View of township facing SE

14 – Allt Ghimner
NMRS – n/a
HSMR – n/a
Grid Ref: - NC 86602/15604 (centred)
Type – Grouse butts
8 grouse butts aligned NE-SW is marked on the latest OS map. Not marked on the 1st or 2nd edition OS maps. Site is not visible on aerial photographs of 1946 or 1989.

Walkover reveals turf built semi-circular structures up to 1m high and 1.3m wide, all look modern in date. Currently not much heather in vicinity.

No recommendations to be made.

Viewof shooting butt - scales 1m

15 – Allt Ghimner
NMRS – n/a
HSMR – n/a
Grid Ref: - NC 86729/14521 (centred)
Type – Grouse butts
11 grouse butts aligned NNW-SSE is marked on the latest OS map. Not marked on the 1st or 2nd edition OS maps. Site is not visible on aerial photographs of 1946 or 1989.

Walkover reveals turf built semi-circular structures up to 1m high and 1.3m wide all look modern in date. Currently not much heather in vicinity.

No recommendations to be made.

16 – Ruidhean
NMRS – NC81SW 47
HSMR – NC81SW 62
Grid Ref: - NC 847/108
Type – Farmstead (possible)
Noted in HSMR and NMRS of 'what may be a farmstead, comprising 1 unroofed building and an unroofed structure, which may be an enclosure is depicted on the 1st edition OS map of 1879 sheet 88. Not shown on OS map of 1963'. Site is not visible on aerial photographs of 1946 or 1989.

Marked on 1st edition OS to lie to E side of track. Unchanged on 2nd edition OS of 1907.

Site visit reveals site to be heavily covered with bracken up to waist height. Site is not discernible though traces of walls were made.

Site lies within wayleave area, to be fenced off during construction work.

17 – Allt a' Mhuilinn
NMRS – n/a
HSMR – n/a
Grid Ref: - NC 82791/115588
Type – Cairn
Small cairn revealed during walkover survey of 4.5m diameter and up to 2.5m in height. Possible kerbstones to south edge.

Site lies within wayleave area, to be fenced off during construction work.

View of cairn facing NE - scales 1m

18 – Allt a' Mhuilinn
NMRS – n/a
HSMR – n/a
Grid Ref: - NC 82756/11523
Type – Structure

Site revealed during walkover survey of a circular structure 5m in diameter with walls 0.7m high and 0.3m thick in area of bracken. Function is unknown.

Existing burrow pit to the north of site 10 should not be used for road construction as may cause damage to this site. If road is to be widened in this area a more detailed survey will be required. Site lies within wayleave area, to be fenced off during construction work.

Viewof structure facing N - scale 2m

Sites 3-4,8,12, 14-15 & 17-18 are additional sites that were found as part of the desktop and walkover survey and are not recorded in the Highland Sites and Monuments Record or the National Monuments Record of Scotland, Edinburgh.

References

Adam, R J (1972) Papers on Sutherland Estate Management 1802-16. 2 volumes. Scottish History Society. T & A Constable Ltd.

County Valuation Rolls for Sutherland 1874 – 1915.

Davidson, J M (1948) A Miscellany of Antiquities in Easter Ross and Sutherland. Proceedings of the Society of Antiquaries of Scotland 1945-6, 80, 25-33.

Henshall, A S (1963) The Chambered Tombs of Scotland. Volume 1. Edinburgh University Press.

Henshall, A S & Ritchie, J N G (1995) The Chambered Cairns of Sutherland : An Inventory of the Structures and their Contents. Edinburgh University Press.

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IFA (1999) By-laws, Standards and Policy Statements of the Institute of Field Archaeologists. Reading.

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Ordnance Survey Name Book Sutherland – Clyne book 26, pages 71,75,76 & 79.

RCAHMS (1911) Royal Commission on the Ancient and Historical Monuments of Scotland: Inventory of Monuments in Sutherland. HMSO. Edinburgh.

OS Maps Consulted

Sutherland Edition of 1879 (surveyed 1871) 6 inch to a mile sheets 88 and 97.
Sutherland Edition of 1907 (revised 1904) 6 inch to a mile sheets 88 and 97.
NC81SW OS map sheet of 1969 1:10,560.
NC81SE OS map sheet of 1963 1:10,560.

Aerial Photographs Consulted

RAF RAF/CPE/Scot/UK 180 1136-1142 (gap) then 1202-1199, 1473-1478, 4133-4137
Flown 8-10-1946 1:10,000

RAF RAF/CPE/UK 297 3197-3196 (end of run for CPE/180 – no cover for rest)
Flown 18-9-1947 1:10,000

OS 61889 158-159, 49-51 Flown 20-5-1989 1:24,000

Photographic Register

1 – View of cairn facing NE – scales 1m
2 – View of chamber of cairn – scales 1m
3 – View of circular structure facing north – scale 2m
4 – View of shooting butt facing east – scales 1m
5 – View of Ascoilbeg township facing SE
6 – View of site of sheepfold facing NW
7 – View of shooting butt facing W
8 – View of house at Badan facing SE – scale 1m
9 – View of wall of enclosure site 6 – facing W
10 – View of sheepfold – site 4 facing SSE
11 – View of house site 3 facing N
12 – View of west gable of house facing NE – scale 2m
13 – View of rear of building facing S
14 – Detail of lean-to at rear of building
15 – View of east gable
16 – Detail of fireplace in west gable
17 – Detail of staircase
18 – Detail of fireplace in east gable
19 – View of structure site 1 facing N
20 – View of sheepfold site 12 facing S
21 – View of enclosure site 1 facing S
22 – View of enclosure of house facing W – scale 1m
23 – View of house facing W
24 – Detail of house facing W
25 – Detail of cow-gate facing E
26 – View of township facing N
27 – View of clearance cairn site 1 facing W

Dep. 313

XI GORDON OF CARROL

Reference	Description	Dates	Remarks
~~Box 1~~	Titles		
3483	Bundle of miscellaneous charters	1553-1774	Bundle 1
	Legal papers		
3484	Bundle of legal papers	1604-1802	" 25
3485	Bundle of miscellaneous papers including:- legal documents 1609-30, 1709-49, receipts of William, Lord Strathnaver (d.1720) to Gordon of Carrol 1701-11, and letters of Elizabeth, Duchess-Countess of Sutherland to Joseph Gordon, 1809.	1609-1809	" 12
3486	Bundle of legal papers	1616-57	" 19
3487	" " "	1619-90	" 22
3488	" " "	1630-84	" 14
3489	" " "	1642-1792	" 17
~~Box 2~~ 3490	" " "	1662-1702	" 21
3491	" " "	1670-89	" 30
3492	" " "	1700-22	" 23
3493	" " "	1723-41	" 9
3494	" " "	1754-1803	" 24
3495	" " "	1801-7	" 3
3496	" " "	1803-19	" 8
	See also Accounts and Correspondence section for further legal papers. Also see miscellaneous section for Inventory of Charters and papers sent to the College of Arms, 1860.		
	Accounts		
~~Box 3~~ 3497	Miscellaneous bundle including receipts 1612-42, verse 1691, tacks of fishings 1619-24.	1612-93	Bundle 13
3498	Accounts with the British Linen Bank	1798-1806	" 4
3499	Account book for crops at Gordon Bush, 1798, and Orderly Book of Captain John Gordon's Company, Sutherland Fencibles, 1722	1782-1798	
3500-6	Account books for Gordon Bush (7 vols).	1800-[illegible]	

Reference	Description	Dates	Remarks
~~Box 4~~ 3507-16	Account books for crops at Gordon Bush (9 vols)	1802-9	
3517	Accounts for work done at Gordon Bush House (1 bundle) See also correspondence section for further Accounts.	1803-8	Bundle 2
	Correspondence		
3518	Bundle of letters of William, 16th Earl to Hugh Gordon of Carrol on the 1745 Rebellion, and of Elizabeth, Countess of Sutherland, née Wemyss, 1746, and others, with miscellaneous legal papers.	1712-1758	" 10
3519	Bundle of letters of William, 16th Earl and others with account of the losses of Clyne parish in the '45. Receipts 1685-1701. and miscellaneous papers.	1685-1750	18
3520	Bundle of letters of John, 15th Earl, William 17th Earl, General St Clair, Lord Reay and others. With legal papers 1711-98.	1703-99	Bundle 15
3521	Bundle of letters of the 15th, 16th and 17th Earls, George Sinclair of Ulster, Lord Reay, Sir John Gordon of Invergordon and others.	1713-1806	" 16
3522	Bundle of letters of the 15th, 16th and 17th Earls, of Elizabeth, Countess of Sutherland, née Wemyss and others.	1715-62	" "
~~Box 5~~ 3523	Letters of Alexander Webster, Advocate Aberdeen.	1621-2	" 7
3524	Correspondence on Gordon of Carrol genealogy See also legal section for further correspondence.	19th cent	" 28
	Miscellaneous papers		
3525	"A Short Account of the Family of Beldornie"	1712	
3526	"The History of the Family of Gordon to 1690" by William Gordon of Old Aberdeen.	1726	
3527	Bundle of papers on Sutherland roads	1805	Bundle 6

Reference	Description	Dates	Remarks
~~Box 5 contd.~~ 3528	Inventory of charters and papers of the Gordons of Carrol sent to the College of Arms, London	1860	
~~Box 6~~ 3529	Unsorted papers	19th cent.	Bundle 2
3530	Unsorted papers on Gordon of Carrol Genealogy.	"	" 2
3531	Pedigree of the Gordons of Carrol	"	" 2
3532-3	Dep 313/1576-7 See ~~Section III Box 409~~ for correspondence regarding the purchase of Carrol.		

Appendix 12.1 **Transport Statement**

GORDONBUSH WINDFARM

TRANSPORT STATEMENT

Scottish and Southern Energy plc

CONTENTS

1. INTRODUCTION

1.1 BACKGROUND

Scottish and Southern Energy is making an application for consent under section 36 of *The Electricity Act 1989* for a windfarm at Gordonbush Estate, near Brora, Sutherland. The principal traffic elements associated with the construction of the windfarm are delivery of turbine components, and delivery of concrete (or materials for mixing concrete), for turbine foundations. There would be a requirement for stone to construct site tracks, but the intention is to source this from borrow pits located at the site, to minimise road transport.

The purpose of this transport statement is to provide information about the proposed transport arrangements.

1.2 LIMITATIONS

The main limitation of this report arises because, in line with standard procurement practice, a specific turbine manufacturer will not be selected until later in the process.

In due course, the construction of the windfarm would be put out to tender. There are three key elements:

- supply and erection of wind turbines
- civil works
- electrical works

Contracts may be let on a multi-contract basis (ie separate contracts let for each element), or on a turn key basis, in which a single contract is let for the construction of the windfarm, and the main turn key contractor then lets sub-contracts for the other elements.

Manufacturers which currently supply turbines which may be suitable include, for example, Bonus, GE Wind, NEG Micon, Nordex, and Vestas. Whilst each manufacturer has a turbine of generally similar characteristics, turbines will vary in detail, and each supplier will favour a different transport solution, the detail of which would be finalised upon award of a contract. It is not appropriate for Scottish and Southern Energy to be prescriptive in terms of the precise transport arrangements, since this may not be the optimum solution for the ultimately selected turbine.

Consequently, the information presented in the Transport Statement should be considered as indicative only in terms of turbine data (although the largest turbines have been assumed), and the proposed routes, vehicles and other arrangements are presented as examples.

1.3 SCOPE

The report is restricted to construction traffic, specifically construction plant, turbine components and materials. It does not consider operational traffic (which will be minimal), or the transport of construction workers.

1.4 REPORT STRUCTURE

Section 2 identifies:

- probable construction plant requirements
- probable concrete / aggregate requirements
- probable turbine components and their quantities, weights and dimensions
- probable balance of plant requirements
- for each of the above, probable vehicle requirements, quantities, weights and dimensions

Section 3 identifies the proposed routes to the site.

Section 4 identifies the proposed road improvements likely to be necessary to accommodate abnormal loads.

Section 5 identifies proposed traffic management measures, including Police supervision, and community liaison.

Section 6 identifies proposed arrangements to address potential abnormal wear and tear of public roads.

Appendix 1 provides an outline construction programme indicating the phasing of movements in relation to the overall programme.

Appendix 2 provides transport guidelines from sample manufacturers.

Appendix 3 illustrates typical abnormal load haulage arrangements.

Appendix 4 illustrates typical construction plant.

2. TRAFFIC MOVEMENTS

2.1 CONSTRUCTION PLANT

Table 2.1 identifies an indicative construction plant inventory, and indicates the likely vehicle characteristics for transporting this to the site.

2.2 CONCRETE

The estimated concrete requirement is as Table [2.2]:

Table 2.2 Concrete Requirement

Number of turbine foundations	35
Foundation width (square)	16m
Foundation depth	1m
Foundation volume	256m^3
Total foundation volume	8960m^3
Other concrete (substation, anemometer foundations, buildings)	200m^3
Total concrete	9160m^3

There are two possibilities for delivering this to the site. Option 1 is standard ready mix concrete mixer wagons. These have a capacity of 6 m^3 (3 axle truck) or 8m^3 (4 axle truck). Each foundations would be continuously poured in a day. Option 2 is to install a batching plant on the site, and to deliver aggregate and cement (and possibly water if site water is unsuitable), in tippers and tankers. Aggregates can be delivered over a longer period than ready mixed concrete.

Table 2.3 indicates the likely vehicle characteristics for each option.

2.3 CABLING SAND

Electrical cables will be laid in trenches and, according to local site conditions, bedded either in sand brought onto the site, or in locally derived materials. The bedding sand has two purposes: firstly, to protect the cables from damage by stones, boulders, and other backfilled material; secondly to ensure adequate heat transfer away from the cable. Sand is required at approximately 0.375 te per linear metre of cable trench. Assuming a worst case of all cables being laid in imported sand, approximately 6750 te of sand are required for the estimated 18,000m of cable trench. Table 2.3 identifies how this might be transported to the site.

2.4 TURBINE COMPONENTS

For the purposes of this report, the largest turbine suitable for the site is considered (the Nordex N80). Its component parts are typical of its similar competitors, although it is slightly heavier. The components are identified in Table 2.4.

Table 2.4 Turbine components

Component	Number per turbine	Length (m)	Height (m)	Width (m)	Weight (te)	Notes
Foundation ring	1					
1st tower section	1	15.18	4.11	4.11	44.5	
2nd tower section	1	15.23	3.87	3.87	31.9	
3rd tower section	1	26.51	3.87	3.87	39.5	
Nacelle	1	10.3	4.7	3.4	97	Including transport frame
Blade	3	39	3.5	3.3	9.2	
Hub	1	3.5	3.2	2.6	22.5	

Table 2.5 indicates the likely vehicle characteristics for transporting each component.

2.5 SUBSTATION TRANSFORMER

The 33/275kV transformer for the substation is a large plant item, with characteristics identified in Table 2.6. Table 2.5 illustrates the likely transportation details.

The substation would also require other loads, allowed for within 2.2 above, and 2.6 below.

Table 2.6 Grid Transformers

Component	Number	Length (m)	Height (m)	Width (m)	Weight (te)	Notes
Transformer	1	7	4	4	100	Stripped for transport

2.6 BALANCE OF DELIVERIES

Other requirements will include:

- Cabling (approximately 114 cable drums, on 13 regular articulated / non-articulated trucks).
- Control room equipment (approximately 5 articulated / non-articulated trucks).
- Reinforcing steel (approximately 35 articulated trucks).
- Plant fuel – One tanker per 10 days (average).
- Substation balance of plant (approximately 10 articulated / non-articulated trucks).
- Other – eg culvert pipes (1-2 loads), geotextile membranes (1-2 loads), transformers (approximately 12 articulated / non-articulated trucks).

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2.7 TRAFFIC MOVEMENTS SUMMARY

Table 2.7 sets out the estimated characteristics of the traffic movements.

Table 2.7 Estimated Traffic Deliveries

Movement	Total number	Duration (days)	Delivery days	Average per day	Peak per day	Comments
Construction plant (in)	35	10	7	5	6	
Construction plant (out)	35	60	20	2	6	Phased removal
Option 1 Concrete	1280	120	35	36	36	Continuous pour
Option 2 Concrete materials[1]	943	180	156	6	25	Spread over long period
Cable sand	386	90	60	6	10	
Turbine components	280	120	35	8	8	
Other	138	300	200	1	5	

[1] Assumed $1m^3$ concrete = 0.8te aggregate + 0.8te sand + 0.4te cement

Table 2.1 Indicative Construction Plant Inventory

Item	Number of loads	Mode of transport	Load length (m)	Overall length (m)	Overall Width (m)	Overall Height (m)	Load weight (te)	Overall weight (te)	No. axles	Max Axle weight (te)	Vehicle track width (m)
Site offices	4	Artic[1]	8	17	2.4	3.4				<12	2.5
360° excavators	8	LL[2]	4	17	2.4, 3	3.5	25, 40	50, 65	6	<12	2.5
Dumpers	6 to 8	LL	8	17	2.8	3.5	18	43	6	<12	2.5
Crusher	1	Mobile[3]	13	17	2.4	4	35	42	6	<12	2.5
JCB	1	LL	4	17	2.4	3.5	7	32	6	<12	2.5
Bowsers	2	LL	8	17	2.4	3.5	18	43	6	<12	2.5
Concrete batcher	3	Mobile	13	17	2.4	4	4, 12, 18	11, 19, 25	6	<12	2.5
Mobile shovels + rollers	2	LL	7	17	2.5	3.5	12	37	6	<12	2.5
800 te crane	1	n/a	-	17.85	3	4	-	96	8	12	3
Ballast truck	1 to 2	Articulated	17	20	2.9	4		96	8	12	2.5
250 te crane	1	n/a	-	17.4	3	4	-	72	6	12	3

[1] Standard articulated tractor / trailer

[2] Low loader

[3] The plant is wheeled and can be towed

Item	Number of loads	Mode of transport	Load length (m)	Overall length (m)	Overall Width (m)	Overall Height (m)	Load weight (te)	Overall weight (te)	No. axles	Max Axle weight (te)	Vehicle track width (m)
Ballast truck	1 to 2	Articulated	17	20	2.9	4		96	8	12	2.5

Table 2.3 Indicative Concrete and Cable Sand Transport Requirements

Item	Number	Mode of transport	Load length (m)	Overall length (m)	Overall Width (m)	Overall Height (m)	Load weight (te)	Overall weight (te)	No. axles	Max Axle weight (te)	Vehicle track width (m)
Option 1											
Concrete wagons	1280	Mixer	-	11	2.4		15, 20	25, 30	3, 4	<12	2.4
Option 2											
Aggregate	820	Tipper	-	11	2.4		15, 20	25, 30	3, 4	<12	2.4
Cement	124	Artic tanker	13	17	2.4		29	40	6	<12	2.4
Cable sand	386	Tipper	-	11	2.4		15, 20	25, 30	3, 4	<12	2.4

Table 2.5 Indicative Component Transport Requirement

Item	Number	Mode of transport	Rigid length (m)	Overall length (m)	Overall Width (m)	Overall Height (m)	Load weight (te)	Overall weight (te)	No. axles	Max Axle weight (te)	Vehicle track width (m)
Foundation ring	18										
1st tower section	35	Extendable stepframe	20	23.2	4.11	4.95	44.5	72	7	13	2.5
2nd tower section	35	Extendable stepframe	20	23.2	3.89	4.85	31.9	60	7	12	2.5
3rd tower section	35	Extendable stepframe	27	30.7	3.35	4.5	39.5	67	7	13	2.5
Nacelle	35	Hydraulic platform *or* hydraulic low loader	15 or 26	19.6 or 30.6	3.4	4.9 or 4.5	97	130	11 or 10	14.1	3
Blade	105	Extendable flat bed	40	43.75	2.55	4.35	9.2	38	6	9	2.5
Hub	35	Flat bed	13	17	3.2	4.2	22.5	47.5	6	8	2.5
Grid Tr'former	1	Hydraulic platform *or* hydraulic low loader	15 or 24	19.6 or 28.6	4	5.2 or 4.8	100	130	11 or 10	14.1	3

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3. ROUTING

3.1 INTRODUCTION

This section identifies the routing options considered, and explains how the likely preferred route has been identified. (Section 4 subsequently identifies the main modifications likely to be necessary to allow passage of the larger loads.)

To put this in context, the likely points of origin of the components and materials, and the principles informing route selection are outlined.

3.2 POINTS OF ORIGIN

3.2.1 Construction Plant

A civil contractor has not been appointed, so the origin of civil plant and craneage is unknown at this stage. However, it can be assumed that there will be reasonable access to a trunk road from the point of origin (the equipment being moved around from contract to contract), and that access can be gained to Brora on the A9.

3.2.2 Concrete / Aggregates and Cement

The civil contractor will be responsible for deciding whether to bring bulk ready mixed concrete to the site, or to use a batching plant on site and haul aggregates and cement. The contractor will be responsible for sourcing these materials. It is likely to be most economical to use local suppliers.

Local readymix concrete suppliers are located at, for example:

- Wick
- Alness
- Inverness

Aggregate quarries are located at, for example:

- Brora
- Alness
- Invergordon
- Invershin (currently mothballed)

As with the construction plant it can be assumed that there will be reasonable access to a trunk road from the point of origin (materials being transported from the site frequently), and that access can be gained to Brora on the A9.

3.2.3 Turbine Components

The potential wind turbine suppliers are all European companies, predominantly Danish and German. One Danish company, Vestas, has established an assembly

plant in the UK, where it manufactures towers, and assembles nacelles at Machrihanish, near Campbeltown. Other manufacturers are considering establishing similar plants in the UK. Typically tower sections are manufactured in the UK.

The following can be assumed:

- tower sections will originate in the UK
- nacelles (including the hub) will originate either in the UK or in Europe, the latter (and possibly the former) shipped to a port
- blades will originate either in the UK or in Europe, the latter (and possibly the former) shipped to a port

It is assumed that the port at Invergordon would be used, and inquiries have indicated that this should be feasible. Scrabster may provide an alternative, but has not been investigated, although it is likely that steep gradients and bends at Berriedale Braes could be problematic.

3.3 ROUTING CONSIDERATIONS

The following factors will influence the choice of route:

- travel time, effected by
  - distance
  - speed
  - congestion
- minimising loading / unloading points
- physical constraints including
  - road width
  - corners, bends, junctions
  - height restrictions
  - buildings and structures
  - street furniture
  - gradients
- structural strength of bridges and culverts
- advice of highways authority and police

The key issue, in particular for the long loads, is the feasibility of overcoming physical constraints.

3.4 ROUTE OPTIONS – TURBINE COMPONENTS / LARGE CONSTRUCTION PLANT

3.4.1 Preferred Route

The preferred route is Route 1 (Figure 1), which is considered to be feasible for large loads, subject to the modifications outlined in section 4. Route 2 may provide a preferable alternative for the heaviest loads (see 3.4.2).

The route leaves the Invergordon port area heading east on the B972, and then turns north on the unclassified road past the former aluminium smelter.[1] This road was purpose built to accommodate abnormal loads. At the junction it turns north west along another unclassified road, turning east onto the A9 at Tomich. The route continues along the A9 to Brora, via Golspie.

The route continues through Brora, then turns west down the unclassified road, past the Clynelish Distillery, and over Clynelish Moss, to meet the C6 Strath Brora road. The route continues north west along the C6 to Ascoile, and the access track to the windfarm site.

The following paragraphs identify the difficulties identified for other options considered.

3.4.2 Route 2 –Variation to Route 1 via C6 at Brora Bridge

This is the original route, subsequently improved upon by Route 1. This would involve turning the longer abnormal loads south of Brora at the Police Station / Hunters of Brora road, and reversing north through the village, past the C6 junction. The vehicles would then approach the junction as an 'open' turn rather than a 'tight' turn, and continue along the C6 to join Route 1. Whilst Route 2 is feasible, Route 1 is preferred since it does not involve reversing through the village; there is more room for manoeuvre at the junction; and it can accommodate larger turbine blades.

This may be the preferred route for the heavy compact loads such as the turbine nacelles, cranes and ballast trucks, and grid transformer to avoid loading of the road at Clynelish Moss. These loads could be turned at the Old School House.

The possibility of continuing through Brora and turning the vehicles north of the village was also investigated, but no suitable turning places were identified.

3.4.3 Route 3 – Via Rogart

This route leaves the A9 on the A839 at Loch Fleet, and continues north west to Rogart. It then turns north east along the C6 opposite Rogart Station, and continues to Ascoile along Strath Brora.

[1] Alternatively the vehicles could head west along the B817, and join the A9 at the Dalmore junction via a flyover and slip road, which would avoid a right turn onto the A9.

Route 1 is preferred since Route 3 is constrained by tight bends in the Rogart area and the bridge at Dalreavoch is understood to be weak.

3.4.4 Route 4 – Rail from Invergordon to Brora

This option has not been evaluated in detail since it presents a number of practical difficulties and disadvantages, and does not provide any specific advantages, being only an alternative to 50km of road transport on the A9 trunk road. The difficulties and disadvantages are:

- 2 additional handling points to transfer from truck to rail at Invergordon, and unload rail to truck at Brora
- the lack of suitable rail sidings at Brora
- the difficulties of accessing the A9 from the railway

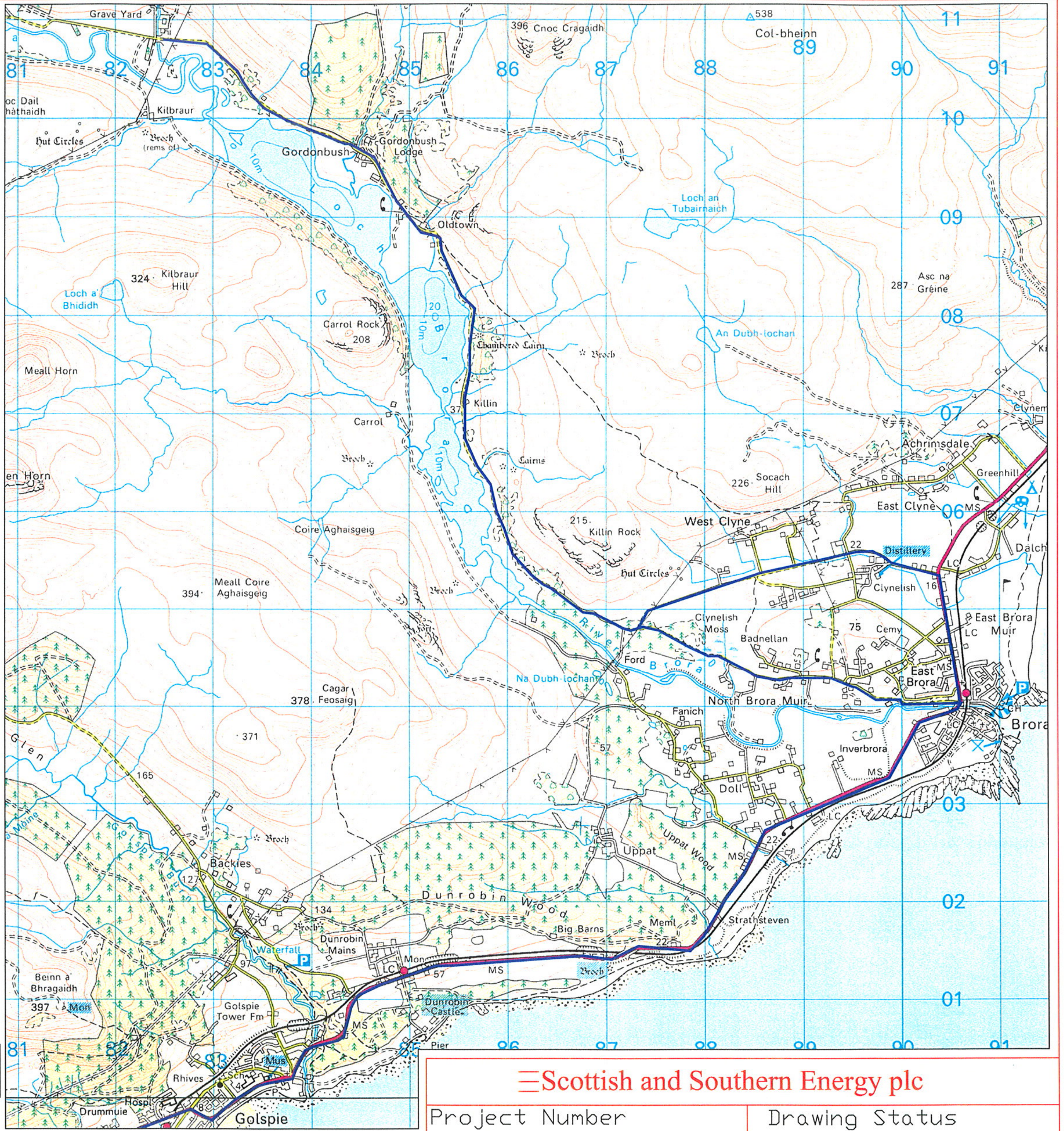
3.5 ROUTE OPTIONS – OTHER HGV TRAFFIC

3.5.1 Route 1, Route 2

Assuming Brora as a starting point, there are two options, Route 1 and Route 2. Route 1 may be preferred in order the limit the length of road that may need to be repaired due to abnormal wear, although Route 2 may be more suitable for larger volumes of heavy traffic.

3.5.2 Route 3

Should concrete or concrete materials be sourced from the west (eg Invershin) then Route 3 would be used to minimise the transport distance.



KEY:– ABNORMAL LOAD ROUTE

WARNING: DRAWING MAY BE REDUCED. DO NOT SCALE.

REV	Date	Drwn	Chkd	Appd	REV	Date	Drwn	Chkd	Appd	REV	Date	Drwn	Chkd	Appd
REV	Date	Drwn	Chkd	Appd	REV	Date	Drwn	Chkd	Appd	REV	Date	Drwn	Chkd	Appd

DATE	27/05/03
SCALE	OS TILE
DRAWN	L.GORDON
CHECKED	C.MARDEN
APPROVED	C.MARDEN

Scottish and Southern Energy plc

Project Number: 81961

Drawing Status: FOR ILLUSTRATIVE PURPOSES ONLY

Title: FIGURE 1: SUGGESTED ABNORMAL LOAD ROUTE

Location	SSE Drawing Number	ShtNo	RevNo
GORDONBUSH WINDFARM	137/1000/0006	00	00

4. ROUTE IMPROVEMENTS

4.1 INTRODUCTION

This section outlines general and specific road improvements that are likely to be necessary in order to accommodate abnormal loads along Route 1. The final improvements will be proposed by the turbine supplier and his haulage contractor, following detailed study, having consulted the highway authorities. It is not possible definitively to define the final improvements at this stage; they may vary according to turbine supplier / haulage contractor depending on the characteristics of their turbines and haulage equipment. However, the following paragraphs are informed by transport specialists with experience of transporting wind turbine components.

Specific items, and general items are considered in turn.

4.2 SPECIFIC IMPROVEMENTS

4.2.1 A9 / Clyne Junction

The Old Schoolhouse (known locally as Knox's Cottage) is currently uninhabited and derelict. Scottish and Southern Energy has purchased the property. It is proposed to widen the junction by removing the stone wall surrounding the property to the south and east, and relocating the post box. The junction would be built to a specification agreed with the highways authorities.

4.2.2 Clynelish Moss

It may be necessary to reinforce the road at Clynelish Moss.

4.2.3 Nam Bam culverts

It is understood that the Nam Bam culverts would require to be replaced.

4.2.4 Oldtown Bridge

The approach to Oldtown Bridge requires to be widened, to allow a straighter approach to the bridge. It is proposed to widen the approach by cutting into the bank on the north side of the road.

It may also be necessary temporarily to remove the bridge parapets.

4.2.5 Gordonbush Bridge

The approach to Gordonbush Bridge requires to be straightened. There are two possibilities; either removal of 1 to 3 trees on the south side to allow more 'air space' for the long loads, or widening on the north side.

It may also be necessary temporarily to remove the bridge parapets.

4.2.6 Formation of New Site Access

An appropriate access will be designed at Ascoile. The first 10-20m will be of tarmac, to provide a sound junction.

4.2.7 Removal of undulations

If Route 2, the C6 via Brora Bridge, is used for some of the abnormal loads, it may be necessary to remove some of the pronounced undulations in the first 1-2km to prevent grounding.

4.3 GENERAL MODIFICATIONS

4.3.1 Street Furniture

It may be necessary temporarily to remove or relocate street signs, street lights, and utility poles and services. The relevant areas would be identified by more detailed studies, and utilities consulted.

4.3.2 Localised Widening

On the final 12km approach to the site it may be necessary to provide a wider running surface (3.5m on straights, more as appropriate at bends), in particular to accommodate the widest vehicles, the cranes which have a 3m wheel track. This can in general be achieved by laying a pipe in the ditch, then overlying this with hardcore. This can be reinstated. Widening will be localised according to road width, and occurrence of bends.

4.3.3 Structural Checks

The highways authorities will be consulted to establish if any structural checks are required on bridges and culverts. Should this indicate that the structure cannot accept the proposed loadings, then solutions may include replacement, propping or spanning, as appropriate.

4.3.4 Passing Places

It will be necessary to create additional passing places on the approach to the site. The location of these additional passing places would be agreed with the highways authority, in consultation with the Police.

5. TRAFFIC MANAGEMENT

5.1 INTRODUCTION

This section proposes traffic management measures to ensure the efficient transport of components and materials to the site, whilst minimising disruption to other road users and ensuring the safety of contractor personnel and the public.

It considers legal requirements, practical measures, and methods to communicate the finally agreed plan in practice.

5.2 LEGAL CONTEXT

Out of gauge loads (on account of their abnormal length, width, height or weight) require notification to the Scottish Executive under *The Special Type General Order 1979* (STGO). Under this procedure, the Scottish Executive will define an approved route, and notify the Police.

It is likely that the following loads will require notification:

- tower sections
- nacelles
- hubs
- blades
- cranes
- crane ballast and rigging trucks

5.3 PRACTICAL MEASURES

5.3.1 Management Co-ordination

It is proposed that, in addition to pre-application consultation, a management co-ordination group is established to facilitate communication and co-ordination by the relevant authorities regarding the abnormal loads. This group may include:

- Highland Council
- Bear
- Northern Constabulary
- Haulage Contractor

5.3.2 Police Escort

It is likely that the Police would escort all abnormal loads from the docks to the site, with the possible exception of hubs. Generally, the preference would be to have a convoy of several vehicles, in order to minimise disruption to other road users. The escorting vehicles (probably motorcycles) would warn oncoming vehicles of the approaching loads, pulling the vehicles in where necessary. The escort would also pull the convoy over to allow any buildup of following traffic to pass, at preidentified suitable locations.

5.3.3 Timing

It is likely that escorted loads would travel during daylight hours, for safety reasons.

Other traffic would, in general, coincide with site working hours, generally 7am to 6pm, although it may occasionally be necessary to extend beyond this.

5.3.4 Road Closures

It may be necessary to close the road on the approach to the site, ie west of Brora, in order to avoid congestion when abnormal loads are on the move. By moving several vehicles at once, the number of closures can be minimised. By careful signage and communication, local residents can be prewarned of these closures, and make alternative arrangements. It may be possible to close the road in sections, thus allowing continued access via alternative routes.

Alternatively, it may be possible to manage oncoming traffic by means of Police outriders without closing roads.

5.3.5 Driver Induction

The drivers' induction will include

- a safety briefing
- the need for appropriate care and speed control
- identification of specific sensitive areas (eg Golspie, Brora)
- identification of the specified route
- the requirement not to deviate from the specified route

Safety is of prime importance to Scottish and Southern Energy; drivers breaching safety rules will be removed from the job.

5.3.6 Signage

Where appropriate, additional warning and speed control signs can be installed, temporarily or otherwise, with the agreement of the highways authority.

5.4 COMMUNICATION

It is proposed that a construction liaison committee be established to ensure the smooth management of the project / public interface. Traffic management is likely

to be an issue considered by the liaison committee. It is proposed that representatives of Scottish and Southern Energy, the construction contractors, the local community, and, if appropriate, the Police form the committee. This committee will form a means of communicating, updating on forthcoming activities and dealing with any issues arising.

In addition, road closures will require notices. There will be an opportunity for interested parties to identify themselves, and be updated of plans by means of email communication, post or telephone. In addition, the Police may be able to arrange notice of abnormal loads on local radio.

6. MAINTENANCE

Highland Council have indicated that they would require an agreement under section 96 of *The Roads (Scotland) Act 1989*. In essence, this agreement provides for a developer to cover the cost of abnormal wear and tear on roads not designed for that purpose. This would relate to the unclassified roads west of Brora.

The detail of this agreement would be agreed subsequent to planning permission, but the requirement to enter into such an agreement may form a planning condition.

APPENDIX 1: EXAMPLE CONSTRUCTION PROGRAMME / TRANSPORT PHASING

Numbers of deliveries

Month	1	2	3	4	5	6	7	8	9	10
Construction plant	30 in		5 in		5 out	5 out	5 out	5 out	5 out	5 out
Concrete*			320	320	320	320				
Aggregates*	157	157	157	157	157	158				
Cabling sand						128	129	128		
Turbines						70	70	70	70	
Other	13	13	13	13	13	21	13	13	13	13
Tracks										
Foundations										
Control building										
Cabling										
Turbine erection										
Commissioning										
Totals (concrete option)	43	13	338	333	338	544	217	216	83	18
Totals (aggregate option)	200	170	175	170	175	382	217	216	83	18
Daily average (concrete option)	2	1	14	14	14	23	9	9	3	1
Daily average (aggregate option)	8	7	7	7	7	16	9	9	3	1

* Alternative options

APPENDIX 2: EXAMPLE TURBINE MANUFACTURERS TRANSPORT GUIDELINES

TRANSPORT OF VESTAS V80

LAND BY TRUCK

The transport will typically consist of the following:

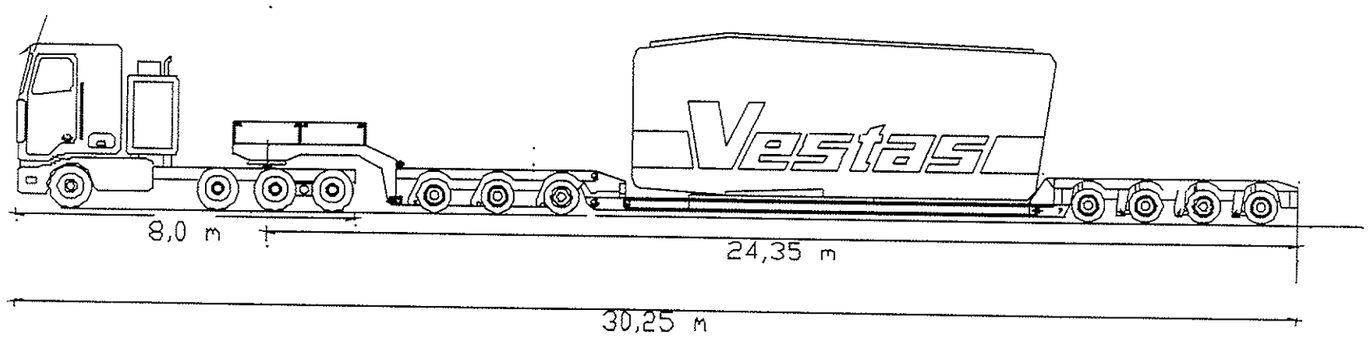
Quantity	Description
1	Float loaded with complete Nacelle
1	Extendible Trailer for Blade Transport
4	Trailers for Towers
1	Trailer loaded with Cables/Controllers
1	Trailer with Blade Hub
1	Trailer loaded with 40 ft Container with Tools and Generator for Erection

The above is for guidance only

EQUIPMENT V80	
NACELLE	
Float including Tractor	50,000 kg
Nacelle	63,000 kg
Transport Frame for Nacelle	7,600 kg
Adapter Ring for Bottom Frame	500 kg
Lifting Yoke	3,600 kg
Total Dimensions for Trailer Combination	30 x 3.40 x 4.35 m
BLADES	
Trailer and Tractor + 1 set (3 pcs.) blades	75,000 kg
Total Dimensions for Trailer Combination	47.00 x 3.10 x 4.20 m

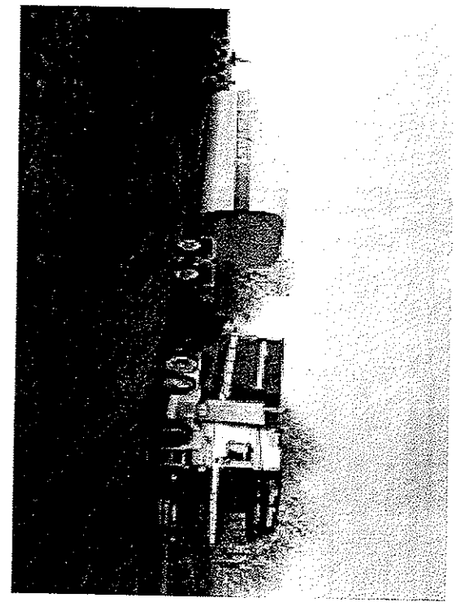
V80

TOTAL VEHICLE WEIGHT CONSISTING OF COMPLETE NACELLE APPROX. 120,000 KG

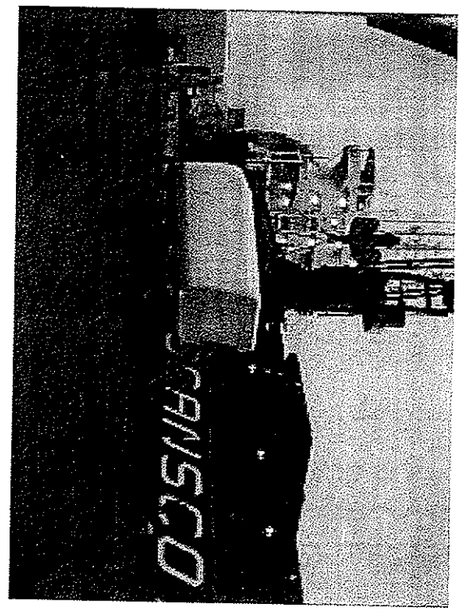


Trailer Transport V80 Nacelle

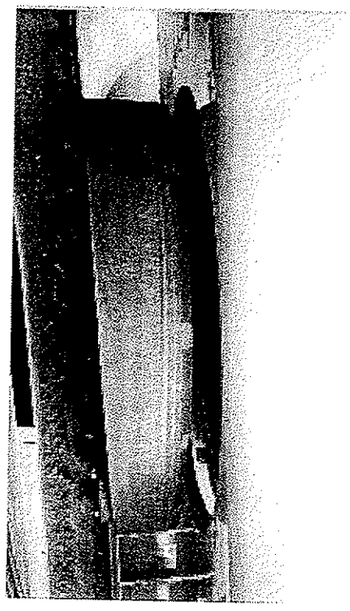
Tractor Trailer Combination



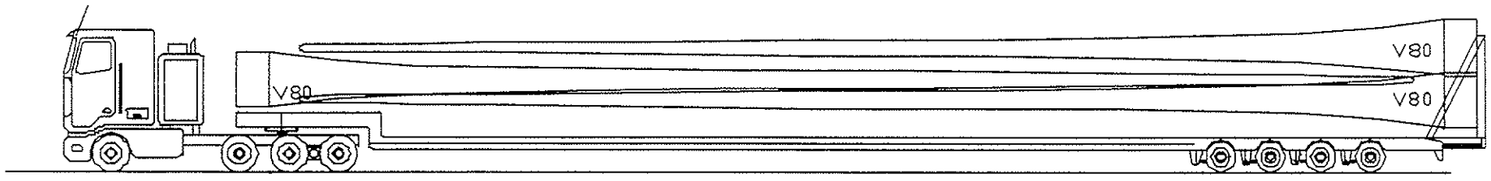
Nacelle lifted onto ship



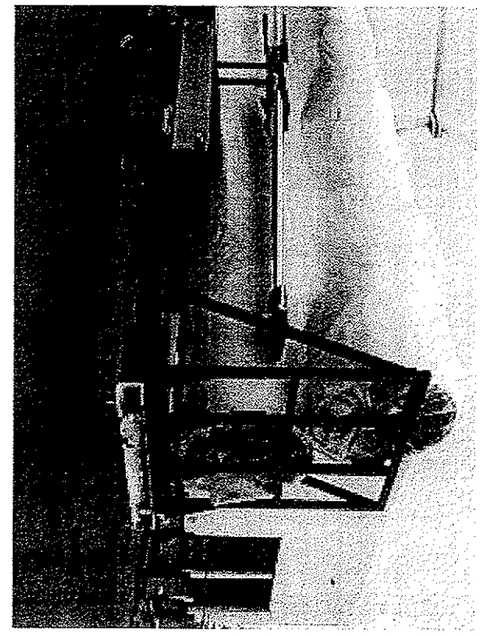
Nacelle mounted on nacelle frame

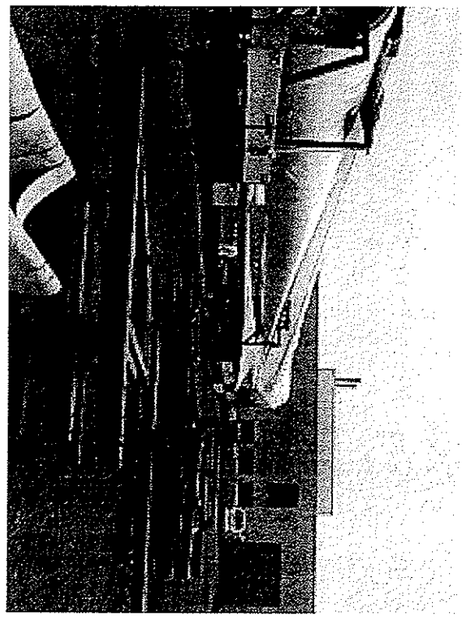


V80 – TRANSPORT OF BLADES

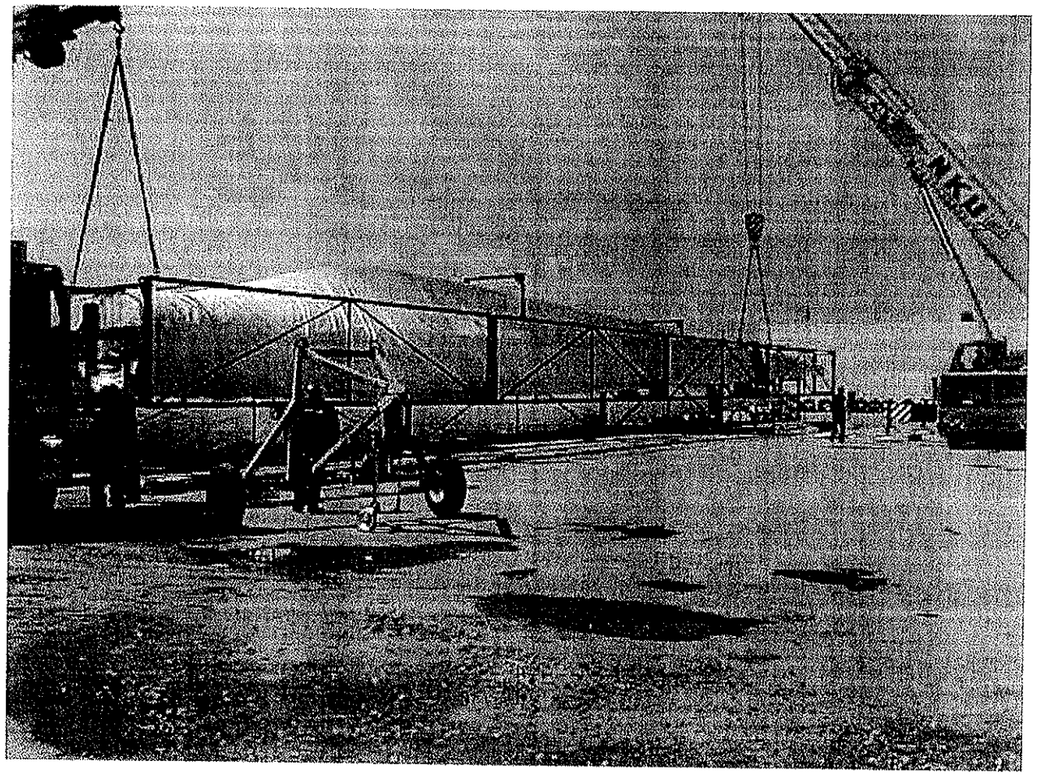


V80 Blade Transport
Trailer

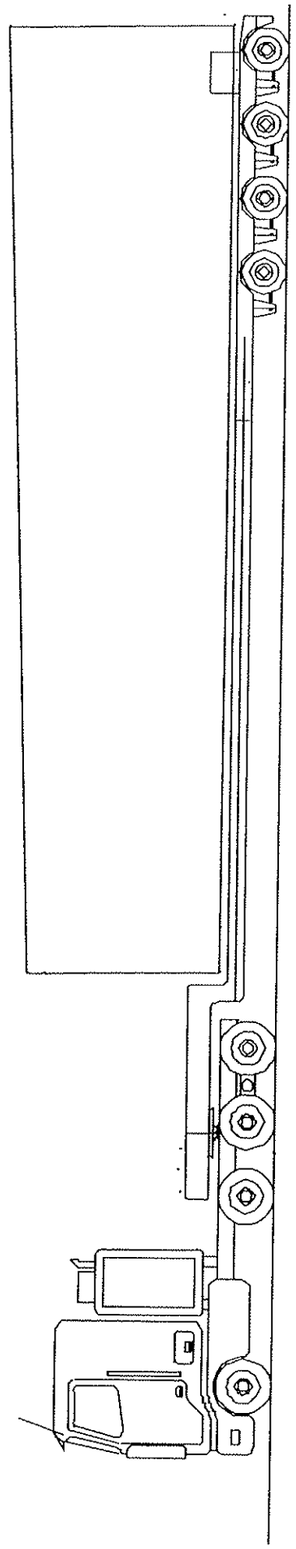




BLADE TRANSPORT V80 FOR SEA TRANSPORT



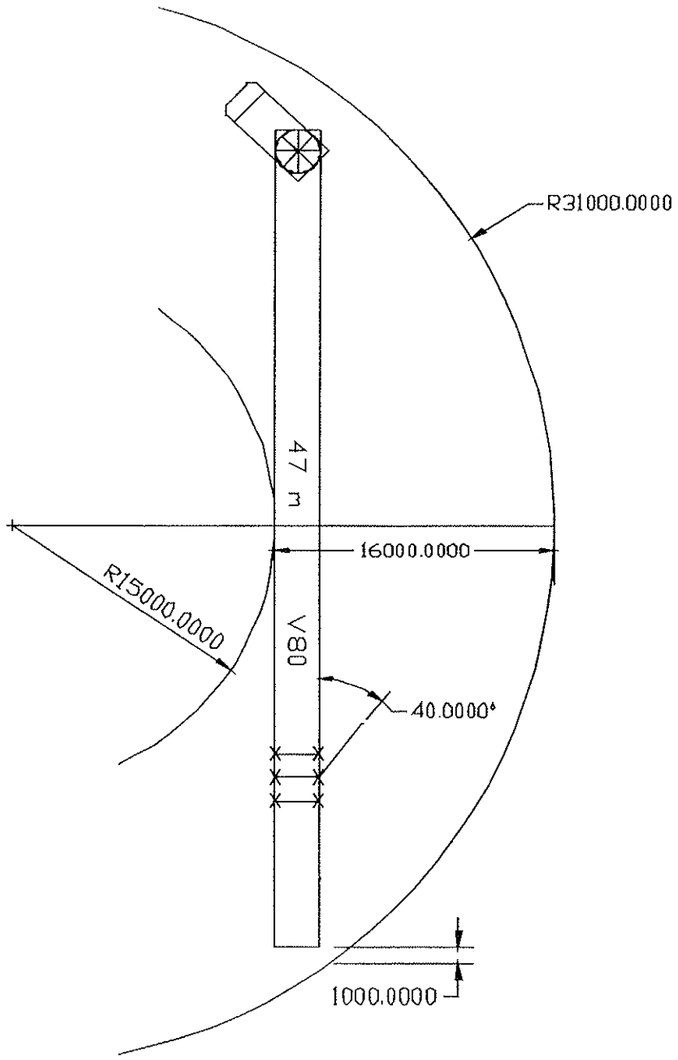
TRANSPORT OF TOWER SECTION V80



ROAD TRANSPORT V80 BLADES

Radius required for 47 m extendible trailer with electric/hydraulic manually controlled turnable rear wheels.

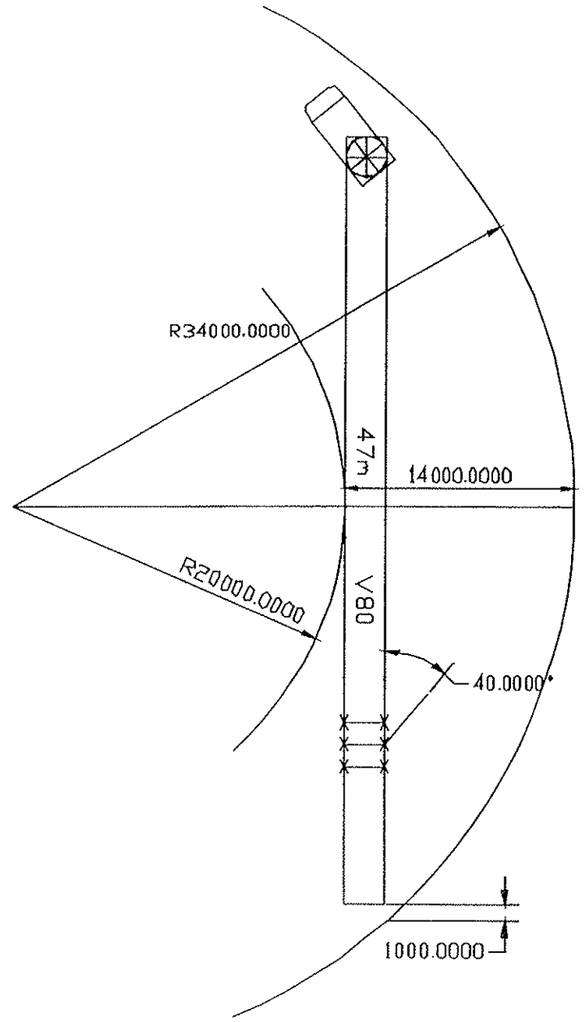
Radius 15 m



ROAD TRANSPORT V80 BLADES

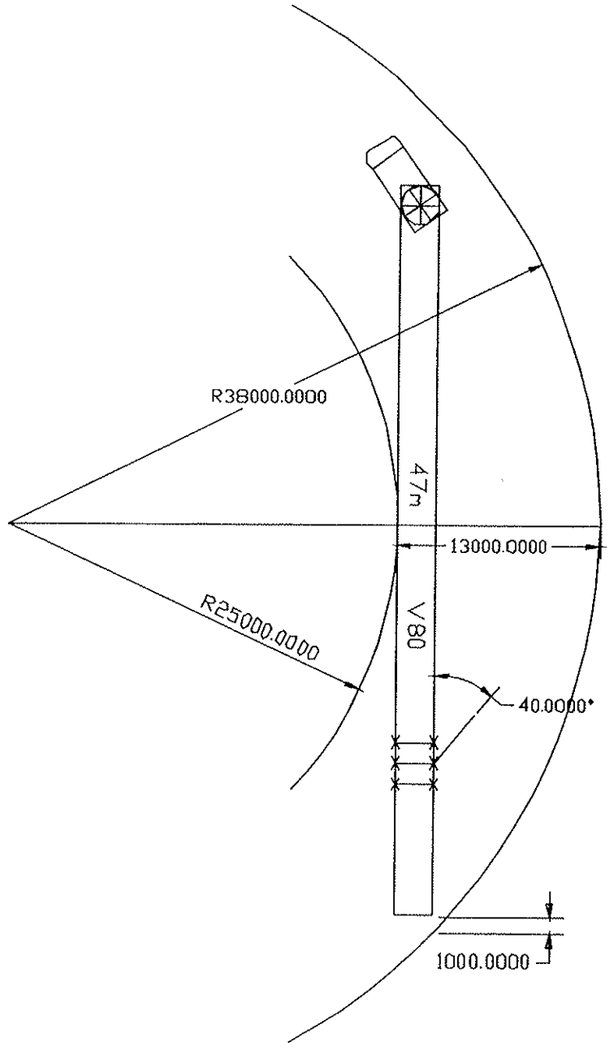
Radius required for 47 m extendible trailer with electric/hydraulic manually controlled turnable rear wheels.

Radius 20 m



Radius required for 47 m extendible trailer with electric/hydraulic manually controlled turnable rear wheels.

Radius 25 m



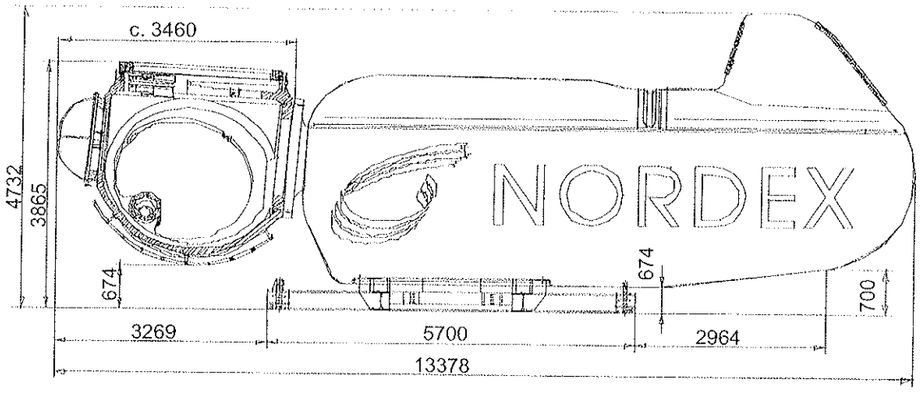
NORDEX N-80

Transport, access roads and crane requirements

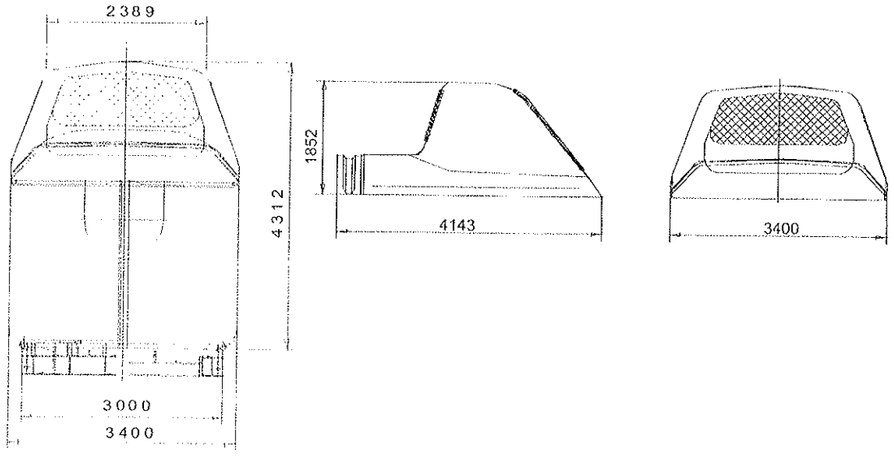
Transport weights and dimensions

Drawings

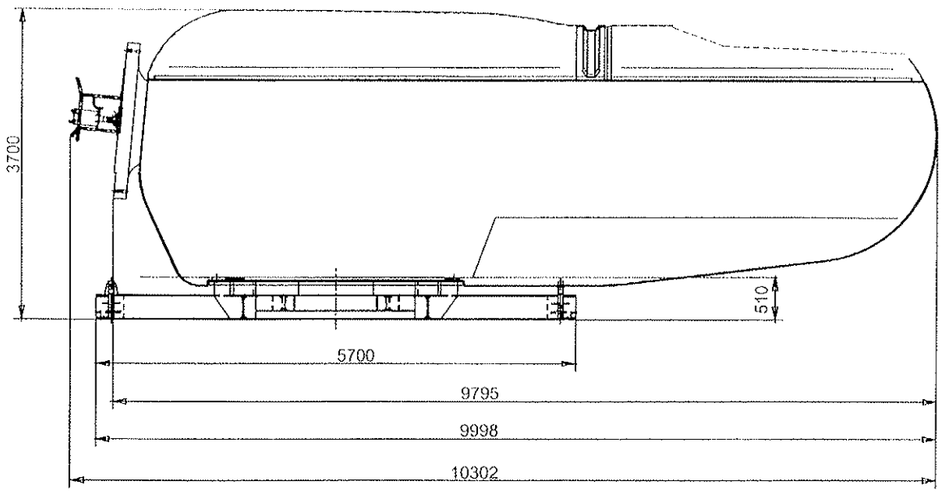
Overview



Rear view with hood



Nacelle on transport frame without hub and hood



To ease the transport hub and hood are not yet mounted.

Hub

Weights of components at crane hook

Nacelle	
Height including transport frame	3.70 m
Width	3.40 m
Length	13.38 (without handrail 12.70 m)
Weight including transport frame, excluding hub, excluding blades	c. 97 t
Weight excluding transport frame, including hub, excluding blades	c. 117 t

Blades	
Length	39.0 m
Height	3.50 m
Diameter flange	2.60 m
Weight per blade	c. 9.2 t

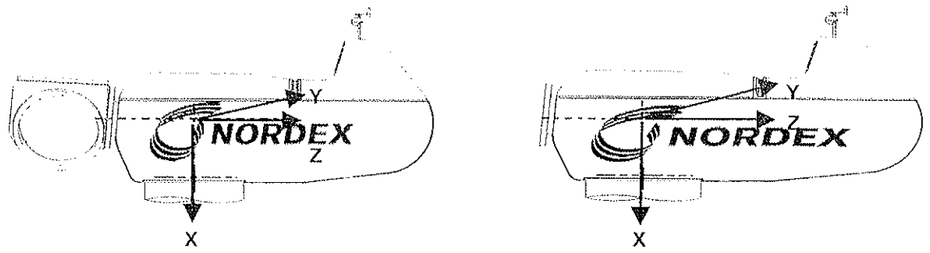
Component weights	
Hub	22.5 t
Rotor, complete	c. 50 t
Transport frame	c. 3.3 t

Centres of gravity

Coordinates of c.o.g.	with hub	without hub
Point of origin of coordinates	intersection of rotor and tower axis	intersection of rotor and tower axis
X_S	- 1.48 m	- 1.37 m
Y_S	0.00 m	0.00 m
Z_S	- 1.07 m	- 0.44 m

The coordinates of c.o.g. of the nacelle with and without hub are determined regardless of the transport frame.

Coordinate system with point of origin placed in intersection of rotor and tower axis:

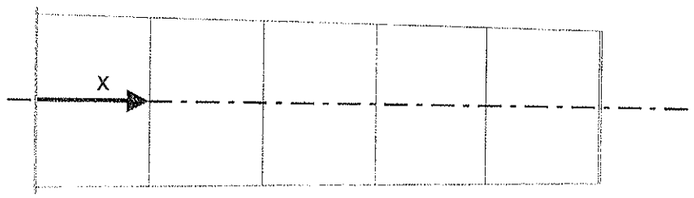


Towers

Hub height Type of tower Regulations		60 m tubular IEC 1	*80 m ** *tubular* *IEC 1*	60 m tubular DIBt 3	80 m tubular DIBt 3	100 m tubular DIBt 3
Total weight	t	115.9	*198.0*	134.7	213.4	281.9
1st Segment (bottom)						
Length	m	15.18	*18.16*	14.00	16.50	15.14
Diameter flange	m	4.11	*4.26*	4.20	4.20	5.72
Diameter bottom	m	3.88	*4.04*	3.89	3.89	5.45
Diameter top	m	3.87	*4.03*	3.62	3.84	5.45
Weight	t	44.5	*70.2*	45.8	69.7	72.9
Centre of gravity x	m	-	-	6.48	7.35	6.94
2nd Segment						
Length	m	15.23	*18.27*	20.29	16.50	15.16
Diameter bottom	m	3.87	*4.03*	3.62	3.84	5.45
Diameter top	m	3.87	*4.02*	3.31	3.62	5.44
Weight	t	31.9	*54.4*	51.7	58.2	56.3
Centre of gravity x	m	-	-	9.47	7.98	7.37
3rd Segment						
Length	m	26.51	*18.22*	23.15	20.50	14.51
Diameter bottom	m	3.87	*4.02*	3.31	3.62	5.44
Diameter top	m	2.96	*4.02*	2.95	3.31	4.20
Weight	t	39.5	*40.5*	37.2	47.9	46.4
Centre of gravity x	m	-	-	10.23	9.47	7.02
4th Segment (top)						
Length	m		*22.26*		23.50	15.24
Diameter bottom	m		*4.02*		3.31	4.20
Diameter top	m		*2.96*		2.95	4.20
Weight	t		*32.9*		37.6	42.6
Centre of gravity x	m		-		10.31	7.47
5th Segment						
Length	m					15.20
Diameter bottom	m					4.20
Diameter top	m					4.20
Weight	t					31.7
Centre of gravity x	m					7.12
6th Segment (top)						
Length	m					21.68
Diameter bottom	m					4.20
Diameter top	m					2.96
Weight	t					32.0
Centre of gravity x	m					10.25

*) - preliminary

Please allow variations of the weight of ± 5 %.



Crane requirements

The data given are for erection by lattice crane.

Hub height	60 m	80 m	100 m
Main crane		550 t	
Hook load of main crane		118 t	
Hook height of main crane		98 m	
Pilot crane		120 t	
Hook load of pilot crane (radius 8m)		38 t	

Example for crane area for erection