

# CLASHINDARROCH II WINDFARM

## **Abnormal Load Route Assessment, Additional Assessment for 70m Turbine Blades**

Prepared for: Vattenfall Wind Power Ltd

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## 1.0 Introduction and Scope

### Introduction

- 1 SLR Consulting has been instructed by Vattenfall to prepare a detailed access report for the delivery of wind turbine components and general construction traffic to the proposed Clashindarroch II Wind Farm (the Site), located near Huntly, Aberdeenshire, Scotland.
- 2 This report addendum is provided to detail the additional implications for the transport of 70m long wind turbine blades to the development site.

### Background

- 3 Clashindarroch II Wind Farm, herein referred to as the Site, is situated within Clashindarroch Forest, approximately 6km southwest of the residential area of Huntly. Vattenfall propose to construct in the order of 14 wind turbines on land adjacent to the existing Clashindarroch I wind farm.
- 4 The previous assessment work completed for the existing wind farm at Clashindarroch included a 'Route Access Study' completed by Collett Consulting in 2011. The study formed an assessment of the impacts which could result from the transport of abnormal loads to the Site. The assessment was undertaken for a blade size of 44m.
- 5 The study included a review of the route from the port at Inverness as well as the port at Aberdeen; the results of the Collett study identify that the route from Aberdeen would result in less of an impact with the removal of street furniture in 3 locations compared to the removal in 21 locations along the route from Inverness.

### Scope of Work

- 6 This Abnormal Load Route Assessment has been prepared to assess the feasibility of the route from the Port of Aberdeen for the transportation of abnormal loads, in the form of wind turbine components, to the Site. The assessment focuses on the suitability of the route option, with identification of specific areas likely to present significant constraints. Swept path analysis is undertaken for those problem areas; any additional areas where road signage may require temporary relocation will be considered as part of the detailed analysis completed by the company commissioned to transport the abnormal loads.
- 7 SLR devised the following scope of works:
  - Review of previous Abnormal Load Route Assessment for the Site;
  - Desk based study to identify potential pinch points along the route;
  - Site visit undertaken on the 30th May – 1st June 2017;
  - Swept Path Analysis of identified potential pinch points; and
  - Production of this Abnormal Load Route Assessment report

### Report Structure

This report contains a logical arrangement of the information and analysis required to properly assess the two potential routes. The information is set out in the following chapters:

- Chapter 1 – Introduction and Scope
- Chapter 2 – Proposed Development
- Chapter 3 – Transport Requirements
- Chapter 4 – Swept Path Analysis Vehicle Configuration
- Chapter 5 – Port of Aberdeen to Site Route Assessment
- Chapter 6 – Summary

## 2.0 Proposed Development

### Site Location

- 8 The application Site is located within Clashindarroch Forest, approximately 6km to the south west of the settlement of Huntly and 55km northwest of Aberdeen, nearby settlements include Rhynie, Haugh of Glass and Cabrach. The Site is located within the Aberdeenshire Council (AC) administrative boundary and is owned by Forestry Commission Scotland. Clashindarroch Forest forms part of the development area which is owned and operated by Forest and Land Scotland (FLS).
- 9 The area of the Site extends to 1,234ha, with the proposed wind turbines located in the southern part of the Site. Access to the Site would be taken from the A920 and would utilise as far as possible the existing on-Site access tracks.

### Description of Proposed Development

- 10 The proposed development would consist of the following components:
- in the order of 14 turbines;
  - substation and control building;
  - onsite access tracks;
  - crane hardstandings adjacent to each turbine;
  - temporary Site construction compound and associated infrastructure; and
  - borrow pits - material for the construction of on-Site tracks would, where possible, be derived from borrow pits within the Site should the materials found be suitable.
- 11 The duration of the construction works is expected to be in the order of 18 months.

### Proposed Access Route

- 12 It is anticipated that access to the Site from the A920 would be provided along much of the same route used for the Clashindarroch I Wind Farm, initially via existing forestry routes onto the highway network. To reach the access junction on the A920 large vehicles would travel east along the A920 from the A96. To reach the A920 there are two main feasible routes. These are:
- **Inverness docks to Site:** Approximately 107.3km with vehicles travelling on the A9 from Inverness onto the A96 to the junction with the A920;
  - **Aberdeen docks to Site:** Approximately 69km with vehicles travelling on the A96 from Aberdeen onto the A9001, the A920 and the A96 to the junction with the A920.
- 13 A route access study, comprising of a site visit to undertake a visual inspection of the identified routes to confirm their suitability and a desk study of available mapping and previous reports has been undertaken for both routes.

### Turbine Details

- 14 The exact model of wind turbine to be installed at the proposed development has yet to be selected. This ALRA has considered the use of an indicative turbine which is referred to as a candidate for the wind farm. Each turbine would have a maximum height of 180m to blade tip in an upright position and

will likely be of a tubular tower design with three rotor blades on a horizontal axis, finished in a light grey semi-matt colour. A connection to the grid is likely to be made at the existing grid connection associated with the Clashindarroch I Wind Farm. The precise route of cabling has not yet been determined. The tower will most likely come in sections not greater than 30m each in length. The exact make and model of the turbine is currently undetermined.



## 3.0 Transport Requirements

- 15 Wind farm developments can generate traffic impacts associated with the vehicles removing and delivering materials during preparation and construction of the wind farm. The delivery of the wind turbine components and any equipment associated with connection and distribution of generated power may bring about impacts beyond that of the general construction traffic.
- 16 Paramount during the consultation period is the need to consider the capacity of the highway network both locally and from the point of disembarkation to accommodate the extraordinary transport configurations necessary to deliver the various components comprising a wind turbine, as the various components are longer, wider and heavier than general construction traffic.
- 17 Movement of transport configurations in excess of 30m length, 5m width, or 44 tonnes gross weight are considered exceptional and are controlled by the Special Types General Order Regulations (STGO) or are subject to Special Order (SO or VR1) requirements depending on their size, which is outlined in Section 3.1. The application process regulating such movements may insist that a thorough examination of structural and negotiability aspects of the move are considered.
- 18 The movement of abnormal indivisible loads is controlled by the requirements of the Department of Transport who stipulate varying notice procedures dependent upon overall dimensions.
- 19 The access study has identified the transport configurations for the most onerous wind turbine components, transported by a specialist vehicle fleet.

### Necessary Agreements

- 20 Anyone who requires to move an abnormal load on the public road network is obliged by law to give advance notification to the relevant local Road and Bridge Authority in order that the proposed route can be assessed for suitability. An abnormal load is defined as a vehicle which exceeds the dimensions set out in the Road Vehicle (Construction and Use) Regulations 1986. Generally these dimensions are:
- Not exceeding 2.9m (9'6") overall width.
  - Not exceeding 18.3m (60'0") overall length.
  - Not exceeding 44,000kgs (44t) gross weight.
- 21 Vehicles exceeding any of the above but not exceeding the following dimensions require a Special Types General Order. These orders require giving a minimum of two days' notice of the intended move to the relevant authorities. In addition with regards to the gross vehicle weight, indemnities are required for the structures that are crossed.
- Exceeding 2.9m (9'6") but not exceeding 6.1m (20') overall width.
  - Exceeding 18.3m (60'0") but not exceeding 30m (98'6") overall length.
  - Exceeding 44,000kgs (44t) but not exceeding 80,000kgs (80t) gross weight (2 days' notice).
  - Exceeding 80,000kgs (80t) but not exceeding 150,000kgs (150t) gross weight (5 days' notice).
- 22 Vehicles exceeding any of the above require a Special Order. These orders require giving a minimum of 5 days' notice to the relevant authorities, in addition with regards to the gross vehicle weight, indemnities are required for the structures that are crossed.

- 23 All new road bridges in the United Kingdom are designed to carry the maximum permitted 44 tonne vehicle in each available traffic lane (at the same time), and all existing bridges are assessed on a regular basis for the vehicle loading. Bridges that fail their assessment are required to display a warning sign giving the maximum permitted weight to prevent further damage to the structure.
- 24 Structures that are crossed along the access routes that do not have a warning sign, are capable of carrying the maximum legal weight vehicle.
- 25 There is no legal maximum height for loads being transported on public roads in the United Kingdom, however all new road bridges are built with a minimum height clearance of 5.2m. Any bridge that has a height clearance of 16 feet, 6 inches (5.03m) or less, legally has to have a warning sign on the road approaching it. Structures that are passed under, along the access routes that do not display a height warning sign are considered to have 16ft 6in clearance. Further advice is available from Transport Scotland, and the relevant local roads authorities for the routes.
- 26 Prior to the movement of abnormal loads, extensive public awareness is required to allow residents to plan and time their journeys to avoid disruption. The haulage contractor shall remain responsible for obtaining all necessary permits from the relevant road and bridge authorities along the access route.

## Time Restrictions

- 27 The movement of abnormal loads will need to be timed to avoid periods of heavy traffic flow to minimise disruption to the public. These include the normal daily rush hour periods, Saturdays and major public events. Specific timing restrictions imposed by the police or local authority have not been determined at this stage.

## Escorts

- 28 Through urban areas temporary parking restrictions may be necessary to guarantee a clear route for the abnormal loads, and these need to be arranged in advance through the appropriate local authority. The parking restrictions will need to be locally enforced.
- 29 Due to the size of vehicles required to transport these loads, escorts will be required for the entire route to control oncoming and conflicting traffic.

## 4.0 Swept Path Analysis Vehicle Configuration

- 30 Swept path has been undertaken for the development on OS base mapping using bespoke vehicle and load combinations appropriate for the size of turbines that are proposed. All vehicles are modelled by SLR from the generic standard vehicles contained in the AutoTRACK software library. The vehicles have been modified in length and number of axles on the trailer. The turning properties of the vehicles have not been modified.
- 31 Data used for determining the length of trailers has been obtained from various manufacturers including Noteboom. SLR is therefore aware that the lengths of trailers used in the assessment are available, but is not aware of which haulage companies will have these trailers available for use.
- 32 The proposed routes have previously been used to transport wind turbine components, and as such, swept path analysis has not been undertaken for the tower sections or the nacelles, as these components are similar in size to those previously transported along the route. However the 56m blade length is greater than those previously transported, and swept path has therefore been undertaken for these components.
- 33 Three trailer lengths have been used for the assessment, as the location of the rear axles can greatly alter the swept path. Other trailer lengths to those used in the assessment are available. All of the trailers used are telescopic, and so any length can potentially be provided up to the maximum 55m. Additionally, three vehicle and load combinations have been used to determine the most appropriate vehicle to transport the turbine blades. The vehicles used are:
- Volvo FH16 8x4 tractor towing a 41m long trailer with rear axle steering
    - The blade will overhang the rear of this vehicle by 15 metres
    - This was previously the longest available vehicle
  - Volvo FH16 8x4 tractor towing a 55m long trailer with rear axle steering
    - The blade will overhang the rear of this vehicle by 1 metre
    - This is the longest available vehicle SLR can find
- 34 Manual override of the rear axle steering has not been used in the assessment, except where stated on the drawings. Manual override of the rear axle steering can allow the vehicle to turn with less space required for the trailer to straighten up; however it needs to be used with caution as the trailer wheels are not powered and they can only follow the tractor. By not using the manual override, an additional factor of safety is built into the assessment.
- 35 The swept path drawings do not identify specific items of street furniture that will need to be temporarily removed to allow the passage of the long vehicles.
- 36 The load height for the trailers is 1.15m, therefore any item of street furniture over this height within the swept area of the load will need to be temporarily removed; this will include all street lights, traffic signals and traffic signs however bollards and street nameplates will typically be low enough to be over sailed.
- 37 Where verges and footways are overrun by the wheels of tractors or trailers, the surface will need to be strengthened and protected. Depending on ground conditions, it may be possible to simply provide plating to these areas.

## 5.0 Port of Aberdeen to Site Route Assessment

### Route Summary

- Leave Aberdeen docks at Waterloo Quay onto Commerce Street.
- At the A956 Commerce Street/ Virginia Street junction continue straight onto Commerce Street;
- Continue along Commerce Street for approx. 150m to roundabout junction with Beach Boulevard. Exit roundabout (2nd exit) onto A956 East North Street.
- Continue on East North Street (A956 becomes A96) to A96 roundabout junction with A944. At roundabout take 3rd exit onto A96 Causeway End Road.
- Continue on A96 leading onto Great Northern Road.
- At roundabout junction of A96/ A978 Leslie Road continue straight (2nd exit) onto A96 Great Northern Road.
- Continue along A96 Great Northern Road to roundabout junction of A96 with A90. At roundabout take 2nd exit onto A96 Auchmill Road.
- Continue along A96 Auchmill Road (becomes A96 Inverurie Road) to roundabout junction with A947. At roundabout take the left slip road (1st exit) onto A96 Inverurie Road.
- At A96 roundabout with Bankhead Avenue take the 2nd exit to continue on A96 Inverurie Road.
- Continue on A96 to traffic signal controlled cross-road junction (formerly Dyce Drive Roundabout). Continue straight on A96.
- At Craibstone Roundabout (new roundabout) continue straight (2nd exit) onto the A96
- Continue straight on A96 under new bridge
- At Clinterty Roundabout continue straight (2nd exit) onto A96
- At Kinellar roundabout take the 2nd exit (straight ahead) to continue onto A96.
- Continue on A96 passing under a road bridge
- At Broomhill Roundabout continue straight on A96 (2nd exit).
- Pass under three road bridges
- At Thainstone Roundabout take the 2nd exit to continue on the A96
- At Inverurie roundabout continue straight on A96 (Inverness) 2nd exit.
- Continue on A96 – road bridges the River Don and passes under road bridge.
- At Blackhall Roundabout take the 2nd exit and continue on A96.
- Continue on A96 to Huntly.
- Overhead Railway Bridge just after arriving in Huntly – Vehicles < 5.1m sign displayed.
- At A96 roundabout with A97 continue straight (2nd exit) onto A96.
- Turn left onto A920 - Site access road.

## Junction Assessment

### **Potential Pinch Point 01**

#### **A956 Commerce Street/ Virginia Street junction**

Signal controlled junction on a predominantly straight, wide road. No issues identified.

### **Potential Pinch Point 02**

#### **Commerce Street/ A956 East North Street Roundabout Junction**

Swept path analysis required due to the close proximity of buildings, in addition to two bollards and a street sign located on central island of roundabout which may need removing.

### **Potential Pinch Point 03**

#### **A96 roundabout junction with A944**

Roundabout has been modified since previous report to widen certain sections of the road. Railings that were previously removed on nearside entry and exit of roundabout are back in place and will require temporary removal again. Swept path analysis required to identify other potential conflicts.

### **Potential Pinch Point 04**

#### **Great North Road A96/ A978 Leslie Road Roundabout**

There are no conflicts with building but possible need to remove barriers and signs on verge side build outs and street furniture on traffic island on roundabout approach.

### **Potential Pinch Point 05**

#### **Roundabout junction of A96 with A90**

Small roundabout with 3 lane entry and 2 lane exit with overrun area built into the roundabout. No potential conflicts identified.

### **Potential Pinch Point 06**

#### **A96 Inverurie Road roundabout junction with A947**

No issues identified at this junction within the previous report or during the site visit.

### **Potential Pinch Point 07**

#### **A96 roundabout with Bankhead Avenue**

Roundabout has 2 lane entry and 2 lane exit with significant deflection. Railings on nearside roundabout entrance may be an issue in addition to a traffic sign on the central roundabout island. Swept path analysis required due to aforementioned issues; this will be completed by the haulage company commissioned to transport the abnormal loads.

### **Potential Pinch Point 08**

#### **Dyce Drive Roundabout**

This roundabout has been replaced with a traffic signal controlled cross-road junction. No issues identified.

### **Potential Pinch Point 09**

#### **Craibstone Roundabout**

This roundabout comprises a 3 lane entry, 3 lane circulatory and a 2 lane exit. Roundabout is still under construction. Pedestrian guard railings are present on both side of roundabout.

### **Potential Pinch Point 10**

#### **Clinterty Roundabout**

Roundabout comprises a two lane approach and 2 lane exit with an early 1990's design with raised chevron block paving. Safety barrier may be an issue as well as the raised central island. Swept path required, but has not been undertaken for this report as identified constraints are not substantial enough to prevent the vehicles from using this route.

### **Potential Pinch Point 11**

#### **Kinellar roundabout**

Roundabout comprises a two lane approach and 2 lane exit with an early 1990's design with raised chevron block paving. Safety barrier may be an issue as well as the raised central island. Swept path required but has not been undertaken for this report as identified constraints are not substantial enough to prevent the vehicles from using this route.

**Potential Pinch Point 12                      Broomhill Roundabout**

This junction has the same potential issues as Clinterty and Kinellar roundabouts. Swept path required but has not been undertaken for this report as identified constraints are not substantial enough to prevent the vehicles from using this route.

**Potential Pinch Point 13                      Thainstone Roundabout**

No issues identified.

**Potential Pinch Point 14                      Inverurie roundabout**

No issues identified.

**Potential Pinch Point 15                      Blackhall Roundabout**

Newly modified roundabout. No issues identified.

**Potential Pinch Point 16                      A96 Inveramsay Bridge Improvements**

This is a new road layout which bypasses the low railway bridge. No issues identified along the new route.

## Swept Path Analysis

- 38        All junctions where the transport configuration will have to make a turn, have been checked through swept path analysis.
- 39        Swept path analysis has been undertaken using AutoTrack Software with two vehicle configurations, both carrying a 70m turbine blade. Both vehicles have been modelled from standard vehicles within the software vehicle library which have simply had their wheelbase extended to match the length of known trailers and a load added, which is the length of the wind turbine blade.
- Vehicle 1 has a 41m length wheel base, which results in a rear overhang of the blade tip by around 30m
  - Vehicle 2 has a 55m length wheel base, which results in a rear overhang of the blade tip by around 15m
- 40        It should be noted that there are trailers available, which allow the assembly holding the blade to slide on the trailer bed, this allows for the wheel base to be amended during transport. Using this trailer would allow a change of up to 15m to be achieved to the wheel base. It is not possible to model a change like this using AutoTrack.
- 41        The locations where swept path analysis has been undertaken are shown on drawing H1000. The results of the swept path analysis are shown on drawings H1001 to H1019, and are summarised below:

### 5.1.1 Beach Boulevard Roundabout (H1001)

- 42        Although the roundabout is large and open, the approach from the port along Commerce Street and the departure along East North Street are both constrained by buildings and retaining walls. These are immovable features that cannot be overcome.
- 43        Although it is possible for the vehicle to traverse the roundabout and keep all of its wheels on the road surface the length of the blade causes many issues, notably with the rear overhang of the blade tip. The blade tip will swing out over oncoming traffic as the transport configuration turns onto the roundabout.
- 44        As the transport configuration goes around the roundabout, the blade tip will swing and be in conflict with a high concrete retaining wall. The pedestrian guard railing that surrounds the roundabout will

need to be taken down, along with a pedestrian crossing and traffic signs.

- 45 The issues with the blade tip being in conflict with the retaining wall, cannot be overcome, as such an alternative is to be sought.
- 46 Commerce Street and East North Street line up with minimal turn being required, it is therefore appropriate to build a roadway across the roundabout central island, as this will overcome all of the issues identified in the swept path analysis.
- 47 The roadway will need to be a minimum of 5m in width and should be easy to construct as the roundabout is relatively flat. Bollards and signs on the roundabout will need to be moved, and the roadway can be blended into the surrounding island with suitable landscaping.
- 48 The roadway will need to be permanent to allow for future projects, therefore to prevent improper use by unauthorised vehicles when the roadway is not required for the transportation of abnormal loads either a gate can be incorporated, or planters can be placed on the roadway.

### **5.1.2 A96 cross roads with Little John Street (H1002)**

- 49 The A96 passes through a sweeping bend at the crossroads with Little John Street, at this location the road is constrained by walls.
- 50 Manual override of the rear axle steering will need to be utilised to get the transport configuration around the bend without the blade tip conflicting with the walls, or without the vehicle needing to be on the opposing carriageway.

### **5.1.3 Change of Carriageway – Morrisons Junction (H1003)**

- 51 In order to be able to get around the A947 roundabout the transport configuration needs to be on the opposing carriageway; the bend in the road coupled with the existing junction allows the transport configuration to change carriageways without the need for a central reservation crossover.
- 52 The blade tip will be in conflict with the existing traffic signals which will need temporary removal.

### **5.1.4 A947 Roundabout (H1004)**

- 53 The roundabout is large and open however it is irregular in shape, requiring some very tight bends to be negotiated to pass around it correctly. There is a pedestrian route across the roundabout at a lower level than the road, with two subways, which constrain the circulatory carriageway. To assist abnormal loads traversing the roundabout, large areas of widening have been provided on the roundabout.
- 54 Although it is possible for the vehicle to traverse the roundabout and keep all of its wheels on the road surface the length of the blade and vehicle body causes many issues, notably with the rear overhang of the blade tip.
- 55 The blade tip will swing out over oncoming traffic as the transport configuration turns onto the roundabout, it will then swing and require some mature trees to be lost. The body of the vehicle will be in conflict with the parapet wall of the pedestrian underpass, the blade tip will then swing out over the footway and highway boundary. As the vehicle leaves the roundabout the body of the vehicle will be in conflict with the wall around the private car park and the blade tip will be in conflict with the raised landscaping on the roundabout.
- 56 It is considered that there are too many issues to be overcome, an alternative way to traverse the



roundabout is therefore needed. The pedestrian route across the roundabout prevents a roadway being built across the island, due to the drop in level to the pedestrian route; a roadway across the island would also require extensive re-landscaping of the roundabout.

- 57 Traversing the roundabout the wrong way is possible and requires less onerous turns to be made. Manual override of the rear axle steering will be required to prevent conflicts with a building and the pedestrian underpass. A small area of hardstanding will be required on the central island. The vehicle will leave the roundabout on the wrong carriageway of the A96 and will remain on it for the 700m to the end of the dual carriageway

#### **5.1.5 A96 Railway Bridge, Belmont Road (H1005)**

- 58 Between Leslie Terrance and Belmont Road the A96 passes through two slight bends and crosses a bridge over a railway. Swept path analysis demonstrates that the vehicle can pass through the bends and over the bridge without any part of the vehicle or its load oversailing the parapet walls of the railway bridge or being in conflict with structure.

#### **5.1.6 A96 Roundabout with St Machar Drive (H1006)**

- 59 The roundabout is large and open and provides a clear direct route for the blade to traverse in the correct motion.
- 60 On approach is a pedestrian crossing with traffic lights and guard rails of which the blade tip will oversail and so no removals are necessary. The vehicle will be required to enter the opposite carriageway during the approach for approximately 70 metres from the southbound bus shelter to entry of the roundabout.
- 61 During traverse of the roundabout the blade tip will oversail both traffic islands with temporary removal of a street light and traffic sign required at the secondary upon exit. Further temporary removal of signs will be required and landscape planting is to be trimmed as necessary on the roundabout central island to allow further oversailing of the blade tip.
- 62 Upon exit of the roundabout the transport configuration and blade will enter the opposite carriageway for approximately 150 metres before continuing the route.

#### **5.1.7 A96 Haudagain Roundabout (H1007)**

- 63 This is a smaller domed roundabout containing central vegetation and signage. Pedestrian guard rails are present at each arm with an official crossing upon the exit arm (Auchmill Road).
- 64 The blade tip is seen to oversail the opposite carriageway into oncoming traffic and clear the pedestrian guard rails. Oversailing of the footway here will mean temporary removal of the street light is necessary. There is a concrete crash barrier surrounding the southern corner of the exit arm which cannot be overrun, therefore the central island will be protected in case of wheel overrun.

#### **5.1.8 A96 Roundabout with A947 (H1008)**

- 65 The transport configuration is able to manoeuvre the roundabout using the correct carriageway. The blade tip will oversail the opposite carriageway and pedestrian guard rail. Signage will be temporarily removed here as necessary. The central island will be oversailed by the blade tip resulting in the further temporary removal of the street light required, and the island at the mouth of the exit arm will be protected in case of wheel overrun.



### 5.1.9 A96 Roundabout with Bankhead Avenue (H1009)

- 66 The vehicle configuration is able to traverse the roundabout, keeping all wheels within the correct carriageway. Slight overrun onto the domed roundabout will occur, therefore protection of the island with its vegetation and signage is required.
- 67 Upon entry the blade tip is set to oversail the central reservation pedestrian guard rail, therefore traffic signs will need to be temporarily removed here. The transport configuration then swings left and straightens during traverse of the central island. The blade tip oversails the footway of the southern bend and so landscape planting needs to be trimmed and the relevant street light temporarily removed.
- 68 The transport configuration and blade exit the roundabout within the boundary of the correct carriageway.
- 69 If the loss of landscaping is considered to be unacceptable, the vehicle would be able to negotiate the roundabout on the opposite carriageway, however this would require works to the central reservation on both sides of the junction to allow the vehicle to change carriageways.

### 5.1.10 A96 Craibstone Roundabout (H1010)

- 70 Craibstone roundabout is a relatively new bypass junction which opened August 2016. It is very large and open and enables the transport configuration to traverse remaining within the correct carriageway.
- 71 Due to slight oversailing of the blade tip during crossing of the roundabout, the traffic signals will need to be temporarily removed from the central island upon the approaching arm and both the south-eastern and south-western outside curvatures of the roundabout. Street lighting will also be required to be temporarily removed from the south-eastern curvature of the roundabout, the central island upon the southern arm (Aberdeen Western Peripheral Route) and from the central island of the exiting arm (A96). Traffic signs will also be required to be temporarily removed from the southern and western islands.
- 72 Pedestrian guard rails are situated at each arm of the junction. These are able to remain in-situ for the duration of the crossing of the transport configuration as the blade tip is able to safely oversail these. The blade then continues along the A96 on the correct carriageway.

### 5.1.11 A96 Clinterty Roundabout (H1011)

- 73 Swept path analysis of the Clinterty roundabout demonstrates that the transport configuration cannot traverse the roundabout without significant works being undertaken that would change the roundabout.
- 74 The roundabout has been constructed with block paving chevron markings, which would need to be lowered around the edge of the roundabout and significant clearance will be required around the junction, along with oversailing of the highway boundary.
- 75 Therefore should the transport configuration traverse the junction using the circulatory carriageway. The blade tip would oversail both the central island and the south-eastern corner into mature plantation landscaping.
- 76 In order to avoid the aforementioned issues identified in the swept path, a dedicated permanent roadway across the roundabout should be constructed to allow straight manoeuvre of the transport configuration and blade. This can be landscaped into the roundabout.

#### 5.1.12 A96 Kinellar Roundabout (H1012)

- 77 This junction also has mature woodland and plants present and is very circular in shape meaning the same issues as per the Clinterty roundabout shall arise.
- 78 In order to overcome the issues it would be easier and more cost effective to construct a permanent road across the central island. With exception to this, the transport configuration can manoeuvre within the boundaries of the correct carriageway.

#### 5.1.13 A96 Broomhill Roundabout (H1013)

- 79 The roundabout is very round and raised as per the previous two junctions which makes traversing more difficult. The surrounding mature plantations cause issues again and the bends are too tight for the transport configuration to avoid oversailing into this with the blade tip. This means that the best approach is to build a permanent road across the central island. This enables easier traverse and the blade tip is able to oversail the central reservation upon the approaching arm.

#### 5.1.14 A96 Thainstone Roundabout (H1014)

- 80 Should the transport configuration travers the roundabout while remaining within the correct carriageway and avoiding the roundabout's central island, the blade tip would again oversail into mature trees and plants while circulating. There is also the risk of overrun of the wheels upon the central island.
- 81 To overcome this issue the swept path shows it would be easier to build a hardstanding area on the edge of the roundabout central island. The traffic signs would need to be repositioned as necessary and a lighting column would have to be taken down from the south-eastern bend due to vehicle load oversail.

#### 5.1.15 A96 Inverurie Roundabout (H1015)

- 82 Mature planting poses an issue again with the blade tip oversailing well into this should the transport configuration utilise the circulatory carriageways. To overcome this issue it would be easier and cost effect to build a hardstanding area on the edge of the roundabout central island while repositioning the traffic signs and landscape planting where necessary. Landscape planting on the south-eastern corner of the junction (at the approach arm) will still need to be trimmed and street lighting temporarily removed as slight oversailing of the blade tip will still occur.
- 83 The verge along the egress arm bend will need to be protected from wheel overrun which is unavoidable during turning of the transport configuration off the roundabout. The vehicle will also need to enter the opposite carriageway for approximately 35 metres to avoid rear overhang which would require traffic signs and light columns to be removed.
- 84 The transport configuration with the larger trailer would require further verge protection on the south-eastern corner due to overrun of wheels.

#### 5.1.16 A96 Blackhall Roundabout (H1016)

- 85 In order to be able to get around the A96 Blackhall roundabout the transport configuration needs to be on the opposing carriageway. The roundabout is large and open, however a tight radius for the transport configuration means using the junction in the usual manner is not appropriate.
- 86 Hardstanding on the edge of the roundabout central island allows the transport configuration to

overrun, reducing the turn and further oversailing of the blade tip. The traffic signs here would need to be repositioned and landscape planting trimmed as necessary. The blade tip will oversail the eastern edge during traverse and so street lights will need to be repositioned and landscape planting trimmed as necessary. The transport configuration with the larger trailer sees less oversail of the blade tip.

- 87 The transport configuration can then egress using the opposite carriageway briefly before continuing on the correct carriageway.

#### **5.1.17 A96 Huntly Roundabout (H1017)**

- 88 The transport configuration is able to traverse the roundabout in the correct circulation. The roundabout central island is large and so wheel overrun is unavoidable. Hardstanding will need to be placed at the southern edge of the roundabout central island for protection from wheel overrun. The approaching arm island will need to be strengthened to allow wheel overrun. Upon approach to the junction the transport configuration utilises the opposite carriageway and will again do so during departure from the junction.

- 89 While the transport configuration is rounding the central island the blade tip oversails the verge of the approaching arm. Street lights are to be temporarily removed here as necessary to allow for this.

- 90 The swept path is under overhead power lines which run parallel to the road.

#### **5.1.18 Change of Carriageway – Huntly Junction (H1018)**

- 91 This junction is a staggered T junction whereby the transport configuration will manoeuvre left from the A96 and onto the A920.

- 92 The swept paths show that the blade tip will oversail the two traffic islands during manoeuvre of the bend and so the traffic signs will need to be temporarily removed to allow for this. Wheel overrun will occur on the second island so protection of the surface is required.

- 93 The transport configuration will enter the opposite carriageway upon entry to the A920 and the wheels will overrun the verge, therefore requiring hardening. This is the best option at this junction to limit the blade tip oversail on the opposite carriageway of the A96. The inside road edge will be protected in case of wheel override.

- 94 Around some of the bends along the A920 minor road, the blade tip will oversail the highway boundary.

#### **5.1.19 A920 Windfarm Junction (H1019)**

- 95 Manoeuvring the transport configuration and blade onto the windfarm junction is relatively straightforward. Protection of the road edges as necessary would need to take place in case of wheel override and there is no known street furniture which would require temporary moving/removing.

- 96 The transport configuration would be required to enter the opposite carriageway prior to the turn which enables the blade tip to oversail the highway boundary. The blade tip oversails the boundary again further down the road should the 41m trailer be used. If the 55m trailer is used manual override of the rear axle steering would be required to be used at the junction to keep the rear wheels of the trailer on the road surface.

## 6.0 Summary

- 97 The route from the Port of Aberdeen to the A920 has previously been utilised for wind turbine component deliveries for the Clashindarroch II Wind Farm, however the previous assessment was undertaken for a smaller blade size. The route survey and inspection identified 19 potential pinch point locations all of which required swept path analysis due to identified physical constraints such as buildings and substantial walls.
- 98 The swept path analysis demonstrates that both vehicle types are able to negotiate all locations with various mitigation measures applied.
- 99 The A96 roundabout with A944 (pinch point location 004) has previously been modified to allow for longer vehicles with areas of widening in the central island that allow long vehicles to make wide swings entering and leaving the roundabout. However vehicles will be required to travel the wrong way around the roundabout to limit the works required.
- 100 Other locations have been identified above as potentially requiring temporary street furniture removal and temporary road widening is likely to be required in places along the route but no significant works are envisaged. A number of roundabouts will require an extent of hardstanding to accommodate the vehicles, with landscaping recommended.
- 101 Swept path analysis has demonstrated that a vehicle carrying a 70m long wind turbine blade would be able to reach the Site from both ports. It should be noted that swept path analysis has only been undertaken in locations where physical constraints such as buildings, bridges and substantial walls are located, as these cannot be easily or economically overcome. There are numerous other locations where road widening and street furniture removal will be required and the amount of work required in these locations would be determined by the haulage company.

## DRAWINGS







NOTES

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



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SWEEP PATH ANALYSIS  
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
A96 BEACH BOULEVARD ROUNDABOUT

H1001-R0

Scale 1:1,000 @ A1 Date APRIL 2019

A05-03640-00011-01-H1001-R0 ABERDEEN BEACH BOULEVARD R0B1.dwg

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



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ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
A96 BEND NEAR LITTLE JOHN STREET

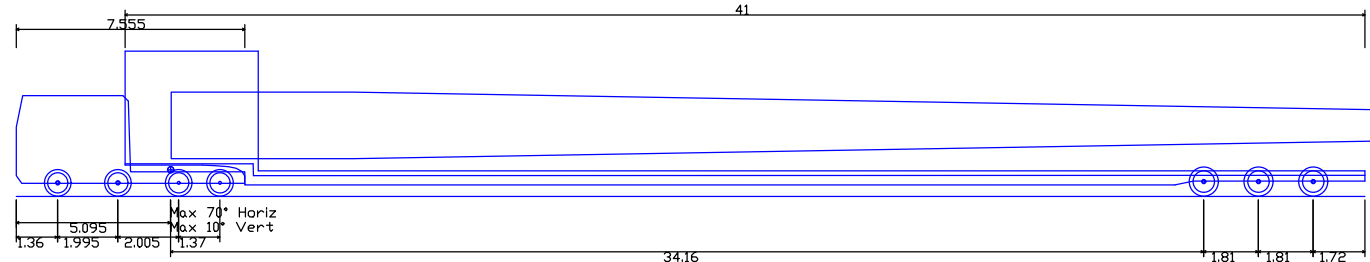
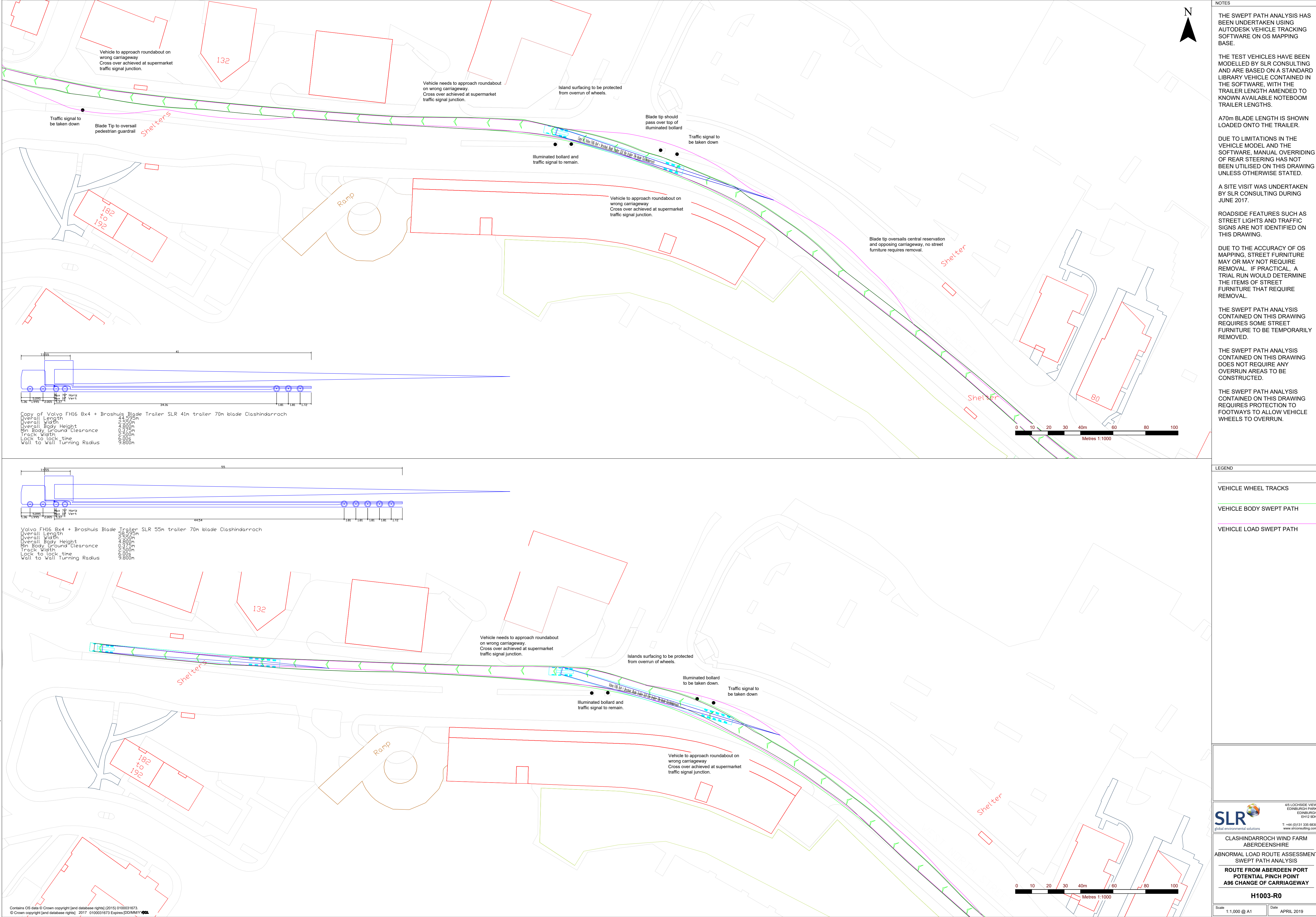
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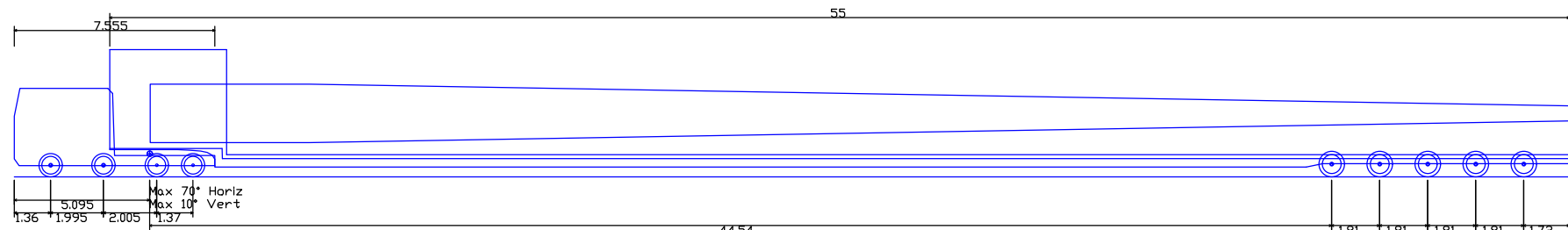
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Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41m trailer 70m blade Clashindarroch  
Overall Length 41.55m  
Overall Width 7.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.37m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.55m  
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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

CLASHINDARROCH WIND FARM  
ABERDEENSHIRE

ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
A96 CHANGE OF CARRIAGEWAY

H1003-R0

Scale 1:1,000 @ A1 Date APRIL 2019

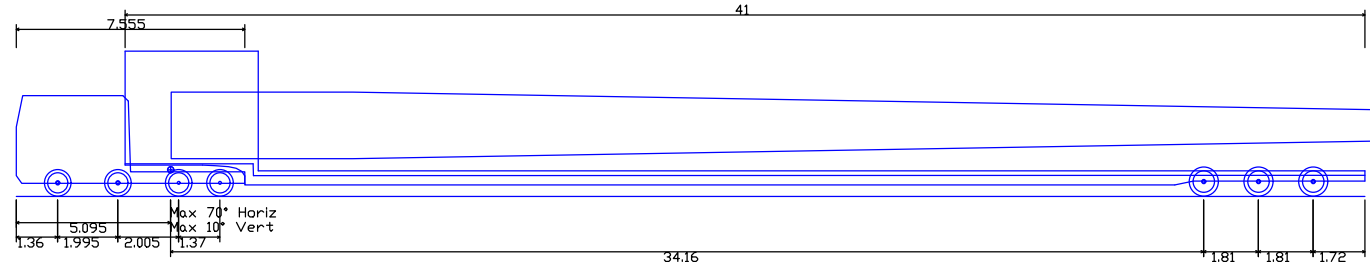
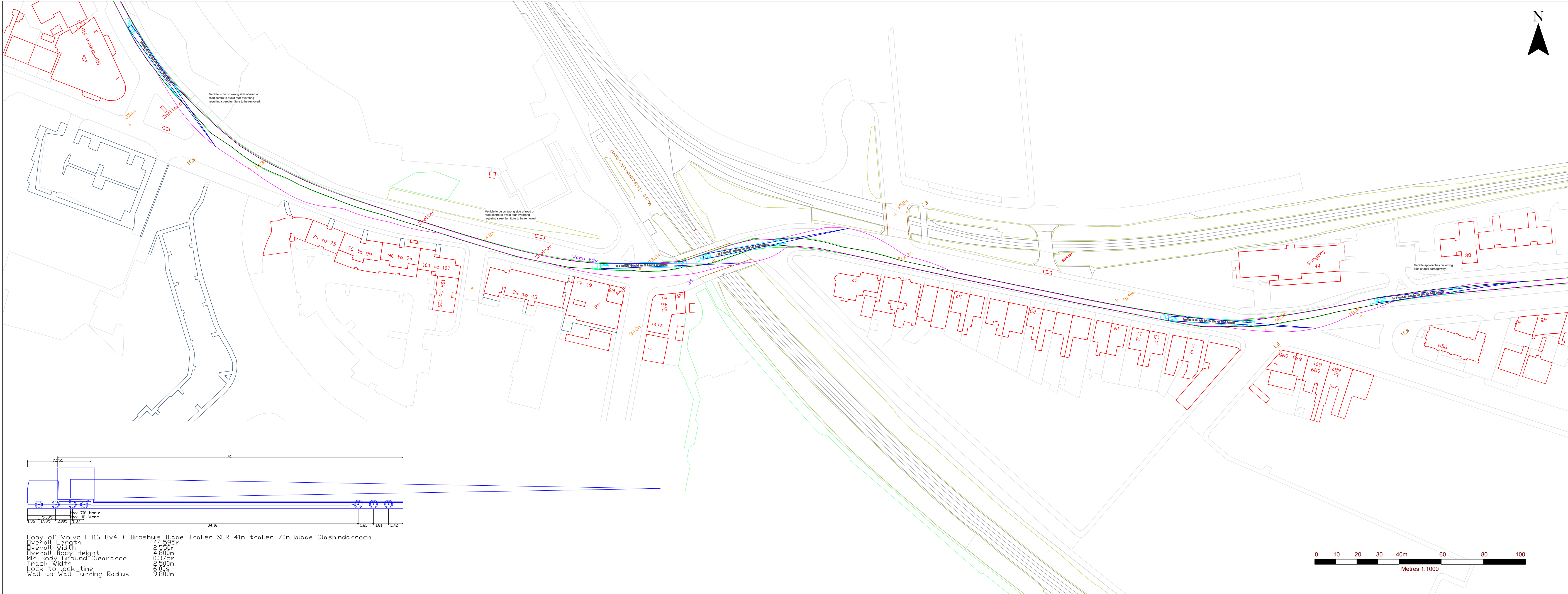




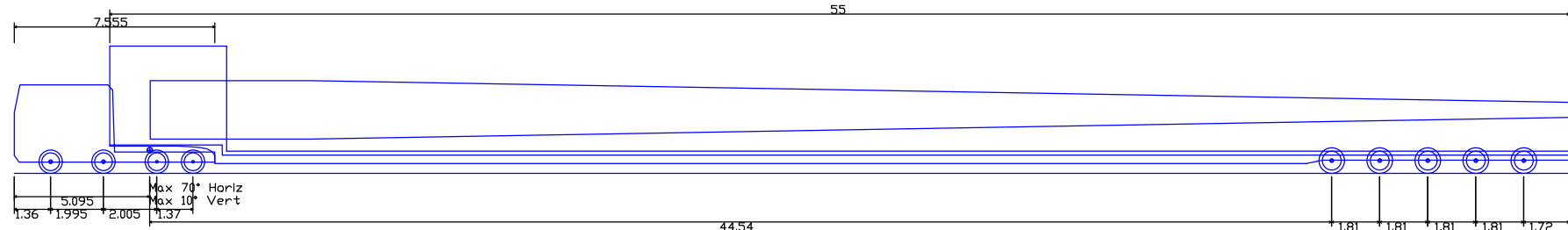
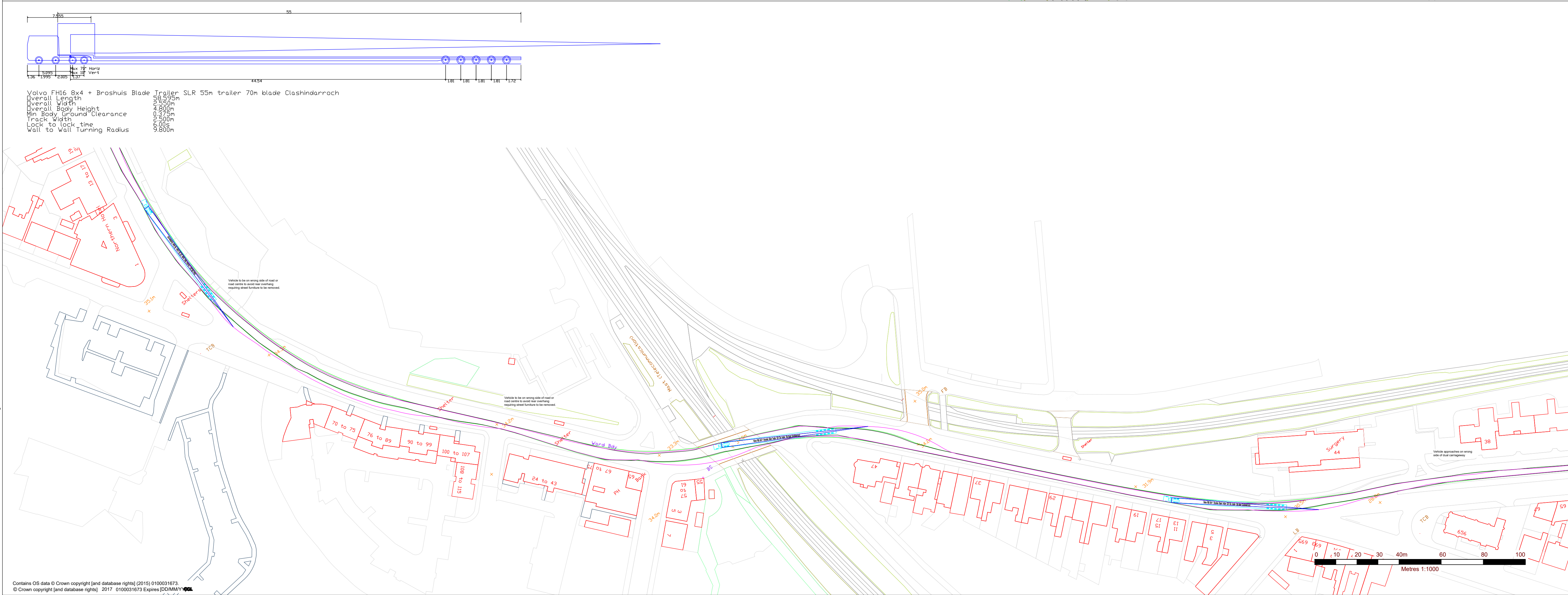








Copy of Volvo FH16 8x4 + Brushhij Blade Trailer SLR 41m trailer 70m blade Clashindarroch  
Overall Length 44.550m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.270m  
Track Width 2.500m  
Lock to lock time 6.000m  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Brushhij Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.350m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.270m  
Track Width 2.500m  
Lock to lock time 6.000m  
Wall to Wall Turning Radius 9.800m

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

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SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
A96 ABERDEEN RAILWAY BRIDGE

H1005-R0

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

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POTENTIAL PINCH POINT

A96 ST MACHAR ROUNDABOUT

H1006-R0

Scale

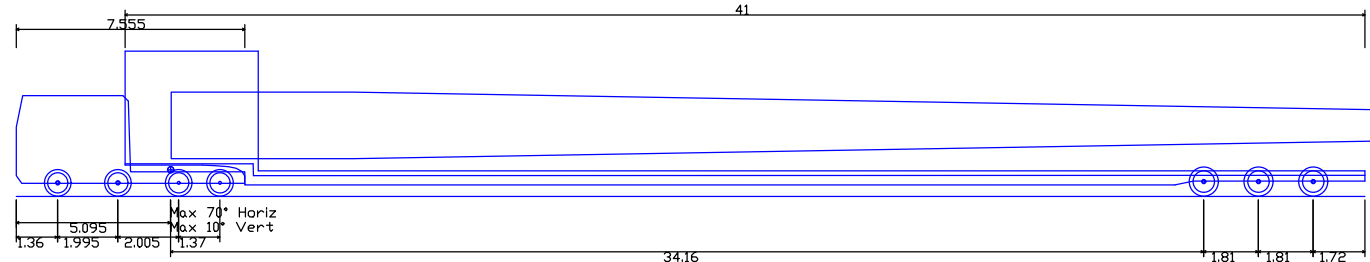
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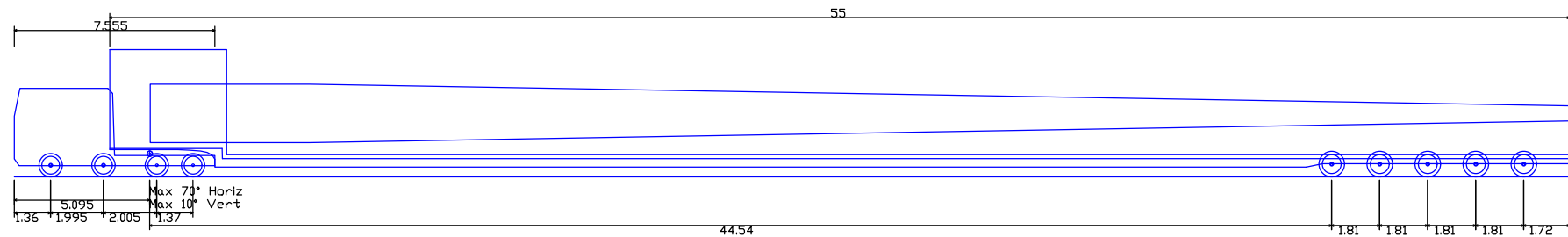
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Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41m trailer 70m blade Clashindarroch  
Overall Length 41.55m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.27m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.55m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.27m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH





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THE SWEEP PATH ANALYSIS CONTAINED ON THIS DRAWING REQUIRES PROTECTION TO FOOTWAYS TO ALLOW VEHICLE WHEELS TO OVERRUN.

LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



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CLASHINDARROCH WIND FARM  
ABERDEENSHIRE

ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
A96 HAUDAGION ROUNDABOUT

**H1007-R0**

Scale: 1:500 @ A1

Date: APRIL 2019

A05-03640-00011-01-H1007-R0 ABERDEEN HAUDAGION R001.dwg





NOTES

THE SWEEP PATH ANALYSIS HAS BEEN UNDERTAKEN USING AUTODESK VEHICLE TRACKING SOFTWARE ON OS MAPPING BASE.

THE TEST VEHICLES HAVE BEEN MODELLED BY SLR CONSULTING AND ARE BASED ON A STANDARD LIBRARY VEHICLE CONTAINED IN THE SOFTWARE, WITH THE TRAILER LENGTH AMENDED TO KNOWN AVAILABLE NOTEBOOK TRAILER LENGTHS.

A70m BLADE LENGTH IS SHOWN LOADED ONTO THE TRAILER.

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



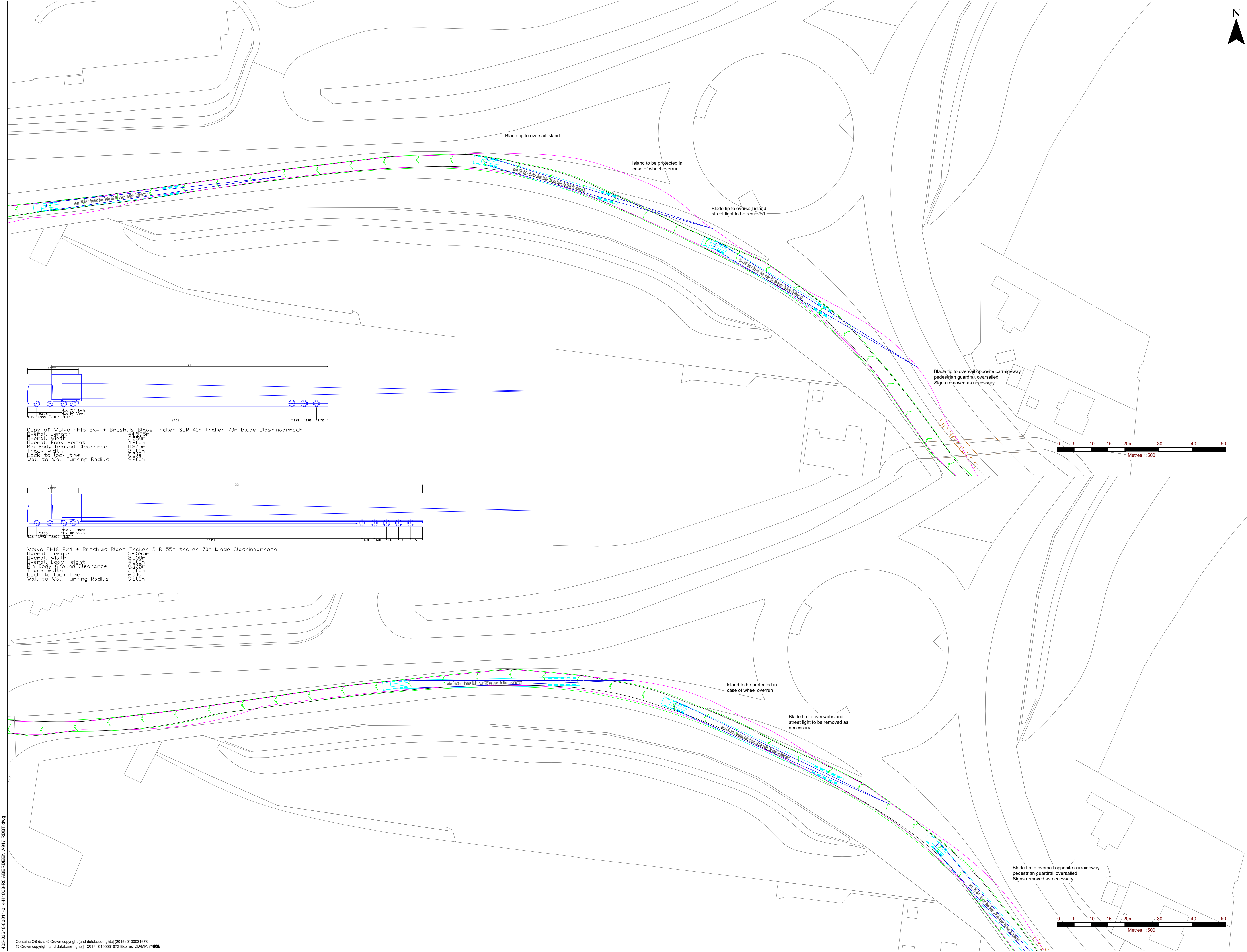
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ROUTE FROM ABERDEEN PORT  
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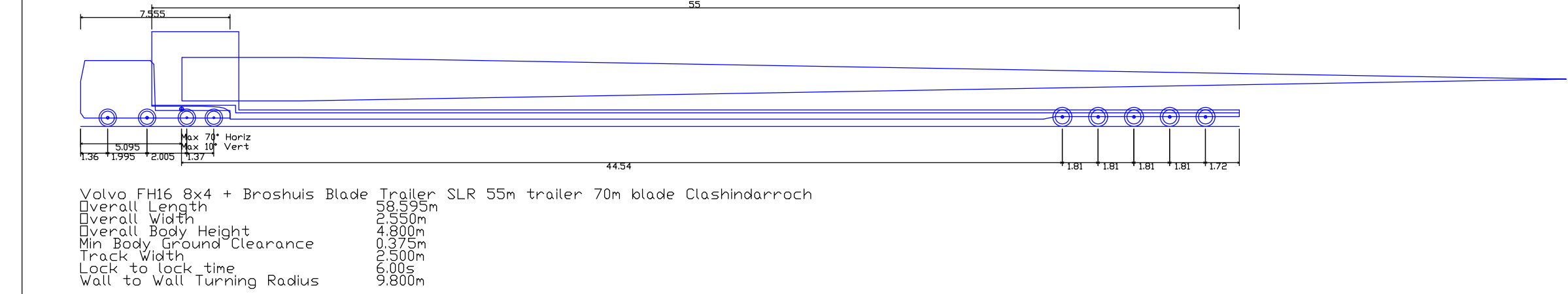
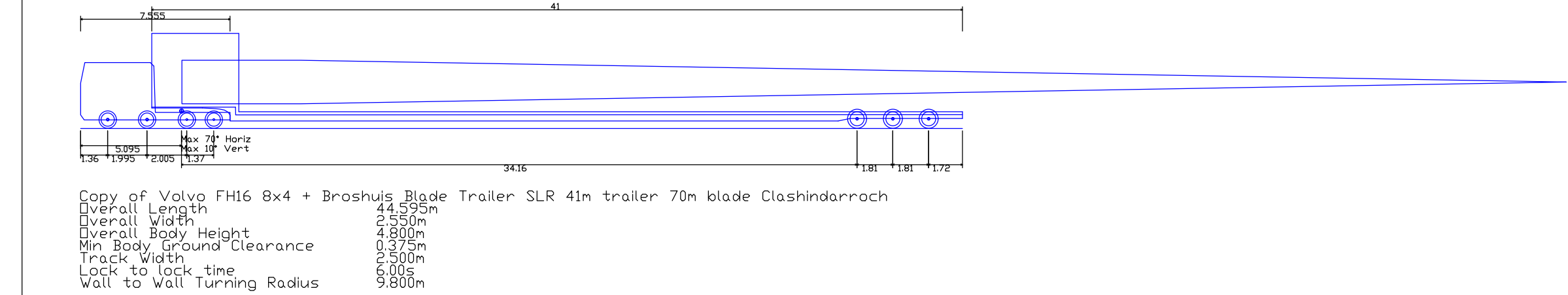
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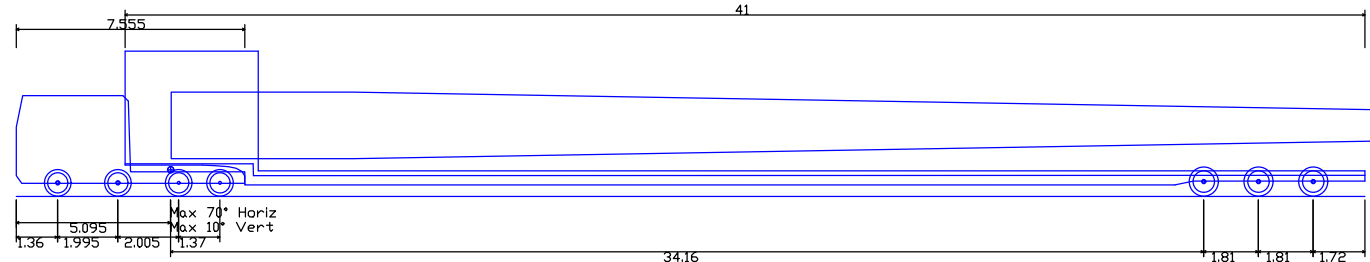
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THE SWEEP PATH ANALYSIS CONTAINED ON THIS DRAWING REQUIRES PROTECTION TO FOOTWAYS TO ALLOW VEHICLE WHEELS TO OVERRUN.

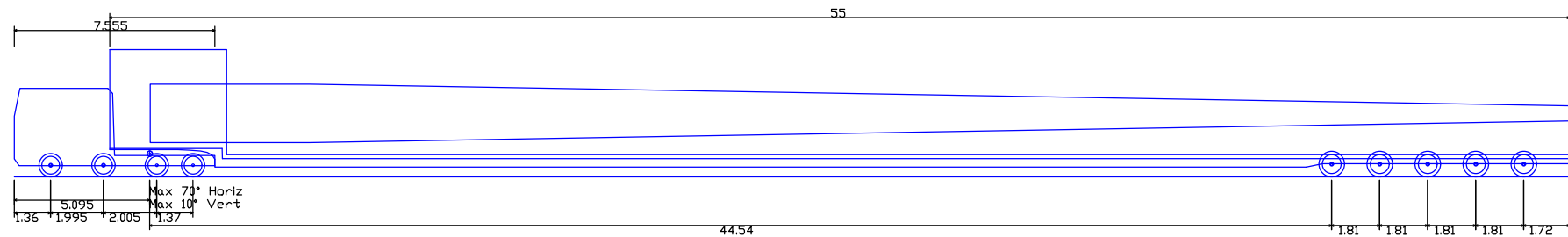


- LEGEND
- VEHICLE WHEEL TRACKS
  - VEHICLE BODY SWEEP PATH
  - VEHICLE LOAD SWEEP PATH





Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41n trailer 70m blade Clashindarroch  
Overall Length 41.55m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.37m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.00m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.37m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m

NOTES

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

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ABERDEENSHIRE

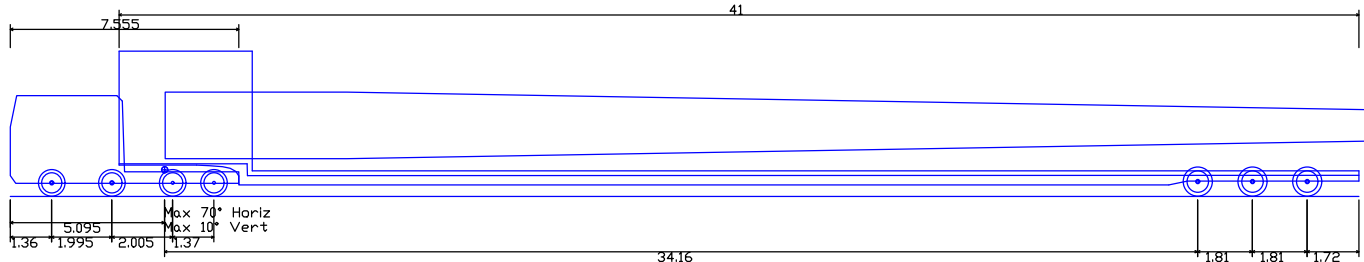
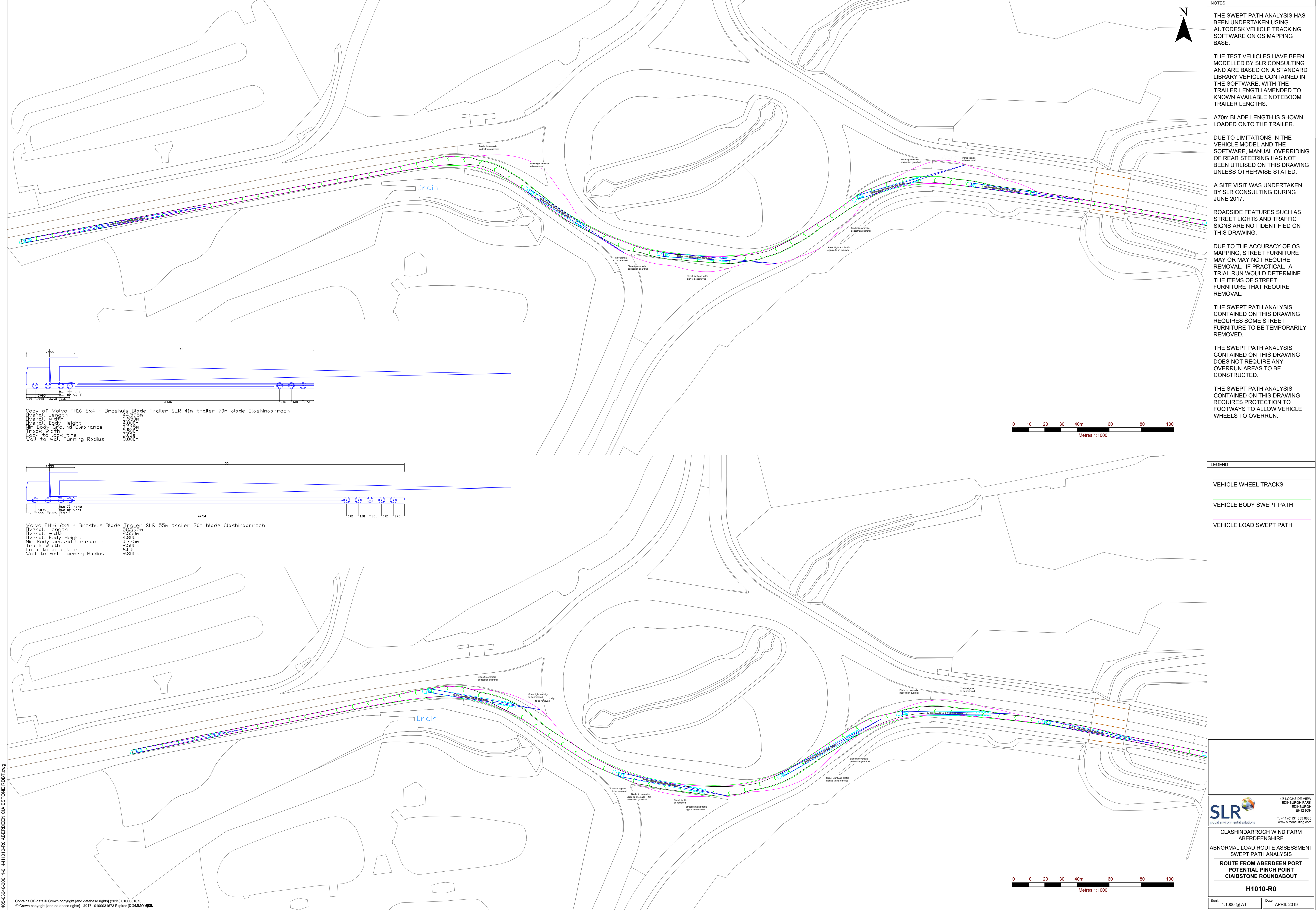
ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
BANKHEAD AVENUE ROUNDABOUT

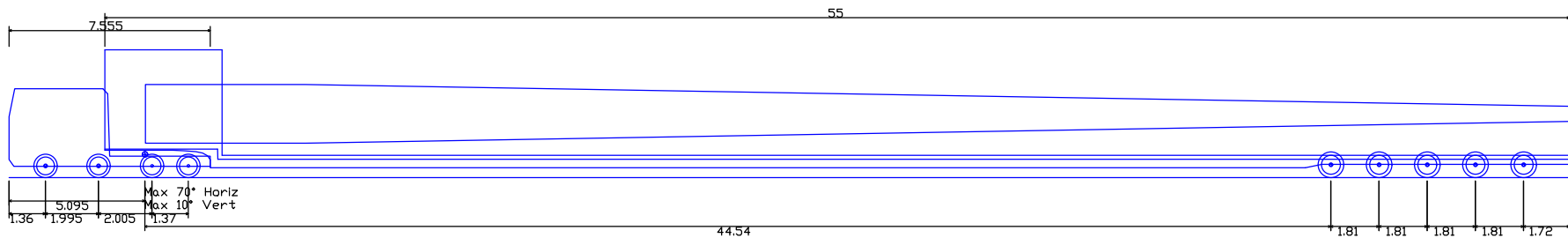
H1009-R0

Scale 1:500 @ A1 Date APRIL 2019





Copy of Volvo FH16 8x4 + Brushhis Blade Trailer SLR 41m trailer 70m blade Clashindarroch  
Overall Length 41.550m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.27m  
Track Width 2.500m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Brushhis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.550m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.27m  
Track Width 2.500m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



#### NOTES

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#### LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

A05-03540-00011-01-H1010-R0 ABERDEEN CIAIBSTONE RDBT.dwg

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**CLASHINDARROCH WIND FARM**  
**ABERDEENSHIRE**  
**ABNORMAL LOAD ROUTE ASSESSMENT**  
**SWEEP PATH ANALYSIS**  
**ROUTE FROM ABERDEEN PORT**  
**POTENTIAL PINCH POINT**  
**CIAIBSTONE ROUNDABOUT**

**H1010-R0**

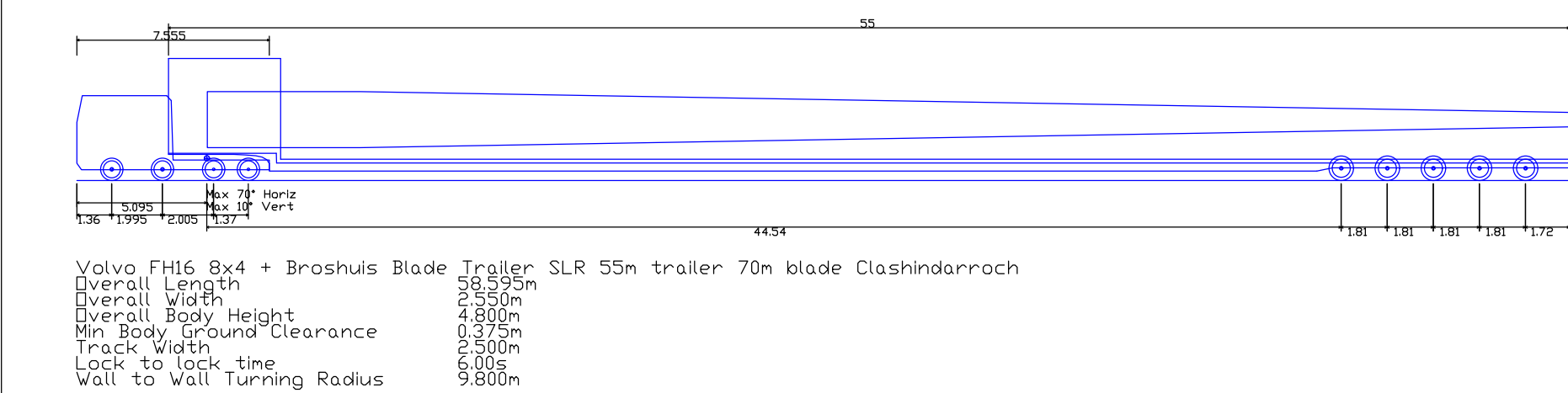
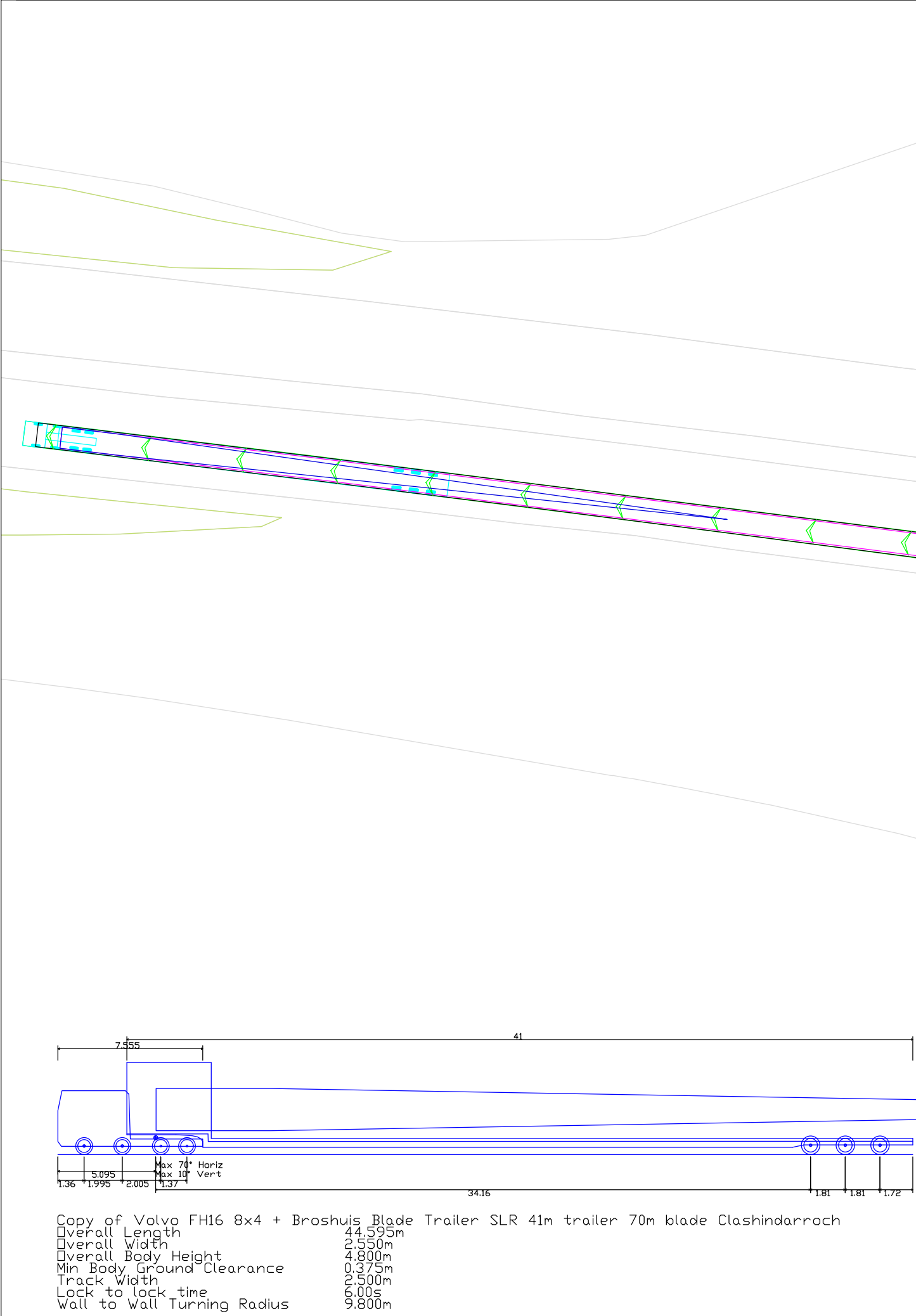
Scale 1:1000 @ A1 Date APRIL 2019

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NOTES

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



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ABERDEENSHIRE

ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

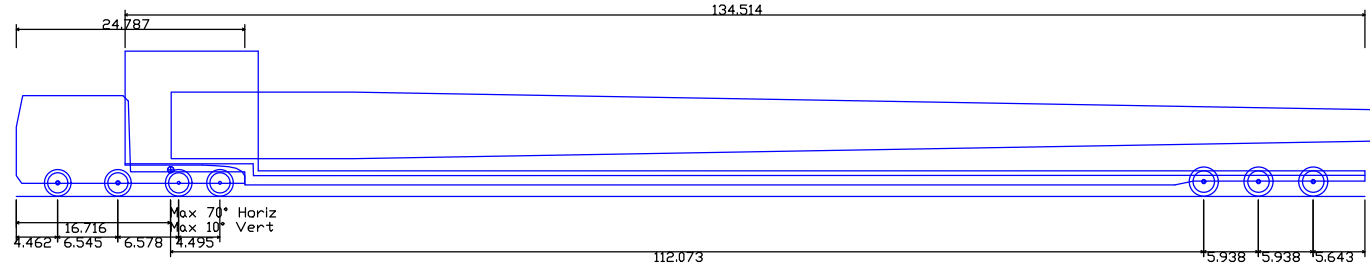
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
KINELLA ROUNDABOUT

**H1012-R0**

Scale: 1:500 @ A1

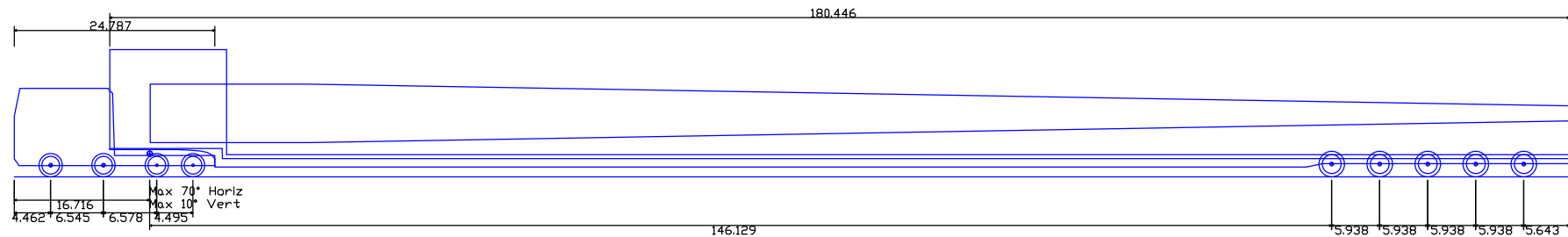
Date: APRIL 2019





Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41m trailer 70m blade Clashindarroch

Overall Length	146.309ft
Overall Width	8.96ft
Overall Body Height	13.748ft
Min Body Ground Clearance	1.53ft
Track Width	8.202ft
Lock to lock time	6.00s
Wall to Wall Turning Radius	32.152ft



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch

Overall Length	192.241ft
Overall Width	8.96ft
Overall Body Height	13.748ft
Min Body Ground Clearance	1.53ft
Track Width	8.202ft
Lock to lock time	6.00s
Wall to Wall Turning Radius	32.152ft



NOTES

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- LEGEND
- VEHICLE WHEEL TRACKS
  - VEHICLE BODY SWEEP PATH
  - VEHICLE LOAD SWEEP PATH



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ABERDEENSHIRE

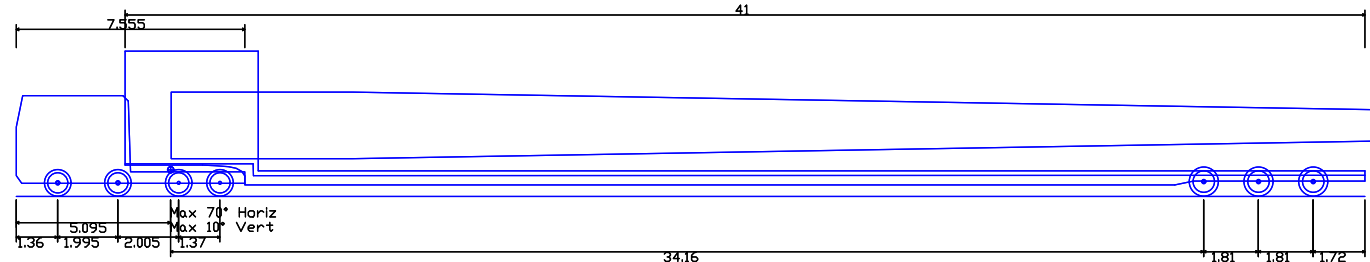
ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
BROOMHILL ROUNDABOUT

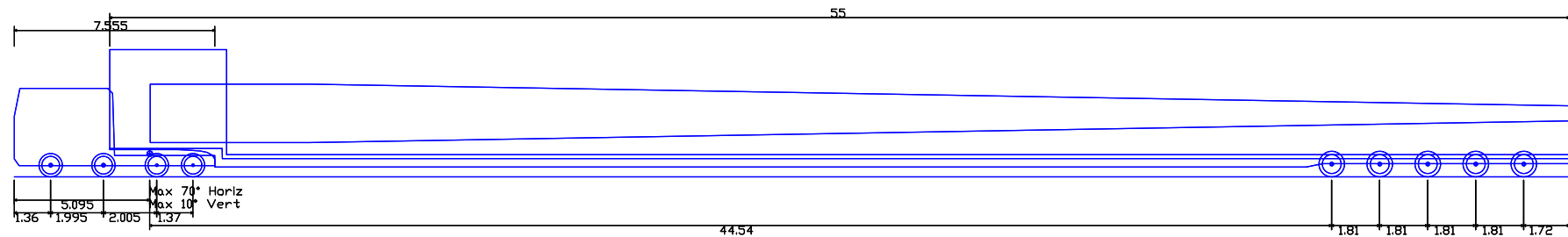
**H1013-R0**

Scale	1:500 @ A1	Date	APRIL 2019
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Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41n trailer 70m blade Clashindarroch  
Overall Length 41.55m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.37m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.35m  
Overall Width 2.55m  
Overall Body Height 4.80m  
Min Body Ground Clearance 0.37m  
Track Width 2.50m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

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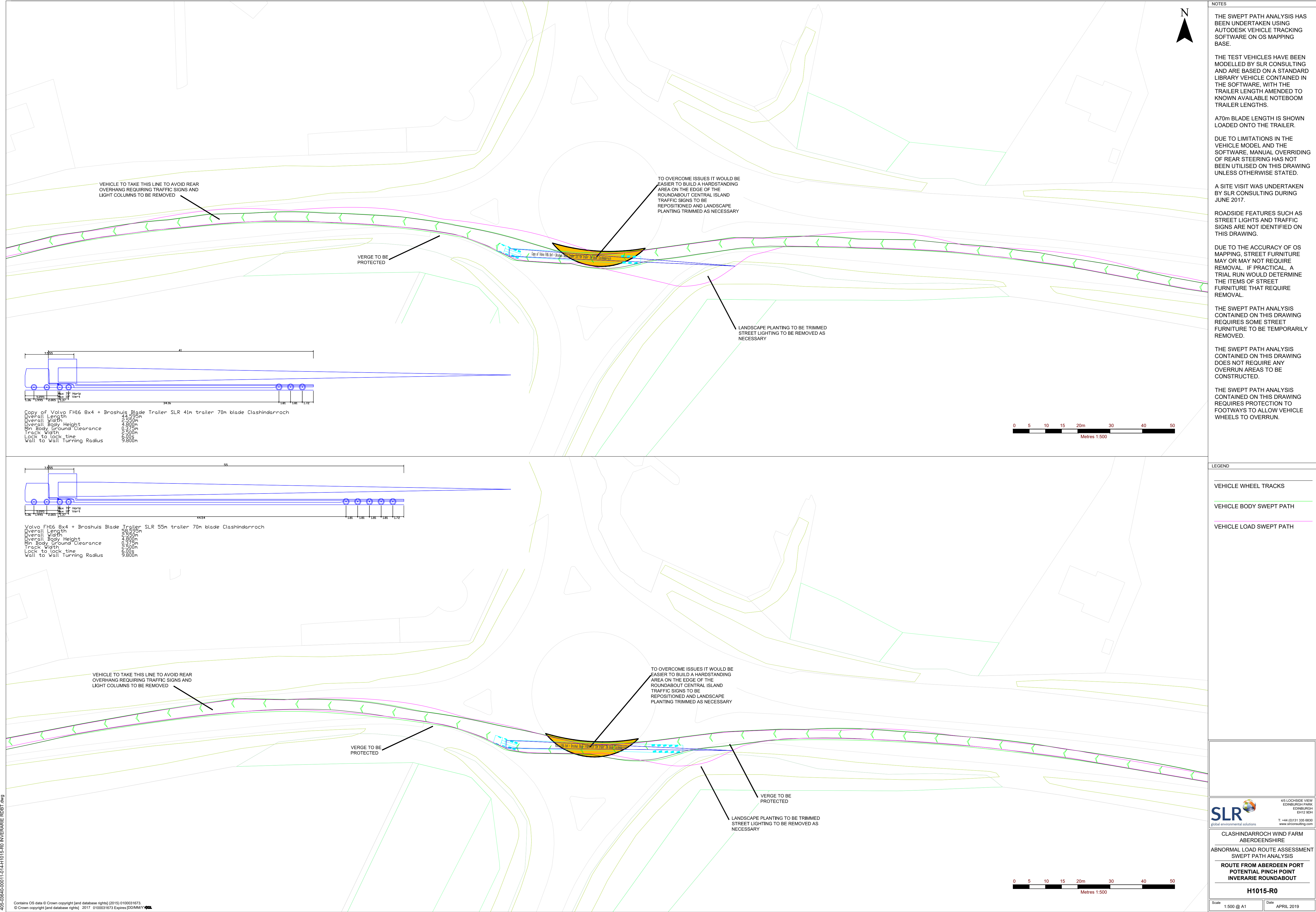
ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
THAINSTONE ROUNDABOUT

H1014-R0

Scale 1:500 @ A1 Date APRIL 2019





NOTES

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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH

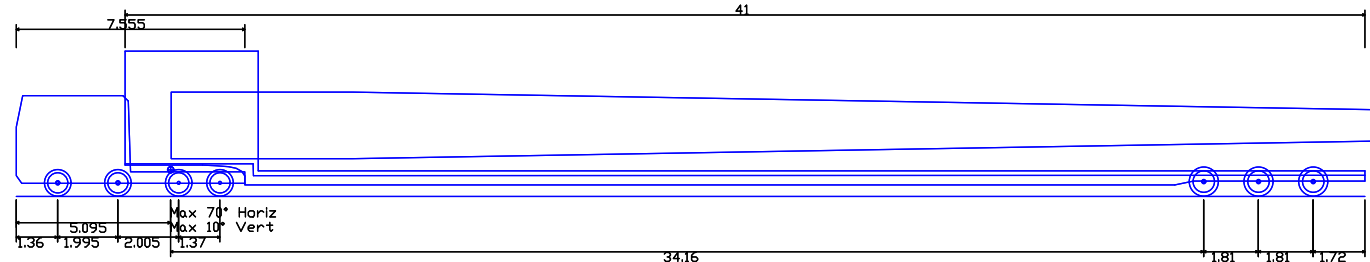
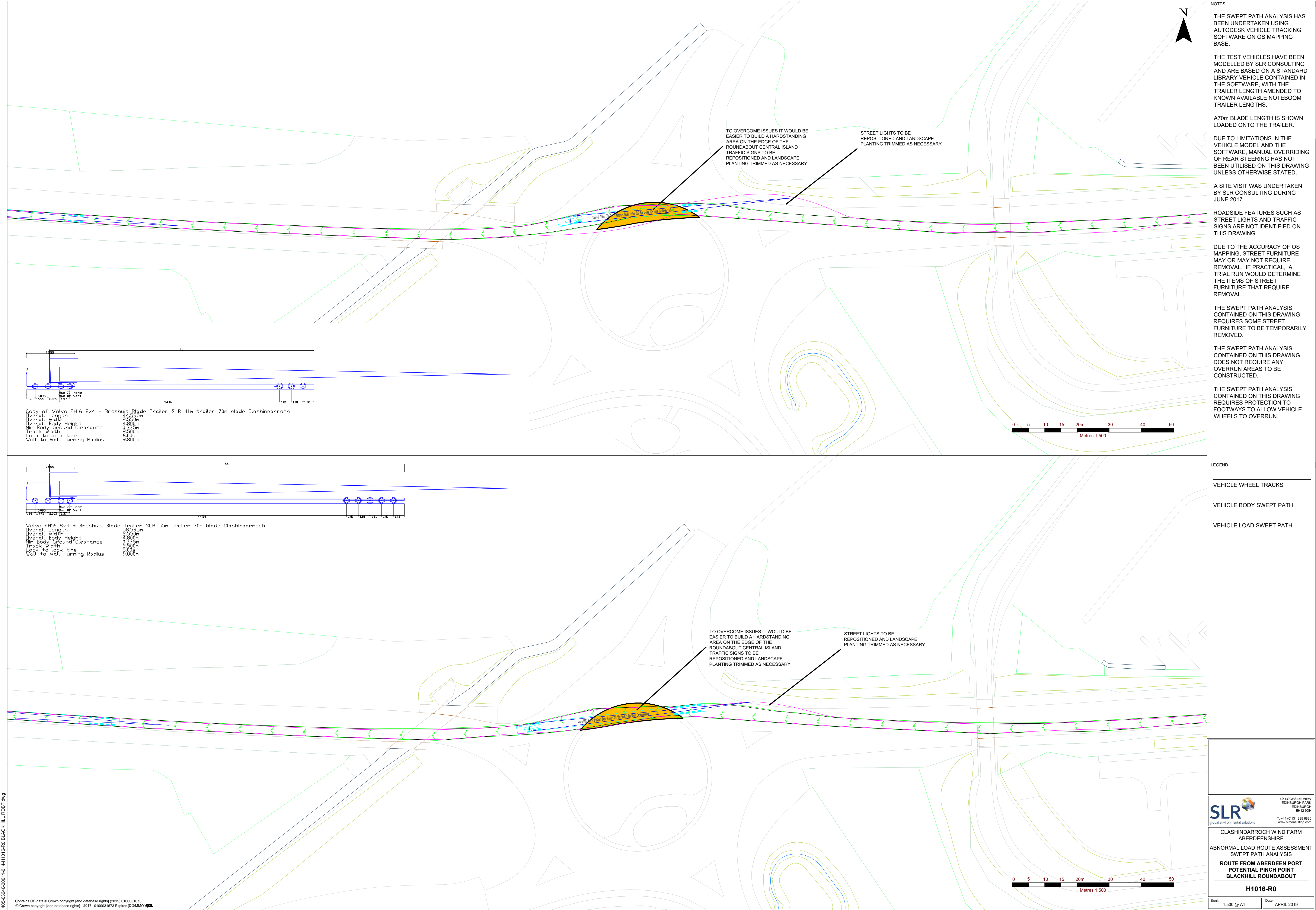
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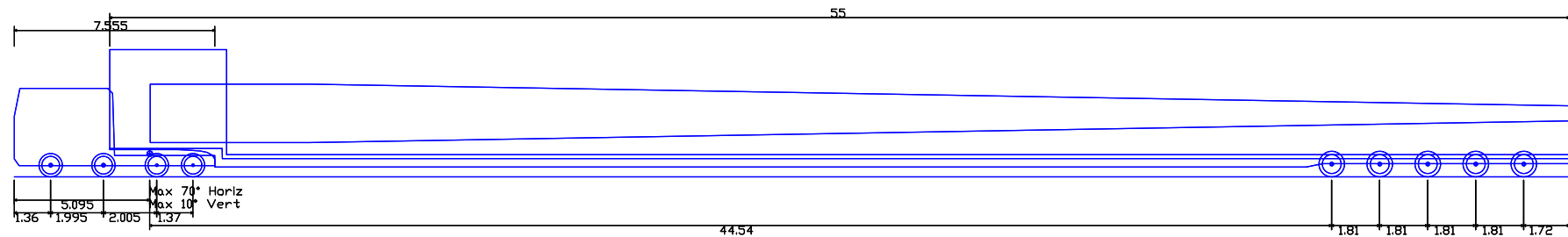
CLASHINDARROCH WIND FARM  
ABERDEENSHIRE  
ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS  
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
INVERARIE ROUNDABOUT  
H1015-R0

Scale: 1:500 @ A1  
Date: APRIL 2019





Copy of Volvo FH16 8x4 + Broshuis Blade Trailer SLR 41m trailer 70m blade Clashindarroch  
Overall Length 44.550m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.375m  
Track Width 2.500m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m



Volvo FH16 8x4 + Broshuis Blade Trailer SLR 55m trailer 70m blade Clashindarroch  
Overall Length 55.550m  
Overall Width 2.550m  
Overall Body Height 4.800m  
Min Body Ground Clearance 0.375m  
Track Width 2.500m  
Lock to lock time 6.00s  
Wall to Wall Turning Radius 9.800m

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A70m BLADE LENGTH IS SHOWN LOADED ONTO THE TRAILER.

DUE TO LIMITATIONS IN THE VEHICLE MODEL AND THE SOFTWARE, MANUAL OVERRIDING OF REAR STEERING HAS NOT BEEN UTILISED ON THIS DRAWING UNLESS OTHERWISE STATED.

A SITE VISIT WAS UNDERTAKEN BY SLR CONSULTING DURING JUNE 2017.

ROADSIDE FEATURES SUCH AS STREET LIGHTS AND TRAFFIC SIGNS ARE NOT IDENTIFIED ON THIS DRAWING.

DUE TO THE ACCURACY OF OS MAPPING, STREET FURNITURE MAY OR MAY NOT REQUIRE REMOVAL. IF PRACTICAL, A TRIAL RUN WOULD DETERMINE THE ITEMS OF STREET FURNITURE THAT REQUIRE REMOVAL.

THE SWEEP PATH ANALYSIS CONTAINED ON THIS DRAWING REQUIRES SOME STREET FURNITURE TO BE TEMPORARILY REMOVED.

THE SWEEP PATH ANALYSIS CONTAINED ON THIS DRAWING DOES NOT REQUIRE ANY OVERRUN AREAS TO BE CONSTRUCTED.

THE SWEEP PATH ANALYSIS CONTAINED ON THIS DRAWING REQUIRES PROTECTION TO FOOTWAYS TO ALLOW VEHICLE WHEELS TO OVERRUN.

- LEGEND
- VEHICLE WHEEL TRACKS
  - VEHICLE BODY SWEEP PATH
  - VEHICLE LOAD SWEEP PATH



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CLASHINDARROCH WIND FARM  
ABERDEENSHIRE

ABNORMAL LOAD ROUTE ASSESSMENT  
SWEEP PATH ANALYSIS

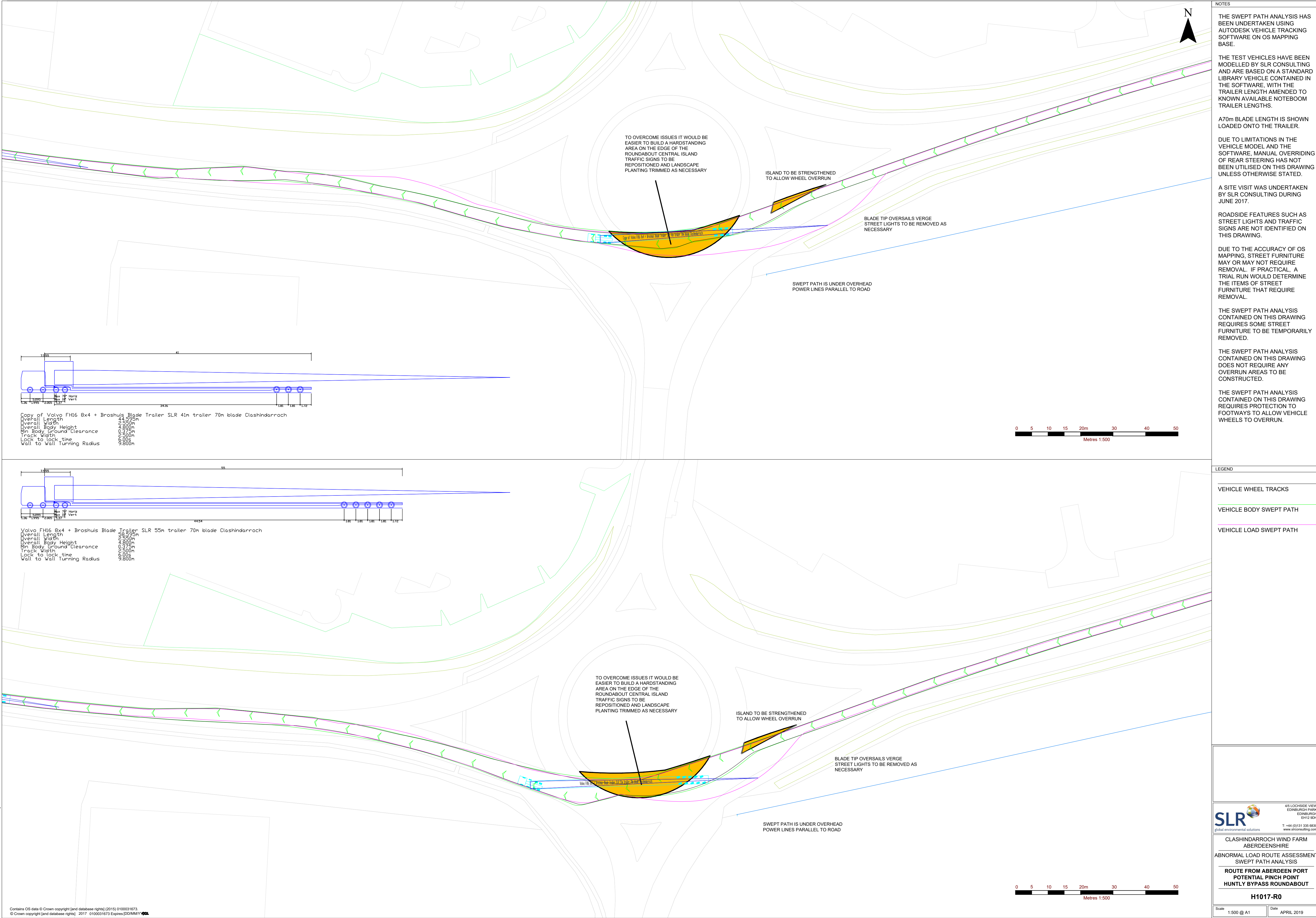
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
BLACKHILL ROUNDABOUT

**H1016-R0**

Scale: 1:500 @ A1

Date: APRIL 2019





NOTES

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- LEGEND
- VEHICLE WHEEL TRACKS
  - VEHICLE BODY SWEEP PATH
  - VEHICLE LOAD SWEEP PATH



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SWEEP PATH ANALYSIS  
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
HUNTLY BYPASS ROUNDABOUT

H1017-R0

Scale: 1:500 @ A1

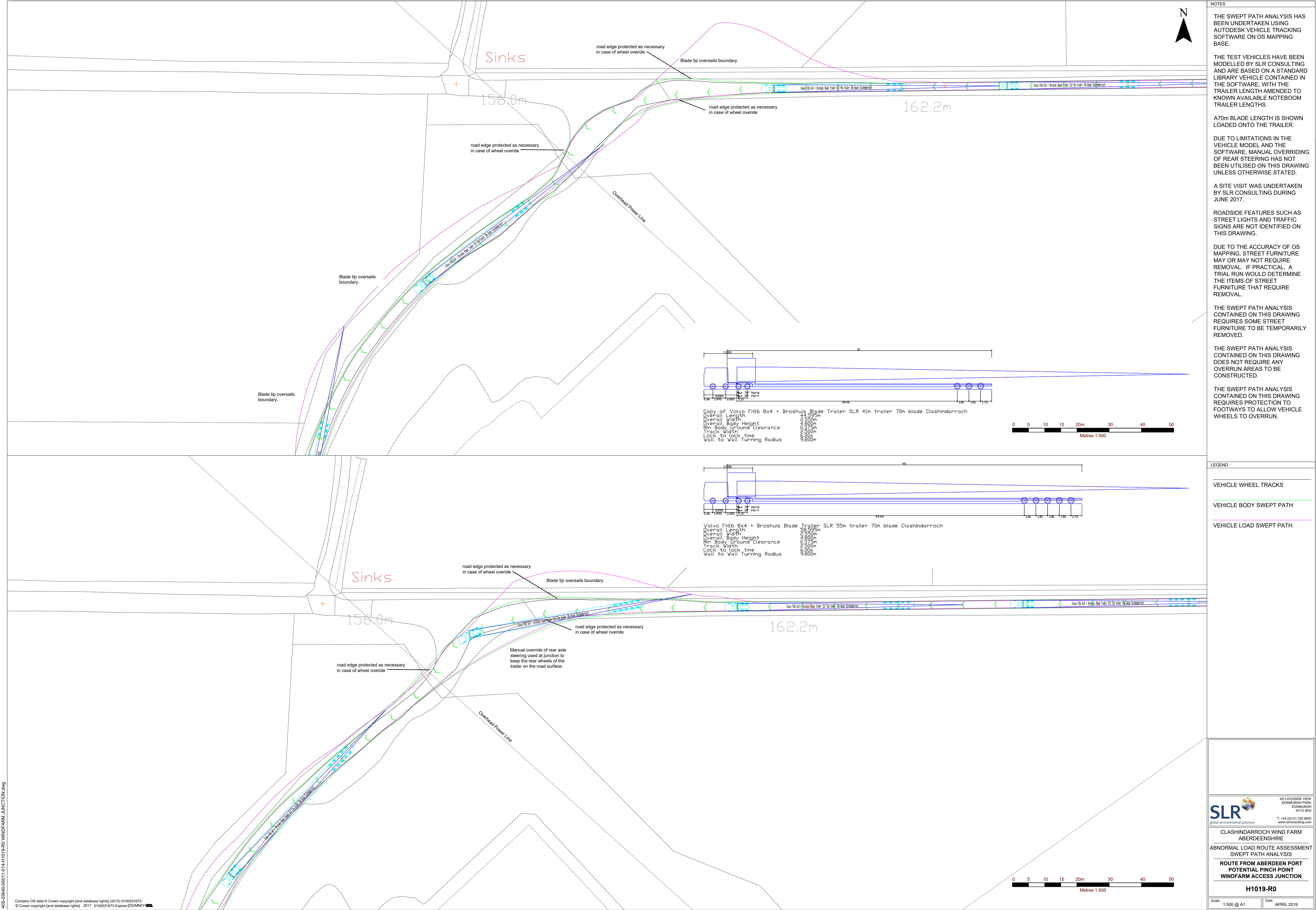
Date: APRIL 2019

405-03640-00011-01-H1017-R0 HUNTLY R0BT.dwg









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LEGEND

VEHICLE WHEEL TRACKS

VEHICLE BODY SWEEP PATH

VEHICLE LOAD SWEEP PATH



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SWEEP PATH ANALYSIS  
ROUTE FROM ABERDEEN PORT  
POTENTIAL PINCH POINT  
WINDFARM ACCESS JUNCTION  
**H1019-R0**

Scale: 1:500 @ A1  
Date: APRIL 2019

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