8m Standard Skybox

Cost comparison Skybox versus TP-less MP with traditional MAP

Stefan Erents
Revision 01, 31 March 2025

Sif OFFSHORE FOUNDATIONS

SHAPING TOMORROW. PERFORMING TODAY.

Contents

1. Introduction

The aim of this document is to present the potential benefits when using the Sif Skybox concept instead of a traditional secondary steel Main Access Platform with TP-less monopiles.
For this, a full and comprehensive Bill of Quantities (BoQ) has been set up for the design, fabrication and supply of the 8m standard Skybox. In addition a comparison has been made between a traditional TP-less monopile (MP) with a traditional Main Access Platform (MAP) versus a TP-less monopile with a Skybox, showing the potential savings when the Skybox concept is selected. To be able to make this comparison, representative data from actual projects with TP-less MP's and traditional MAP's was used. To account for the potential savings coming from offshore installation of Skybox, a logistical study was performed by Heerema Engineering Solutions.

Following sections dive into the details of each aspect and at the end of the document the relevant appendices with the Skybox 8m standard design, the corresponding BoQ, the comparison with a traditional TP-less setup, the knock-on effects for the MP design for the 2 scenarios and the logistical study are listed.

Supporting documents are presented in following annexes:

- *Annex 1 - BoQ 8m standard Skybox:* The full Bill of Quantities including pricing for 60 pcs 8m Skybox.
- *Annex 2 - Comparison traditional TP-less vs Skybox:* A price comparison showing potential savings when implementing Skybox.
- *Annex 3 - 8m Skybox standard design:* The reference design drawings of the 8m standard Skybox.
- *Annex 4 - Monopile design comparison:* The reference MP design drawings for comparison.
- *Annex 5 - HES logistical analysis*: The logistical study as perform by Heerema Engineering Solutions.
- *Annex 6 - Get Up Safe Gx2 quotation:* The budgetary quotation for supply of the Get Up Safe Gx2 system.

2. The 8m Standard Skybox BoQ and pricing

Initially the BoQ and pricing for the 8m standard Skybox was set-up by our fabrication partner Smulders for fabrication and supply of **60** Skybox platforms and is based on a full design package made by KCI. It contains of the main steel welded assembly, consisting of the box platform with the 2 cones and steel attachments for handrails and other appurtenances. In addition, all non-steel items such as (aluminium) handrails, appurtenances, electrical items and cables (including installation of all these items) are also included.

Secondly, there are a number of items included by us, in addition to the Smulders initial BoQ.
The cost for the Polyurethane (PUR) pads which are an essential part of the Skybox concept, is based on the supply of these pads by Skybox BV and also includes the application of these pads onto the Skybox.

The cost for design and engineering of the Skybox by KCI is presented for a conversion of the standard 8m Skybox design into a site specific design. This can be reduced for the case that only a load-capacity check of the standard 8m Skybox design against the site specific loads is required. Once the Skybox design is converted to the site specific conditions, further project specific changes can be implemented as the 3rd step in the Skybox design process. In summary:

1) Standard Skybox design (available off the shelf as per annex 3);
2) Site specific adaptation (or simplified load check) of the standard Skybox design against the LS in the BoQ;
3) Project specific changes of the design coming out of step 2.

For the Get Up Safe Gx2 system, the BoQ contains only the cost for installation of the Gx2 under the assumption that this a company supplied / free issued item.

Rental costs for the proprietary Skybox installation tool are given, which can be used for installation of the Skybox onto the monopile.

Logistical costs for transport from Smulders to Sif yard, load-in /load-out and storage are given, and finally costs for bonds and insurances are specified.

The total cost for design and engineering, fabrication and supply, and additional project and handling costs for a series of **60** Skybox platforms sums up to **€ 59.487.485,22.**

See **annex 1** for the full 8m standard Skybox BoQ and pricing.

3. Cost comparison Skybox vs. traditional Main Access Platform

To determine the potential savings coming from applying the Skybox concept on a TP-less MP, data from actual representative projects was used to make a comparison on several key differentiating items.
This comparison therefor does not provide an overview of the complete costs for 60 TP-less MP's, with a traditional MAP versus the Skybox , but it shows the items that can be considered like-for-like (equal cost) and the items that cause the potential cost savings.
The used data was normalised to be applicable for a MP with 8m top diameter, in a series size of 60 pieces.

See **annex 2** for the full cost comparison.

The sections below provide details on the cost differentiators between a TP-less MP with traditional MAP and a Skybox.

3.1 Main Access Platform / Skybox

The biggest cost saving here comes from the fact that the 8m standard Skybox is design exactly as that; a standard platform. This standard design includes all basic functionalities that are normally required from a Main Access Platform to be suitably for it's application and offshore use, but not more than that. This includes basic size and shape of the platform but also items such as load capacity, lay-down area size, handrails and swing gates, electrical and LV items such as navigation aids, ID-markings, etc.

Another cause for cost saving is the structure of the platform itself. Instead of a beam girder structure (which required a lot of fabrication effort for cutting, assembling and welding) with grating panels on top, the Skybox concept consists of a box structure made up out of a deck plate on top, internal stiffeners and a cone, and closing plates at the bottom. This concept allows for a high level of automation and therefore cost efficient fabrication.

See **annex 3** for design details of the 8m standard Skybox.

An additional benefit of the 8m standard Skybox design is that the often observed so-called "AFC" (Approved For Construction) effects are not applicable. With "AFC" effect, the situation is meant where the design on which the initial BoQ and price were based at the time of contract award, is influenced by changes when moving to an AFC design. These changes can come from additional requirements, design detailing or fabrication optimisations and they usually lead to variation orders and with that to a significant increase in final price (often through some kind of remeasurement process). For the 8m standard Skybox design this would not be not applicable since the design and functionality of the Skybox does not need to see changes towards AFC status (it is already available!) and since the fabrication of the 8m standard Skybox design has already been thoroughly discussed, reviewed, checked and optimised together with our partner Smulders.
Data from recent projects show that this "AFC" effect can accumulate up millions of Euros in cost.

3.2 Monopile

To be able to make a comparison on the effect on the monopile, KCI have performed a design study (in-place analysis including driving assessment for pile-driving on a cone) where 3 scenarios where investigated:

1) A TP-less MP with boat landing and traditional MAP;
2) A TP-less MP with boat landing but with Skybox instead of traditional MAP;
3) A TP-less MP with Skybox but without boat landing.

See **annex 4** for the details on the 3 MP design variants.

For this study, actual data for a project with a 15MW turbine, and a 7,5m diameter MP was used and following observations where made:
When adding of a cone at the top of the MP (necessary for the Skybox), but keep the attachments for the boat landing in place this would lead to an increase in MP weight of ~17mt. This mainly comes from the increase in diameter of the top section of the MP directly below the conical section at the top but (although it must be noted that this larger diameter also allows for some wall-thickness optimisations in that top section) and the effects of the increased wave loading on this larger diameter.
When removing the boat landing attachments from the Skybox MP, this leads to a weight reduction of ~22mt compared to the TP-less MP with traditional MAP, even when taking into account the increased wave loading on the larger diameter MP top section. This reduction comes from the reduction in wall-thickness that is possible when SCF's (Stress Concentration Factors) for the boat landing attachments are no longer applicable, and from the wall-thickness optimisations for the larger diameter MP top section.

When assessing the impact on the MP, it must also be considered that a conical section is somewhat more expensive to make when compared to a straight can-section.
For steel saving, a unit rate of € 1.500,- / mt is used and for cost increase of fabricating a cone a unit rate of € 1.000,- / mt is used. This leads to the following comparison:
Cost saving from reduction in MP steel weight: ~22mt x € 1.500,- = ~€ 33.000,-
Cone weight ~ 62mt x € 1.000,- = ~€ 62.000,-
Total cost increase of a 7,5m diameter MP with cone for the Skybox is then ~ € 29.000,-

When extrapolated from a 7,5m diameter MP to an 8m diameter MP this would lead to an approximate total MP costs increase estimate of ~€ 30.933,- per MP for a TP-less MP with Skybox compared to a TP-less MP with traditional MAP.
This gives a total estimated cost increase for 60 MP's of ~ € 1.855.980.

3.3 Boat landing vs. Get Up Safe system

An integral part of the Skybox concept is the deletion of the boat landing and replacement of this by the so called Get Up Safe system. With a Get Up Safe system, personnel can be lifted from the CTV deck onto the Skybox platform, fully motion compensated, in a safe and fast way.
The latest version of this system, the Gx2, also has an integrated davit crane functionality which allows for omission.
The Get Up Safe Gx2 system is considered as a company supplied / free issued item but for the sake of the comparing, both supply as well as installation costs are included in the comparison.

See **annex 6** for further cost specification of the Get Up Safe Gx2 system.

3.4 Cost comparison conclusion

Taking into account the key cost differentiators as explained above, it is estimated that the total cost saving when implementing the 8m standard Skybox can accumulate up to a sum of **€ 18.608.946** for 60 TP-less MP's with 60 Skybox platforms.

This is without the additional benefits of the Skybox concept regarding offshore installation on which next section will provide more details.

4. Offshore installation

Apart from the cost saving in fabrication and supply, additional cost savings can be realised during the offshore installation of the Skybox platform. To investigate this, Sif have commissioned Heerema Engineering Solutions (HES) to perform a logistical study where different foundation types (MP/TP, TP-less MP with traditional MAP, TP-less with concrete MAP and grouted connection and TP-less MP with Skybox) have been compared for installation time and cost with different types of vessels (Monohull Floating Heavy Lift Vessel, Jack-up Vessel, and split installation with Heavy Lift vessel for primary steel and smaller vessel for secondary steel).

See **annex 5** for the full logistical report.

One of the key contributors to a significantly faster offshore installation of the Skybox platform, is the use of our proprietary Skybox installation tool, which allows for the Skybox platform, the internal platform (ATP) and the temporary cover to be installed in one lift, fully remote without the need for human intervention. This enables optimum efficient use of the const-intensive Heavy Lift vessels and have these do what they are good at and intended for; install the MP, then place on the secondary steel components as fast as possible and then move on to the next location.
The proprietary Skybox installation tool is included in the 8m standard Skybox BoQ as rental equipment and the price for the temporary covers is based on representative project data.

When comparing the different relevant cases from the HES logistical study and correcting these for 60 instead of 100 foundations and based on a P50 scenario, following comparison can be made (case numbers correspond to the cases in the HES report, Appendix D):

Jack-up vessel	**Case**			
	1b) MP/TP	**2b) TP-LESS**	**3b) Skybox**	**4b) Concrete platform** (with grouted connection)
Total installation cost	€ 43.230.000	€ 45.040.000	€ 39.100.000	€ 52.282.000
Savings compared to 2b) TP-less set-up	€ 1.810.000	-	**€ 5.940.000**	-/- € 7.242.000

It can be concluded that using the Skybox concept with the proprietary installation tool can lead up to a potential saving of **€ 5.940.000,-** compared to the TP-less MP with traditional MAP, on top of the savings already achieved in the fabrication and supply of Skybox platform and MP.

5. Annexes

5.1 Annex 1 - BoQ 8m standard Skybox

5.2 Annex 2 - Comparison traditional TP-less vs. Skybox

5.3 Annex 3 - 8m Skybox standard design

5.4 Annex 4 - Monopile design comparison

5.5 Annex 5 - HES Logistical analysis

5.6 Annex 6 - Get Up Safe Gx2 quotation

5.1 Annex 1 - BoQ 8m standard Skybox

Sif Skybox - BoQ - 8m	Skybox	pcs 60	Rev. 01	31-3-2025						
Item	**Sub category2**	**Description**	**Unit**	**No of Items**	**Qty per Items**	**Tot Qty**	**Currency**	**PS/LS**	**Sales rate unit**	**Sales price**	**Comment**
1		**General**								**€ 540.731,06**	
1.1	General and equipment	**Performance Bond**	Ea	1	1	1	EUR	LS	€ 81.109,66	€ 81.109,66	
1.2	General and equipment	**Warranty Bond**	Ea	1	1	1	EUR	LS	€ 121.664,49	€ 121.664,49	
1.3	General and equipment	**CAR Insurance**	Ea	1	1	1	EUR	LS	€ 337.956,91	€ 337.956,91	
2		**Design**								**€ 2.114.586,38**	
2.1	General and equipment	**Design by KCI from standard Skybox (acc. This BoQ table) to site specific Skybox including Employer's requirements**	Ea	1	1	1	EUR	LS	€ 660.000,00	€ 660.000,00	KCI, in case only load check of the standard design (8m Skybox): can be reduced to 220k
2.2	General and equipment	**Project management, Engineering & fabrication drawings Smulders**	Ea	1	1	1	EUR	LS	€ 1.234.586,38	€ 1.234.586,38	Preparation of fabrication drawings and interface with electrical appurtenances
2.3	General and equipment	**Interface engineering by KCI with MP designer**	Ea	1	1	1	EUR	LS	€ 220.000,00	€ 220.000,00	Only applicable if MP designer is other than KCI. If MP is designed by KCI, this item can be omitted from the budget
3		**Skybox Main Acces Platform**								**€ 36.853.037,05**	
3.1		**Skybox Main Acces Platform main structure & supports/brackets**								**€ 20.612.313,38**	
3.1.1	Main Access Platform	External Skybox steel boxed Main Access Platform (basic shape), including welding of main cone, wave run-up cone and all steel brackets, stubs etc.	Kg	60	30.944	1.856.654	EUR	PS	€ 6,20	€ 11.518.684,51	Incl. welding of both cones to the basic structure Alternative 1 for 3.1.1+3.1.2+3.1.3 in concrete is in development Alternative 2 for 3.1.1+3.1.2+3.1.3 in steel girders is in development
3.1.2	Main cone	Supply of main cone		60	11.000	660.000	EUR	LS	€ 5,50	€ 3.630.000,00	Free issued by Sif to Smulders
3.1.3	Wave run-up cone	Supply of wave run-up cone		60	7.400	444.000	EUR	LS	€ 5,50	€ 2.442.000,00	Free issued by Sif to Smulders
3.1.4	Crane pedestal	Foundation for Get Up Safe Gx2 system As part of steel platform assembly		60	1,00	60	EUR	LS	€ 2.671,34	€ 160.280,36	
3.1.5	Lifting points (3pcs)	Main lifting points for Skybox As part of steel platform assembly		60	3,00	180	EUR	LS	€ 5.279,43	€ 950.297,13	
3.1.6	Fog horn support	As part of steel platform assembly		60	1,00	60	EUR	LS	€ 350,50	€ 21.029,78	
3.1.7	UNP Gangways (2pcs)	Landing beams for gangway system As part of steel platform assembly		60	2,00	120	EUR	LS	€ 878,80	€ 105.456,02	
3.1.8	Swing gate access step	Access step for Gx2 system As part of steel platform assembly		60	1,00	60	EUR	LS	€ 1.584,40	€ 95.063,77	
3.1.9	Cable trays	Steel supports for cable conduits As part of steel platform assembly		60	1,00	60	EUR	LS	€ 7.159,24	€ 429.554,19	
3.1.10	Gate posts	As part of steel platform assembly		60	6,00	360	EUR	LS	€ 796,00	€ 286.559,84	
3.1.11	Steel deck sensor support + Swing gate stopper	Access gate for Gx2 system As part of steel platform assembly		60	1,00	60	EUR	LS	€ 394,31	€ 23.658,83	
3.1.12	Railing supports	As part of steel platform assembly		60	46,00	2.760	EUR	LS	€ 96,07	€ 265.162,86	
3.1.13	Kick plates	As part of steel platform assembly		60	1,00	60	EUR	LS	€ 4.106,68	€ 246.401,06	
3.1.14	Stubs (27pcs)	Additional stubs for decommissioning of platform As part of steel platform assembly		60	27,00	1.620	EUR	LS	€ 194,87	€ 315.695,26	
3.1.15	Locking open/close gate	Locking plates for locking pins of swingates As part of steel platform assembly		60	5,00	300	EUR	LS	€ 92,04	€ 27.610,59	
3.1.16	Support points	Support points for Gx2 system As part of steel platform assembly		60	4,00	240	EUR	LS	€ 133,72	€ 32.093,35	
3.1.17	Earthing stubs (43pcs)	As part of steel platform assembly		60	43,00	2.580	EUR	LS	€ 24,33	€ 62.765,82	
3.2		**Surface protection**								**€ 3.257.892,00**	
3.2.1	Surface protection	System 7Aacc Norsok M501 alt. CX acc. EN-ISO 12944. Rate to include both supply and application of the surface protection	m^2	60	385	23.100	EUR	PS	€ 136,75	€ 3.158.892,00	2 layer 300 Mu epoxy coating + topcoat 80 Mu, coating of appurtenaces included in indivudual items
3.2.2	Surface protection	Anti slip grit on top of platform	m^2	60	100	6.000	EUR	PS	€ 16,50	€ 99.000,00	Unit rate per m2 & total price per Skybox, excl. equipment supports & fixtures
						0					
3.3		**Handrails & gates incl assy to the MAP**								**€ 3.681.254,30**	
3.3.1	Handrails & gates	Handrail panels incl. kickplates	Meter	60	52	3.123	EUR	PS	€ 663,22	€ 2.071.224,85	Unit price per meter & total price for full set per Skybox
3.3.2	Handrails & gates	Swinggates	Ea	60	4	240	EUR	PS	€ 2.990,37	€ 717.688,13	For total of all swingates per Skybox (2 single gate, 1 swing gate, 1 double gate)
3.3.3	Handrails & gates	Stainless Steel hinges & locks	Ea	60	10	600	EUR	PS	€ 322,58	€ 193.545,00	For total of all hinges & locks per Skybox
3.3.4	Handrails & gates	Vertical Carbon Steel posts near swinggates	Ea	60	4	240	EUR	PS	€ 423,94	€ 101.745,80	
3.3.5	Handrails & gates	Hook-on points	Ea	60	2	120	EUR	EUR	€ 166,70	€ 20.004,10	
3.3.6	Handrails & gates	Equipment supports & fixtures	Ea	60	1	60	EUR	PS	€ 9.617,44	€ 577.046,43	
3.4		**Electrical equipment**								**€ 5.030.241,39**	
3.4.1	Electrical equipment	External Light	Ea	60	11	660	EUR	PS	€ 1.171,81	€ 773.396,46	
3.4.2	Electrical equipment	Temporary navigation aid (3pc; necessary for visibility) + permanent navigation aid (2pcs, acc. MTO)	Ea	60	5	300	EUR	PS	€ 3.465,91	€ 1.039.772,25	
3.4.3	Electrical equipment	Fog horn	Ea	60	1	60	EUR	PS	€ 17.958,82	€ 1.077.529,20	
3.4.4	Electrical equipment	Wave radar	Ea	60	1	60	EUR	PS	€ 1.170,69	€ 70.241,52	
3.4.5	Electrical equipment	ID board(s) with lighting	Ea	60	6	360	EUR	PS	€ 4.580,18	€ 1.648.863,81	
3.4.7	Electrical equipment	Visibility meter	Ea	60	1	60	EUR	PS	€ 7.007,30	€ 420.438,15	
3.5		**LV cables & earthing**								**€ 4.026.449,58**	
3.5.1	LV cables	Power cables	Meter	60	473	28.393	EUR	PS	€ 32,09	€ 911.081,42	
3.5.2	LV cables	Signal cables	Meter	60	77	4.597	EUR	PS	€ 23,79	€ 109.372,19	
3.5.3	LV cables	Earthing cables	Meter	60	111	6.630	EUR	PS	€ 76,63	€ 508.060,77	
3.5.4	Earth boss	Earth Boss for Davit Crane	Ea	60	1	60	EUR	PS	€ 127,99	€ 7.679,10	
3.5.5	Earth boss	Earth Boss for GUS system	Ea	60	1	60	EUR	PS	€ 127,99	€ 7.679,10	
3.5.6	Earth boss	Earth Boss for Platform to temp cover (after construction and later to WTG tower)	Ea	60	1	60	EUR	PS	€ 127,99	€ 7.679,10	
3.5.7	Cable trays	HDPE piping	Meter	60	122	7.320	EUR	PS	€ 205,10	€ 1.501.327,61	
3.5.8	Cable trays	Cable fixations; other	Ea	60	1	60	EUR	PS	€ 7.288,60	€ 437.316,00	
3.5.9	Cable trays	Roxtec(s)	Ea	60	3	180	EUR	PS	€ 2.979,19	€ 536.254,29	
						0					
3.6		**Installation of items**								**€ 244.886,40**	
3.6.1	Installation of Company provided items	GUS (Gx2) installation. The GUS will be Company provided.	Ea	60	1	60	EUR	PS	€ 4.081,44	€ 244.886,40	Installation only; equipment is assumed to be provided by employer
4		**PUR pads**								**€ 14.824.255,73**	
4.1	General and equipment	Development costs, 3rd party licensing, profit & risk, Pur pads incl application	Ea	60	1	60	EUR	PS	€ 247.070,93	€ 14.824.255,73	-14577184,81
5		**Skybox Temporary Cover / installation tool**								**€ 2.970.000,00**	
5.1	General equipment	Installation tool rental	Ea	60	1	60	EUR	LS	€ 16.500,00	€ 990.000,00	
5.2	General equipment	Temporary covers	Ea	60	1	60	EUR	LS	€ 33.000,00	€ 1.980.000,00	
6		**Logistics**								**€ 2.184.875,00**	
6.1	General and equipment	Transportation from Skybox subcontractor to Sif location MV2	Ea	1	1	1	EUR	PS	€ 1.676.125,00	€ 1.676.125,00	All logistics & transportation costs to Sif MV2 yard, delivery at Quay side, excluding unloading. Max waiting time 2 hrs.
6.2	General and equipment	Logistic costs for Skybox at Sif location MV2 for load-in, storage and FAS load-out	Ea	60	1	60	EUR	PS	€ 8.250,00	€ 495.000,00	This item includes load-in of Skyboxes, storage and FAS load-out Delivery: FAS Sif fabrication yard, Maasvlakte 2, Rotterdam (NL) According incoterms 2020 Including 2 Months storage Additional storage will be charged at €1.050 per Skybox per week for the first two months, thereafter rates to be discussed
6.3	General and equipment	Logistics cost for installation tool MV2	Ea	1	1	1	EUR	PS		€ 13.750,00	This item includes the load-in of the installation from fabricator onto MV2 and the load-out of the installation tool FAS at MV2.
		Total								**€ 59.487.485,22**	

5.2 Annex 2 - Comparison traditional TP-less vs. Skybox

Cost Estimate 60MP OWF Skybox		Rev 01		31-3-2025	Notes
Item	Description	Currency	Currency	Currency	
		60 pcs current State of Art TP-less 8m	**60 pcs Skybox 8m**	**Savings Skybox vs TP less 60pcs /8m**	
1	**General**	**€ 0**	**€ 0**	**€ 0**	
1.1	Performance Bond Skybox	Like for Like	Like for Like	€ 0	
1.2	Warranty Bond Skybox	Like for Like	Like for Like	€ 0	
1.3	CAR Insurance Skybox	Like for Like	Like for Like	€ 0	
2	**Design**	**€ 4.311.120**	**€ 2.114.586**	**€ 2.196.534**	
2.1	Engineering & Project management prim steel Fabrication	Like for Like	Like for Like	€ 0	
2.2	Engineering & Project management sec steel Fabrication	€ 2.811.120	€ 1.234.586	€ 1.576.534	Reduction for Skybox is caused by standardisation; the standard 8m Skybox design
2.3	Design & Engineering prim steel	Like for Like	Like for Like	€ 0	
2.4	Design & Engineering sec steel	€ 1.500.000	€ 880.000	€ 620.000	Reduction for Skybox is caused by standardisation; the standard 8m Skybox design
3	**Primary structure**	**€ 9.349.671**	**€ 1.855.980**	**€ 7.493.691**	
3.1	MP tubulars	Like for Like	€ 1.855.980	€ 0	See Annex 4; a monopile design comparision to show the impact of the Skybox concept on the monopile
3.2	Holes in MP	Like for Like	Like for Like	€ 0	
3.3	Attachments on MP	€ 9.349.671	€ 0	€ 9.349.671	With further potential cost saving for no manual coating around attachments, with additional benefit of life time extension for coating without attachments
3.4	MP coating	Like for Like	Like for Like	€ 0	
3.5	Flanges	Like for Like	Like for Like	€ 0	
4	**Boatlanding**	**€ 9.451.107**	**€ 0**	**€ 9.451.107**	
4.1	Boatlanding	€ 8.434.001	€ 0	€ 8.434.001	
4.2	Intermediate rest platform	€ 307.941	€ 0	€ 307.941	
4.3	Upper ladder	€ 286.705	€ 0	€ 286.705	
4.4	Gratings intermediate platform	€ 422.460	€ 0	€ 422.460	
5	**Main Access platform**	**€ 46.571.051**	**€ 42.375.715**	**€ 4.195.335**	
5.1	MAP steel structure, including attachments, handrails, coating etc.	€ 46.571.051	€ 27.551.460	€ 19.019.591	Even without the "AFC" effect, the Skybox has lower cost due to the standardised design
5.2	PUR pads	€ 0	€ 14.824.256	-€ 14.824.256	3rd party license cost, development cost and profit included
6	**"AFC effect"**	**€ 0**	**€ 0**	**€ 0**	
6.1	Impact of design development after contract award	€ 12.000.000	€ 0		The "AFC"effect, accounts for the impact of changes to the initial BoQ contract award and; items such as further design development, variation orders, fabrication optimisation etc.
7	**Airtight platform**	**€ 0**	**€ 0**	**€ 0**	
7.1	Airtight platform (=Flange access platform)	Like for Like	Like for Like	€ 0	
8	**Technical appurtenances**	**€ 3.697.291**	**€ 8.425.011**	**-€ 4.727.720**	
8.1	LV equipment & appurtenances	Like for Like	Like for Like	€ 0	
8.2	LV equipment & appurtenances installation	Like for Like	Like for Like	€ 0	
8.3	Davit crane supply	€ 3.458.976	€ 0	€ 3.458.976	The Gx2 system replaces both the boatlanding and the davit crane
8.4	Davit crane installation	€ 238.316	€ 0	€ 238.316	The Gx2 system replaces both the boatlanding and the davit crane
8.5	GUS Gx2 system supply	€ 0	€ 8.180.125	-€ 8.180.125	The Gx2 system replaces both the boatlanding and the davit crane
8.6	GUS Gx2 system installation	€ 0	€ 244.886	-€ 244.886	The Gx2 system replaces both the boatlanding and the davit crane
9	**Other**	**€ 0**	**€ 0**	**€ 0**	
9.1	ICCP system monopile	Like for Like	Like for Like	€ 0	
9.2	Primary & Secondary steel (ID)markings	Like for Like	Like for Like	€ 0	
10	**Total Savings 60 Skybox FAS MV2 Rotterdam**	**€ 73.380.240**	**€ 54.771.293**	**€ 18.608.946**	Potential savings for 60pcs 8m standard Skybox, compared to 60pcs traditional TP-less monopile with Main Access Platform
11	**Offshore installation cost savings**	**€ 0**	**€ 5.940.000**	**€ 5.940.000**	Savings in offshore installation cost when using the proprietary Skynbox installation tool
12	**Total savings 60 Skybox installed offshore**	**€ 0**	**€ 0**	**€ 24.548.946**	Savings in offshore installation cost when using the proprietary Skybox installation tool based on P50 scenario

5.3 Annex 3 - 8m Skybox standard design

GENERAL NOTES

THE FOLLOWING GENERAL NOTES SHALL APPLY TO ALL DRAWINGS UNLESS NOTED OTHERWISE.

1. GENERAL

A. IT IS THE RESPONSIBILITY OF THE FABRICATOR TO VERIFY ALL DIMENSIONS AND ANGLES (OTHER THAN MAIN LAYOUT DIMENSIONS) PRIOR TO FABRICATION.

B. DRAWINGS SHOULD NOT BE SCALED.

C. ALL DIMENSIONS AND ANGLES ARE TRUE IN THE PLANE IN WHICH THE VIEW LIES U.N.O.

2. DATUMS AND ELEVATIONS

A. ALL ELEVATIONS ARE RELATIVE TO ELEVATION 0.000 AT L.A.T. LEVEL.

B. ALL DIMENSIONS ARE IN MILLIMETERS (mm), ELEVATIONS IN METERS (m).

C. ALL ANGLES ARE IN DEGREES (360°).

3. STEEL TYPES

A. ALL STRUCTURAL STEEL SHALL BE IN ACC. WITH [EN 10025], [EN 10210], [EN 10225] OR [DNV-OS-B101].

B. ALL STAINLESS STEEL MATERIALS SHALL BE IN ACC. WITH [EN 10088], MATERIAL TO BE GRADE 1.4404 (AISI 316L) U.N.O.

C. STEEL TYPE DESIGNATION, SEE TABLE 1.

D. STEEL GRADE SUBSTITUTION SHALL ONLY BE MADE WHERE THE SUBSTITUTED MATERIAL IS EQUIVALENT OR OF HIGHER GRADE, UNLESS PRIOR APPROVAL IS OBTAINED.

E. ALL SPECIAL STEEL SHALL BE DELIVERED WITH CERTIFICATE 3.2, ALL PRIMARY STEEL WITH CERT. 3.1 AND ALL SECONDARY & TERTIARY STEEL WITH CERT. 3.1 ACCORDING TO [EN 10204] U.N.O.

F. STEEL WHICH WILL BE HOT DIPPED GALVANIZED SHALL BE CONFORM CLASS 3 OF [EN 10025-2 TO -3] AND WITH OPTION 1.4 FOR HOLLOW SECTIONS ACCORDING TO [EN 10210-1].

G. WHEN THROUGH-THICKNESS PROPERTIES (Z QUALITY) ARE REQUIRED THIS WILL BE INDICATED ON THE DRAWINGS, WITH Z-25 IN ACC. WITH [EN 10164] U.N.O.

H. MATERIALS WITH THROUGH-THICKNESS PROPERTIES (Z QUALITY) SHALL BE ULTRASONIC TESTED IN ACC. WITH [EN 10160] CLASS [S2/E2] U.N.O.

I. SEE FOR MATERIAL INFORMATION "MATERIAL AND FABRICATION SPECIFICATION", DOCUMENT NO. SP2400127-S-S-02001-00.

4. TUBULAR SIZES

A. ALL TUBE NOTATIONS ARE OUTSIDE DIAMETER (O.D.) x WALL THICKNESS (WT).

5. FABRICATION/WELDING

A. DRAWINGS SHALL NOT BE USED FOR CONSTRUCTION UNTIL SPECIFICALLY CERTIFIED FOR THAT PURPOSE AND A.F.C. ISSUED.

B. FABRICATION SHALL BE CARRIED OUT IN ACC. WITH [DNV-OS-C401] AND [EN 1090-2] [EXEC. CLASS 3 (FOR PRIMARY CONE) & CLASS 2 (FOR REMAINING ITEMS)], REF. TO DOCUMENT SP2400127-S-S-02001-00 "MATERIAL AND FABRICATION SPECIFICATION".

C. GENERAL TOLERANCES FOR WELDED CONSTRUCTION IN ACC. WITH [EN ISO 13920] [CLASS C] U.N.O.

D. GENERAL TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS IN ACC. WITH [ISO 2768-mK].

E. ALL BEAMS, SECTIONS AND (STIFFENER) PLATES ARE CUT TO SUIT BY FABRICATOR.

F. ALL WELDING TO BE IN ACC. WITH SPECIFICATION [EN ISO 3834]. WELDING PROCEDURES TO BE PROVIDED BY FABRICATOR.

G. ALL WELDING (SYMBOLS) ARE IN ACC. WITH [AWS A2.4] AND [AWS D1.1].

H. WELDING PERSONNEL SHALL SATISFY THE REQUIREMENTS IN ACC. WITH [EN ISO 9606-01] AND [EN ISO 14732].

I. QUALITY LEVELS FOR WELD IMPERFECTIONS SHALL BE IN ACC. WITH [EN ISO 5817, CAT B].

J. ALL WELDS TO BE CONTINUOUS U.N.O.

K. FILLET WELD SIZE REPRESENT THE [LEG LENGTH].

L. PARTIAL PENETRATION WELD SIZE REPRESENT THE [LEG LENGTH].

M. ALL WELDS AT TUBULAR MEMBERS TO BE FULL PENETRATION U.N.O.

N. MINIMUM SEAL WELD THICKNESS TO BE 4 mm [LEG LENGTH] FILLET WELD U.N.O.

O. ALL WELDS IN AREAS SUPPORTING GRATING OR DECK PLATE TO BE GROUND FLUSH.

P. ALL WALL THICKNESS TRANSITIONS TO BE CHAMFERED 1:4 U.N.O.

Q. ALL SHARP EDGES TO BE BROKEN (R=3) AND ALL BURRS SHALL BE REMOVED.

R. AREAS FORMING WATER TRAPS OR INACCESSIBLE FOR SHOTBLASTING AND PAINTING TO BE SEALED OFF WITH MINIMUM 6 mm PLATE TO SUIT U.N.O.

S. STANDARD FILLET WELD SIZE (STEEL): ALL FILLET WELDS TO BE [LEG LENGTH] OF 5 mm U.N.O.

T. THE DESIGN OF ACTUAL PROJECTS, WITHIN REASONABLE LIMITS, WILL BE AIMED WITH THE STANDARD WELD AS MUCH AS POSSIBLE.

6. SURFACE CONDITIONS & DELIVERY REQUIREMENTS

A. ALL STRUCTURAL STEEL SHALL BE IN ACC. WITH:

- SPECIAL & PRIMARY STEELWORK;

  PLATE MATERIAL: MIN. [EN 10163-2 CLASS B SUB-CLASS 3]

  SECTIONS: MIN. [EN 10163-3 CLASS D SUB-CLASS 3]

- SECONDARY STEELWORK;

  PLATE MATERIAL: MIN. [EN 10163-2 CLASS B SUB-CLASS 3]

  SECTIONS: MIN. [EN 10163-3 CLASS D SUB-CLASS 3]

B. STEEL WHICH IS DAMAGED OR HAS IMPERFECTIONS IN THE SURFACE SHALL BE EVALUATED IF IT IS ALLOWED FOR PRODUCTION OR SHALL BE REJECTED.

C. IN SOME CASES REPAIR BY WELDING MAY BE PROPOSED AFTER APPROVAL OF THE DESIGNER PRIOR TO EXECUTION.

D. ANY REPAIR BY GRINDING SHALL BLEND SMOOTHLY WITH THE CONTOUR OF THE BASE MATERIAL AND THIS MAY ONLY BE USED IF THE IMPERFECTIONS WILL BE REMOVED COMPLETELY THEREAFTER.

E. REPAIR BY GRINDING SHALL BE CHECKED 100% MPI, UNLESS OTHERWISE AGREED WITH THE DESIGNER.

7. RATHOLES

A. RATHOLES AND OTHER CUTOUTS SHALL BE AVOIDED WHEREVER POSSIBLE.

B. WHEN NOT OTHERWISE INDICATED ON THE DESIGN DRAWINGS, RATHOLES SHALL BE AS FOLLOWS:

STIFFENER THICKNESS (t)	RATHOLE RADIUS (R)
t ≤ 20 mm	R = t + 15 mm
t ≤ 35 mm	R = t + 25 mm
t > 35 mm	R = t + 35 mm

C. THE SURFACE AROUND THE HOLES SHALL BE SMOOTH WITHOUT INDENTATION.

D. RATHOLES OR CUTOUTS IN ANY TUBULAR MEMBER ARE STRICTLY PROHIBITED UNLESS SPECIFICALLY DETAILED ON DESIGN DRAWINGS.

8. BOLTS, NUTS & WASHERS

A. ALL FASTENERS IN STEEL / ALUMINIUM STRUCTURES AND BETWEEN ALUMINIUM & COATED STEEL STRUCTURES TO BE STAINLESS STEEL GRADE A4-50/70 AND IN ACC. WITH [EN 1090-2] U.N.O.

B. STANDARD FASTENER PARTS USED, IN DESIGN, ARE;

- FOR BOLTS [ISO 4017] (FULL THREAD) OR [ISO 4014] (PARTIAL THREAD) U.N.O.
- FOR WASHERS [ISO 7089] U.N.O.
- FOR NUTS [ISO 4032] U.N.O.

C. ALL NON-PRELOADED BOLTS ACCORDING TO [EN 1090-2] TO BE SNUG TIGHTENED U.N.O.

D. FOR ALL PRE-LOADED BOLTS ACCORDING TO [EN 1090-2] SPECIFIC PRE-TENSIONING OF BOLTS GIVEN ON DESIGN DRAWINGS.

E. ALL BOLTS, WHICH COULD CAUSE A HAZARD WHEN FALLING DOWN FROM HEIGHTS, ARE HARD TO INSPECT OR ARE CRITICAL TO OPERATION FUNCTIONS ARE TO BE SECURED WITH: LOCTITE, PRE-TENSION AND/OR WIRE LOCKING [ISO 7378], COTTER PIN [ISO 1234], METALLIC LOCK NUT [ISO 7042], NORDLOCK WASHERS.

F. FOR BOLTS TO BE PART OF A REGULAR MAINTENANCE & INSPECTION REGIME, MARKING WITH COLOR STRIPE IS ADVISED FOR INSPECTION EASE.

G. ALL FASTENERS SHALL BE DELIVERED WITH MINIMUM 3.1 CERTIFICATES ACCORDING TO [EN 10204].

H. ALL BOLTS & NUTS TO BE LUBRICATED BEFORE PRE-LOADING PER SUPPLIER RECOMMENDATION U.N.O.

I. ALL STAINLESS STEEL BOLTS, WASHERS & NUTS TO BE ISOLATED FROM STEEL & ALUMINIUM PARTS BY MEANS OF HDPE ISOLATORS.

9. FABRICATION TOLERANCES – MAIN CONE

A. THE CIRCUMFERENCE LENGTH TOLERANCE AT TOP/BOTTOM DIAMTER IS ±15 mm.

B. THE OVALITY TOLERANCE AT TOP/BOTTOM DIAMETER IS: D(max.) – D(min.) = 10 mm.

C. THE LOCAL OUT-OF-ROUNDNESS TOLERANCE, MEASURED WITH A GAUGE OF 20 DEGREES, IS 4 mm.

D. THE HEIGHT (LENGTH) OF CONE TOLERANCE IS ±4 mm.

E. THE TOLERANCES SHOULD BE READ AS: "WHEN THE CIRCUMFERENCE TOLERANCE ON THE TOP OF THE CONE IS POSITIVE, THEN THE BOTTOM SHOULD ALSO BE EQUALLY POSITIVE."

10. GRATING

A. ALL GRATING TO BE OF GRP U.N.O.

B. ALL GRATING TO BE OF TYPE GRP-BK 538-38-38-5 (33x33 MESH WIDTH) (LICHTGITTER) OR EQUIVALENT U.N.O.

C. ALL GRATING TO BE FIXED TO SUPPORT FRAMING, BY BOLTED CONNECTION. MIN. THICKNESS OF STEEL BASE MATERIAL IS 6 mm. FIXING LOCATIONS BY FABRICATOR U.N.O.

D. ALL GRATING HEIGHT TO BE 38 mm U.N.O.

E. SPAN DIRECTION OF GRATING INDICATED THUS: ←→

F. ALL GRP GRATING TO BE UV LIGHT RESISTANT.

TABLE 1:		
DESCRIPTION	STEEL GRADE (1,3)	STANDARD
PRIMARY STEEL	S355NL OR S355ML	EN 10025-3 OR -4
SECONDARY STEEL, FLAT AND LONG PRODUCTS:		
* t≤25 mm	S355J2 OR S355K2	EN 10025-2
* t>25 mm:		
- SUBJECT TO THROUGH THICKNESS LOADS (2)	S355J2+N+Z25	EN 10164 + EN 10025-2
- OTHERS	S355J2+N	EN 10025-2
SECONDARY STEEL, HOLLOW SECTIONS:		
* t≤25 mm	S355J2H	EN 10210
* t>25 mm:		
- SUBJECT TO THROUGH THICKNESS LOADS (2)	S355J2H+N+Z25	EN 10164 + EN 10210
- OTHERS	S355J2H+N	EN 10210
(NOTE 1): GRADES CONFORM EN 10225 CAN ALSO BE USED WHEN THEIR PROPERTIES ARE EQUAL OR BETTER THAN THE PROPERTIES OF THE GRADE SPECIFIED IN THE TABLE ABOVE.		
(NOTE 2): THROUGH THICKNESS LOADED PLATES ARE MARKED IN THE DRAWINGS.		
(NOTE 3): THE MAX. CARBON EQUIVALENT VALUES OF BOTH [DNVGL-OS-B101 (CH. 2 SEC. 2 TABLE 10)] AND [EN 10210] MUST BE ADHERED TO.		

STEEL SELECTION SHALL BE IN ACC. WITH FOLLOWING DEFINITIONS:

PRIMARY STEEL: PRIMARY (MAIN) CONE, HOOK ON POINTS & LIFTING POINTS.

SECONDARY STEEL: ALL APPURTENANCES ATTACHED TO THE PRIMARY STEELWORK (I.E. BL STRUCTURES, INTERNAL/EXTERNAL/REST PLATFORMS, LADDERS, ANODE SUPPORTS, INSTALLATION GUIDES, RAILINGS, BRACKETS, EARTHING & GRATING STUBS, ELECTRICAL SUPPORTS).

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: SKYBOX 8 m MP

TITLE: GENERAL NOTES STANDARD INFORMATION SHEET 1

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
N/A		A3	SP2400127	- D -	S -	01001 -	01	02

11. NON-DESTRUCTIVE TESTING (NDT)

A. ALL WELDS TO BE 100% VISUALLY INSPECTED.

B. THE EXTENT OF NDT SHALL BE CONFORM AS A MIN. TO [DNV-OS-C401] WITH SPECIFIC EXTENT AS SHOWN BELOW:

	VT:	MT:	UT:
– SPECIAL & PRIMARY STRUCTURE BUTT WELDS:			
LONGITUDINAL WELDS:			
* STEEL STRUCTURE:	100%	20%	20%
CIRCUMFERENTIAL WELDS (NON & FLUSH GRINDED):	100%	100%	100% (1)

(NOTE 1): – FIRST 100 m OF WELDING => EXTENT 100%,
– WHERE REPAIR RATE <2% => EXTENT 20%.

	VT:	MT:	UT:
– WELD ATTACHMENTS TO PRIMARY STEEL:			
BUTT WELDS:	100%	100%	100%
FILLET WELDS:	100%	100%	0%
– SECONDARY STRUCTURE WELDS:	VT:	MT:	UT:
BUTT WELDS:	100%	20% (2,3)	20% (2,3)
CROSS & T-JOINTS, FP'S:	100%	20% (2,3)	20% (2,3)
CROSS & T-JOINTS, PP'S & FILLET WELDS:	100%	20% (2,3)	0%

(NOTE 2): THE PERCENTAGE OF NDT SHALL BE CARRIED OUT ON EACH INDIVIDUAL ASSEMBLY.

(NOTE 3): FOR WELDS WITH A LENGTH <300 mm, THIS WILL BE TESTED 100%.

C. IN CASE DEFECTS ARE REMOVED, THE EXCAVATED AREA SHALL BE DRESSED BY GRINDING AND TESTED BY MEANS OF MPI OR PT PRIOR TO RE-WELDING.

D. FINAL INSPECTION AND NDT OF STRUCTURAL STEEL WELDS SHALL BE INSPECTED AFTER A HOLDING TIME CONFORM [DNV-OS-C401 (CH. 2, SEC. 7, PAR. 1.2.4)].

E. REPAIRED WELDS HAVE TO BE INSPECTED BY NDT AND FULFILL THE SAME REQUIREMENTS AS STIPULATED FOR THE ORIGINAL WELD.

F. NDT PERSONNEL PERFORMING TESTING & EVALUATION SHALL MIN. BE QUALIFIED TO [LEVEL 2] ACCORDING TO [EN ISO 9712].

G. NDT SUPERVISORS SHALL BE CERTIFIED [LEVEL 3] IN THE TESTING METHOD CONCERNED.

H. THE WELDS SHALL FULFILL THE FOLLOWING QUALITY CLASSES ACCORDING TO [EN ISO 5817]:

– SPECIAL & PRIMARY WELDS:	[EN ISO 5817, LEVEL B]
– SECONDARY WELDS:	[EN ISO 5817, LEVEL C]

I. ADDITIONAL REQUIREMENTS FOR VISUAL AND MAGNETIC INSPECTION:

– UNDERCUT IS NOT ALLOWED FOR PRIMARY STEELWORK.

– UNDERCUT IS NOT ALLOWED FOR SPECIAL STEELWORK.

– POROSITY IS NOT PERMITTED.

12. PROTECTIVE COATINGS

A. ALL STRUCTURAL STEEL TO BE GRIT BLASTED (Sa 2 1/2) BEFORE APPLICATION OF PAINTS AND RELATED PRODUCTS, IN ACC. WITH [EN ISO 8501-3] U.N.O.

B. ALL STRUCTURAL STEEL TO BE COATED IN ACC. WITH [EN ISO 12944, CX] OR [NORSOK M-501, SYSTEM 7A] U.N.O.

C. ALL EDGES TO BE COATED SHALL BE ROUNDED TO A MINIMUM RADIUS R=3 mm.

D. SEE FOR COATING INFORMATION "COATING AND CORROSION PROTECTION SPECIFICATION", DOCUMENT NO. SP2400127-S-S-02002-00.

E. FOR STAINLESS STEEL TO CARBON STEEL WELDED CONNECTIONS, APPLY A 30 mm COATING OVERLAP ON THE STAINLESS STEEL PART TO AVOID GALVAINC CORROSION.

13. FOR PADEYES (AND TRUNNIONS)

A. CONSTANT VISUAL OBSERVATION OF THE WELDING PROCESS.

B. 100% VISUAL INSPECTION OF WELDS INCLUDING MEASUREMENT OF WELD REINFORCEMENT.

C. 100% DIMENSIONAL CONTROL INCLUDING ORIENTATION.

D. 100% ULTRASONIC TESTING OF ALL WELDS MIN. 48 HRS AFTER COMPLETION OF WELDING.

E. MAGNETIC PARTICLE INSPECTION OF ALL WELDS MIN. 48 HRS AFTER COMPLETION OF WELDING.

F. ROLLING DIRECTION OF PADEYE MAIN PLATE MATERIAL ACCORDING TO SLING ANGLE +/- 10°.

G. ALL WELDS TO BE FULL PENETRATION BUTT WELD U.N.O.

H. ALL PAD EYES TO BE LABELED WITH W.L.L.

14. ANCHORAGE POINTS

A. ANCHORAGE POINTS [EN 795] ARE MADE TO FULFILL THE REQUIREMENTS IN [EN 50308].

B. S.W.L. OR RATED AMOUNT OF PERSONS SHALL BE INDICATED NEAR EACH ANCHORAGE POINT OR HOOK-ON-POINT, IN BLACK TEXT U.N.O.

C. NO SHARP EDGES ALLOWED, EDGES ROUNDED TO MIN. R5.

D. ALL ANCHORAGE POINTS SHALL BE PAINTED IN YELLOW AND DEMARCATED WITH A 10 mm THICK RED LINE AROUND THE START OF THE FIXING POINT IF MOUNTED IN YELLOW STEELWORK.

E. ALL HOOK-ON-POINTS SHALL BE PAINTED IN RED U.N.O.

15. ALUMINIUM

A. ALUMINIUM STRUCTURES SHALL IN GENERAL BE EXECUTED IN ACC. WITH [EN 1090-3].

B. EXECUTION CLASS [2] OF [EN 1999-1-1] SHALL BE APPLIED.

C. SERVICE CATEGORY [1] OF [EN 1090-3] SHALL BE APPLIED.

D. ALUMINIUM PROFILES SHALL BE OF [EN-AW 6082 T6] ACCORDING TO [EN 755] AND SHALL BE DELIVERED WITH CERTIFICATE 3.1 IN ACC. WITH [EN 10204].

E. ALL ALUMINIUM PROFILES SHALL BE ISOLATED FROM CARBON AND/OR STAINLESS STEEL, BY MEANS OF HDPE ISOLATORS.

F. ALUMINIUM PROFILES AND PARTS ARE NOT REQUIRED TO BE COATED FOR CORROSION PROTECTION U.N.O.

G. FILLET WELD SIZE DESIGNATION (ALUMINIUM): FILLET WELDS TO BE SPECIFIED ON DRAWINGS.

16. GROUT

A. THE MINIMUM MASS OF GROUTING, REQUIRED AS COUNTER BALANCE, IS 17.7 mT.

B. THE WEIGHT OF THE GROUTING IS ASSUMED TO BE 2300 kg/m^3.

C. THE DESIGNED VOLUME ACCOMMODATE THE GROUTING IS APPROX. 7.7 m^3.

D. THE STEEL BOX STRUCTURE AREA TO BE FILLED WITH GROUT IS MENTIONED ON RELEVANT DRAWINGS.

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: SKYBOX 8 m MP

TITLE: GENERAL NOTES STANDARD INFORMATION SHEET 2

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
N/A		A3	SP2400127	– D –	S –	01001 –	02	02

STANDARD ABBREVIATIONS

AB	– ANGLE BAR
ACC.	– ACCORDANCE
A.F.C.	– APPROVED FOR CONSTRUCTION
AISI	– AMERICAN IRON & STEEL INSTITUTE
ALU.	– ALUMINIUM
ANS	– AMERICAN NATIONAL STANDARDS
ANSI	– AMERICAN NATIONAL STANDARDS INSTITUTE
API	– AMERICAN PETROLEUM INSTITUTE
APPROX.	– APPROXIMATE(LY)
ASAP	– AS SOON AS POSSIBLE
ATP	– AIRTIGHT PLATFORM
AWS	– AMERICAN WELDING SOCIETY
BL	– BOATLANDING
B.O.B.	– BOTTOM OF BEAM
B.O.F.	– BOTTOM OF FLANGE
B.O.P.	– BOTTOM OF PLATE
B.O.S.	– BOTTOM OF STEEL
BS	– BRITISH STANDARD
B/S	– BOTH SIDES
BSI	– BRITISH STANDARD INSTITUTE
BTM	– BOTTOM
BTWN	– BETWEEN
°C	– CELSIUS
CCW.	– COUNTER CLOCKWISE
CERT.	– CERTIFICATE
CHK'D	– CHECKED
CH.PL.	– CHEEK PLATE
CHS	– CIRCULAR HOLLOW SECTION
CL OR ℄	– CENTERLINE
C.O.G.	– CENTER OF GRAVITY
CONC.	– CONCENTRIC
CONN.	– CONNECTION
CONT'D	– CONTINUED
C.P.	– CENTER POINT
C.T.C.	– CENTER TO CENTER
C.T.E.	– CENTER TO END
C.T.F.	– CENTER TO FACE
CTV	– CREW TRANSFER VESSEL
CTR(S)	– CENTER(S)
CW.	– CLOCKWISE
C/W	– COMPLETE WITH
CYL.	– CYLINDER
DEG.	– DEGREE
DESC.	– DESCIPTION
DET.	– DETAIL
DIA. , D OR ø	– DIAMETER
DIM.	– DIMENSION
DIN	– DEUTSCHER INSTITUTE f. NORMUNG
DISC.	– DISCIPLINE
DNV	– DET NORSKE VERITAS
DOC.	– DOCUMENT
DRG.	– DRAWING
E.B.	– EARTHING BOSS
E.G.	– EXAMPLE GIVEN
E&I	– ELECTRICAL & INSTRUMENTATION
EL.	– ELEVATION
EN	– EUROPEAN STANDARD
EQUIP.	– EQUIPMENT
EQUIV.	– EQUIVALENT
E.T.E.	– END TO END
EXEC.	– EXECUTION
EXCL.	– EXCLUDED
FAT	– FACTORY ACCEPTANCE TEST
FB	– FLAT BAR
FEED	– FRONT END ENGINEERING & DESIGN
FEM	– FINITE ELEMENT METHOD
FL. OR FLG.	– FLANGE
FLEX.	– FLEXIBLE
F.O.F.	– FACE OF FLANGE
FP	– FULL PENETRATION
F.P.	– FOUNDATION PLATE
FR.	– FRAME
FS	– FAR SIDE
F.T.F	– FACE TO FACE
FW	– FILLET WELD
GA	– GENERAL ARRANGEMENT
GEN.	– GENERAL
GR.	– GRADE
GRP	– GLASS REINFORCED PLASTIC
GRTG	– GRATING
GUS	– GET–UP–SAFE
HAT	– HIGHEST ASTRONOMICAL TIDE
HAZID	– HAZARD IDENTIFICATION
HAZOP	– HAZARD & OPERABILITY ANALYSIS
HDPE	– HIGH DENSITY POLYETHYLENE
HEA/HEB	– BEAM SECTION
HEX.	– HEXAGON, HEXAGONAL
H'RAIL	– HANDRAIL
HRS	– HOURS
HSE	– HEALTH, SAFETY & ENVIRONMENT
HV	– HIGH VOLTAGE
HVAC	– HEATING, VENTILATION & AIR CONDITIONING
ID.	– IDENTIFICATION
I.D. OR I/DIA.	– INSIDE DIAMETER
I.E.	– THAT IS (ID EST)
INCL.	– INCLUDED
INSTR.	– INSTRUMENT
INTERM.	– INTERMEDIATE
IPE	– BEAM SECTION
ISO	– INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
kg	– KILOGRAM
LAT	– LOWEST ASTRONOMICAL TIDE
LH	– LEFT HAND
LOC.	– LOCATION
LOCS	– LOCATIONS
LONG.	– LONGITUDINAL
LV	– LOW VOLTAGE
MACH.	– MACHINING
MAT.	– MATERIAL
MAX.	– MAXIMUM
MIN.	– MINIMUM
m	– METER
mm	– MILLIMETER
MP	– MONOPILE
MPI	– MAGNETIC PARTICLE INSPECTION
MSL	– MAIN SEA LEVEL
MT	– MAGNETIC TESTING
mT	– METRIC TONNES
MTO	– MATERIAL TAKE–OFF
NAV.	– NAVIGATION
N/A	– NOT APPLICABLE
NB	– NOMINAL BORE
NDT	– NON–DESTRUCTIVE TESTING
NEN	– DUTCH STANDARD
Nm	– NEWTON METER
NO.	– NUMBER
NOM.	– NOMINAL
NS	– NEAR SIDE
N.T.S.	– NOT TO SCALE
O/A	– OVERALL
O.D. OR O/DIA.	– OUTSIDE DIAMETER
O.F.C.	– OMITTED FOR CLARITY
O/O	– OUT OF
P.C.D.	– PITCH CIRCLE DIAMETER
PEN.	– PENETRATION
PFC	– PARALLEL FLG CHANNEL
PL OR PLT	– PLATE
PP	– PARTIAL PENETRATION
PRESS.	– PRESSURE
PS	– PORT SIDE
PT	– PENETRANT TESTING
PU	– POLYURETHANE
QA	– QUALITY ASSURANCE
QC	– QUALITY CONTROL
QTY.	– QUANTITY
RAD. OR R	– RADIUS
R.D.	– ROLLING DIRECTION
REF.	– REFERENCE ONLY
REINF.	– REINFORCEMENT
REQ'D	– REQUIRED
REV.	– REVISION
RF	– RAISED FACE
RFC	– REQUEST FOR CLARIFICATION
RFI	– REQUEST FOR INFORMATION
RFQ	– REQUEST FOR QUOTATION
RH	– RIGHT HAND
RHS	– RECTANGULAR HOLLOW SECTION
SAT	– SITE ACCEPTANCE TEST
SB	– STARBOARD SIDE
SECOND.	– SECONDARY
SHS	– SQUARE HOLLOW SECTION
SHT.	– SHEET
SI	– INTERNATIONAL STANDARD OF UNITS
SIM.	– SIMILAR
SN	– SERIAL NUMBER
SO	– STRUCTURAL OPENING
SPEC.	– SPECIFICATION
SQ.	– SQUARE
SS	– STAINLESS STEEL
STAT.	– STATIONARY
STD	– STANDARD
STIFF.(S)	– STIFFENER(S)
STWK	– STEELWORK
S.W.L.	– SAFE WORKING LOAD
t	– PLATE THICKNESS
T&B	– TOP & BOTTOM
T.B.C.	– TO BE CONFIRMED OR CLARIFIED
T.D.	– TYPICAL DETAIL
TEMP.	– TEMPERATURE
THK	– THICK(NESS)
THR.	– THREADED
T.O.B.	– TOP OF BEAM
T.O.F.	– TOP OF FLANGE
T.O.G.	– TOP OF GRATING
T.O.P.	– TOP OF PLATE
T.O.S.	– TOP OF STEEL
TP	– TRANSITION PIECE
TS	– TENSILE STRENGTH
T.T.P.	– THROUGH THICKNESS PROPERTIES
TYP.	– TYPICAL
U.N.O.	– UNLESS NOTED OTHERWISE
UNP	– BEAM SECTION
U/S	– UNDERSIDE
UT	– ULTRASONIC TESTING
UV	– ULTRA VIOLET
VT	– VISUAL TESTING
W.L.L.	– WORK LOAD LIMIT
WN	– WELD NECK
WP OR ⌖	– WORK POINT
WRT	– WITH RESPECT TO
WT	– WALL THICKNESS
WTG	– WIND TURBINE GENERATOR
WTW	– WALK–TO–WORK
W/WAY	– WALK WAY

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23–10–24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04–07–24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

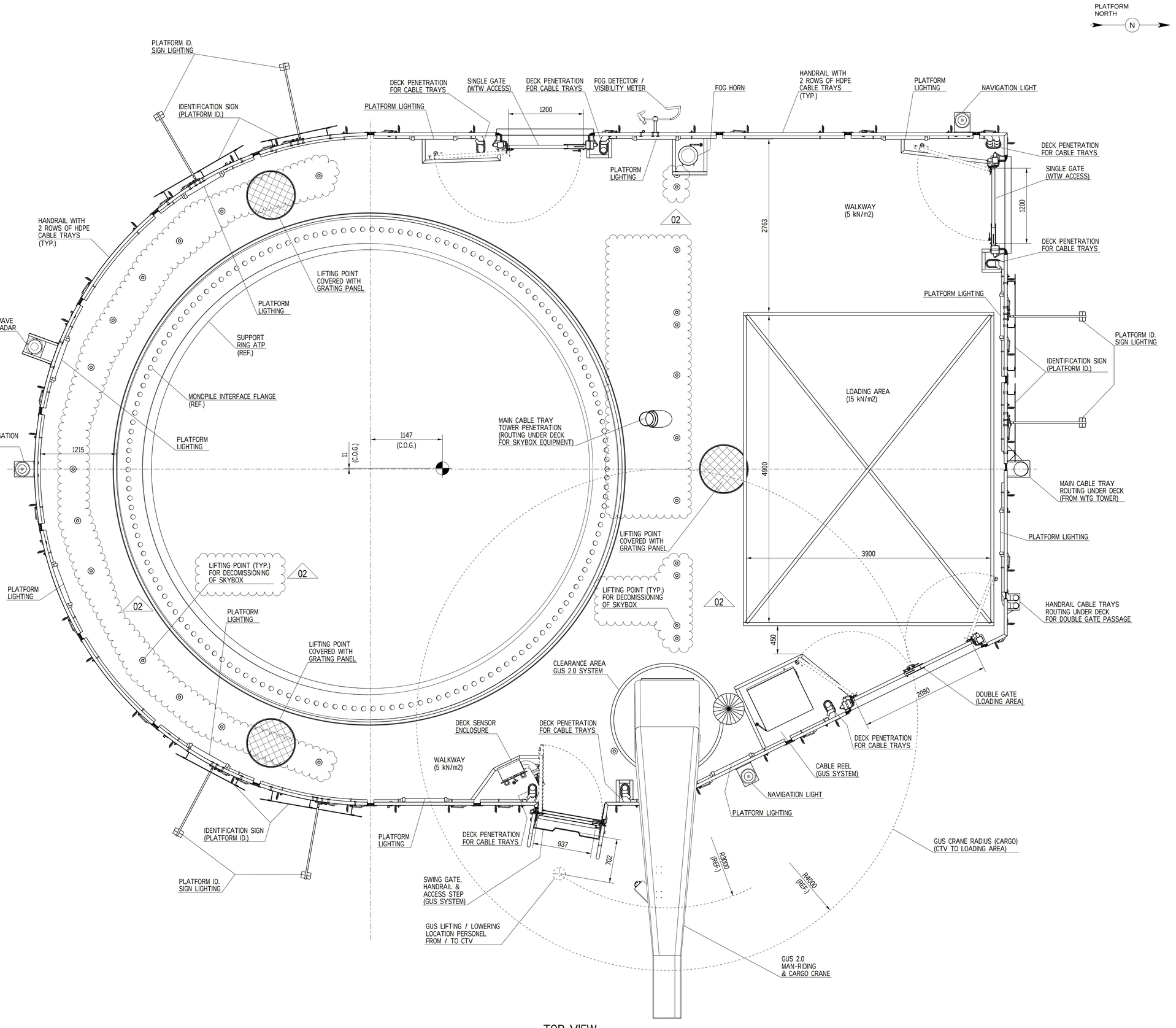
PROJECT: SKYBOX 8 m MP

TITLE: GENERAL NOTES ABBREVIATIONS

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
N/A		A3	SP2400127	– D –	S –	01002 –	01	02



TOP VIEW
SCALE: 1:30
(VIEW ROTATED 90° CLOCKWISE)

GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ...-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.

- APPROX. WEIGHT OF GUS SYSTEM	2500 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF CABLE REEL (GUS SYSTEM)	220 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF DECK SENSOR (GUS SYSTEM)	20 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF FOG HORN	175 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF FOG DETECTOR	5 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF NAVIGATION LIGHTS (3x)	63 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF WAVE RADAR	12.5 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF PLATFORM LIGHTING (11x)	33 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF ID SIGN LIGHTING (6x)	12 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF EARTHING CABLES	42 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF GRATING PANELS	26 kg (EXCL. CONTINGENCY)
- ABOVE GIVEN WEIGHTS ARE ALL TOTAL WEIGHTS PER SYSTEM.	

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - WELDING DETAILS

02

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	KCI APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

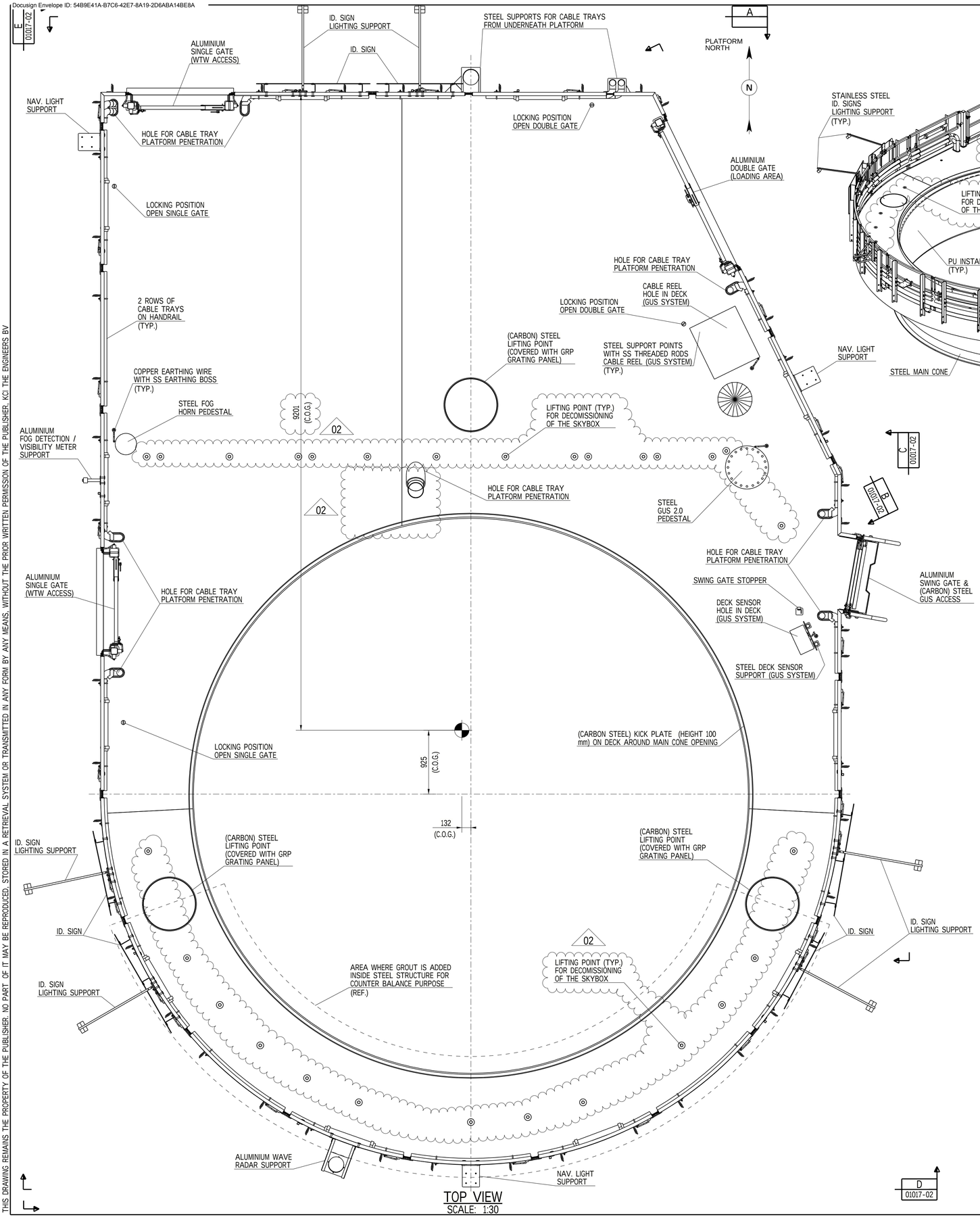
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP
DECK LAYOUT SKYBOX

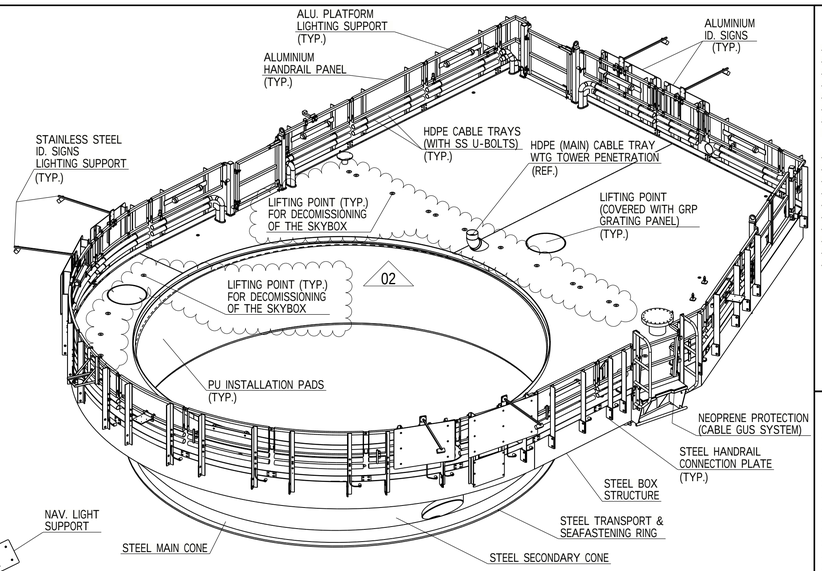
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:30		A1	SP2400127	– D –	S –	01016	– 01	02



TOP VIEW
SCALE: 1:30



ISOMETRIC VIEW
N.T.S.

GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ..-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.
- HEIGHT ADJUSTABLE STAIR & PLATFORM (ACCESS TO WTG TOWER DOOR) ARE OMITTED FOR CLARITY.
- GUS SYSTEM AND RELATED CABLE REEL, DECK SENSOR ARE OMITTED FOR CLARITY.
- ALL OTHER EQUIPMENT (E.G. WAVE RADAR, FOG HORN & NAV. LIGHTS) ARE OMITTED FOR CLARITY.
- ALL ALUMINIUM, STAINLESS STEEL AND CARBON STEEL ARE ISOLATED FROM EACH OTHER BY HDPE PLATES, WASHERS AND/OR BUSHINGS U.N.O.

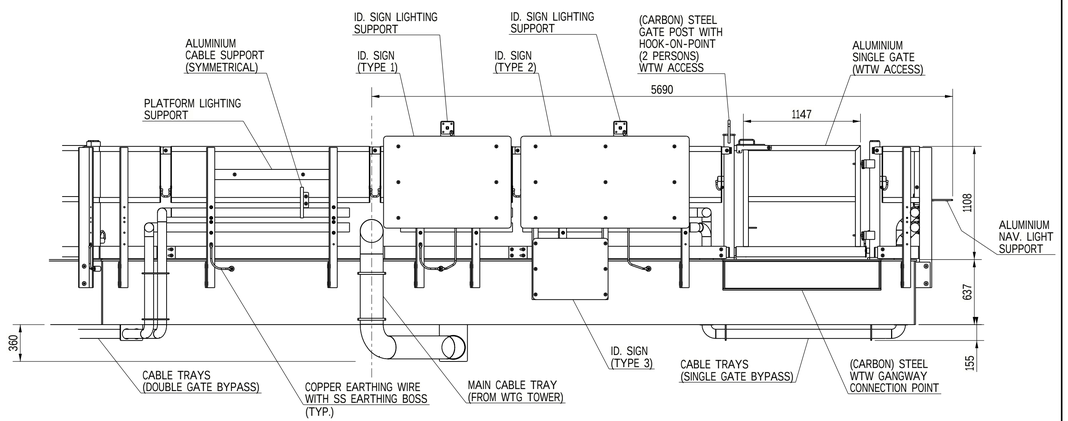
- APPROX. WEIGHT OF (CARBON) STEEL	50490 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF STAINLESS STEEL	125 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF ALUMINIUM	1033 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF COPPER	42 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF GROUT	17721 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF HDPE	169 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF PU	1143 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF GRP	26 kg (EXCL. CONTINGENCY)
- APPROX. WEIGHT OF NEOPRENE	1 kg (EXCL. CONTINGENCY)

- ABOVE GIVEN WEIGHTS ARE ALL TOTAL WEIGHTS PER MATERIAL.

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - WELDING DETAILS

02



VIEW A
SCALE: 1:30

TOLERANCE (CONE):

CIRCUMFERENCE	±15 mm
OVALITY	AS INDICATED ON DRAWING
LOCAL OUT OF ROUNDNESS	4 mm MEASURED WITH A GAUGE OF 20 DEGREES
HEIGHT (LENGTH) OF CONE	±4 mm

THE TOLERANCES SHOULD BE READ AS:
WHEN THE CIRCUMFERENCE TOLERANCE ON THE TOP OF THE CONE IS POSITIVE, THEN THE BOTTOM SHOULD ALSO BE EQUALLY POSITIVE.

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	KCI APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

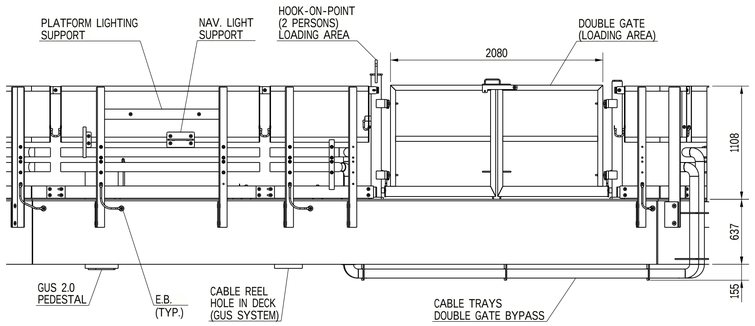
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP ARRANGEMENT SKYBOX SHEET 1

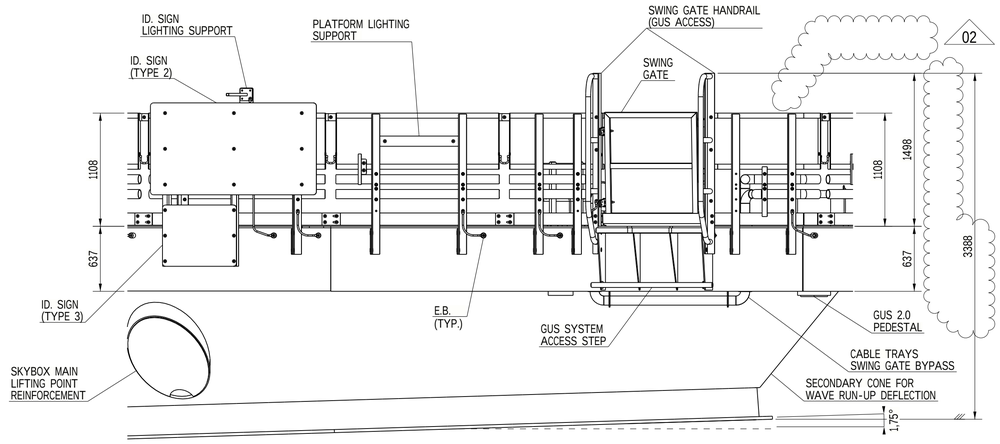
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:30		A1	SP2400127	– D –	S –	01017 –	01	02



VIEW B
SCALE: 1:30
01017-01



VIEW C
SCALE: 1:30
01017-01

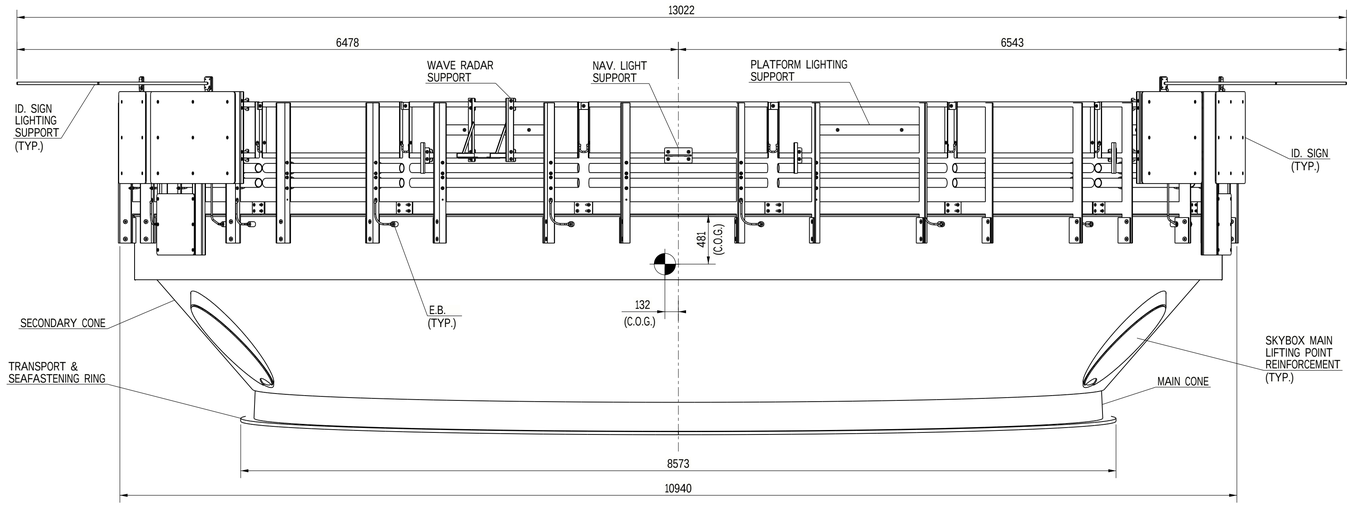
GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ...-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.

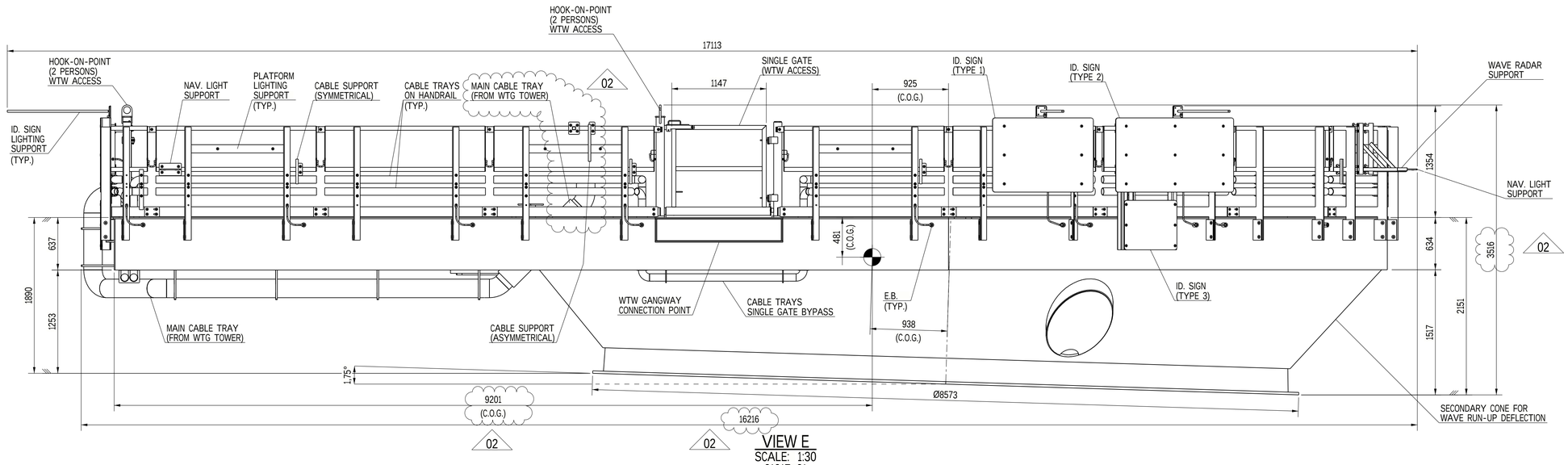
REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - WELDING DETAILS

02



VIEW D
SCALE: 1:30
01017-01



VIEW E
SCALE: 1:30
01017-01

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	KCI APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

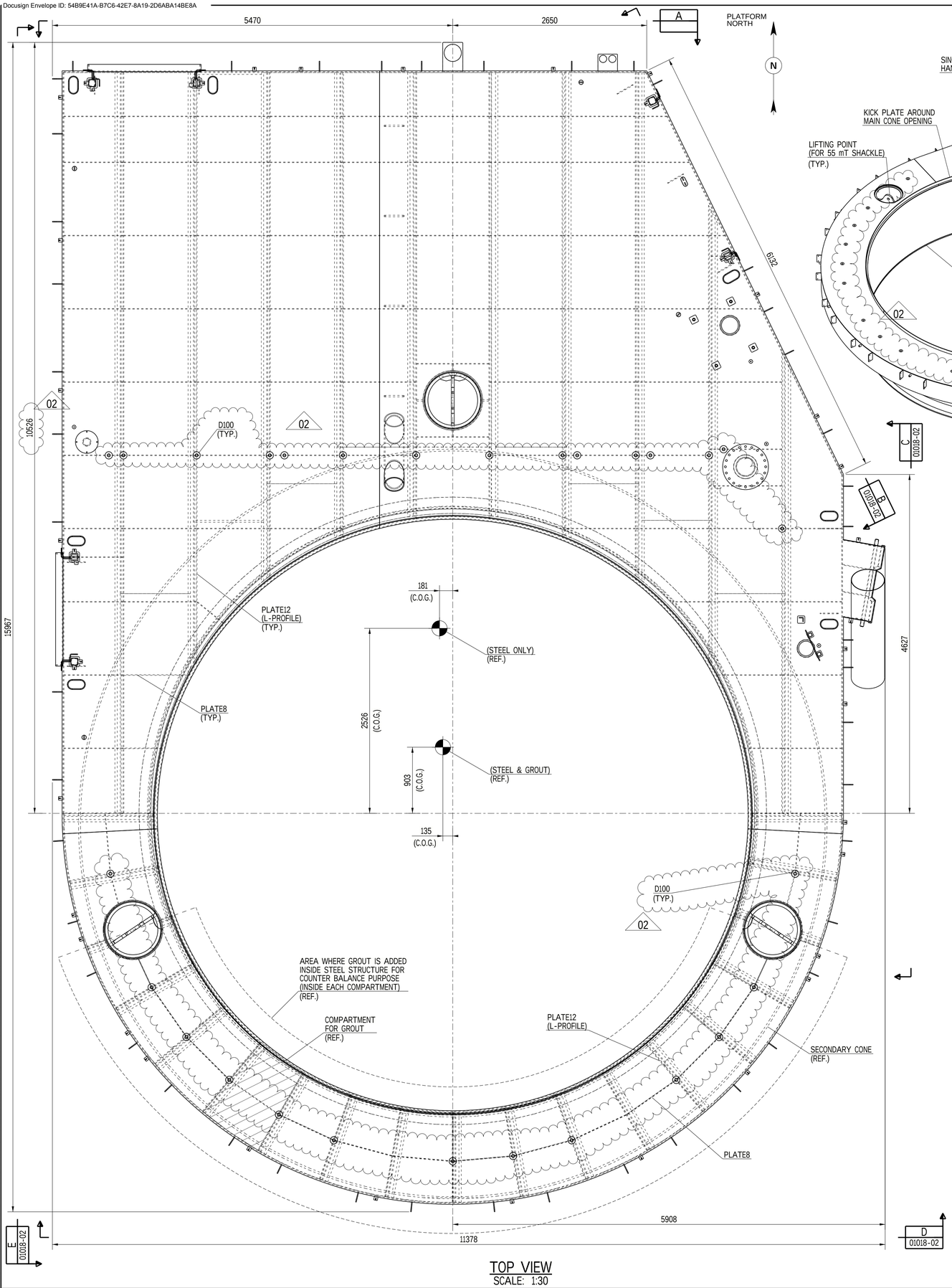
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP ARRANGEMENT SKYBOX SHEET 2

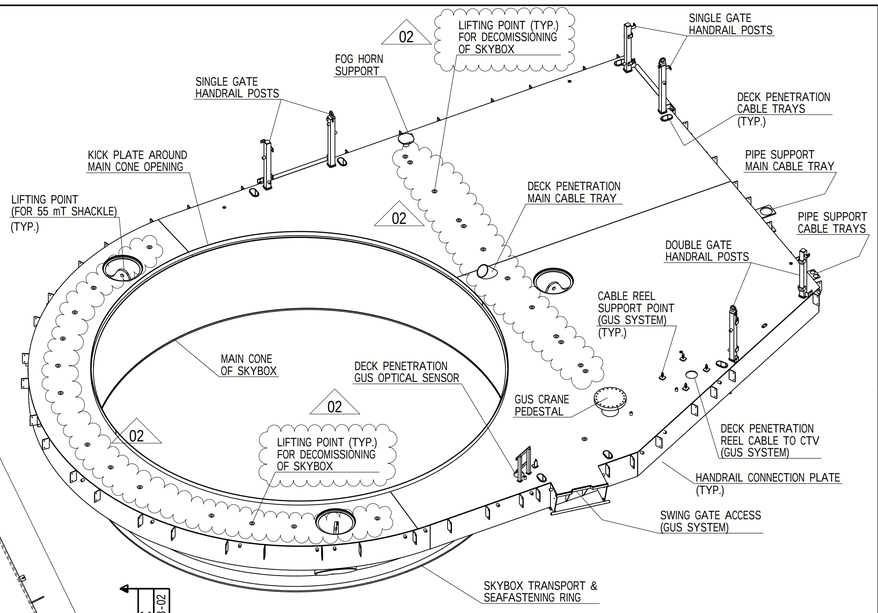
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

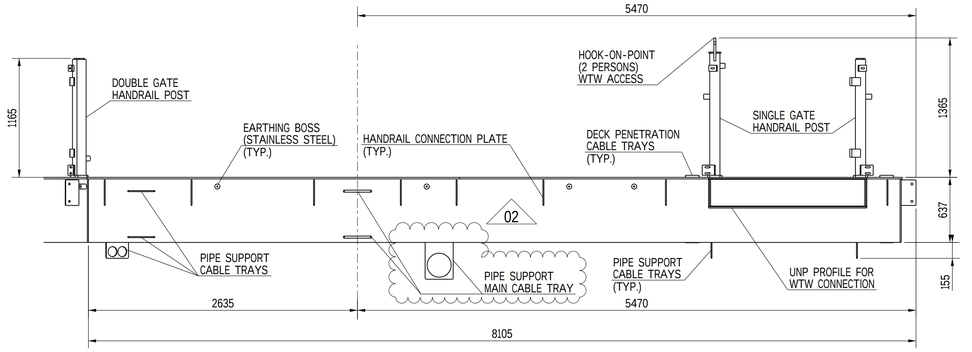
SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT	REV.
1:30		A1	SP2400127	– D –	S –	01017 –	02	02



TOP VIEW
SCALE: 1:30



ISOMETRIC VIEW
N.T.S.



VIEW A
SCALE: 1:30

GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ...-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.

- APPROX. STEEL WEIGHT	50490 kg (EXCL. CONTINGENCY)
- APPROX. STAINLESS STEEL WEIGHT (E.B. & THREADED RODS)	43 kg (EXCL. CONTINGENCY)
- APPROX. GROUT WEIGHT	17721 kg (EXCL. CONTINGENCY)
- APPROX. TOTAL WEIGHT	68254 kg (EXCL. CONTINGENCY)

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - WELDING DETAILS

02

TOLERANCE (CONE):

CIRCUMFERENCE	±15 mm
OVALITY	AS INDICATED ON DRAWING
LOCAL OUT OF ROUNDNESS	4 mm MEASURED WITH A GAUGE OF 20 DEGREES
HEIGHT (LENGTH) OF CONE	±4 mm

THE TOLERANCES SHOULD BE READ AS:
WHEN THE CIRCUMFERENCE TOLERANCE ON THE TOP OF THE CONE IS POSITIVE, THEN THE BOTTOM SHOULD ALSO BE EQUALLY POSITIVE.

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	KCI APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

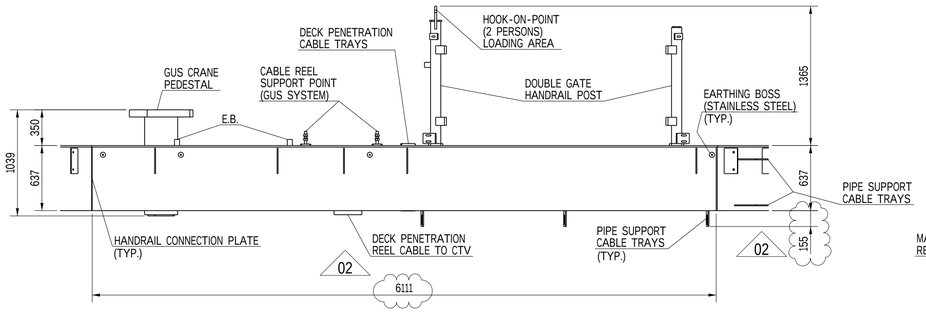
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP
ARRANGEMENT SKYBOX
STEEL WORK - SHEET 1

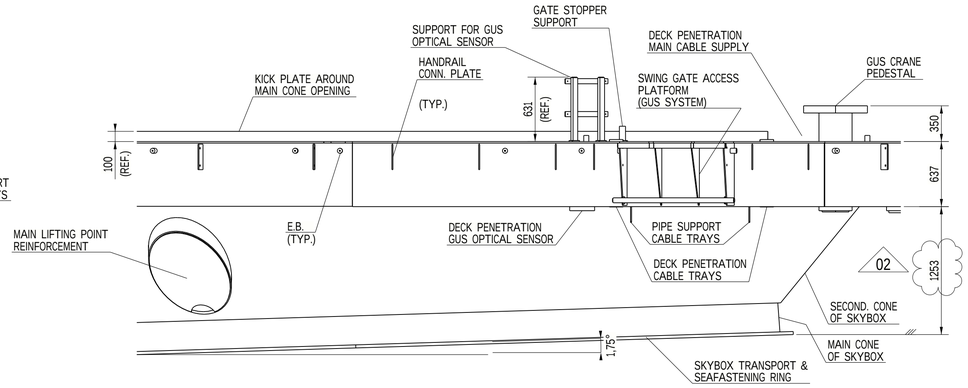
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

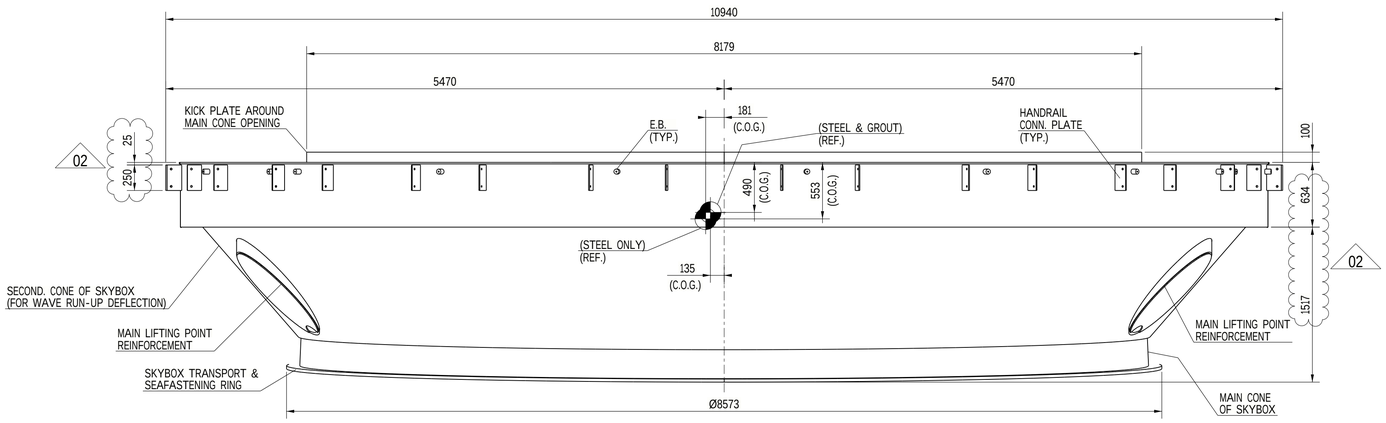
SCALE	PROJEC.	SIZE	CLIENT DRG No.						
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV
1:60		A1	SP2400127	– D –	S –	01018 –	01	02



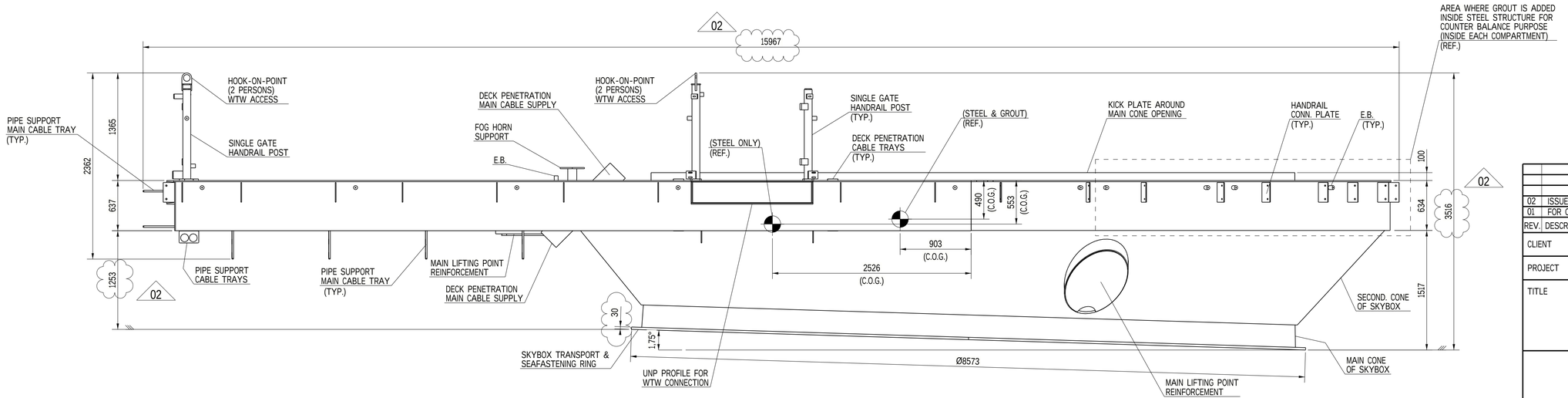
VIEW B
SCALE: 1:30
01018-01



VIEW C
SCALE: 1:30
01018-01



VIEW D
SCALE: 1:30
01018-01



VIEW E
SCALE: 1:30
01018-01

GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ...-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - TYPICAL WELDING DETAILS

02

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

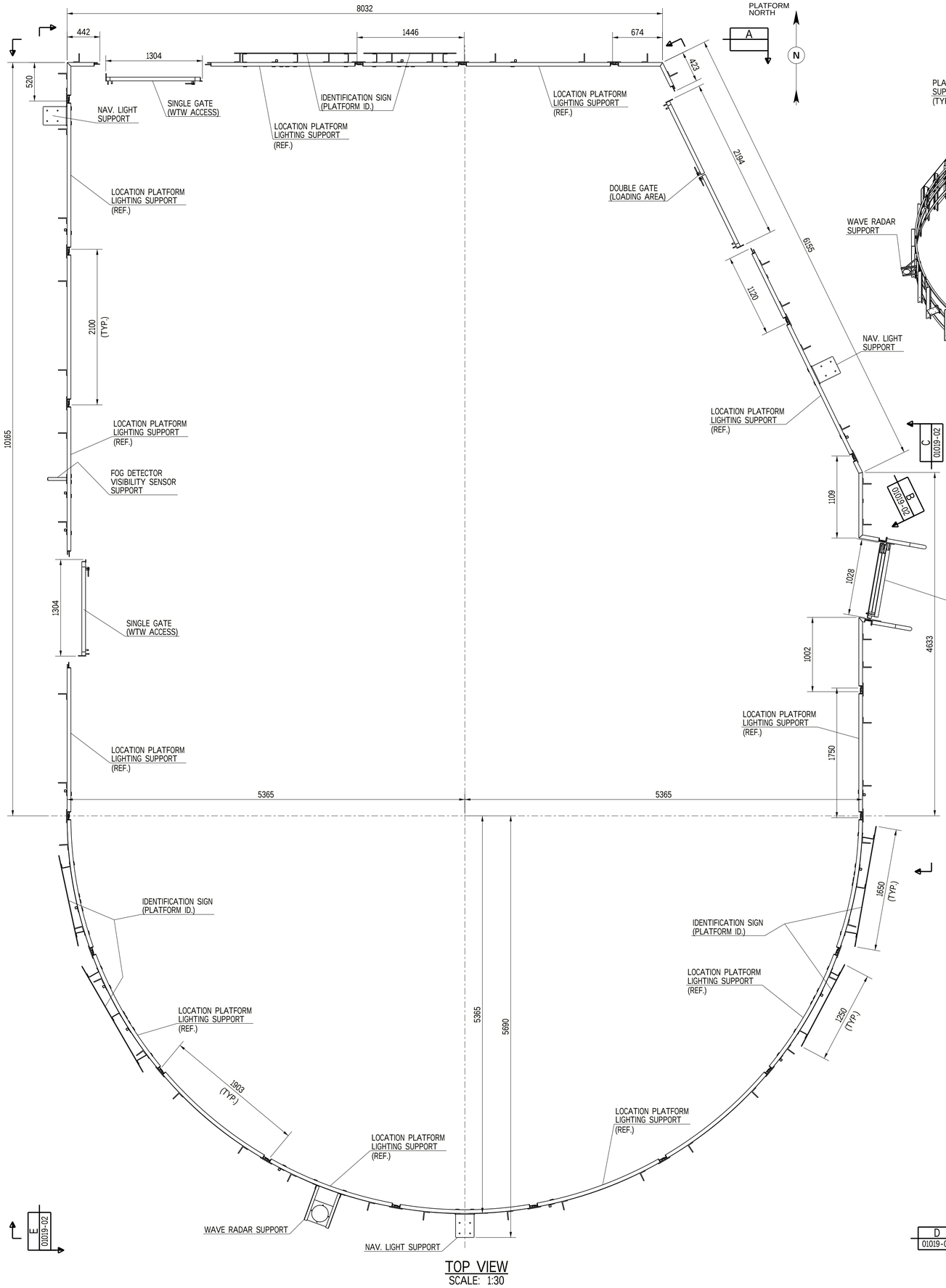
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP
ARRANGEMENT SKYBOX
STEEL WORK - SHEET 2

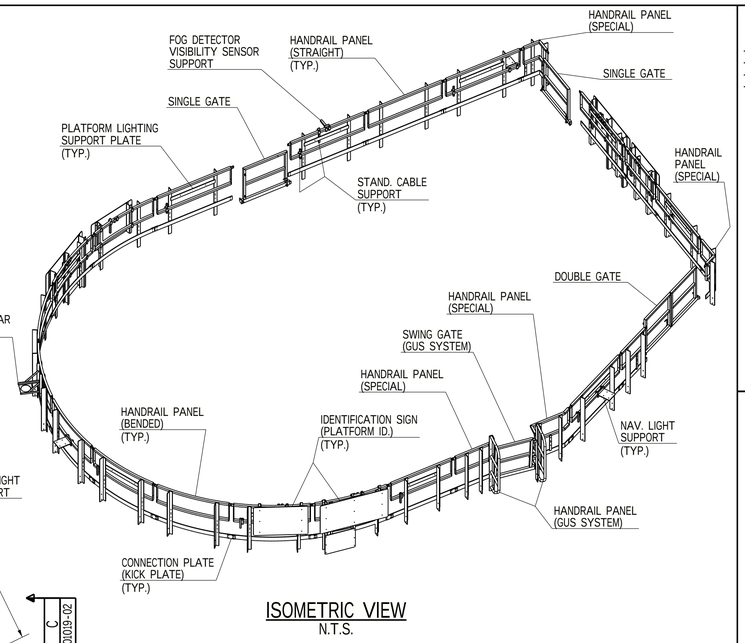
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:30		A1	SP2400127	– D –	S –	01018 –	02	02



TOP VIEW
SCALE: 1:30



ISOMETRIC VIEW
N.T.S.

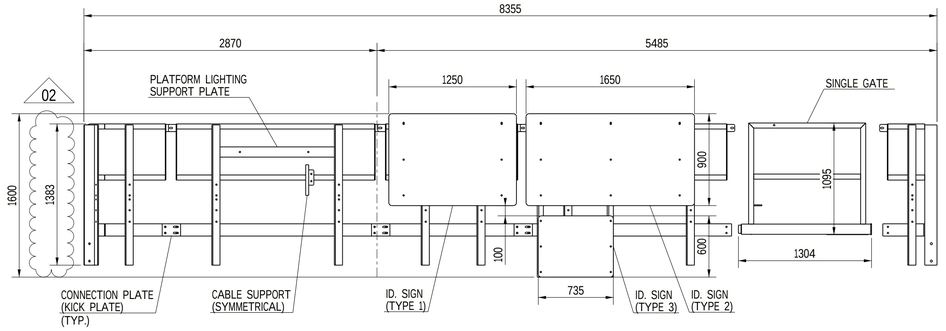
GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ..-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.
- APPROX. TOTAL ALUMINIUM WEIGHT 1033 kg (EXCL. CONTINGENCY & EQUIPMENT)

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - TYPICAL WELDING DETAILS

02



VIEW A
SCALE: 1:30

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

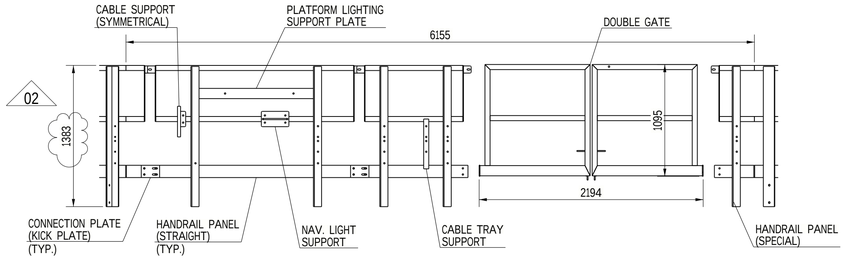
PROJECT: SKYBOX 8 m MP

TITLE: STEEL PLATFORM - 8 m MP
ARRANGEMENT SKYBOX
ALUMINIUM WORK - SHEET 1

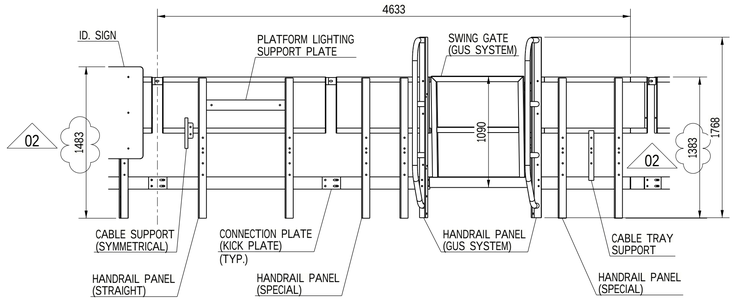
Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

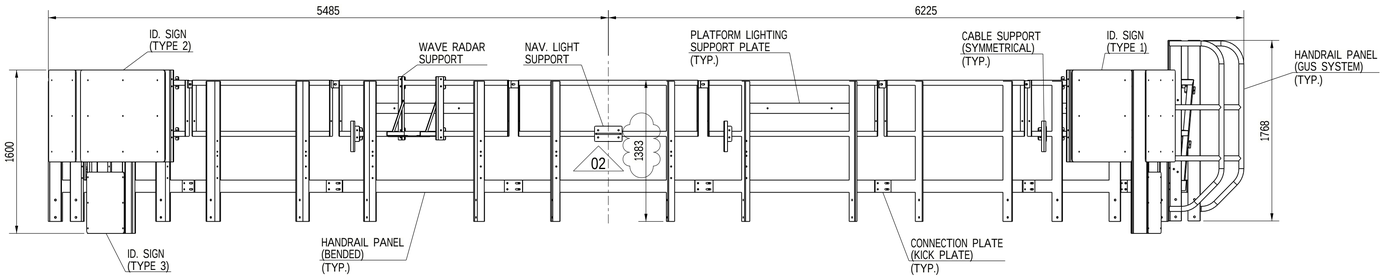
SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:30		A1	SP2400127	– D –	S –	01019 –	01	02



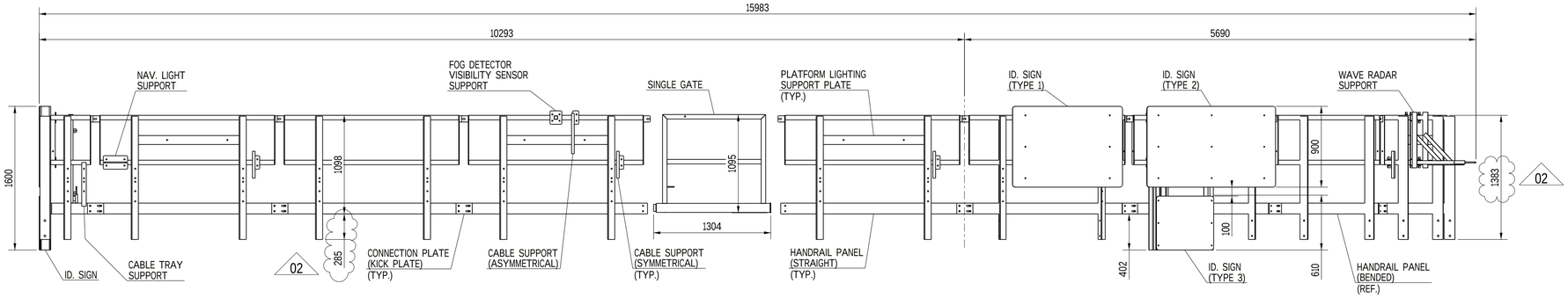
VIEW B
SCALE: 1:30
01019-01



VIEW C
SCALE: 1:30
01019-01



VIEW D
SCALE: 1:30
01019-01



VIEW E
SCALE: 1:30
01019-01

GENERAL NOTES

- FOR GENERAL NOTES & ABBREVIATIONS SEE DRG. SP2400127-D-S-01001-01 TO ...-01002-01.
- THIS DRAWING IS FOR INFORMATION ONLY, DUE TO INCOMPLETE STRUCTURAL ASSESMENT.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY.

REFERENCE DRAWINGS

SP2400127-D-S-01001-01	GENERAL NOTES - STANDARD INFORMATION - SHEET 1
SP2400127-D-S-01001-02	GENERAL NOTES - STANDARD INFORMATION - SHEET 2
SP2400127-D-S-01002-01	GENERAL NOTES - ABBREVIATIONS
SP2400127-D-S-01011-01	GENERAL ARRANGEMENT - MONOPILE DESIGN - (REFERENCE)
SP2400127-D-S-01012-01	GENERAL ARRANGEMENT - MONOPILE INTERFACE FLANGE - (REFERENCE)
SP2400127-D-S-01013-01	GENERAL ARRANGEMENT - MONOPILE ATP SUPPORT RING - (REFERENCE)
SP2400127-D-S-01014-01	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01014-02	STEEL PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01015-01	STEEL PLATFORM - 8 m MP - ELEVATIONS - (REFERENCE)
SP2400127-D-S-01016-01	STEEL PLATFORM - 8 m MP - DECK LAYOUT SKYBOX
SP2400127-D-S-01017-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 1
SP2400127-D-S-01017-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - SHEET 2
SP2400127-D-S-01018-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 1
SP2400127-D-S-01018-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - STEEL WORK - SHEET 2
SP2400127-D-S-01019-01	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 1
SP2400127-D-S-01019-02	STEEL PLATFORM - 8 m MP - ARRANGEMENT SKYBOX - ALUMINIUM WORK - SHEET 2
SP2400127-D-S-01020-01	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 1 - (REFERENCE)
SP2400127-D-S-01020-02	AIRTIGHT PLATFORM - 8 m MP - GENERAL ARRANGEMENT - SHEET 2 - (REFERENCE)
SP2400127-D-S-01022-01	STEEL PLATFORM - 8 m MP - TYPICAL WELDING DETAILS

02

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
02	ISSUED FOR TENDER	23-10-24	MuD	JdK	AmS	AmS	
01	FOR COMMENTS	04-07-24	DeV	LeH	MdB	AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: SKYBOX 8 m MP

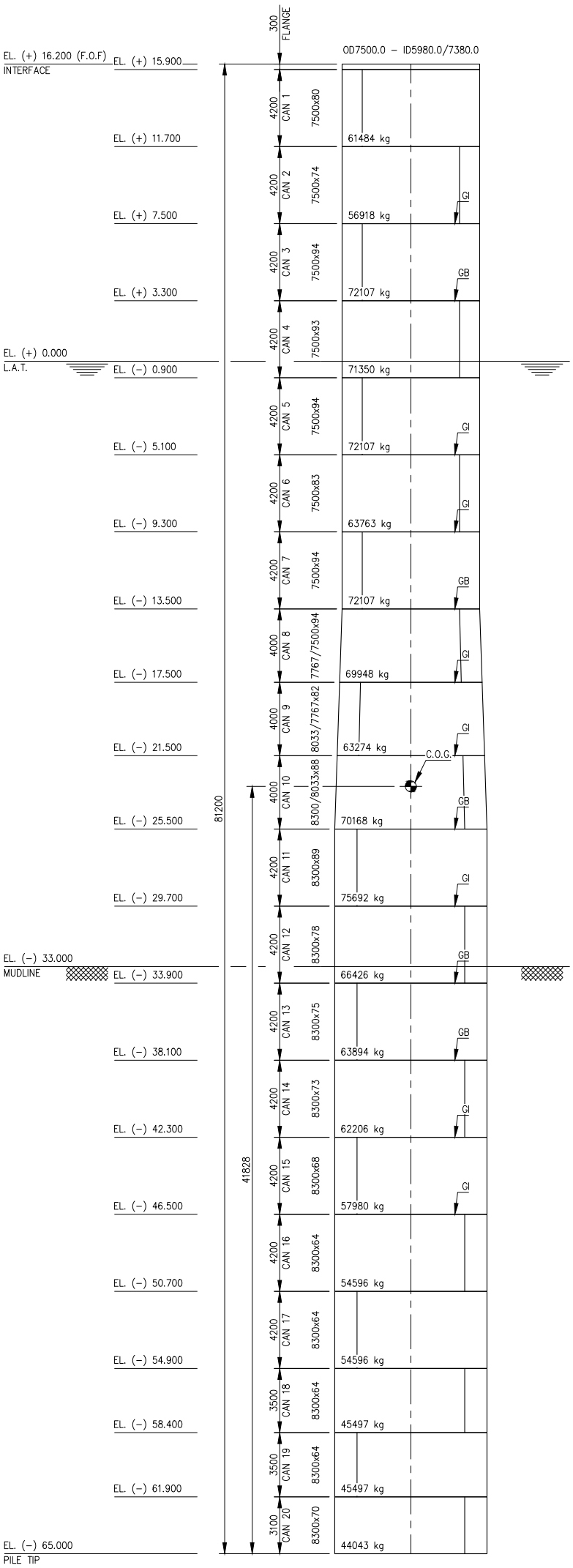
TITLE: STEEL PLATFORM - 8 m MP ARRANGEMENT SKYBOX ALUMINIUM WORK - SHEET 2

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJEC.	SIZE	CLIENT DRG No.					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:30		A1	SP2400127	– D –	S –	01019	– 02	02

5.4 Annex 4 - Monopile design comparison



FRONT VIEW

GENERAL NOTES

- ALL DIMENSIONS ARE GIVEN IN MILLIMETERS (mm) U.N.O.
- ALL ELEVATION ARE GIVEN IN METERS (m).
- ALL DIAMETERS ARE GIVEN AS O.D. U.N.O.
- ALL MATERIAL TO BE STEEL GRADE S355JR ACC. TO EN 10025-2
- ALL WELDS TO BE FULL PEN FROM BOTH SIDES
- TWO LONGDITUDINAL WELDS PER CAN CONSIDERED (180° APART)
- NO GRINDING U.N.O.
- GRIND MARKINGS:
  - GI : GRIND INSIDE
  - GO : GRIND OUTSIDE
  - GB : GRIND BOTH
- TOTAL WEIGHT OF 1268 mT (EXCL. FLANGE)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
01	FOR INFORMATION	02-04-25				AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: CONICAL MONOPILE DESIGN

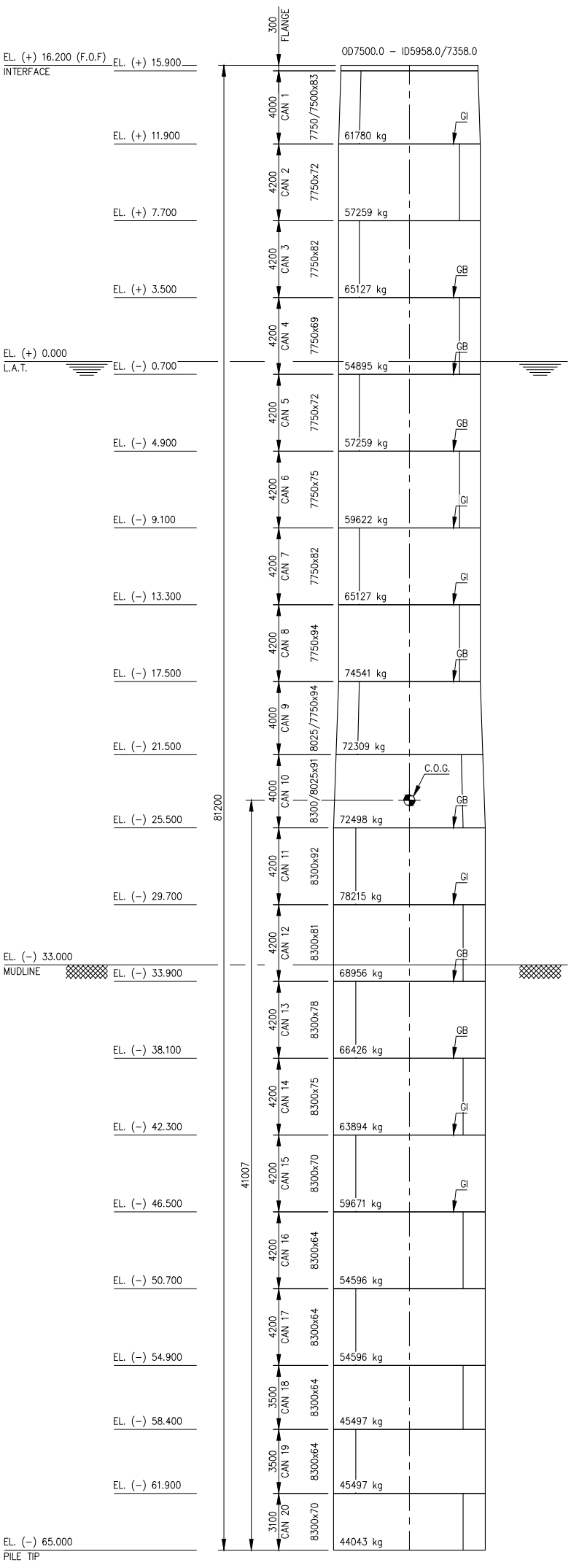
TITLE: MONOPILE Acb, WITH CONVENTIONAL PLATFORM

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No. –					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:150		A1	SP2300089	– D –	S –	23101 –	01	01

Z:\Project\SP2300089\Structural\Datasheets-Drawings\SP2300089-D-S-23101-01-01.dwg



FRONT VIEW

GENERAL NOTES

- ALL DIMENSIONS ARE GIVEN IN MILLIMETERS (mm) U.N.O.
- ALL ELEVATION ARE GIVEN IN METERS (m).
- ALL DIAMETERS ARE GIVEN AS O.D. U.N.O.
- ALL MATERIAL TO BE STEEL GRADE S355JR ACC. TO EN 10025–2
- ALL WELDS TO BE FULL PEN FROM BOTH SIDES
- TWO LONGDITUDINAL WELDS PER CAN CONSIDERED (180° APART)
- NO GRINDING U.N.O.
- GRIND MARKINGS:
  - GI : GRIND INSIDE
  - GO : GRIND OUTSIDE
  - GB : GRIND BOTH
- TOTAL WEIGHT OF 1246 mT (EXCL. FLANGE)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
01	FOR INFORMATION	04–02–25				AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: CONICAL MONOPILE DESIGN

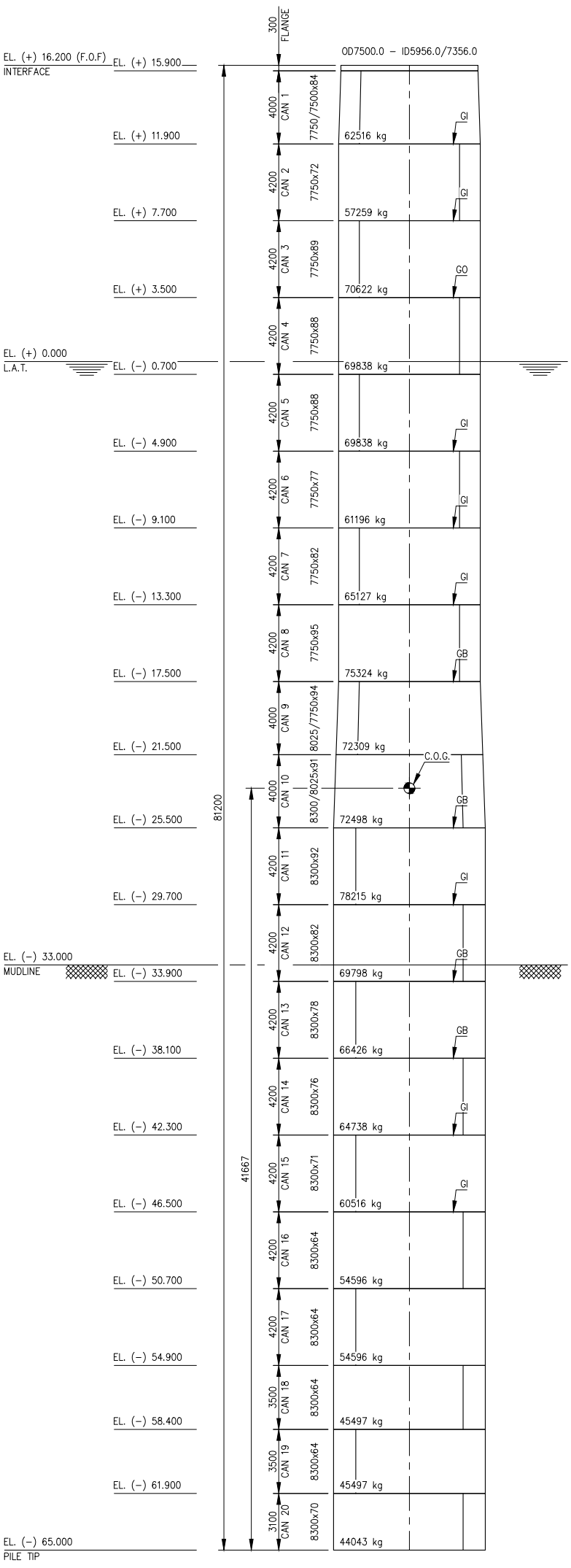
TITLE: MONOPILE As, WITH SKYBOX PLATFORM

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No. –					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:150		A1	SP2300089	– D –	S –	23102 –	01	01

Z:\Project\SP2300089\Structural\Datasheets-Drawings\SP2300089-D-S-23102-01-01.dwg



FRONT VIEW

GENERAL NOTES

- ALL DIMENSIONS ARE GIVEN IN MILLIMETERS (mm) U.N.O.
- ALL ELEVATION ARE GIVEN IN METERS (m).
- ALL DIAMETERS ARE GIVEN AS O.D. U.N.O.
- ALL MATERIAL TO BE STEEL GRADE S355JR ACC. TO EN 10025–2
- ALL WELDS TO BE FULL PEN FROM BOTH SIDES
- TWO LONGDITUDINAL WELDS PER CAN CONSIDERED (180° APART)
- NO GRINDING U.N.O.
- GRIND MARKINGS:
  - GI : GRIND INSIDE
  - GO : GRIND OUTSIDE
  - GB : GRIND BOTH
- TOTAL WEIGHT OF 1285 mT (EXCL. FLANGE)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	DISC. ENG.	K.C.I. APPR.	CLIENT APPR.
01	FOR INFORMATION	04–02–25				AmS	

CLIENT: SIF OFFSHORE FOUNDATIONS

PROJECT: CONICAL MONOPILE DESIGN

TITLE: MONOPILE Asb, WITH SKYBOX AND BOATLANDING

Sif OFFSHORE FOUNDATIONS

KCI THE ENGINEERS.

SCALE	PROJ.	SIZE	CLIENT DRG No. –					
			PROJECT	TYPE	DISC.	NUMBER	SHT.	REV.
1:150		A1	SP2300089	– D –	S –	23103 –	01	01

Z:\Project\SP2300089\Structural\Datasheets-Drawings\SP2300089-D-S-23103-01-01.dwg

5.5 Annex 5 - HES Logistical analysis

<>

SIF – Logistical Analysis Skybox

CLIENT NAME

DOC NUMBER **HES-217-RPT-001 – 00U**

DATE **05-03-2025**

		PREP HES	CHECK HES	APPROVE HES
		DDa	SdB	RvR
00U	IFU			

Revision Record

Rev	Description	Issue Date	Revision amendment details	Prep	Check	Appr.
00R	IFR	05-02-2025	Updated analysis for revision	DDa	SdB	RVR
00U	IFU	03-03-2025	Issue for use: - Text adjusted in Section 3.2.5 - Native files cost comparison (Appendix D) shared via email	DDa	SdB	RVR

Hold Record

Hold Ref	Description / Reason for Hold

ENGINEERING SOLUTIONS

Table of Contents

1.0 INTRODUCTION

1.1 General

SIF has requested Heerema Engineering Solutions (HES) to provide an update on the logistical analysis performed in 2022 (HES-0128-RPT-001). The Skybox concept has matured which results in a slightly different installation approach. In addition, SIF requested to add a comparison with the installation of a concrete platform into the study. This report quantifies the potential advantage of using the Skybox concept with respect to a conventional transition piece (TP), TP-less monopile with access platform and boat landing installation, or a concrete platform installation. The Skybox is a new type of access platform which can be installed in a more cost efficient way. The installation of this system requires less critical installation time and has less stringent operational limits during installation.

A comparison will be made between the following installation scenario's and methodologies:

1. **Conventional MP and TP installation**
   This scenario involves a typical foundation installation using a monohull vessel (scenario 1a) and a jackup (scenario 1b). After the monopile has been installed a TP will be installed using the same vessel.
2. **TP-less foundation installation (MP + access frame/boat landing)**
   This scenario involves the installation of a TP-less MP foundation using a monohull vessel (scenario 2a) and a jackup (scenario 2b). However, some secondary steel such as a boat landing will still have to be installed by the vessel after the MP has been installed.
3. **MP and Skybox installation**
   This scenario involves the installation of a typical MP foundation using a monohull vessel (scenario 3a) and jackup (scenario 3b), after which the Skybox will be installed by the same vessel. Furthermore, a sensitivity (scenario 3c) is investigated where the MP is installed by the Monohull vessel and the Skybox by a smaller vessel.
4. **Concrete platform installation**
   This scenario involves the installation of a concrete platform using a monohull vessel (scenario 4a) and jackup (scenario 4b). Two more sensitivities are investigated, the first sensitivity is where MP is installed with the Monohull vessel and the concrete platform is installed by a separate smaller vessel (scenario 4c). The second sensitivity (scenario 4d) is where the MP and concrete platform are both installed by the same Monohull vessel, but the grouting is done by a separate smaller offshore support vessel (OSV).

1.2 Scope Description

The purpose of this document is to show the logistics potential of a new 'Skybox' concept with respect to a conventional transition piece (TP), TP-less monopile(MP) with an access platform and boat landing installation, or a concrete platform. This report is an updated version of the previously issued report HES-0128-RPT-001.

1.3 Abbreviations & Acronyms

ATP	Airtight Platform
DP	Dynamic Positioning
HES	Heerema Engineering Solutions
HKZ	Hollandse Kust Zuid
Kn	Knots
MHV	Monohull vessel
MP	Monopile
nm	Nautical Mile
OSV	Offshore support vessel
P10	10% percentile
P50	50% percentile
P90	90% percentile
RAO	Response Amplitude Operator
TP	Transition Piece
Vw	Wind speed

2.0 SUMMARY AND CONCLUSIONS

2.1 Summary

This report shows the logistics potential of a new 'Skybox' concept with respect to a more conventional MP and TP installation and the TP-less variant. These scenarios are compared to each other using two different installation vessels, namely a monohull vessel and a jackup.

Various assumptions were made to be able to conduct a valid comparison between the Skybox and the other installation methods. One of the assumptions is that there is a DP Gripper solution available for the installation of the foundation for the monohull vessel.

Every scenario consists of various activities in a certain order (sequence) such that it resembles a foundation installation. Each activity has a unique duration and a unique combination of weather limits which best represents engineering judgement and prior experience. However, similar activities between scenarios have similar durations and weather limits. This allows for a fair comparison between the scenarios.

A net simulation run and many Monte Carlo runs are performed to get insights into the workability of every scenario. The simulations vary in the total number of installed foundations and the date in which the simulations starts its installation campaign. By creating "buckets" of simulations of a starting month and simulating over 20 years of historical weather data, allows for the workability to be quantified with statistics. Consequently, the 10%, 50% and 90% percentiles can be determined for every starting month and number of installed foundations (up to 150 foundations have been simulated in this study).

The results show that the Skybox variant has a faster project execution duration for every amount of installed foundations and every start month. This is the case for the monohull and jackup installation vessels.

A sensitivity of the Skybox variant using a monohull is where the Skybox and MP are installed using separate vessels. This variant is faster than using just one vessel. However, it comes with additional costs as an additional vessel is needed.

At last, the results show that the start date is important for the total project execution duration. This duration also increases and shifts more towards the winter with increasing number of installed foundations. As the skybox installation uses less installation days than the other scenarios, it provides more flexibility to select a starting date.

2.2 Conclusion

Based on the logistical comparison of the Skybox installation against conventional secondary steel system installations, several conclusions are drawn with respect to the simulated scenarios.

The Skybox installation scenario is always faster compared to the conventional MP and TP installation scenario, TP-less scenario, and the concrete platform. This is the case for a monohull vessel and a jackup. The magnitude of the duration reduction depends on the amount of foundations, the starting date of the foundation installation campaign, and the specific scenario. In general, the results show an increased performance of 0 days up to about 4 months depending on the aforementioned variables. Furthermore, the Skybox scenario is less sensitive to weather during the installation campaign.

A sensitivity of the Skybox scenario using a monohull is investigated, where the Skybox and MP are installed using separate installation vessels. This scenario is faster than using a single installation vessel. When using the same scenario for the concrete platform installation (MP and secondary steel installed by separate MHVs), the Skybox and concrete platform scenarios have similar durations. The MP installation is governing in this case, which has a similar duration for both cases. However, the separate vessel installing the skybox has more idle time that the separate vessel installing the concrete platform. This means that the use of the vessel installing the skybox can be optimized, resulting in a shorter hiring period. This will make the skybox installation economically favourable compared to the concrete platform from an installation asset point of view.

2.3 Recommendations

The following recommendations are made regarding the Skybox logistical study.

All of the activity durations and weather limits included in the analysis are based on engineering judgement and experience. The durations and weather limits provide a preliminary indication of the workability for the Skybox and conventional scenarios. When more detailed activity durations become available at a later design stage, it is recommended to perform another logistical assessment with the updated durations, as the durations and weather limits greatly influence the resulting workability.

This study was done to get an objective and a representative view on the installation time reduction potential of the Skybox. The weather limits and activity durations were selected to represent an average vessel able to install such foundations. A more detailed study should be done for specific project with their vessels including weather limits and activity durations.

As concluded in Section 2.2, there is potential for optimizing the schedule of the second installation vessel when used for installing Skyboxes. Hence, it is recommended to investigate how much vessel hire time can be reduced for this second installation vessel, and which would allow quantifying the cost savings that be achieved for scenario 3c.

3.0 BASIS OF ANALYSIS

3.1 Assumptions

To be able to simulate the scenarios and allow for a fair comparison between the scenarios, several assumptions are made. This section describes the assumptions made and the reasoning behind these assumptions.

For this study the Hollandse Kust Zuid (HKZ) project is used for the locations of the imaginary wind farm. The distance from the field to SIF's yard is approximately 25 nautical miles (nm).

There are two types of vessels used in this study: a monohull vessel (MHV) based on Heerema's Aegir and Seaway's Strashnov, and a jackup vessel based on van Oord's Aeolus. The vessel specific response amplitude operators (RAO's) are computed based on these vessels. The average sailing speed for the MHV is 10 knots (kn) and 8kn for the jackup.

It is assumed that the monohull vessels will have a DP Gripper like solution to install the foundations on DP. The expectation is that in several years, multiple functioning DP Gripper systems will be available as multiple companies are developing these kind of solutions at the time of writing this report.

Another assumptions is that breakdown of equipment is not included in the simulations. Breakdown can have a big impact on the workability of a simulation or scenario. However, this will make the simulation more complex and harder to compare as well.

The last assumption is that the yard (SIF) can handle the loadout of the MPs and Skyboxes on two separate vessel at the same time. It is assumed that the yard is big enough to serve two vessels. Furthermore, the MP, TP, Skyboxes and other components are always ready and are not on the critical path of the installation sequence.

3.2 Simulation input

Every scenario (as described in section 1.1) has specific installation sequences. These sequences consist of consecutive activities where each activity has a combination of multiple of the following attributes:

- Activity (-): A description of the activity;
- Time (hours): The duration of the activity;
- Weather window (hours): The duration of which the activities weather limits are checked;
- Break (-): Similar consecutive labels have to be executed together without having to wait on weather;
- Weather limits (-): Weather limits which cannot be exceeded for the activity to be executed. If the weather limit is exceeded then the first moment where the activity can be executed for a duration of the weather window will be used to execute

the activity instead. There are multiple or a combination of weather limits possible. In this study there's a variation on:

- Roll (deg): Maximum roll of the vessel;
- Pitch (deg): Maximum pitch of the vessel;
- Hs (meter): Maximum allowed significant wave height;
- Vw (m/s): Maximum allowed wind speed;
- specHsTp2 ($m*s^2$): Maximum combined significant wave height, peak period squared, which is a measure of the sea state.

Many of the activity durations and weather limits are based on the experience of HES' project and marine engineers.

3.2.1 Scenario 1a – Conventional MP/TP installation using a monohull vessel

The installation sequence for all scenarios are similar. Therefore scenario 1a is explained in more detail (see Table 3-1) after which the differences for the other scenarios are highlighted in the next sections.

Table 3-1, activity details including weather limits of scenario 1a

1a) MP and TP installation Monohull vessel (3x MP / TP on deck)								
						Weather limits		
Activity	Time [h]	Weather window [h]	Break	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field [1]	2.50					4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Install TP, release rigging and transfer to deck [2]	1.50	2.50	TP	0.50	0.50		12.90	
Connect TP to MP (bolting) (including mod/demob equipment [3]	3.00	3.00	TP			3.00	12.90	200.00
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Install TP, release rigging and transfer to deck	1.50	2.50	TP	0.50	0.50		12.90	
Connect TP to MP (bolting) (including mod/demob equipment	3.00	3.00	TP			3.00	12.90	200.00
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Install TP, release rigging and transfer to deck	1.50	2.50	TP	0.50	0.50		12.90	
Connect TP to MP (bolting) (including mod/demob equipment	3.00	3.00	TP			3.00	12.90	200.00
Sail to yard (SIF)	2.50							
Load next set of MP and TP	24.00						12.90	
	71.50							

The sequence starts with the monohull vessel moving from the yard to the field. An OWF location approximately 25nm from the yard is considered. This results in a 2.5hr sail at a speed of 10kn. The significant wave height (Hs) limit is 4 meters due to the MP and TP being on the deck of the vessel. Furthermore, there is a specHsTp2 limit to limit swell driven sea states.

The next two activities are the "Lift, upend & stab monopile" and "Drive monopile to final penetration and retrieve hammer to deck". These two have to be executed together without having downtime due to weather. The durations and weather windows are assumed based on experience from previously executed projects. A roll and pitch limit are included to make sure the vessel does not move too much which could impact the

operation. The roll and pitch limits are stricter compared to the MP driving activity because the MP is hanging in the crane when lifting it. The MP or hammer will be hanging in the crane during the operations and therefore the wind speed must be limited to prevent the pile from moving too much as well.

The operation is continued with "Install TP, release rigging and transfer to deck" and "Connect TP to MP (bolting) (including mod/de mob equipment)". These two activities have to be executed subsequently without interruption due to weather. Again, the durations are assumed based on experience. The "Install TP, release rigging and transfer to deck" activity has roll, pitch and wind speed limits as the TP may not move too much as a result of the vessel's motion or excitation due to the wind (12.9 m/s). The maximum allowable set-down load of the TP may not be too large. For the bolting operation it has been assumed a walk-to-work system is operational on the installation vessel which has a Hs limit of 3m. This will have some vessel movement limits as well when working from a monohull.

The last operation in one cycle is "Relocate to next location". It is assumed that the relocating within the same field to the next location, including preparations takes approximately 1 hour. The weather limits are similar to that of "Sail from Yard (SIF) to field" as the MP and TP are still on the deck.

It is assumed that the MHV can store 3-off MP's and TP's on its deck. The activities are repeated 2 times to empty the deck of the MHV after which it will sail to the yard to pick-up the next set of components. There is no weather limit on "sail to yard (SIF)" as the deck is empty and it is assumed that the vessel can always sail to the yard. In the yard the MPs and TPs are loaded on the vessel in sets of 3. There is a wind speed limit of 12.9 m/s which is a limit used in the offshore industry for crane operations.

3.2.2 Scenario 1b – Conventional MP/TP installation using a jackup

This scenario is similar to scenario 1a. The only difference is that two activities have been added.

Table 3-2, activity details including weather limits of scenario 1b

1b) MP and TP installation Jack-up (3x MP / TP on deck)		Weather limits			
Activity	Time [h]	Weather window [h]	Break	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field [1]	3.00	3.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Install TP, release rigging and transfer to deck [2]	1.50	2.50	TP		12.90
Connect TP to MP (bolting) (including mod/demob equipment [3]	3.00	3.00	TP		12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Install TP, release rigging and transfer to deck	1.50	2.50	TP		12.90
Connect TP to MP (bolting) (including mod/demob equipment	3.00	3.00	TP		12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Install TP, release rigging and transfer to deck	1.50	2.50	TP		12.90
Connect TP to MP (bolting) (including mod/demob equipment	3.00	3.00	TP		12.90
Jack down	3.00	4.00		1.50	
Sail to yard (SIF)	3.00	3.00		1.80	
Load next set of MP and TP	24.00	24.00			12.90
	93.50				

The first added activity is the "Setup Jack-up (pre-load, jack-up)". This activity includes preloading of the jackup and jackup up itself. The preloading is a critical sub activity where a strict weather limit is used (1.8m), which is also why the required weather window is relatively large. Once the jackup is out of the water, the sea has no impact on the workability of the jackup anymore.

The second added activity is the jackdown activity. Returning the jackup into the sea where the legs will be removed from the soil is a critical part for this activity. Which is why this activity also has a strict significant wave height limit of 1.5m.

At last, there is a difference in the weather limits of the activities once the jackup is jacked up. As the jackup is out of the water and therefore will not move due to sea states, the operations are only limited by the wind speed for the crane operations (12.9 m/s).

3.2.3 Scenario 2a – TP-less installation using a monohull vessel

Table 3-3, activity details including weather limits of scenario 2a

2a_1) MP, platform and boatlanding installation Monohull vessel (3x MP, platform and boatlanding)								
						Weather limits		
Activity	Time [h]	Weather window [h]	Break	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck[4]	3.50	4.50		1.00	1.00		12.90	
Lift and install access platform[5]	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50		1.00	1.00		12.90	
Lift and install access platform	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50		1.00	1.00		12.90	
Lift and install access platform	2.00	3.00		1.00	1.00		12.90	
Sail to yard (SIF)	2.50							
Load next set of MP, access platform and boat landing	24.00	24.00					12.90	
	74.50							

The TP related activities from scenario 1a are replaced with the installation of an airtight platform, boatlanding and access platform. For this scenario it is assumed that the airtight platform and boatlanding are installed in a single lift, using a combi installation tool, based on the latest insights in the industry.

The "Lift and install airtight platform, and boatlanding, retrieve rigging to deck" has the following sub activities including durations: connect crane to rigging (0.5 hr), lift and place platform (0.5 hr), install airtight platform (1.5 hr), install boatlanding (0.5 hr), retrieve tool and rigging (0.5 hr), connect platform to MP in non-critical time.

Furthermore the "Lift and install access platform" has the following sub-activities including durations: "Connect crane to rigging (0.5 hr), lift and place platform (0.5 hr), retrieve rigging (0.5 hr), connect platform (0.5 hr)"

Both the lift tool with airtight platform and boatlanding, and the access platform have roll and pitch limits of 1 degree to limit the movement and orientation changes of these components. There is a wind speed limit as this is the general limit for the cranes.

3.2.4 Scenario 2b - TP-less installation using a jackup

This scenario is similar to scenario 3a, the only difference is that a jackup is used instead. Section 3.2.2 describes the differences between a monohull and jackup which also applies to this scenario compared to scenario 2a.

Table 3-4, activity details including weather limits of scenario 2b

2b_1) MP, platform and boatlanding installation Jack-up (3x MP, platform and boatlanding)			Weather limits		
Activity	Time [h]	Weather window [h]	Break	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	3.00	3.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, install boatlanding, retrieve rigging to deck [4]	3.50	4.50			12.90
Lift and install access platform [6]	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, install boatlanding, retrieve rigging to deck	3.50	4.50			12.90
Lift and install access platform	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, install boatlanding, retrieve rigging to deck	3.50	4.50			12.90
Lift and install access platform	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Sail to yard (SIF)	3.00	3.00		1.80	
Load next set of MP, access platform and boat landing	24.00	24.00			12.90
	96.50				

3.2.5 Scenario 3a – MP/Skybox installation using a monohull vessel

The only difference between scenario 1a and this scenario is that the installation of the TP is replaced with the installation of a Skybox.

Table 3-5, activity details including weather limits of scenario 3a

3a) MP and Skybox installation Monohull vessel (3x MP and skybox)				Weather limits				
Activity	Time [h]	Weather window [h]	Break	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install skybox, retrieve installation tool[7]	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install skybox, retrieve installation tool[7]	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install skybox, retrieve installation tool [7]	2.00	3.00		1.00	1.00		12.90	
Sail to yard (SIF)	2.50							
Load next set of MP and skybox	24.00	24.00					12.90	
	64.00							

It is assumed that all items (air tight platform, skybox and cover) are pre-connected to the installation tool. Furthermore, the 'Lift and install Skybox, retrieve installation tool' consists of the following sub-activities: connect crane to tool (0.5 hr), lift and engage all onto MP (0.5 hr), lower ATP, retrieve tool and close cover (1 hr). The difference between the TP and Skybox installation is driven by the allowable TP set down impact (low speed), the Skybox is connected by a slip joint which installation is less weather restricted.

3.2.6 Scenario 3b – MP/Skybox installation using a jackup

The only difference between scenario 3a and this scenario is that the a jackup vessel is used instead of a monohull vessel. Section 3.2.2 describes the differences between a monohull and jackup which also applies to this scenario compared to scenario 3a.

Table 3-6, activity details including weather limits of scenario 3b

3b) MP and Skybox installation Jack-up (3x MP and skybox)			Weather limits		
Activity	Time [h]	Weather window [h]	Break	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	3.00	3.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	5.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install skybox, retrieve installation tool [7]	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	5.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install skybox, retrieve installation tool	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	5.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install skybox, retrieve installation tool	2.00	3.00			12.90
Jack down	3.00	4.00		1.50	
Sail to yard (SIF)	3.00	3.00		1.80	
Load next set of MP skybox	24.00	24.00			12.90
	86.00				

3.2.7 Scenario 3c - Skybox installation using a separate vessel

Scenario 4a is a different from the previous scenarios. It is a sensitivity based on scenario 3a where one monohull vessel picks up and installs the MPs and another one the Skyboxes. The durations and weather limits are similar to the activities found in scenario 3a, however, there are two sequences in parallel (see Table 3-7 and Table 3-8).

Table 3-7, activity details including weather limits scenario 3c

3c) MP and Skybox installation Monohull vessel (3x MP)			Weather limits				
Activity	Time [h]	Weather window [h]	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Relocate to next location [1]	1.00	1.00			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Relocate to next location	1.00	1.00			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Sail to yard (SIF)	2.50						
Load next set of MPs	16.00	16.00				12.90	
	50.00						

Table 3-8, activity details including weather limits scenario 3c

3c) MP and Skybox installation Monohull vessel (10x skybox)			Weather limits			
Activity	Time [h]	Weather window [h]	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	2.50					
Lift and install skybox, retrieve installation tool [1]	2.00	3.00	1.00	1.00		12.90
Relocate to next location	1.00	1.00				12.90
Repeat 9x						
Sail to yard (SIF)	2.50					
Load next set of Skybox [2]	24.00	24.00				12.90
	32.00					

It is assumed that 10 skyboxes fit on deck of the separate monohull vessel. This is based on a Jumbo Fairplayer with 1500m^2 free deck space and a skybox having an area of 140m^2 (see Figure 3-1).

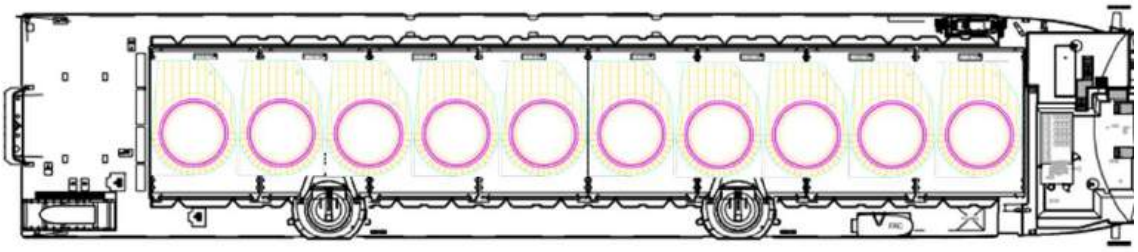


Figure 3-1: schematic of Jumbo Fairplayer with 10 skyboxes placed on deck

3.2.8 Scenario 4a – Concrete platform installation using a monohull vessel

Scenario 4a consists of the installation of a MP and a grouted concrete platform. The scenario setup is the same as scenario 2a, only the concrete platform has to be grouted after installation which adds an estimated duration of 3 hours to each installation.

The duration of three hours is composed of 1 hr mobilizing personnel and equipment onto the platform, 1 hr grouting and 1 hr demobilizing the personnel and equipment off the platform.

Table 3-9: activity details including weather limits scenario 4a

4a) MP and concrete platform installation Monohull vessel (3x MP and skybox)			Weather limits				
Activity	Time [h]	Weather window [h]	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp 2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50	1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00	1.00	1.00		12.90	
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			3.00	12.90	200.00
Relocate to next location	1.00	1.00			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50	1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00	1.00	1.00		12.90	
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			3.00	12.90	200.00
Relocate to next location	1.00	1.00			4.00		250.00
Lift, upend & stab monopile	3.00	4.00	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50	1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00	1.00	1.00		12.90	
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			3.00	12.90	200.00
Sail to yard (SIF)	2.50	2.50					
Load next set of MP, ATPs, Covers, grout and concrete platform	30.00	30.00				12.90	
	89.50						

3.2.9 Scenario 4b – Concrete platform installation using a jackup

Scenario 4b is the same as scenario 4a, but then the foundation and concrete platform are installed by a jack up vessel.

Table 3-10: activity details including weather limits scenario 4b

4b) MP and Concrete platform installation Jack-up (3x MP and Concrete platform)			Weather limits		
Activity	Time [h]	her window	Break	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	3.00	3.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50			12.90
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00			12.90
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50			12.90
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00			12.90
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			12.90
Jack down	3.00	4.00		1.50	
Relocate to next location	1.00	1.00		1.80	
Setup Jack-up (pre-load, jack-up)	4.00	6.00		1.50	
Lift, upend & stab monopile	3.00	4.00	MP		12.90
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP		12.90
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50			12.90
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00			12.90
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			12.90
Jack down	3.00	4.00		1.50	
Sail to yard (SIF)	3.00	3.00		1.80	
Load next set of MP, ATPs, Covers and concrete platform	30.00	30.00			12.90
	111.50				

3.2.10 Scenario 4c – Concrete platform installation using a separate vessel

Scenario 4c is a sensitivity on scenario 4a, whereby the MP is installed by a MHV and the concrete platform installation and grouting operation are performed by a smaller installation vessel, like Jumbo Fairplayer.

It is assumed that 5 sets of secondary steel (concrete platform, ATP, cover) fit on deck of the Jumbo Fairplayer, as illustrated in Figure 3-2 below.

Table 3-11: activity details including weather limits scenario 4c

4c) MP and Concrete installation Monohull vessel (3x MP)						Weather limits		
Activity	Time [h]	Weather window [h]	Break	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Sail to yard (SIF)	2.50							
Load next set of MPs	16.00	16.00					12.90	
	50.00							

4c) MP and Concrete installation Monohull vessel (10x concrete + grouting)						
Activity	Time [h]	Weather window [h]	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	2.50					
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50	1.00	1.00		12.90
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00	1.00	1.00		12.90
Bring grout personnel on concrete platform, grouting annulus, bring personnel back	3.00	4.00			3.00	12.90
Relocate to next location	1.00	1.00				12.90
Repeat 4x						
Sail to yard (SIF)	2.50					
Load next set of concrete platforms, ATPs, covers and grout	30.00	30.00				12.90
	44.50					

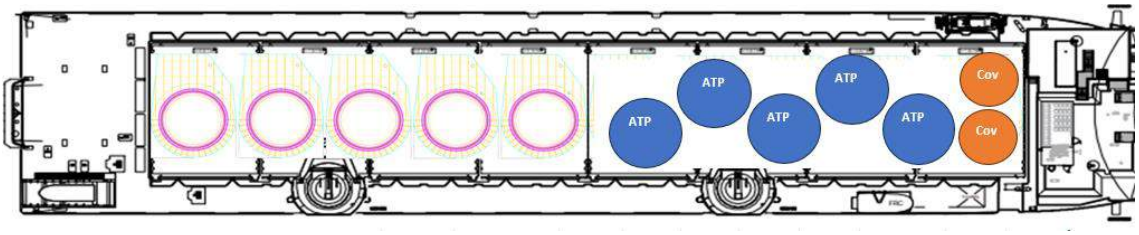


Figure 3-2: Schematic deck layout of Jumbo Fairplayer with 5 sets of secondary steel

3.2.11 Scenario 4d – Concrete platform installation using a separate vessel for grouting

Scenario 4d is a second sensitivity on scenario 4a, whereby the installations of the MP and concrete platform are done by a MHV, and an Offshore Supply Vessel (OSV) is performing the grouting after the secondary steel is installed. The OSV is assumed a vessel similar to the Normand Baltic OSV. For determining the amount of grout the OSV can bring, the vessel Normand Baltic is used as an example. This vessel can take a grout volume of approximately 400 m3 grout onboard. The required grout for one concrete platform is estimated to be 6 m3, hence it is assumed that the OSV can grout roughly 50 locations before loading new grout in the port.

The grouting duration in this scenario is 0.5 hr longer than in scenario 4a, 4b and 4c (3.5 hr instead of 3 hr), as the OSV is a smaller and less stable vessel, and therefore takes more time to get into position and prepare for the grouting operation.

Table 3-12: activity details including weather limits scenario 4d

4d) MP and concrete platform installation Monohull vessel (3x MP and skybox)				Weather limits				
Activity	Time [h]	Weather window [h]	Break	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]	specHsTp2 [m*s^2]
Sail from Yard (SIF) to field	2.50	2.50				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck	3.50	4.50		1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck [8]	3.50	4.50		1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00		1.00	1.00		12.90	
Relocate to next location	1.00	1.00				4.00		250.00
Lift, upend & stab monopile	3.00	4.00	MP	0.50	0.50		12.90	
Drive monopile to final penetration and retrieve hammer to deck	6.00	7.00	MP	1.00	1.00		12.90	
Lift and install airtight platform, and boatlanding, retrieve rigging to deck [8]	3.50	4.50		1.00	1.00		12.90	
Lift and install concrete platform and cover, retrieve installation tool	2.00	3.00		1.00	1.00		12.90	
Sail to yard (SIF)	2.50							
Load next set of MP and skybox	30.00						12.90	
	80.50							

4d) MP and Concrete installation Offshore support vessel (50x grouting)						
Activity	Time [h]	Weather window [h]	Roll [deg]	Pitch [deg]	Hs [m]	Vw [m/s]
Sail from Yard (SIF) to field	2.50				4.00	
grouting operation	3.50	4.50			3.00	12.90
Relocate to next location	1.00	1.00				12.90
Repeat 49x						
Sail to yard (SIF)	2.50				4.00	
Load next batch of grout and change crew	24.00					12.90
	33.50					

3.3 Simulation software (Metis)

Offshore wind turbine T&I projects involve large vessel spreads and complex logistical interaction between different supply chains. In order to simulate these projects and determine the weather risk associated with these operations, HES has developed an in-house discrete event simulator called Metis. This software package provides both high-level and detailed schedules, is able to quickly determine the sensitivity of different aspect of the installation schedule and eases the process of optimizing the offshore operation.

Metis is used to analyse how the Skybox system compares to the conventional concepts with respect to installation duration, weather risk and operational performance.

4.0 METHODOLOGY

4.1 Monte Carlo

In the Monte Carlo simulations downtime owing to weather limits are included. To get statistical measures for the expected workability due to weather, many simulations are performed over a historical weather database. In section 3.1 the project location HKZ was chosen as a representative location. For the historical database a nearby location has been chosen which represents the project location well. This historical weather database consists of 20 years of data (1995 up to 2015).

Weather in the historical database will greatly vary between weeks, months and years. Therefore, no single day will be similar to another day. The effects of weather will therefore impact the total installation time for any amount of installed foundations (n-installed foundations), which is why it is essential to include weather into the logistics of the multiple scenarios. The weather limits for every scenario were described in section 3.2.

The Monte Carlo simulations are run with an interval of seven days from each other. This means that the simulation starting date will vary every 7 days. It was shown in a previous study conducted by HES that there is not much difference in the final statistics between a 1 day and 7 day interval and it will significantly increase the computational speed and reduce the storage space required.

Eventually there are approximately 1040 simulations done for every scenario (which is 7*1040 ~ 7280 simulations total). Multiple results (figures and tables) will show a project duration for n-installed foundations if one was to start in a certain starting month, for example: 100 foundations starting in January. These results were obtained by:

1. Calculating the time required for every foundation to be fully installed;
2. Placing all starting dates for every year in buckets of single months;
3. Calculating the n% percentile of the time required for every foundation to be fully installed if one was to start in a certain month.

After doing so, results such as the 50% (P50) and 90% (P90) project duration for n-installed foundations can be determined. The P50 will be a certain simulation (out of the 1040 total simulations) with a certain starting date which best represents the P50 for the n-installed foundations. It is highly likely that the simulation after the P50 (for example P51) will have a starting date of a totally different year. Therefore, it is not possible to extrapolate the P50 to any other percentile. Furthermore, it is also not possible to extrapolate the n-installed foundations to any other n-installed foundations. In chapter 5.0, a surface plot with all combinations of n-installed foundations is shown such that interpolation is not needed.

5.0 RESULTS

The results will be shown in two sections. The first section will show the net simulation results. These are simulations without weather limits included. The second section are the workability results, which will include weather limits.

5.1 Net simulation

The net simulation will show the results without weather limits. The main purpose of this section is to show that a) the logic of the simulation is correct and b) which simulation would be the fastest without weather limits which also allows it to show the impact weather limits have on the simulation. The net simulation results are shown per scenario with a short description in Appendix A. The skybox solution installed with a monohull vessel (scenario 3a) for the first 15 installed foundations is shown in Figure 5-1.

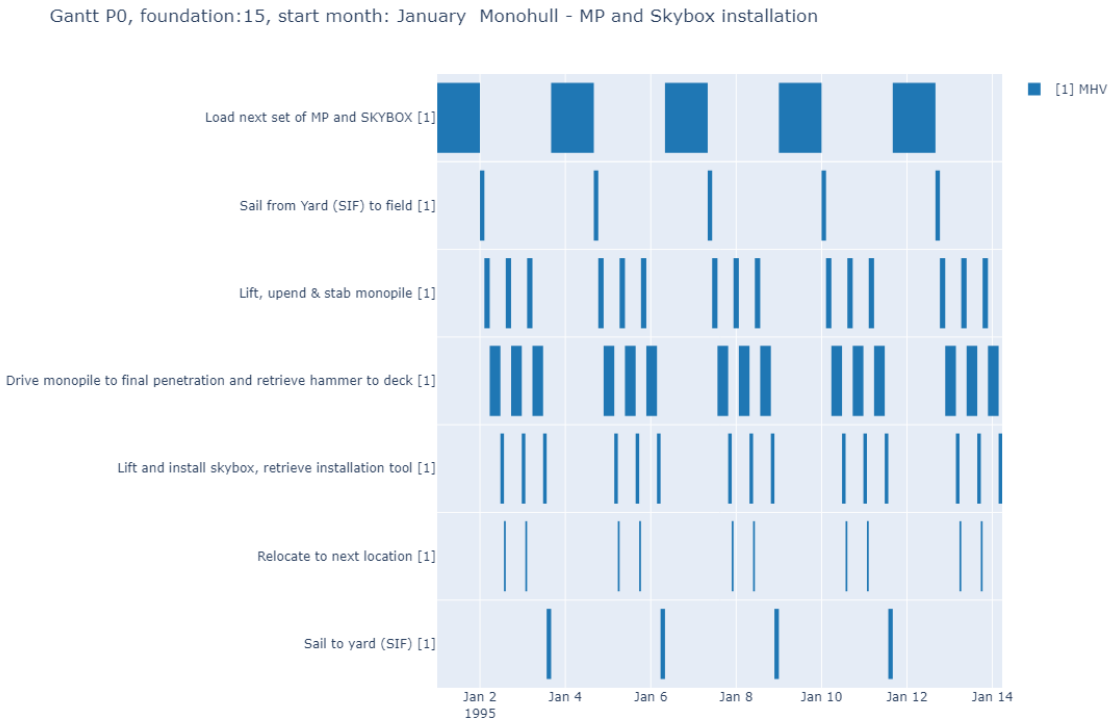


Figure 5-1, Gantt chart without weather of scenario 3a for the first 15 foundation installations.

Table 5-1 shows a summary of the net total installation time of 100 foundations. The net results show that the skybox scenarios are the fastest for both the monohull (1a, 2a, 3a and 4a) and jackup (1b, 2b, 3b and 4b). Adding weather limits may change this. Furthermore, scenario 3c where a separate vessel installs the skyboxes, is the overall fastest scenario, which is a sensitivity of scenario 3a. Moreover, the installation of concrete platforms in slower than the other scenarios due having to install multiple

components and having to grout. When comparing the installation of the skybox with a separate vessel (3c) and a concrete platform with a separate vessel (4c), the duration to install 100 foundations is similar. The MP installation is governing in this case, which has a similar duration for both cases. However, the separate vessel installing the Skybox has more idle time that the separate vessel installing the concrete platform. This means that the use of the vessel installing the Skybox can be optimized, resulting in a shorter hiring period.

Furthermore, if grouting of the concrete platform is done by a separate vessel (4d) then the installation takes less time compared to when this is done by the same vessel as which does the concrete platform installation (4a).

In general a jackup vessel is slower than a monohull vessel because of the additional time required for jacking up and jacking down.

Table 5-1, summary of the net simulation project duration (days) for 100 installed foundations

Net simulation results (days)			Scenario			
			MP & TP	TP-Less	Skybox	Concrete Platform
			1	2	3	4
Vessel	Monohull	a	100	104	90	125
	Jackup	b	130	135	120	156
	Separate vessel	c	-	-	70	70
	Separate grouting vessel	d	-	-	-	113

5.2 Workability

This section will show various results for all simulations including downtime owing to the weather limits being exceeded. A useful figure is the bar plot which indicates the project duration for 100 installed foundations for every month during the year. Such a figure shows the optimum start month and the risks (defined as the difference between the P90 and P10) involved compared to the other scenarios.

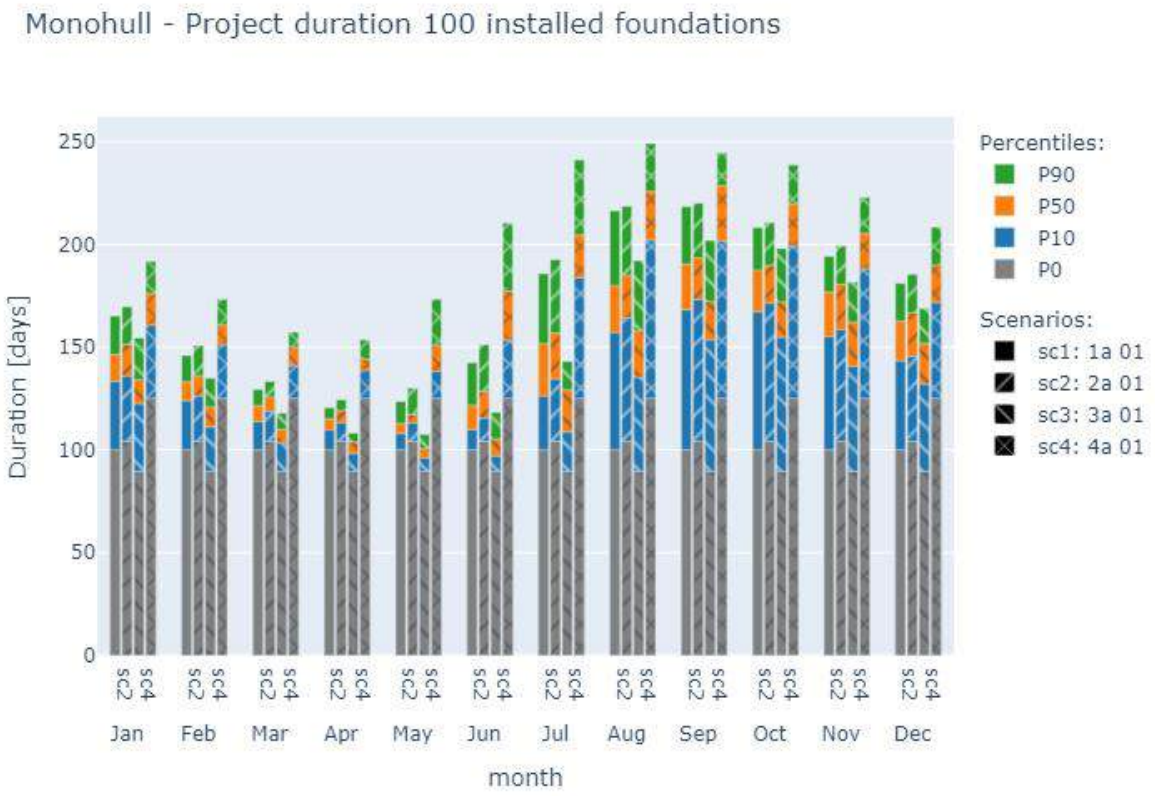


Figure 5-2, the P10, P50 and P90 project durations for 100 installed foundations for scenarios 1a, 2a, 3a and 4a (monohull vessel).

For the scenarios with a monohull vessel it can be seen that the Skybox (scenario 3a) variant is the fastest, no matter which month the project starts (see Figure 5-2). However, the risk of delay due to weather limitations (quantified as P90 – P10) is approximately equal compared to the other scenarios. An ideal month to start is April/May as this has the shortest project duration and lowest risk. Which is expected given the installation campaign is mostly done in the summer months.

Scenario 1a (conventional MP and TP installation) takes longer to complete than the Skybox variant, however, is faster than a TP-less variant (scenario 1b). The installation of a concrete platform takes the longest time to complete due to the additional time required for grouting. The optimum start month is therefore shifted to earlier in the year, approximately March/April.

In general similar results are observed for the jackup scenarios (Figure 5-3). The skybox variant installs all 100 foundations the fastest out of the other 2 jackup scenarios. The best months for starting the jack-up scenarios is March / April.

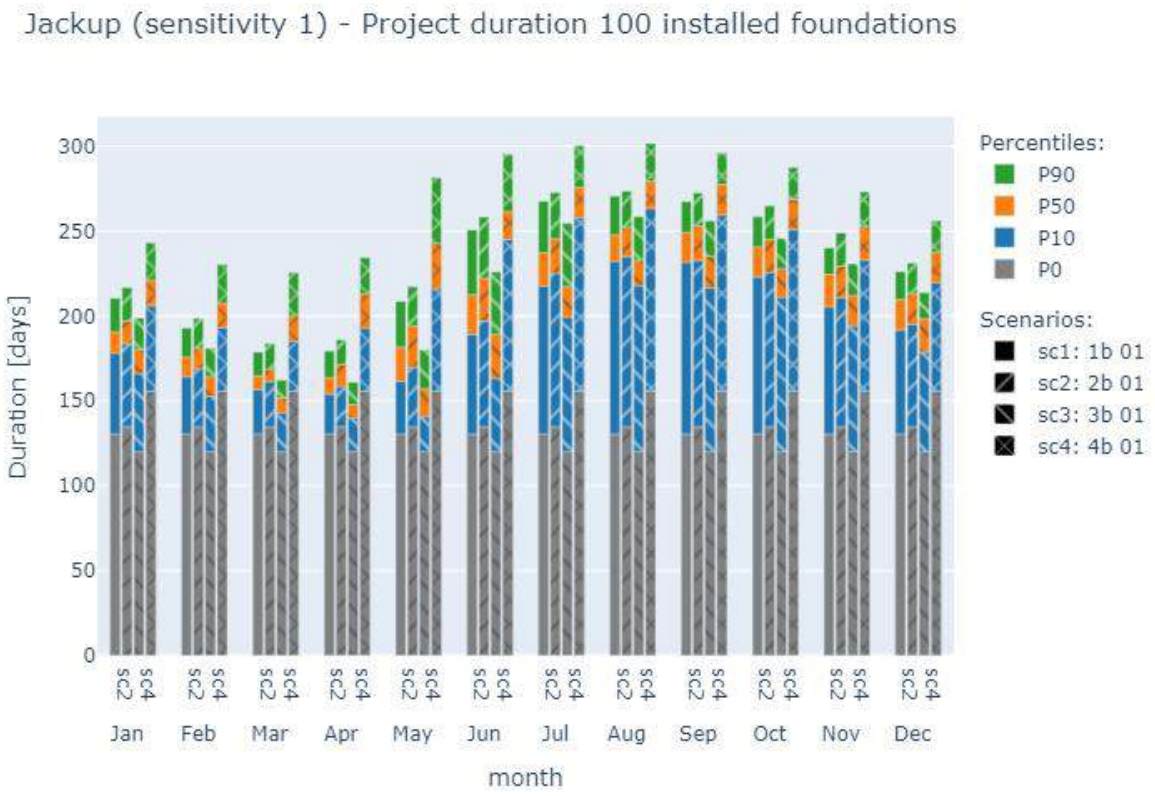


Figure 5-3, the P10, P50 and P90 project durations for 100 installed foundations for scenarios 1b, 2b and 3b (jackup).

Scenario 3c with a separate vessel to install the skyboxes using a MHV is faster than having just one vessel to install the MP and skyboxes (scenario 3a), except for the autumn and winter months (Figure 5-4). In the winter months both vessels installing the MP and skyboxes have a lot of waiting on weather. Although having a separate vessel for the installation of the skyboxes is faster than having just one vessel for both the MP and skybox installation, there is a tradeoff between the costs as in scenario 3c two vessels need to be paid instead of just one.

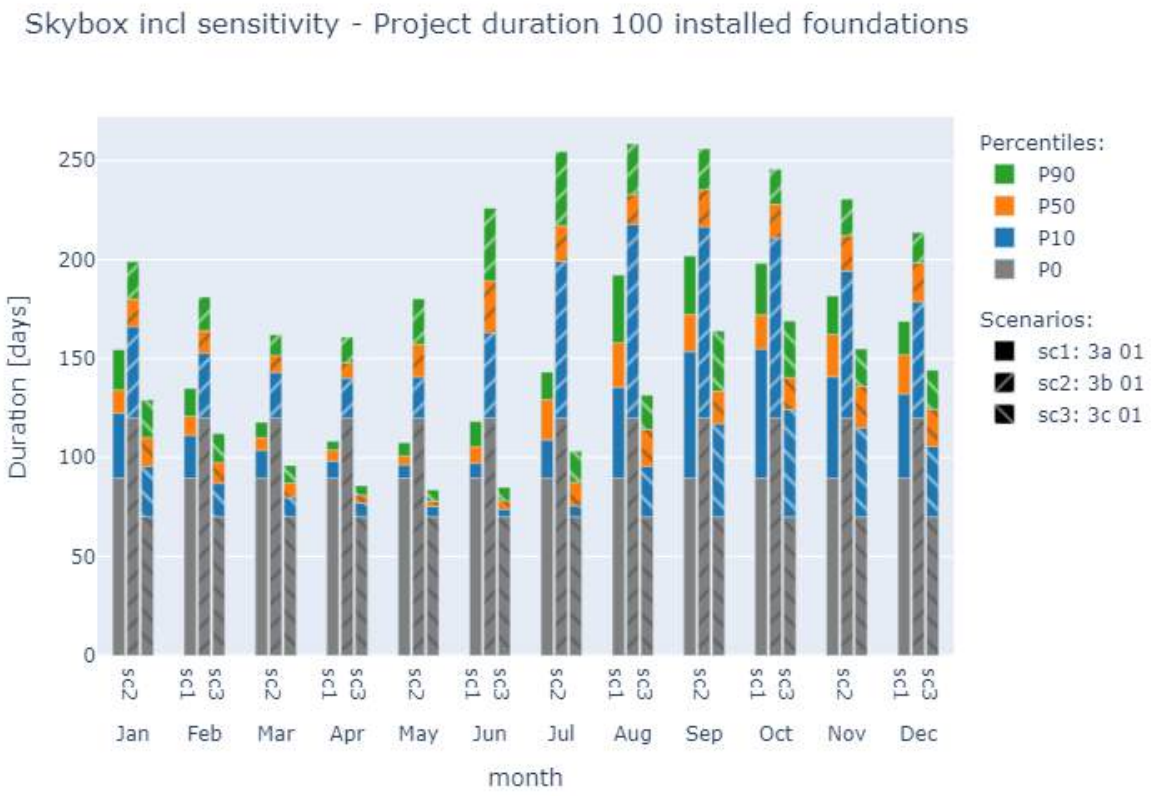


Figure 5-4, the P10, P50 and P90 project durations for 100 installed foundations for the skybox installations using a MHV vessel (3a) or a separate vessel for the skybox (3c).

Similar observations can be done when comparing all concrete platform installation durations (Figure 5-5). Having a separate vessel to install the concrete platforms will significantly speed up the installation campaign. Moreover, having a separate vessel to do the grouting (4d) will also speed up the installation slightly compared to having the same MHV do the grouting (4a).

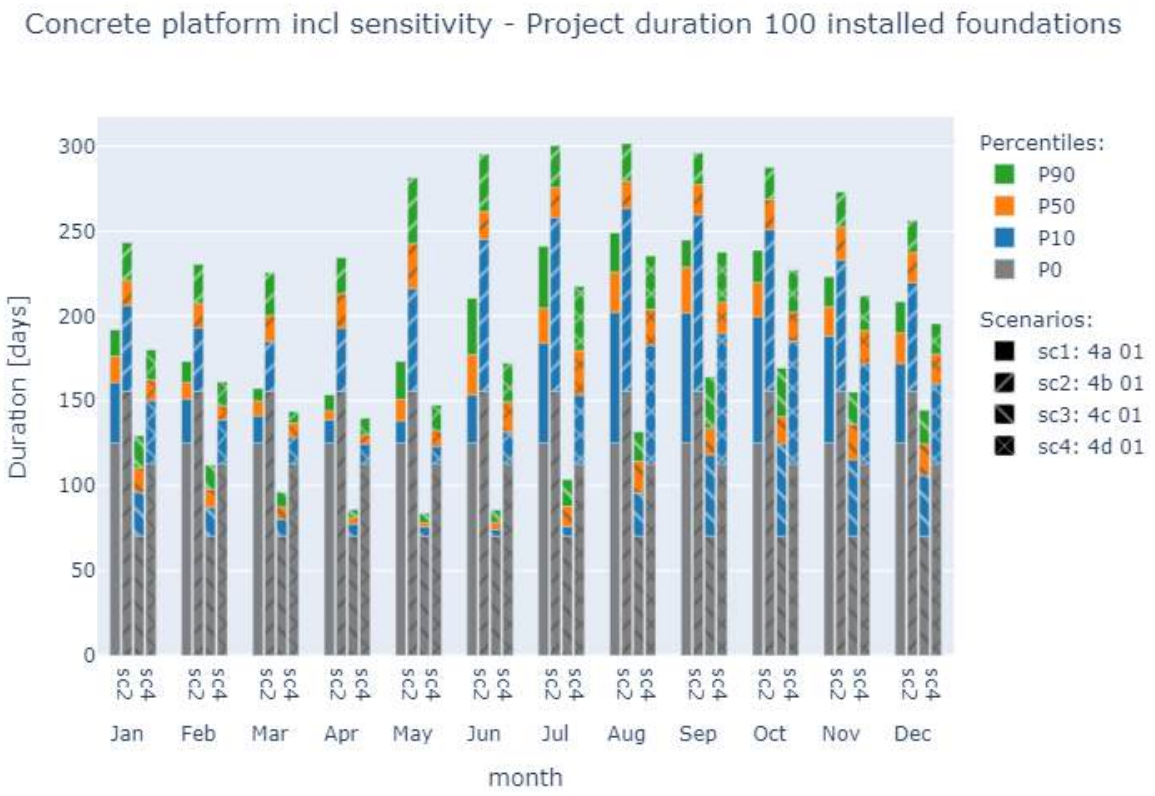


Figure 5-5, the P10, P50 and P90 project durations for 100 installed foundations for the concrete platform installations using a MHV vessel (4a), a separate vessel for the skybox (4c) or a separate grouting vessel (4d).

Finally, the installation duration of 100 foundations using a separate vessel to install the skybox (3c) or concrete platform (4c) is approximately similar even when, in general, the skybox installation is faster compared to a concrete platform installation (see Figure 5-6). This is due to the installation of the MPs being on the critical path for the Skybox as well as for the concrete platform. As mentioned earlier, the MP installation net durations and weather limits are similar between the two scenarios. The MP installation is governing, therefore the time reduction of the separate vessel installing Skyboxes is idle time. This means that the use of the vessel installing the Skybox can be optimized, resulting in a shorter hiring period, which would make the Skybox scenario more economically attractive.

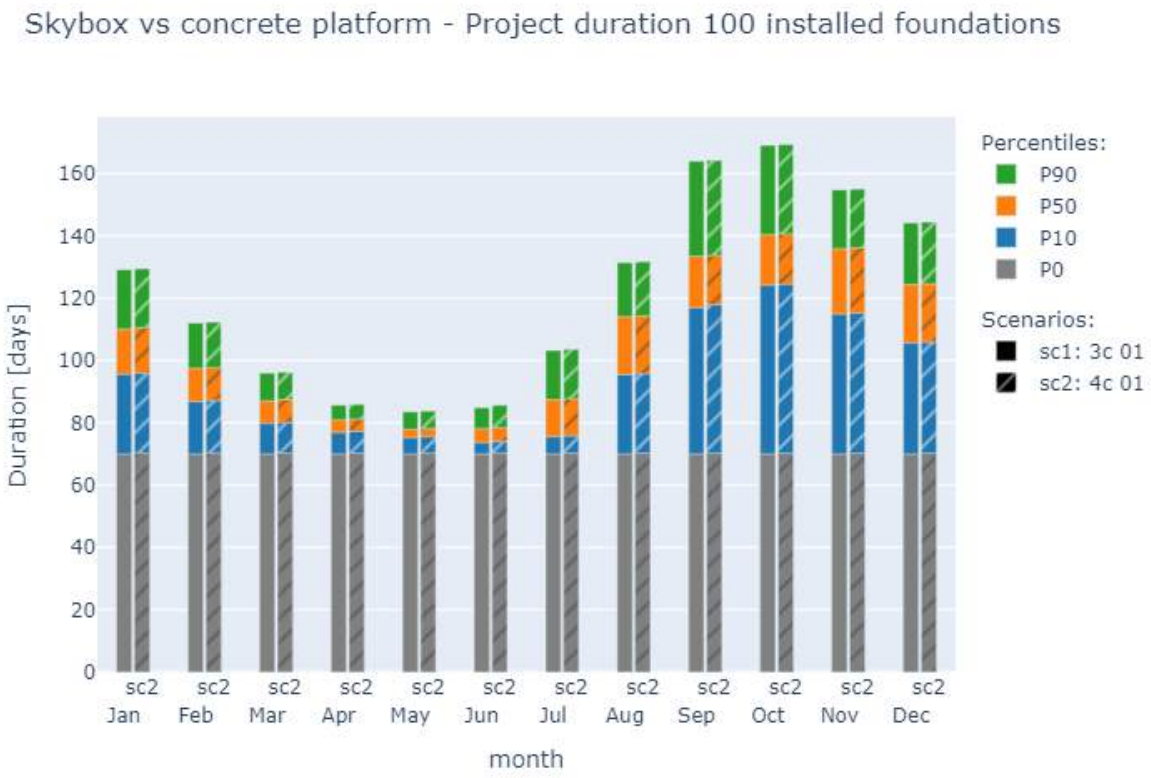


Figure 5-6, the P10, P50 and P90 project durations for 100 installed foundations using a separate vessel to install the skybox (3c) and concrete platform (4c).

5.2.1 Project duration all n-installed foundations and starting months

The previous section showed the project durations for 100 installed foundations. In essence, this is just a 'slice' of n-installed foundations. The project durations for every starting month and every amount of installed foundations can be shown in a 2d surface plot for the P50 (Figure 5-7 and Figure 5-8) for both the monohull and jackup installation vessels. In both figures it can be seen that the project duration increases with increasing amount of installed foundations. Another observation is that the ideal starting month shifts to earlier months in a year with increasing amount of installed foundations. The reason behind this principle is that the project duration increases such that the installation campaign surpasses the summer period. The summer is the period where there is a high workability which decreases during the autumn and winter.

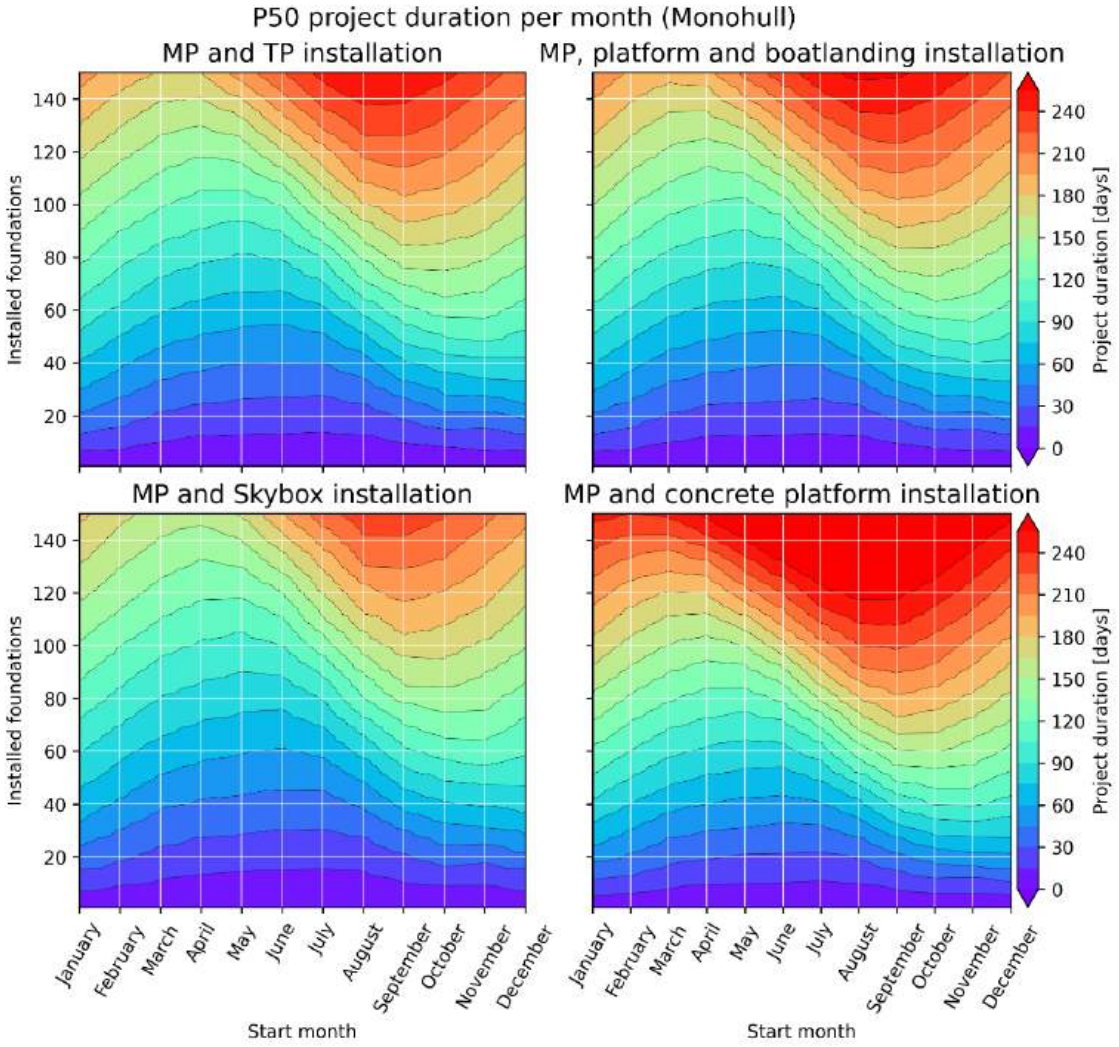


Figure 5-7, 2d-surface plot of the P50 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a monohull vessel (scenarios 1a, 2a, 3a and 4a).

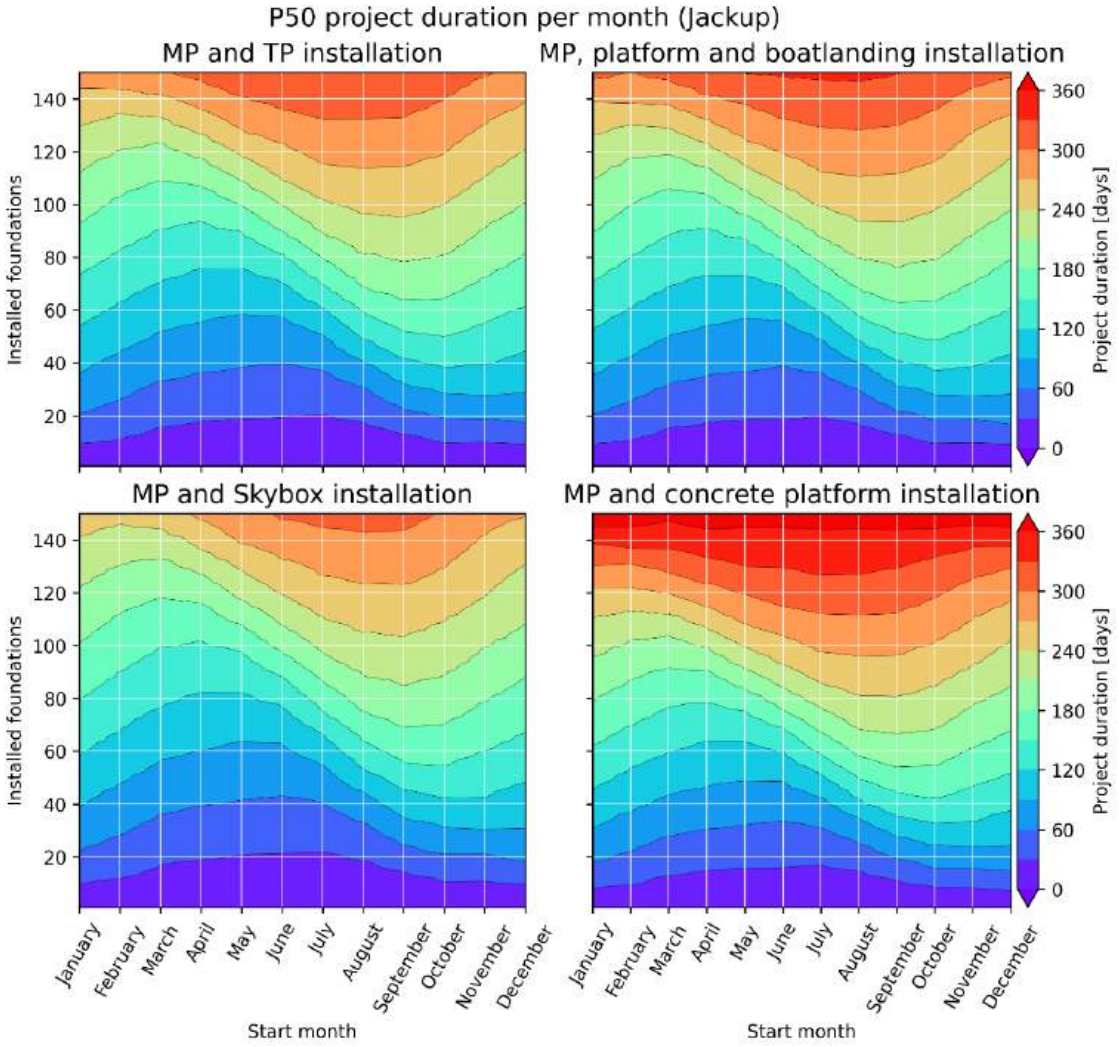


Figure 5-8, 2d-surface plot of the P50 and P90 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a jackup (scenarios 1b, 2b, 3b and 4b)

Both figures also show that the workability of the Skybox scenario is fastest for all n-installed foundations, both when compared against the MHV and the jackup. To highlight this difference in more detail, the time reductions of the Skybox scenarios against the conventional scenarios are plotted in Figure 5-9 and Figure 5-10.

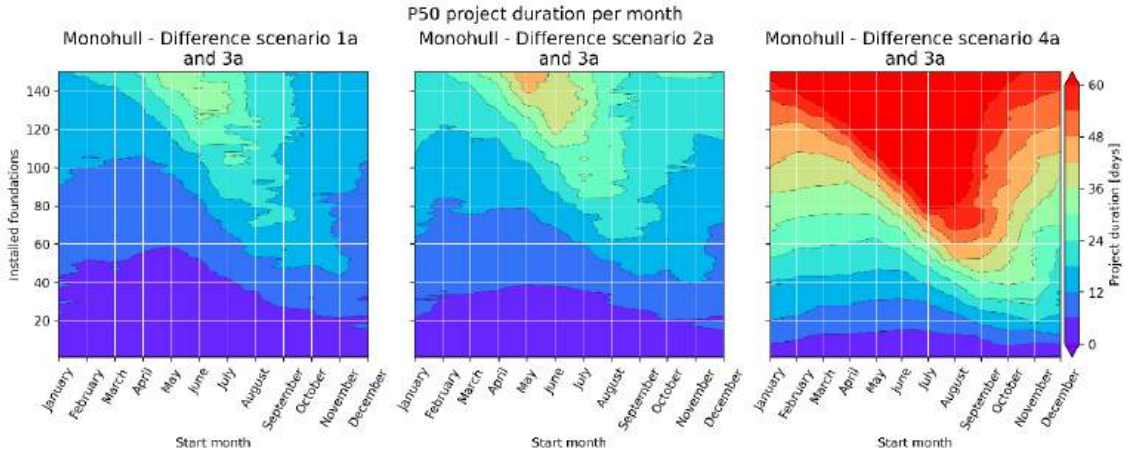


Figure 5-9, P50 difference in project duration, from left to right: scenario 3a compared against 1a, 2a, 4a for every n-installed foundation and starting month.

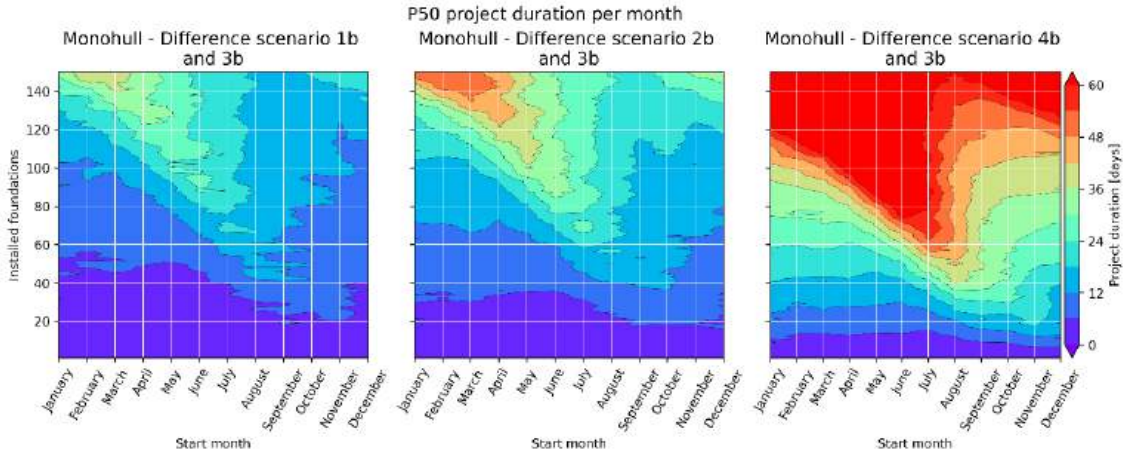


Figure 5-10, P50 and P90 difference in project duration, from left to right: scenario 3b compared against 1b, 2b, 4b for every n-installed foundation and starting month.

In general, the results show that the Skybox scenarios are faster for all combinations of n-installed foundations and starting months. It can be observed from the plots that the maximum time reduction of the Skybox scenarios shift to earlier months in the year, when the project size increases. This is likely the effect of the Skybox scenario avoiding more installation time in the winter months which generally have less favourable weather for installation.

In 5.3Appendix B the 2d-surface plots are also included for the P90 of the scenarios shown above. Moreover, a surface plot is included to show the skybox and concrete platform installation using a separate vessel.

5.2.2 Representative Gantt chart

The previous section discussed the project durations for all n-installed foundations and starting dates for every scenario and every scenario compared to skybox scenario. In essence there's a simulation behind each of these project durations. This section will show a few Gantt charts of single simulations which represent either the P50 or P90 for some of the scenarios. All information has effectively already be given, however, it is good to show what a P50 or P90 simulation actually looks like (enlarged Gantt charts are shown in Appendix C).

Scenario 1a with 100 installed foundations starting in August showing the effect of the percentile (P50 and P90)

The worst moment to start a 100 foundation campaign for scenario 1a is in August (see Figure 5-2). In Figure 5-11 this can be observed. There is a lot of waiting on weather during the winter months. Which means that there is always a significant amount of waiting on weather expected during the winter months. The P90 shows that in a bad year there is a lot of waiting on weather which results in about a month longer project duration to be able to install all 100 foundations (see Figure 5-12).

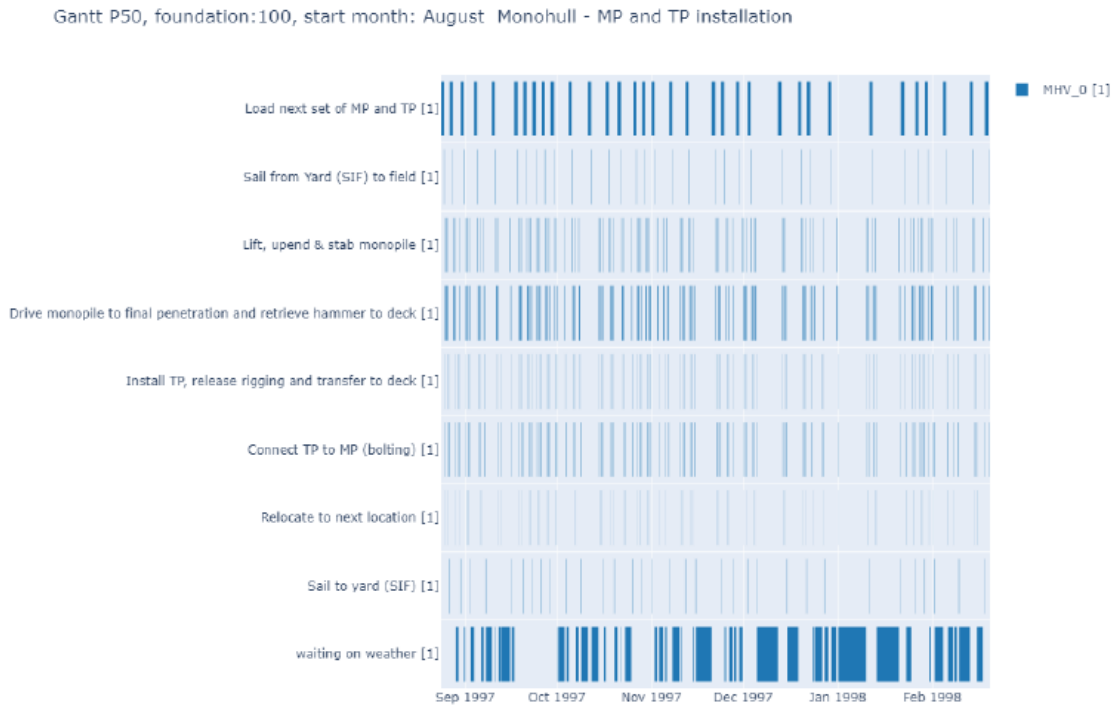


Figure 5-11, representative P50 simulation of scenario 1a installing 100 foundation with a starting date in August

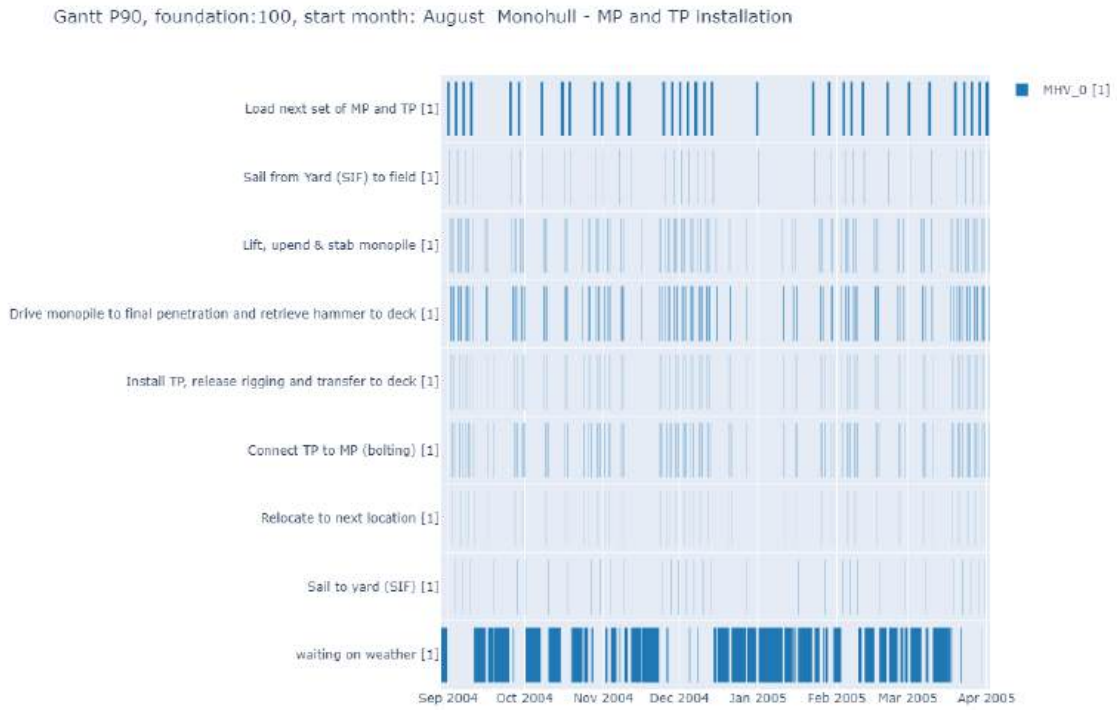


Figure 5-12, representative P90 simulation of scenario 1a installing 100 foundation with a starting date in August

Scenario 1a showing the effects of starting the campaign in a favourable month

Figure 5-2 shows that the optimum starting month for scenario 1a is April. It can be observed that there is waiting on weather in April and to a lesser extent in May and June (see Figure 5-13). However, this is much less compared to a start month of August (see Figure 5-11). Eventually, when starting in April, the project is finished at the beginning of August, well before the weather start to deteriorate during the autumn.

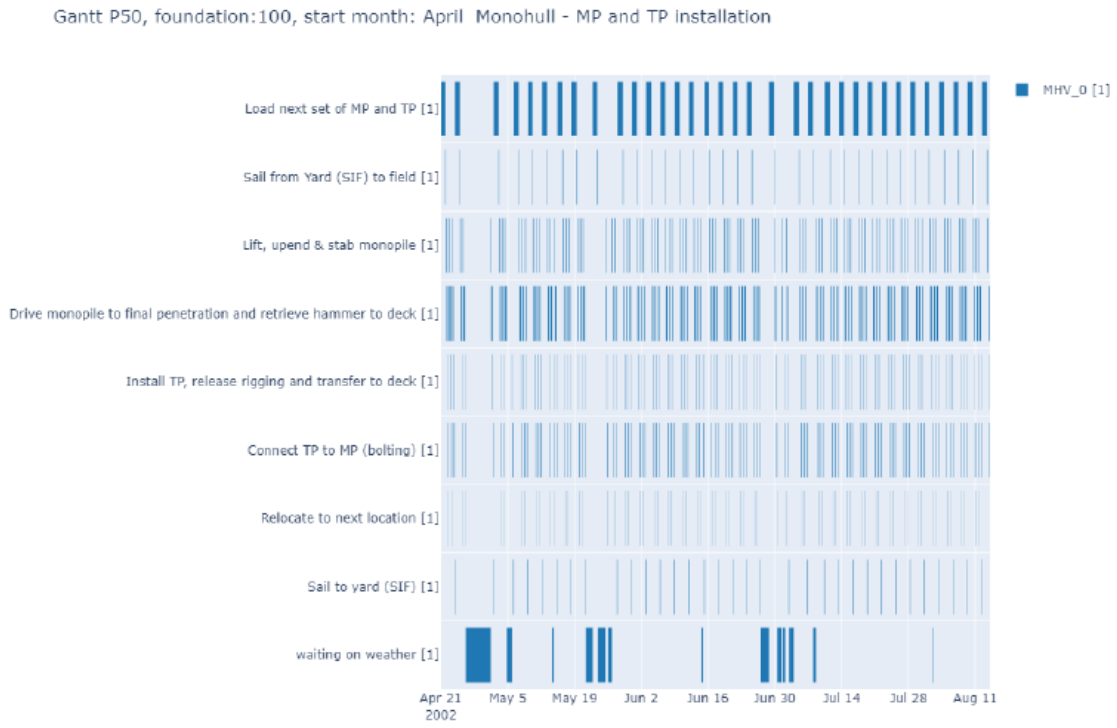


Figure 5-13, representative P50 simulation of scenario 1a installing 100 foundation with a starting date in April

Scenario 1a and 3a showing the increased performance of the skybox

Figure 5-10 shows that for 100 installed foundations the project time difference between scenario 1a and 3a is largest when starting in July. This means that the Skybox variant is about 1 month faster compared to scenario 1a when starting at the same date. This can also be observed in Figure 5-14 and Figure 5-15, where the P90 start date for scenario 1a was chosen as a start date for both scenarios. Due to the Skybox variant being faster without weather it can make larger progress in the relatively good months. Consequently, the campaign will be finished before the bad weather months start.

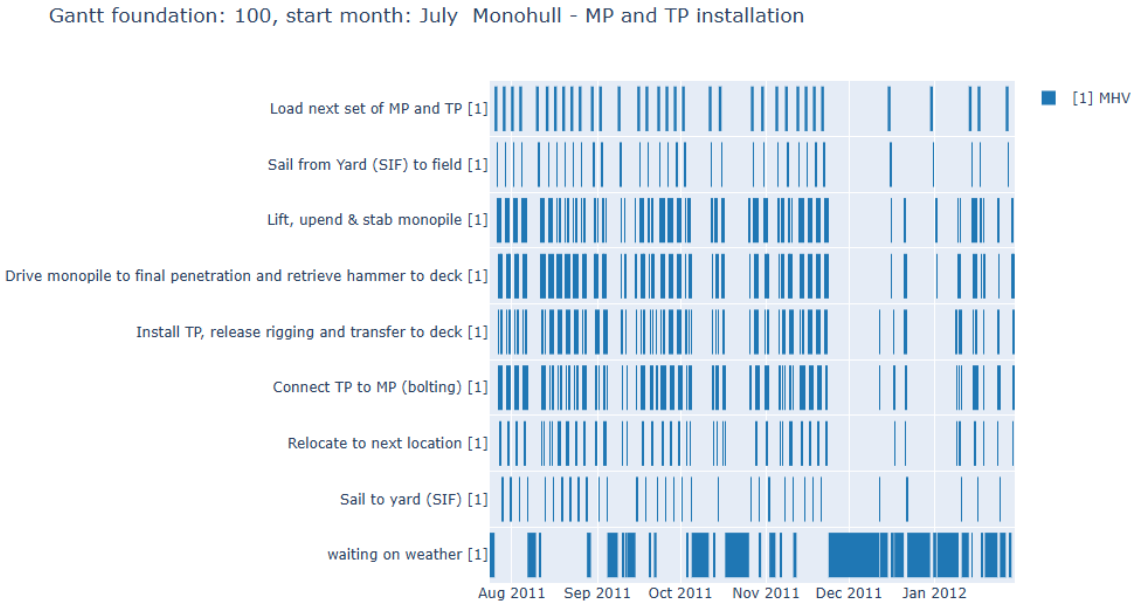


Figure 5-14, simulation of scenario 1a installing 100 foundation with a starting date of 24 July 2011

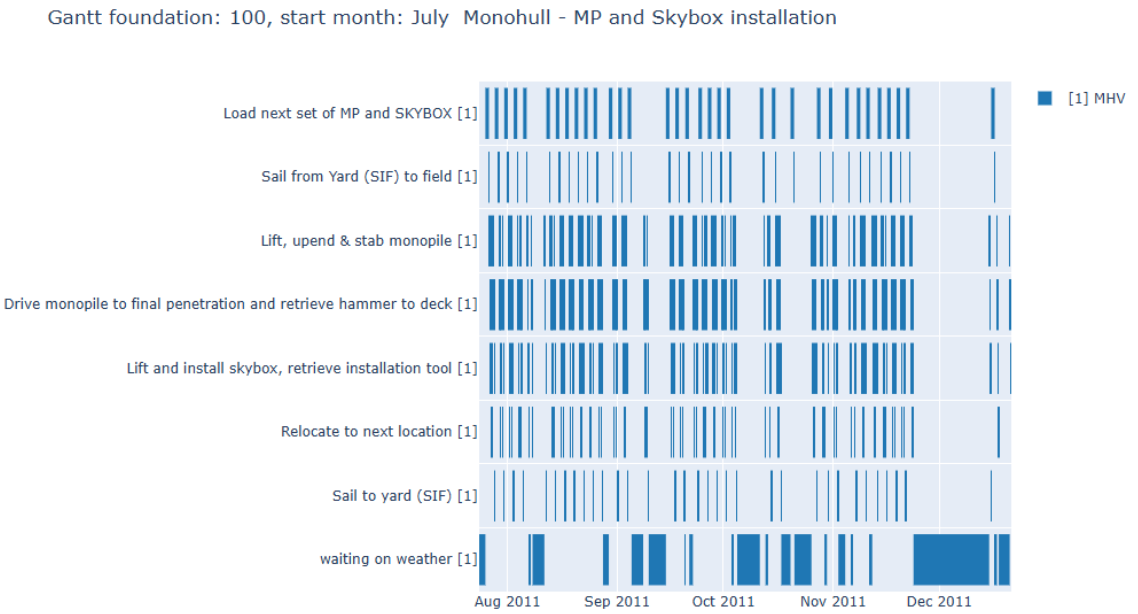


Figure 5-15, simulation of scenario 3a installing 100 foundation with a starting date of 24 July 2011

Figure 5-2 and Figure 5-3, showed that in general, the installation of a Skybox was the fastest of all foundations types using a MHV or jackup. Furthermore, the installation of a concrete platform, in general, is the slowest of the foundation types. On the contrary, Figure 5-6 showed that having a separate vessel to install the Skybox (scenario 3c) and having a separate vessel to install the concrete platform (scenario 4c) resulted in a total project duration similar to each other. This is due to the MP installation being similar for the two types and being on the critical path. Figure 5-16 and Figure 5-17 show that there is idle time where the MHV installing the Skybox or concrete platform, meaning that the

separate vessel has to wait for new MPs to be installed before it can continue with installing the Skybox or concrete platform.

Figure 5-16, shows that there is more idle time installing the Skybox compared to the installation of the concrete platform (Figure 5-17). The longer net duration of the concrete platform installation (Table 3-9) can be mitigated by the idle time, having to wait for MPs to be installed.

An optimization on this scenario can be done where the MHV installing the Skybox or concrete platform starts later, thus requiring this separate vessel for a shorter duration. The vessel installing the Skybox can start later compared to the vessel installing the concrete platform due to the shorter net installation duration of the Skybox.

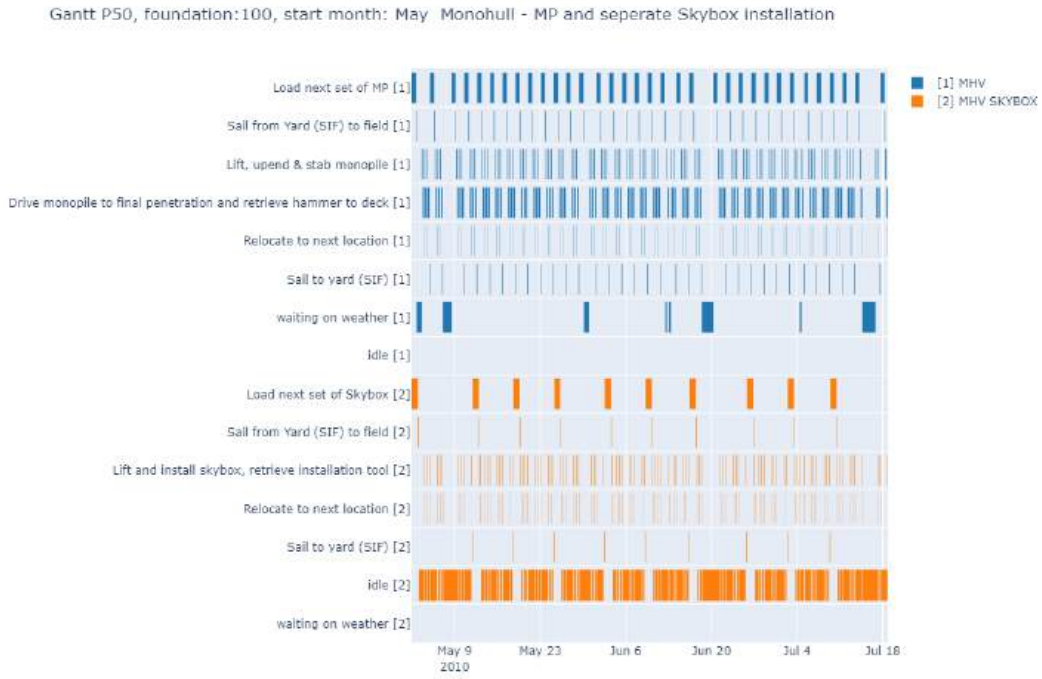


Figure 5-16, simulation of scenario 3c installing 100 foundations with a starting date in May

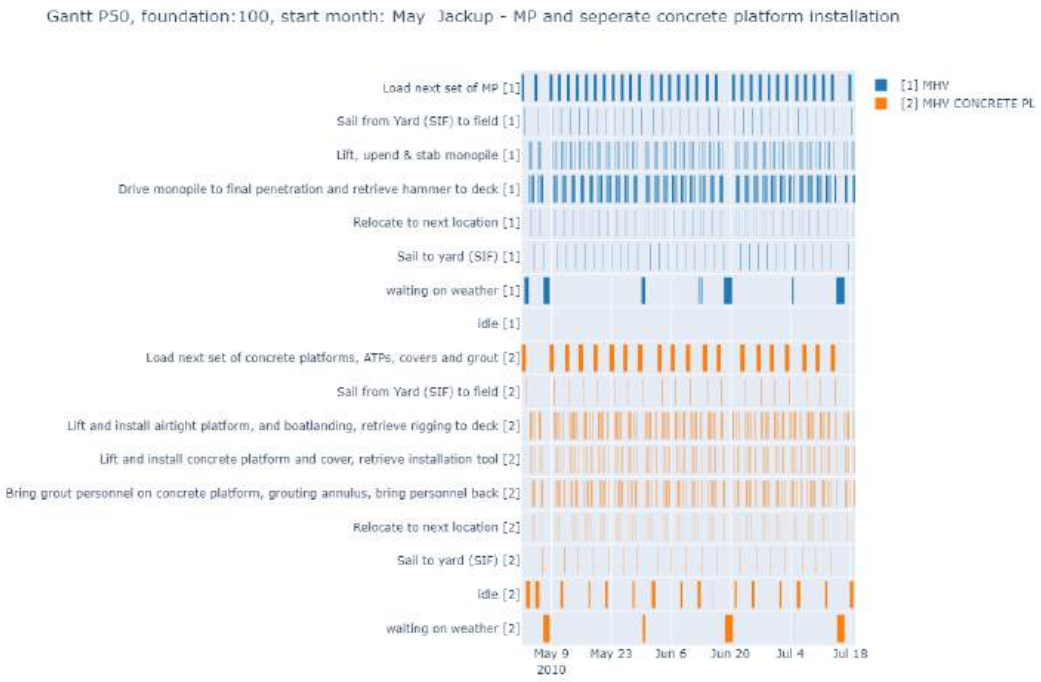


Figure 5-17, simulation of scenario 4c installing 100m foundations with a starting date in May

5.3 Indicative cost comparison

Based on the workability results presented in Section 5.2, and assumed rates for the considered vessels and equipment, an indicative cost comparison is made for the different scenarios in Appendix D, for P50 and P90 installation durations.

The cost assessment is intended to be used for comparison of high-level installation costs of the different scenario's. The vessel day rates and equipment costs are estimated values and are depending on market conditions. In addition, it should be noted that vessel fuel costs are not included in the comparison.

From the costs comparison it can be observed that the Skybox scenario has the lowest costs compared to the conventional secondary steel installations, for all vessel types (MHV, jack up and MHV + small MHV). In addition, there is an opportunity to reduce the cost of scenario 3c when the schedule of the small MHV installing Skyboxes is optimized, as recommended in Section 5.2.1.

APPENDIX A NET SIMULATION

Appendix A shows the net simulation project duration for 15 installed foundations for all scenarios. 15 Installed foundations is chosen to visualize the results more clearly instead of 100 installed foundations. Table 5-1 summarizes these results for 100 installed foundations. Since the effect of weather is not included, and the scenario consists of only one sequence (MHV or jackup installing the MP, TP or skybox), the results can be linearly interpolated to any number of installed foundations (except for scenario 4a where there are two sequences/vessels depending on each other).

A.1 SCENARIO 1A – SEPARATE MP AND CONVENTIONAL TP INSTALLATION USING A MONOHULL VESSEL

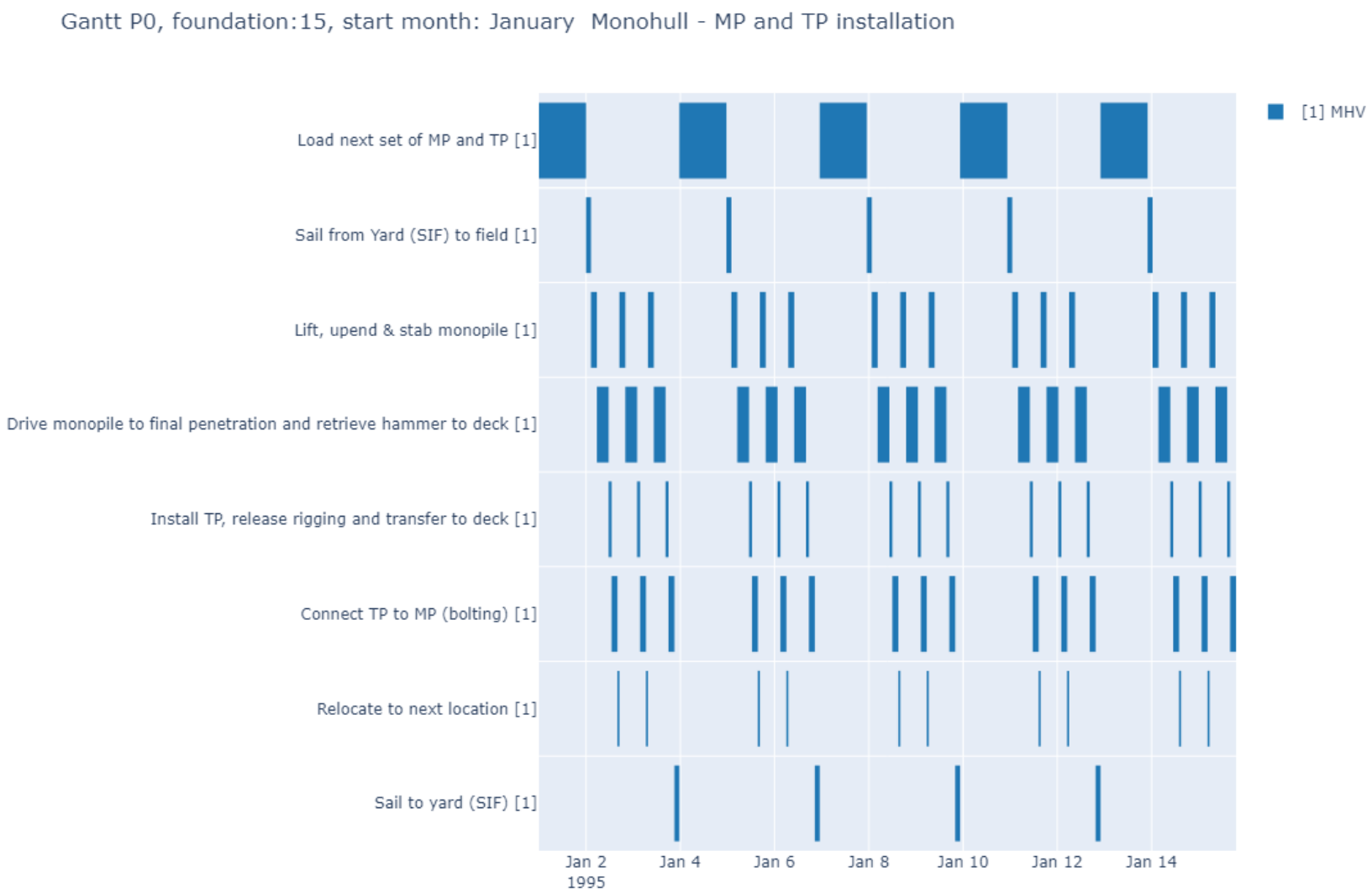


Figure A-1, Gannt chart net simulation scenario 1a for the first 15 foundation installations.

A.2 SCENARIO 1B – SEPARATE MP AND CONVENTIONAL TP INSTALLATION USING A JACKUP

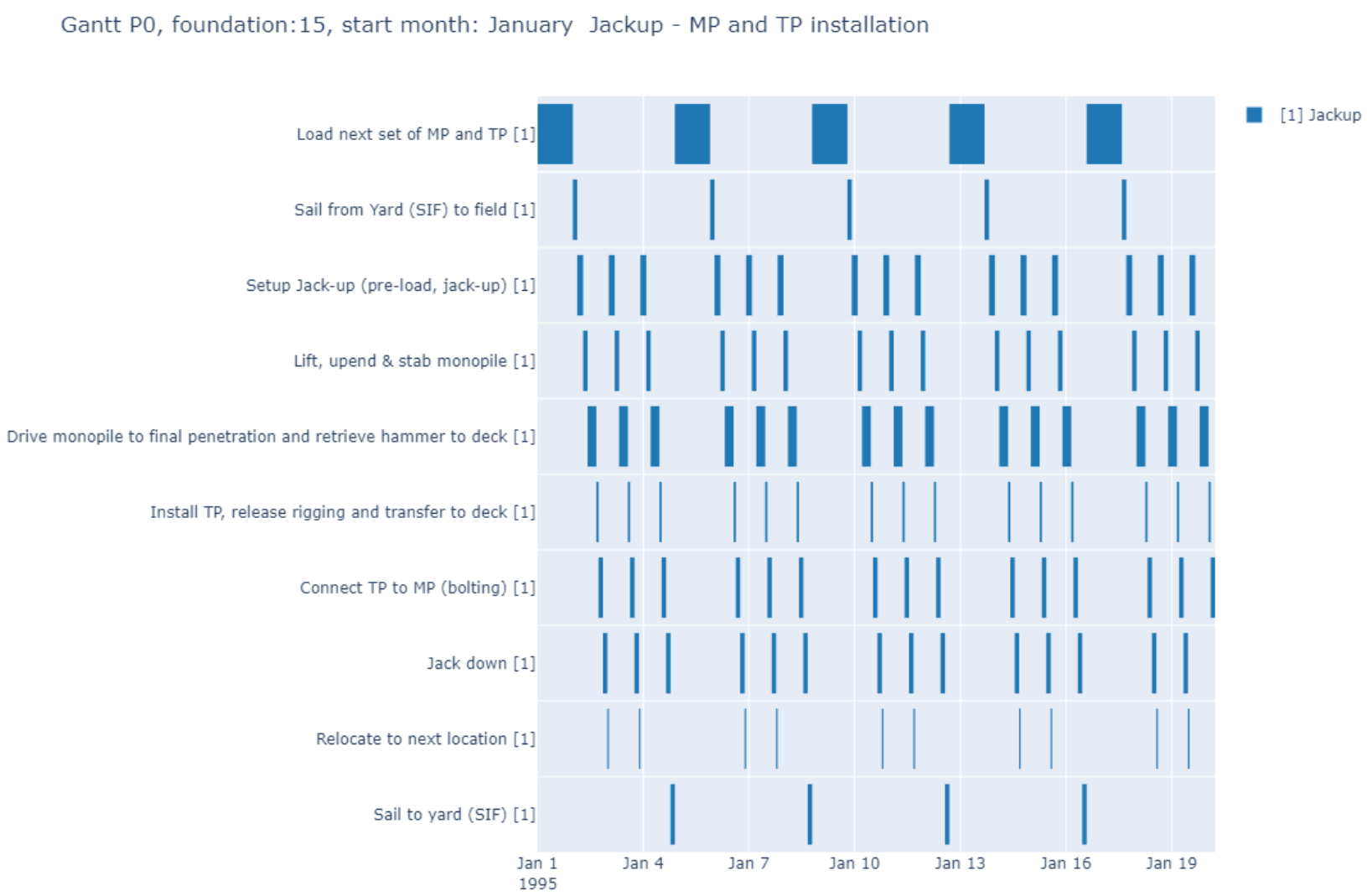


Figure A-2, Gannt chart net simulation scenario 1b for the first 15 foundation installations.

A.3 SCENARIO 2A - TP-LESS FOUNDATION INSTALLATION (MP + ACCESS FRAME/BOAT LANDING) USING A MONOHULL VESSEL

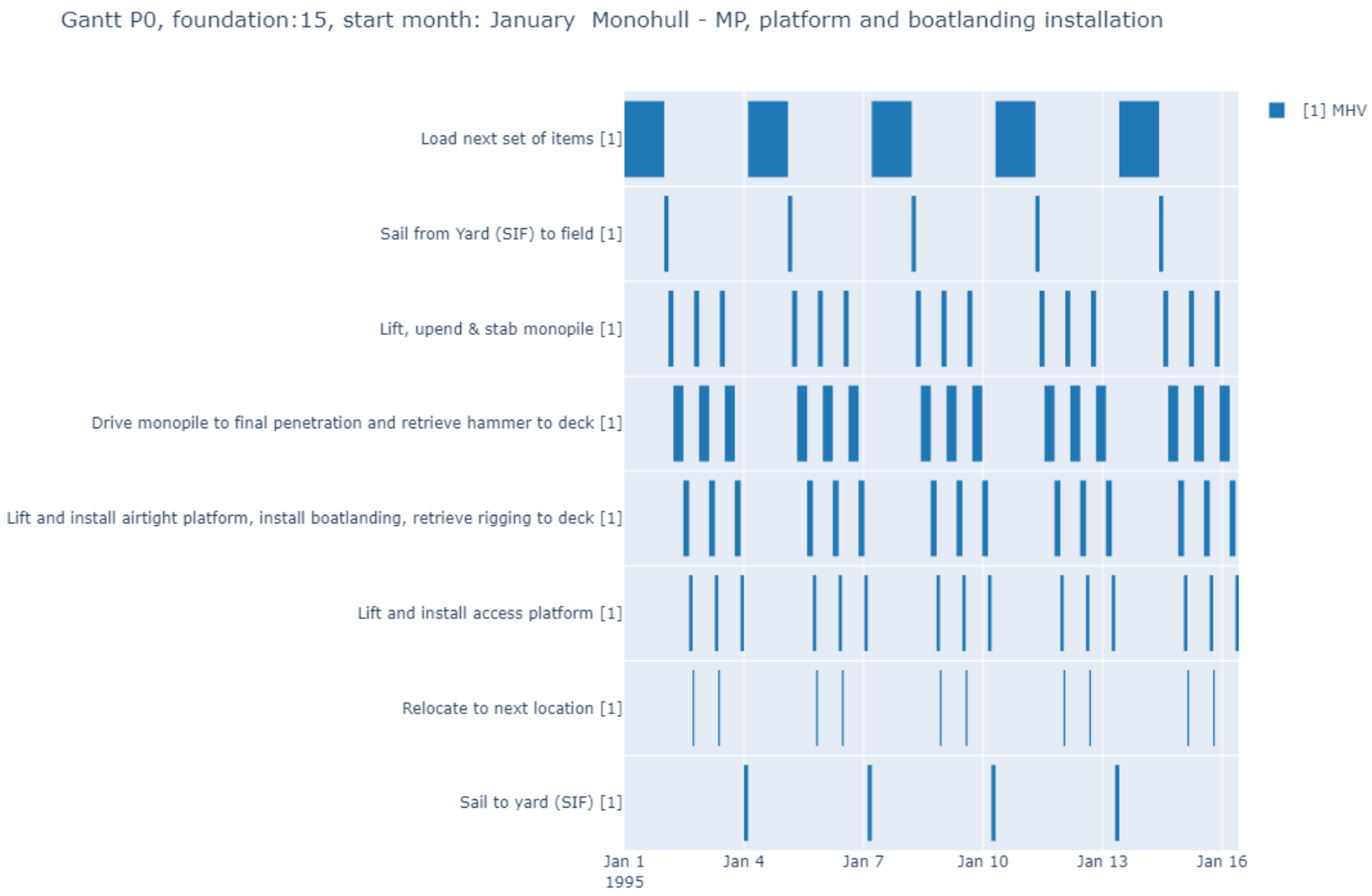


Figure A-3, Gannt chart net simulation scenario 2a for the first 15 foundation installations.

A.4 SCENARIO 2A 02 - TP-LESS FOUNDATION INSTALLATION (MP + ACCESS FRAME) USING A MONOHULL VESSEL

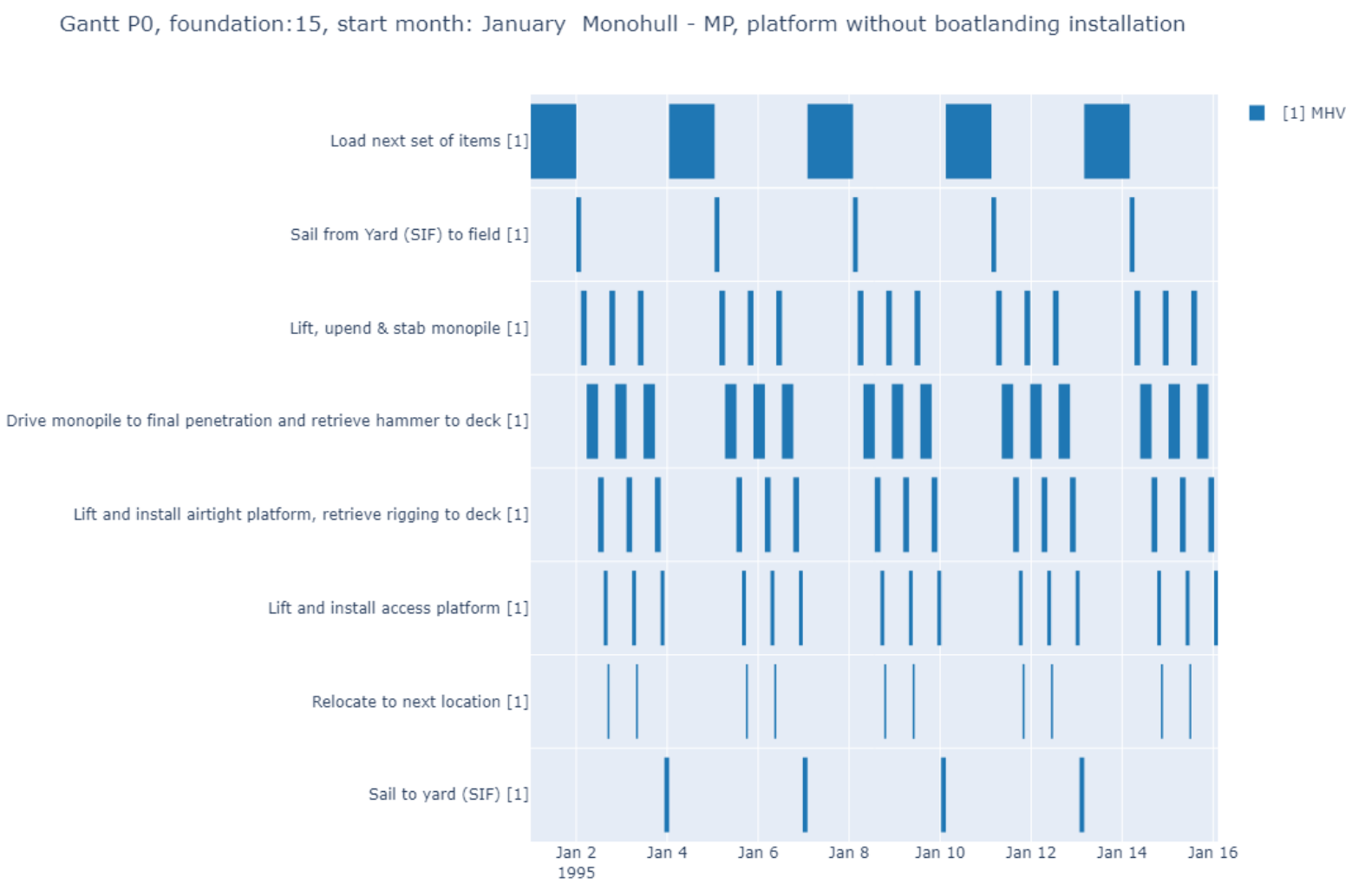


Figure A-4, Gannt chart net simulation scenario 2a 02 for the first 15 foundation installations.

A.5 SCENARIO 2B - TP-LESS FOUNDATION INSTALLATION (MP + ACCESS FRAME/BOAT LANDING) USING A JACKUP

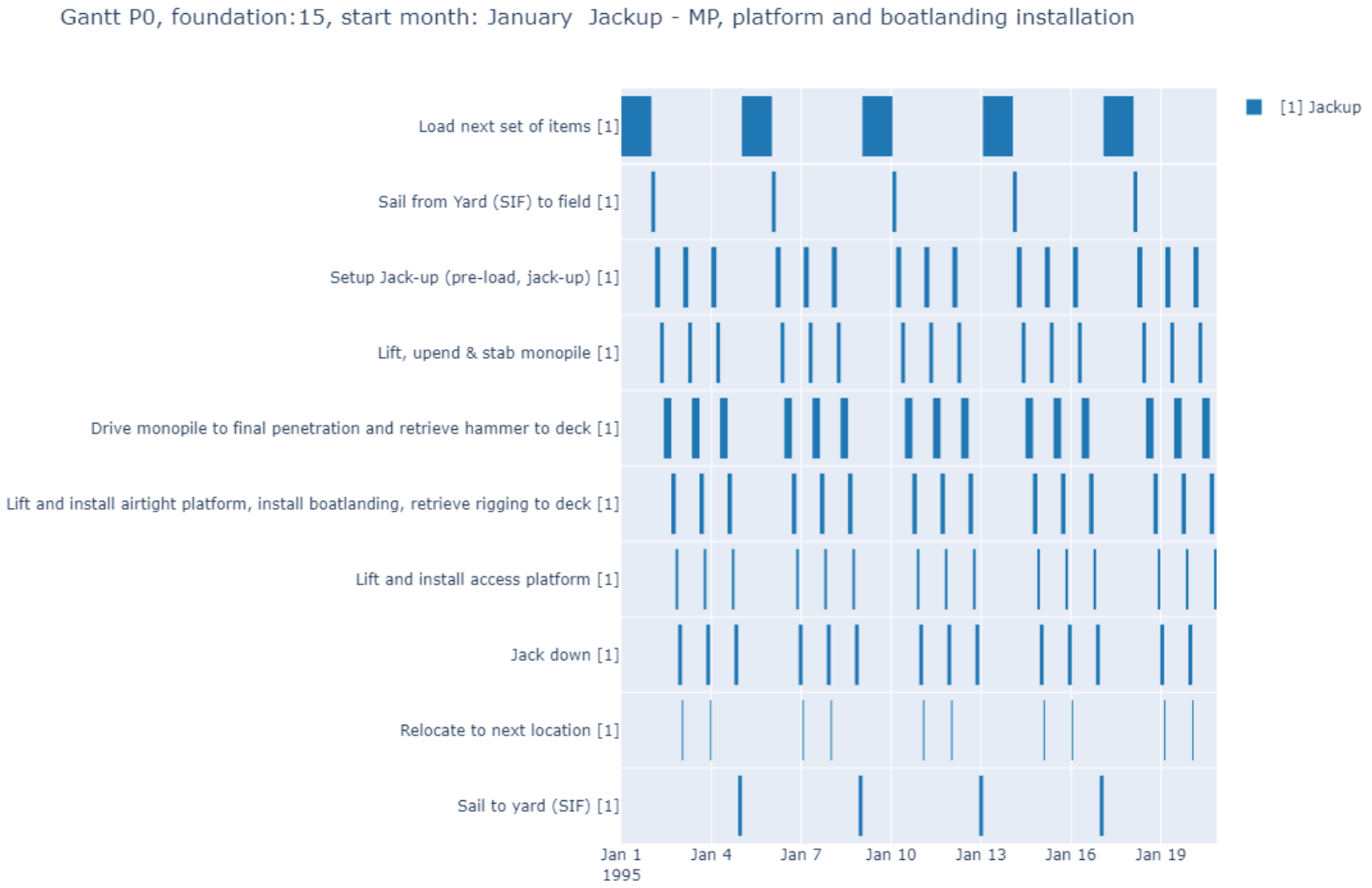


Figure A-5, Gannt chart net simulation scenario 2b for the first 15 foundation installations.

A.6 SCENARIO 2B 02 - TP-LESS FOUNDATION INSTALLATION (MP + ACCESS FRAME) USING A JACKUP

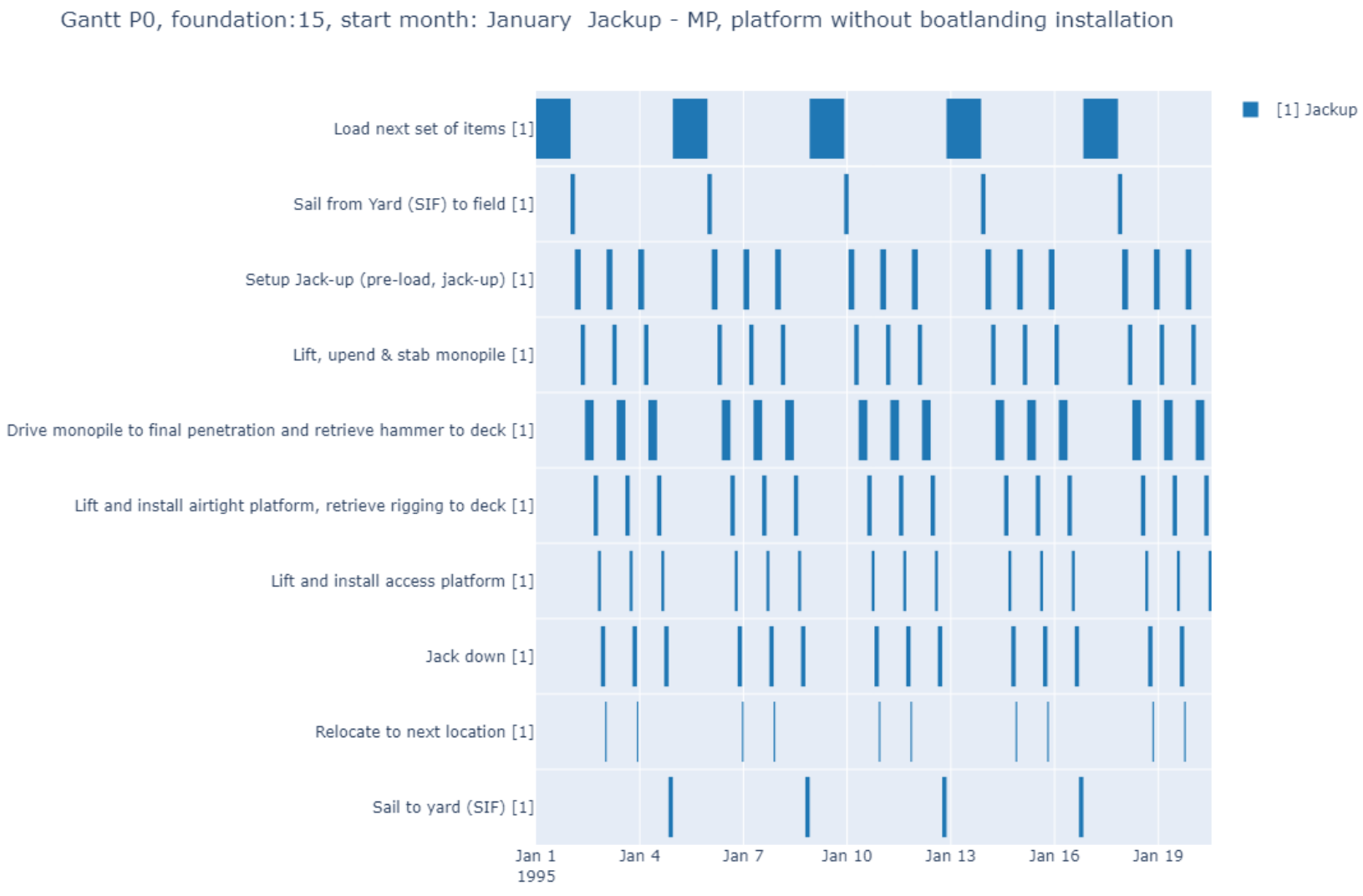


Figure A-6, Gannt chart net simulation scenario 2b 02 for the first 15 foundation installations.

A.7 SCENARIO 3A - MP AND SKYBOX INSTALLATION USING A MONOHULL VESSEL

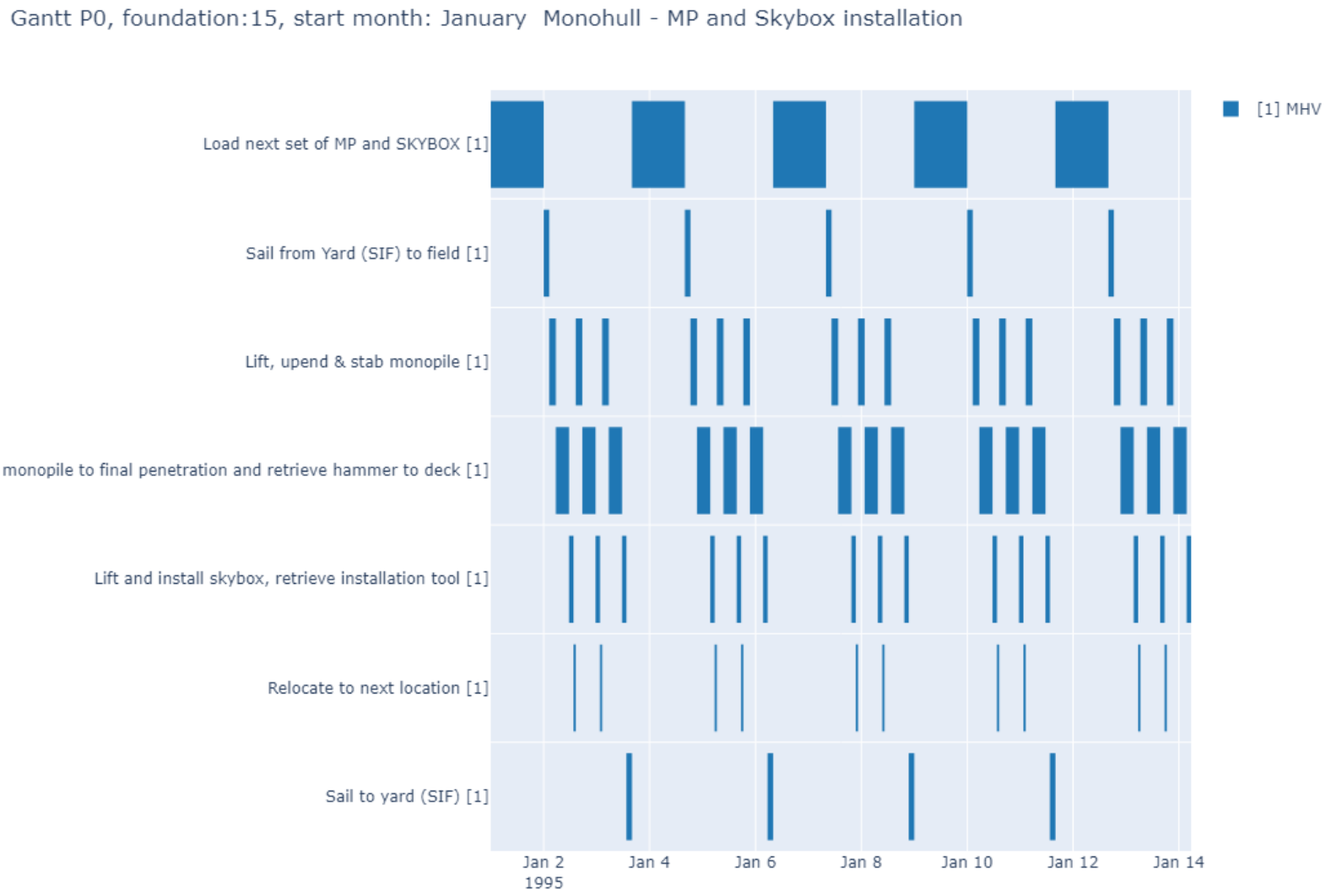


Figure A-7, Gannt chart net simulation scenario 3a for the first 15 foundation installations.

A.8 SCENARIO 3B - MP AND SKYBOX INSTALLATION USING A JACKUP

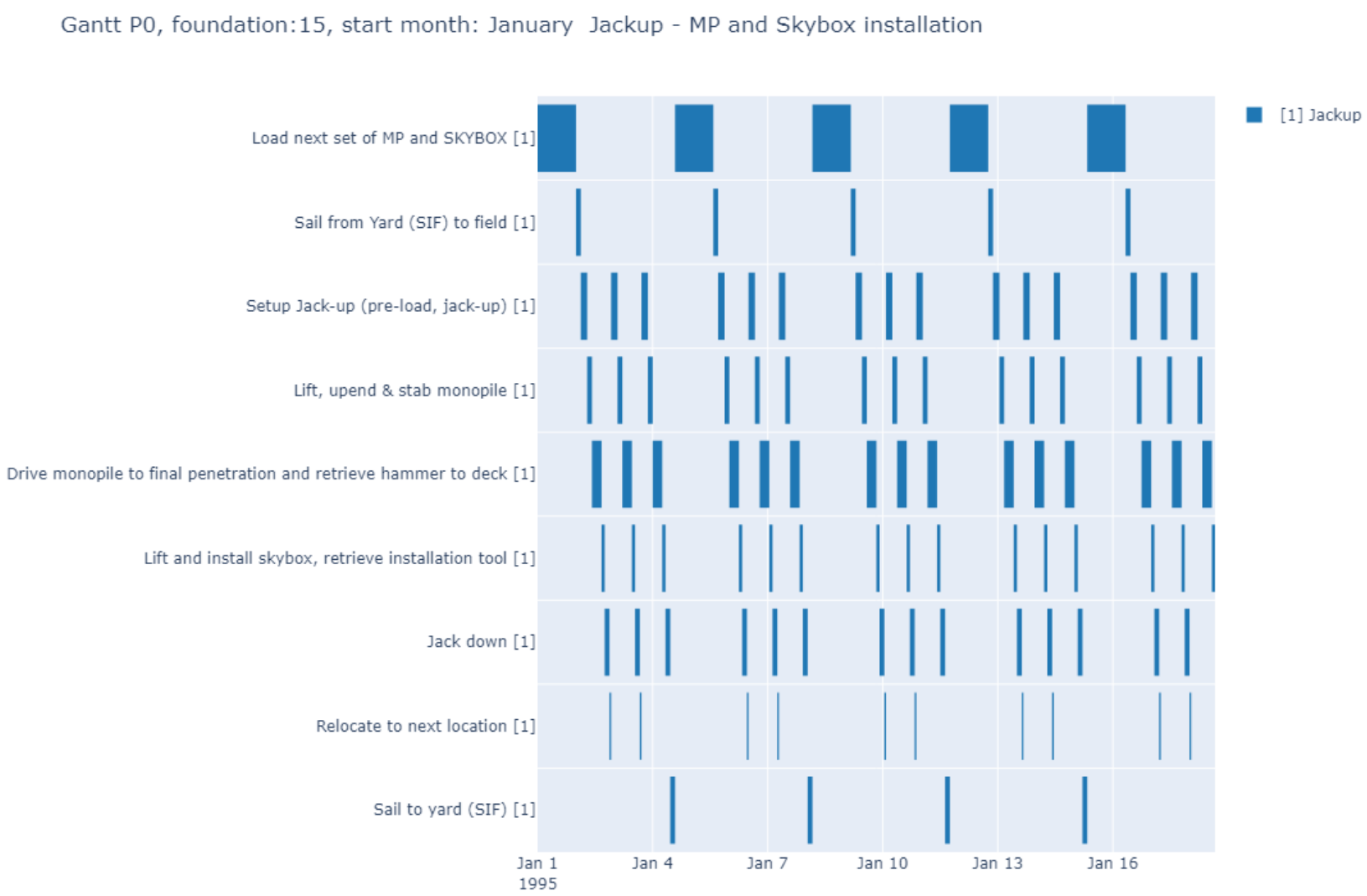


Figure A-8, Gannt chart net simulation scenario 3b for the first 15 foundation installations.

A.9 SCENARIO 3C - SKYBOX INSTALLATION USING A SEPARATE VESSEL

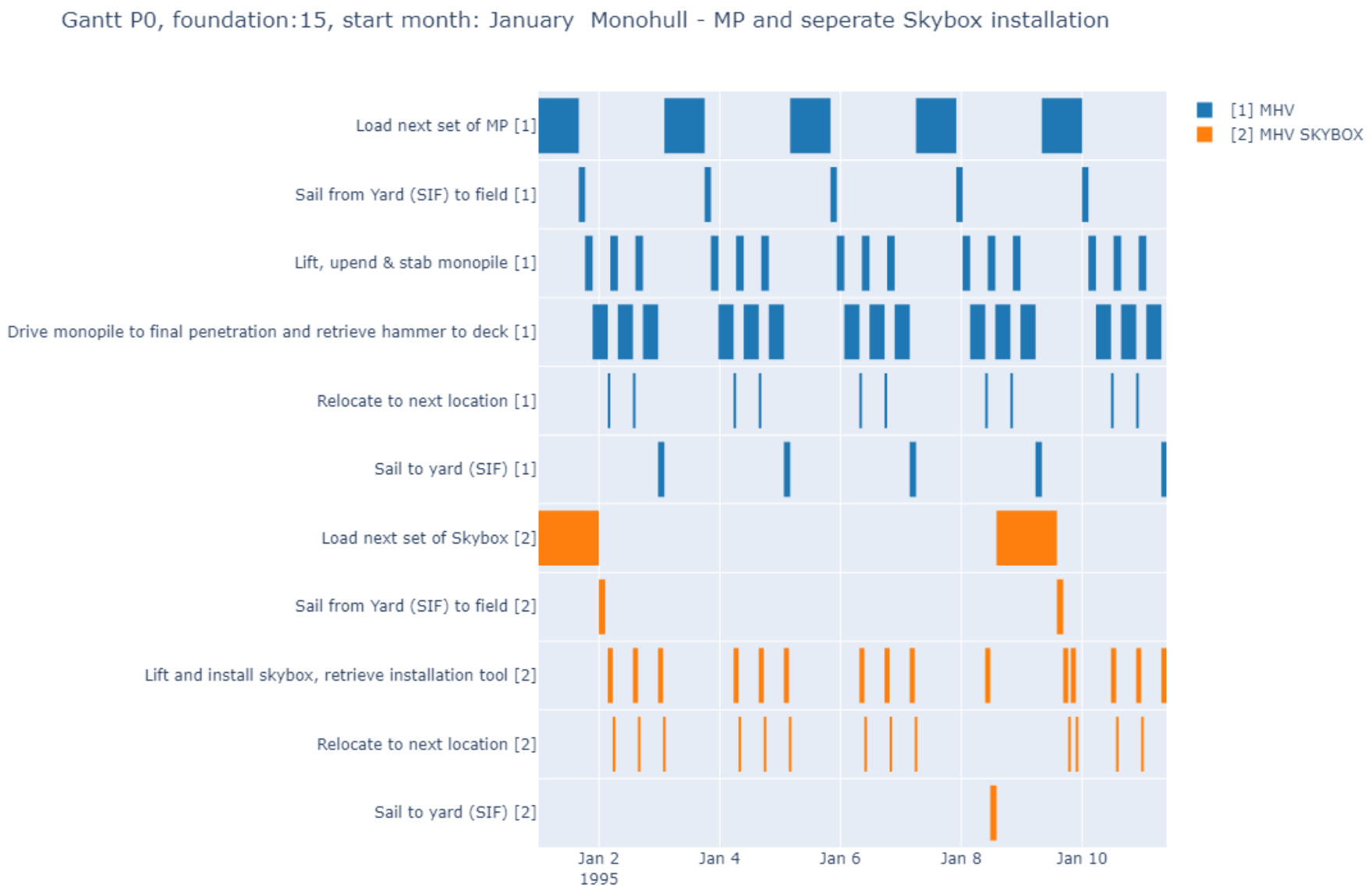


Figure A-9, Gannt chart net simulation scenario 3c for the first 15 MP installations.

A.10 SCENARIO 4A - MP AND CONCRETE PLATFORM INSTALLATION USING A MONOHULL VESSEL

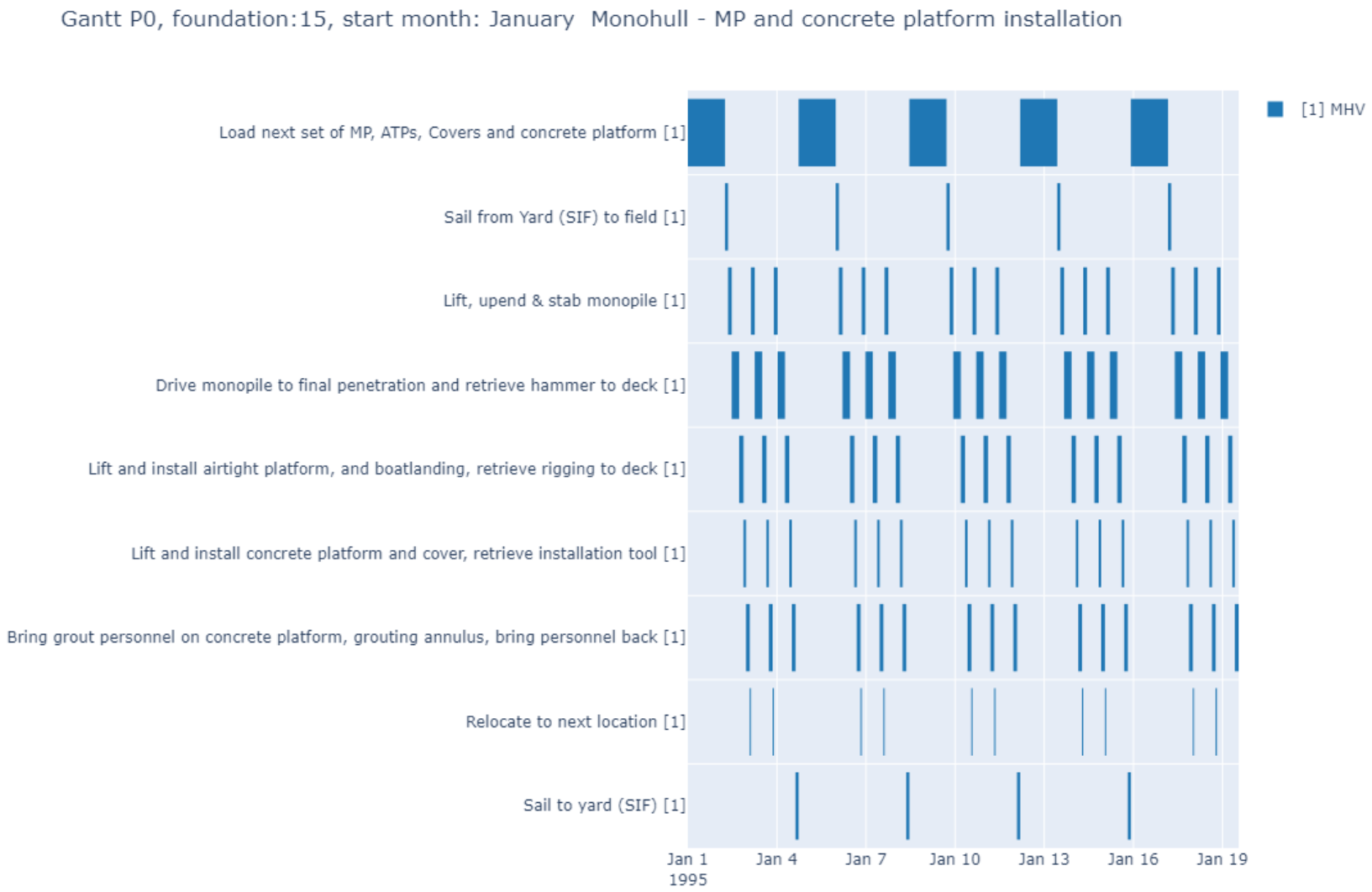


Figure A-10, Gannt chart net simulation scenario 4a for the first 15 foundation installations.

A.11 SCENARIO 4B - MP AND CONCRETE PLATFORM INSTALLATION USING A JACKUP

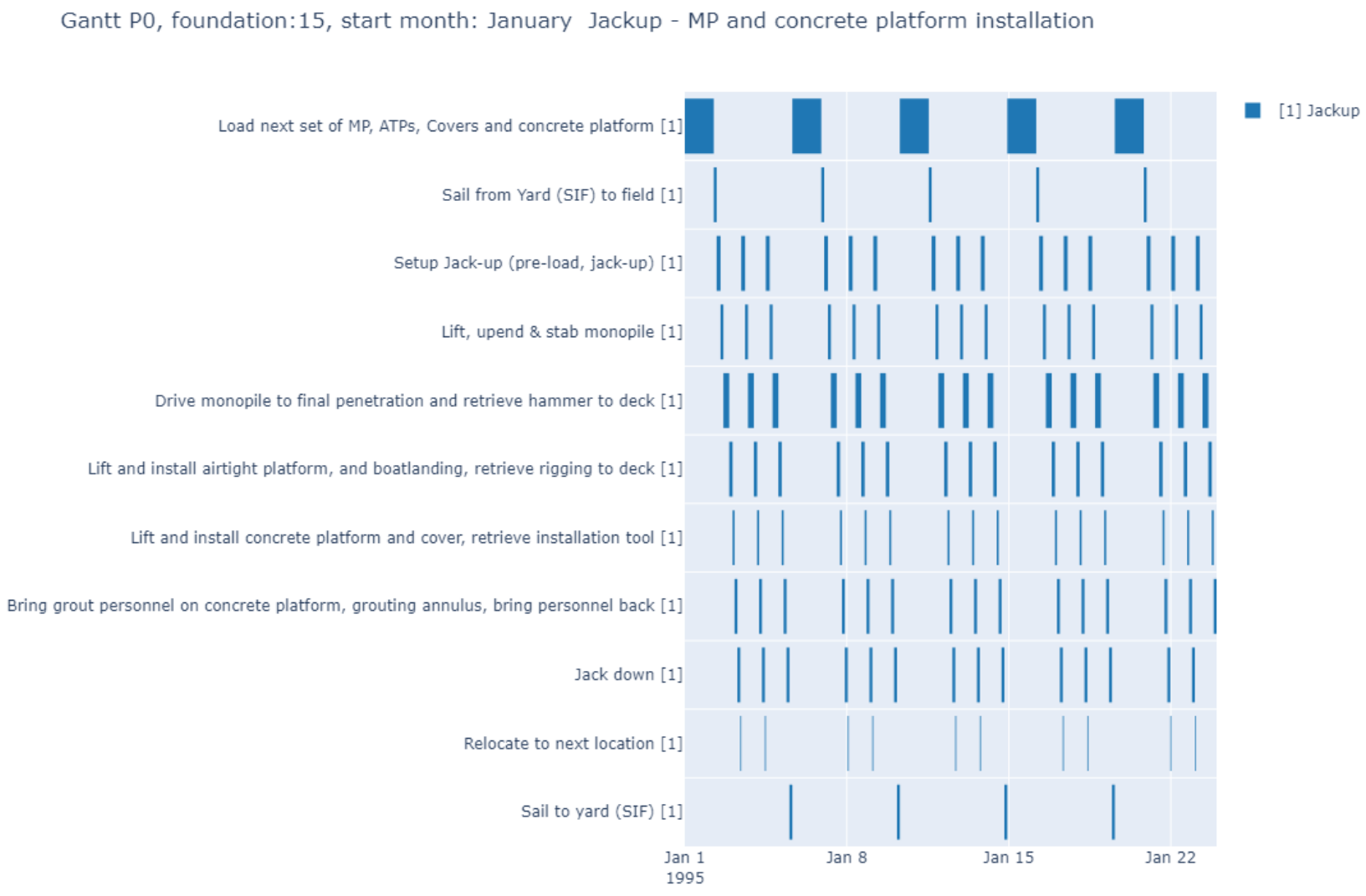


Figure A-11, Gannt chart net simulation scenario 4b for the first 15 foundation installations.

A.12 SCENARIO 4C – CONCRETE PLATFORM INSTALLATION USING A SEPARATE VESSEL

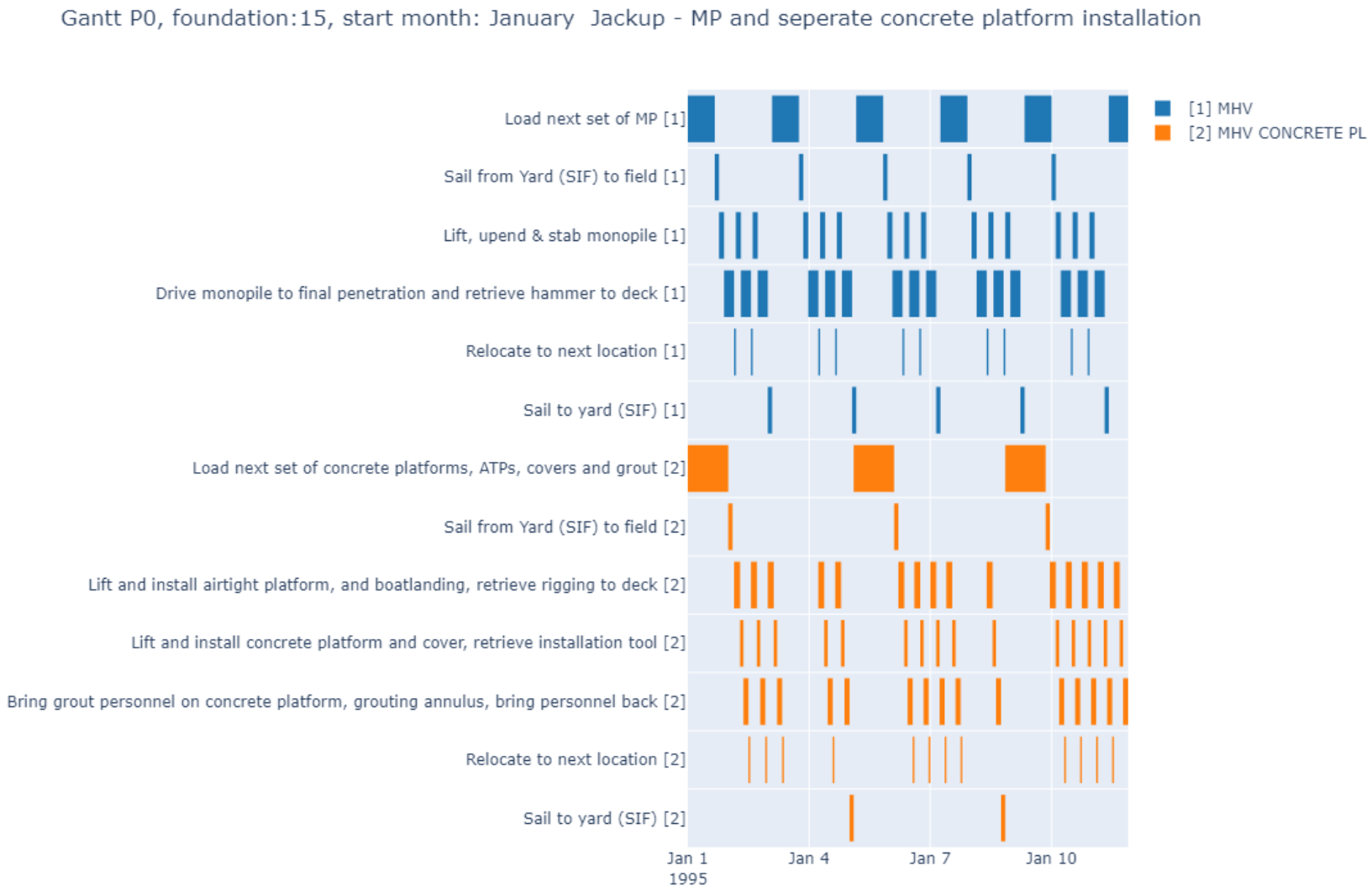


Figure A-12, Gannt chart net simulation scenario 4c for the first 15 MP installations.

A.13 SCENARIO 4D – CONCRETE PLATFORM INSTALLATION USING A SEPARATE VESSEL TO GROUT (OSV)

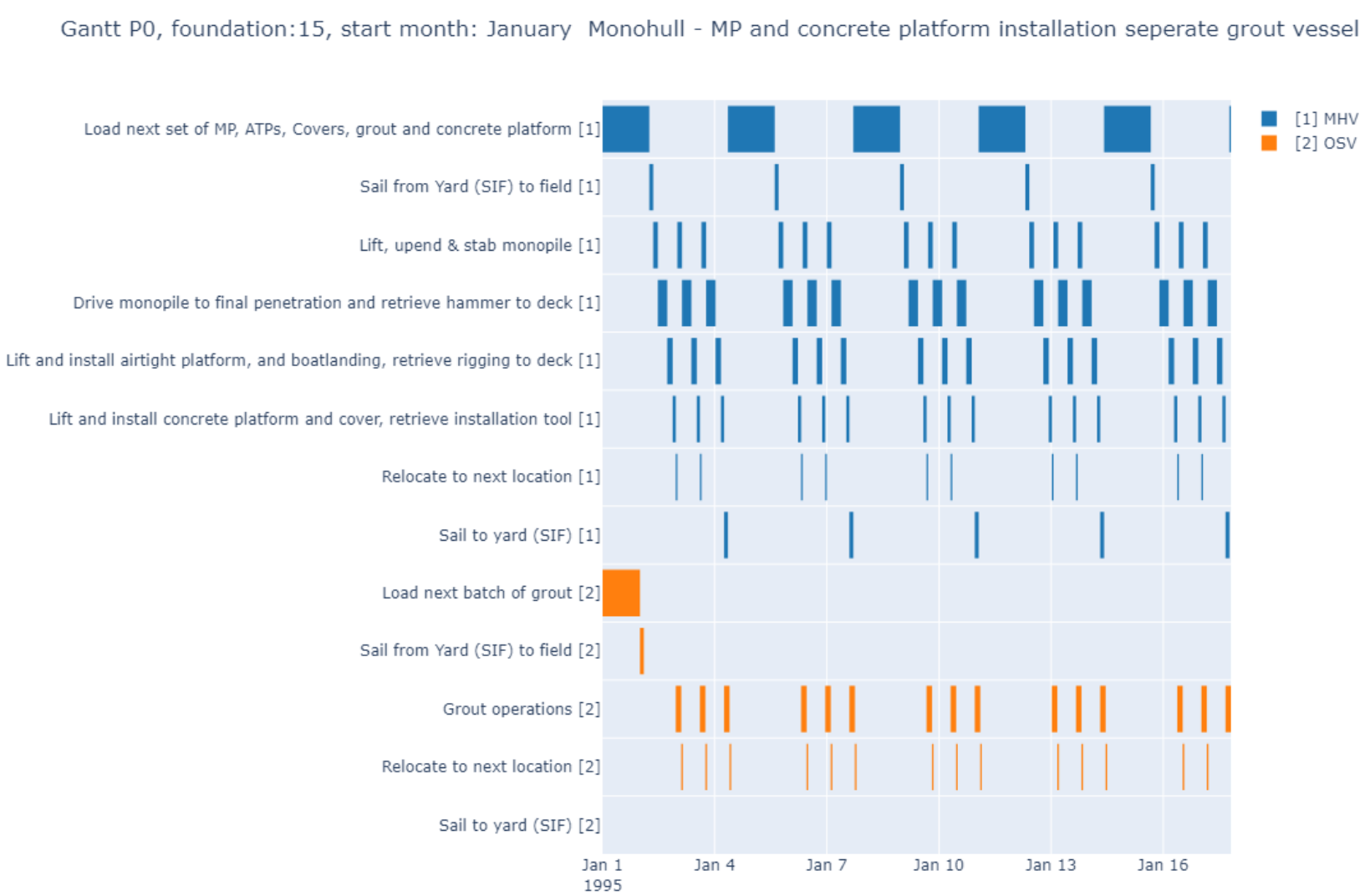


Figure A-13, Gannt chart net simulation scenario 4d for the first 15 MP installations.

APPENDIX B - PROJECT DURATION N-INSTALLED FOUNDATIONS

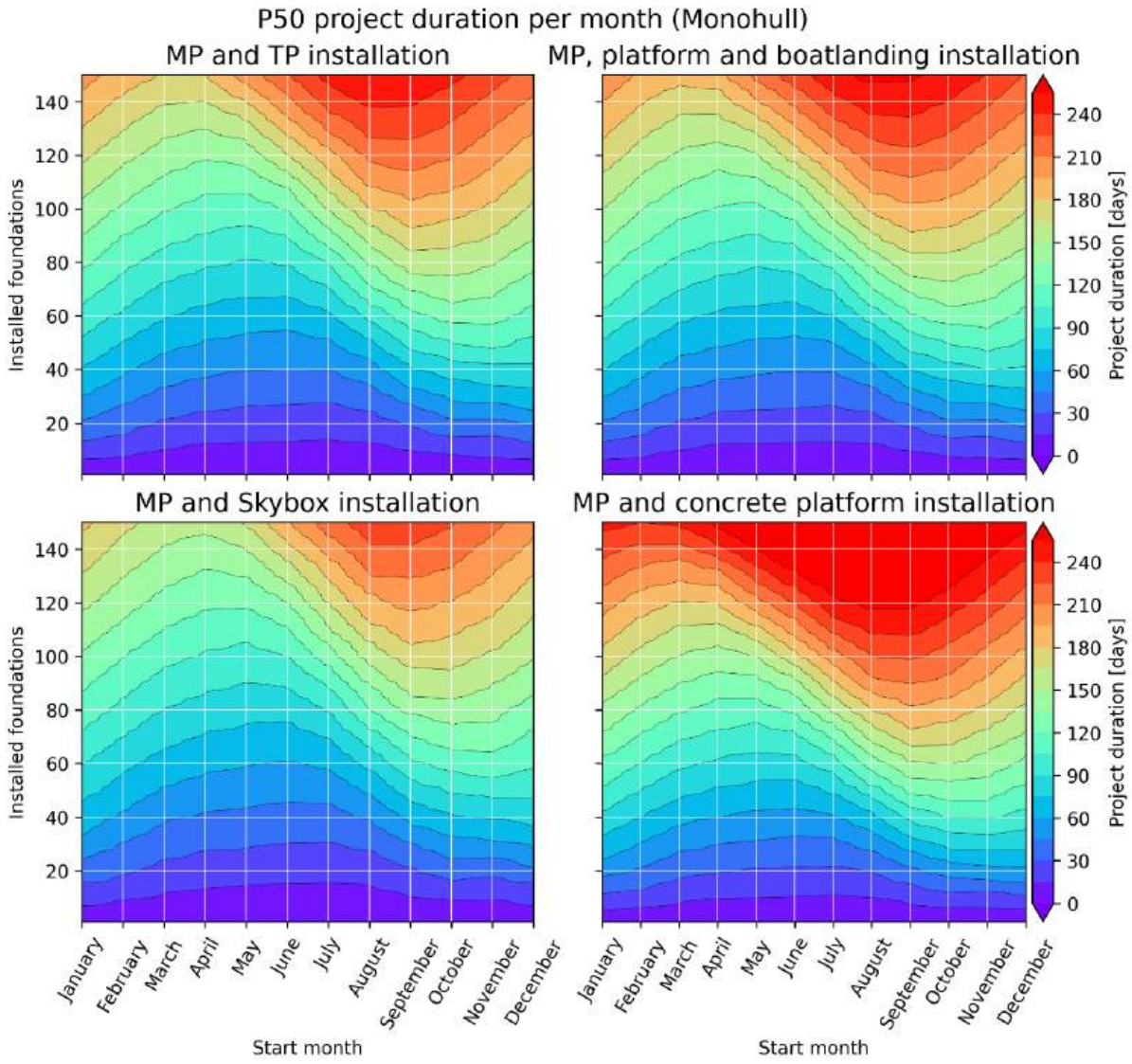


Figure 5-18, 2d-surface plot of the P50 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a monohull vessel (scenarios 1a, 2a, 3a and 4a).

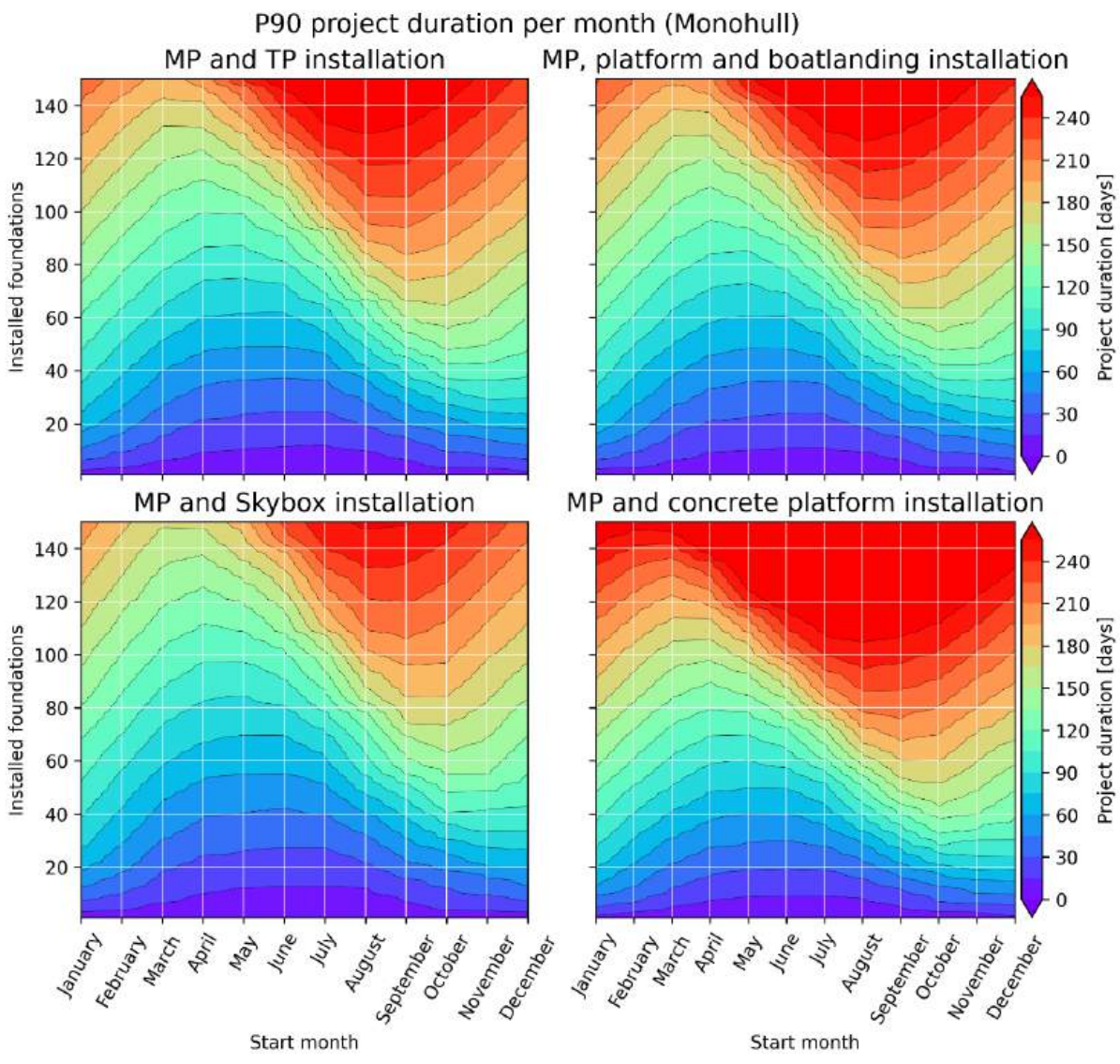


Figure 5-19, 2d-surface plot of the P90 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a monohull vessel (scenarios 1a, 2a, 3a and 4a).

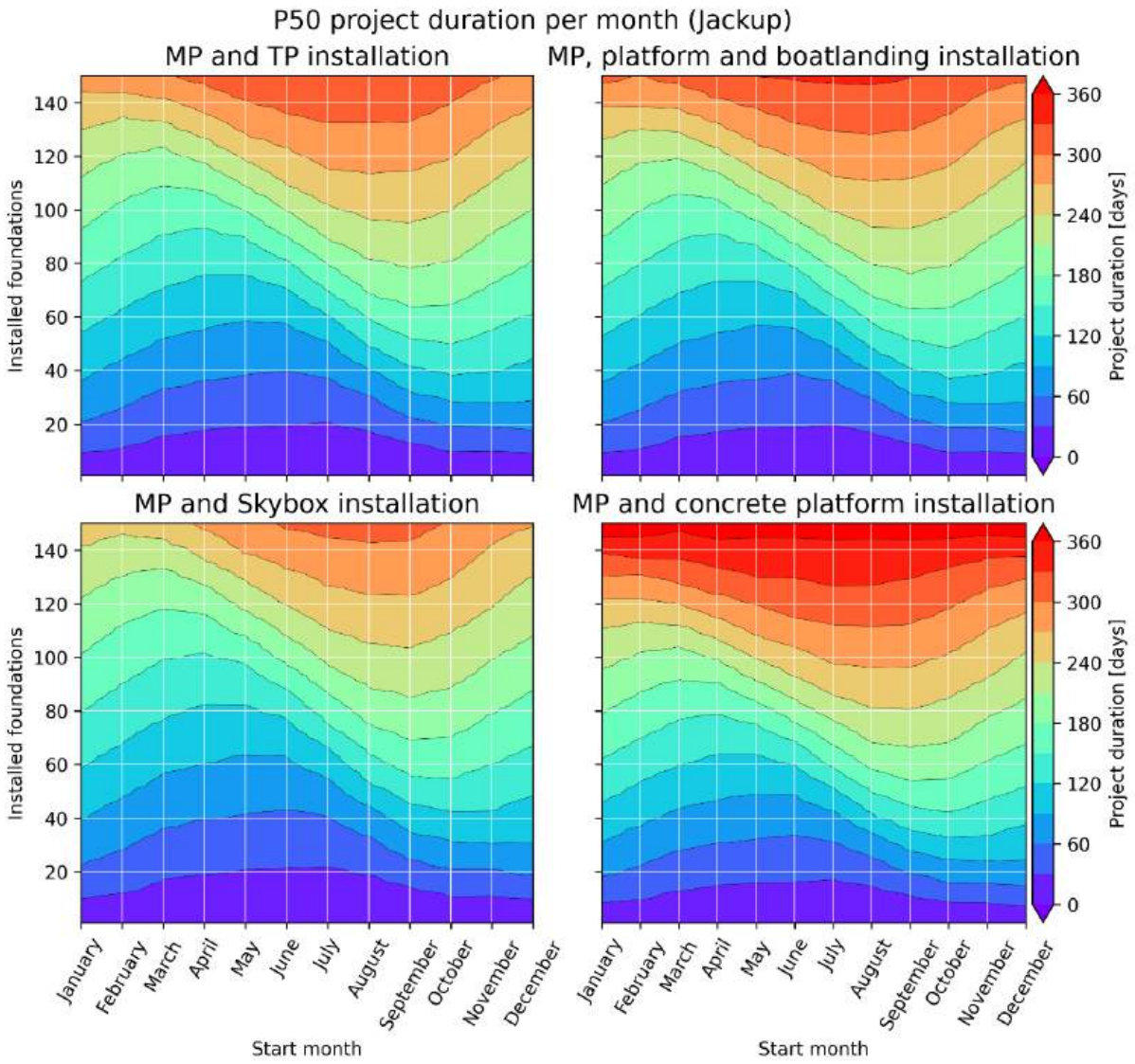


Figure 5-20, 2d-surface plot of the P50 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a jackup (scenarios 1b, 2b, 3b and 4b)

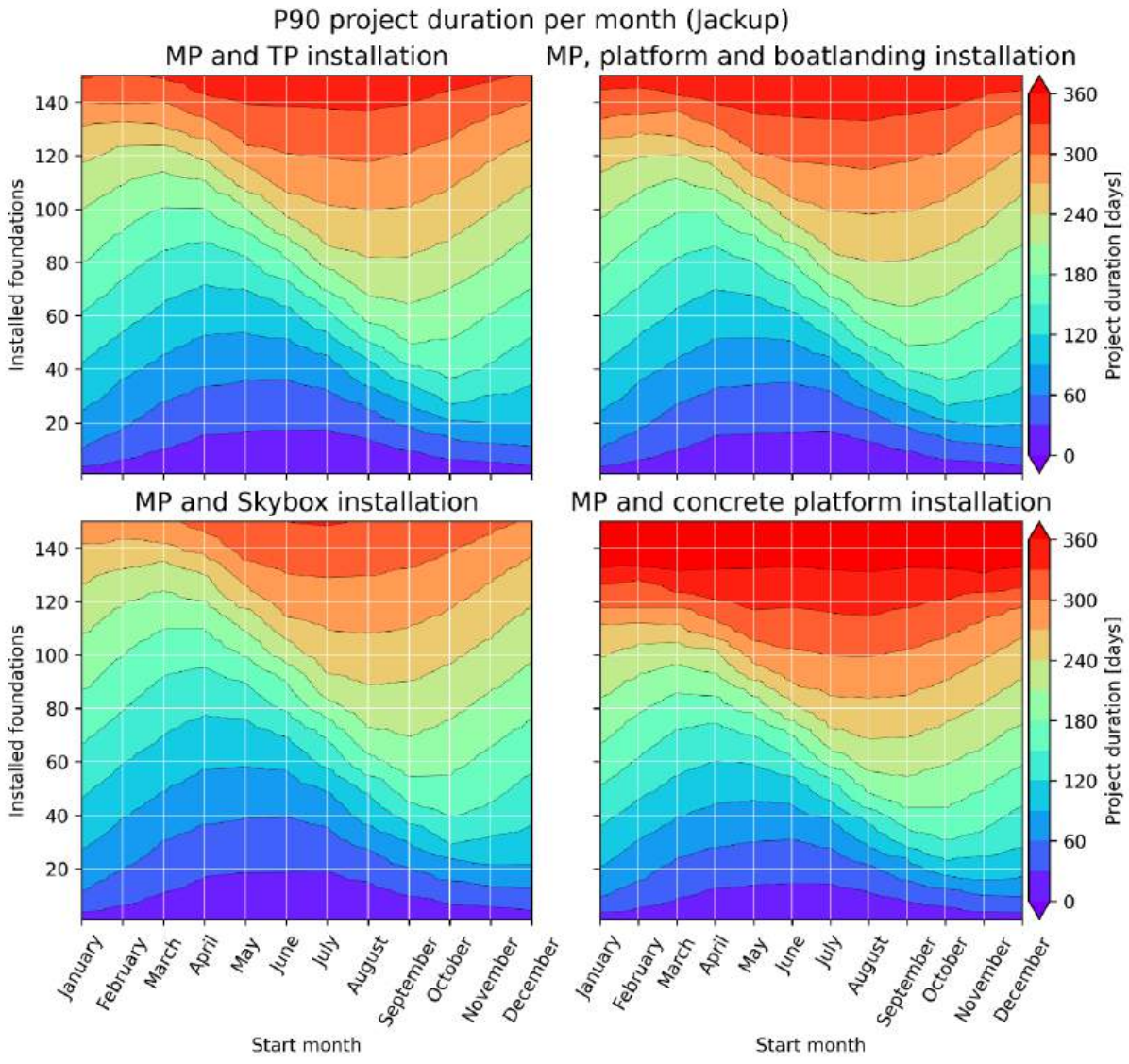


Figure 5-21, 2d-surface plot of the P90 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for all scenarios using a jackup (scenarios 1b, 2b, 3b and 4b)

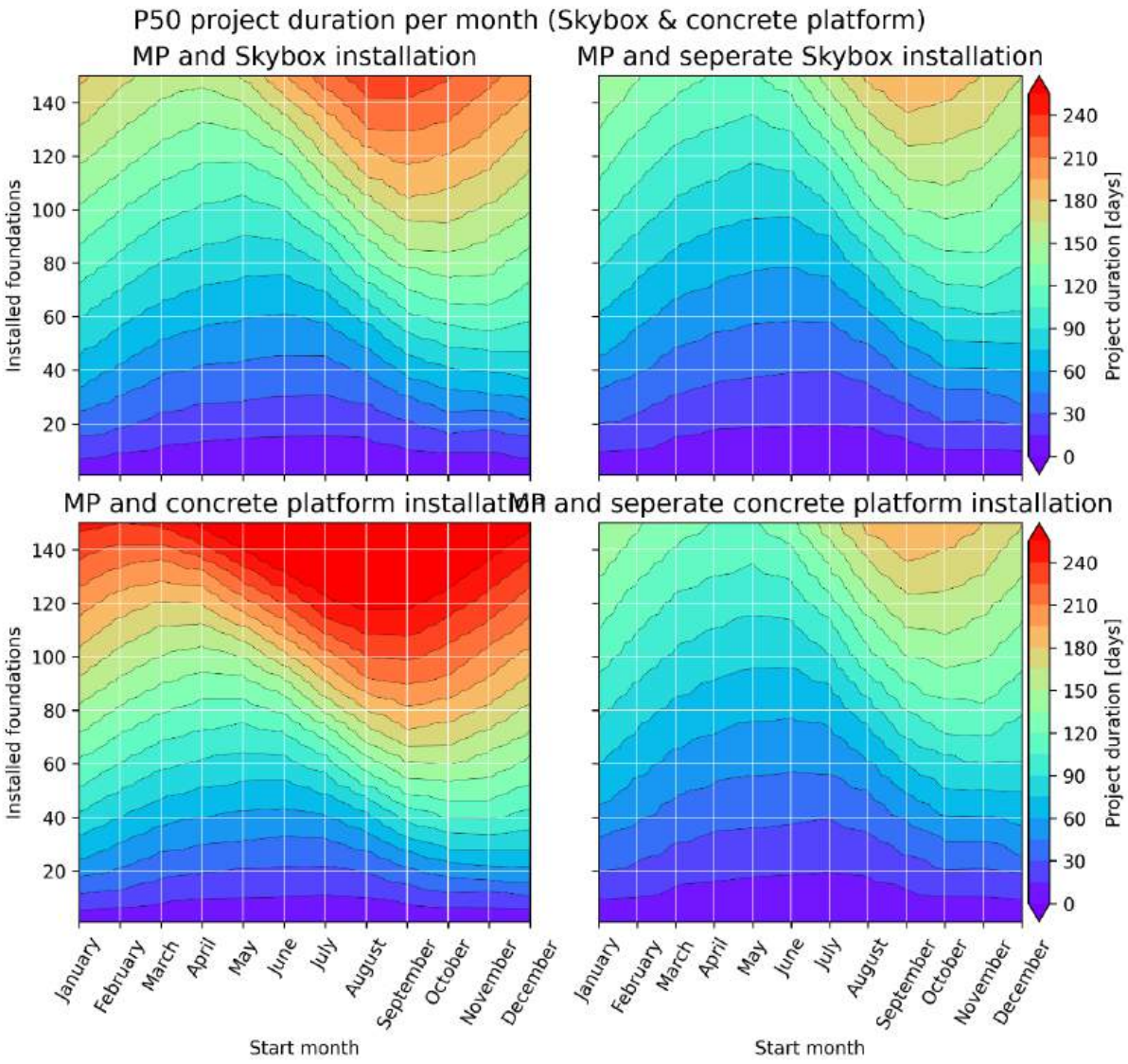


Figure 5-22, 2d-surface plot of the P50 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for the skybox scenario using a single MHV (3a) or a separate vessel (3c) and for the concrete platform using a single MHV (4a) or separate vessel (4c).

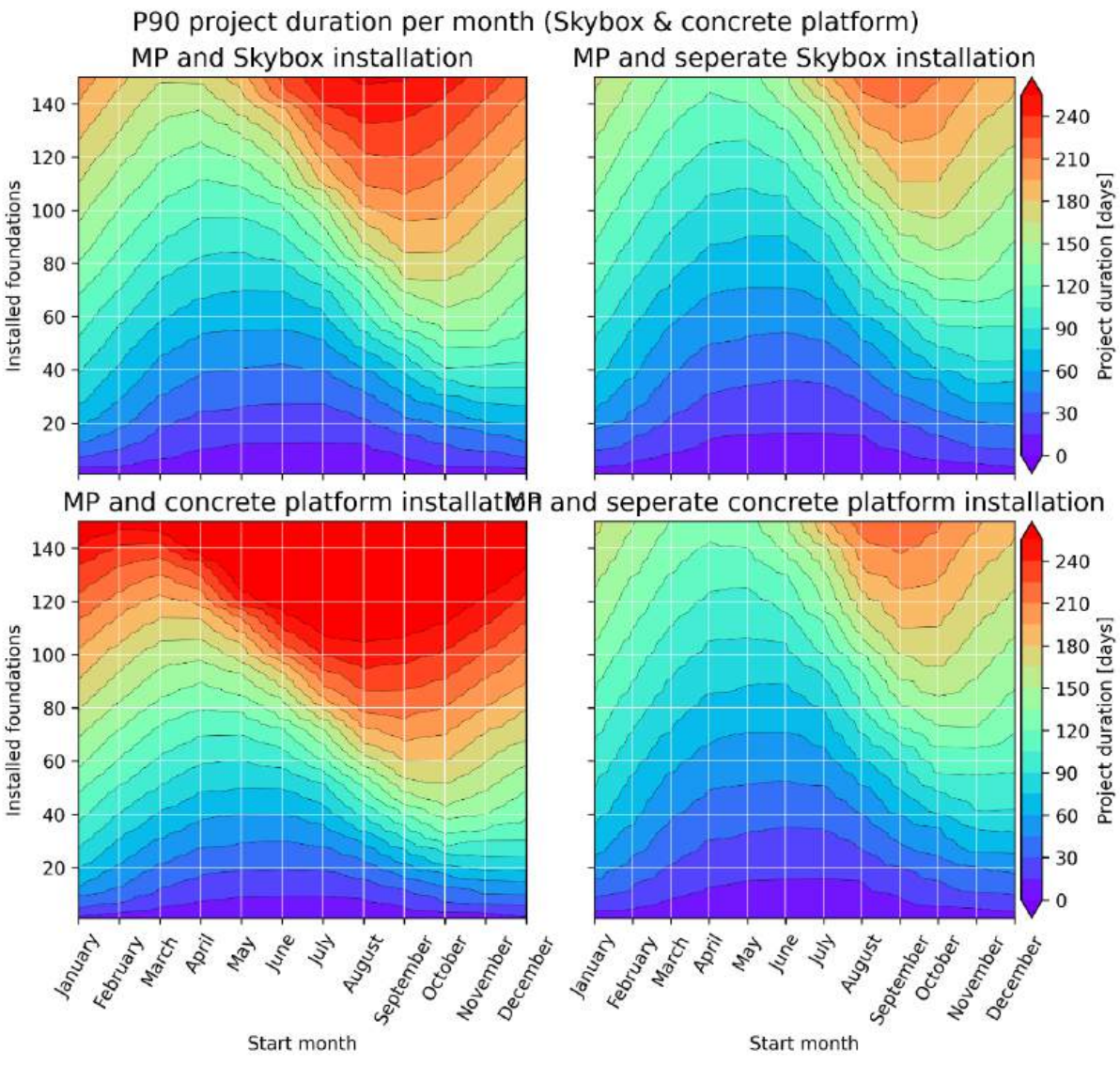


Figure 5-23, 2d-surface plot of the P90 project duration (z-axis/color) of every n-installed foundations (y-axis) and every starting month (x-axis) for the skybox scenario using a single MHV (3a) or a separate vessel (3c) and for the concrete platform using a single MHV (4a) or separate vessel (4c).

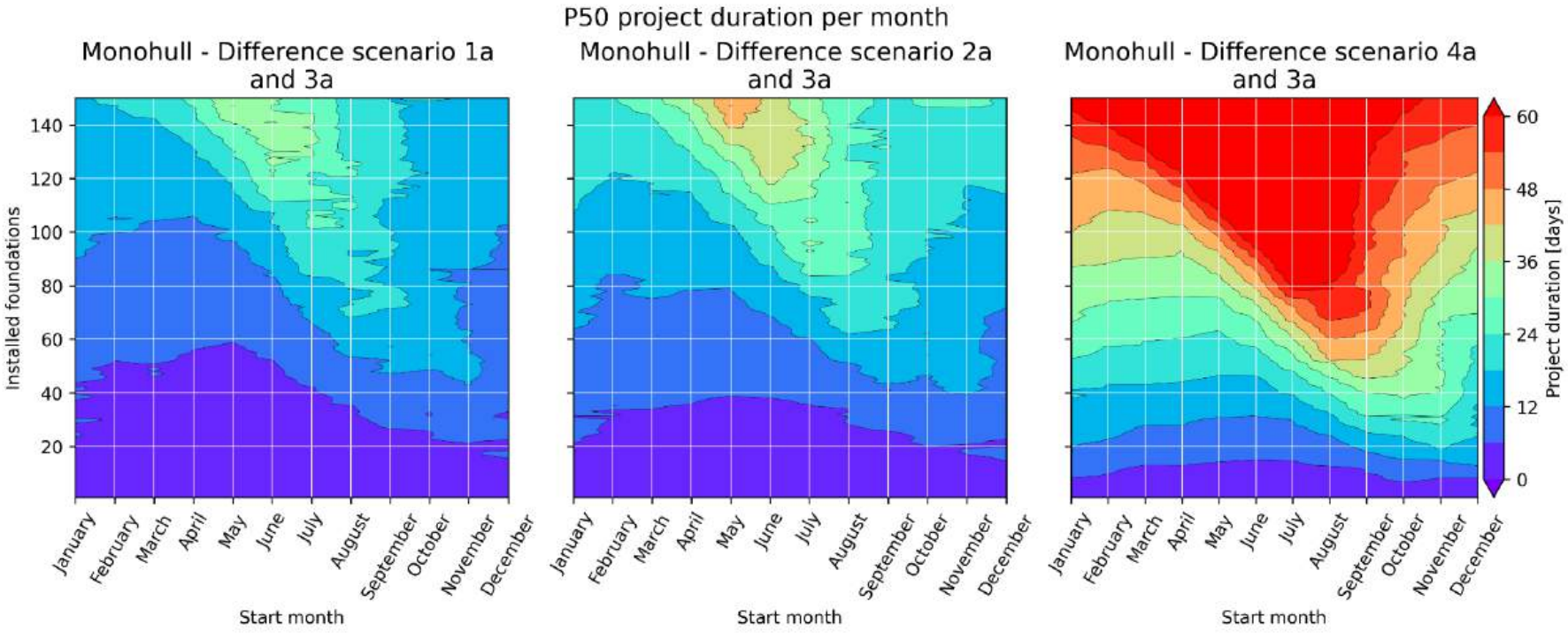


Figure 5-24, P50 difference in project duration between, from left to right: scenario 1a, 2a, 4a and 3a for every n-installed foundation and starting month.

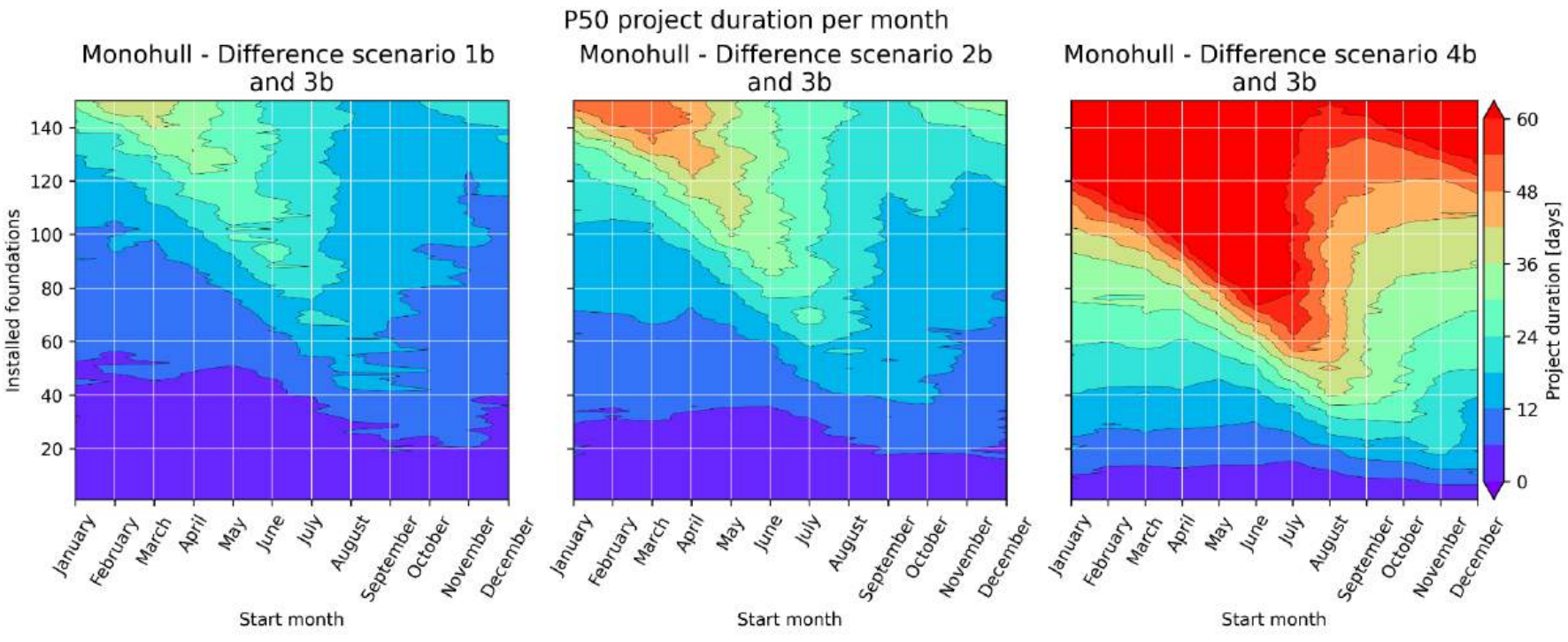


Figure 5-25, P50 difference in project duration between, from left to right: scenario 1b, 2b, 4b and 3b for every n-installed foundation and starting month.

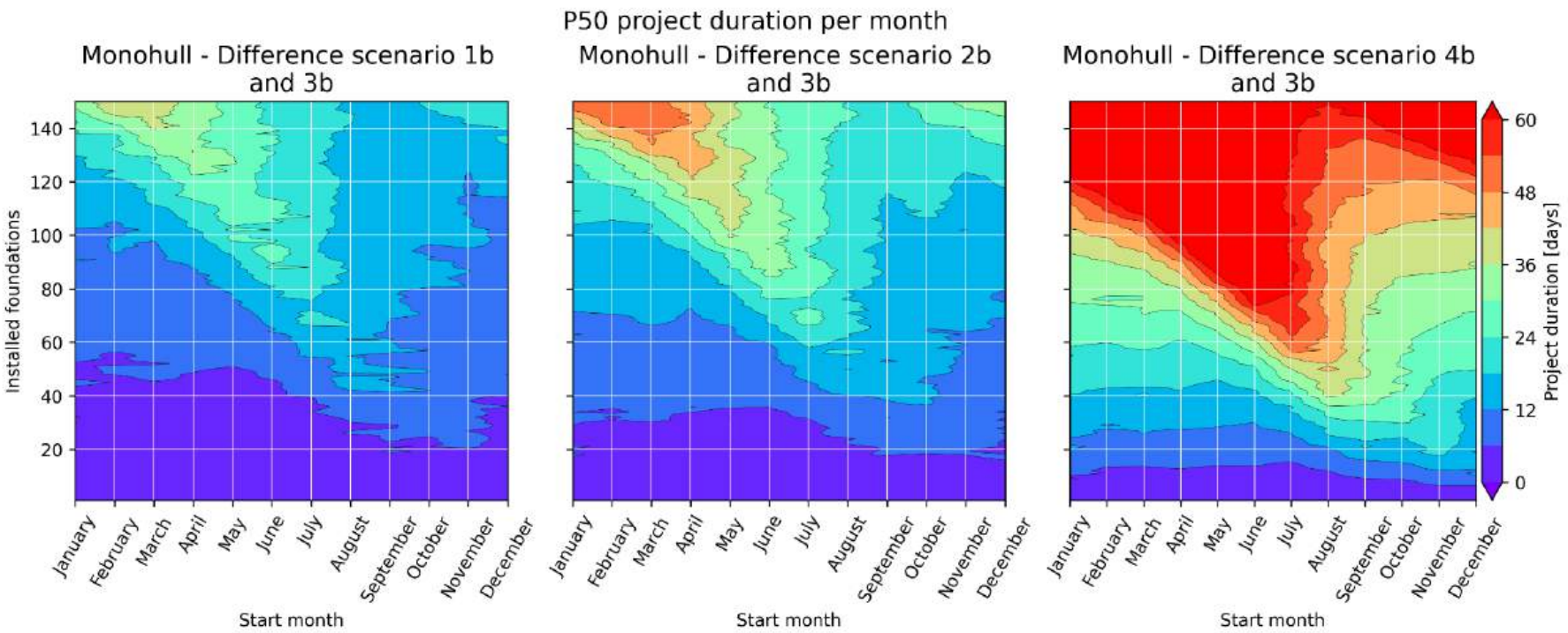


Figure 5-26, P90 difference in project duration between, from left to right: scenario 1a, 2a, 4a and 3a for every n-installed foundation and starting month.

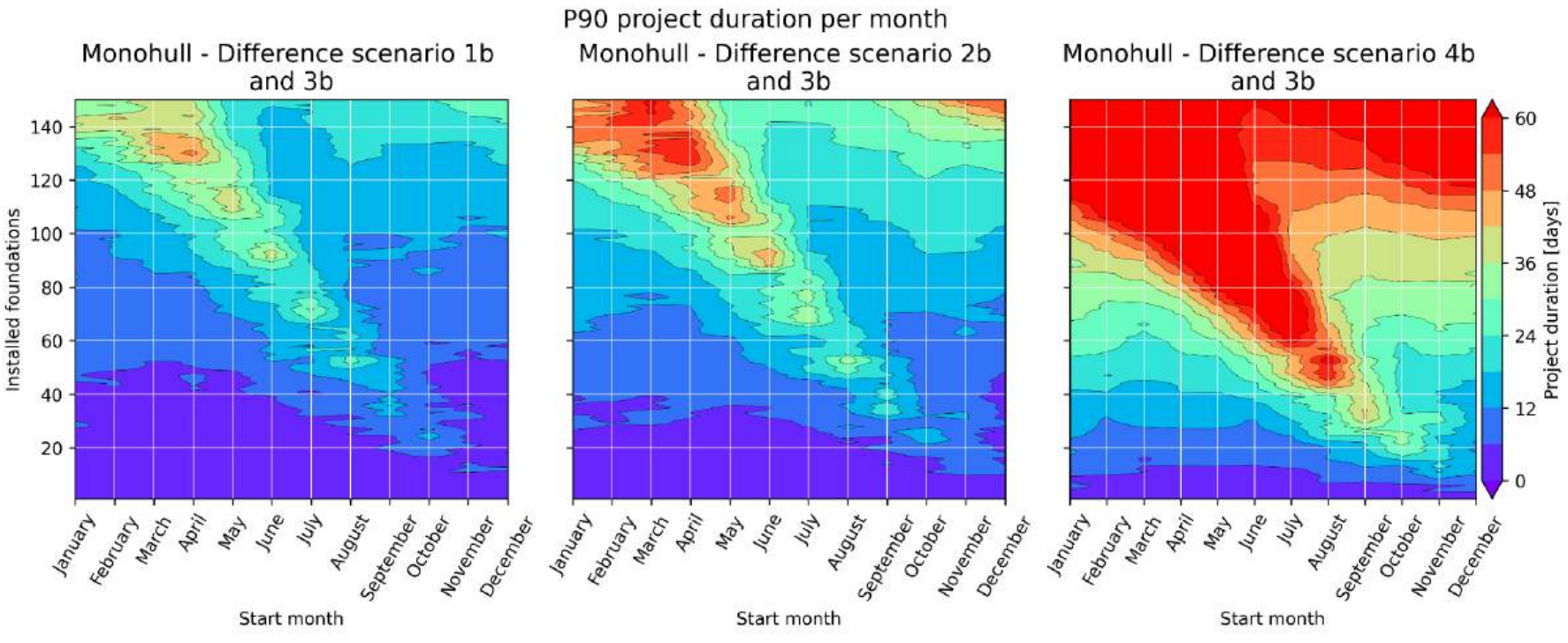


Figure 5-27, P90 difference in project duration between, from left to right: scenario 1b, 2b, 4b and 3b for every n-installed foundation and starting month.

APPENDIX C REPRESENTATIVE GANTT CHARTS

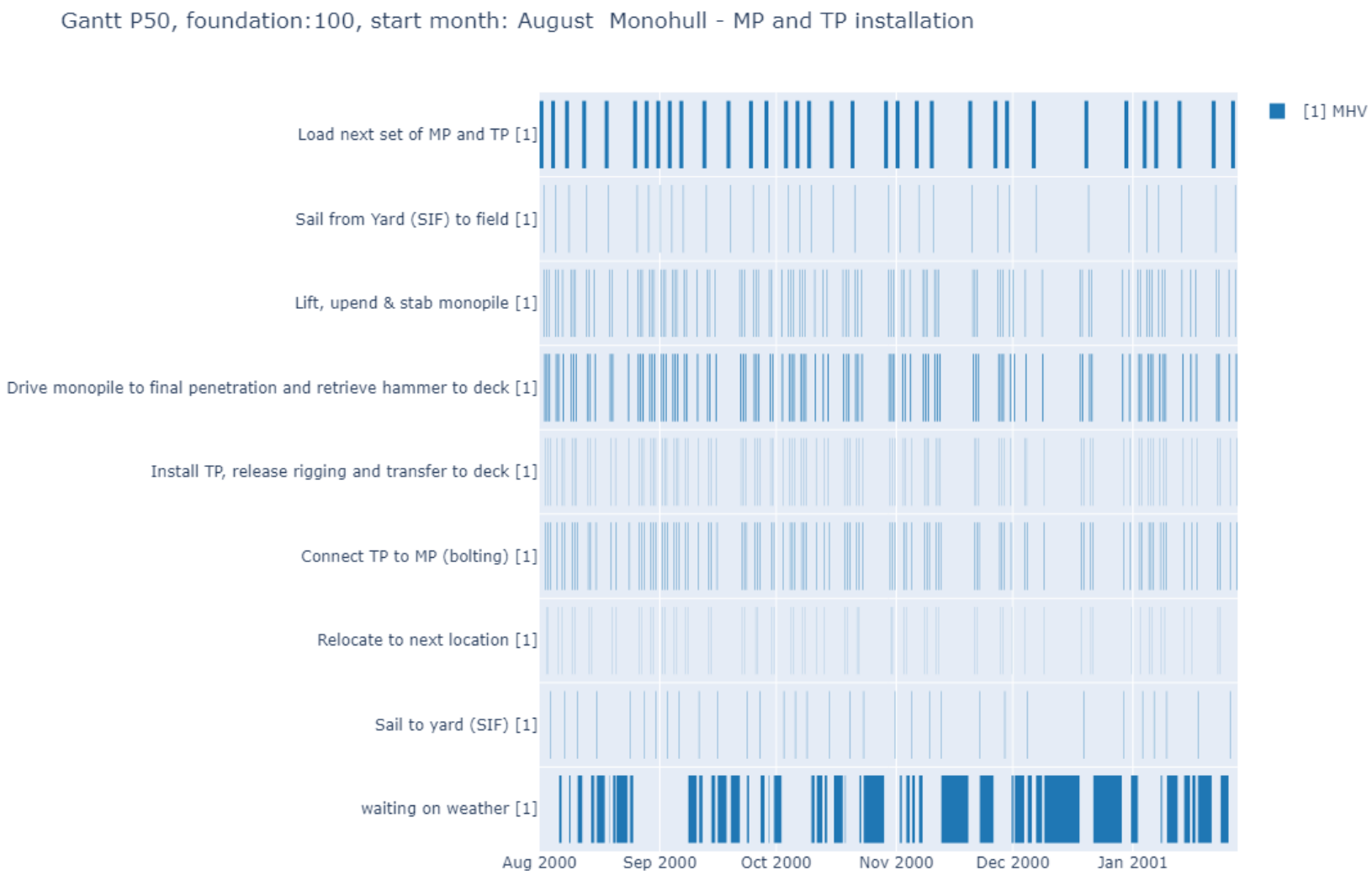


Figure C-1, representative P50 simulation of scenario 1a installing 100 foundation with a starting date in August

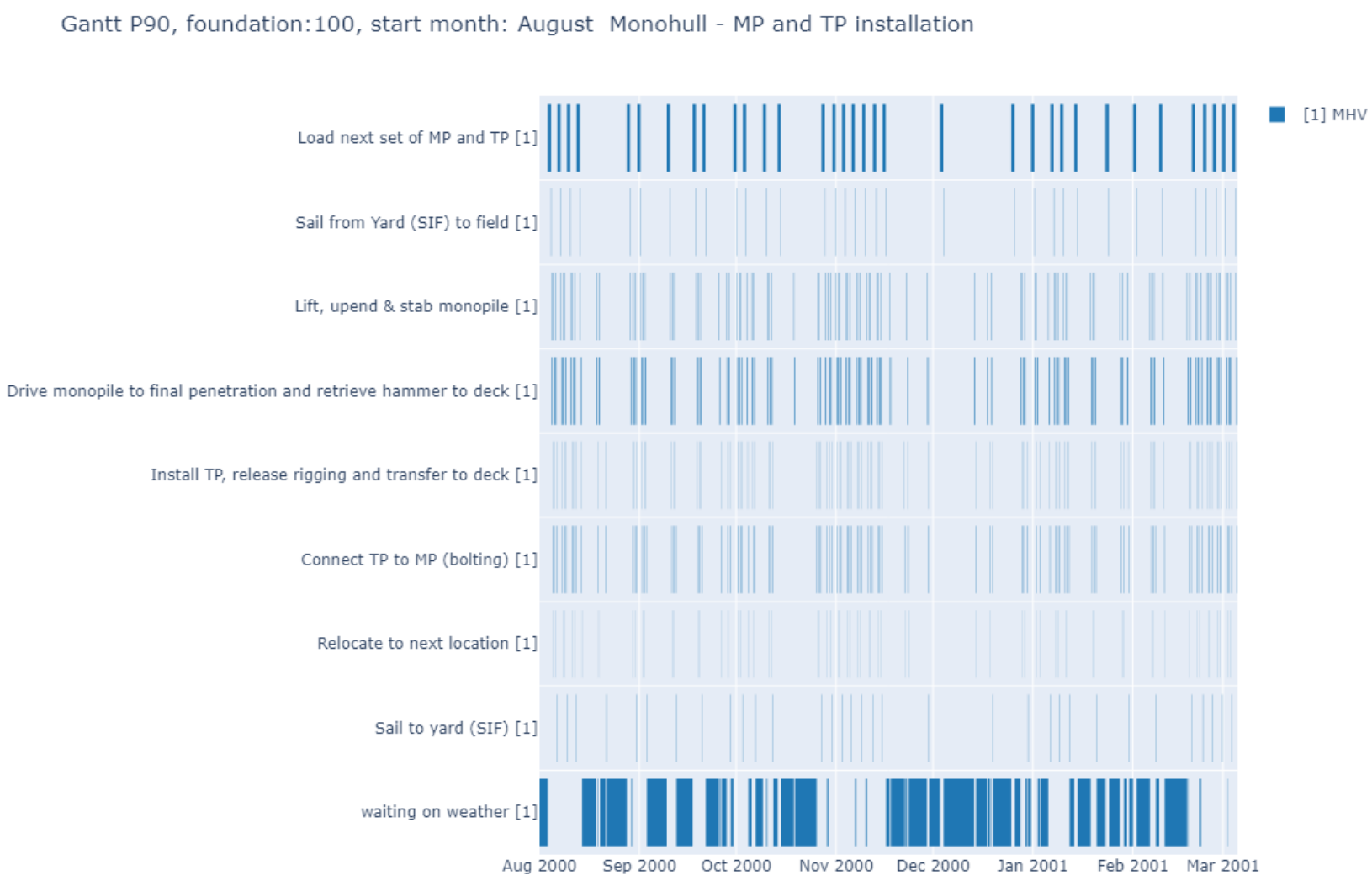


Figure C-2, representative P90 simulation of scenario 1a installing 100 foundation with a starting date in August

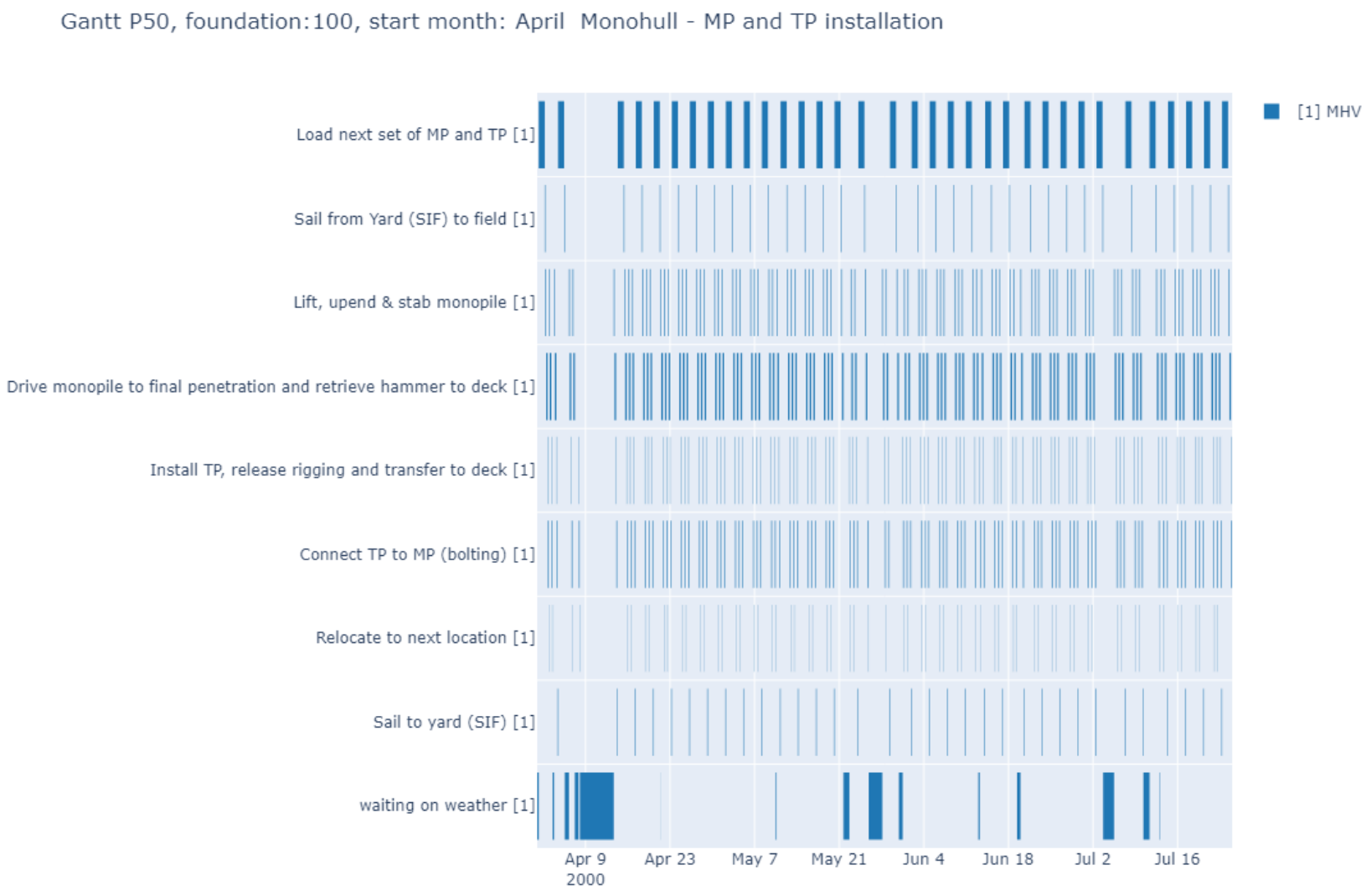


Figure C-3, representative P50 simulation of scenario 1a installing 100 foundation with a starting date in April

ENGINEERING SOLUTIONS

APPENDIX D SCENARIO COST COMPARISON

Installation costs	1a) MP/TP	2a) TP-LESS	3a) Skybox	4a) Concrete platform
Probability (Px)	**P50**	**P50**	**P50**	**P50**
Vessel	**MHV**	**MHV**	**MHV**	**MHV**
One-off costs: grillage / seafastening / installation tooling	€ 1,150,000.00	€ 3,000,000.00	€ 1,500,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal	equal
Dayrate of next gen large installation vessels as from 2025 campaigns	€ 400,000.00	€ 400,000.00	€ 400,000.00	€ 400,000.00
Grouting spread dayrate				€ 10,000.00
Hourly rate	€ 16,666.67	€ 16,666.67	€ 16,666.67	€ 17,083.33
Nr. foundations	100	100	100	100
Start month [1-12]	3	3	3	3
P0 (days)	100.00	104.10	89.60	125.10
Wow (days)	21.60	21.40	20.10	24.90
Total lifting time (days)	121.60	125.50	109.70	150.00
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 51,790,000**	**€ 53,200,000**	**€ 45,380,000**	**€ 64,500,000**
	MP/TP	**TP-LESS**	**Skybox**	**Concrete platform**
Total installation cost	€ 51,790,000	€ 53,200,000	€ 45,380,000	€ 64,500,000

Table D-1, indicative cost comparison of the installation logistics between scenarios (1a, 2a, 3a & 4a) for the 50% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

Installation costs	1b) MP/TP	2b) TP-LESS	3b) Skybox	4b) Concrete platform
Probability (Px)	**P50**	**P50**	**P50**	**P50**
Vessel	**Jackup**	**Jackup**	**Jackup**	**Jackup**
One-off costs: grillage / seafastening / installation tooling	€ 1,150,000.00	€ 3,000,000.00	€ 1,500,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal	equal
Dayrate of next gen large installation vessels as from 2025 campaigns	€ 400,000.00	€ 400,000.00	€ 400,000.00	€ 400,000.00
Grouting spread dayrate	-	-	-	€ 10,000.00
Hourly rate	€ 16,666.67	€ 16,666.67	€ 16,666.67	€ 17,083.33
Nr. foundations	100	100	100	100
Start month [1-12]	3	3	3	3
P0 (days)	130.40	134.60	120.00	155.60
Wow (days)	34.20	33.90	31.50	44.80
Total lifting time (days)	164.60	168.50	151.50	200.40
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 68,990,000**	**€ 70,400,000**	**€ 62,100,000**	**€ 85,164,000**
	MP/TP	**TP-LESS**	**Skybox**	**Concrete platform**
Total installation cost TP/TP-less/Skybox	€ 68,990,000	€ 70,400,000	€ 62,100,000	€ 85,164,000

Table D-2, indicative cost comparison of the installation logistics between scenarios (1b, 2b, 3b & 4b) for the 50% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

Installation costs	3c) Skybox with separate vessel	4c) Concrete platform with separate vessel	4d) Separate grouting vessel
Probability (Px)	**P50**	**P50**	**P50**
Vessel	**MHV + Small MHV**	**MHV + Small MHV**	**MHV + OSV**
One-off costs: grillage / seafastening / installation tooling	€ 1,500,000.00	€ 3,000,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal
Dayrate MHV	€ 400,000.00	€ 400,000.00	€ 400,000.00
Dayrate separate vessel	€ 150,000.00	€ 150,000.00	€ 65,000.00
Grouting spread dayrate	-	€ 10,000.00	€ 10,000.00
Hourly rate	€ 22,916.67	€ 23,333.33	€ 19,791.67
Nr. foundations	100	100	100
Start month [1-12]	3	3	3
P0 (days)	76.50	71.90	134.20
Wow (days)	10.60	15.50	2.30
Total lifting time (days)	87.10	87.40	136.50
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 51,405,000**	**€ 51,944,000**	**€ 67,837,500**
	Skybox	**Grouted platform**	**Grouted platform**
Total installation cost TP/TP-less/Skybox	€ 51,405,000	€ 51,944,000	€ 67,837,500

Table D-3, indicative cost comparison of the installation logistics between scenarios (3c, 4c & 4d) for the 50% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

Installation costs	1a) MP/TP	2a) TP-LESS	3a) Skybox	4a) Concrete platform
Probability (Px)	**P90**	**P90**	**P90**	**P90**
Vessel	**MHV**	**MHV**	**MHV**	**MHV**
One-off costs: grillage / seafastening / installation tooling	€ 1,150,000.00	€ 3,000,000.00	€ 1,500,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal	equal
Dayrate of next gen large installation vessels as from 2025 campaigns	€ 400,000.00	€ 400,000.00	€ 400,000.00	€ 400,000.00
Grouting spread dayrate				€ 10,000.00
Hourly rate	€ 16,666.67	€ 16,666.67	€ 16,666.67	€ 17,083.33
Nr. foundations	100	100	100	100
Start month [1-12]	3	3	3	3
P0 (days)	100.00	104.10	89.60	125.10
Wow (days)	29.50	29.30	28.30	32.10
Total lifting time (days)	129.50	133.40	117.90	157.20
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 54,950,000**	**€ 56,360,000**	**€ 48,660,000**	**€ 67,452,000**
	MP/TP	**TP-LESS**	**Skybox**	**Concrete platform**
Total installation cost	€ 54,950,000	€ 56,360,000	€ 48,660,000	€ 67,452,000

Table D-4, indicative cost comparison of the installation logistics between scenarios (1a, 2a, 3a & 4a) for the 90% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

Installation costs	1b) MP/TP	2b) TP-LESS	3b) Skybox	4b) Concrete platform
Probability (Px)	**P90**	**P90**	**P90**	**P90**
Vessel	**Jackup**	**Jackup**	**Jackup**	**MHV**
One-off costs: grillage / seafastening / installation tooling	€ 1,150,000.00	€ 3,000,000.00	€ 1,500,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal	equal
Dayrate of next gen large installation vessels as from 2025 campaigns	€ 400,000.00	€ 400,000.00	€ 400,000.00	€ 400,000.00
Grouting spread dayrate	-	-	-	€ 10,000.00
Hourly rate	€ 16,666.67	€ 16,666.67	€ 16,666.67	€ 17,083.33
Nr. foundations	100	100	100	100
Start month [1-12]	3	3	3	3
P0 (days)	130.40	134.60	120.00	155.60
Wow (days)	48.40	49.30	42.20	69.90
Total lifting time (days)	178.80	183.90	162.20	225.50
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 74,670,000**	**€ 76,560,000**	**€ 66,380,000**	**€ 95,455,000**
	MP/TP	**TP-LESS**	**Skybox**	**Concrete platform**
Total installation cost TP/TP-less/Skybox	€ 74,670,000	€ 76,560,000	€ 66,380,000	€ 95,455,000

Table D-5, indicative cost comparison of the installation logistics between scenarios (1b, 2b, 3b & 4b) for the 90% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

Installation costs	3c) Skybox with separate vessel	4c) Concrete platform with separate vessel	4d) Separate grouting vessel
Probability (Px)	**P90**	**P90**	**P90**
Vessel	**MHV + Small MHV**	**MHV + Small MHV**	**MHV + OSV**
One-off costs: grillage / seafastening / installation tooling	€ 1,500,000.00	€ 3,000,000.00	€ 3,000,000.00
	* MP cradles 250keu * TP seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * TP lifting padeyes&spreader&rigging 150keu	* MP cradles 250keu * Sec steel seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Sec steel installation tools 2000keu	* MP cradles 250keu * Skybox seafastening grillage 250keu * MP upending & lifting tools & rigging 500keu * Skybox installation tool 500keu
Transport to site: lifting onboard vessel and transport to site	equal	equal	equal
Dayrate MHV	€ 400,000.00	€ 400,000.00	€ 400,000.00
Dayrate separate vessel	€ 150,000.00	€ 150,000.00	€ 65,000.00
Grouting spread dayrate	-	€ 10,000.00	€ 10,000.00
Hourly rate	€ 22,916.67	€ 23,333.33	€ 19,791.67
Nr. foundations	100	100	100
Start month [1-12]	3	3	3
P0 (days)	92.00	85.40	141.50
Wow (days)	4.00	10.80	2.40
Total lifting time (days)	96.00	96.20	143.90
Installation of MP/TP bolts (per foundation)	€ 20,000.00	€ 0.00	€ 0.00
100 Fou, starting in month 3 ,in field and in position, excl to-and-fro voyage, jacking, anchoring etc)	**€ 56,300,000**	**€ 56,872,000**	**€ 71,352,500**
	Skybox	**Grouted platform**	**Grouted platform**
Total installation cost TP/TP-less/Skybox	€ 56,300,000	€ 56,872,000	€ 71,352,500

Table 5-2, indicative cost comparison of the installation logistics between scenarios (3c, 4c & 4d) for the 90% percentile simulation. The results are shown for 100 installed WTGs and with a starting month of March

5.6 Annex 6 - Get Up Safe Gx2 quotation

RFQ Prepared by:

Pict Offshore Ltd (POL)

For offshore wind operators and developers seeking cost-effective, safer, and more accessible wind farms, Pict offers an innovative personnel and cargo transfer solution with advanced heave compensation for personnel. This solution enhances safety by eliminating the need for boat landings and ladders, provides greater accessibility in higher sea states, increases operational time, and optimises offshore foundation design, ultimately reducing costs.

Commercial and Technical Proposal

In response to Client Request For Quotation (RFQ) for the supply of the Get Up Safe 'GUSx2' Systems.

Proposal submission date: **18/03/2025**

Prepared For:

Sif
Stefan Erents
Engineering Manager

GUSx2 Budgetary Quotation - Priced

Year of Quotation 2025
Year of Supply 2026

	Description	Quantity	Unit	Unit price £ (GBP)	Total price £ (GBP)	Total Price € (EURO)	Pict notes
	Product Offering - GUSx2						
	GUSx2 - dual function personnel (150kg)/ cargo (1000kg) lifting system.	60	1 per foundation	£ 96,612	£ 5,796,720	€ 6,956,064	2-year warranty as standard. Specifications per separate technical specifications sheet (options not included)
	Retractable power cable reel for powering from CTV (e.g. During construction phase of project when no power available from WTG) and emergency lowering function that can be activated from CTV.	60	1 per foundation	£ 7,733	£ 463,980	€ 556,776	
	CTV package (see separate itemised list)	1	1 per CTV	£ 7,391	£ 7,391	€ 8,869	
					£ 6,268,091	**€ 7,521,709**	
	Optional Extras - GUSx2						
Optional	Rope Transfer System	60	1 per foundation	£ 6,570	£ 394,200	€ 473,040	
Optional	RTS CTV kit	1	1 per CTV	£ 22,300	£ 22,300	€ 26,760	
Optional	Step-down transformer (690V - 400V)	60	1 per foundation	£ 863	£ 51,780	€ 62,136	
Optional	SCADA connectivity (enables remote system diagnostics/data capture)	60	1 per foundation	£ 940	£ 56,400	€ 67,680	
Optional	OVP (Over Voltage Protection)	60	1 per foundation	£ 400	£ 24,000	€ 28,800	
					£ 548,680	**€ 658,416**	
	Packaging (includes metal transport pallet)		1 per GUS 2.0		£ -	€ -	Cost + 15% will apply.
	Transportation - DAP Incoterms (Inverkeithing, Scotland - Location Specific)		3 per container		£ -	€ -	Cost + 15% will apply.
				TOTAL	**£ -**	**€ -**	

Notes:

1. This is a budgetary quotation and is not a binding offer of sale.
2. Prices are provided in GBP and EURO and do not include VAT.
3. GBP to EURO exchange rate: 1 GBP to 1.20 EURO.
4. Should inflation (as measured by UK CPI rate) be greater than 3% in any year (2025 onwards) then these prices may be revised to reflect this.
5. Should the exchange rate fluctuate by more than 5% in any year (2025 onwards) then these prices may be revised to reflect this.
6. Transportation of GOODs - customer will be responsible for any import duties and tariffs that may apply.

Crew Transfer Vessel (CTV) Equipment
2025 Pricing

The equipment detailed below is a requirement for the operation of the personnel access functions of the GUS 2.0 system.

Description	Unit price £ (GBP)	Unit Price € (EURO)	Recommended QTY	Minimum QTY	Recomm. Qty Total £	Min. Qty Total £
CTV Package Items						
Radio Remote Control (RRC)	£ 2,457.75	€ 2,949.30	2	1	£ 4,915.50	£ 2,457.75
RRC transport case	£ 134.69	€ 161.63	1	1	£ 134.69	£ 134.69
Cable Reel Connection Cables	£ 1,228.16	€ 1,473.79	2	1	£ 2,456.32	£ 1,228.16
Cable reel transport cases	£ 113.07	€ 135.68	1	1	£ 113.07	£ 113.07
24v Emergency Rescue Kit (ERK)	£ 1,201.97	€ 1,442.36	2	1	£ 2,403.94	£ 1,201.97
ERK transport case	£ 97.78	€ 117.34	2	1	£ 195.56	£ 97.78
Personal Evacuation Device (PED)	£ 1,033.90	€ 1,240.68	4	1	£ 4,135.60	£ 1,033.90
PED transport case	£ 134.69	€ 161.63	1	1	£ 134.69	£ 134.69
Reach Rescue Kit (RRK)	£ 762.37	€ 914.84	1	1	£ 762.37	£ 762.37
RRK transport case	£ 134.69	€ 161.63	1	1	£ 134.69	£ 134.69
Long boat hook (24')	£ 91.45	€ 109.74	1	1	£ 91.45	£ 91.45

Grand Total	**£ 15,478**	**£ 7,391**
	€ 18,573	€ 8,869

Notes:

1. This is a budgetary quotation and is not a binding offer of sale.
2. Prices are provided in GBP and EURO and do not include VAT.
3. GBP to EURO exchange rate: 1 GBP to 1.20 EURO.
4. Should inflation (as measured by UK CPI rate) be greater than 3% in any year (2025 onwards) then these prices may be revised to reflect this.
5. Should the exchange rate fluctuate by more than 5% in any year (2025 onwards) then these prices may be revised to reflect this.
6. Transportation of GOODs - customer will be responsible for any import duties and tariffs that may apply.

TECHNICAL SERVICES RATE CARD 2025

Role	Location	Min Hours	Rate per hour (GBP)	Work Rate (GBP)	Per Diem (GBP)	Total Daily Rate (GBP)	Overtime per Hour (GBP)	Pict Comments
Pict Technician	Offshore - Active	12	94	1,128	218	1,346	94	
Pict Technician	Onshore/Training/Consulting	8	90	720	218	938	90	
Pict Technician	Standby	8	90	720	218	938	90	Mobilisation next day, otherwise retainer fees apply
Any	Mobilisation/Demobilisation			1,483	round trip			This covers one day mobilisation and demobilisation: labour time and UK travel only.
Any	International Travel				cost + 15%			Including but not limited to: flights, accommodation, car hire, excess baggage
Per diem	Per Diem			218				Alternative to accomodation plus subsistence on Cost + basis
Other costs					cost + 15%			

Offshore working rate
Working rate is based on 12-hour days Monday to Sunday. Inclusive of PPE, per diem allowance. During rotation offshore technician shall be athe accommodation is not offered by client during the rotation, accommodation will be charged according to price table.

Onshore working rate
Working rate is based on 8-hour days Monday to Saturday and applies on preassembly sites and onshore sites. Inclusive of PPE, per diem allowance. In the event the accommodation is not offered by client during the rotation, accommodation will be charged according to price table.

Per Diem
Per diem, including overnight accomodation, is charged at £218 per day. Either party may request cost +15% instead

Offshore standby rate
Standby offshore on hotel vessel/DP2 due to weather conditions, lack of work permit, cancellation of work. A maximum of 12 hours will be charged on a full standby day.

Onshore standby rate
Standby onshore due to weather conditions, lack of work permit, cancellation of work. A maximum of 8 hourswill be charged on a full standby day.

Nightshift
Nightshift must be agreed in advance.

Standby rate at home
A maximum of 40 hours will be charged as follows Monday to Friday 8 hours per day.

Other Costs
Additional costs (consumables, training, mileage (out with normal mobilisation)) – at cost + 15%

RPI
Prices apply until 31 December 2025 or from commencement of contract, after which prices will be subject to annual RPI increases, effective 01 January 2026 and annually thereafter.

GUSx2 Maintenance Schedule

Activity / Preventative maintenance item	Maintenance Birthdate (Manufacture/Installation/Offshore Commission)
Thorough Examination (UK)	On Commissioning, every 6 months (refer to rates card)
Thorough Examination (Non-UK)	On Commissioning, every year after (refer to rates card)
Grease Magnetic Gate Lock	On Commissioning, every year after
Lubricate EOL Spring	On Commissioning, every year after
Replace Desiccant Cartridges	On Commissioning, every year after
Grease slew ring	From manufacture, every year after
Replace Wire Rope - Personal - 6mm	4 years from Rope Installation (incl. at FAT) or at 900 transfers at time of installation.
Brake contactors (qty 6)	4 years from Commissioning and every 4 years thereafter
Replace Wire Rope - Cargo - 10mm	5 years from Installation of Rope (at FAT or service)
Brake rotor (personnel)	6 years from FAT and every 6 years thereafter
Brake rotor (cargo)	6 years from FAT and every 6 years thereafter
DLC modules (qty 6)	10 years from manufacture date, 10 year interval
PLC memory card	10 years from manufacture date, 10 year interval
Deck Sensor	12 years from comissioning date, 12 year interval
24V PSU	15 years from manufacture date, 15 year interval
Servo control unit (qty 2)	20 years from manufacture date, 20 year interval
Servo power module (qty 2)	20 years from manufacture date, 20 year interval
PLC unit	20 years from manufacture date, 20 year interval
Safety input module (qty 1)	20 years from manufacture date, 20 year interval
Safety output module (qty 1)	20 years from manufacture date, 20 year interval
Load pin	20 years from manufacture date, 20 year interval

Maintenance Year:	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15	Yr 16	Yr 17	Yr 18	Yr 19	Yr 20	Yr 21	Yr 22	Yr 23	Yr 24	Yr 25	Yr 26	Yr 27	Yr 28	Yr 29	Yr 30	Yr 31	Yr 32	Yr 33	Yr 34	Yr 35
Annual Selling Price (2024 pricing)	£110	£110	£110	£887	£869	£110	£110	£887	£110	£9,762	£110	£4,112	£110	£110	£1,333	£887	£110	£110	£110	£22,600	£110	£110	£110	£4,112	£869	£110	£110	£887	£110	£10,226	£110	£887	£110	£110	£869
Cumulative Annual Selling Price GBP (2024 pricing)	£110	£220	£330	£1,217	£2,086	£2,196	£2,306	£3,193	£3,303	£13,065	£13,175	£17,287	£17,397	£17,507	£18,840	£19,727	£19,837	£19,947	£20,057	£42,657	£42,767	£42,877	£42,987	£47,098	£47,967	£48,077	£48,187	£49,074	£49,184	£59,410	£59,520	£60,407	£60,517	£60,627	£61,496
Cumulative Annual Selling Price GBP (2024 pricing)	€ 132	€ 264	€ 396	€ 1,460	€ 2,503	€ 2,635	€ 2,767	€ 3,832	€ 3,964	€ 15,678	€ 15,810	€ 20,744	€ 20,876	€ 21,008	€ 22,608	€ 23,672	€ 23,804	€ 23,936	€ 24,068	€ 51,188	€ 51,320	€ 51,452	€ 51,584	€ 56,518	€ 57,561	€ 57,693	€ 57,825	€ 58,889	€ 59,021	€ 71,292	€ 71,424	€ 72,489	€ 72,621	€ 72,753	**€ 73,796**

£ 61,496

€ 73,796

Prices apply until 31 December 2025 or from commencement of contract, after which prices will be subject to annual RPI increases, effective 01 January 2026 and annually thereafter.

Light Offshore Crane and Heave Compensated Personnel Hoist

Gx2 Technical Specification

The GUS 2.0 system is under development, and therefore all technical specifications are subject to change without notice.

Rev.	Release Date	Description	Author	Checked	Approved
001	13/07/2024	First release	AK	PT	

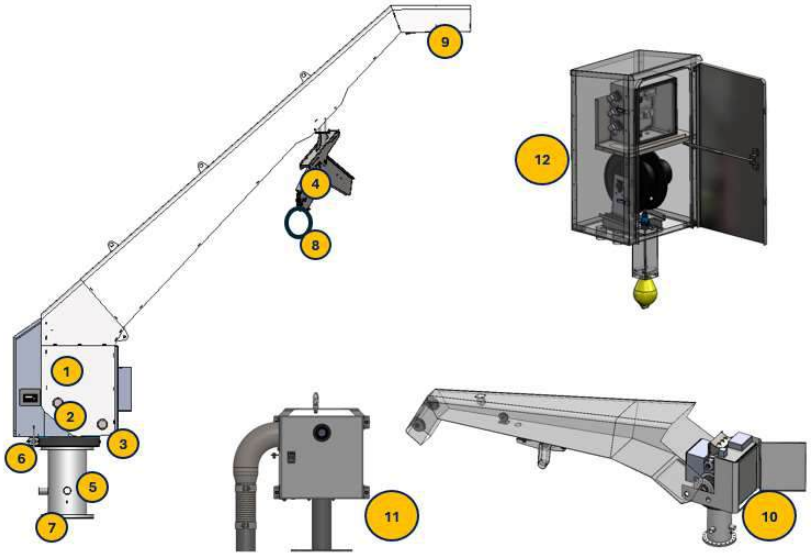
Pict Offshore Limited

Pict House
13/14 Belleknowes Industrial Estate
Inverkeithing
KY11 1HZ
T. +44 (0) 1383 431 891
E. Info@pictoffshore.com
W. www.pictoffshore.com

This document was originally drafted in English

1 Technical Specifications

1. Personnel winch
2. Cargo winch
3. Boom lowering pivot
4. Swing arm pulley
5. Pedestal
6. Slewing ring
7. Foundation interface
8. Personnel lifting masterlink
9. Cargo lifting hook
10. Easy access, high-IP enclosures
11. High IP laser sensor enclosure
12. Retractable power cable



	General Information
Model Name	Gx2: Personnel and Cargo Transfer System
Crane Type	Fixed boom
Luffing boom	Manual operation for service and maintenance
Design life	35yrs +2yrs during installation phase
Service interval	Cargo: 12 months max Personnel: 12 months max (unless local requirements differ)
Certification	• Machinery Directive, 2006/42/EC • Electromagnetic Compatibility (EMC) Directive 2014/30/EU
Certification	• EU Declaration of Conformity (CE marked) • EN 61000-6-2: 2005 Electromagnetic compatibility (EMC) - Part 6-2: Immunity for industrial environments • EN 61000-6-4: 2007 Electromagnetic compatibility (EMC) - Part 6-4: Emission standard for industrial environments • Low Voltage Directive 2014/35/EU • Radio Equipment Directive 2014/53/EU • EN13852-3: Light Offshore Cranes • EN ISO 13849-1: Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design • EN ISO 13849-2: Safety of machinery – Safety-related parts of control systems – Part 2: Validation • EN 12100: Safety of machinery – General principles for design – Risk assessment and risk reduction • EN 60204-32: Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines • EN ISO 1461 Hot dip galvanised coatings on fabricated iron and steel articles • EN 1005-2: Safety of machinery – Human physical performance – Part 2: Manual handling of machinery and component parts of machinery

	Main Dimensions
Slew radius (m)	Project specific
Height (m)	5975
Maximum hook height (mm)	4500
Maximum lifting height (m)	Project specific
Maximum slewing handle height (m)	1.2
Boom pivot height above service level (m)	1.1
Total crane mass (kg)	1900 - 2400

	Technical Specifications
Working load limit (kg)	Personnel: 150 Cargo: 1000-3000
Lifting speed (m/s)	Cargo: variable up to 0.7 Personnel: 0.5 up to 2.12 in automatic deck tracking mode
Hoisting type	Electrical
Wire rope material	Galvanised steel
Wire Construction	Cargo: 10mm 18 x 7 WSC Personnel: 6mm 18 x 7 WSC
Wire Minimum break load (kN)	Cargo: 64.28 Personnel: 23.14
Rope storage on drum	Cargo: Multi-layer Personnel: Single layer
Cargo slewing type	Manual or electric
Ingress Protection	IP56
Frequency of operation of radio remote control (GHz):	2.4
Personnel rescue device on line	Yes
Emergency boom mounted pad-eye	Yes
Remote measurement	Significant wave height, via OPC-UA
Deck sensor	Via fixed infrared Class 1 laser with built-in anti-condensation heating
Control	Personnel: Wireless remote control from vessel. Cargo: hard-wired pendant at crane

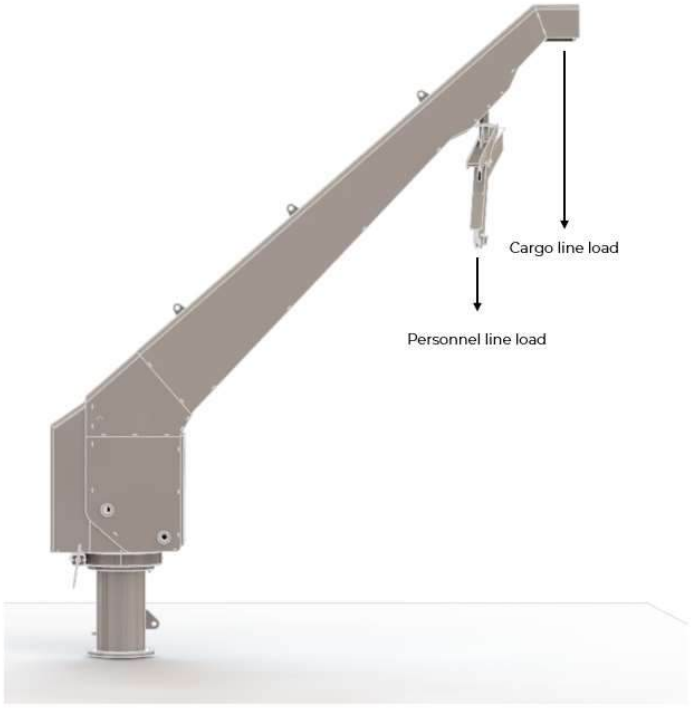
	Electrical
Power Requirements	400V AC (3P+E) 50/60Hz
Power Rating (kVA)	11
Short circuit power rating (kA)	tbc
Protection	Three phase 16A circuit breaker (tbc)
Remote condition monitoring	Yes, via OPC-UA. SCADA connection from Gx2 to WTG, consisting of CAT6 Ethernet connection (RJ45)
Platform connections	1.. WTG power/ pull-down power cable reel, 2. Access gate safety interlock wired to Gx2 unit and mounted to Gx2 access gate. 3. Remote deck sensing module

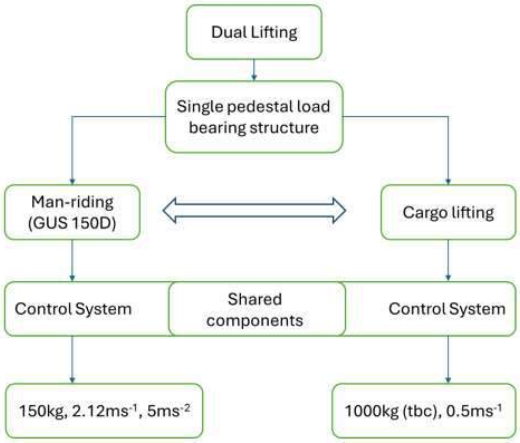
	Key Features and Benefits
	• Designed to best-in-class standards for offshore wind davit cranes e.g. EN13852-3 • Fully enclosed outer shell. Inner enclosures to min IP65, CX coating (EN12944-9) and 316 stainless steel • Wireless and pendant controllers • Siemens logic control software (EN13849) • Safety features per EN13852-3 (AOPS, ELL, slack wire detection) • Integrated super-capacitor emergency power supply for personnel backup • Pull down umbilical power cable for CTV powering - allows use during project construction and WTG power outages (automatic electrical power switch from turbine supply or vessel) • Emergency descent lowering activated from CTV and platform • Active heave compensated personnel lifting for safer, faster, healthier access more of the year around • Remote system status. diagnostics and troubleshooting via SCADA • Real time laser measurement of sea state (Hs) for each WTG position • Optional removal/ optimisations of secondary steel and primary steel • Accredited training program for users/ operators and service technicians

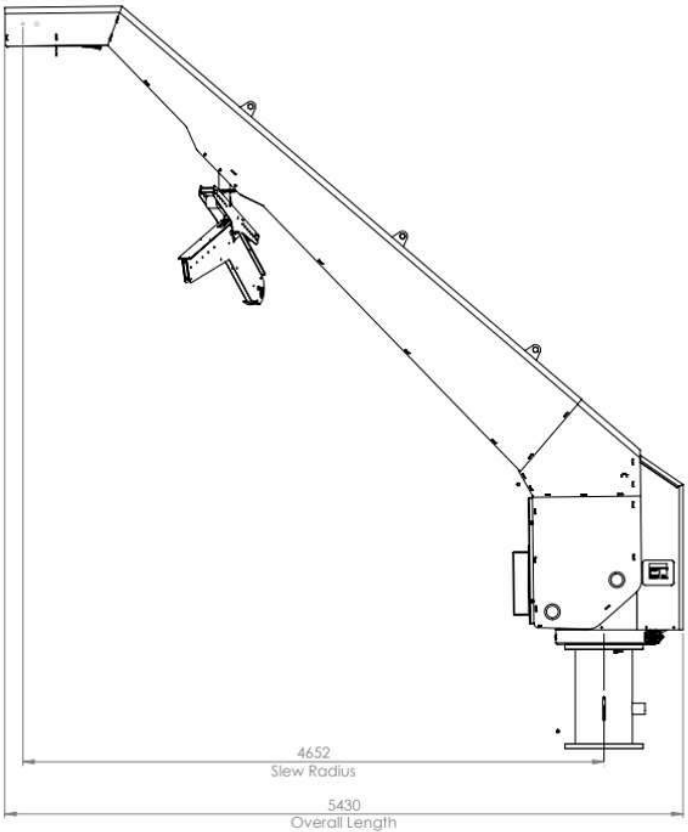
	Environment
Operating temperature range (degC)	-20 to +40
Storage temperature range (degC)	-10 to +40
Wind design speed - lifting (m/s)	15
Wind design speed - Stowed (m/s)	63
Maximum wave height (mHs)	2.0
Operating environment	Marine

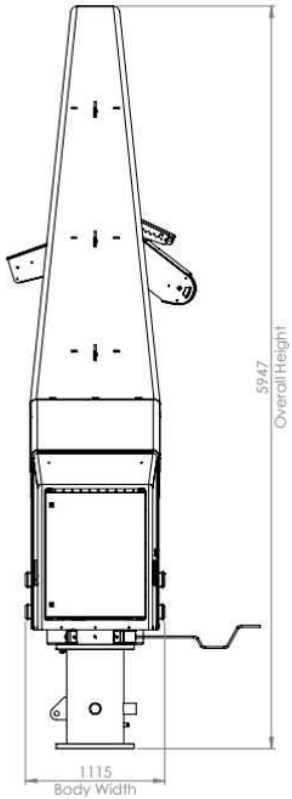
	Corrosion Protection
Coating system	CX classification to ISO 12944-9
Main colour (RAL)	9016 Traffic White or 7035 Light Grey

	Options
Step-down transformer	Yes
CEEE power inlet	Yes
Reeving	Yes
External Lighting	Yes
Electric Slewing	Yes
Rope transfer system (backup)	Yes
Safety line for personnel transfer (backup)	Yes









Slew model: 4.6m. Note - dimensions subject to change.

END OF DOCUMENT