LERWICK TO BRESSAY

ZETTRANS

STAG 2 REPORT

FIXED TUNNEL LINK

May 2008

Date	Revision	Pages	Appendices	Originator	Check	Approved
13/5/08	B05	1 – 16	-	JP/AS	AS	AS

Donaldson Associates Ltd
The Pentagon Centre
Washington Street
Glasgow
G3 8AZ

CONTENTS

DRAWINGS

1.0 INTRODUCTION

1.1 An initial study of options has been carried out and reported in a STAG Part 1 Report published in February 2008. That report concluded a single bore, bi-directional road tunnel constructed using mechanised drill and blast techniques met national and local objectives and recommended that this option, along with several others, be taken forward to more detailed appraisal (STAG Part 2).

1.2 This report has been produced as part of the STAG process and is to be considered as a supporting document. The intention is that it be included as an Annex to the Stag 2 report. It summarises the more pertinent information contained in the report entitled 'Fixed Tunnel Link Report', produced by Donaldson Associates Ltd (DAL) in May 2008, which should be referred to for further detail if required.

1.3 The report provides information on tunnel construction and makes recommendations for the tunnel geometry, alignment, required support, and the mechanical and electrical provisions that should be allowed for. The report concludes with budget costs and an indication of programme if such a tunnel was taken forward.

2.0 DESCRIPTION OF TUNNEL PROPOSAL

2.1 General

2.1.1 The preferred tunnel crossing is at the Point of Scattland to the north of lerwick town centre, across to Heogan Road on Bressay. A site location plan showing the proposed alignment is included as Figure 1 and more detail is presented in drawing JS533/101.

2.1.2 The tunnel would be 1200m long and at its deepest point the road would be 43 metres below Ordnance Datum (OD). The cover above the tunnel would be a minimum of 25m to sea bed level which for the purposes of design is taken as -10 mOD.

Plate 1 Typical sub-sea road tunnel

2.2 Route Selection

2.2.1 In determining the horizontal alignment of possible crossings, the main objectives were:

- To minimise road gradients, adopting a maximum of 8%.
- To achieve road curvature to comply with British Standards.
- To portal (i.e. locate the tunnel exit) as close as possible to the centre of Lerwick and the population centre of Bressay.
- To have relatively level ground at the portals.
- To minimise the effect on existing buildings and utilities wherever possible.
- To have the shortest possible crossing.

2.2.2 A selection of routes was considered during the study commissioned by LPA[1,2]. At that time alternative routes were considered but discounted. A crossing at Greenhead Base, further north at Turra Taing was rejected due to the difficulty in constructing roads to connect into the Lerwick to Dales Voe road. Further, the depth to rockhead and the onshore topography in this location resulted in the need for a relatively long tunnel and long portal approaches in contrast with the

[1] Lerwick to Bressay Fixed Link, Tunnel Preliminary Feasibility Study carried out for Lerwick Port Authority by Donaldson Associates Limited, September 2005

[2] Lerwick to Bressay Fixed Link, Tunnel Stage 1 Study Report carried out for Lerwick Port Authority by Donaldson Associates Limited, November 2

Point of Scattland crossing. In addition, the distance from the centre of Lerwick and the portal position on Bressay were impractical from an end use perspective.

2.2.3 Crossings to the centre of Lerwick were considered impractical from a technical and cost perspective, in addition to the disruption that would be required to Lerwick town. The technical reasons are given in section 2.2.4 below. The route shown on drawing JS533/101 is considered to be optimum in light of the above requirements.

2.2.4 The issue of route alignment was re-visited during the STAG process. There has been interest from stakeholders in the possibility of forming a tunnel that would portal (i.e. exit) closer to Lerwick town centre than that proposed for the optimum alignment. This has been reviewed and while there are many benefits from an end user perspective it is not considered practicable when compared with the Scattland to Heogan alignment. The reasons for this are as follows;

- The length of the tunnel would be much greater than the Scattland to Heogan alignment. This would significantly increase construction costs.
- The land in Lerwick rises steeply from the harbour front making it difficult to bring a tunnel to the surface over a short distance while keeping gradients to a minimum.
- There is little free land in Lerwick town centre where a tunnel portal and new link road and approaches could be constructed.
- Overcoming the difficulty in finding available land and reducing the length of the tunnel by reclaiming land and forming a tunnel portal in the harbour has been suggested by a stakeholder. This has been reviewed and the conclusion reached that this could not be achieved by any tunnel other than an immersed tube tunnel. The high financial cost, the disruption to shipping during construction and heightened environmental impact of this form of construction led immersed tube tunnels to be dropped from the assessment process at STAG 1 stage.

3.0 DESIGN CONSIDERATIONS FOR A ROAD TUNNEL

3.1 Planning

3.1.1 The design of road tunnels in the UK is undertaken to the requirements of BD 78/99 ‘Design of Tunnels’, Volume 2, Section 2.

3.1.2 It is likely that the tunnelled link would fall into Category B of Table 3.1 of BD 78/99 on the basis that the tunnel would be nominally 1200m in length and have a low annual average daily traffic flow (AADT). BD 78/99 recommends that the following basic safety provisions set out in Table 1 are made for tunnels in Category B.

Emergency telephones	●
Radio rebroadcasting system	○
Traffic loops	○
CCTV	○
Hand held fire extinguishers	●
Pressurised fire hydrants	●
Fire hose reels	○
Emergency exit signs	●
Lane control and tunnel closure signs/signals	●
Emergency walkway	●
Ventilation for smoke control	●
Emergency Stopping Lane *[1]	○

*[1] BD 78/99 acknowledges that due to high cost there are very few examples of these and it is not proposed here-in

● Normal provision

○ Requirements to be determined during planning

Table 1 Basic Safety Provisions for Category B Tunnel (after BD 78/99)

3.1.3 A traffic management scheme would be developed for the tunnel. This would be focused on the safety of tunnel users.

3.1.4 Further risk management measures may need to be introduced during the planning stage of the tunnel and this may include a fire suppression system.

3.1.5 The tunnel operating systems are likely to be remotely operated. CCTV and traffic management systems would be controlled by Lerwick police. In addition, overtaking would not be permitted in the tunnel.

4.0 DESIGN OF TUNNEL LINK TO BRESSAY

4.1 Tunnel Internal Space Provision

4.1.1 The internal space provision of the tunnel has been developed on the basis of the anticipated constraints and is shown on drawing JS533/102. In view of the anticipated rock mass strength and the low in situ stress a simple “D” shaped tunnel is considered appropriate. This would have an arched roof, straight vertical side walls and a flat invert.

4.1.2 A carriageway width of 6.5m and a clear height of 5.3m have been provided together with a footpath/cycleway of 2.0m width plus additional carriageway width of 1.05m to be used as hard shoulder on the opposite side of the tunnel.

4.2 Link Road Alignment

4.2.1 In Lerwick the new link road would connect to the Gremista Road at a ‘T’ junction just north of the Bod of Gremista. This would require junction upgrades. The new link road would run north eastwards along the shore of the marina and the junction with the Lower Gremista Road would be improved. The link road would decline from the ‘T’ junction and at chainage 165m it would enter a cutting (with 70° side slopes and a maximum depth of c.15m) which would be 185m long. Figure 2 and Plate 2 below give details of the proposals of the approaches to the tunnel on the Lerwick side.

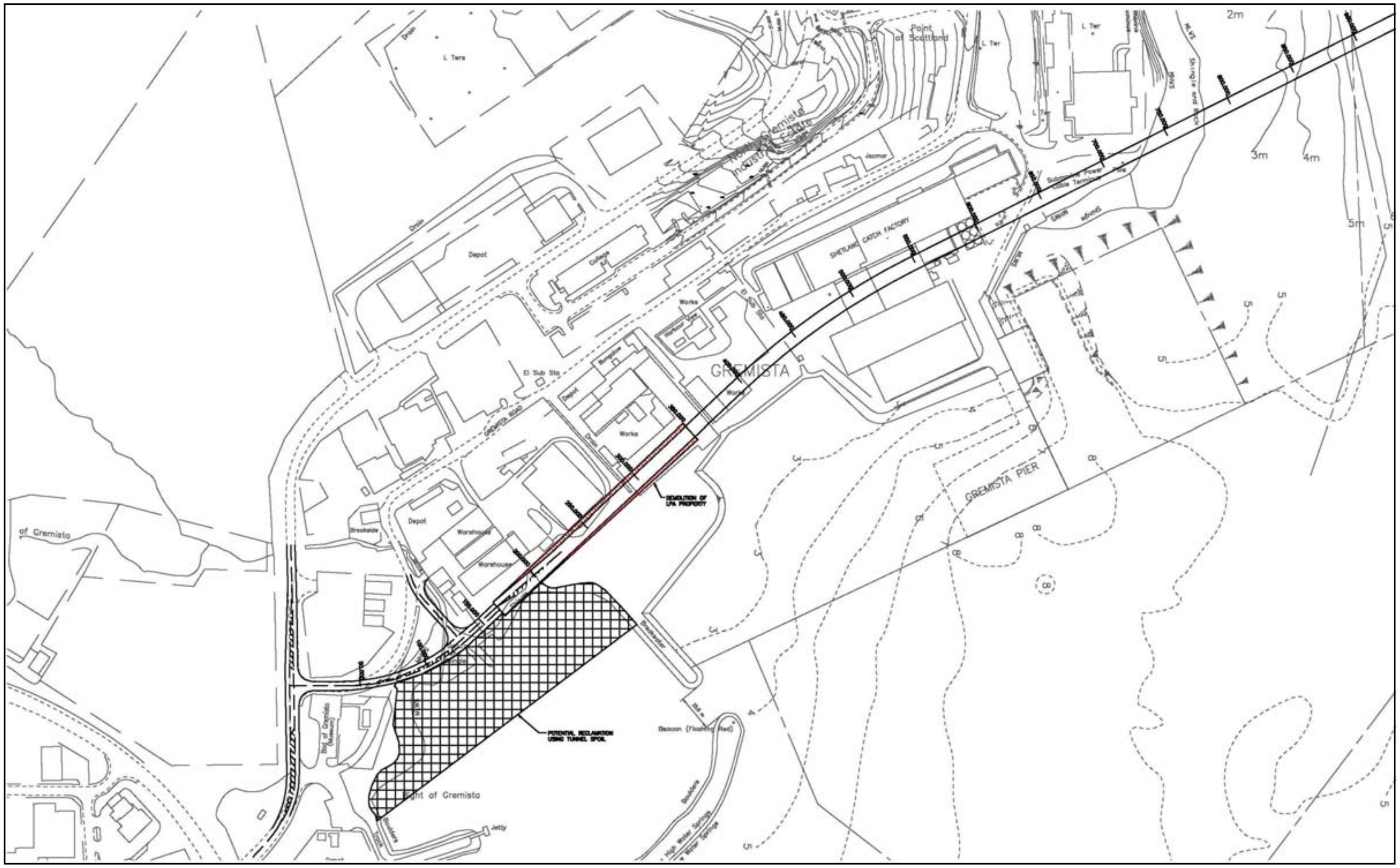


Figure 2 Tunnel Alignment Showing Details of Lerwick Approach

Plate 2 Tunnel Alignment Showing Details of Gremista Approaches

4.2.2 At chainage 350m the road would enter the tunnel. The road would descend at a maximum gradient of 7% in the tunnel for a distance of circa 500m to reach a maximum depth of circa 40m below existing sea bed level (and circa 45m below Mean Low Water Springs, MLWS), approximately midway beneath the Bressay Sound. The road at this point is orientated east-west. The road then ascends towards Bressay at 8% gradient swinging to a more south easterly direction and exits via a portal approximately 18m deep on the Bressay side (Ch. 1550m).

4.2.3 The road then passes between a cottage and the factory where it would allow connection to the existing Heogan Road. No road modifications to the Heogan Road are included in the tunnel proposals but it is understood that SIC plan to make some improvements to the road. Figure 3 and Plates 3 & 4 below give details of the proposals for the tunnel approached on the Bressay side.

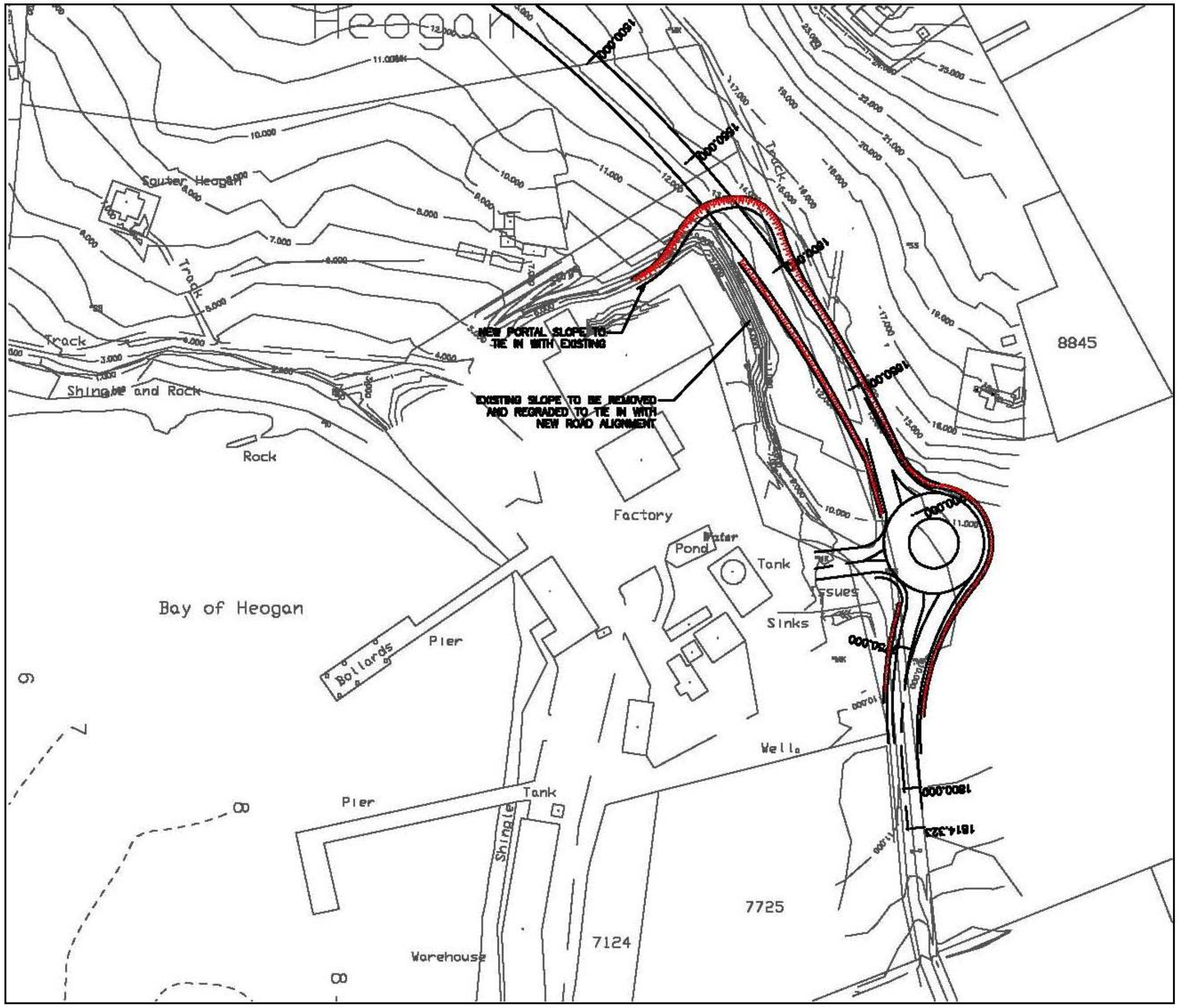


Figure 3 Tunnel Alignment Showing Details of Bressay Approach

Plate 3 Tunnel Alignment Showing Bressay Approach

Plate 4 Tunnel Alignment Showing Bressay Approach (from Heogan Rd)

4.2.4 In arriving at the alignment, a design speed for the road was set at 40mph with a speed limit of 30mph (Table 4.3, BD 78/99). This has been discussed and agreed with SIC.

4.3 Existing Structures Along the Route

4.3.1 Warehouses owned by LPA are shown in Figure 2 and Plate 5. One of these warehouses lies on the proposed alignment and would have to be demolished. The tunnel would pass beneath a new LPA owned warehouse and beneath part of the factory owned by Shetland Catch. The cover of rock between the tunnel and LPA warehouse would be 10m, and circa 20m beneath Shetland Catch. It is considered that these buildings would be unaffected by the tunnelling works. Specific measures would be used to reduce and manage ground borne vibration from blasting in the tunnel.

Plate 5 Link Road Alignment at Gremista Showing Affected Structures

4.3.2 On Bressay the tunnel portal, road cutting and new road have been designed such that the factory and cottage structures in this area would be unaffected physically by the works.

4.4 Tunnel Spoil

4.4.1 A total volume of 124,000m^3 in situ material would be removed during the construction process. Once blasted this would bulk to a volume of circa 167,400m^3. Spoil disposal in tunnelling work is the aspect that has the greatest potential for environmental impact. The crossing location has been selected to minimise this impact. From discussions with LPA it is understood that permanent spoil disposal could be obtained by reclamation projects within Lerwick Harbour subject to appropriate consents.

5.0 TUNNEL SUPPORT

5.1 At this stage the tunnel support is anticipated to comprise a sprayed concrete/rock bolt system as a primary lining. A secondary lining of sprayed concrete may be adopted below the sub-sea section of tunnel; it has been assumed that a waterproof membrane would be installed between the primary and secondary linings.

5.2 The permanent lining would be designed to provide fire resistance in the event of a vehicle fire.

6.0 CONSTRUCTION

6.1 Construction of the tunnel will follow a cycle of grouting, drill/blast, ‘mucking out’ and installation of support (rock bolts/sprayed concrete). A series of drawings has been developed and included herein to show details the cyclic process of constructing the tunnel (JS533/103-106). In addition plates 6 – 8 show typical drilling equipment.

6.2 The tunnel would be constructed wholly within rock beneath the Bressay Sound by advancing an open tunnel face from one side of the crossing to the other. It is likely that the crossing would be advanced from the Lerwick side to ease logistics of material supply and spoil disposal. The tunnel could however be advanced from the Bressay side, as an alternative or in conjunction with the advance of a face from Lerwick if rock is required on Bressay.

Plate 6 Multi boom Drilling jumbo drilling holes in a tunnel face

Plate 7 Single boom drilling jumbo in a tunnel face

Plate 8 Multi boom jumbo installing additional rock support

7.0 MECHANICAL AND ELECTRICAL PROVISION

7.1 M & E provisions for the purposes of the study have been developed upon the requirements of BD 78/99. With a typical layout of the anticipated tunnel services shown on Drawing JS333/107.

7.2 There has been discussion as to the requirement for a fire suppression system within the tunnel. This has not been included at this stage given the very low traffic volumes and in particular the likely low volume of HGVs.

8.0 COST AND PROGRAMME

8.1 In arriving at a cost for the project, a detailed approach has been adopted in preference to inferring unit rates from other tunnelling projects, which may not be similar to the conditions of Shetland.

8.2 To provide construction costs, an outline construction programme has been developed. Mobilisation and completing of the cuttings on the Lerwick and Bressay sides would take 4 months. Tunnelling would take 12 months following the above cycle procedures. A further 6 months would be required to complete the final support, the road and the associated M & E provisions, giving an overall programme of 22 months.

8.3 Prior to commencing site work it is considered that a period of eight months would be required for ground investigation drilling and design.

8.4 The cost estimate for a drill and blast tunnel with 25m cover to the sea bed is presented in Table 2 below. Points to note are as follows;

- Prices are all inclusive, net of taxes with March 2008 taken as a reference date.
- Prices are based on a thorough assessment of tunnel construction cycle times.

Item	Quantity		Rate	Cost estimate
Construction Costs				
Excavation and support of driven tunnel	1200	m	£12,257	£14,708,400
Drainage, concrete and associated pipes	1200	m	£500	£600,000
Road construction outside tunnel (portal and tie-in roads)	575	m	£3,000	£1,725,000
Bressay Cutting (in Rock)	25,000	m^3	£42	£1,050,000
Lerwick Cutting (in Rock)	15,000	m^3	£42	£630,000
Road construction within	1.2	Km	£250,000	£300,000

tunnelled section				
M&E Equipment		Sum		£3,600,000
Total				**£22,613,400**
Contingency for secondary lining (inc membrane)	350	m	£3,416	£1,195,600
Extra over total				£23,809,000

Table 2 Cost Estimate

- The cost above includes a cost of £5/m^3 for transporting muck to a local repository. This assumes that there are opportunities to dispose of all of the spoil as reclamation of the harbour at both portals/exit.
- The costs for secondary lining allow for 350m length of secondary lining around the tunnel nadir.
- The cost for this secondary lining includes for a 2mm thick waterproof membrane.

8.5 To the above costs the following should also be added;

Ground investigation *	£950,000
Design, EIA Liaison, etc**	£1,100,000
Total	**£2,050,000**

* This includes the costs of consultant supervision and interpretative reports.

** The professional fees are inclusive of independent checking, procurement, construction supervision and all work necessary to secure consents, including EIA, etc,.

9.0 CONCLUSIONS

9.1 This report concludes that construction of a drill and blast tunnel is feasible.

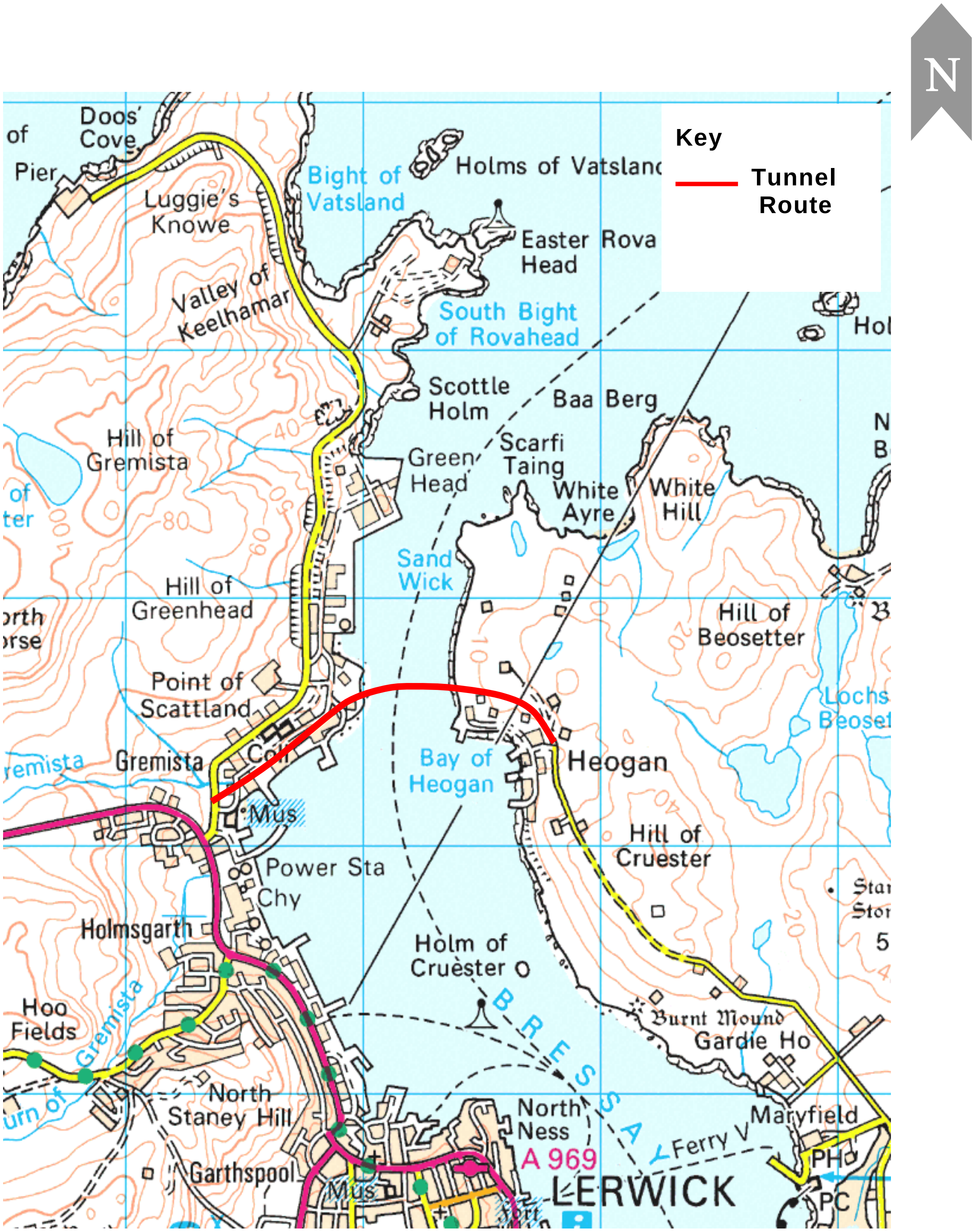
9.2 The proposed tunnel alignment extends from Gremista Road, Lerwick, to Heogan Road on Bressay, a length of 1200m. The tunnel geometry has provision for two way traffic, a footpath/cycle of 2m width plus additional carriageway width of 1.05m to be used as hard shoulder. Preliminary assessment of the rock mass indicates that a primary lining comprising 100mm fibre reinforced shotcrete and pattern rock bolts at 2m centres is necessary with provision for a 200mm secondary lining (incorporating a waterproof membrane) over the sub-sea section only.

9.3 Preliminary costs estimates are in the order of £23.8M plus £2.05M for ground investigation and detailed design consultancy costs.

9.4 Mobilisation and completing of the cuttings at Bressay and Lerwick will take in the order of 4 months. Tunnelling is anticipated to take 12 months to complete with a further 6 months to complete final support, road construction and M&E fit out. This gives an overall programme of 22 months. Prior to commencing site work it is considered that a period of eight months would be required for ground investigation drilling and design.

FIGURES

Figure 1: Site Location Plan



Key	DRAWN BY: AS	CHECKED BY: AS	DATE: April 2008
	Bressay Link STAG 2 Report		
	Figure 1: Location Plan		

ZetTrans · natural CAPITAL · Anderson Solutions · Halcrow · Donaldson Associates

DRAWINGS

JS533/101: Horizontal and Vertical Alignment

JS533/102: Typical Tunnel Section

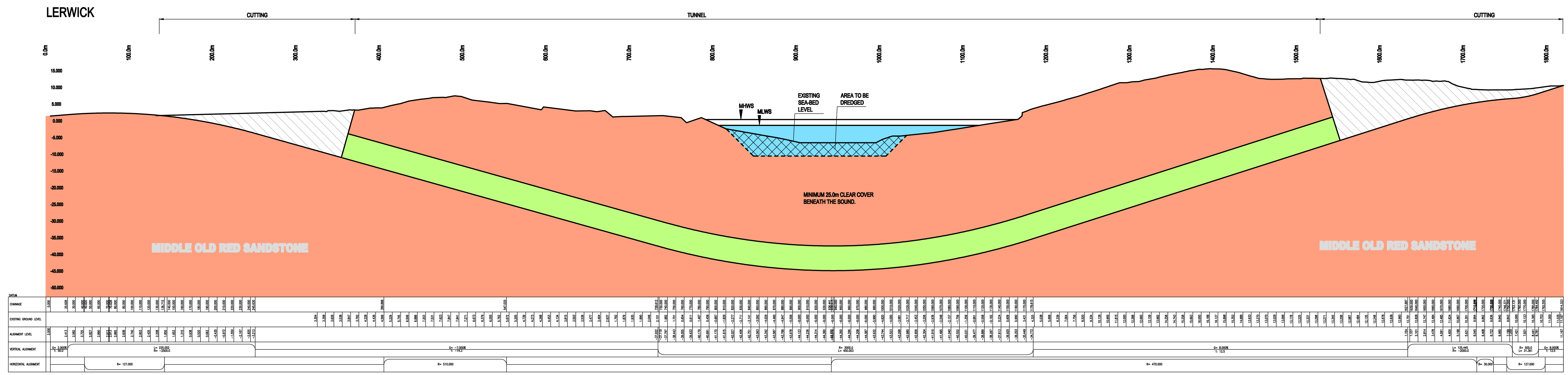
JS533/103: Excavation Sequences Stages 1 & 2

JS533/104: Injection Ring (Grouting Ahead)

JS533/105: Excavation Sequences Stages 3 & 4

JS533/106: Excavation Sequences Stage 5

JS533/107: Tunnel Services



POINT OF SCATTLAND - HARD ROCK TUNNEL
1:2000 H, 1:500 V

PLAN OF PROPOSED LERWICK - BRESSAY FIXED LINK TUNNEL
(HARD ROCK TUNNEL)
Scale 1:2500

KEY PLAN (n.t.s.)

KEY
- SUPERFICIAL DEPOSITS (SCHEMATIC ONLY)
- MIDDLE OLD RED SANDSTONE
- TUNNEL
- CUTTING

STRUCTURE	CHAINAGE	LENGTH
CUTTING (LERWICK)	165m TO 350m	185m
TUNNEL	350m TO 1550m	1200m
CUTTING (BRESSAY)	1550m TO 1775m	175m

NOTES.
1. ALL LEVELS IN METRES, RELATIVE TO LOCAL (LERWICK) DATUM .
2. MHWS AND MLWS OBTAINED FROM THE NATIONAL TIDAL AND SEA LEVEL FACILITY.
3. SEABED LEVELS TAKEN FROM DATA PROVIDED BY LERWICK PORT AUTHORITY.
4. ALL LEVELS SHOWN ARE RELATIVE TO LERWICK ORDNANCE DATUM. DATA RELEATIVE TO CHART DATUM HAS BEEN CONVERTED TO LERWICK ORDNANCE DATUM, ASSUMING CHART DATUM IS 1.22m BELOW ORDNANCE DATUM.
5. 25.0m CLEAR COVER MAINTAINED TO THE TUNNEL CROWN BENEATH DREDGED CHANNEL.
6. GROUND LEVELS TAKEN FROM PROVIDED SURVEY AND ORDNANCE SURVEY 1:50,000 MAPPING SOFTWARE AND ARE CONSIDERED ACCURATE TO ±2.0m

Rev.	Revision Description	Drn.	Chkd.	Appd.	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status: **REPORT**

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scattunnels@donaldsonassociates.com

Client: ZETTRANS

Project: LERWICK – BRESSAY STAGE 2 FIXED LINK TUNNEL

Title: HORIZONTAL & VERTICAL ALIGNMENT

Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:100	Index No.: JS533-101	
Drawing No.: JS533/101		Revision: 0

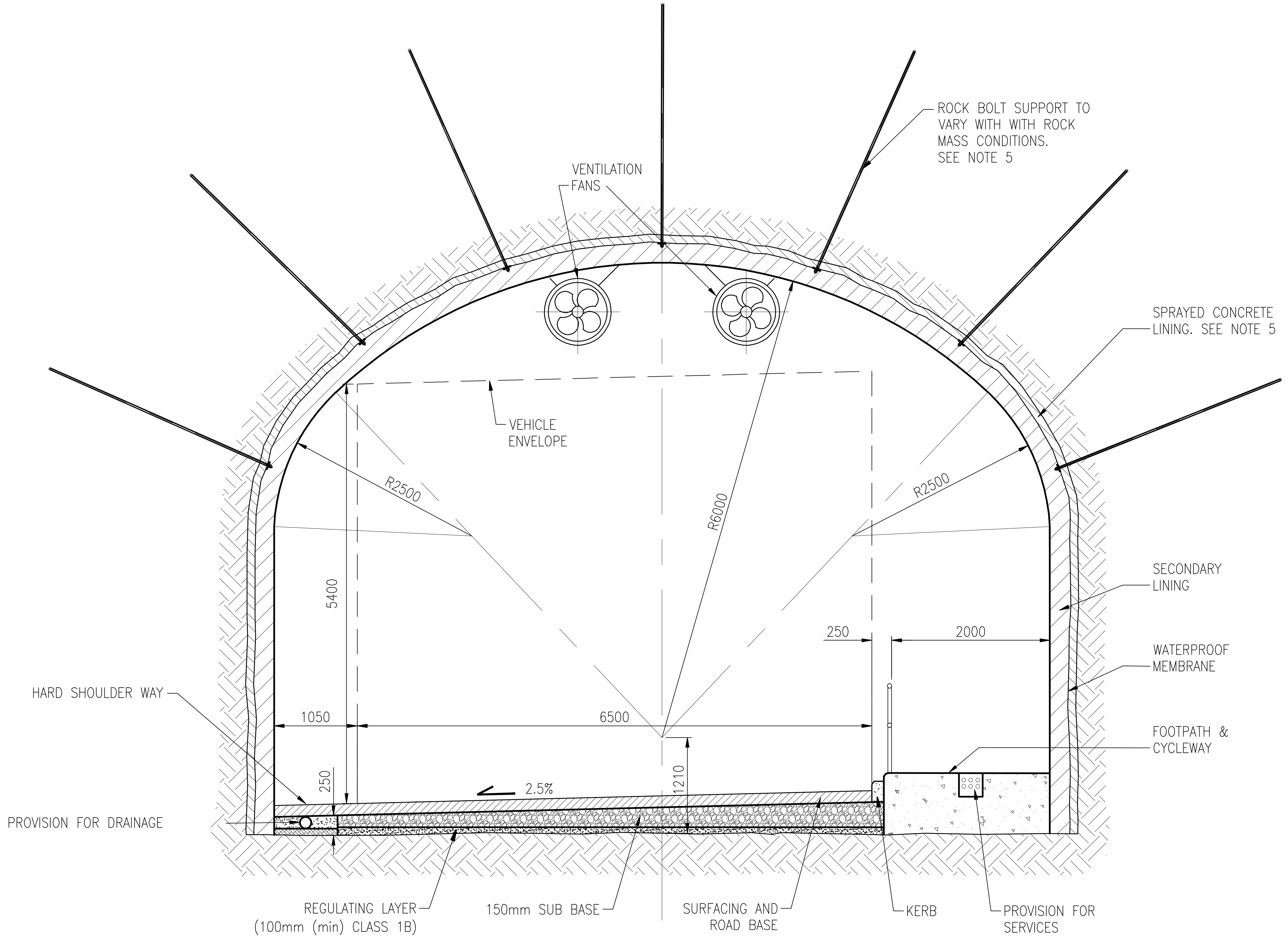
NOTES.

1. WORK TO FIGURED DIMENSIONS ONLY DO NOT SCALE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ASSUMED ROCK MASS CONDITIONS AS SHOWN IN TABLE BELOW.
5. ROCK QUALITY ASSUMPTIONS.

LENGTH	NGI 'Q'	SUPPORT
850m	1–4	100mm S FIBRE SCL PLUS 3.0m BOLTS AT 2.0m c/c AROUND ARCH
200m	4–10	75mm S FIBRE SCL PLUS 3.0m BOLTS AT 3.0m c/c AROUND ARCH
150m	0.1–1	150mm S FIBRE SCL PLUS 4.0m BOLTS AT 2.0m c/c AROUND ARCH

SECONDARY LINING OF 200mm CAST INSITU CONCRETE PLUS WATERPROOF MEMBRANE ARE INCLUDED OVER SUB–SEA SECTION

FACE AREA CIRCA $70m^2$



TUNNEL GEOMETRY

Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status: **REPORT**

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

Client: ZETTRANS

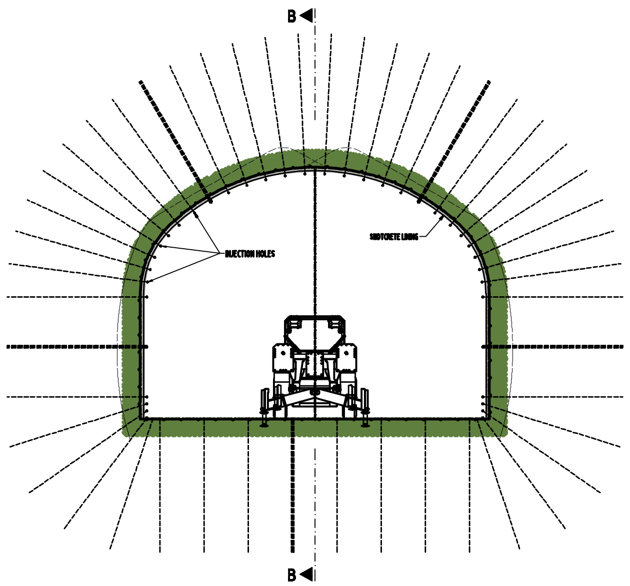
Project: LERWICK – BRESSAY STAGE 2 FIXED LINK TUNNEL

Title: TYPICAL TUNNEL SECTION

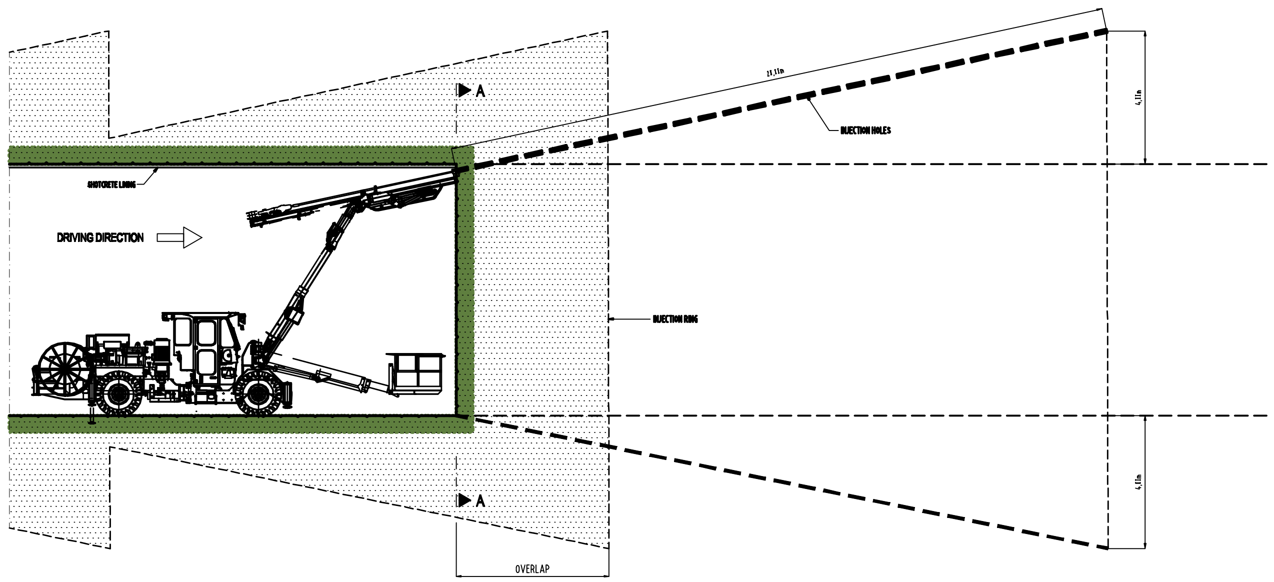
Drawn by: SK	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A3	Approved by: AS
Scales: 1:50	Index No.: JS533-102	
Drawing No: JS533/102	Revision: 0	

STAGE 1 - Grouting ahead

CROSS SECTION A-A

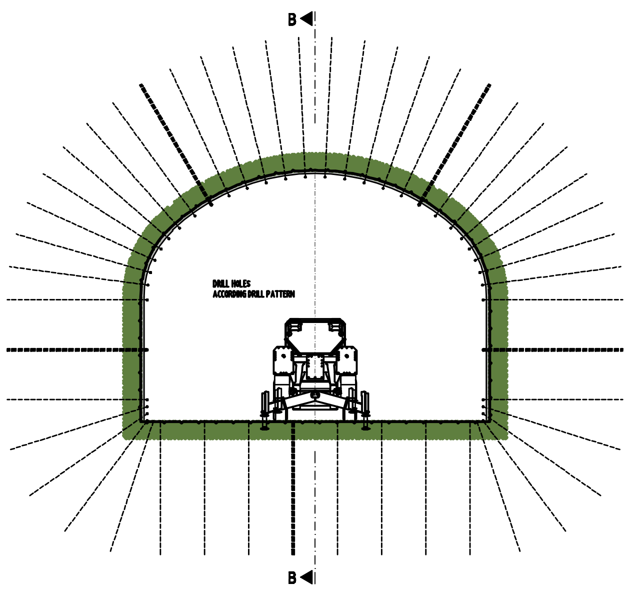


LONGITUDINAL SECTION B-B

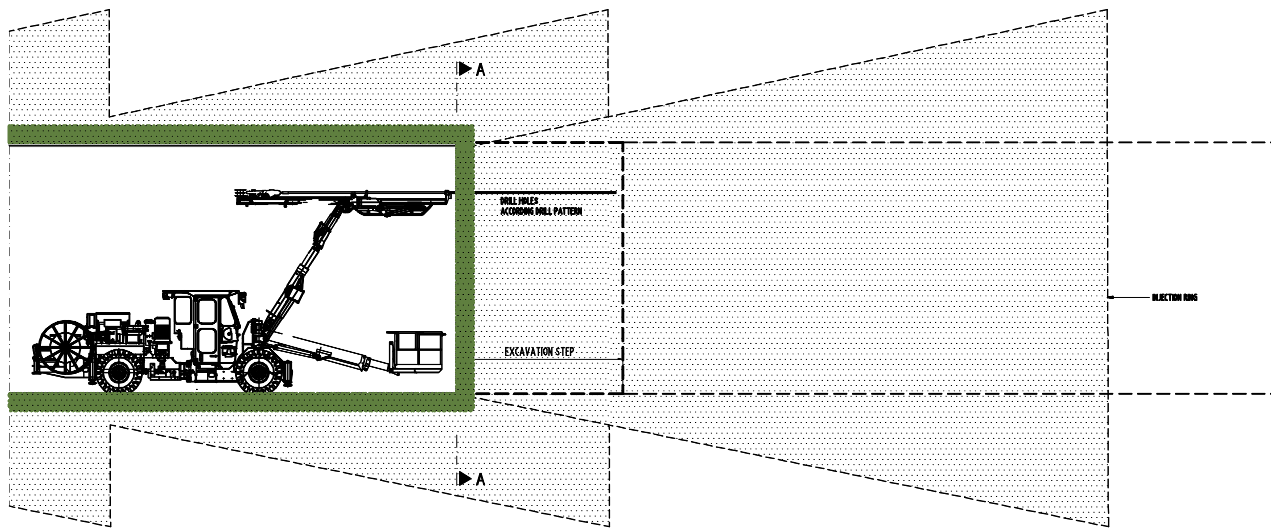


STAGE 2 - Drill / Blast

CROSS SECTION A-A



LONGITUDINAL SECTION B-B



Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status: **REPORT**

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

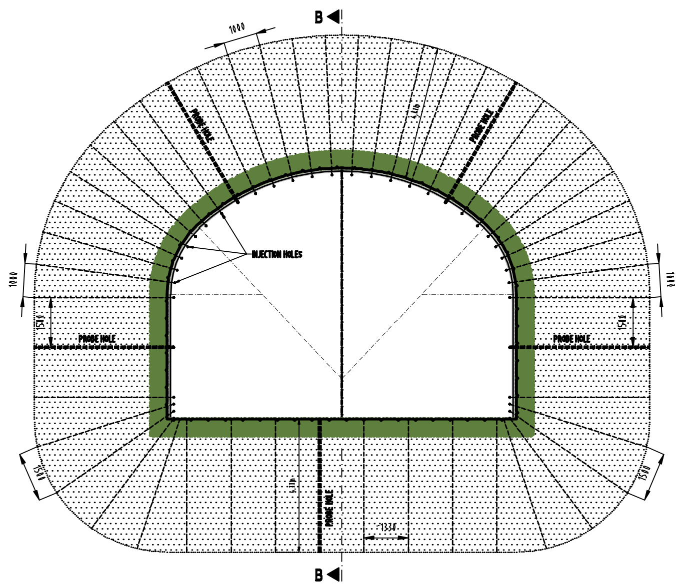
Client: ZETTRANS

Project: LERWICK – BRESSAY STAGE 2 FIXED LINK TUNNEL

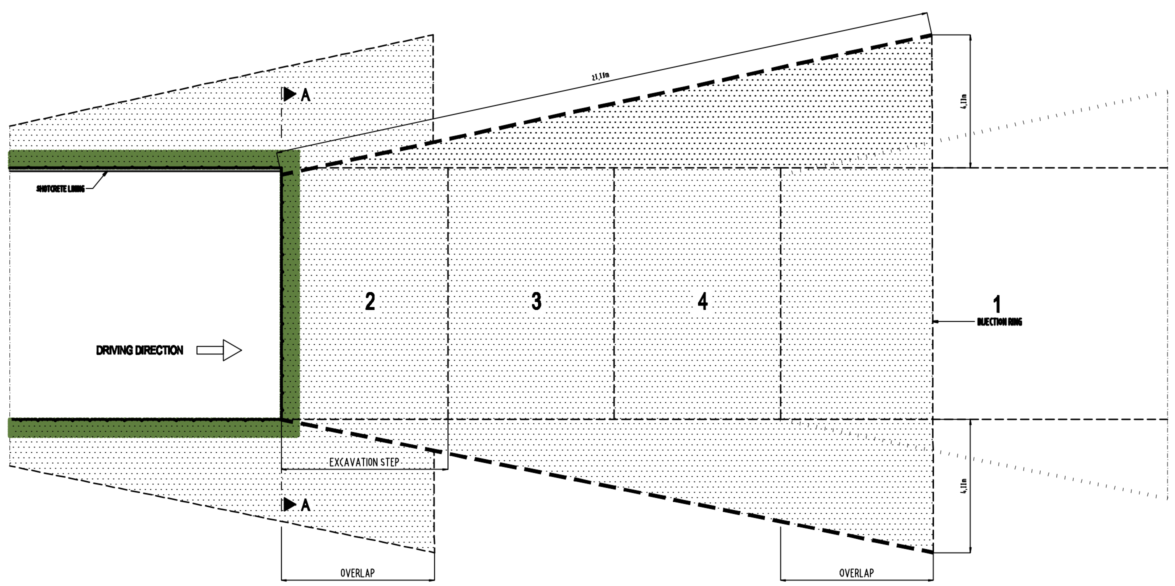
Title: EXCAVATION SEQUENCES STAGES 1 & 2

Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:100	Index No.: JS533-103	
Drawing No: JS533/103	Revision: 0	

CROSS SECTION A-A



LONGITUDINAL SECTION B-B



Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status:

REPORT

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

Client:
ZETTRANS

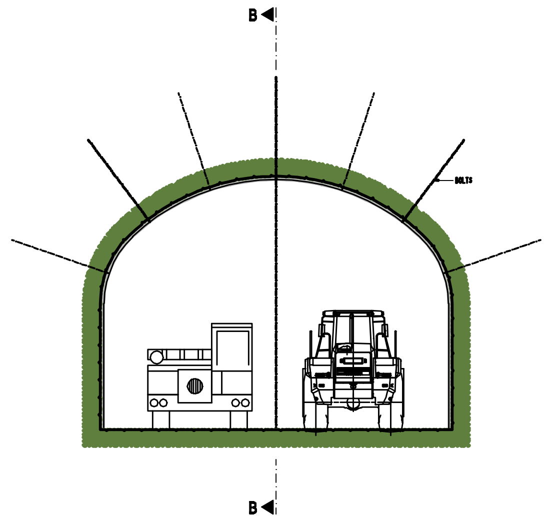
Project:
LERWICK – BRESSAY
STAGE 2
FIXED LINK TUNNEL

Title:
INJECTION RING
(GROUTING AHEAD)

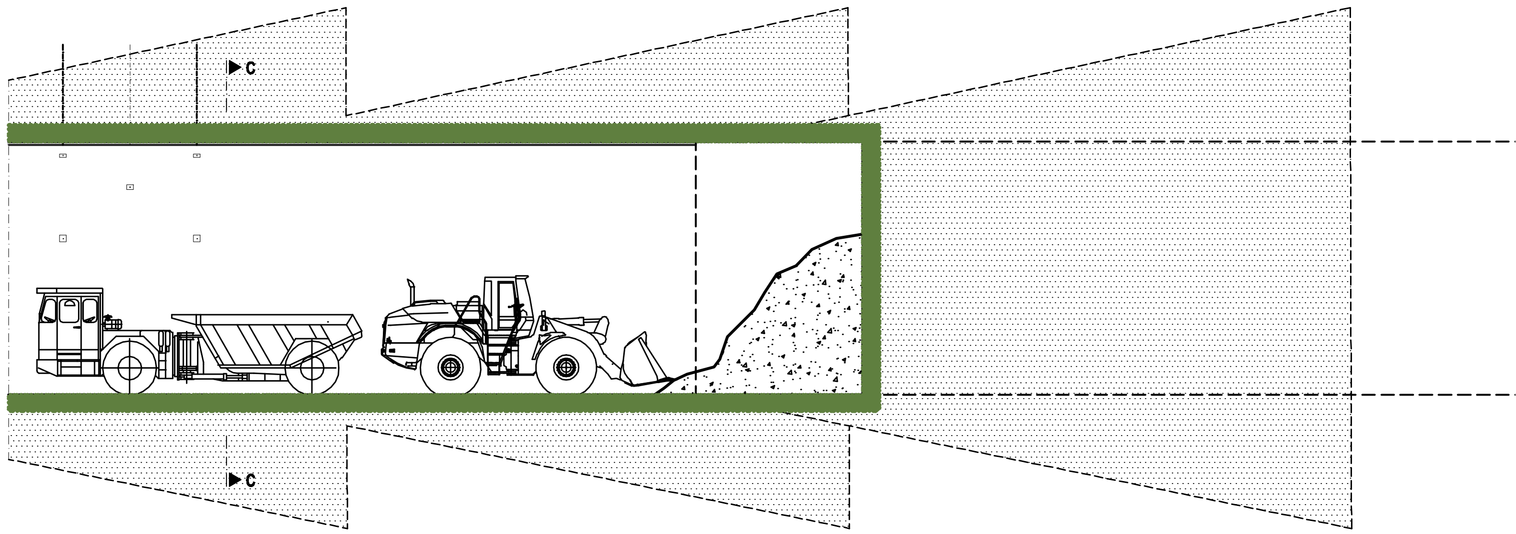
Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:100	Index No.: JS533-104	
Drawing No: JS533/104		Revision: 0

STAGE 3 - Muck Out

CROSS SECTION C-C

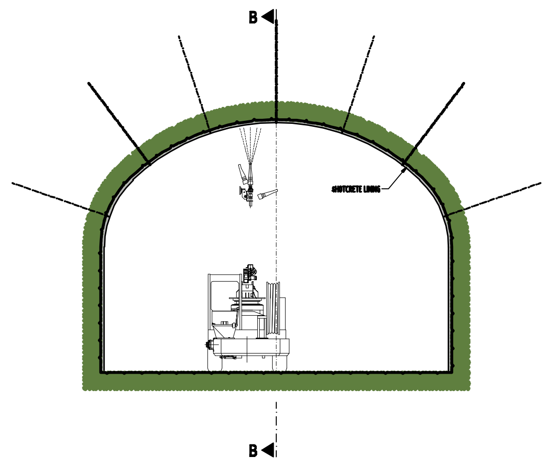


LONGITUDINAL SECTION B-B

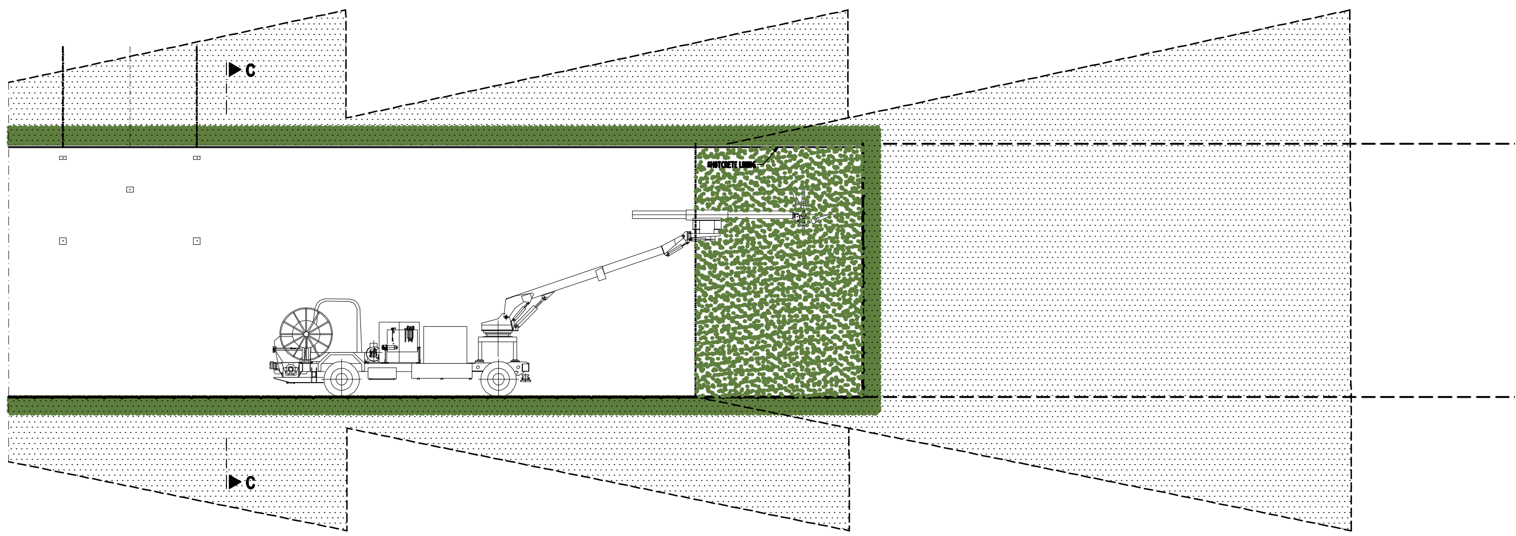


STAGE 4 - Immediate Support

CROSS SECTION C-C



LONGITUDINAL SECTION B-B



Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status: **REPORT**

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

Client: ZETTRANS

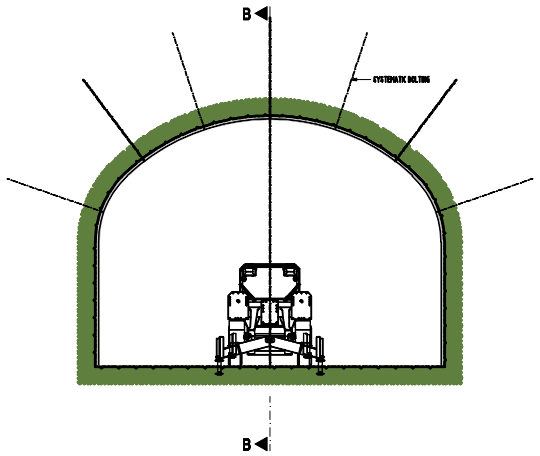
Project: LERWICK – BRESSAY STAGE 2 FIXED LINK TUNNEL

Title: EXCAVATION SEQUENCES STAGES 3 & 4

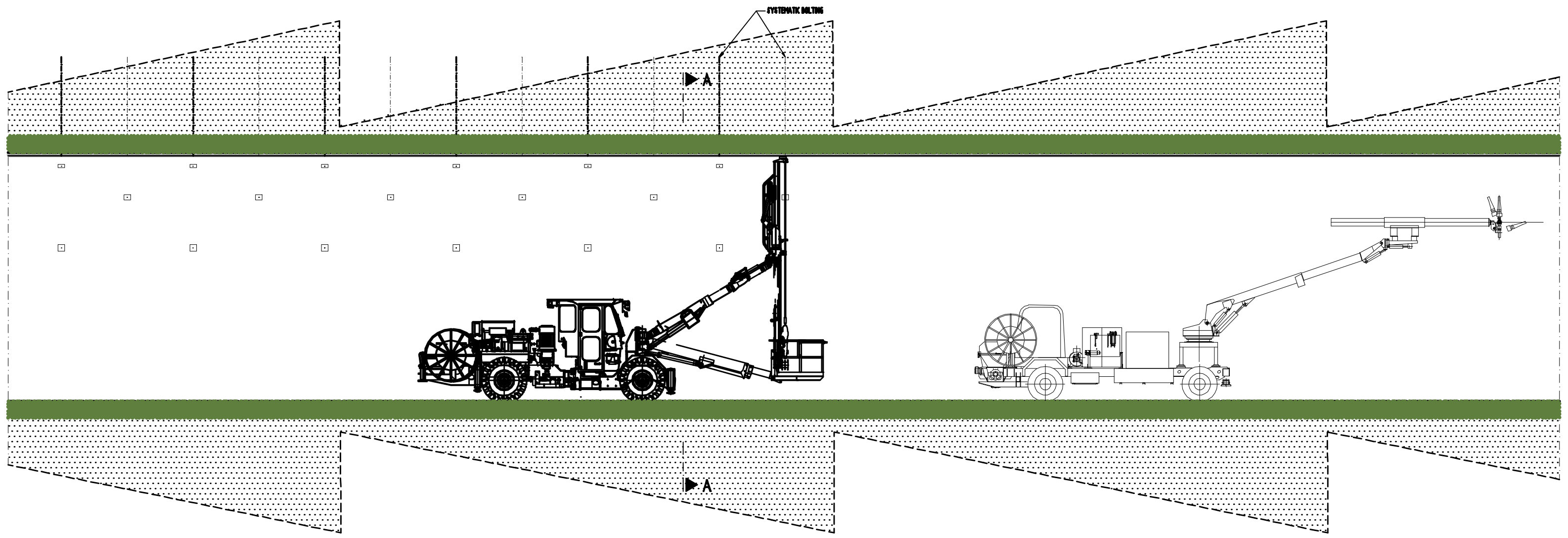
Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:100	Index No.: JS533-105	
Drawing No: JS533/105	Revision: 0	

STAGE 5 - Additional Support

CROSS SECTION A-A



LONGITUDINAL SECTION B-B



Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status: **REPORT**

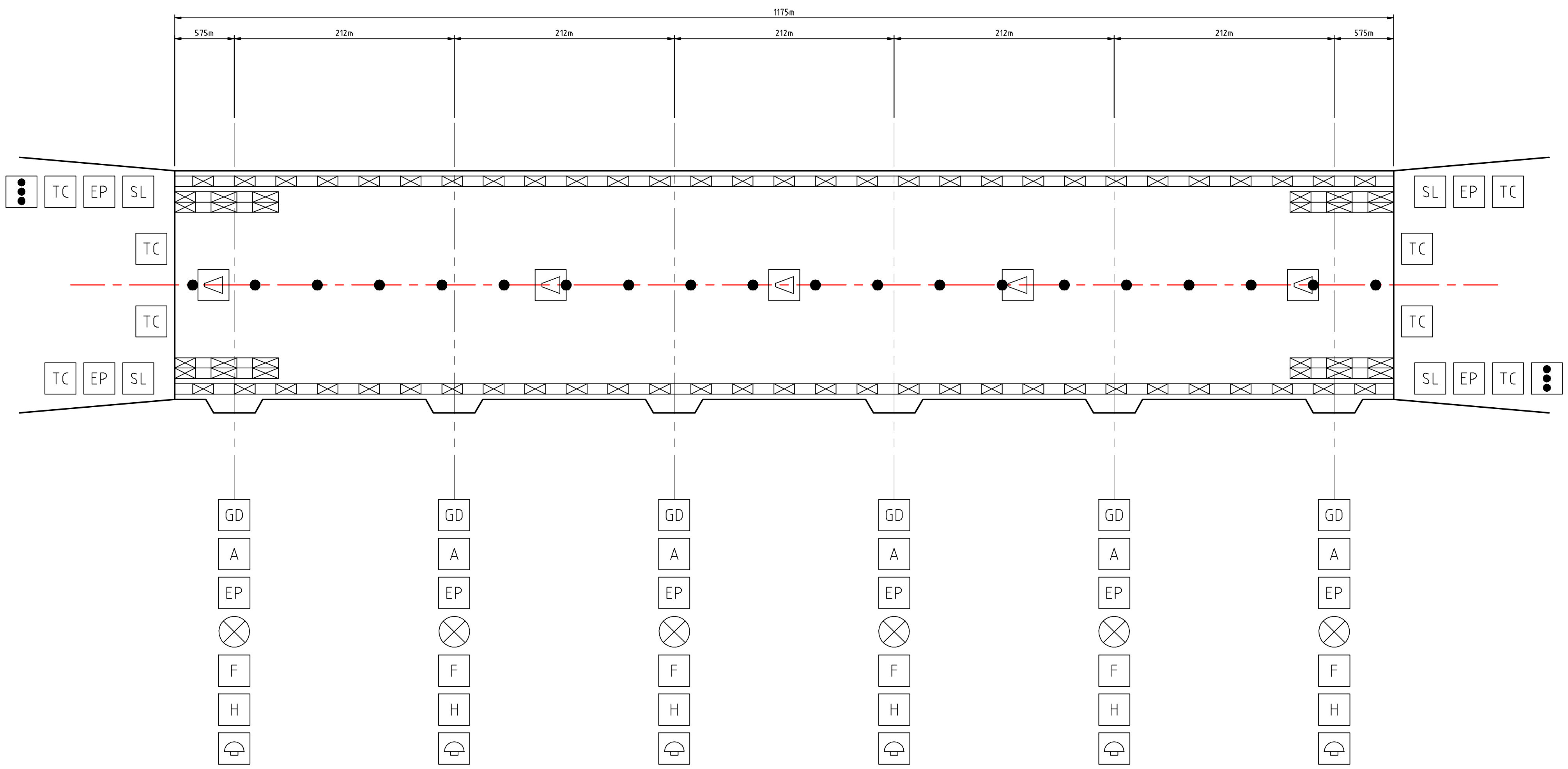
DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

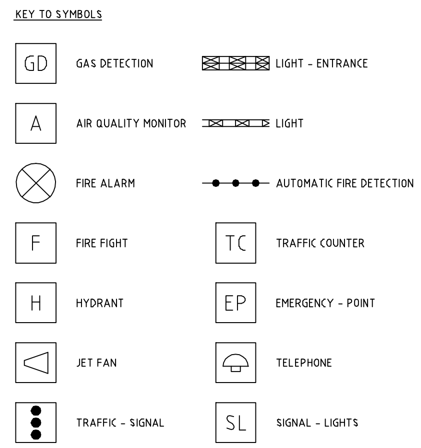
Client: ZETTRANS

Project: LERWICK – BRESSAY STAGE 2 FIXED LINK TUNNEL

Title: EXCAVATION SEQUENCES STAGE 5

Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:100	Index No.: JS533-106	
Drawing No: JS533/106		Revision 0





Rev.	Revision Description	Drn	Chkd	Appd	Date
0	FIRST ISSUE	GM	JS	AS	MAR'08

Status:

REPORT

DONALDSON ASSOCIATES
CONSULTING ENGINEERS
The Pentagon Centre, Washington Street, Glasgow G3 8AZ
Tel:0141 248 2410 Fax:0141 248 2415 E-Mail:scottunnels@donaldsonassociates.com

Client:

ZETTRANS

Project:

LERWICK – BRESSAY
STAGE 2
FIXED LINK TUNNEL

Title:

TUNNEL SERVICES

Drawn by: GM	Designed by: JP	Checked by: AS
Date: MAR 2008	Original sheet size: A1	Approved by: AS
Scales: 1:1000	Index No.: JS533-107	
Drawing No: JS533/107		Revision 0