TWA: 442 mg/m ³ 8 hour/hours. Form: All forms TWA: 100 ppm 8 hour/hours. Form: All forms

Personal protective equipment

General	: Gloves must be worn for all work that may result in soiling. Apron/coveralls/protective clothing must be worn when soiling is so great that regular work clothes do not adequately protect skin against contact with the product. Safety eyewear should be used when there is a likelihood of exposure.
Respiratory system	: If working areas have insufficient ventilation: When the product is applied by means that will not generate an aerosol such as, brush or roller wear half or totally covering mask equipped with gas filter of type A, when grinding use particle filter of type P. When the product is applied by spraying and for continuous or prolonged work always wear an air-fed respirator e.g. hood with supply of fresh or compressed air or a full face, powered air purifying filter. Be sure to use approved/certified filter, respirator or equivalent.
Skin and body	: Wear suitable protective clothing. Always wear protective clothing when spraying.
Hands	: Wear suitable gloves. Barrier creams may help to protect the exposed areas of the skin, but should not be applied once exposure has occurred. Barrier creams may not be used under or instead of gloves. It is not possible to specify precise type of gloves, since the actual work situation is unknown. Supplier of gloves should be contacted in order to find the appropriate type.
Eyes	: Use safety eyewear designed to protect against splash of liquids.

9. Physical and chemical properties

Physical state	: Liquid.
Density	: Weighted average: 0.96 g/cm ³
Solubility	: Partially soluble in cold water, hot water.
Flash point	: Closed cup: 23°C (73.4°F).
Explosion Limits	: 1 - 15 vol %
% Solvent by Weight	: Weighted average: 23 %
% Water by Weight	: Weighted average: 0 %
VOC Content	: Weighted average: 219 g/l (CEPE)
TOC Content	: Weighted average: 335 g/l (based on data for: Solvent.)
Solvent Gas	: 0.049 m ³ /l

10. Stability and reactivity

Stable under recommended storage and handling conditions (see section 7).

Highly reactive or incompatible with the following materials: oxidizing materials.

Reactive or incompatible with the following materials: reducing materials.

When exposed to high temperatures (i.e. in case of fire) harmful decomposition products may be formed:

These products are carbon oxides (CO, CO₂), nitrogen oxides (NO, NO₂ etc.).

11. Toxicological information

Effects and symptoms

Exposure to component solvent vapor concentrations may result in adverse health effects such as mucous membrane and respiratory system irritation and adverse effects on the kidneys, liver and central nervous system. Solvents may cause some of the above effects by absorption through the skin. Symptoms and signs include headaches, dizziness, fatigue, muscular weakness, drowsiness and, in extreme cases, loss of consciousness. Repeated or prolonged contact with the preparation may cause removal of natural fat from the skin, resulting in non-allergic contact dermatitis and absorption through the skin. If splashed in the eyes, the liquid may cause irritation and reversible damage. Accidental swallowing may cause stomach pain. Chemical lung inflammation may occur if the product is taken into the lungs via vomiting.

Sensitization : Contains (triethylenetetramine). May produce an allergic reaction.

Acute toxicity

Ingredient Name	Test	Result	Route	Species
xylene	LD50	4300 mg/kg	Oral	Rat
	LD50	>1700 mg/kg	Dermal	Rabbit
	LDLo	50 mg/kg	Oral	Human
	LC50	>6700 ppm (4 hour/hours)	Inhalation	Rat
benzyl alcohol	LD50	1230 mg/kg	Oral	Rat
2,4,6-tris(dimethylaminomethyl)phenol	LD50	1200 mg/kg	Oral	Rat
	LD50	1280 mg/kg	Dermal	Rat
ethylbenzene	LD50	3500 mg/kg	Oral	Rat
triethylenetetramine	LD50	2500 mg/kg	Oral	Rat
	LD50	805 mg/kg	Dermal	Rabbit

12. Ecological information

The product must not be drained into water courses or drainage system.

Ingredient Name	Species	Period	Result
xylene	Oncorhynchus mykiss (LC50)	96 hour/hours	8.2 mg/l
benzyl alcohol	Lepomis macrochirus (LC50)	96 hour/hours	10 mg/l
	Pimephales promelas (LC50)	96 hour/hours	460 mg/l
ethylbenzene	Daphnia magna (EC50)	48 hour/hours	2.93 mg/l
	Selenastrum capricornutum (EC50)	48 hour/hours	7.2 mg/l
	Fish (LC50)	96 hour/hours	9.09 mg/l

13. Disposal considerations

Residues of the product is listed as hazardous waste. Dispose of according to all state and local applicable regulations.

Spillage, remains, discarded clothes and similar should be discarded in a fireproof container.



European waste catalogue no. (EWC) and national waste group, catalogue, code or number is given below.

EWC no. : 08 01 11

14. Transport information

Transport may take place according to national regulation or ADR for transport by road, RID for transport by train, IMDG for transport by sea.


The transport classification is according to ADR 2005, IMDG edition 2004 (incl. Amdt. 32-04).

	UN-no.	Proper shipping name	Class	PG*	Label	Additional information
ADR/RID Class	UN1263	PAINT	3	III		Remarks H-14
IMDG Class	UN1263	PAINT	3	III		Emergency schedules (EmS) F-E, S-E

PG* : Packing group

15. Regulatory information

Classification and labelling according to EU-Directives (the Preparations directive etc.).

Symbol	: Harmful
Contains	:  xylene
Risk Phrases	: R10- Flammable. R20/21- Harmful by inhalation and in contact with skin. R38- Irritating to skin.
Safety Phrases	: S23- Do not breathe vapor/spray. S36/37- Wear suitable protective clothing and gloves. S51- Use only in well-ventilated areas.
Additional Warning Phrases	: Contains (triethylenetetramine). May produce an allergic reaction.

Other EU Regulations

Classification and labeling have been performed according to EU Directives 67/548/EEC and 1999/45/EC (including amendments) and the intended use.

- Industrial applications, Used by spraying.

16. Additional information

Full text of R-phrases referred to in the Safety Data Sheet	: R11- Highly flammable. R10- Flammable. R20- Harmful by inhalation. R20/21- Harmful by inhalation and in contact with skin. R20/22- Harmful by inhalation and if swallowed. R21- Harmful in contact with skin. R22- Harmful if swallowed. R34- Causes burns. R36/38- Irritating to eyes and skin. R38- Irritating to skin. R43- May cause sensitization by skin contact. R52/53- Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
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Product Data

HEMPATHANE® ENAMEL 5510E

BASE 55109 with CURING AGENT 97050

Description: HEMPETHANE ENAMEL 5510E is a two-component, high-gloss acrylic polyurethane enamel with good gloss and colour retention. Approved to UK Highways Agency item 168.

Recommended use: As a glossy decorative finishing coat on a variety of substrates such as steel, aluminium, glassfibre, reinforced polyester, plywood, hardwood etc. in severely corrosive atmospheric environment. Minimum temperature for curing is -10°C/14°F.

Service temperatures: Maximum, dry exposure only: 120°C/248°F (see REMARKS overleaf).

Availability: Not included in Group Assortment. Availability subject to special agreement.

PHYSICAL CONSTANTS:

Colours/Shade nos: White/10000*
Finish: High-gloss
Volume solids, %: 54 ± 1
Theoretical spreading rate: 15.4 m²/litre - 35 micron
619 sq.ft./US gallon - 1.4 mil
Flash point: 31°C/88°F
Specific Gravity: 1.3 kg/litre - 10.8 lbs/US gallon
Surface dry: 2½ (approx.) hrs at 20°C/68°F (ISO 1517)
Dry to touch: 4-5 hours at 20°C/68°F
Fully cured: 7 days at 20°C/68°F
V.O.C.: 420 g/litre - 3.5 lbs/US gallon

**Other shades according to assortment list.*

The physical constants stated are nominal data according to the HEMPEL Group's approved formulas. They are subject to normal manufacturing tolerances and where stated, being standard deviation according to ISO 3534-1.

APPLICATION DETAILS:

Mixing ratio for 5510E: Base 55109 : Curing agent 97050
7 : 1 by volume

Application method:	Airless spray	Air spray	Brush
Thinner (max.vol.):	See REMARKS overleaf	See REMARKS overleaf	08080 (5%)
Pot life:	2 hours (20°C/68°F)		
Nozzle orifice:	.017"-.019"		
Nozzle pressure:	75-100 bar /1100 -1450 psi (Airless spray data are indicative and subject to adjustment)		
Cleaning of tools:	THINNER 08080 or 08510		
Indicated film thickness, dry:	35 micron/1.4 mil		
Indicated film thickness, wet:	75 micron/3 mils		
Recoat interval, min:	8 hours (20°C/68°F)		
Recoat interval, max:	See REMARKS overleaf		

Safety: Handle with care. Before and during use, observe all safety labels on packaging and paint containers, consult HEMPEL Material Safety Data Sheets and follow all local or national safety regulations. Avoid inhalation, avoid contact with skin and eyes, and do not swallow. Take precautions against possible risks of fire or explosions as well as protection of the environment. Apply only in well ventilated areas.



HEMPATHANE ENAMEL 5510E

APPLICATION AND CURING CONDITIONS: The surface must be completely clean and dry at the time of application, and its temperature must be above the dew point to avoid condensation. Minimum temperature for curing is -10°C/14°F. At the freezing point and below, be aware of the risk of ice on the surface which will hinder the adhesion. Light rain, high humidity and/or condensation during application and the following 16 hours (20°C/68°F) may adversely affect the film formation. The humidity of plywood/hardwood should not exceed 16% w/w. In confined spaces provide adequate ventilation during application and drying.

PRECEDING COAT: HEMPADUR 45080/45083, HEMPADUR HI-BUILD 45200, HEMPADUR MASTIC 45880 or according to specification.

SUBSEQUENT COAT: None.

REMARKS:

Colours: Certain lead-free red and yellow colours may discolour when exposed to chlorine- containing atmosphere. Leaded colours may become discoloured when exposed to sulphide-containing atmosphere. To obtain full opacity, an extra coat may be necessary, especially for certain lead-free colours in eg red, orange, yellow and green.

Service temperatures: At service temperatures above 100°C/212°F, slight discoloration may be expected.

Film thicknesses: May be specified in another film thickness than indicated depending on purpose and area of use. This will alter spreading rate and may influence drying time and recoating interval. Normal range is 20-40 micron/0.8 -1.6 mils.

Thinning: The type and amount of thinner depend on application conditions, application method, temperature, ventilation, and substrate. THINNER 0808 is recommended in general. THINNER 08510 may be used alternatively depending on local conditions.
Airless spray: 15-20% thinning is recommended. Under extreme conditions more than 25% may be necessary to obtain satisfactory film formation.
Conventional air spray: Dilute to a viscosity of 17-20 s/DIN 4 (approx 35% by volume). Use lowest possible air pressure and a small nozzle.
 For both kinds of spray application the best result is obtained by applying a mist coat of HEMPATHANE ENAMEL 5510E at first, and then 2-15 minutes later apply to full film thickness giving a uniform film formation. Do not exaggerate the film thickness.

Recoating and drying/curing time:

Physical data versus temperatures (35 micron/1.4 mil dry film thickness - sufficient ventilation):						
Surface temperature		-10°C/14°F	0°C/32°F	10°C/50°F	20°C/68°F	30°C/86°F
Dry to touch, approx.		45 hours	20 hours	9 hours	5 hours	3 hours
Resist condensing humidity/light showers after:		(7 days)	3 days	32 hours	16 hours	12 hours
Fully cured, 70% RH		(2 months)	32 days	14 days	7 days	5 days
Recoating interval, recoating 5510E with 5510E	Min	3 days	1½ day	16 hours	8 hours	6 hours
	Max*	(6 months)	(6 months)	(6 months)	3 months	2 months

*The maximum recoating intervals apply to surfaces exposed to very severe conditions of periodical immersion, heavy condensation, great variations in temperatures, chemical attack and/or abrasion during service life of the coating system. Under other conditions no maximum recoating interval. **A completely clean surface is anyhow mandatory to ensure intercoat adhesion, especially at long recoating intervals. Any dirt, oil, and grease has to be removed. e.g. with suitable detergent. Salts to be removed by fresh water hosing. To check an adequate quality of the surface cleaning a test patch is recommended before actual recoating.**

If the maximum recoating interval is exceeded, roughening of the surface is necessary to ensure intercoat adhesion. In the case of recoating with other paint materials maximum will be 1-3 days (20°C/68°F) depending on type.

Notes: CURING AGENT 97050 is sensitive to moisture. Store in a dry place and keep the can tightly closed until use. Open curing agent cans with caution as overpressure might exist. Even small traces of water in the mixed paint will reduce the pot-life and result in film defects.

HEMPATHANE ENAMEL 5510E is for professional use only.

ISSUED BY: HEMPEL A/S - 5510E1000CR001

This Product Data Sheet supersedes those previously issued.

For explanations, definitions and scope, see "Explanatory Notes" in the HEMPEL Book.

Data, specifications, directions and recommendations given in this data sheet represent only test results or experience obtained under controlled or specially defined circumstances. Their accuracy, completeness or appropriateness under the actual conditions of any intended use of the Products herein must be determined exclusively by the Buyer and/or User.

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Product Data

HEMPADUR® ZP 47940

BASE 47949 with CURING AGENT 98140

Description: HEMPADUR ZP 47940 is a two-component polyamide adduct cured, high build epoxy paint which combines a relatively high volume solids content with a short drying time. Pigmented with zincphosphate. Approved to Highways Agency item 111

Recommended use: As a primer in epoxy systems in atmospheric exposure.

Service temperatures: Maximum, dry exposure only: 140°C/284°F

Availability: Not included in Group Assortment. Availability subject to special agreement.

PHYSICAL CONSTANTS:

Colours/Shade nos: Grey/12170 - Red/50630
Finish: Semi-gloss
Volume solids, %: 76 ± 1
Theoretical spreading rate: 6.1 m²/litre - 125 micron
244 sq.ft./US gallon - 5 mils
Flash point: 24°C/75°F
Specific gravity: 1.0 kg/litre - 8.3 lbs/US gallon
Dry to touch: (app.) hours at 20°C/68°F
Fully cured: 7 days at 20°C/68°F
V.O.C.: 245 g/litre - 2.0 lbs/US gallon

The physical constants stated are nominal data according to the HEMPEL Group's approved formulas. They are subject to normal manufacturing tolerances and where stated, being standard deviation according to ISO 3534-1.

APPLICATION DETAILS:

Mixing ratio for 47940: Base 47949 : Curing agent 98140
5 : 1 by volume
Application method: Airless spray Brush (*touch up*)
Thinner (max. vol.): Depending on purpose usually less than 5% THINNER 08450 (*See REMARKS overleaf*)
Pot life: 1 hour (20°C/68°F)
Nozzle orifice: .019"-.021"
Nozzle pressure: 225 bar/3300 psi
(*Airless spray data are indicative and subject to adjustment*)
Cleaning of tools: HEMPEL'S TOOL CLEANER 99610
Indicated film thickness, dry: 125 micron/5 mils (*see REMARKS overleaf*)
Indicated film thickness, wet: 175 micron/7 mils
Recoat interval, min: 6 hours (20°C/68°F)
Recoat interval, max: None (*see REMARKS overleaf*)

Safety: Handle with care. Before and during use, observe all safety labels on packaging and paint containers, consult HEMPEL Material Safety Data Sheets and follow all local or national safety regulations. Avoid inhalation, avoid contact with skin and eyes, and do not swallow. Take precautions against possible risks of fire or explosions as well as protection of the environment. Apply only in well ventilated areas.



HEMPADUR ZP 47940

SURFACE PREPARATION: **New steel (dry conditions):** Abrasive blasting to Sa 2½. For temporary protection, if required, use suitable shopprimer. All damage of shopprimer and contamination from storage and fabrication should be thoroughly cleaned prior to final painting. For repair and touch-up use HEMPADUR ZP 47940.

APPLICATION CONDITIONS: Apply only on a dry and clean surface with a temperature above the dew point to avoid condensation. Use only when application and curing can proceed at temperatures above 0°C/32°F. The temperature of the paint itself should be 15-25°C/59-77°F to secure proper application properties. In confined spaces provide adequate ventilation during application and drying. It is important that the surface is completely clean to ensure the adhesion. Any oil, grease, etc. to be removed by suitable detergent.

PRECEDING COAT: None. Aluminium/zinc spray-metallisation which preferably are to be "sealed" with HEMPADUR 17940 or according to specification.

SUBSEQUENT COAT: None, HEMPADUR or according to specification.

REMARKS: Weathering/service temperatures: The natural tendency of epoxy coatings to chalk in outdoor exposure and to become more sensitive to mechanical damage and chemical exposure at elevated temperatures is also reflected in this product.

Application onto non-sealed aluminium/zinc metallised surfaces or zincsilicates: A proper mist-coat technique is necessary in order to avoid/reduce the risk of "popping" / "pinholes". Add up to 50% thinner depending on the actual conditions of application.

Recoating: **General notes on prolonged recoating intervals:** A completely clean surface is mandatory to ensure intercoat adhesion, especially in the case of long recoating intervals. Any dirt, oil and grease have to be removed with eg suitable detergent followed by high pressure fresh water cleaning. Salts to be removed by fresh water hosing.

Any degraded surface layer, as a result of a long exposure period, must be removed as well. Water jetting may be relevant to remove any degraded surface layer and may also replace the above mentioned cleaning methods when properly executed. Consult HEMPEL for specific advice if in doubt.

To determine whether the quality of the surface cleaning is adequate, a test patch may be relevant, however, this test patch should not be a final proof of the durability of the coating systems.

Note: **HEMPADUR ZP 47940 is for professional use only.**

ISSUED BY: HEMPEL A/S - 4794012170CR002

This Product Data Sheet supersedes those previously issued. For explanations, definitions and scope, see "Explanatory Notes" in the HEMPEL Book. Data, specifications, directions and recommendations given in this data sheet represent only test results or experience obtained under controlled or specially defined circumstances. Their accuracy, completeness or appropriateness under the actual conditions of any intended use of the Products herein must be determined exclusively by the Buyer and/or User. The Products are supplied and all technical assistance is given subject to HEMPEL's GENERAL CONDITIONS OF SALES, DELIVERY AND SERVICE, unless otherwise expressly agreed in writing. The Manufacturer and Seller disclaim, and Buyer and/or User waive all claims involving, any liability, including but not limited to negligence, except as expressed in said GENERAL CONDITIONS for all results, injury or direct or consequential losses or damages arising from the use of the Products as recommended above, on the overleaf or otherwise. Product data are subject to change without notice and become void five years from the date of issue.



Product Data

HEMPADUR® MIO 47950

BASE 47959 with CURING AGENT 98140

Description: HEMPADUR MIO 47950 is a two-component polyamide adduct cured, high build epoxy paint which combines a relatively high volume solids content with a short drying time. Has a high load of MIO-pigment. Approved to Highways Agency item 112.

Recommended use: As an intermediate or finishing coat in epoxy systems in atmospheric exposure.

Service temperatures: Maximum, dry exposure only: 140°C/284°F

Availability: Not included in Group Assortment. Availability subject to special agreement.

PHYSICAL CONSTANTS:

Colours/Shade nos: MIO grey/12130 - grey/13480
Finish: Semi-gloss
Volume solids, %: 76 ± 1
Theoretical spreading rate: 6.1 m²/litre - 125 micron
244 sq.ft./US gallon - 5 mils
Flash point: 24°C/75°F
Specific gravity: 1.2 kg/litre - 10.0 lbs/US gallon
Dry to touch: 2 (app.) hours at 20°C/68°F
Fully cured: 7 days at 20°C/68°F
V.O.C.: 245 g/litre - 2.0 lbs/US gallon

The physical constants stated are nominal data according to the HEMPEL Group's approved formulas. They are subject to normal manufacturing tolerances and where stated, being standard deviation according to ISO 3534-1.

APPLICATION DETAILS:

Mixing ratio for 47950: Base 47959 : Curing agent 98140
5 : 1 by volume
Application method: Airless spray Brush (*touch up*)
Thinner (max. vol.): Depending on purpose usually less than 5% THINNER 08450 (*See REMARKS overleaf*)
Pot life: 1 hour (20°C/68°F)
Nozzle orifice: .019"-.021"
Nozzle pressure: 225 bar/3300 psi
(*Airless spray data are indicative and subject to adjustment*)
Cleaning of tools: HEMPEL'S TOOL CLEANER 99610
Indicated film thickness, dry: 125 micron/5 mils (*see REMARKS overleaf*)
Indicated film thickness, wet: 175 micron/7 mils
Recoat interval, min: 6 hours (20°C/68°F)
Recoat interval, max: HEMPATHANE: None (*See REMARKS overleaf*)

Safety: Handle with care. Before and during use, observe all safety labels on packaging and paint containers, consult HEMPEL Material Safety Data Sheets and follow all local or national safety regulations. Avoid inhalation, avoid contact with skin and eyes, and do not swallow. Take precautions against possible risks of fire or explosions as well as protection of the environment. Apply only in well ventilated areas.



HEMPADUR MIO 47950

APPLICATION CONDITIONS: Apply only on a dry and clean surface with a temperature above the dew point to avoid condensation. Use only when application and curing can proceed at temperatures above 0°C/32°F. The temperature of the paint itself should be 15-25°C/59-77°F to secure proper application properties. In confined spaces provide adequate ventilation during application and drying. It is important that the surface is completely clean to ensure the adhesion. Any oil, grease, etc. to be removed by suitable detergent.

PRECEDING COAT: HEMPADUR ZP 47940. Aluminium/zinc spray-metallisation which preferably are to be "sealed" with HEMPADUR 17940 or according to specification.

SUBSEQUENT COAT: None, HEMPATHANE or according to specification.

REMARKS: Weathering/service temperatures: The natural tendency of epoxy coatings to chalk in outdoor exposure and to become more sensitive to mechanical damage and chemical exposure at elevated temperatures is also reflected in this product.

Application onto non-sealed aluminium/zinc metallised surfaces or zincsilicates: A proper mist-coat technique is necessary in order to avoid/reduce the risk of "popping" / "pinholes". Add up to 50% thinner depending on the actual conditions of application.

Recoating: Maximum recoating interval: HEMPADUR MIO 47950 may provide extended recoating properties if it is applied **in a way that allows a MIO structure to develop**. This may necessitate application of HEMPADUR MIO 47950-12130 in reduced filmthickness, down to 50 micron/2 mils dry filmthicknesses. For such purpose, addition of 5-10% THINNER 08450 is recommended.

General notes on prolonged recoating intervals:

Besides the Note above about MIO, the following applies:

A completely clean surface is mandatory to ensure intercoat adhesion, especially in the case of long recoating intervals. Any dirt, oil and grease have to be removed with eg suitable detergent followed by high pressure fresh water cleaning. Salts to be removed by fresh water hosing.

Any degraded surface layer, as a result of a long exposure period, must be removed as well.

Water jetting may be relevant to remove any degraded surface layer and may also replace the above mentioned cleaning methods when properly executed. Consult HEMPEL for specific advise if in doubt.

To determine whether the quality of the surface cleaning is adequate, a test patch may be relevant, however, this test patch should not be a final proof of the durability of the coating systems.

Note: HEMPADUR MIO 47950 is for professional use only.

ISSUED BY: HEMPEL A/S - 4795012130CR001

This Product Data Sheet supersedes those previously issued.

For explanations, definitions and scope, see "Explanatory Notes" in the HEMPEL Book.

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Product data are subject to change without notice and become void five years from the date of issue.

Date In	Works No	Customer	Customer Order No.	Description						
16.05.06	2691	Taylor and Son Ltd	SZ84177/CAR/JR	Hand rail Units						
PROCESS	As Specification. Look at painting Sheet for Top coat			Operator insp	Date	On	Off	Materials Used		
DEGREASE	N/A Mask out as required to D.R.G				14.07.06					
MASKING	As Specification and D.R.G. Paint no Top Coat on Hand Rail / Top Tube.				15.07.06 17.07.06					
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum				
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	24.5 25.5 28.5	76%-16. 81%-19. 79%-18.			
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		24. 25.5 28.5	76%-16. 81%-19. 79%-18.			
1st COAT	2/Pack	150mic.	150 / 160mic.	Hempel Paints, 47940/9 RED	126020179	24.5 24. 25.5 28.5	76%-16. 76%-16. 81%-19. 79%-18.			
2nd COAT	2/Pack	150mic.	167 / 170mic.	Hempel Paints, 47950/9 GREY	126020189	33.5 23.5 27.5 28.5	76%-16. 79%-16. 76%-17. 75%-18.			
3rd COAT	2/Pack	50mic.	54 / 60mic.	Hempel Paints, 5521E.	C6050273.	28.5 26. 28.5 23.5	79%-16. 76%-17. 74%-16. 78%-15.			
4th COAT										
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C			
350mic.	No	White			31.07.06	3278				


Date In	Works No	Customer		Customer Order No.	Description				
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR	Bridge Steel work. 1st 2 Units. 16.Mtr Long.				
PROCESS	As Specification. Look at painting Sheet for Top coat				Operator insp	Date	On	Off	Materials Used
DEGREASE	N/A Mask out as required to D.R.G					17.05.06			
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,								
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum			
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work		16.5	70%-9.		17.05.06
						15.5	74%-9.		18.05.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		16.5	70%-9.		17.05.06
						15.5	74%-9.		18.05.06
1st COAT	2/Pack	150mic.	175 / 182mic.	Hempel Paints, 47940/9 RED	126020179	15.5	74%-9.		18.05.06
2nd COAT	2/Pack	150mic.	169 / 167mic.	Hempel Paints, 47950/9 GREY	126020189	15.5	74%-9.		18.05.09
						12.5	76%-8.		19.05.06
3rd COAT	2/Pack	50mic.	56 / 63mic.	Hempel Paints, 5521E. In Side face,	C6050273.	15	78%-7.		20.05.06
						12.5	71%-7.		22.05.06
4th COAT									
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/O		
350mic.	No	White			22.05.06	3186			

Date In	Works No	Customer		Customer Order No.	Description				
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR	Bridge Steel work. 3,units 16.Mtr Long. Plus 10mtr Long				
PROCESS	As Specification. Look at painting Sheet for Top coat				Operator insp	Date	On	Off	Materials Used
DEGREASE	N/A Mask out as required to D.R.G					23.05.06			
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,								
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum			
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	14.5	74%-9.		23.05.06
						15.	76%-8.		
						17.5	73%-6.		
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		14.5	74%-9.		23.05.06
						15.	76%-8.		
						17.5	73%-6.		
1st COAT	2/Pack	150mic.	181 / 192mic.	Hempel Paints, 47940/9 RED	126020179	14.5	74%-9.		23.05.06
						15.	76%-8.		
2nd COAT	2/Pack	150mic.	158 / 168mic.	Hempel Paints, 47950/9 GREY	126020189	17.5	73%-6.		25.05.06
						16.	70%-9.		
3rd COAT	2/Pack	50mic.	59 / 60mic.	Hempel Paints, 5521E. In Side face,	C6050273.	15.5	72%-8.		27.05.06
4th COAT									
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C		
350mic.	No	White			30.05.06	3186			



Date In	Works No	Customer		Customer Order No.		Description					
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR		Bridge Steel work. 3no units X 16.Mtr Long.					
PROCESS	As Specification. Look at painting Sheet for Top coat					Operator insp	Date	On	Off	Materials Used	
DEGREASE	N/A Mask out as required to D.R.G						26.05.06				
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,										
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum					
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	16.5	70%-9.				26.05.06
						15.5	72%-8.				27.05.06
						23.5	78%-18.				30.05.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		16.5	70%-9.				26.05.06
						15.5	72%-8.				27.05.06
						23.5	78%-18.				30.05.06
1st COAT	2/Pack	150mic.	165 / 180mic.	Hempel Paints, 47940/9 RED	126020179	23.5	78%-18.				30.05.06
						24.5	76%-19.				31.05.06
2nd COAT	2/Pack	150mic.	158 / 161mic.	Hempel Paints, 47950/9 GREY	126020189	23.5	76%-18.				02.06.06
						25.5	78%-19.				03.06.06
3rd COAT	2/Pack	50mic.	50 / 69mic.	Hempel Paints, 5521E. In Side face,	C6050273.	24.5	72%-15.				05.06.06
						22.5	76%-17				06.06.06
4th COAT											
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C				
350mic.	No	White			06.06.09	3186					

Date In	Works No	Customer	Customer Order No.	Description							
16.05.06	2691	Taylor and Son Ltd	SZ84177/CAR/JR	Bridge Mast unit and Steel work.							
PROCESS	As Specification. Look at painting Sheet for Top coat					Operator insp	Date	On	Off	Materials Used	
DEGREASE	N/A Mask out as required to D.R.G						17.06.06				
							18.06.06				
MASKING	As Specification and D.R.G.						19.06.06				
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum					
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	24.5	79%-17.				
						23.5	76%-16.				17.06.06
						21.5	79%-18.				18.06.06
										19.06.06	
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		24.5	79%-17.				17.06.06
						23.5	76%-16.				18.06.06
						21.5	79%-18.				19.06.06
1st COAT	2/Pack	150mic.	162 / 180mic.	Hempel Paints, 47940/9 RED	126020179	23.5	76%-16				18.06.06
						21.5	79%-18.				19.06.06
						25.5	76%-19.				20.06.06
2nd COAT	2/Pack	150mic.	157 / 163mic.	Hempel Paints, 47950/9 GREY	126020189	25.5	76%-19.				20.06.06
						24.5	78%-19.				21.06.06
						23.	76%-18.				22.06.06
3rd COAT	2/Pack	50mic.	58 / 60mic.	Hempel Paints, 5521E.	C6050273.	24.5	78%-19.				21.06.06
						23.	76%-18.				22.06.06
						25.	80%-19.				23.06.06
						24.	79%-17.				24.06.06
4th COAT											
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C				
350mic.	No	White		06.06.09	3186						

1. CONTRACT TITLE: EXETER RUGBY GROUND CABLE STAY BRIDGE STRUCT. NO: GRID REF:			
2. DATE OF ISSUE OF DOCUMENTS TO TENDERERS: 2006			
3. ENVIRONMENT AND ACCESSIBILITY		Inland A – Difficult Access.	
4. REQUIRED DURABILITY OF SYSTEM NO MAINTENANCE Up to 12 years MINOR MAINTENANCE From 12 years MAJOR MAINTENANCE After 20 years		5. COLOUR OF FINISH: RAL 9003 - SEMI GLOSS	
6. PAINT SYSTEM TO BE APPLIED OVER: Blast cleaned to Sa 2.5 AREA REF: All AREA DESCRIPTION: All Permanent Support Steelwork PROTECTIVE SYSTEM TYPE: I			
7. DETAILS			
	1 st Coat	2 nd Coat	3 rd Coat
DTP Registered Description	ZP HB Quick drying epoxy blast primer	MIO HB Quick drying epoxy undercoat/finish	Polyurethane 2 pack finish
Item No. & Colour	111 – 50630 oxide	112 – 13480 grey	169, RAL 9003
Date Registered by DTP	14/01/2004	14/01/2004	19/08/03
Brand Name and Manufacturers Ref No.	Hempadur 47940	Hempadur 47950	Hempathane 5521E
Data Sheet Ref No.	47940	47950	5521E
Where applied	Shop	Shop	Shop/Site
How applied	AS/B	AS/B	B/AS
Minimum dry film Thickness (mdft)	150	150	50
Max local dry film thickness (See C1.1914.7)	175	175	60
Estimated total volume of paint Likely to be used (Ltrs)			
"A" type testing required? (YES/NO) (See C1 1912.3)			
"B" type testing required? (YES/NO) (See C1 1912.9)			
8. STRIPE COAT DESCRIPTION (Including Item No. and Colour) SHOP: Stripe coats with item 112 between 2 nd /3 rd coats to all corners, sharp edges, joints etc		9. PAINT MANUFACTURERS OFFICIAL STAMP  HEMPEL UK LTD Llantarnam Park Cwmbran NP44 3XF	
10. MIN TOTAL DRY FILM THICKNESS OF PAINT SYSTEM (See note). 350µm NOTE: The minimum total dry film thickness of the paint system, neglecting primers and sealers under 30 microns, shall be 15% greater (to the nearest 25 microns) than the sum of the mdft of the individual coats.		11. APPROVED BY: DATE:	

Maintenance Information

MAINTENANCE SCHEDULE

Item	Inspection	Checks	Maintenance	Tools	Outline Method
A379 Central Reservation Crash Barrier (Eastbound)	Weekly	Visual Inspection	Remove build-ups of silt & debris; re-tension fasteners; arrange for professional repairs to be carried out.	Appropriate traffic management to Chapter 8.	Check for unrecorded impacts; misalignment; loose fasteners; cable damage; corrosion; vandalism; build-ups of silt or debris; and anything else which may cause the system to not function correctly.
	Annually	Physical Inspection		Torque wrench.	
Bridge Structure	Annually	Inspect Paint System	Check for damaged paintwork, & touch-up as necessary.	High Pressure Jet wash and water supply; Detergent; Paint brushes; Access system and Traffic Management as necessary	Thoroughly remove oils, dirt, grease and salts by washing with a suitable detergent, and then high pressure wash off with fresh water. Any degraded surface layer must be removed as well – high pressure water jetting may be sufficient. Touch up with Hempel paint system identified in Section 4 – Taylor & Sons.
	2 Yearly	General Inspection	Inspections to requirements of BD 63/94 and Devon County Council 'in-house' requirements.	As required	To be drawn up by a competent person
Bridge Structure cont.	6 Yearly	Principal Inspections	Inspections to requirements of BD 63/94 and Devon County Council 'in-house' requirements.	As required	To be drawn up by a competent person

Item	Inspection	Checks	Maintenance	Tools	Outline Method
	As Required	Special Inspections	Special inspections to be arranged if concern is raised over any parts of the structure (this mainly relates to old structures with defects).	As required	To be drawn up by a competent person
Street Lighting	As Required	Bulb / Glass / Housing Inspection	Replace Bulb / Glass / Housing	As required	Work to be carried out by competent persons, e.g. Councils street lighting contractor.

There are a number of maintenance items which have detailed method statements due to the nature of their importance in the structure and these detailed method statements are identified separately for the following:

- Changing a stay cable (other than the backstay cable);
- Replacing a bearing.

Replace Bushes or Bearing Pin on North Abutment

Interface with Public Right of Way

- The bridge should be closed to all public access during these works.

Hazards

- Working adjacent to Highway;
- Work at height;
- Lifting operations.

Plant & Equipment

- Task lighting;
- 2 nr. 50te x 50mm closed height pad jacks;
- 1 nr. 50te x 300mm closed height jack;
- 2 nr. Hydro wedges;
- Variety of spanners;
- Lump / Sledge hammer.

Personal Protective Equipment

- Protective footwear;
- Safety goggles or glasses;
- Gloves or gauntlets.

Methodology

- Position 2 nr. 50te jacks between the lower bearing stool and the abutment wall;
- Push the rams out to "take the weight";
- Position 1 nr. 50te jack under the end cross member to the abutment wall and push the ram out to "take the weight";
- Insert two bolts through the bearing cheek plates to hold the bearing static;
- Remove the cap plate retaining bolt;
- Adjust jacks to take load off of the bearing pin;
- Drive out the bearing pin;
- Bushes can be driven out and new inserted as necessary;
- Re-insert bearing pin, or new pin as required (note that this is a tight fit, and the bush will need to be restrained to ensure it is not pushed out);
- Check the bushes are in the correct position;
- Replace bearing retaining plate and fully tighten the retaining bolt;
- Remove temporary bolts;
- Lower off the jacks, observing the movement of the bridge;
- Remove jacks from site;
- Carry out paint repairs as necessary.

Changing a Stay Cable (not Backstay cables)

Interface with Public Right of Way

- The bridge should be closed to all public access during these works.

Hazards

- Working over the Highway;
- Work at height;
- Lifting operations.

Plant & Equipment

- Task lighting;
- Theodolite or Total Station;
- Hollow core hydraulic jack of suitable capacity, and spacers;
- Threaded bar extensions and couplers;
- Spanner, lump hammer, etc;
- Mobile Crane and mobile crane with Man rider basket.

Personal Protective Equipment

- Protective footwear;
- Safety goggles or glasses;
- Gloves or gauntlets;
- Hard hats.

Methodology

- Level Bridge at all cable positions, and verticality of tower;
- Close section(s) of road as required (the most effective access is MEWP, operating from the road below);
- Erect temporary access structure, with lifting beam (for jacks and other heavy equipment) - or similar (see note above re MEWP);
- Attach couplers and bar extensions to lower threaded bars;
- Attach jacks and jacking frame (spacers);
- Jack enough load so that the nuts can be undone;
- Run nuts back and release load in stages;
- Check level of bridge and verticality of tower at all stages - **ensure tower top is never more than 150mm out of verticality**;
- Once the cable load is removed the bottom end can be removed from the deck connection;
- Attach cable to crane with webbing strops;
- Attach the top of the cable to the crane;
- Remove top pin and lower cable to the ground;
- Replacement of cable is reverse of removal;
- Jack load in stages checking level of deck and tower constantly;
- Bring deck back to position before cable load released; **if cable load exceeds the loads shown on Hyder drawing by 20% seek further advice.**

Engineers Notes:

The load put into the cable should be similar to that shown on the Hyder cable drawing, although there must be a judgement made between load and level. The levels of the bridge deck should be checked during re-tensioning.

The important thing is to bring the deck back to the same position, providing the cable load shown on Hyder's drawing is not exceeded. If the cable load is not achieved but the deck has been returned to the same position that is fine.

Verticality of the main tower must be maintained, because if it moves more than 150mm from the vertical, some load will need to be released from a cable on the other side of the tower to ensure this movement is reduced - this should not need to happen - but it needs to be mentioned, as anything over 150mm will introduce high stresses in the tower connections.

Backstay Cable Change

The backstay cables are highly loaded, and control the verticality of the tower. If these need to be replaced a Consultant **MUST** be engaged to assess the load cases!

Hyder would suggest either a separate restraint system to take a similar load parallel to the existing cable is designed and introduced, (the same levelling stipulations will apply as for the cable replacement - deck and tower); or all the cables are released to such an extent that the cable can be replaced.

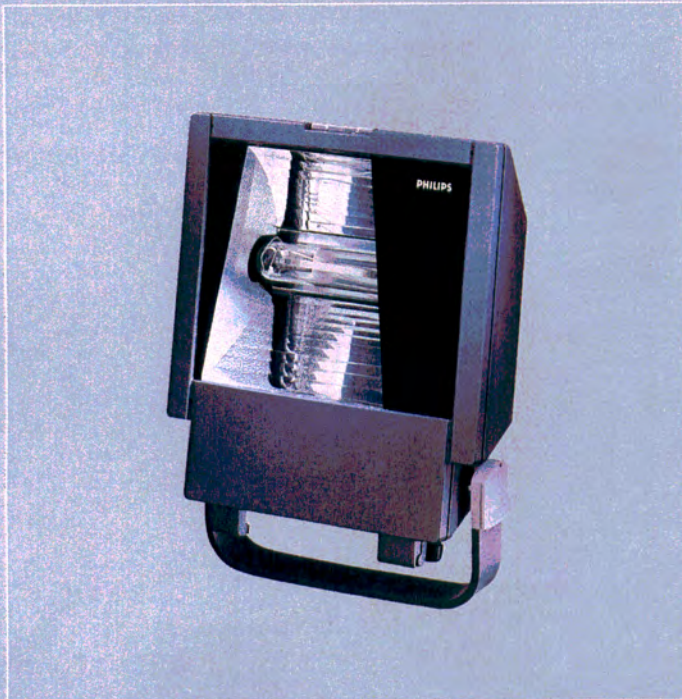
For any bridge of this type this is not a routine operation and Hyder would expect some form of analysis and detailed method statement to be developed in conjunction with the contractor. The critical member for any work on the cables is the tower. It is a tall slender structure with simple end connections.

Section Five

MECHANICAL & ELECTRICAL SERVICES

Southern Electric Contracting
(SEC)

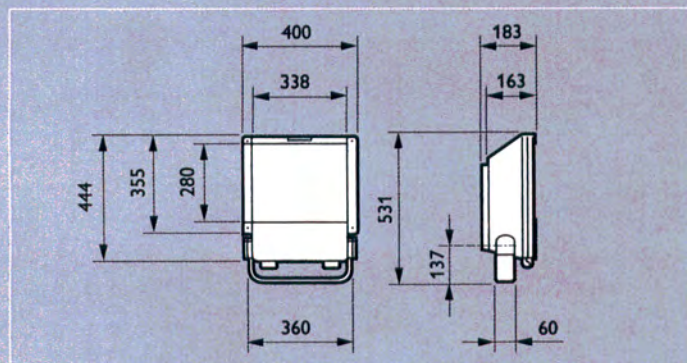




MVF617



Dimensions in mm



Decoflood MVF617

A large, high grade, asymmetrical floodlight with a choice of three light distributions from a variety of lamps. Well suited to city environments.

A wide range of accessories for lighting effects, glare reduction and damage protection. All-weather construction designed for simple cleaning and speedy servicing.

Main applications

- Parks / Pathways / Gardens
- Sculptures
- Bridges and structures
- Architectural floodlighting

Suitable lamp types

- SON-T 70W-400W
- HPI-T 250W-400W
- MHN-TD 250W
- CDM-T/TT 70W-150W

Available with CosmoPolis system in the course of 2006.

Luminaires are available as standard in kombipack format (K), complete with relevant lamp type.

Features

- Reflectors to project a symmetrical narrow (NB), medium (MB) or wide (WB) beam suited to façade lighting and CT-POT reflector (OR) suited to architectural street lighting
- Protractor scale for easy aiming. 'Memory ring' for immediate re-aiming if the floodlight should be swivelled off-beam
- Suitable for mounting on horizontal surfaces, walls and ceilings, and for pole mounting using suitable brackets
- Fast access to lamp and terminal blocks through front with snap action clip
- 240V/50Hz integral gear. Versions without gear available on request. Through-wiring facilities

Materials and finish

- High pressure die-cast aluminium housing, front frame and rear cover
- High grade anodised aluminium reflector
- Toughened 4mm thick glass
- UV stabilised polypropylene end caps
- Zinc coated aluminium mounting bracket
- Silicone rubber gaskets
- Finishing of housing and bracket in dark grey, other colours available on request, and end caps in light grey

Installation

Universal mounting bracket allows ceiling, wall or surface mounting. Cable entry via PG13.5 cable gland. Front window with snap action clip for in-position lamp replacement. Housing dustproof and waterproof to IP65; no internal cleaning required. Tilt angle 5° minimum when installed in post top.

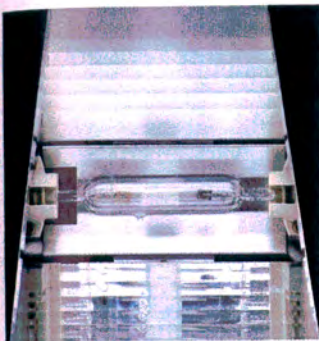
Accessories

For available accessories, please refer to the overview on page 5.40.

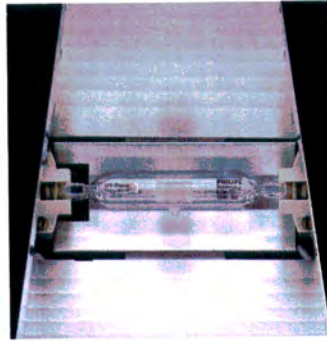
For an overview of the configuration possibilities, please refer to the range overview on page 5.37.

Preferred selection

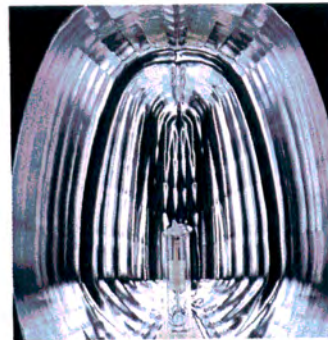
Product ID	Weight (kg)	European Order Code (EOC)	Product ID	Weight (kg)	European Order Code (EOC)
MVF617 CDO-TT70W/828 K 240V I OR GR ST	8.50	84991100	MVF617 SON-T70W K 240V I OR GR SP	8.50	84963800
MVF617 CDO-TT150W/828 K 240V I OR GR ST	8.50	84992800	MVF617 SON-T100W K 240V I OR GR SP	8.50	84964500
MVF617 CDM-T150W/830 K 240V I OR GR ST	8.50	84966900	MVF617 SON-T150W K 240V I OR GR SP	8.50	84965200
MVF617 HPI-TP250W K 240V I MB GR SP	10.56	84988100	MVF617 SON-T250W K 240V I MB GR SP	11.61	84986700
MVF617 HPI-TP250W K 240V I NB GR SP	10.56	67751400	MVF617 SON-T250W K 240V I NB GR SP	11.61	67717000
MVF617 HPI-TP250W K 240V I WB GR SP	10.56	67721700	MVF617 SON-T250W K 240V I WB GR SP	11.61	67718700
MVF617 MHN-TD250W K 240V I MB GR SP	11.61	84990400	MVF617 SON-T400W K 240V I MB GR SP	13.37	84987400
MVF617 MHN-TD250W K 240V I NB GR SP	11.61	67724800	MVF617 SON-T400W K 240V I NB GR SP	13.37	67719400
MVF617 MHN-TD250W K 240V I WB GR SP	11.61	67725500	MVF617 SON-T400W K 240V I WB GR SP	13.37	67720000
MVF617 HPI-TP400W K 240V I MB GR SP	11.66	84989800			
MVF617 HPI-TP400W K 240V I NB GR SP	11.66	67722400			
MVF617 HPI-TP400W K 240V I WB GR SP	11.66	67723100			



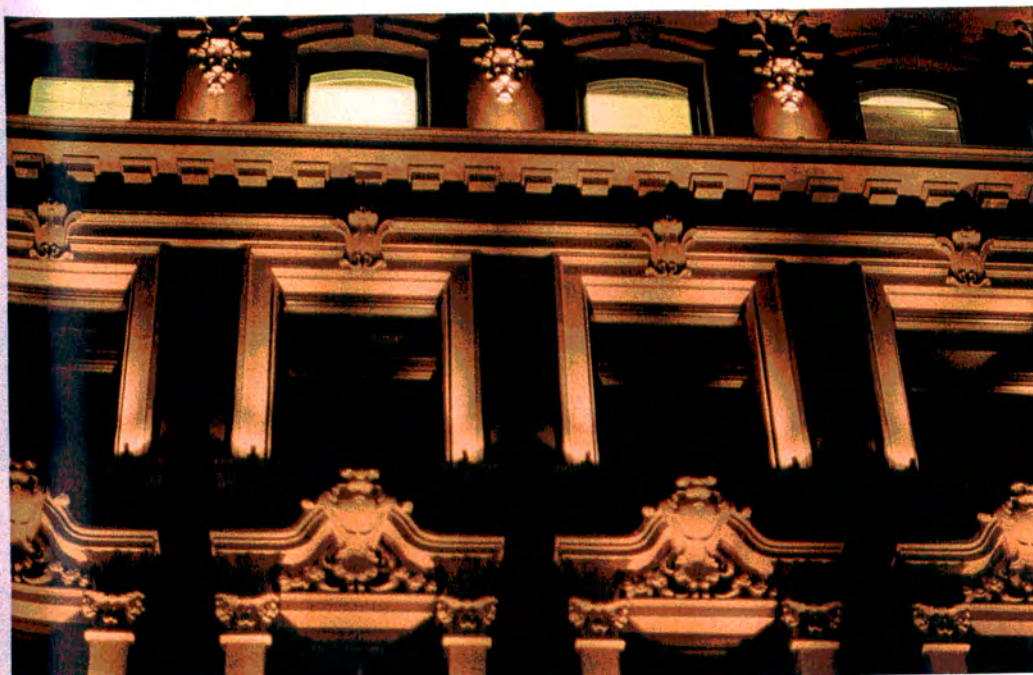
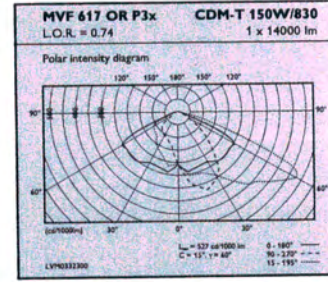
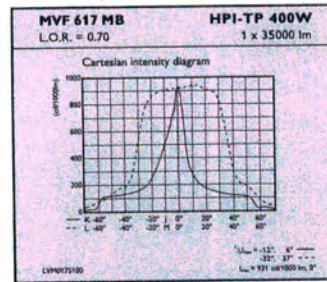
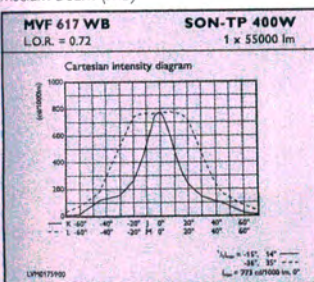
Medium beam (MB)



Wide beam (WB)



Open CT-POT (OR)



Trent



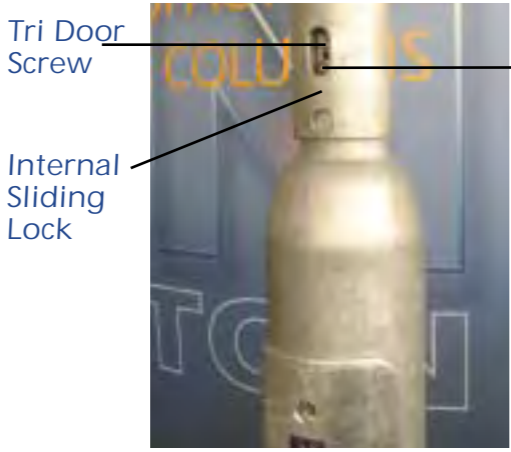
Trent

Mid Hinged Tubular Column 3m to 12m

A range of Mid Hinged Tubular Steel Lighting Columns for heights from 3 metres up to 12 metres.

Designed with simplicity in mind, the hinging method is a simple one man see-saw operation requiring no special tools.

Designed with security in mind, the unique triple locking device prevents accidental lowering of the column.



Tri Door Screw

Internal Sliding Lock

Anti-Vandal Locking Screw

Optional Extras

- Flange Plates
- Cross arm for floodlight
- Flush door
- Various paint finishes

Specification

Column Height	Base Diameter	Shaft Diameter	Maximum Weight	Maximum Wind Area
3m to 6m	139 mm	76 mm	20 kg	0.3 m ²
8m	168 mm	89 mm	20 kg	0.3 m ²
10m	168 mm	114 mm	20 kg	0.3 m ²
12m	194 mm	139 mm	20 kg	0.3 m ²

Locking Devices



Dukesway,
Teesside Industrial Estate,
Stockton on Tees,
United Kingdom,
TS17 9LT.
Tel: +44 (0)1642 766242
Fax: +44 (0)1642 765509
Website: www.stainton-metal.co.uk
Email: enquiries@stainton-metal.co.uk

Door opening size and planting depths are in accordance with EN40

Mid Hinged Tubular Column
3 to 12 metre



Raising the Standard



SGS252/452

Iridium SGS252/452

The Iridium range has an elegant, gently rounded form. It offers a wide choice of optical, electrical and mechanical combinations to suit all applications. In addition, its modularity allows the integration of new optical or electronic components in order to adapt to the changing demands of road lighting, e.g. the growing demand for white light and controls. Iridium ensures low cost of ownership thanks to its superior optics and low maintenance and installation costs. Iridium SGS252/452 has been designed for use with lamps up to SON-T 100W for lower mounting heights in residential areas and on minor roads.

Main applications

- Minor roads
- Residential areas
- Industrial estates
- Cycleways and footpaths

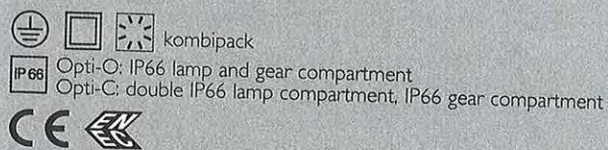
Suitable lamp types

- CosmoPolis*
 - CPO-TW 60W
 - SON-E/T 50/70/100W
 - SON-I 50/70W
- HPL-N 50/80/125W
- CDM-T 35/70/150W
- CDO-ET/TT 70/100W
- PL-T 32/42W

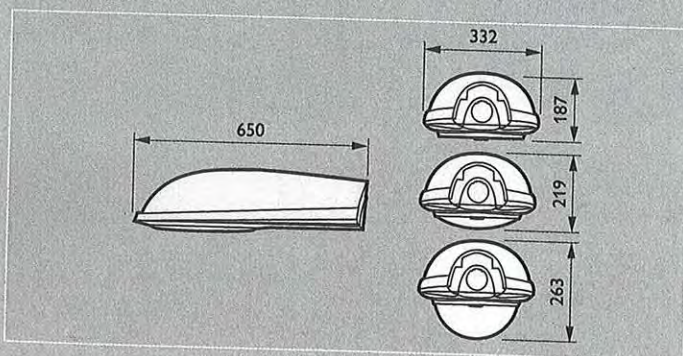
* Remaining CosmoPolis system types available in due 2005/2006. The SON-T Pia Plus and CDO-TT lamps can be supplied as standard in kombipack format (K). CosmoPolis system types are only available in kombipack format (K).

Features

- A timeless luminaire with an elegant, gently rounded form
- Two concepts within one luminaire: the 'Opti-C', where the reflector forms one unit with the bowl, and the lamp holder is attached to the reflector. This minimises maintenance due to the double protection (optic and luminaire), and the 'Opti-O', where the reflector is attached to the canopy. This facilitates maintenance because it provides easy access for relamping
- A future-proof luminaire: IP66 for the whole luminaire, including gear tray, giving a high level of protection for future electronic components, double protection for Opti-C, giving maximum assurance that no dust and water will penetrate throughout the life of the luminaire
- More efficiency: with the integration of the CosmoPolis system; the CPO-TW lamp with the Highly efficient reflector and electronic ballast, better spacing (in new installations) and less energy consumption (in new and existing installations) can be obtained
- Optics: the CT-POT is a newly developed optic that delivers outstanding performance and is the first to do so with CDM-T, CDO-TT and SON-T lamps. Adjustable optical distribution, thereby ensuring maximum flexibility
- Long-life canopy: the canopy is made of aluminium (SGS452) or glass fiber reinforced polyester (SGS252) with In Mould Coating (IMC), which prevents the glass fibers becoming exposed
- RAL colours on request, either for the canopy on its own or for the complete luminaire
- Choice of bowls: vandal-resistant polycarbonate bowl, ensuring widest spacings and best vandal resistance, a toughened shallow glass bowl, reducing light pollution and enhancing the design,



Dimensions in mm



- a flat glass, preventing glare and light pollution
- Wide range of electrical options: knife connector, fuse, series and semi-parallel ignitors, photocell options
- Chronosense stand alone dimming system, which does not require a signal cable
- Also available with DynaVision electronic ballast and with Starsense Telemangement
- Environmental friendly: energy saving by dimming, reduction of light pollution with a choice of optic cover, louvres and light output. Designed for full disassembly at the end of life: plastic parts are coded to facilitate recycling
- Fast installation: a 'flexi-fit' for simple mounting, side-entry or post-top
- Easy maintenance from above. Exchange of lamp, gear unit and bowl is tool-less. Plug and socket connectors for tool-less disconnection
- The whole luminaire complies with the standards laid down by EN 60598-2-3

Materials and finish

- Canopy: aluminium or glass-fibre-reinforced polyester with In-Mould Coating (IMC)
- Standard colour: grey RAL 7035, other RAL colours on request
- Frame: sand-blasted die-cast aluminium

Preferred selection

Product ID	Weight (kg)	European Order Code (EOC)
SGS252 SON-T PIA Plus		
SGS252 SON-T50W K 240 I CR PC GR ST	7.40	67685200
SGS252 SON-T70W K 240V I CR PC GR ST	7.40	67686900
SGS252 SON-T100W K 240 I OR GB GR ST	8.70	67687600
SGS252 CDO-TT MASTERCOLOUR		
SGS252 CDO-TT70W K EB 240 I CR PC GR	6.50	67688300
SGS252 CDM-T MASTERCOLOUR		
SGS252 CDM-T35W 240 I CR PC GR ST	7.10	67689000

Accessory	Weight (kg)	European Order Code (EOC)
Louvres		
ZGS252 L-FRONT V2	0.06	83758100
ZGS252 L-BACK V2	0.06	83759800
Spigot adaptor		
ZGP340 AD34	0.63	13148199



Front and back louvres, easily and quickly attached to the Iridium luminaire after installation.

- Bowls: UV stabilised polycarbonate bowl, toughened flat glass or toughened shallow glass bowl
- Reflector: high-purity aluminium
- Gear-tray housing: polyamide
- Clip: stainless steel

Installation

Integrated spigot adaptor, flexible for side-entry 34-60mm and post-top 60-76mm. The spigot adaptor does not have to be ordered and installed separately.

Accessories

- Louvres (ZGS252): easy-to-install front and back louvres help to eliminate spill light
- Spigot adaptor (ZGP340 AD34), required for 'hockey stick' columns with spigots of 34mm diameter, to ensure clearance of spigot / column shoulder when opening canopy.

For an overview of the configuration possibilities, please refer to the range overview on page 3.16.

Product ID	Weight (kg)	European Order Code (EOC)
SGS252 CPO-T COSMOPOLIS		
SGS252 CPO-T60W/728 K EB 240 I OC PC GR	6.50	67690600

Notes:

Photocell options; add suffix P1 for NEMA socket or P3 for integrated electronic mini photocell.
Aluminium canopy; replace SGS252 with SGS452
Colours; replace GR with COXXXX or ALXXXX (CO; canopy only, AL; all luminaire, XXXX; RAL code).
Electronic ballasts; add prefix EB to 240V
Electronic dimming ballasts; P.O.A.
Voltage option; replace 240 with 230 for 230 Volt



"Opti-O", where the reflector is attached to the canopy. This facilitates maintenance because it provides easy access.



"Opti-C", where the reflector forms one unit with the bowl, and the lamp holder is attached to the reflector. This requires no internal cleaning of the optic assembly.

Corniche

Updated January 2006

T16 (FD)	3000/6000K
G5	24 - 39W
EN 60598	Class II Electrical
Ta (max): 35°C	IK10/20Nm
IP65	CE

Slim linear T5 (T16) luminaire providing 'close off-set' façade illumination with good uniformity



- Ideal for providing a broad band of even illumination on a surface from a close mounting position
- Built in thermal protection device maintains lamp operating temperature for optimum output
- Possibility of uplighting as well as downlighting
- Neat profile enables unobtrusive installation
- Supplied with high output T5 (T16) fluorescent lamps, operating from electronic control gear. Choice of wattages and colour temperature - 3000 or 6000K
- Available in 2 lengths: 620mm and 920mm
- Choice of asymmetric or symmetric reflectors
- Extruded aluminium body and aluminium end caps

Materials/Finish

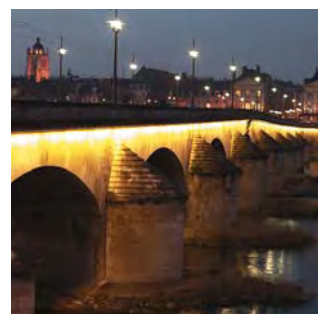
Body: extruded aluminium, finished in powder coated polyester paint
 End caps: aluminium, finished in powder coated polyester paint.
 Brackets: galvanised steel, finished in 'Contrast Grey' powder coated polyester paint.
 Lens: polycarbonate sealed by neoprene gasket.
 Facetted reflector: bandoxal aluminium.
 Screws: stainless steel.
 RAL colours: available on request.

Installation/Mounting

Supplied with a pre-wired 1.0m length of cable (3 x 1.0mm²) with a connected IP54 rated Wieland plug (4Kv/3 VDE 0110/01.89). Terminal block capacity of Wieland plug: 3 x 2.5mm². Access to lamp and control gear gained by removing front lens. The projector is supplied with two versatile brackets which can be slid along the length of the extrusion so that a variety of different fixing points are available. These brackets provide easy installation and maintenance on uneven surfaces.

Specification

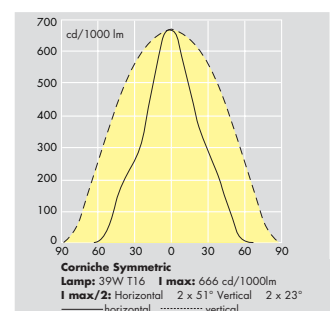
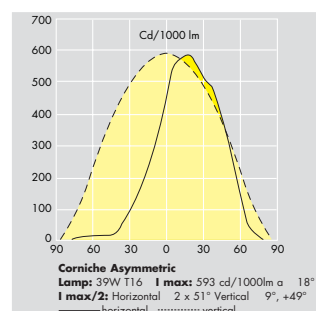
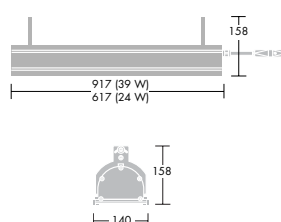
Wall washing linear floodlight for 24/39W T5 (T16) linear fluorescent lamps with symmetric/asymmetric light distribution and glass/polycarbonate enclosure. Sealed to IP65. As Thorn Corniche.



Sliding fixing brackets

Ordering Guide

New Description	Weight (Kg)	SAP code	Old Cat. No.	SAP code	Old Cat. No.
Polycarbonate		Asymmetric	Asymmetric	Symmetric	Symmetric
CORNICHE 24W T16/LI/830 E/PC	3.6	96010444	CCT5243KAR.4	96010440	CCT5243KSR.4
CORNICHE 24W T16/LI/860 E/PC	3.6	96010451	CCT5246KAR.4	96010447	CCT5246KSR.4
CORNICHE 39W T16/LI/830 E/PC	5.0	96010445	CCT5393KAR.4	96010442	CCT5393KSR.4
CORNICHE 39W T16/LI/860 E/PC	5.0	96010453	CCT5396KAR.4	96010449	CCT5396KSR.4
Accessory		SAP code	Old Cat. No.		
ALTERNATIVE RAPID DE-MOUNT SURFACE MOUNTING BRACKET (PAIR)	0.3	96012339	CCTBKT		
830 - 3000K lamp temperature 860 - 6000K lamp temperature					



Setting Out Drawings Showing Lighting to Bridge & Footpath



PLEASE NOTE: This plan only shows details of the Western Power Distribution. Electricity assets owned by other undertakers are shown as they appear in the area.

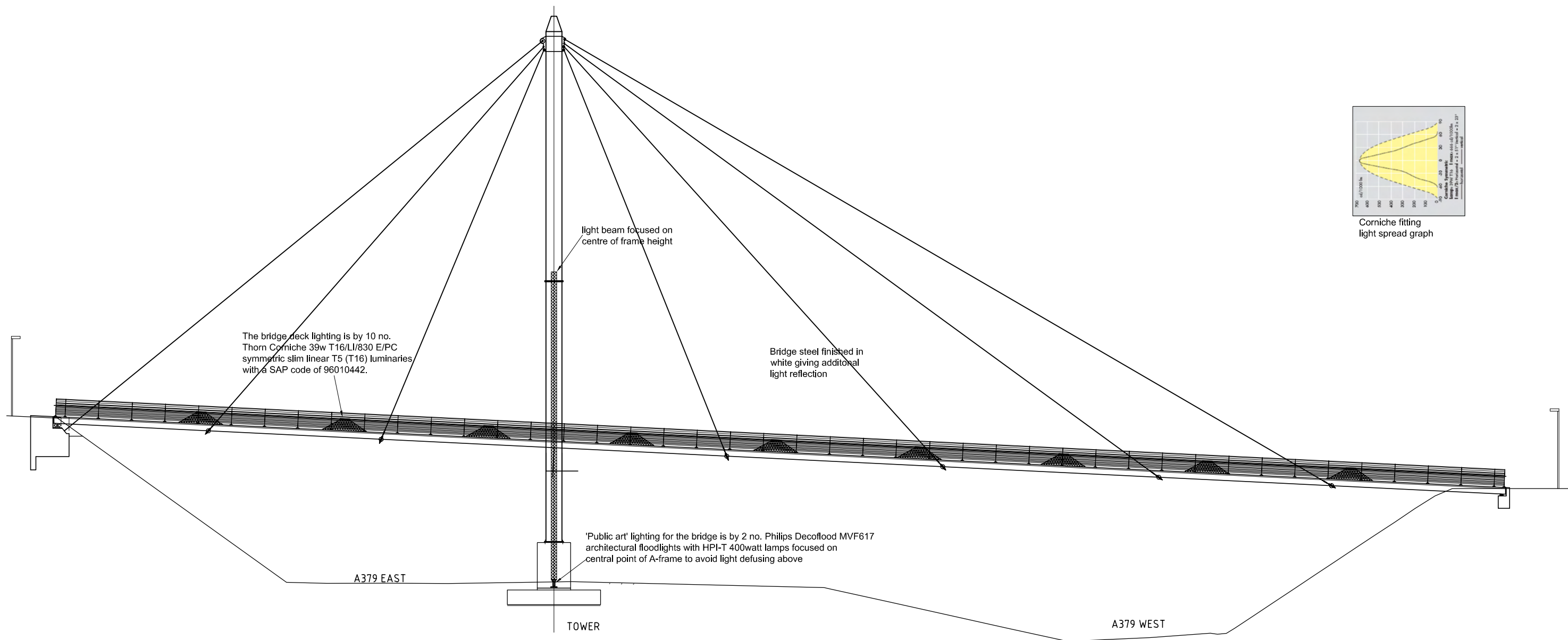
Based upon the information furnished to the author by the Engineer of the Western Power Distribution Office, Exeter, Devon, and the author's own observations on the spot, the author is not responsible for any errors or omissions in this plan.

WESTERN POWER DISTRIBUTION has been made by me with the authority of Western Power Distribution and I warrant to the best of my knowledge and belief that the information contained in this plan is true and correct.

ADVISE ENGINEER OF ANY CHANGES TO THIS PLAN IN PROXIMITY TO 33KV OVERHEAD CABLES AND 132KV OVERHEAD LINES

SWP TELEGRAPH	REPEAT LINE	PL	OVERHEAD CABLE	11kV Earth	Site Mounted Transformer
PILOT CABLES	DUCT	SPUR	UNDERGROUND CABLE	11kV Earth	Ground Mounted Transformer
		11kV			
		6.6kV			
		3.3kV			
		1.1kV			
		0.4kV			
		0.2kV			
		0.1kV			
		0.05kV			
		0.02kV			
		0.01kV			

DATE: 21-5-2006
 SCALE: 1:500
 DRAWN BY:
 TITLE:
 PLOT CENTRE: 286352.057, 91063.061



The bridge deck lighting is by 10 no. Thorn Corniche 39w T16/LI/830 E/PC symmetric slim linear T5 (T16) luminaries with a SAP code of 96010442.

light beam focused on centre of frame height

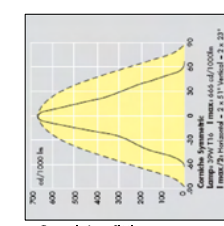
Bridge steel finished in white giving additional light reflection

'Public art' lighting for the bridge is by 2 no. Philips Decoflood MVF617 architectural floodlights with HPI-T 400watt lamps focused on central point of A-frame to avoid light defusing above

A379 EAST

TOWER

A379 WEST



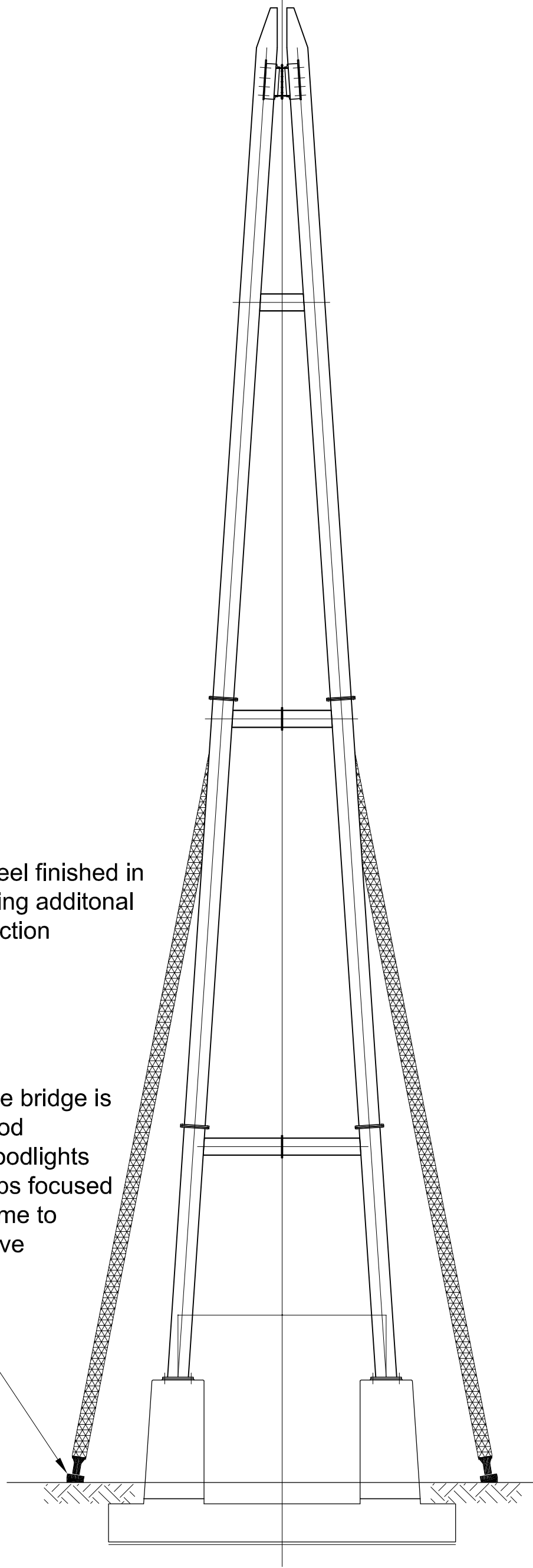
Corniche fitting light spread graph

ELEVATION OF PROPOSED PUBLIC ART LIGHTING SCHEME FOR THE NEW CYCLE / FOOTBRIDGE OVER A379 CARRIAGEWAY
 REV 'A' - lighting references added

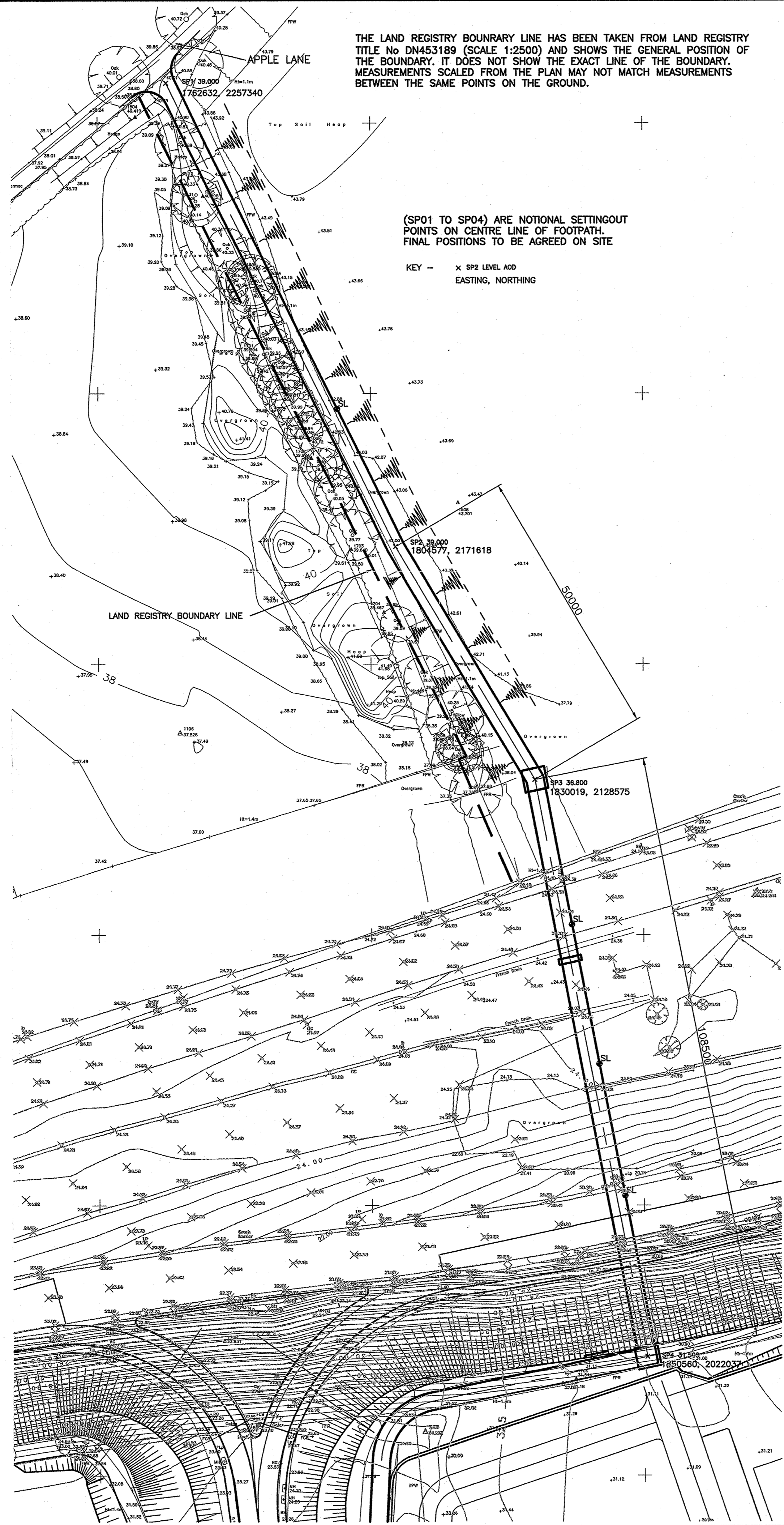
BRIDGE

Bridge steel finished in white giving additional light reflection

'Public art' lighting for the bridge is by 2 no. Philips Decoflood MVF617 architectural floodlights with HPI-T 400watt lamps focused on central point of A-frame to avoid light defusing above



BRIDGE TOWER
SECTIONAL ELEVATION



THE LAND REGISTRY BOUNDARY LINE HAS BEEN TAKEN FROM LAND REGISTRY TITLE No DN453189 (SCALE 1:2500) AND SHOWS THE GENERAL POSITION OF THE BOUNDARY. IT DOES NOT SHOW THE EXACT LINE OF THE BOUNDARY. MEASUREMENTS SCALED FROM THE PLAN MAY NOT MATCH MEASUREMENTS BETWEEN THE SAME POINTS ON THE GROUND.

(SP01 TO SP04) ARE NOTIONAL SETTINGOUT POINTS ON CENTRE LINE OF FOOTPATH. FINAL POSITIONS TO BE AGREED ON SITE

KEY - x SP2 LEVEL ADD EASTING, NORTHING

NOTES

1. DO NOT SCALE THIS DRAWING.
2. ALL ERRORS & OMISSIONS ARE TO BE REPORTED TO THE ENGINEER FOR CLARIFICATION.

C1 10/01/06 CONSTRUCTION ISSUE WNM

Client: EXETER RUGBY GROUP (ERG)

Project: EXETER RUGBY CLUB DESTINATION SITE

Title: SETTINGOUT POINTS FOR PEDESTRIAN FOOTPATH & CYCLE WAY FROM APPLE LANE

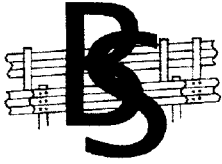
Design: TDG CAD: WNM
 Chkd: CC App'd: TG
 Date: 10/01/06 Scale: 1:200

FABER MAUNSELL | AECOM

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No. 41538WXC/CL(9)410 Rev: C1

Testing & Commissioning



FINAL INSPECTION CERTIFICATE

CONTRACT NO.: Sw938

CONTRACT NAME: A379 Sandy Gate, Exeter Rugby Club

DATE: 24th August 2006

DETAILS OF WORKS:- To Construct Safety Barrier in Accordance with Highways
Construction Manual & Design

DROBB To Structure with GA35 Transitions, P4 Approach Terminal, Tie in
Departure to Existing TCB

The above contract works are substantially completed to my satisfaction:-

SIGNED: _____
(for BARRIER SERVICES LIMITED)

NAME: _____

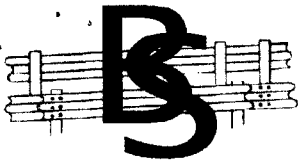
POSITION HELD: Contracts Manager

SIGNED: _____
(for Client)

NAME: _____

POSITION HELD: _____

NOTE: Notwithstanding the above BSL agree to carry out any outstanding remedials that the
Engineer deems necessary during the period of maintenance as detailed in the Contract.



QMS: INSPECTION REPORT

No:

(Begin each new contract with 1)

IN - PROGRESS *FINAL *

* Please tick as appropriate

Contract Name: A379 Exeter Rugby Club
 Client: Dean & Dyball
 Area / Location Inspected: A379 Footbridge Protection
 Date: 24th August 2006

No	Inspection Element	Requirement	Comment (Please use reverse of this form for additional space if necessary).	Conforms Yes or No	NCR No. (if any)
1	Method Statement and Risk assessment briefing	Required		Yes	
2	Permit to Dig issued	Required		Yes	
3	Setting out	Line and level from contract drawings		Yes	
4	Safety Fence Components	To BS EN 10 025 Grade S275	Hill and Smith	Yes	
5	Minimum Clearance and Post Centres	GA33 & GA35		Yes	
6	Height of Beam Centres	610mm from c/w		Yes	
7	Fence Post Footings	Concrete	Machine Excavated	Yes	
8	Footing Compaction	Hand Tamped Concrete Poker Unit	Poker Unit	Yes	
9	Push Over Tests Pull Tests	Tested to HCD Volume 3 Section 2 Drg No PTE/09 Tested to HCD Volume 1 Clause 404	N/A		
10	Tensioning	Tensioned to BS7669: Part 3 Section 2.1	N/A		

Number of NCR's raised on this report

FINAL INSPECTION ONLYTotal number of NCR's on this job

Have all NCR's been satisfactorily addressed and corrective actions successfully applied?

If no, please give details: YES

Inspected by:  (Sign) (Print)

Date In	Works No	Customer		Customer Order No.	Description				
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR	Hand rail Units				
PROCESS	As Specification. Look at painting Sheet for Top coat				Operator insp	Date	On	Off	Materials Used
DEGREASE	N/A Mask out as required to D.R.G					14.07.06			
MASKING	As Specification and D.R.G. Paint no Top Coat on Hand Rail / Top Tube.					15.07.06 17.07.06			
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum			
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	24.5 25.5 28.5	76%-16. 81%-19. 79%-18.	14.07.06 15.07.06 17.07.06	
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		24.5 25.5 28.5	76%-16. 81%-19. 79%-18.	14.07.06 15.07.06 17.07.06	
1st COAT	2/Pack	150mic.	150 / 160mic.	Hempel Paints, 47940/9 RED	126020179	24.5 24. 25.5 28.5	76%-16. 76%-16. 81%-19. 79%-18.	12.07.06 14.07.06 15.07.06 17.07.06	
2nd COAT	2/Pack	150mic.	167 / 170mic.	Hempel Paints, 47950/9 GREY	126020189	33.5 23.5 27.5 28.5	76%-16. 79%-16. 76%-17. 75%-18.	19.07.06 21.07.06 23.07.06 25.07.06	
3rd COAT	2/Pack	50mic.	54 / 60mic.	Hempel Paints, 5521E.	C6050273.	28.5 26. 28.5 23.5	79%-16. 76%-17. 74%-16. 78%-15.	27.07.06 28.07.06 29.07.06 31.07.06	
4th COAT									
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C		
350mic.	No	White			31.07.06	3278			



Date In	Works No	Customer		Customer Order No.	Description				
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR	Bridge Steel work. 1st 2 Units. 16.Mtr Long.				
PROCESS	As Specification. Look at painting Sheet for Top coat				Operator insp	Date	On	Off	Materials Used
DEGREASE	N/A Mask out as required to D.R.G					17.05.06			
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,								
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum			
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work		16.5	70%-9.		17.05.06
						15.5	74%-9.		18.05.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		16.5	70%-9.		17.05.06
						15.5	74%-9.		18.05.06
1st COAT	2/Pack	150mic.	175 / 182mic.	Hempel Paints, 47940/9 RED	126020179	15.5	74%-9.		18.05.06
2nd COAT	2/Pack	150mic.	169 / 167mic.	Hempel Paints, 47950/9 GREY	126020189	15.5	74%-9.		18.05.09
						12.5	76%-8.		19.05.06
3rd COAT	2/Pack	50mic.	56 / 63mic.	Hempel Paints, 5521E. In Side face,	C6050273.	15	78%-7.		20.05.06
						12.5	71%-7.		22.05.06
4th COAT									
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/O		
350mic.	No	White			22.05.06	3186			

Date In	Works No	Customer		Customer Order No.	Description				
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR	Bridge Steel work. 3,units 16.Mtr Long. Plus 10mtr Long				
PROCESS	As Specification. Look at painting Sheet for Top coat				Operator insp	Date	On	Off	Materials Used
DEGREASE	N/A Mask out as required to D.R.G					23.05.06			
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,								
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum			
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	14.5	74%-9.		23.05.06
						15.	76%-8.		24.05.06
						17.5	73%-6.		25.05.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		14.5	74%-9.		23.05.06
						15.	76%-8.		24.05.06
						17.5	73%-6.		25.05.06
1st COAT	2/Pack	150mic.	181 / 192mic.	Hempel Paints, 47940/9 RED	126020179	14.5	74%-9.		23.05.06
						15.	76%-8.		24.05.06
2nd COAT	2/Pack	150mic.	158 / 168mic.	Hempel Paints, 47950/9 GREY	126020189	17.5	73%-6.		25.05.06
						16.	70%-9.		26.05.06
3rd COAT	2/Pack	50mic.	59 / 60mic.	Hempel Paints, 5521E. In Side face,	C6050273.	15.5	72%-8.		27.05.06
									28.05.06
4th COAT									
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C		
350mic.	No	White			30.05.06	3186			

Date In	Works No	Customer		Customer Order No.		Description					
16.05.06	2691	Taylor and Son Ltd		SZ84177/CAR/JR		Bridge Steel work. 3no units X 16.Mtr Long.					
PROCESS	As Specification. Look at painting Sheet for Top coat					Operator insp	Date	On	Off	Materials Used	
DEGREASE	N/A Mask out as required to D.R.G						26.05.06				
MASKING	As Specification and D.R.G. Paint on Top Coat on inSide Face Only,										
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum					
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	16.5	70%-9.				26.05.06
						15.5	72%-8.				27.05.06
						23.5	78%-18.				30.05.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		16.5	70%-9.				26.05.06
						15.5	72%-8.				27.05.06
						23.5	78%-18.				30.05.06
1st COAT	2/Pack	150mic.	165 / 180mic.	Hempel Paints, 47940/9 RED	126020179	23.5	78%-18.				30.05.06
						24.5	76%-19.				31.05.06
2nd COAT	2/Pack	150mic.	158 / 161mic.	Hempel Paints, 47950/9 GREY	126020189	23.5	76%-18.				02.06.06
						25.5	78%-19.				03.06.06
3rd COAT	2/Pack	50mic.	50 / 69mic.	Hempel Paints, 5521E. In Side face,	C6050273.	24.5	72%-15.				05.06.06
						22.5	76%-17				06.06.06
4th COAT											
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C				
350mic.	No	White			06.06.09	3186					

Date In	Works No	Customer	Customer Order No.	Description							
16.05.06	2691	Taylor and Son Ltd	SZ84177/CAR/JR	Bridge Mast unit and Steel work.							
PROCESS	As Specification. Look at painting Sheet for Top coat					Operator insp	Date	On	Off	Materials Used	
DEGREASE	N/A Mask out as required to D.R.G						17.06.06				
							18.06.06				
MASKING	As Specification and D.R.G.						19.06.06				
	Quality	Min Thickness		Paint MFR + Ref No.	Batch No.	Temp/Hum					
SHOT BLASTING	SA2.5	50 / 75 ym.		Shot blast all steel work	G17 / G24	24.5	79%-17.				17.06.06
						23.5	76%-16.				18.06.06
						21.5	79%-18.				19.06.06
METAL SPRAYING	N/A	N/A	N/A	Remove all spent shot		24.5	79%-17.				17.06.06
						23.5	76%-16.				18.06.06
						21.5	79%-18.				19.06.06
1st COAT	2/Pack	150mic.	162 / 180mic.	Hempel Paints, 47940/9 RED	126020179	23.5	76%-16				18.06.06
						21.5	79%-18.				19.06.06
						25.5	76%-19.				20.06.06
2nd COAT	2/Pack	150mic.	157 / 163mic.	Hempel Paints, 47950/9 GREY	126020189	25.5	76%-19.				20.06.06
						24.5	78%-19.				21.06.06
						23.5	76%-18.				22.06.06
3rd COAT	2/Pack	50mic.	58 / 60mic.	Hempel Paints, 5521E.	C6050273.	24.5	78%-19.				21.06.06
						23.5	76%-18.				22.06.06
						25.5	80%-19.				23.06.06
						24.5	79%-17.				24.06.06
4th COAT											
TOTAL DFT	Gloss	Colour	Final Inspection		Date	D/N	C/C				
350mic.	No	White		06.06.09	3186						