REALIZZAZIONE DI UN IMPIANTO EOLICO DA 50.4 MW IN LOCALITÀ "MAMONE"

- COMUNI DI BITTI (NU) E BUDDUSÒ (SS) -

ORDINE INGEGNERI PROVINCIA CAGLIARI
N. 3453 Dott. Ing. Giuseppe Frongia

OGGETTO ***PROGETTO DEFINITIVO OPERE CIVILI***	***TITOLO*** ***REPORT DEI TRASPORTI SPECIALI (ROAD SURVEY REPORT)***
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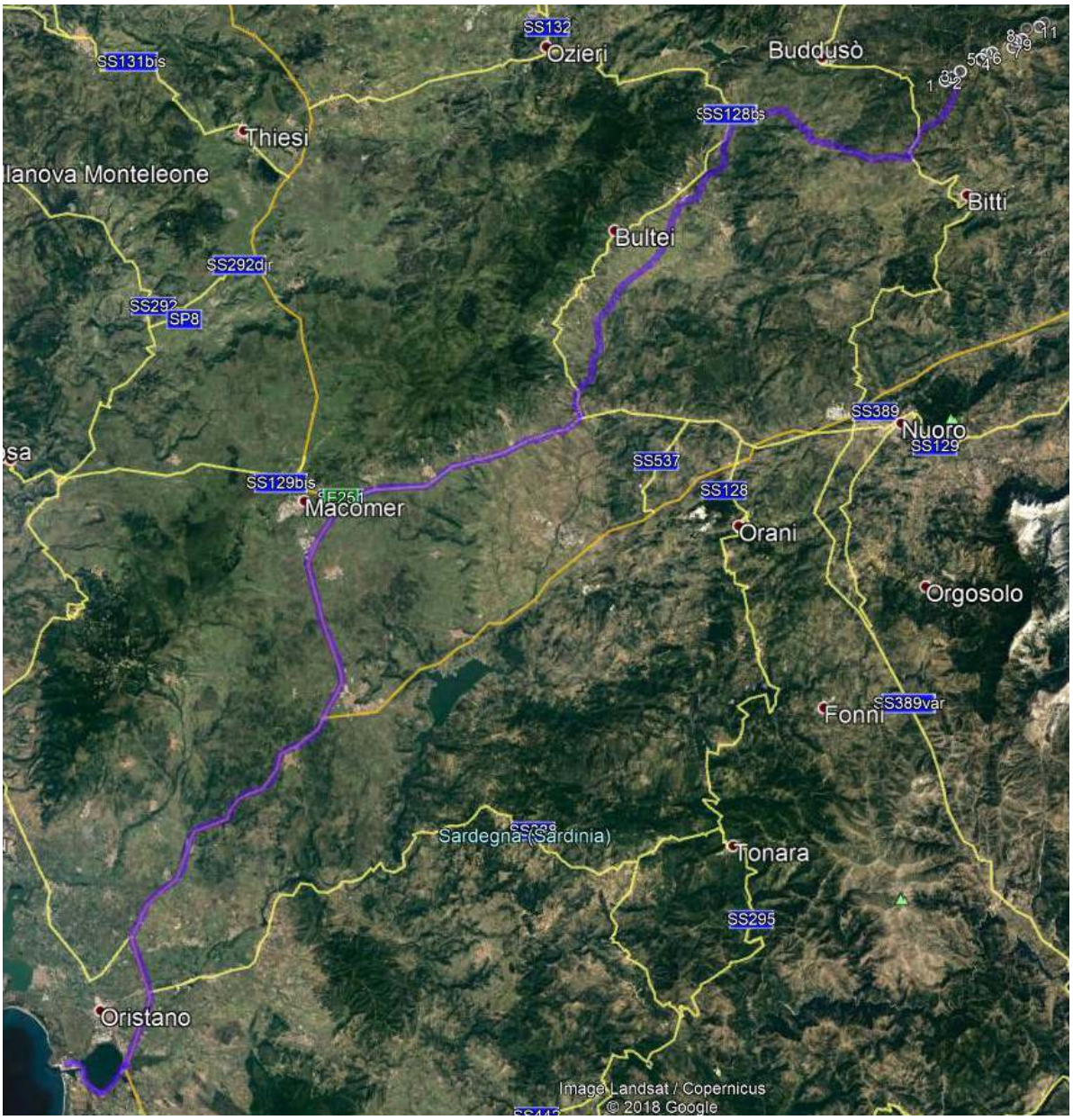
	DATA	***DESCRIZIONE***	***ESEG.***	***CONTR.***	***APPR.***

GE Renewable Energy	Bitti WPD Europe GmbH 12x 5.X-158 101mHH GE Ref.#: 1213643 Route & Site Report	
	Rev.0	10/07/2019

This report is based on a site & route survey from GE, that took place on 04.07.2019. The scope of this report is to show the Transportation Route & all the needed civil works starting from the Port of Oristano up to the site entrance north of Bitti. The port has large storage areas, is experienced in the handling of wind components but hasn't cranes with sufficient capacity. They need to be brought in from Cagliari and/or from the continent.



The route from the port of Oristano to the site is:
Port of Oristano exit, Via Marongiu, SP 97, SP 49, SS 131, **Handover Point**, SS 129, SS 128 bis, SP 10M, SP32, Municipal roads, SP 15, SS 389, SP 50.

All road modifications starting from the port of Oristano via the route described above up to the Handover Point are the responsibility of GE. All road modifications and requirements starting from (and including) the Handover Point to the Wind Farm site entrance is the responsibility of the Buyer.

The report also includes general information based on the GE road-crane specifications as to the requirements that will be required by GE on the site itself. The exact details as to what is required from the site entrance to each individual turbine will be discussed and agreed upon later.
The civil works and the land areas required, starting from the Handover Point up to the Site Entrance are shown in this report. The exact requirements & details of exactly what is required will be discussed and planned by both parties later.

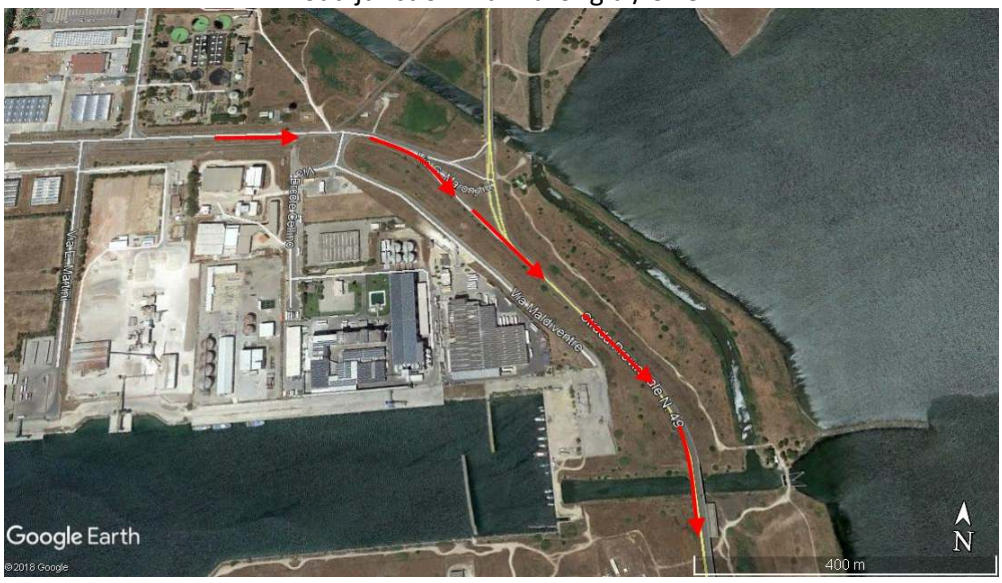
Below table provides an overview of the components that need to be transported to the site. Actual weights may vary depending on final configuration and below values should be used as an indication only. The weights and dimensions for the towers are incl. H-Frames. For road transportation the H-Frames can be disassembled and would reduce the length by 82cm, the height by 30 cm and the weight by 4451 kg. The weights and dimensions for all other components listed below do not include shipping frames/fixtures.

Commodity	Dimensions (mm)			Weight (kg)
	length	width	height	
Tower Base	11150	4300	4700	74,451
Tower Mid C	15660	4300	4700	74,451
Tower Mid B	19020	4300	4700	61,150
Tower Mid A	26020	4300	4700	61,650
Tower Top	28890	4300	4700	51,850
Blade (root part)	65800	4000	3300	27,270
Blade (tip part)	15100	2000	800	850
Nacelle	15100	3900	3450	86,200
Drive Train inc. Gearbox	6230	3630	3080	90,200
Hub	3500	4000	3800	51,500

Weights and dimensions of the components

Port gate 39°52’03” N 08°33’22” E

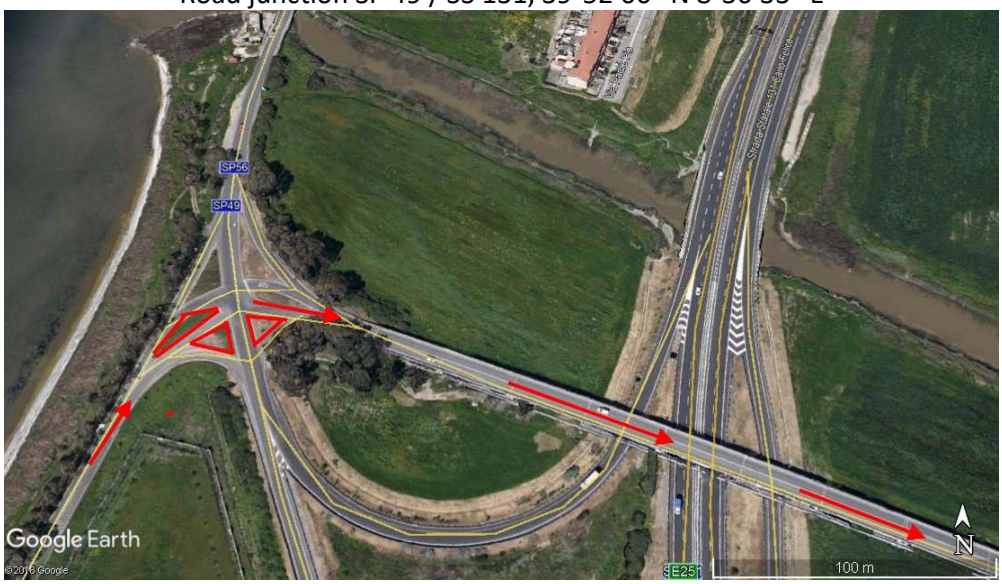
Road junction Via Marongiu / SP 97

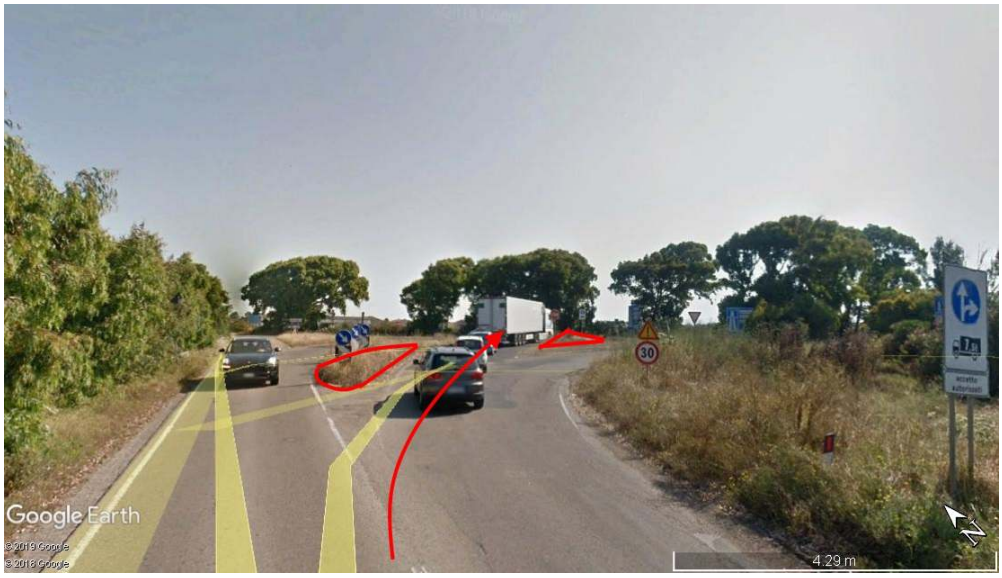


Road junction SP 97 / SP 49, 39°50’47” N 08°35’21” E

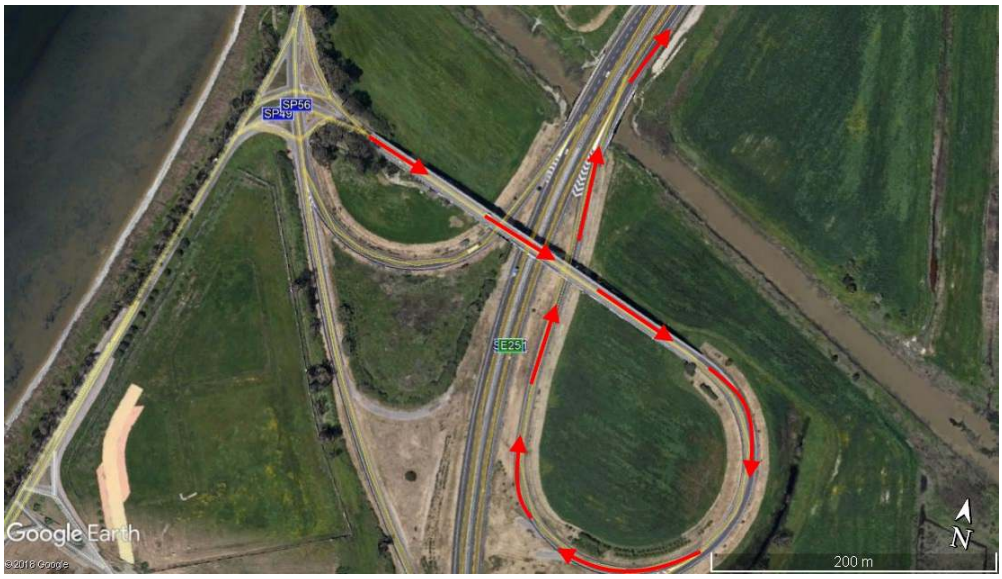
drive in opposite way, clear inside for oversail

Road junction SP 49 / SS 131, 39°52’06” N 8°36’33” E



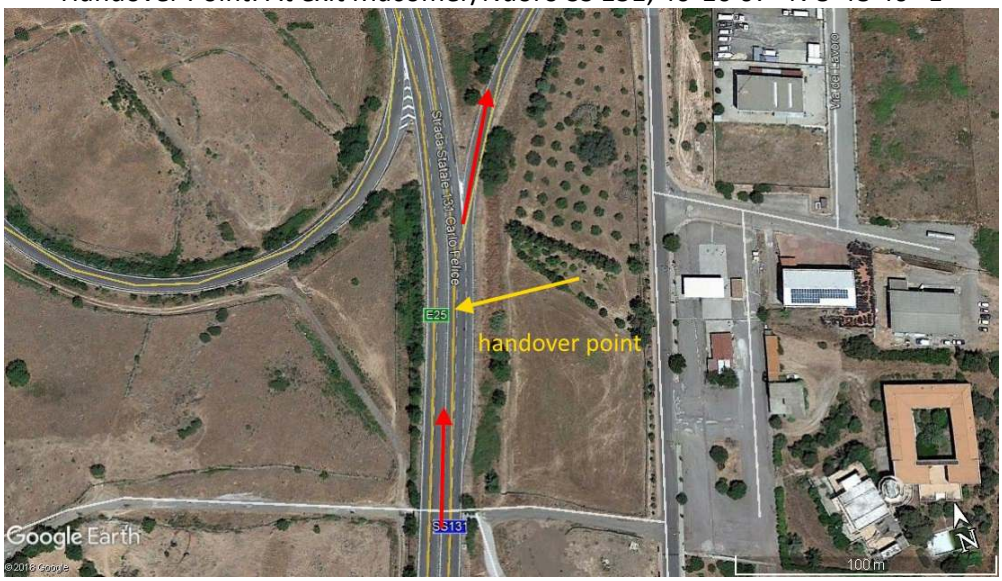


Remove 3 traffic islands and signs
Continue on SS 131



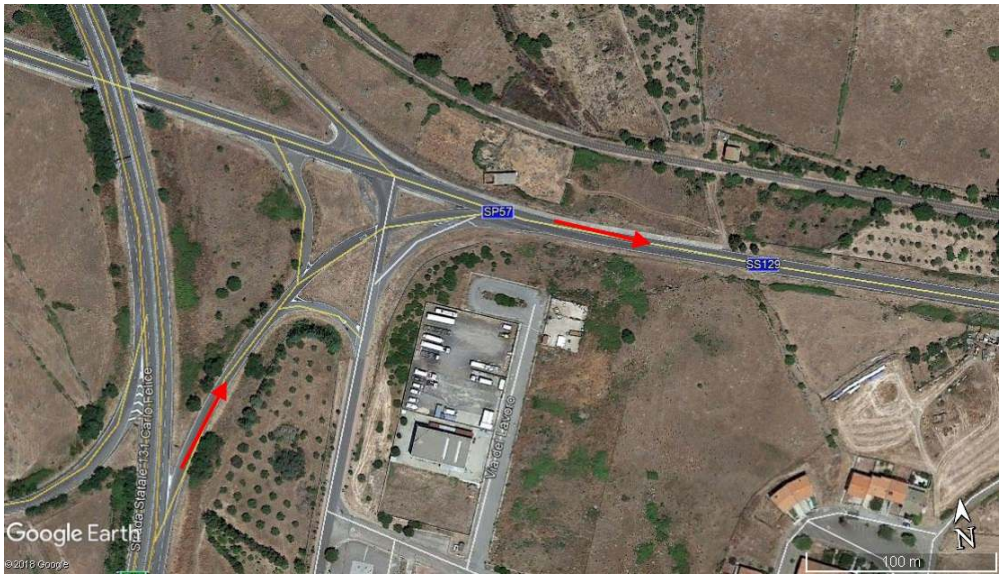
Remove barriers on right side.
Continue on SS 131 up to exit Macomer/Nuoro

Handover Point: At exit Macomer/Nuoro SS 131, 40°16'07" N 8°48'40" E



The Handover Point is the point from where on the Buyer is responsible for carrying out all the required road modifications and civil works that will be necessary along the final chosen route, so as to allow the transport vehicles and components to reach the Wind Farm.

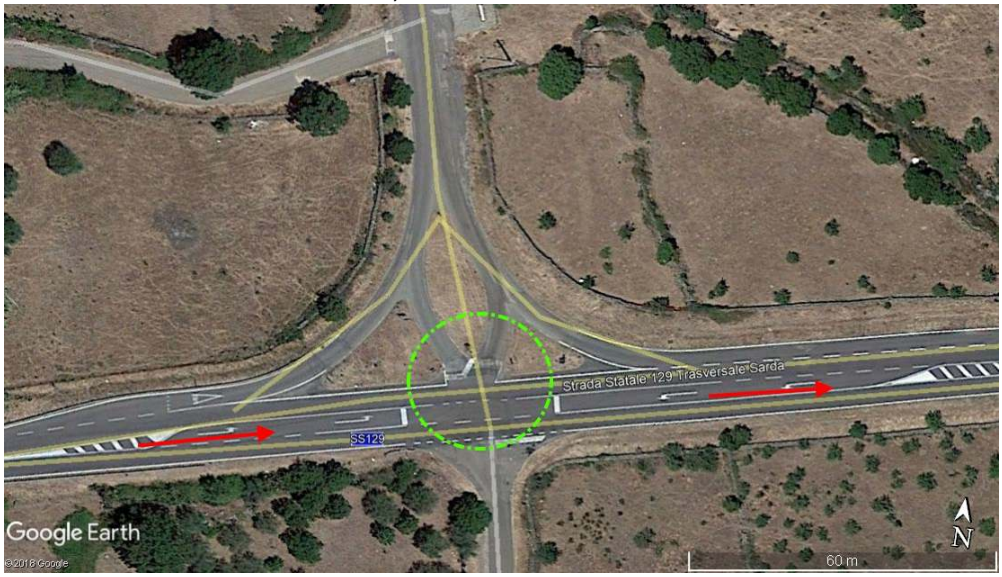
Remove signs



Road junction SS 131 / SS 129, 40°16’13” N 8°48’46” E

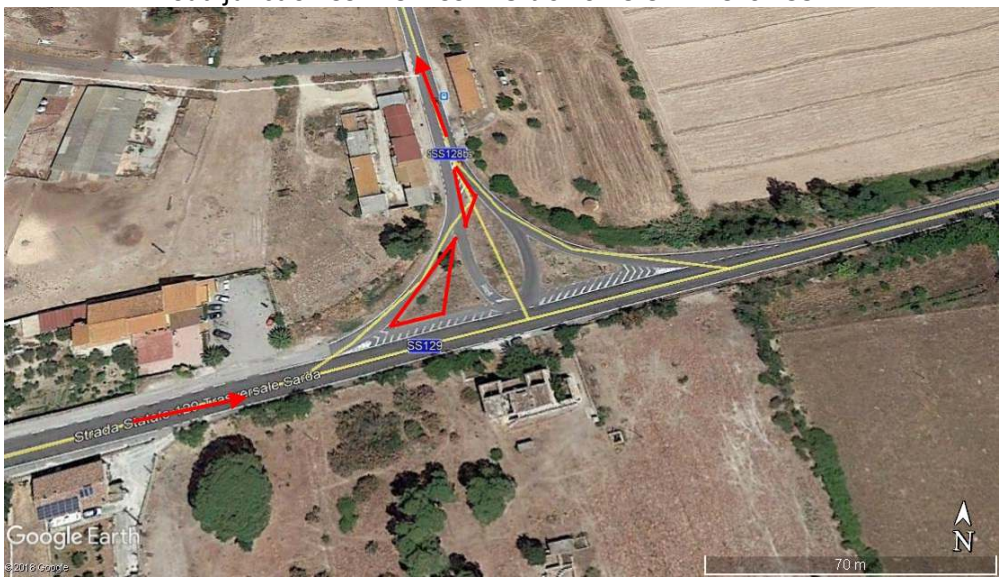
remove signs

SS 129, 40°19’31” N 8°50’29” E



There is a new roundabout currently in construction. Necessary modifications can be defined once the construction is finished.

Road junction SS 129 – SS 128 bis 40°19’31” N 9°01’55” E



Cut 2 traffic islands and compact

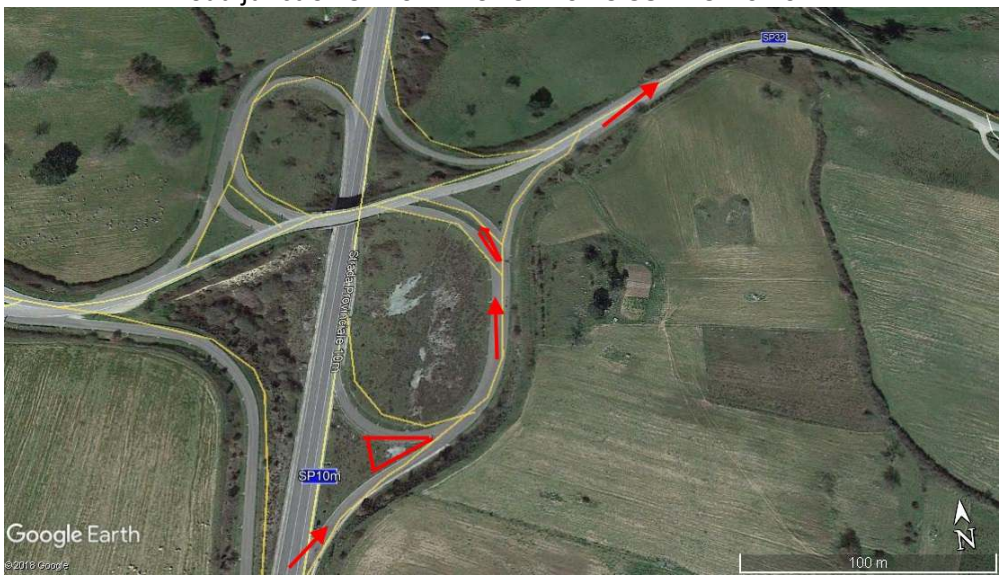
cut trees

remove signs, remove traffic island

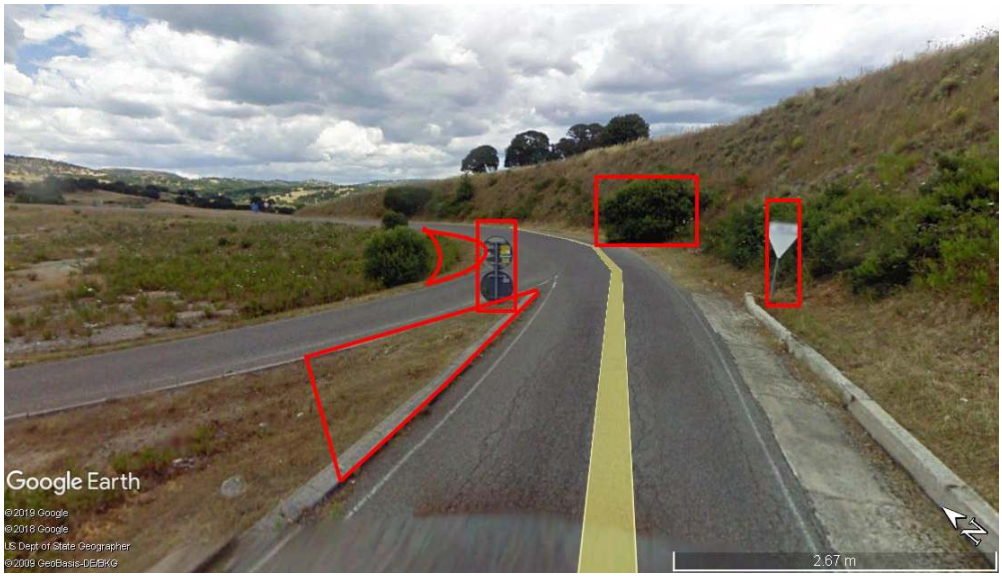
Road junction SS 128 bis – SP 10 M 40°19’42” N 9°01’51” E

Remove and widen 3 traffic islands, remove signs

Road junction SP 10 M – SP 32 40°19’58” N 9°10’20” E



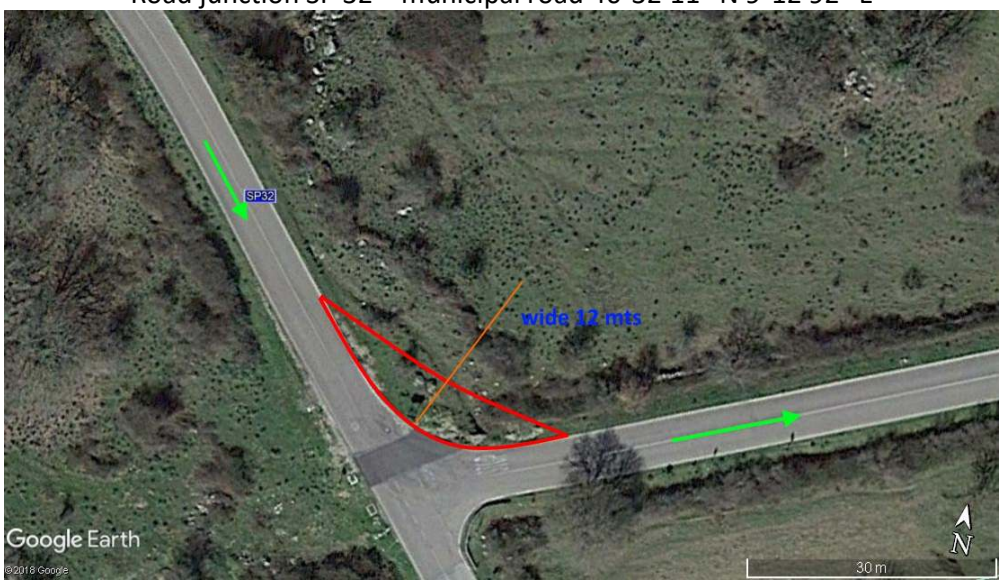
Remove signs

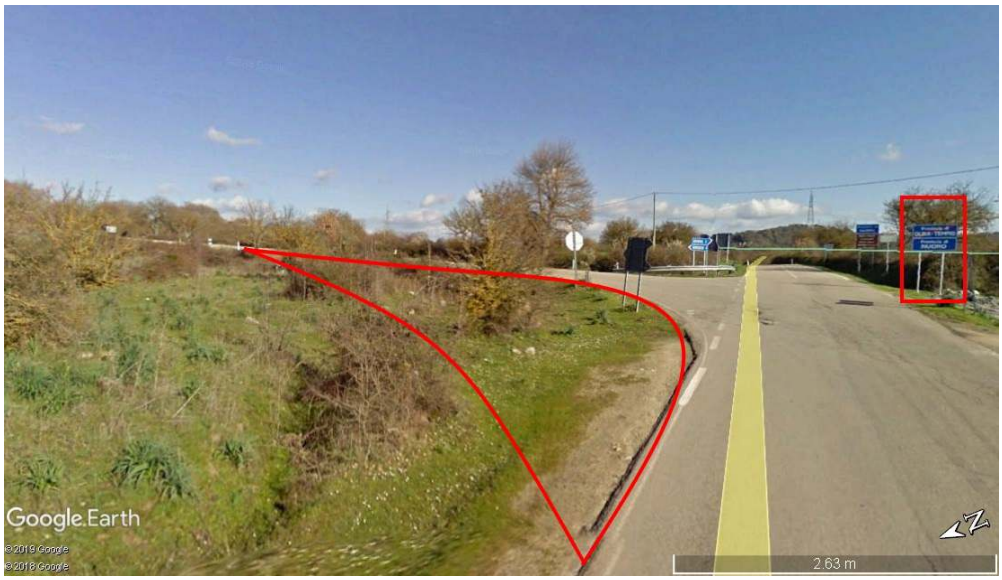


Remove signs, remove bushes, modify traffic islands widen 8 mt.

Modify traffic islands and compact width 8 mt., remove signs, cut branches

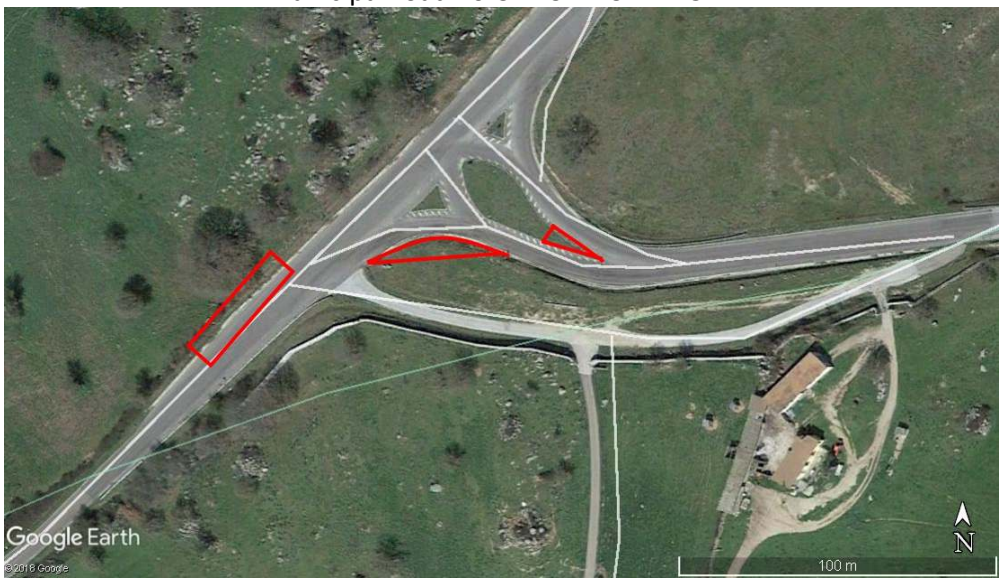
Road junction SP 32 – municipal road 40°32’11” N 9°12’92” E





Widen left side, width 12 mt., remove signs, cut trees

Municipal road 40°32’19” N 9°12’25” E

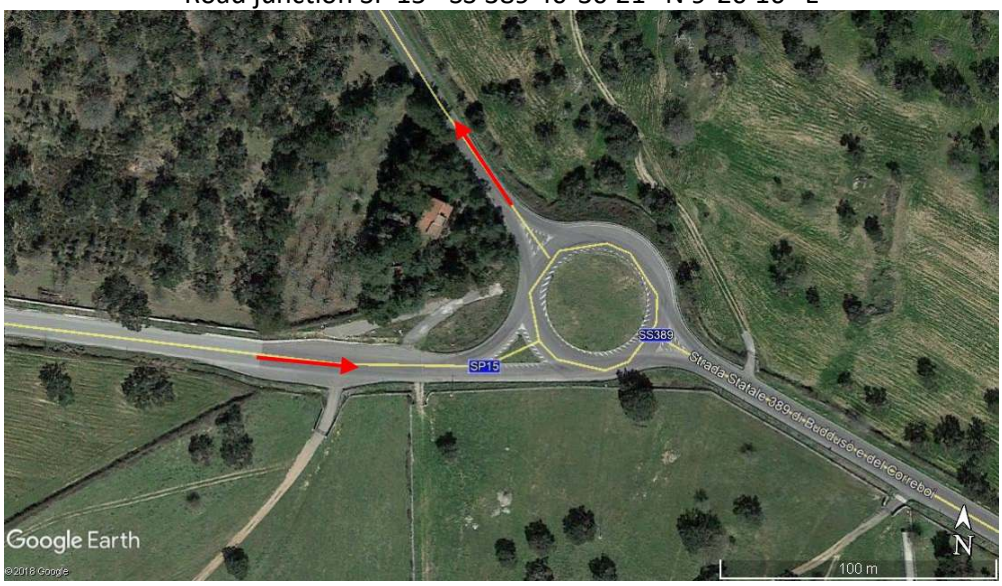


Widen traffic island, width 8 mt., cut trees
Alternatively, increase widening on the curve inside to avoid treecutting

Roundabout Municipal road – SP 15 40°31’11” N 9°14’35” E

Make part of roundabout accessible

Road junction SP 15 - SS 389 40°30’21” N 9°20’16” E

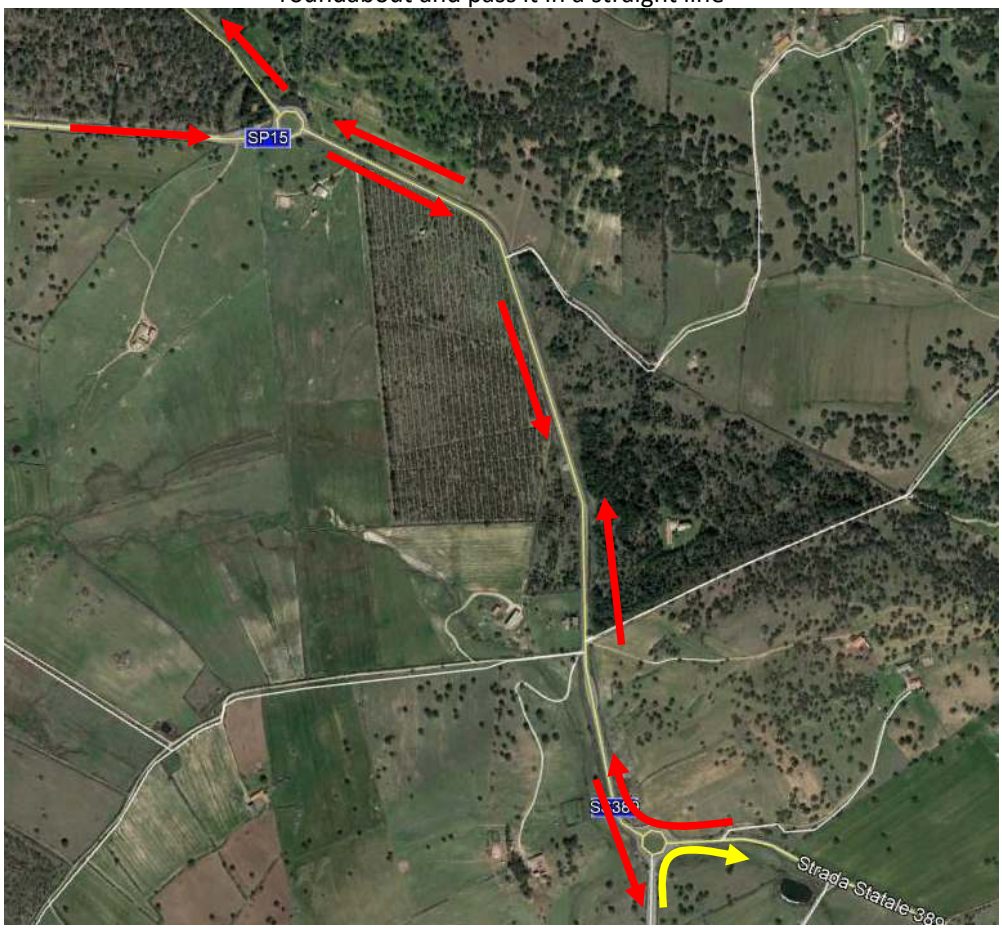


There are two options to cross this roundabout

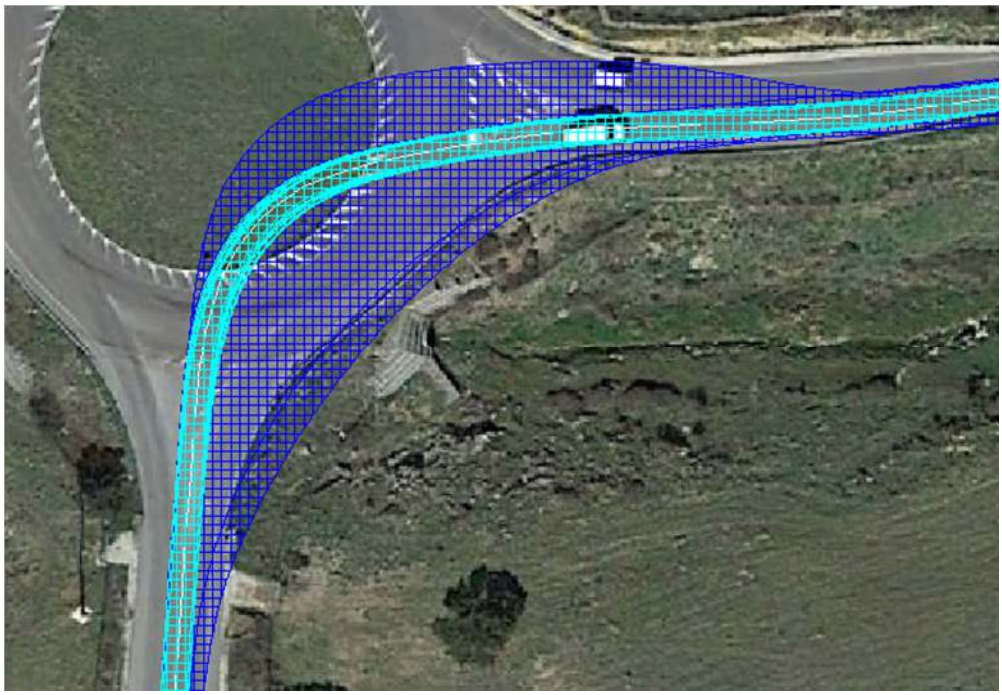
Option 1: Turn left directly

Turn left on the roundabout. Enlarge road on the north side (otherwise we have problems with the steering of the dolly). Remove electricity pole in the south. Little oversail on private property.

Option 2: Continue to second roundabout, drive to the south, reverse on SS 389, then continue back to first roundabout and pass it in a straight line



Remove signs, make part of roundabout accessible

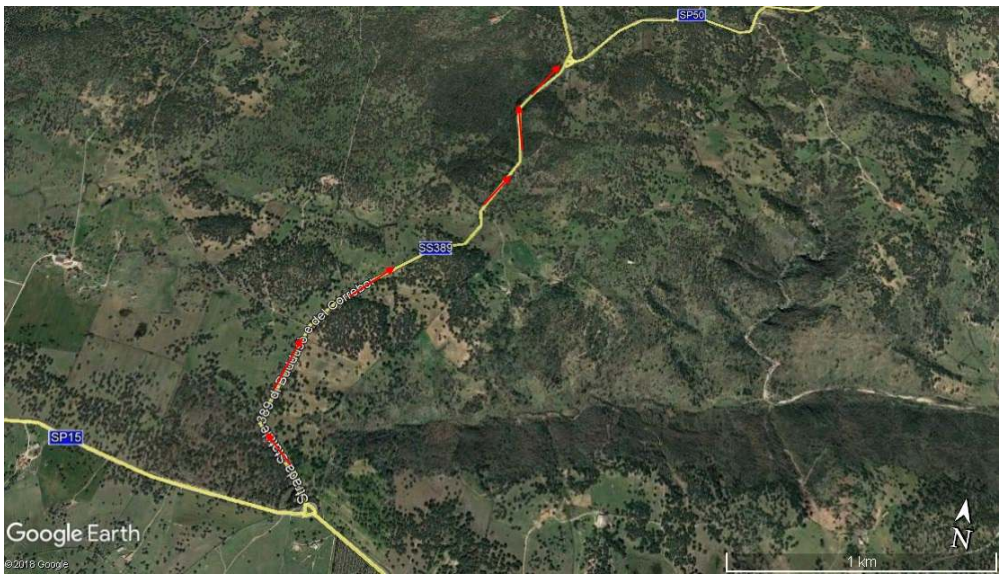


Remove signs, make part of roundabout accessible, clear inside, build straight road through first roundabout

SS 389 40°30’30” N 9°20’04” E

widen right side, width 10 mt., remove barrier, cut trees.

SS 389 and SP 50

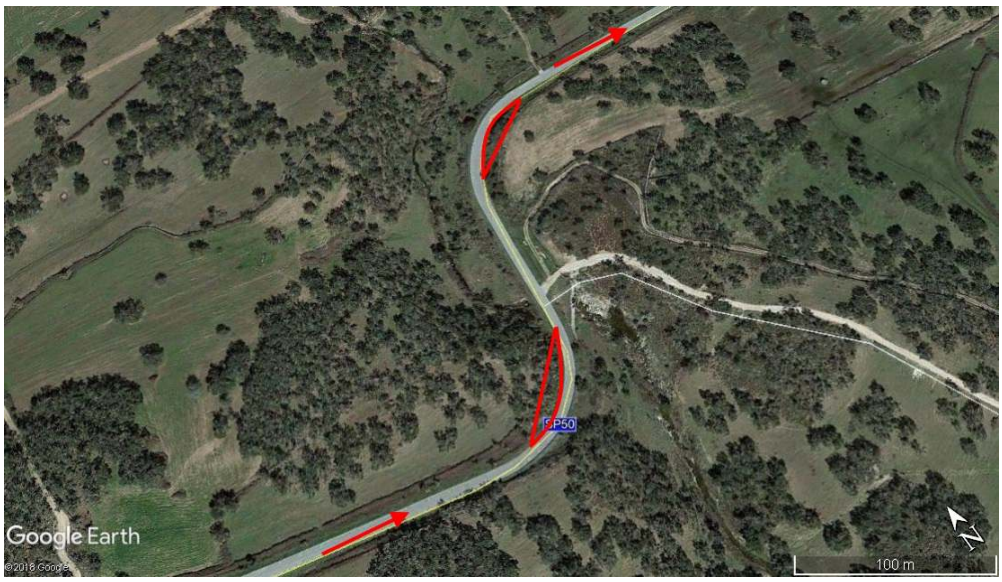


cut trees along the roads (private property), organize team during trial run

Road junction SS 389 – SP 50 40°31’33” N 9°20’45” E

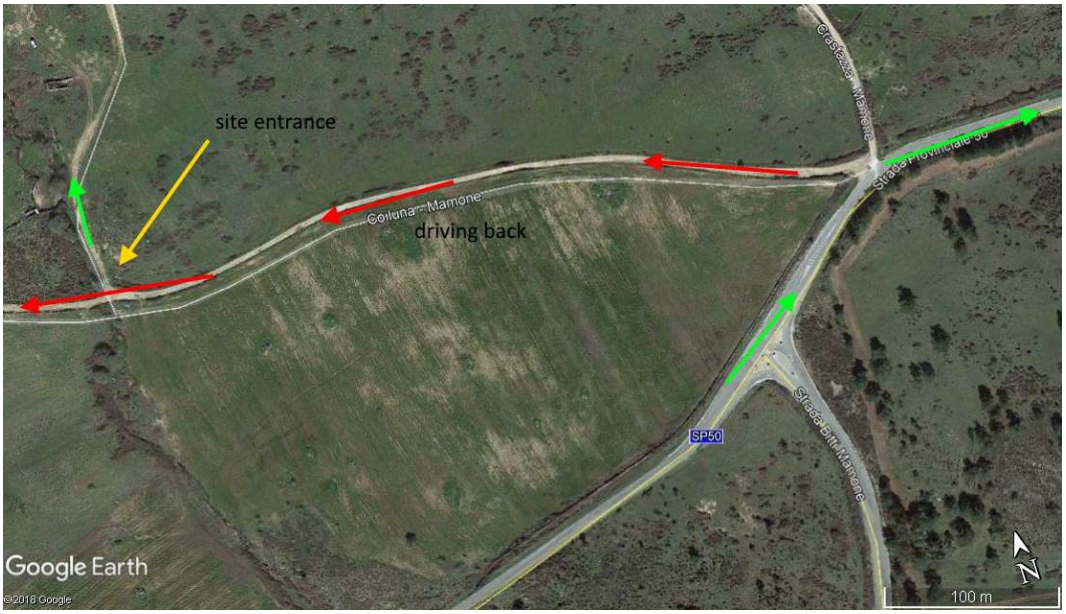
Widen right side, width 8 mt., remove 2 traffic islands and signs

SP 50 40°31’45” N 9°21’21” E



widen left and right side, width 8 mt.
Continue on SP 50

Site entrance 40°34’17’’N 9°24’36’’ E



Possibility to reach site entrance: drive on SP 50, reverse on Strada Coiluna-Mamone, enter the site. All roads in the windfarm must be designed according to GE Specification for Site Roads and Crane Pads

General remarks on the route survey:

a) The proposed transport route is only valid under the consideration of getting approval of the authorities. No bridge calculations in regard to weight capacities have taken place at the time of the Route Survey.
b) In terms of vehicle weight and axle loads in regard to weight capacities at bridge crossing it may be useful for the Buyer/Developer to obtain information from the relevant road authorities and/or District offices in advance.
c) The proposed Transport Route is only valid under the consideration that the road conditions do not change.
d) After signing the contract between Buyer and GE, a logistic company has to carry out a validity check for the Transport Route.
e) Based on the route survey, the maximum tower diameter for this route is 4.3m.
f) The route was checked for a tip frame position of 50m.

Site Survey Report:

In general, the windfarm site has to be compliant with the GE Specification for Site Roads and Crane Hard Standings. Deviations from the Specifications must be communicated to GE in written and need to be confirmed by GE. The site survey report provides information on the area of the windfarm and necessary BOP works.

During the Route & Site Survey, no detailed layout was available from the customer. Therefore, only a rough check of the terrain and area was done.

a) Windfarm area

- the turbines are located in complex terrain (high slopes to be expected)
- slopes above 8% require towing vehicles
  - Currently it is not clear if there are slopes in the windfarm, that require towing vehicles. This must be clarified on a later stage.
- slopes above 10% require a bonded surface layer (e.g. asphalt or concrete mix)
- in case of bumps in the road (e.g. hill top), the vertical radius must be min. R400m
- in case of dips on the road (e.g. bottom of valley), the vertical radius must be min. R350m
- The customer needs to be aware of oversailing areas. Example: For a 90° curve, GE requires R45 for the road itself, but additionally R70 for the oversailing area.
  The oversailing area needs to be free of obstacles. In case of agricultural areas, crop damage might occur. It's the customers obligation to have an agreement in place with all landowners where oversailing occurs. GE can support to identify possible oversailing issues.

b) Crane hardstand / Crane strategy / Rotor Assembly / delivery strategy

- To avoid waiting time of the main crane, GE intends to pre-deliver wind turbine components to the site. Instead of a central storage area, GE intends to lay down all components on the pad. That includes tower sections, blades, nacelle and hub. A layout check will be conducted to check if this is possible / what modifications to the layout are necessary. To avoid expensive storage at the port or on the vessel, GE intends to bring the components to the site as soon as possible. It may occur, that components stay on site for several weeks without an installation team being present.
- For this turbine type, predelivery areas are inevitable, as the nacelle is delivered to the site in separate parts. Also, the blade is split in two parts and the blade tip has to be assembled on site. Therefore, the dedicated areas as described in the GE Specifications are necessary.
- The required dimensions of the crane pad and the associated storage/assembly areas can be found in the GE Specification for Site Roads and Crane Hard Standings.
- The -158m rotor can only be built with a single blade installation
- For this turbine, a Terex/Demag CC 3800 crawler crane will be used.
- For this project, 1 installation team & 1 main crane team should be considered.

- Crane movement between the turbine locations should not be considered at the moment. The turbines are located in complex terrain with little space. If there are turbine locations where this is possible, GE and the customer will find an agreement at a later stage. In general, a crane movement is beneficial for both parties. The installation is quicker, and the installation costs are reduced.
- Depending on the exact crane configuration, support areas (5m x 5m, 100 kN/m², 2% levelness) for the crane boom are necessary. Especially, if the crane is assembled in a negative slope / downhill.

c) Parking-, turning- and passing areas

- The amount and dimensions of parking- turning- and passing areas will be determined in a later stage, once a detailed layout is available.

d) Site office and container compound

- In this project with 12 units, GE requires a site compound of 30m x 20m.
- The site compound should be located in the windfarm area, ideally close to one of the entrances
- The site compound should be positioned outside of crane working zone to avoid the hazard of falling objects.
- The exact location will be mutually agreed between GE and the customer on a later date.

e) General Remarks

- A trail run is to be carried out at least 6 weeks before the project is due to start. The trail run needs to be carried out when all road modifications and site roads have been completed.
- From the handover point to the individual turbine locations, the customer has to ensure a clearance of six meters height and five meters width.
- That includes cutting/trimming of bushes and branches, as well as lifting/removing telecom/power cables.
- Clearance to cables has to be the minimum in accordance with the National Safety Regulations and/or the Safety Guidelines of the Grid Owner in the Country that the project is to be constructed. A guideline can be DIN VDE 0105-100.

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