



LID ENERGY



PRELIMINARY METHOD OF STATEMENT

LID Energy 30 MW Wind Turbine Erection Project



Belen / TURKEY

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1. Cranes:

Liebherr LG 1550 is going to be used as main crane to erect 15 units of Sinovel SL1500/82 wind turbines.

(a). LIEBHERR LG 1550, 550 TON CAPACITY CRAWLER CRANE: Main Crane.

90 ton lifting capacity while having 91m+6m main boom, 20m radius and 200 ton counterweight.

(b). LIEBHERR LTM 100, 100 TON CAPACITY MOBILE TELESCOPIC CRANE:

Tailing Crane

Liebherr LTM 1100 is going to be used as tailing crane to erect 20 units of Sinovel SL1500/82 wind turbines.

34,5 ton lifting capacity while having 30,1 m main boom, 8,3 m radius and 35 ton counterweight.

(c). HIDROKON HK 225, 75 TON CAPACITY TRUCK MOUNTED CRANE:

Hidrokon HK 225 is going to be used as auxiliary crane.

43,9 ton lifting capacity in 4,83 m radius and 27,37 ton lifting capacity in 7,5 m radius

2. Tackle Check List

Adequate set of chains and shackles, soft slings and wire rope slings for main and tailing crane is going to be provided by Sarilar Heavy Lift & Transport.

All cranes which are going to participate in your project, are certificated by authorized inspectors. These certificates can be asserted upon request.

All tackle for lifting wind turbine components is going to be supplied by client.

3. Turbine Details

Dimensions and weight for Sinovel SL1500 can be found below:

Nacelle: 11,40 x 3,50 x 3,85 m; 87,1 tons

Towers: 3 parted, modular tower

- i) Top tower section : 36,50 x 4,20 x 2,39; 52 tons
- ii) Middle tower section : 26,88 x 4,20 x 4,20; 62 tons
- iii) Base tower section : 15,66 x 4,50 x 4,20; 63 ton

Other technical details about wind turbines can be found in “**Sinovel SL1500/82**” provided by LID Energy.

4. Crane Selection

Crane selection was done according to the most critical value which is Nacelle’s height and weight, regarding whole weight which is under the main boom such as hook’s weight, sling’s weight etc... under appropriate working conditions.

(a) Liebherr LG 1550: 550 ton capacity Liebherr LG 1550 has 90 ton lifting capacity while having 91 m+6 m main boom, 21 m radius, 200 ton counter weight in the configuration shown below.

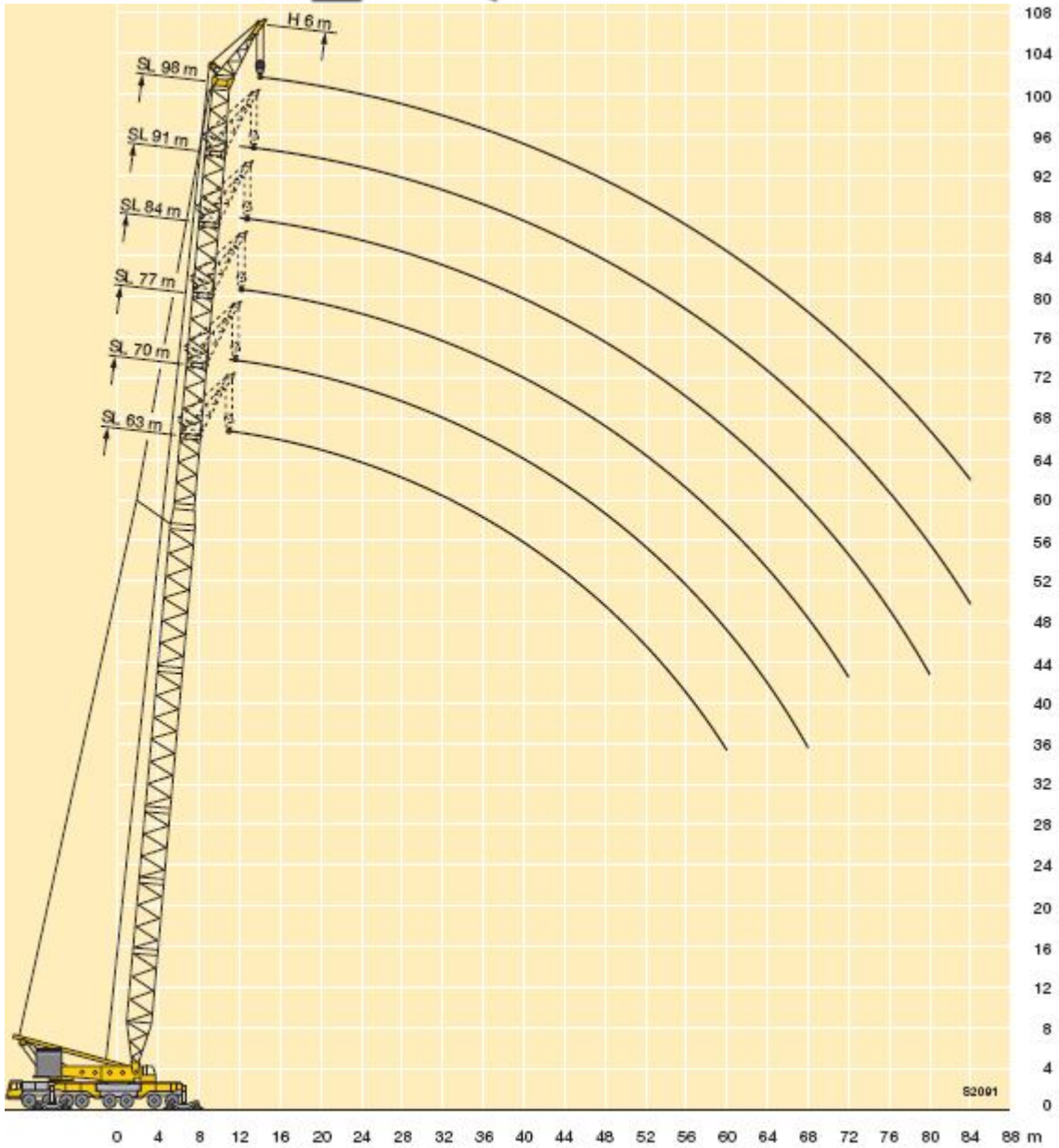


Figure 1: Liebherr LG 1550 Configuration -98 m + 6 m Main Boom

Total perpendicular projection length between boom end point and ground is 98 m with the altitude of boom bottom point which is 3,6 m. By taking 80 m nacelle height, 87 ton nacelle weight and weight of the equipment under the boom's end point into consideration, we can work safely in 91 m + 6 m main boom configuration.

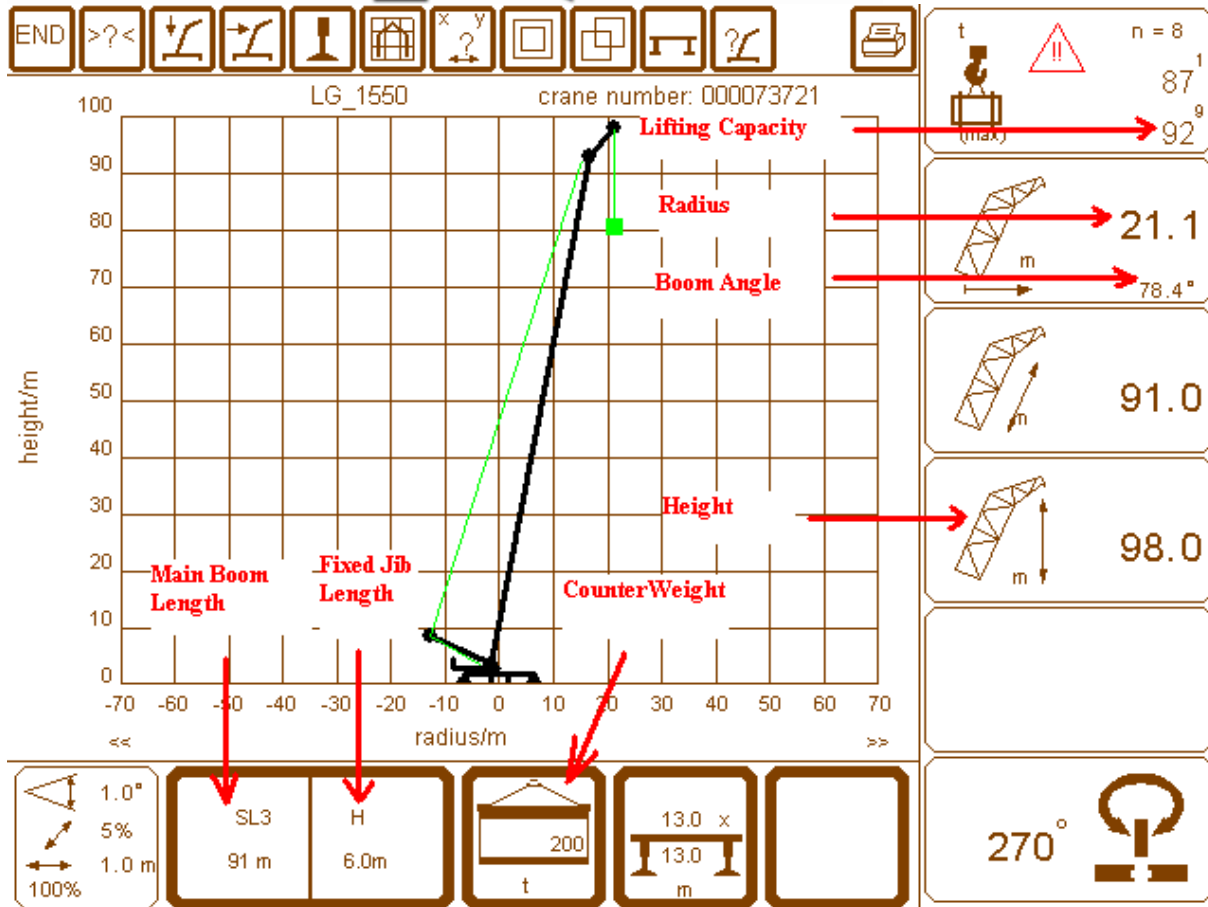


Figure 2: Liebherr LG 1550 Liccon Work Planner Details

In given configuration, Liebherr LG 1550 can lift up to 92,9 tons at 21 m radius.
 Liebherr LG 1550 is going to use 200 tons counterweight.

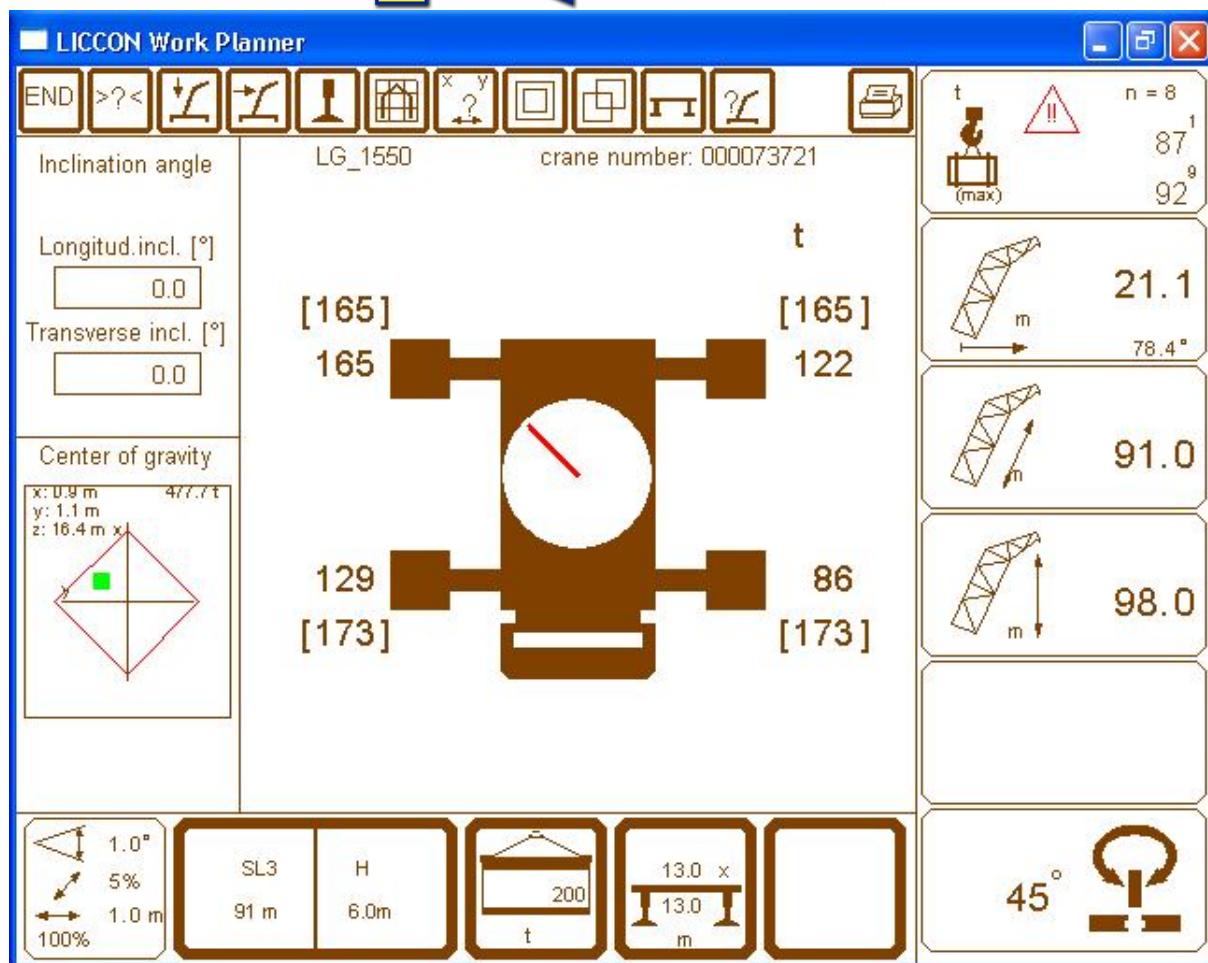


Figure 3: Liebherr LG 1550 Liccon Work Planner Ground Pressure Values

While lifting 87 tons nacelle, maximum force exerted onto ground from hydraulic leg is 173 tons. For 3m x 3m mats are going to be used under the hydraulic legs, **ground pressure value can be stated as 22 tons/m²**.

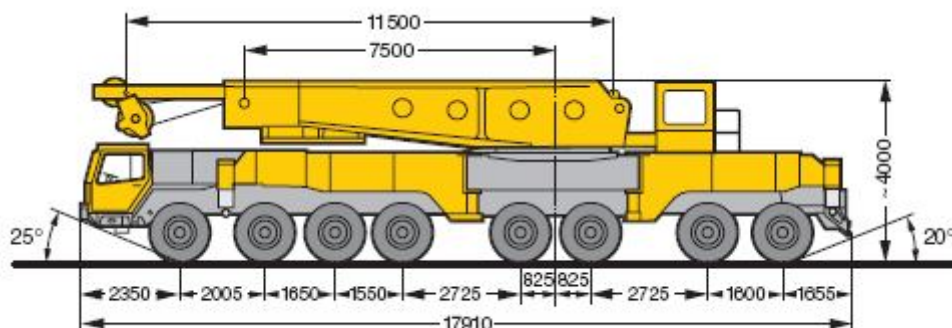


Figure 4: Liebherr LG 1550 Transport Dimensions

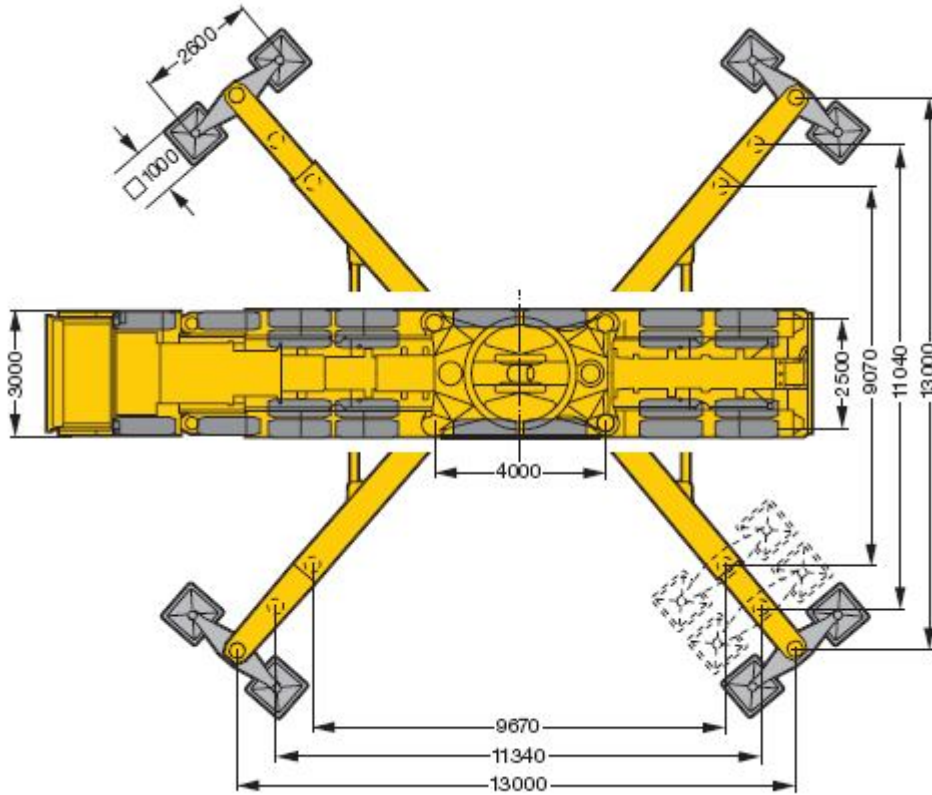


Figure 5: Liebherr LG 1550 Operation Dimentions

Liebherr LG 1550's transport and operation dimensions shall be taken into account while planning site dimensions.

(b) **Liebherr LTM 1100:** 100 ton capacity Liebherr LTM 1100 has 34,5 ton lifting capacity under 75 percentage of efficiency while having 30.1 m main boom length, 8,3 m radius and 35 ton counterweight in the configuration shown below.

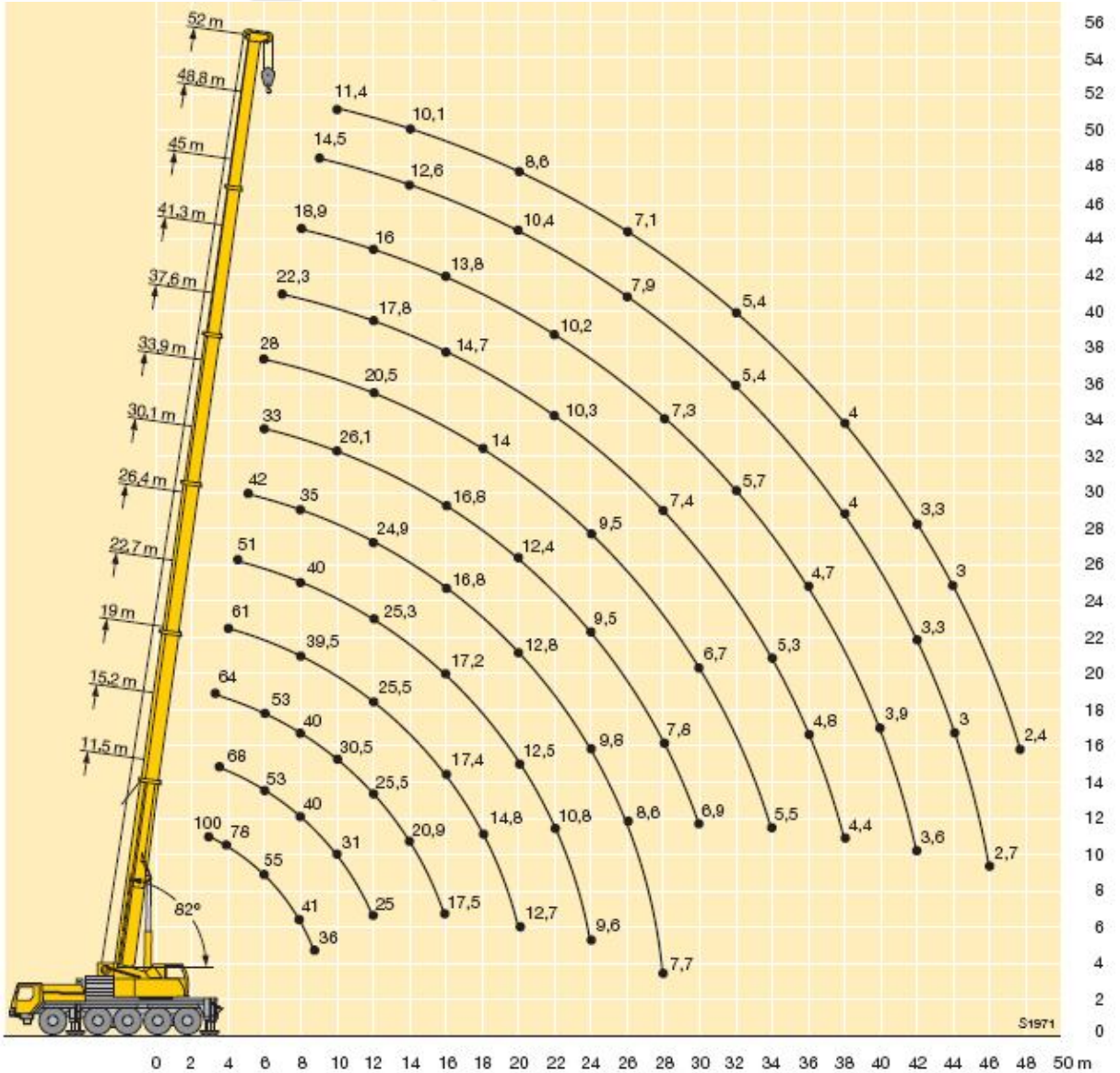


Figure 6: Liebherr LTM 1100 Working Configuration - 30.1 m Main Boom out of 52 m Main Boom

Total perpendicular projection length between boom end point and ground is 32,3 m with the altitude of boom bottom point which is 1,89 m. By taking half of the tower base's weight (31,5 tons) into consideration, we can work safely in this configuration.

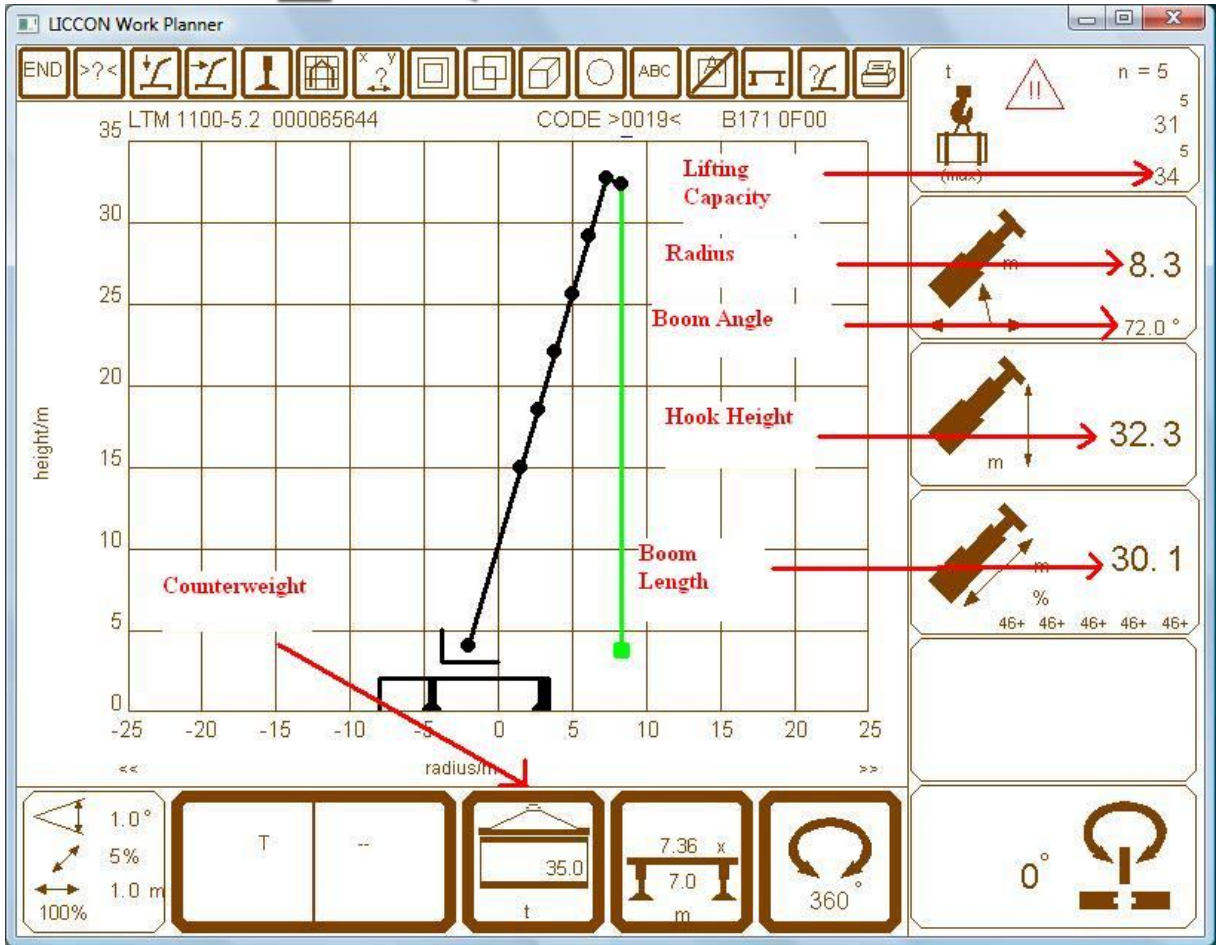


Figure 7: Figure 2: Liebherr LTM 1100 Liccon Work Planner Details

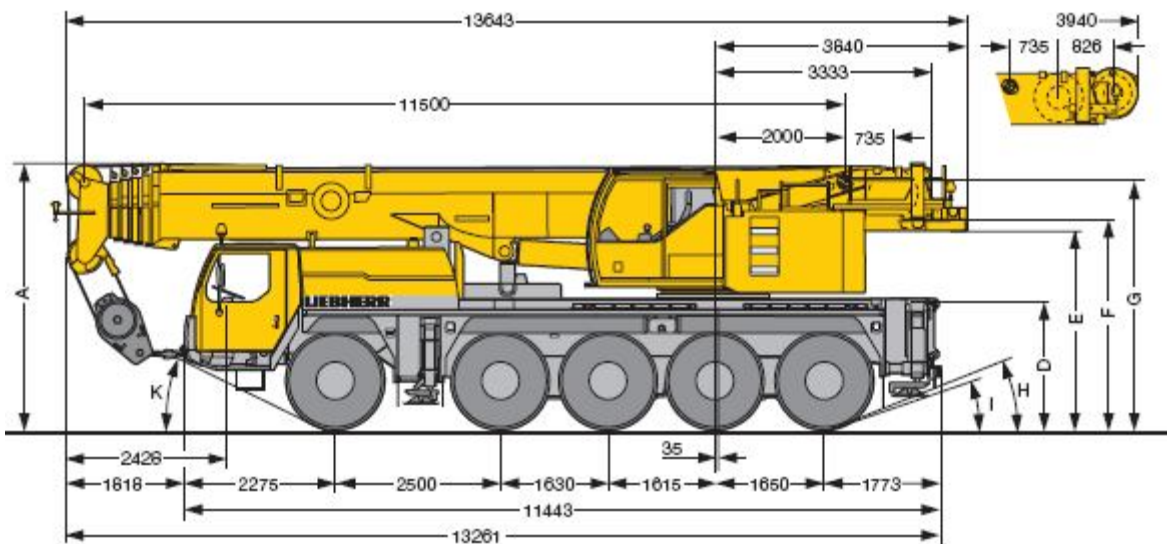


Figure 8: Liebherr LTM 1100 Transport Dimensions

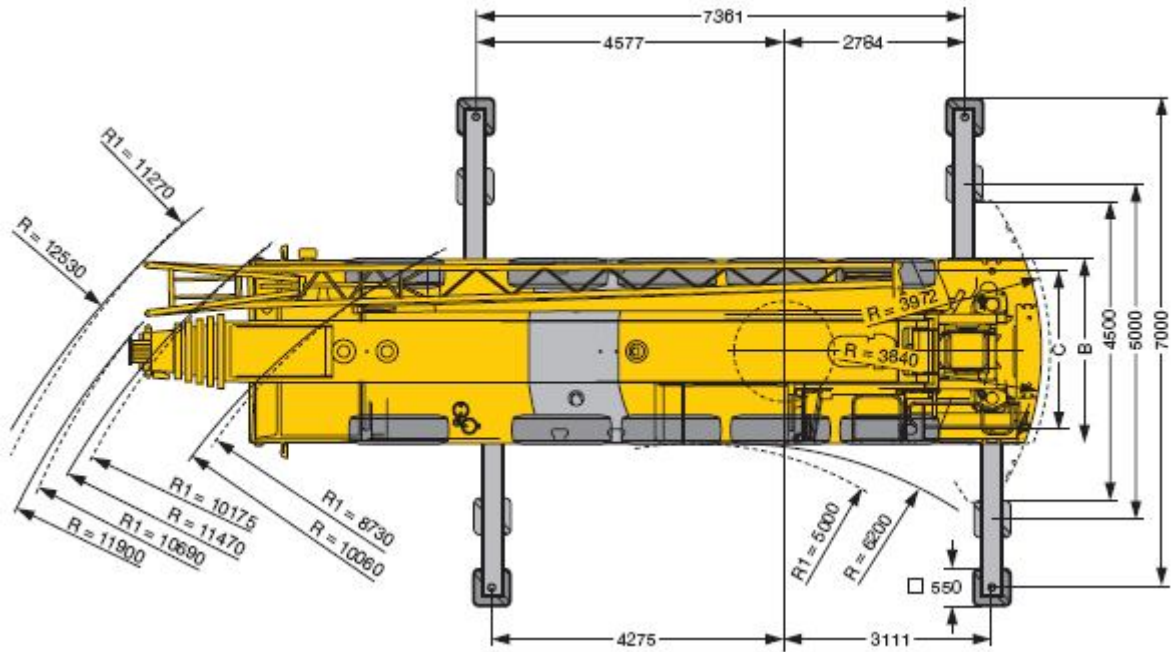


Figure 9: Liebherr LTM 1100 Operation Dimensions

(c) **Hidrokon HK 225:** 75 ton capacity HK 225 has 43,91 ton lifting capacity under 75 percentage of efficiency in 4,83 m radius.

hk 225 L6	kg	43910	27,37	20790	16410	13300	10970	9180	7650	6490
	mt	4,83	7,49	9,59	11,79	14,09	16,49	18,99	21,73	24,57

Table 1: Hidrokon HK 225 Load Chart

5. Transportation to Operation Site

(i). **Liebherr LG 1550:** The dimensions and the weight of most critical part which is main carbody is shown in *Figure 10* below.

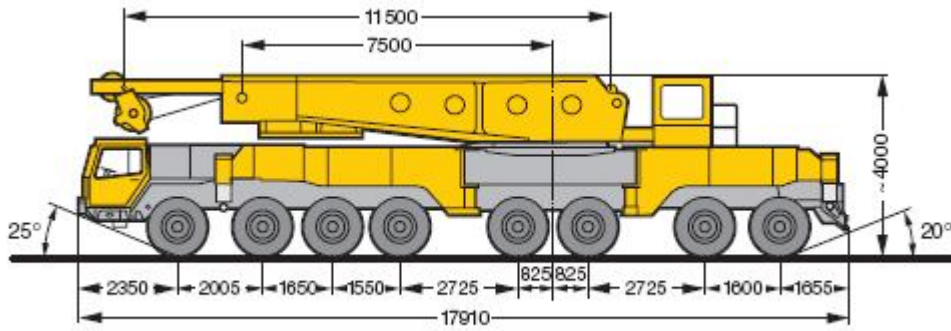


Figure 10: Liebherr LG 1550 – Main CarBody Dimensions

Length of main carbody is 18 m and height is 4 m.

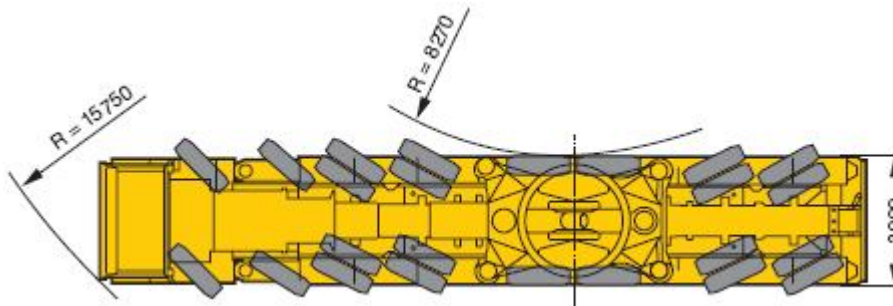


Figure 11: Liebherr LG 1550 – Main CarBody Turning Radius

Turning radius without factor of safety is indicated above figure. Curves on site road shall be prepared by taking **7 m inner radius and 17 m outer radius** into account by adding enough space for cable conduit.

Achse Axle Essieu t	1	2	3	4	5	6	7	8	Gesamtgewicht t Total weight (metric tons) Poids total t
	12	12	12	12	12	12	12	12	96

Figure 12: Liebherr LG 1550 – Load per Axle

Loads exerted onto each axle is 12 tons. Liebherr LG 1550 is going to be transported which three (3) boom sections which are 16,5 tons, 6,1 tons and 12,1 tons in ideal conditions. By taking these information into account, **load exerted on each axle can be calculated as 17 tons.**

Rated voltage	Minimum distance
up to 1000 V	1 m
over 1 kV up to 110 kV	3 m
over 110 kV up to 220 kV	4 m
over 220 kV up to 380 kV	5 m
if the rated voltage is unknown	5 m

Table 2: Working Near Overhead High-Tension Wires

Precautions must be taken while passing under the high-tension wire between pad no.11 and pad no.12 according to information given in Table 2. For the cable is just around 6 m above the road, it is impossible for main crane body pass under it and power from the mains must be taken for this section.

(ii). **Liebherr LTM 1100:** The dimensions and the weight of most critical part which is main carbody is shown in Figure 13 below.

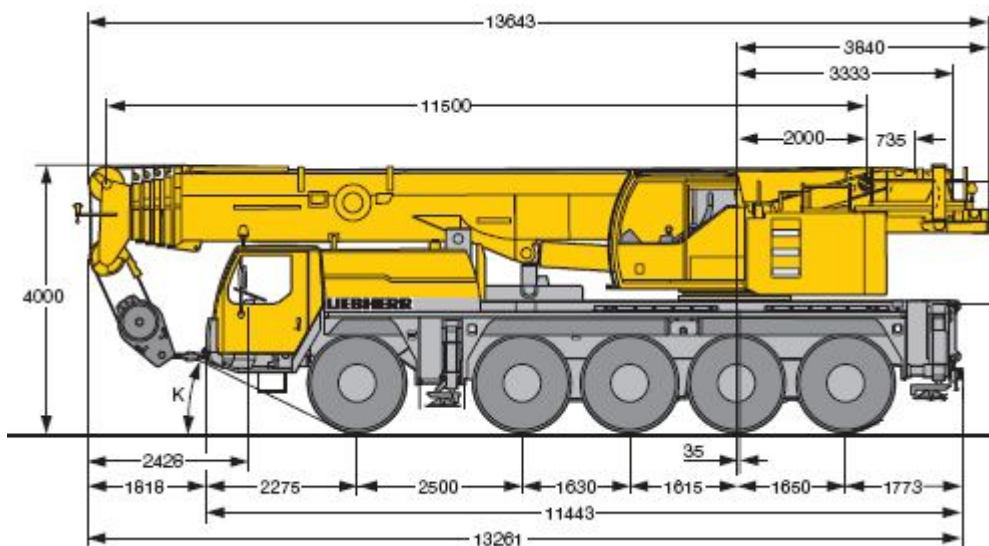


Figure 13: Liebherr LTM 1100 – Main CarBody Dimensions

Length of main carbody is around 14 m and height is 4 m.



Achse · Axle Essieu · Asse Eje · Мосты	1	2	3	4	5	Gesamtgewicht · Total weight t Poids total · Peso totale t Peso total · Общий вес, т
t	12	12	12	12	12	60 ¹⁾

Figure 14: Liebherr LTM 1100 – Load per Axle

Loads exerted onto each axle is 12 tons.

Precautions must be taken while passing under the high-tension wire between pad no.11 and pad no.12 according to information given in *Table 2*. For the cable is just around 6 m above the road, it is impossible for main crane body pass under it and power from the mains must be taken fort his section.

6. Transportation Between Turbine Pads

Transportation of mobile cranes' some parts is going to be done by two trailers and a low-bed. Dismantling of cranes is going to be done by the help of tailing crane under the supervision of operators. If required, turbine montage crew is going to help at the time of dismantling in terms of cleaning turbine pad. After dismantling, parts positioned on trailers and low-bed are going to be moved to other turbine pad and are going to be assembled on standard crane pad again. The roads which are prepared regarding directives indicated in Sinovel Wind Co., Ltd's "*Specific Site Requirements*" booklet, are adequate and sufficient for transportation between turbine pads. Parts which is subject to be transported in terms of having most critical turning values, are blades. As it is shown in 9th page of Sinovel Wind Co., Ltd's "*Specific Site Requirements*", total length of trailer is going to be 54,5 m while transporting blades.

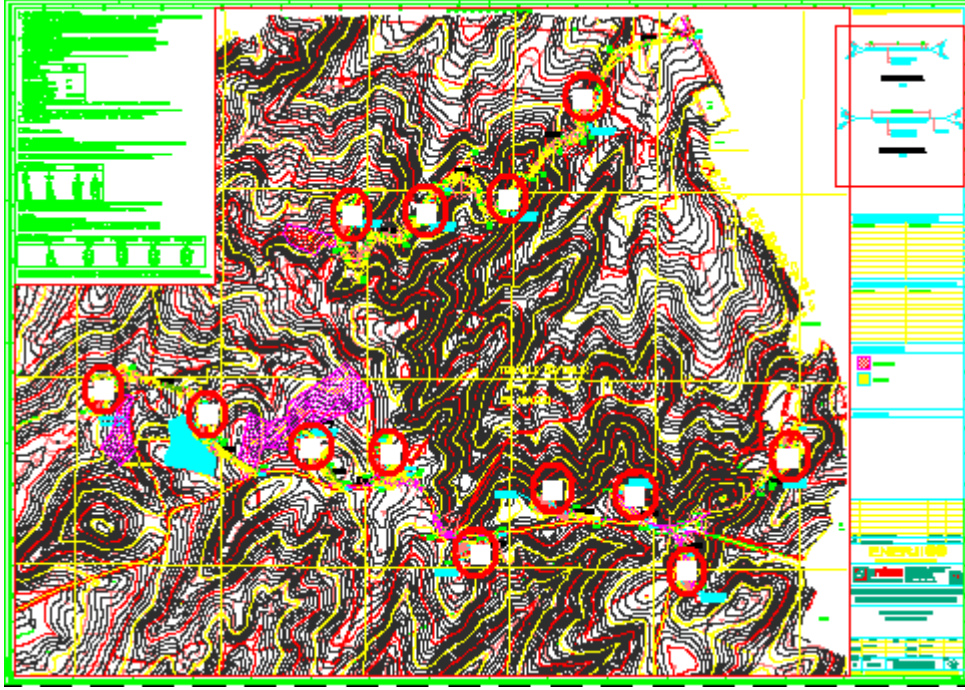


Figure 15: Wind Turbine Pads

7. Crane Pad (Assembly & Operation)

(i). **Assembly:** Site which is going to be used for main crane assembly is going to be prepared by **Client**. By taking 97 m boom length (91 m main boom+6 m boom extension) and 17 m crane length into consideration, Liebherr LG 1550 is going to occupy 120-125 m length crane pad where slope is not exceeding 2%. Crane pads are shown in the attachments by taking CADs provided by **Client** into account.

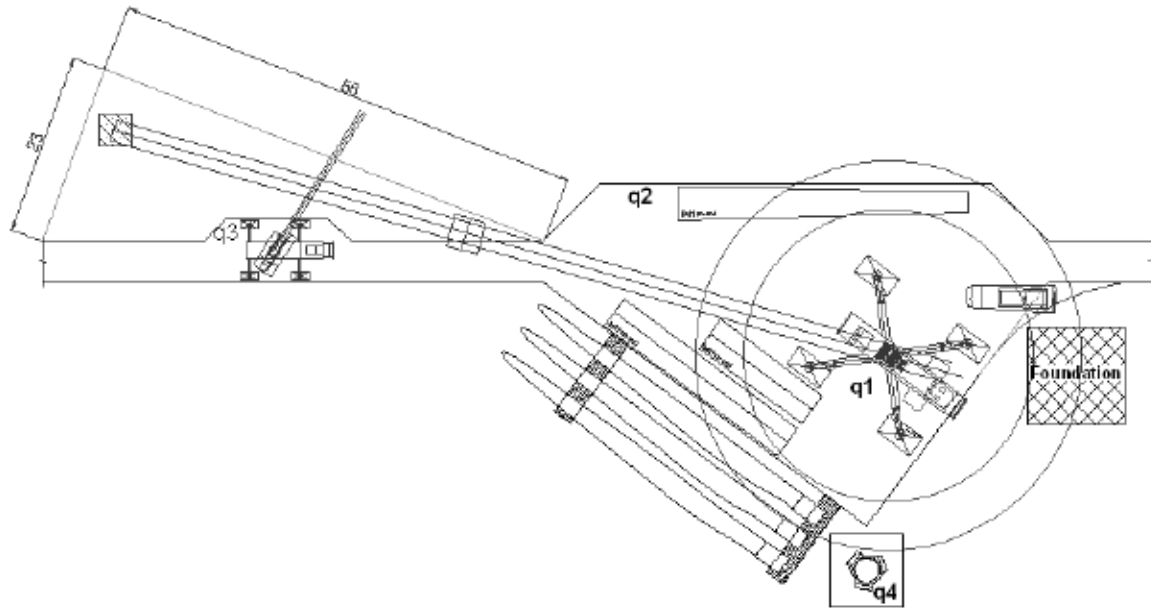


Figure 16: Standart Turbine Pad

Compact ground on turbine pads which are indicated in Sinovel Wind Co., Ltd's "Specific Site Requirements" booklet, has to be expanded from blue section to red section where Liebherr LTM 1100 is going to mount booms on, indicated in figure below.

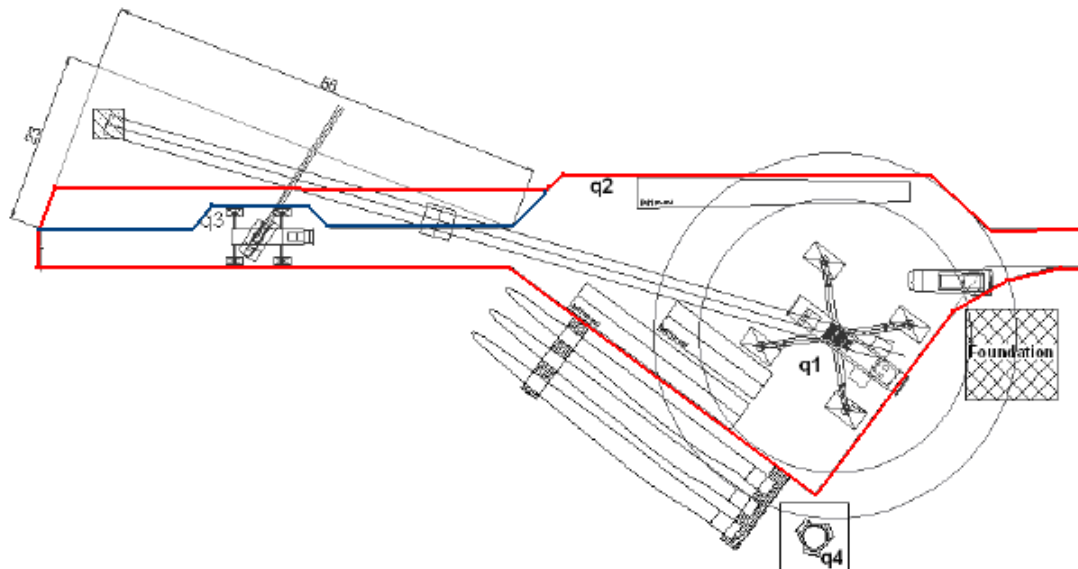


Figure 17: Adequate Turbine Pad

The reason why we are expanding the section that Liebherr LTM 1100 is going to work on, is to maket his crane assemble crane booms on every section of site.

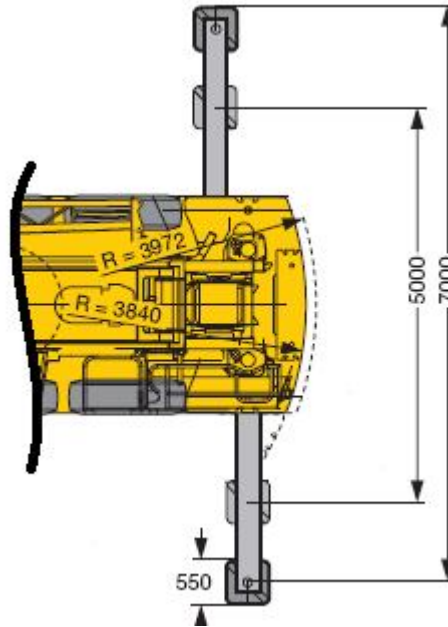


Figure 18: Width of Liebherr LTM 1100

Width of Liebherr LTM 1100 in working position is around 7,5 m. Section indicated in Figure 18 has to be extended by taking this width and cable conduits into account.

8. Ground Pressure Values

Most critical ground pressure value is the value arising while lifting nacelle.

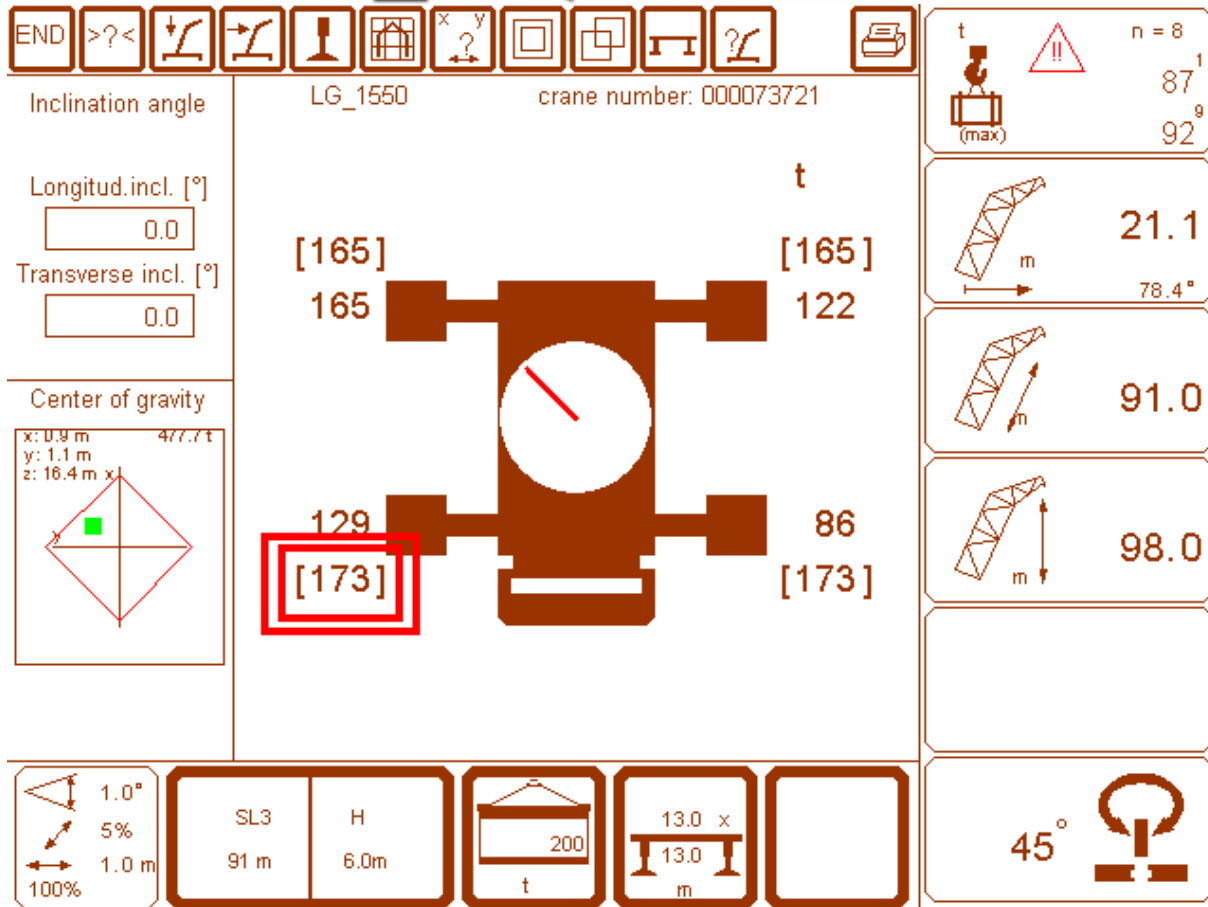


Figure 19: Liebherr LG 1550 Liccon Work Planner Ground Pressure Values

While lifting 87 tons nacelle, maximum force exerted onto ground from hydraulic leg is 173 tons. For 3m x 3m mats are going to be used under the hydraulic legs, **ground pressure value can be stated as 22 tons/m²**.

Liebherr LG 1550 is going to be transported which three (3) boom sections which are 16,5 tons, 6,1 tons and 12,1 tons in ideal conditions. By taking these information into account, **load exerted on each axle of Liebherr LG 1550 can be calculated as 17 tons in transport position.**

9. Layout of Wind Turbine Parts on Work Site

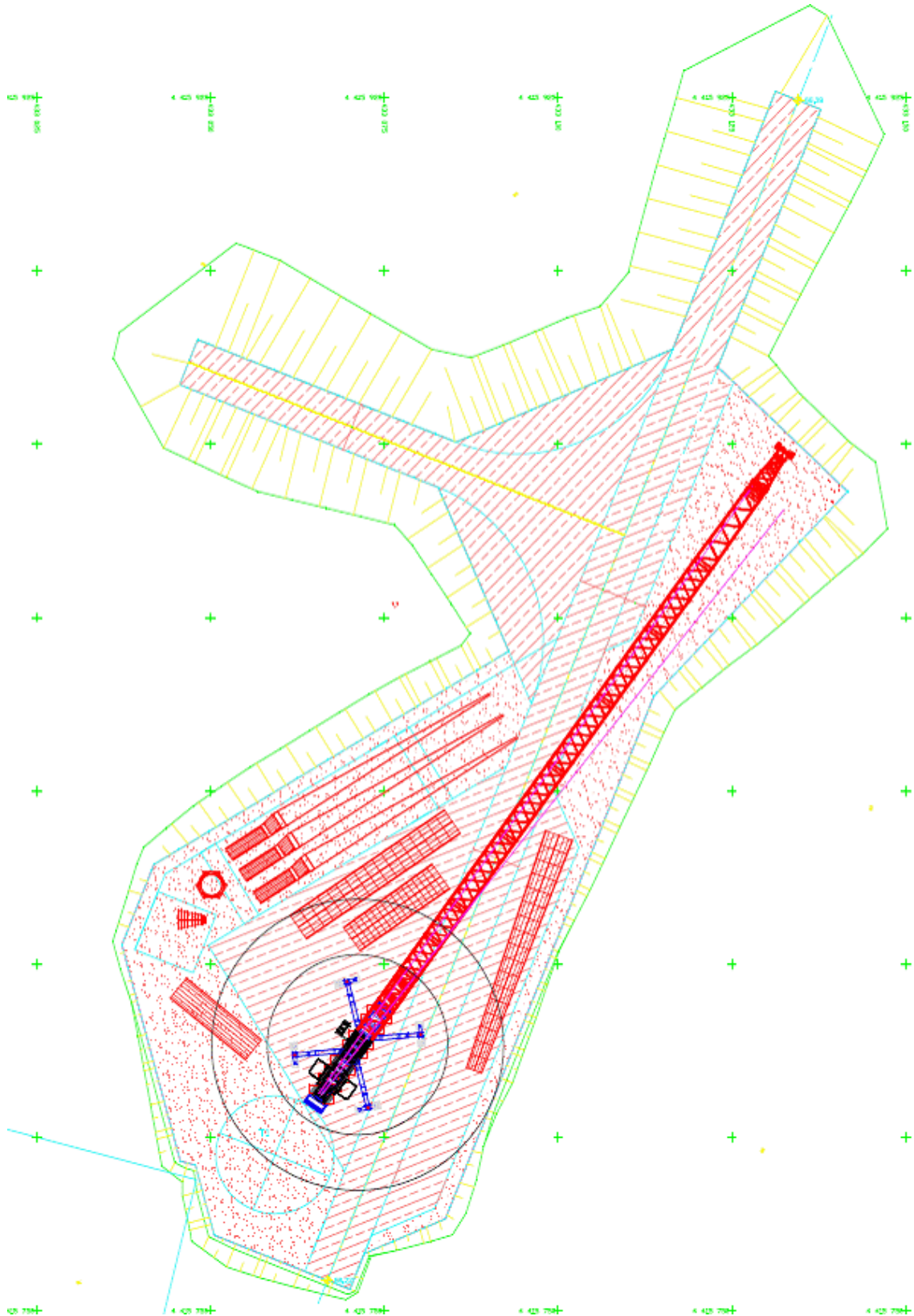


Figure 20: Turbine Pad 1 Layout

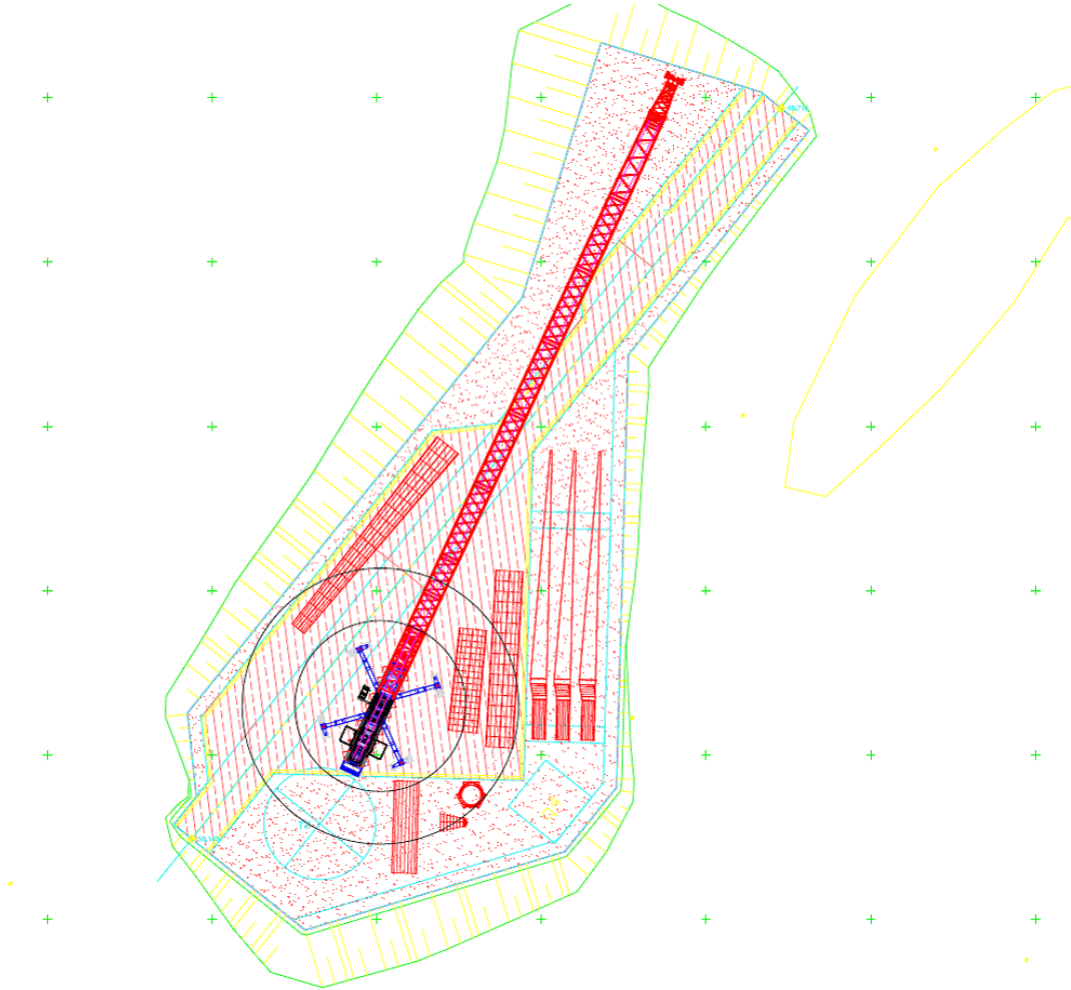


Figure 21: Turbine Pad 2 Layout

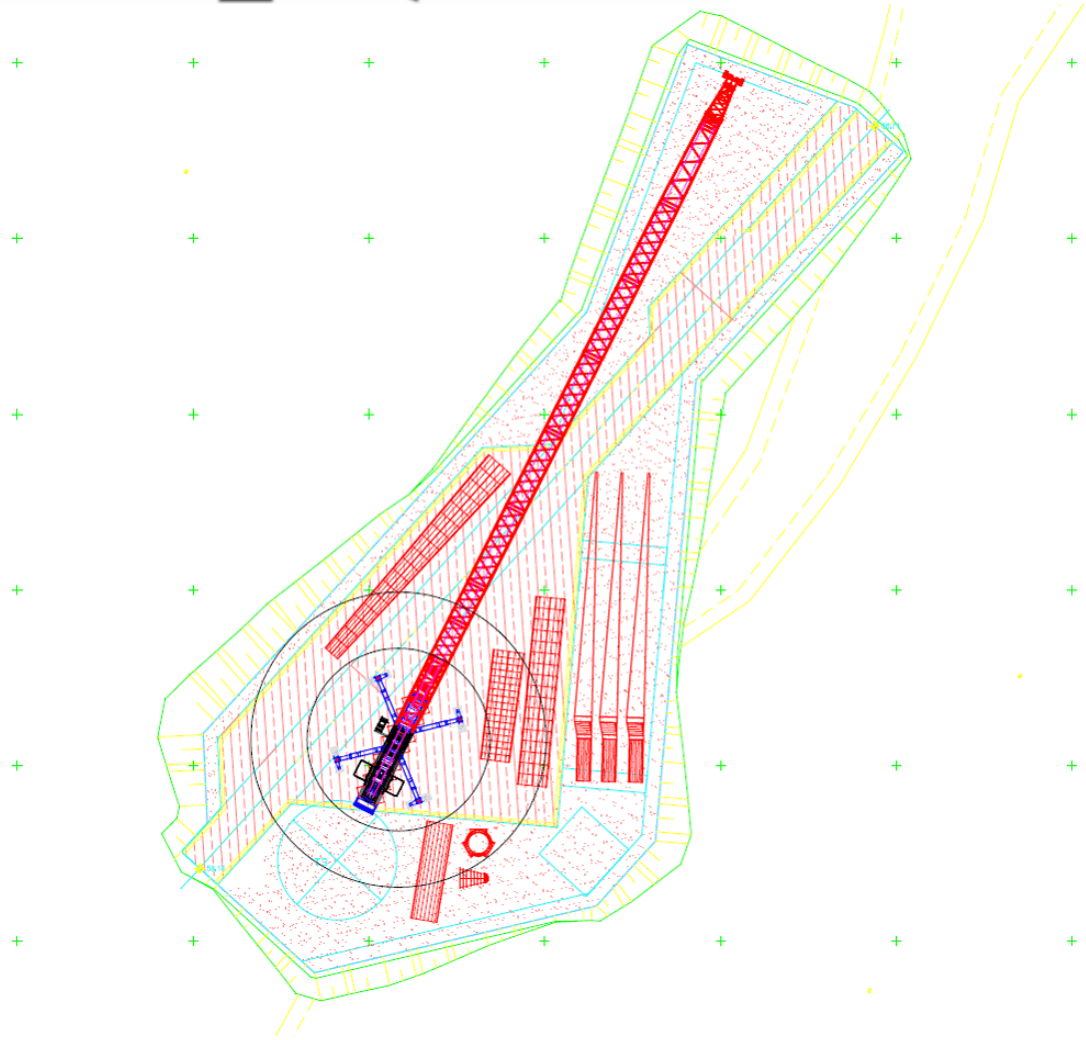


Figure 22: Turbine Pad 3 Layout

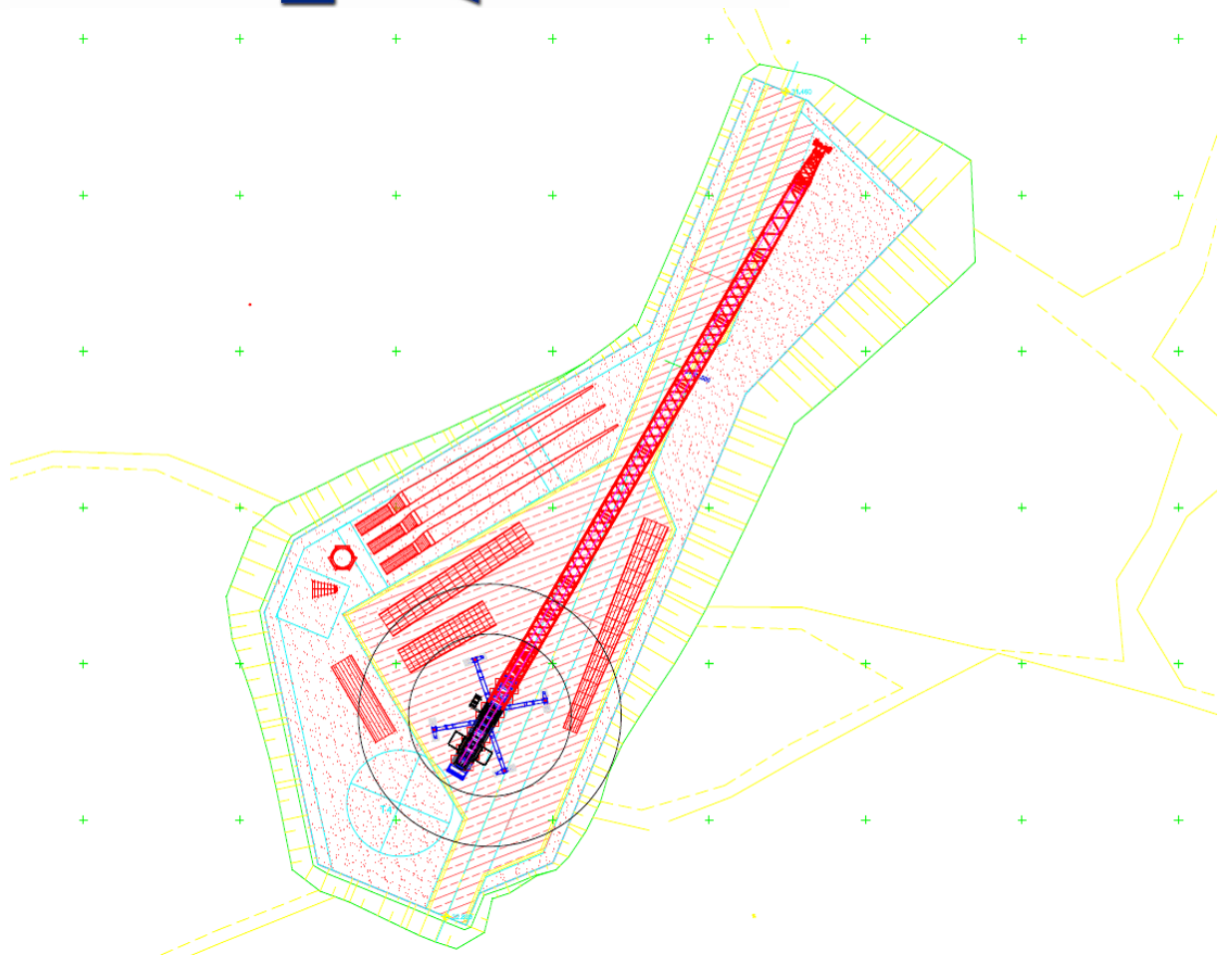


Figure 23: Turbine Pad 4 Layout

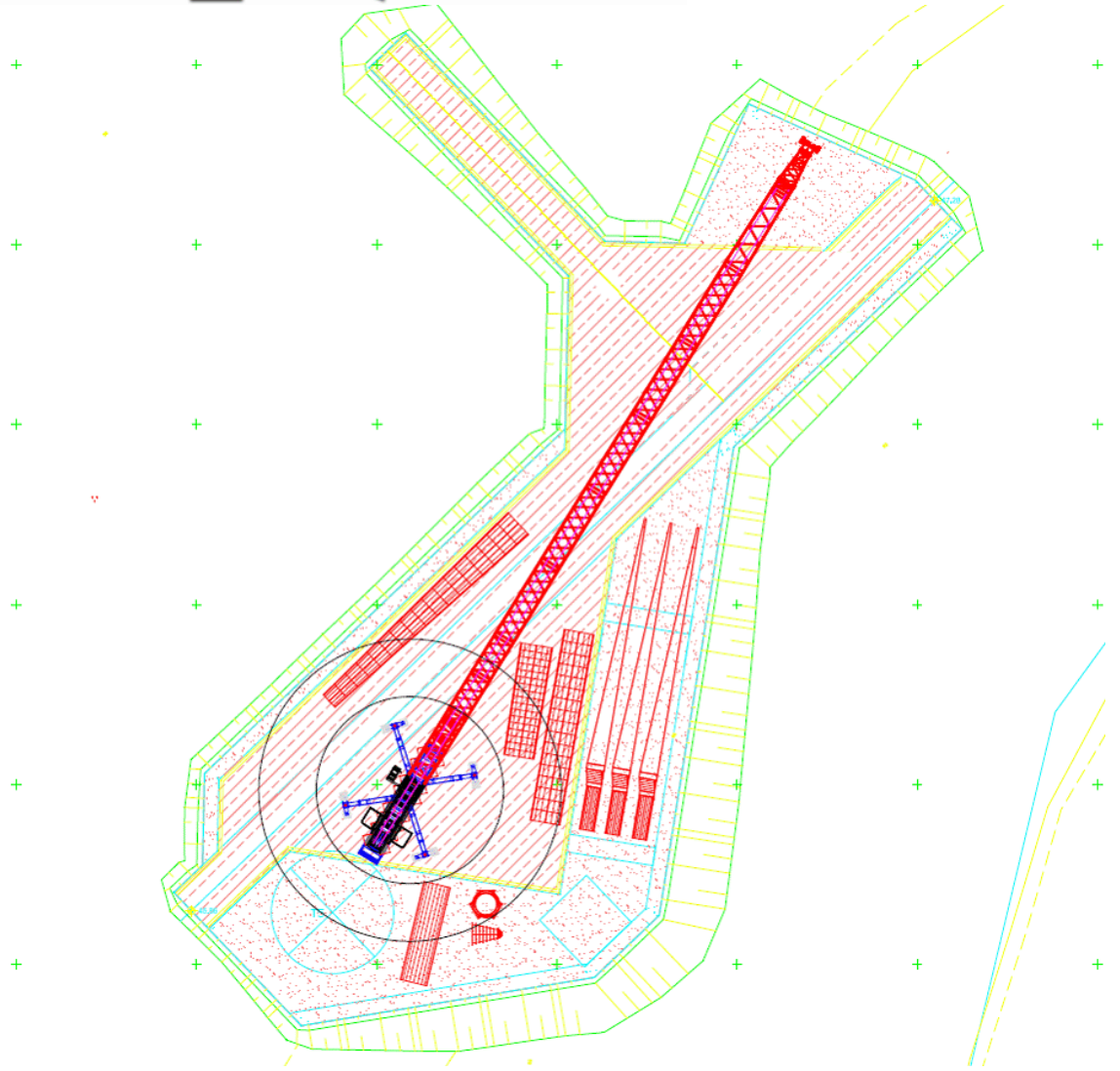


Figure 24: Turbine Pad 5 Layout

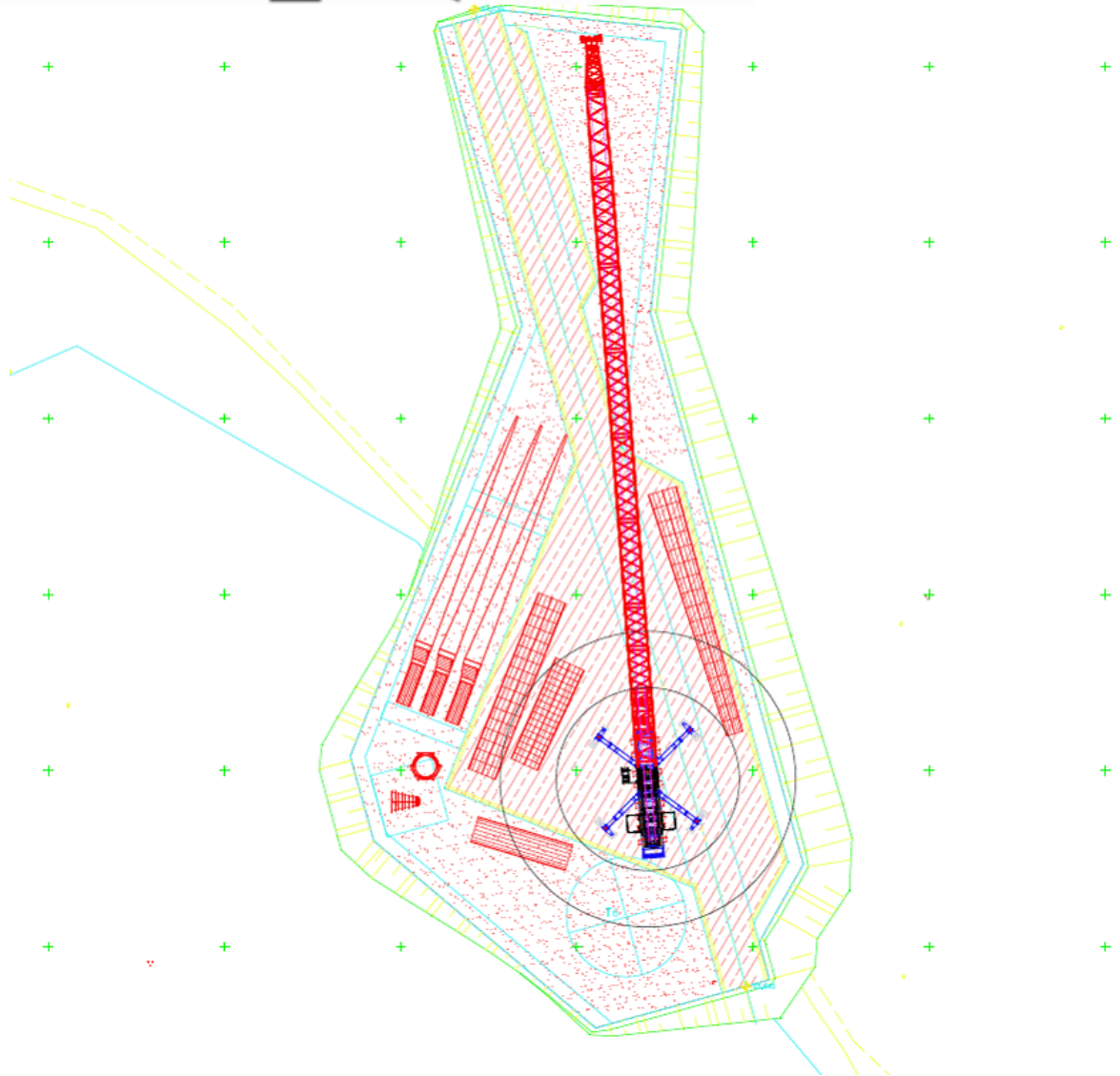


Figure 25: Turbine Pad 6 Layout

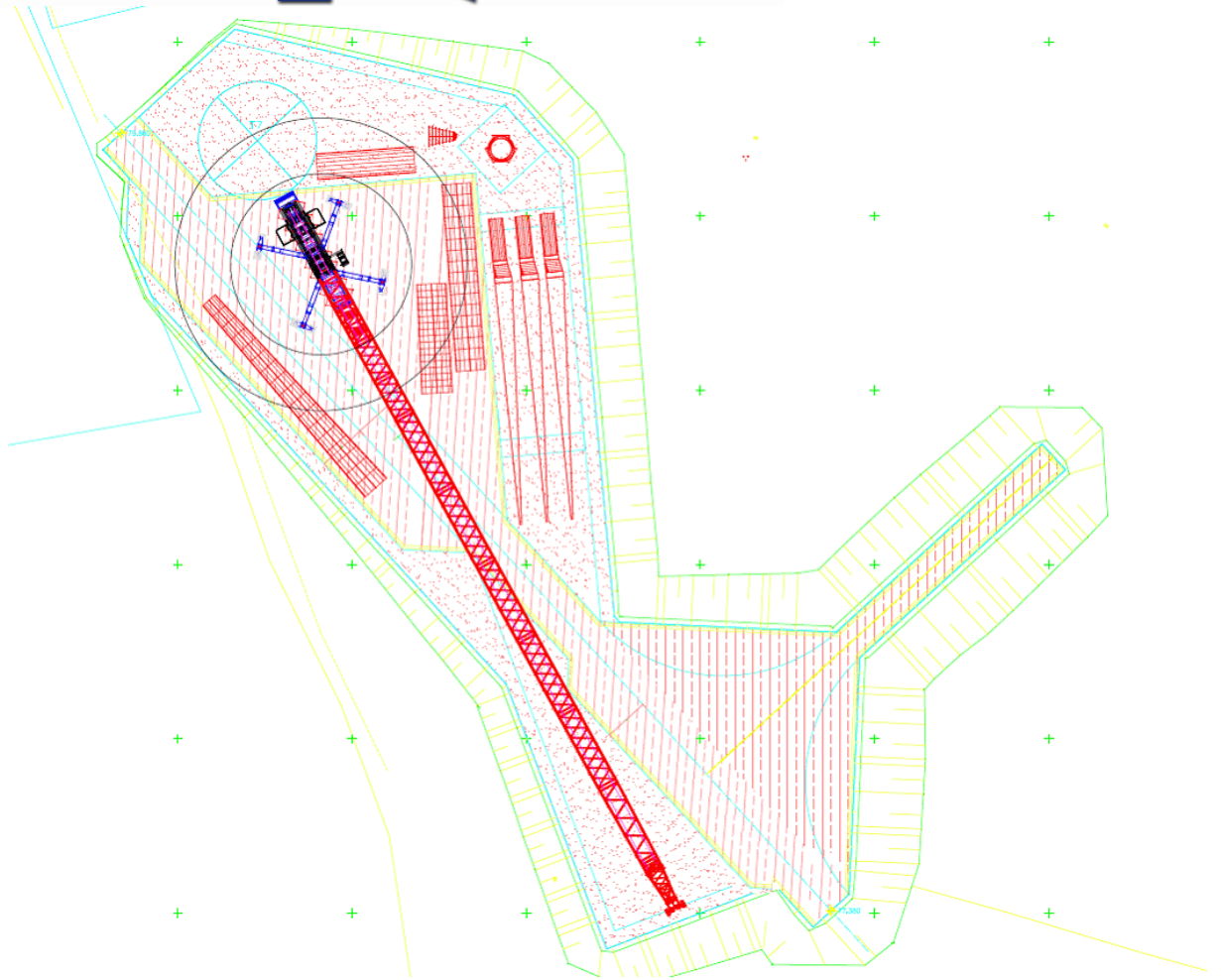


Figure 26: Turbine Pad 7 Layout

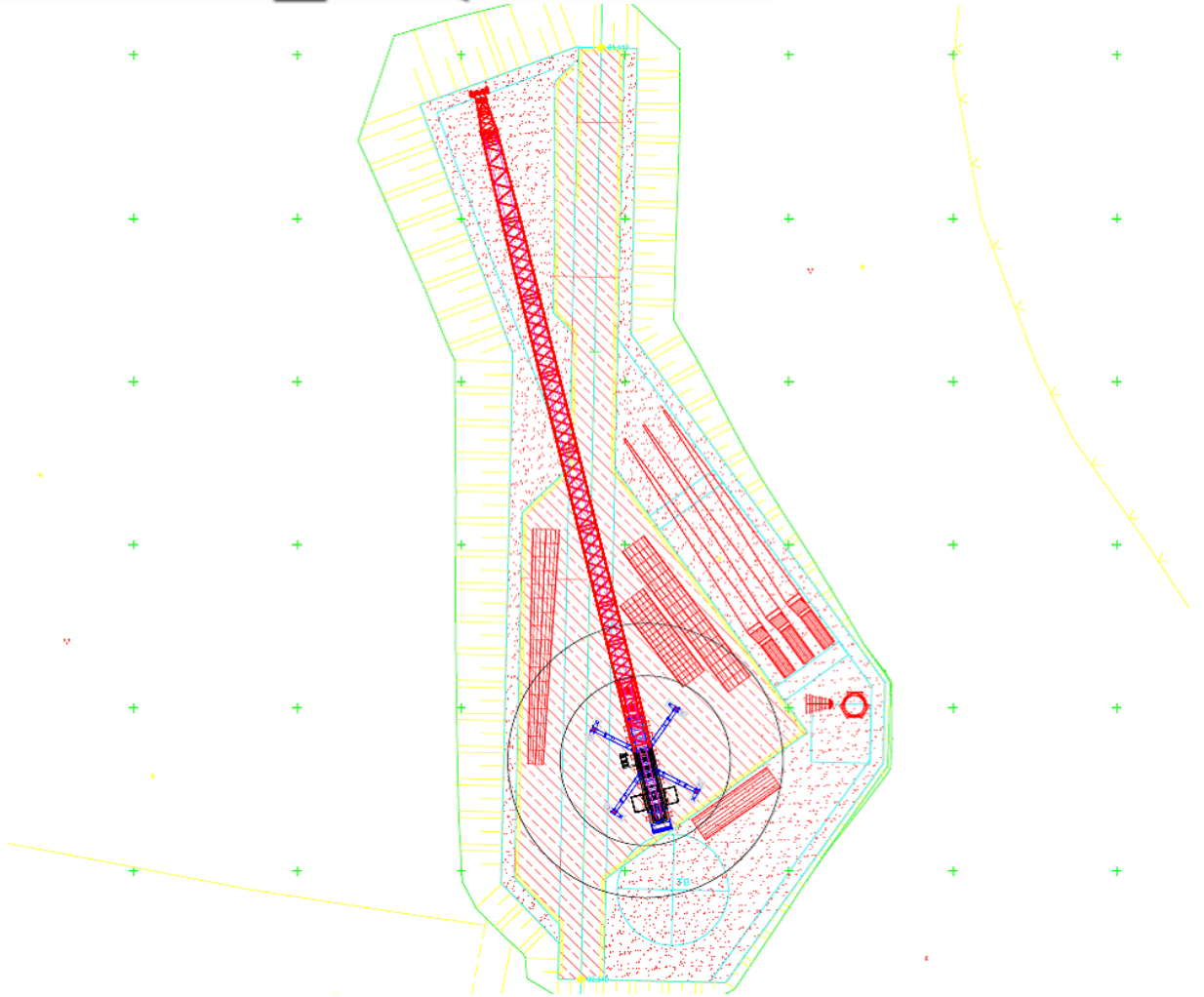


Figure 27: Turbine Pad 8 Layout

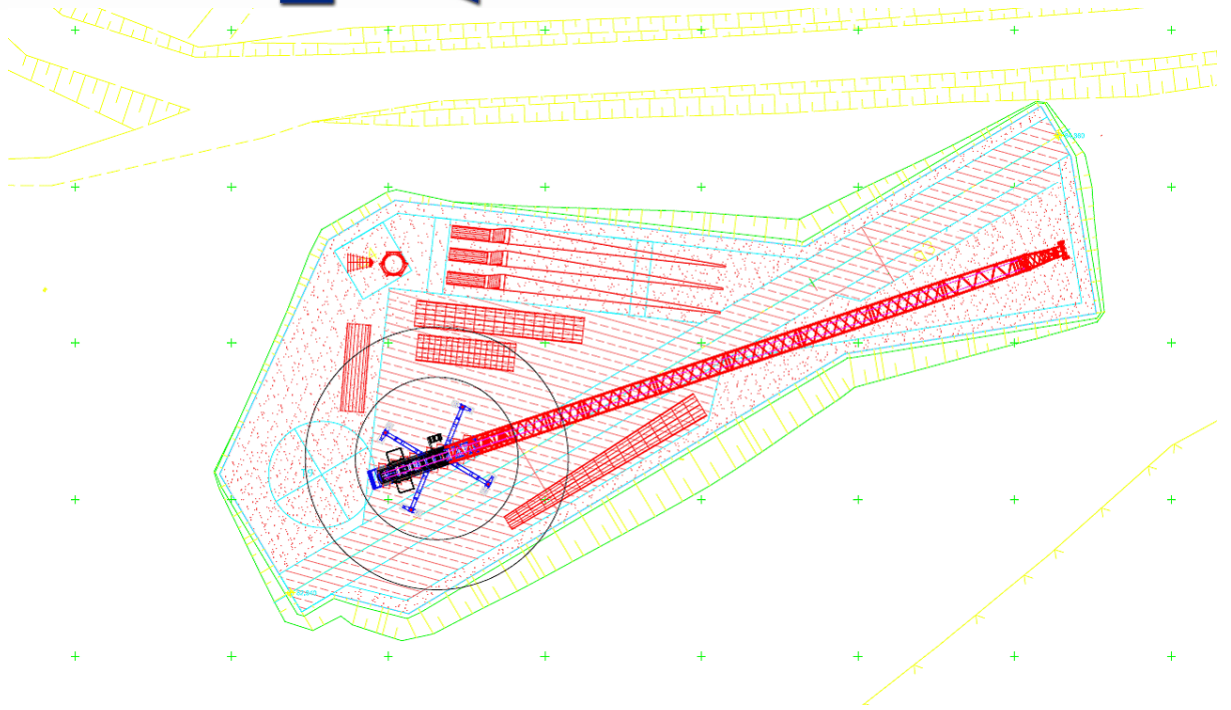


Figure 28: Turbine Pad 9 Layout

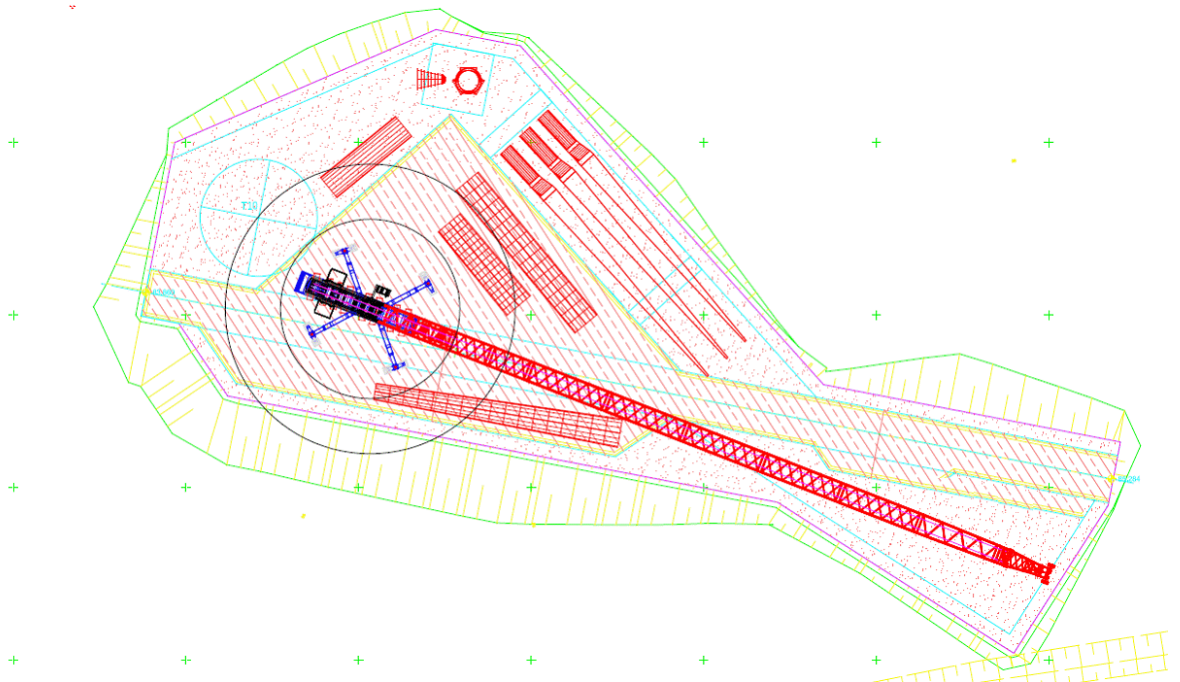


Figure 29: Turbine Pad 10 Layout

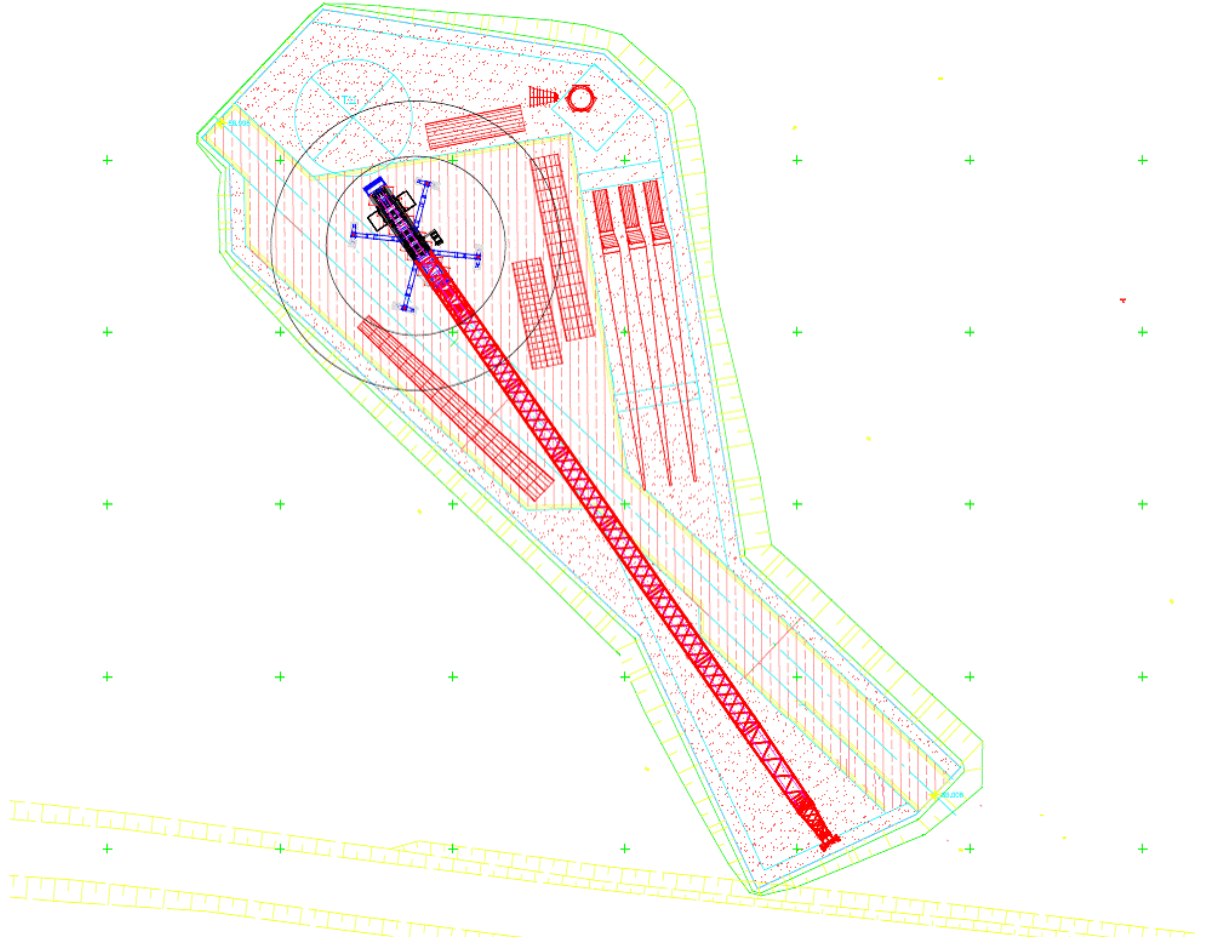


Figure 30: Turbine Pad 11 Layout

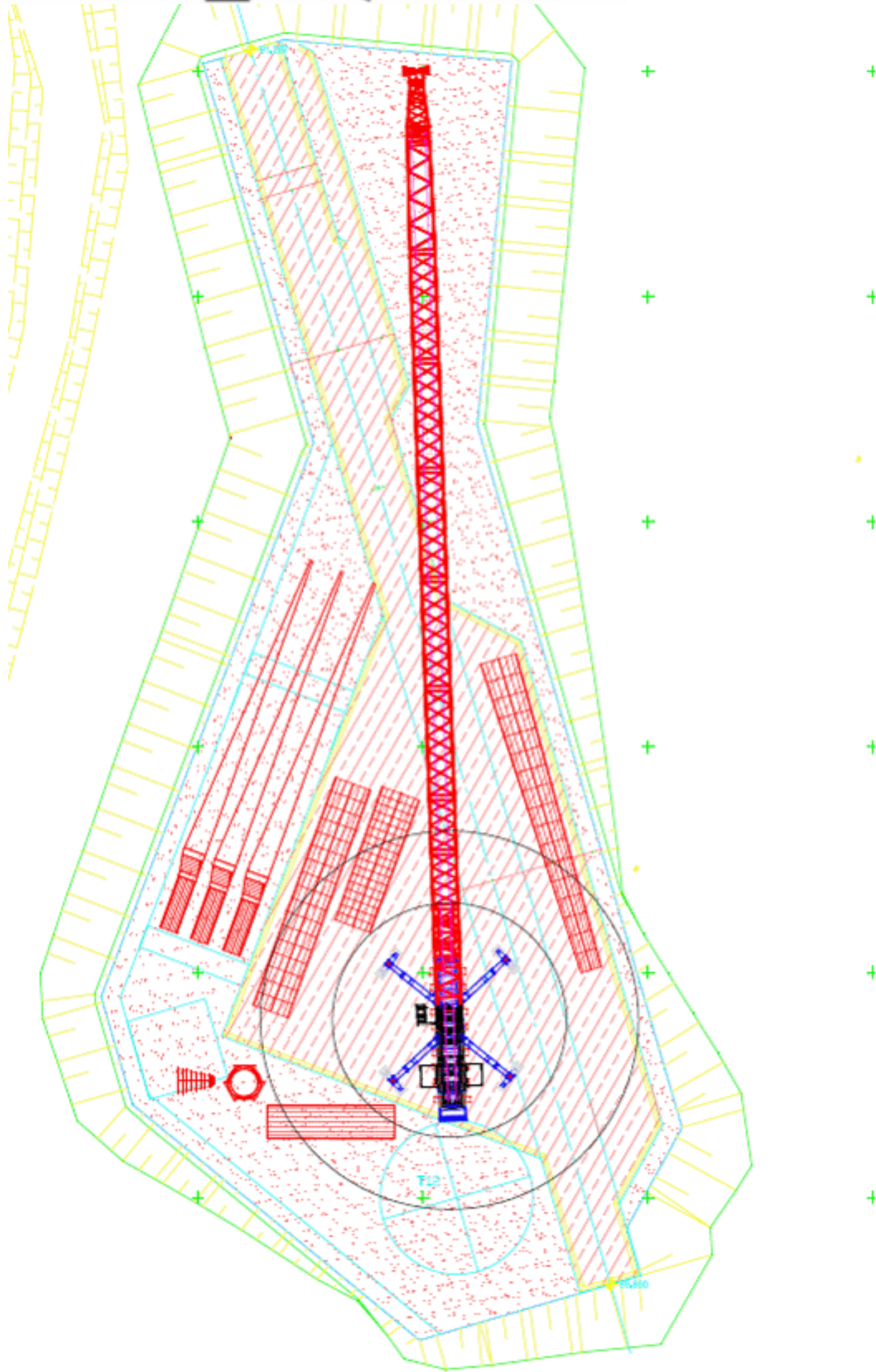


Figure 31: Turbine Pad 12 Layout

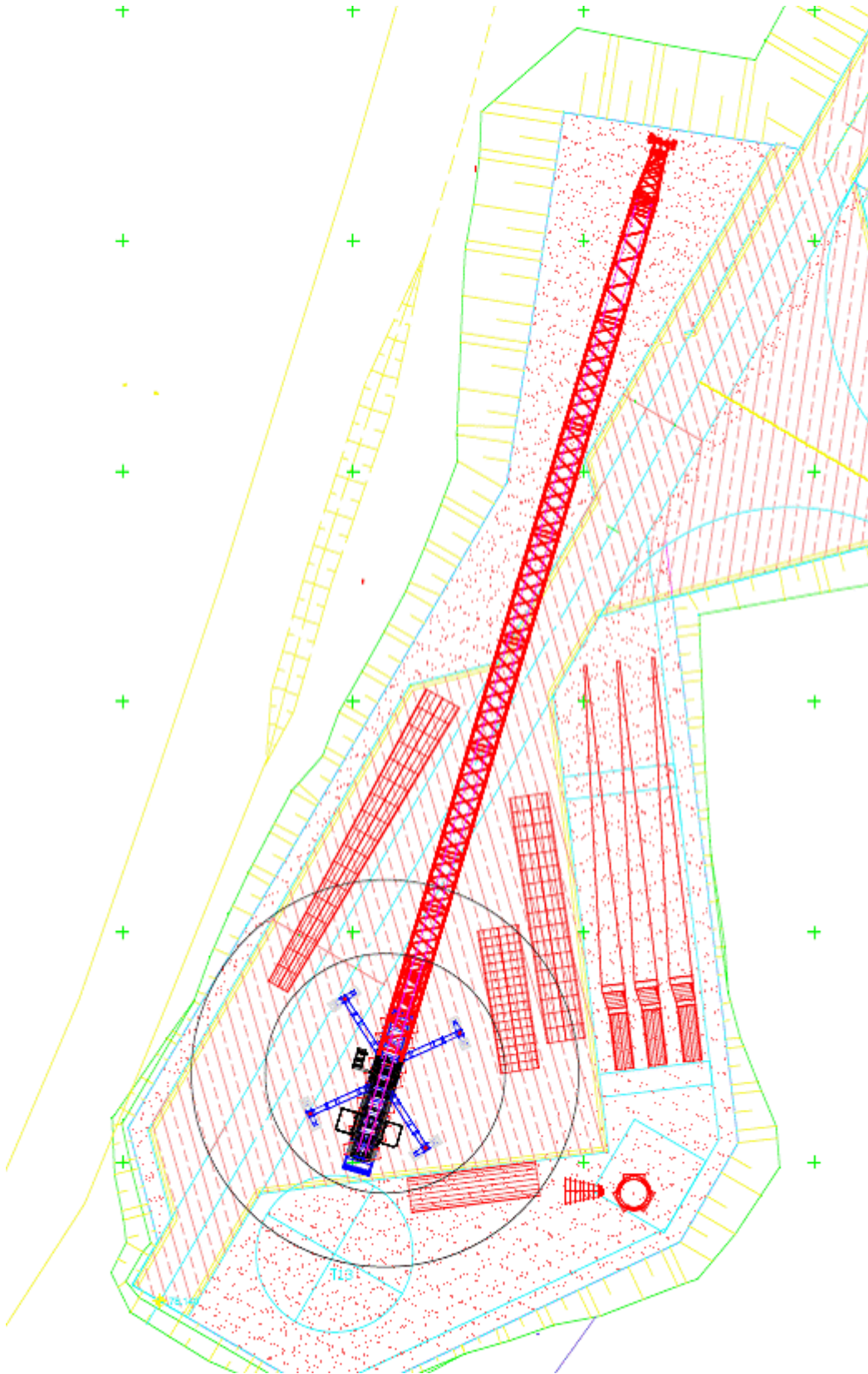


Figure 32: Turbine Pad 13 Layout

Compact ground on turbine pads which are indicated in Sinovel Wind Co., Ltd's "Specific Site Requirements" booklet, has to be expended to be able to make Liebherr LTM 1100 mount booms of Liebherr LG 1550 as it is shown in pad drawings above.

10 . Wind Turbine Erection

Erection of Tower Sections:

550 ton capacity Liebherr LG 1550 is going to erect bottom tower under 75 percentage of efficiency by the help of 100 ton capacity LTM 1100 tailing crane. This twain operation is going to prevent any harm that can occur. Tower erection steps for each tower sections can be listed below:

- (a). Arrival to site on designated time.
- (b). Contacting with officer authorized by Sinovel Wind Co., Ltd and getting information about turbine number and erection site...
- (c). Arrival to turbine pad...
- (d). After positioning 100 ton capacity LTM 1100 on prepared base, extending outriggers to 50%...
- (e). Lifting boom and placing 3 m x 3 m steel support pads onto prepared base...
- (f). Extending outriggers fully, and leveling crane to +/- 1° by the help of hydraulic pistons.
- (g). Attaching counterweights to crane body according to manufacturer's instructions...
- (h). Ensuring adequate steel plate matting is used underneath each outrigger...
- (i). Positioning Liebherr LG 1550 ready for erection.
- (j). Controlling the position of tower sections which has to be positioned closer to erection area...
- (k). Controlling the position of tower sections on supports...
- (l). Hoisting and derricking simultaneously until tackle is positioned on base section at the top end...

- (m). Connecting special tackle (i.e. shackles, pulley blocks and 2 wire ropes – to be provided by Client) to base section.
- (n). Hoisting up until slight tension is provided on tackle.
- (o). Hoisting main crane and tailing crane up very gently until parts detach from supports.
- (p). Rotating 550 ton capacity lattice boom mobile crane slightly and positioning tower section perpendicular to ground by the help of tailing crane...
- (r). Removing tackle of 100 ton capacity tailing crane from the base of tower. Swinging jib of tailing crane clear, and lowering section gently onto base bolts.
- (s). Lowering down 550 ton capacity lattice boom mobile crane's wire ropes slowly and erecting tower section by the help of montage crew...
- (t). Removing tackle of main crane from the base of tower and completing erection process...

NOTE: The reason of performing bottom tower section erection by twain operation of LG 1550 and LTM 1100, is to prevent any harm that can occur while hoisting up parts with only one crane.

Erection of Nacelle:

Information about the erection of most critical part in terms of being heaviest part and having highest elevation point (nacelle), can be found below.

- (a). Lowering off hook block close to ground, and attaching special tackle or wire ropes (if required)...
- (b). Connecting tackles to 550 ton capacity lattice boom mobile crane from eyebolts by the help of montage team...
- (c). Hoisting up until tension is provided on tackle ...
- (d). Hoisting crane up very gently until parts detach from supports...
- (e). Hoisting up Nacelle to specified elevation level...
- (f). Completing nacelle positioning by the help of Sinovel Wind Co., Ltd crew...
- (g). Removing shackles from Nacelle by the help of montage crew...

Liebherr LG 1550: Total perpendicular projection length between Liebherr LG 1550's boom end point and ground is 98 m. Liebherr LG 1550 has 92,9 ton lifting capacity while having 91 m main boom, 6 m fixed jib and 21,1 m radius. By taking 80 m nacelle height, 87,1 ton nacelle weight and weight of the equipment under the boom's end point into consideration, we can work safely in this configuration.

Erection of Rotor Blades:

Information about the erection of rotorblades, can be found below.

- (a). Lowering off hook block close to ground, and attaching special tackle on crane booms and wire ropes.
- (b). Connecting tackles to 550 ton capacity mobile crane from eyebolts by the help of montage crew.
- (c). Hoisting up until tension is provided on tackle.
- (d). Hoisting crane up very gently until parts detach from supports.
- (e). Hoisting up Nacelle to specified elevation level.
- (f). Completing rotoblade positioning by the help of Sinovel Wind Co., Ltd crew...
- (g). Removing shackles from rotorblade by the help of montage crew...
- (h). Repeating this process for each rotorblade.

11 . Extra Notes

- (a). Construction area must be free of muddy ruts, trucks, trenches, clumps and build ups, standing water and pot holes which impede the safe and efficient use of such roads.
- (b). While calculating width of the road, radius of towers must also be taken into account and covering area must be cleared.
- (c). For reverse drive, gradient must not exceed 1% as it is indicated in Sinovel Wind Co., Ltd's "*Specific Site Requirements*" booklet.

(d). There must be an excavator ready for operation in turbine pads in case of site arrangements

(e). 4 m blade section which is going to be extend over the edge of trailers must be taken into account while preparing transport roads between turbine pads for these sections can extend over the edge of roads while taking a corner.