A40 Rheinbrücke Duisburg-Neuenkamp

Dálniční most s osmi jízdními pruhy přes řeku Rýn/

An Eight Lane Highway Bridge Crossing the Rhine

Ing. Tomáš Vojtěchovský, MBA

MCE GmbH | Franzosenhausweg 25, A-4030 Linz

part of the family HABAU GROUP

Obsah / Contents

Smluvní schéma / Contractual Situation

Zákazník / Client

DEGES Deutsche Einheit Fernstraßenplanungs- und bau GmbH

Zhotovitel / Contractor

ARGE A40 Rheinbrücke Duisburg-Neuenkamp

HOCHTIEF Infrastructure GmbH (TGF) – MCE GmbH (KGF)

MCE Nyiregyhaza Kft – MCE Slany s.r.o. – ZSB Zwickauer Sonderstahlbau GmbH – Plauen Stahl Technologie GmbH

Ingenieurbau

HOCHTIEF INFRASTRUCTURE DEUTSCHLAND WEST

Stahlbau

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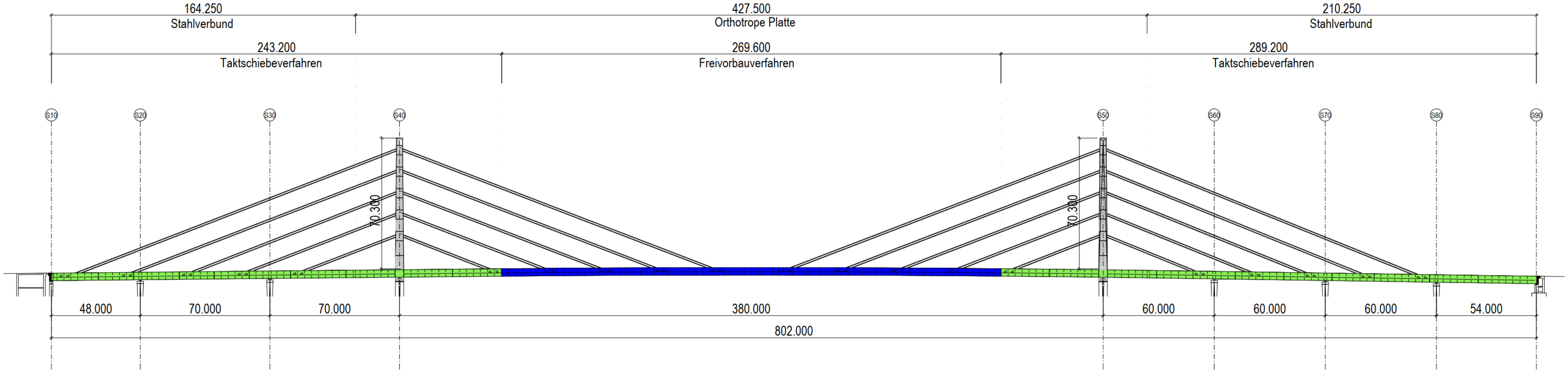
- MCE Nyiregyhaza Kft.
- MCE Slany s.r.o.
- ZSB Zwickauer Sonderstahlbau GmbH
- Plauen Stahl Technologie GmbH

Hmotnost ocelové konstrukce & nátěrové plochy pro jednu nosnou konstrukci / Main Steel & Corrosion Protection Quantities per Bridge

Část / Bridge Part	Množství / Qty	Ocel	
Pylon / Pylon	1.650 t	S355	Z35 pro t ≥ 15 mm / Z15 pro t < 15 mm
Nosná ocelová kce / Steel Superstructure	13.600 t	S355 / S460	Z35 pro t ≥ 15 mm / Z15 pro t < 15 mm
Mostní závěsy / Stay Cable Strands	850 t (724km/ 450 mi)	St 1570/1770	7-drátové svazky/ 7-wire stay cable strands
Protikorozní ochrana / Corrosion Protection	142.500 m2		Vnitřní 3-vrstvý & Vnější 4-vrstvý systém / Interior 3-layer & Exterior 4-layer application
Izolace ortotropní mostovky / Sealing orthotropic plate	10.200 m2		Více druhý bezešvých druhů izolací/ Various sealing materials

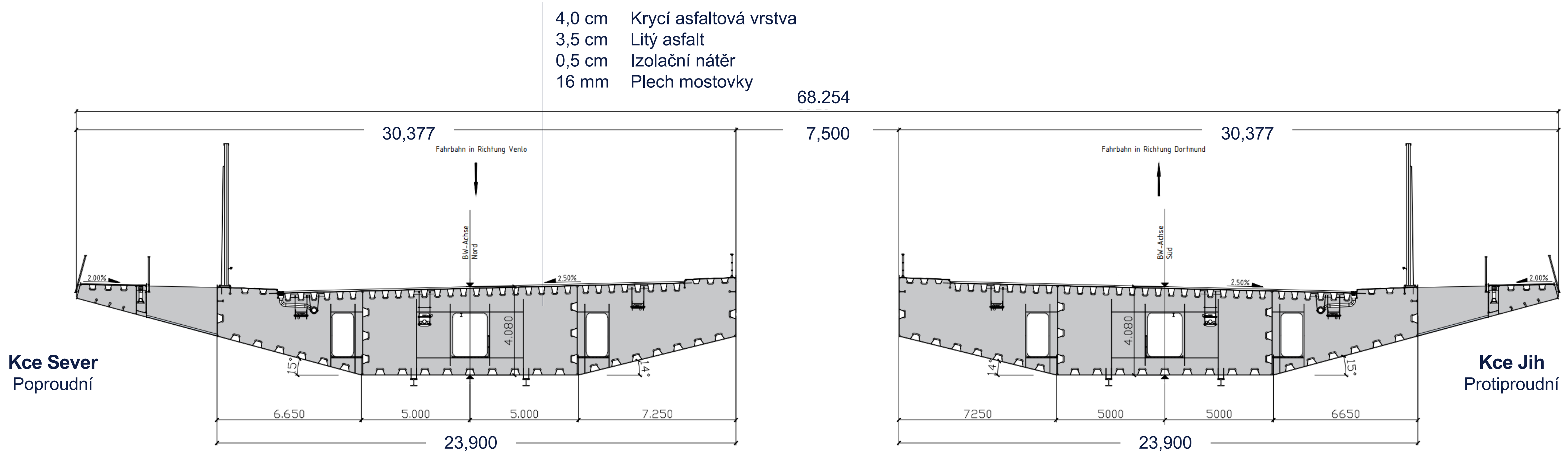
Podélný řez / Longitudinal Section



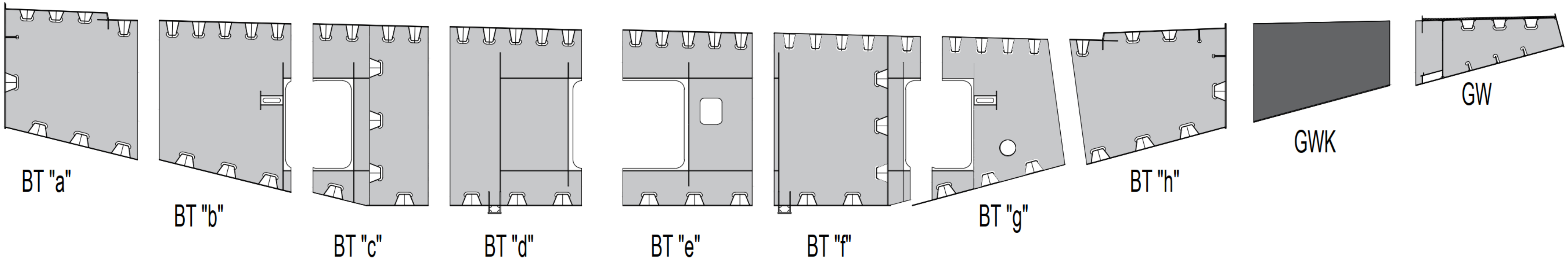
<u>Dělení v podélném směru / Sectioning of the Bridge Longitudinally</u>

Nosná ocelová kce / Bridge : 30 Sekcí / Segments (Délky / Lengths 18,75 – 30,0 m)
2 PQT / Pylon Cross Beam
2 EQT / End Cross Beam

Bežný příčný řez | Ortotropní deska / Standard Cross-Section | Orthotropic Plate



Montážní dělení dílců | Ortotropní část | Příčně **/ Segmental split** | orthotropic plate | Transverse direction



Počet dílců / Number of parts: 9
Šířka dílců/ Width of parts: 3.858 – 5.711 mm

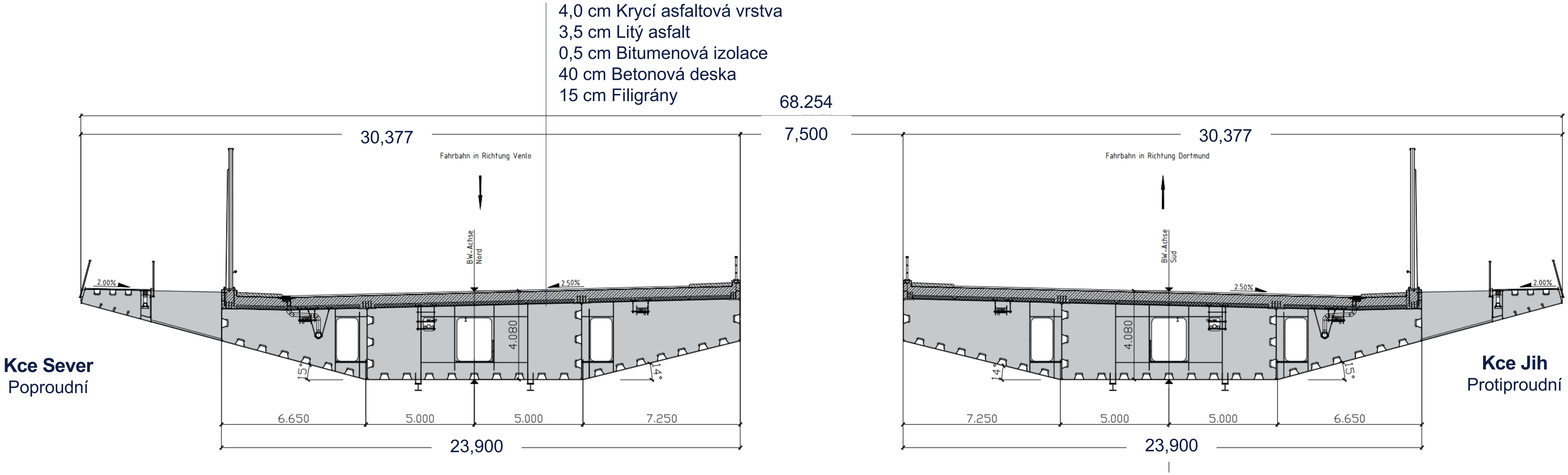
Nosná ocelová kce | Výroba / Fabrication of Parts

Dílec „a“

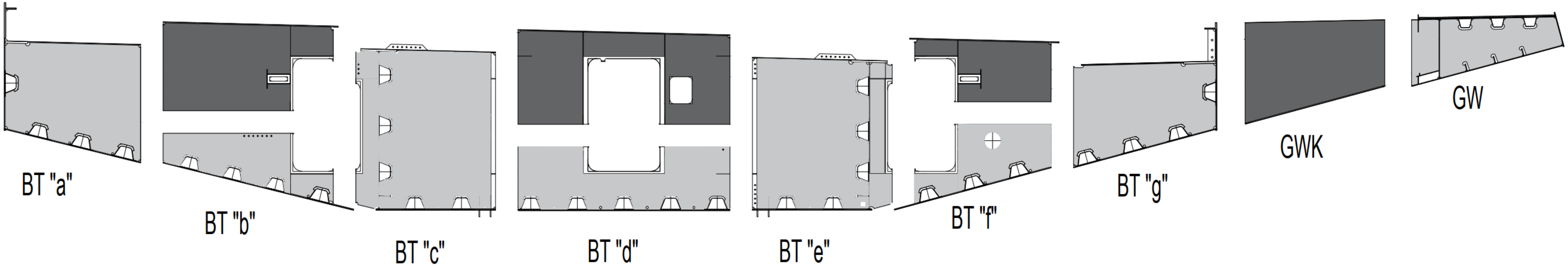
Dílec „g“

Dílec „e“

Běžný příčný řez | Spřažená deska / **Standard Cross-Section** | Composite slab section

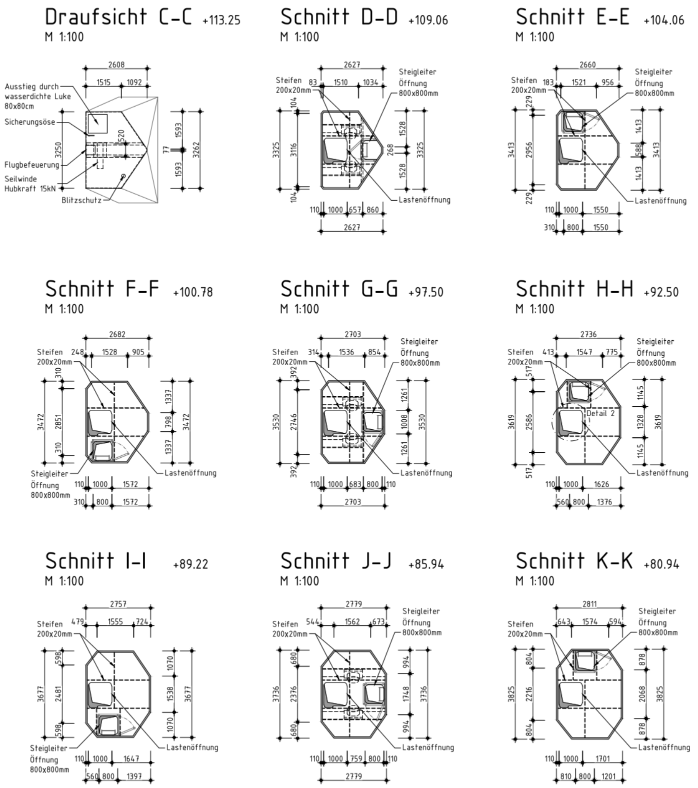


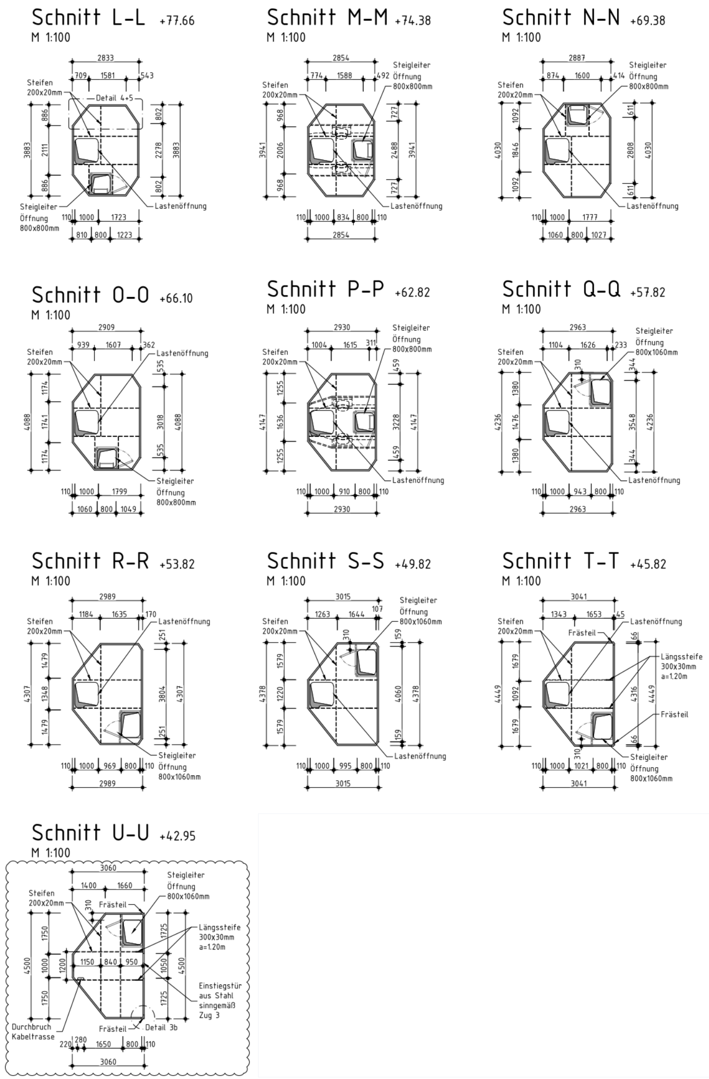
Montážní dělení dílců | Spřažená kce | Příčně **/ Segmental split** | Composite section | Transverse direction



Počet dílců / No. of Parts: 8
Šířka dílců / Width of Parts: 4.053 – 5.609 mm

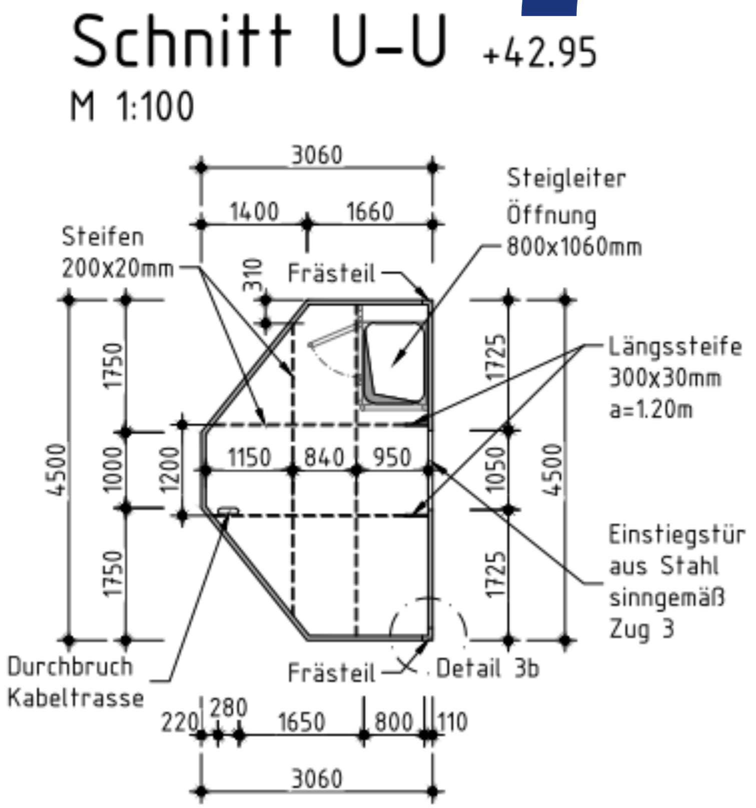
Pylon | Geometrie / **Pylon** | Geometry

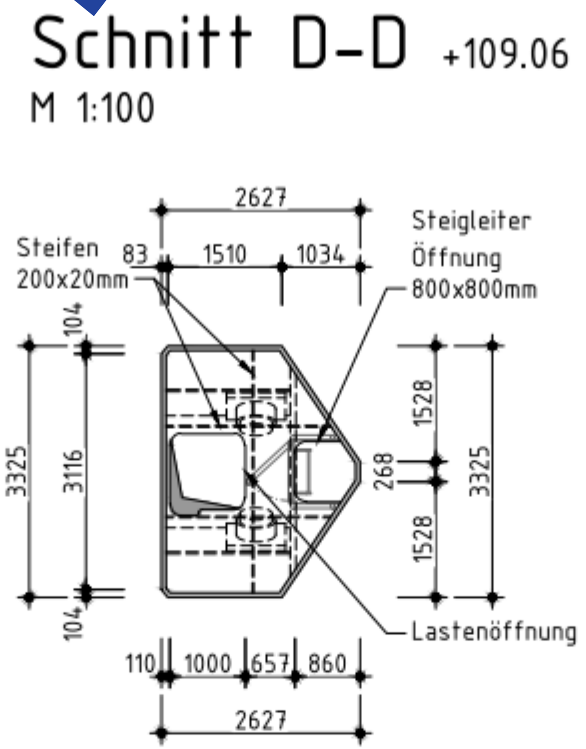




H = 70,79 m nad mostovkou / m above Deck level
Počet dílců / No. of Sections: 12

Pylon | Geometrie / **Pylon** | Geometry





Pylon | Výroba **/ Pylon** | Fabrication

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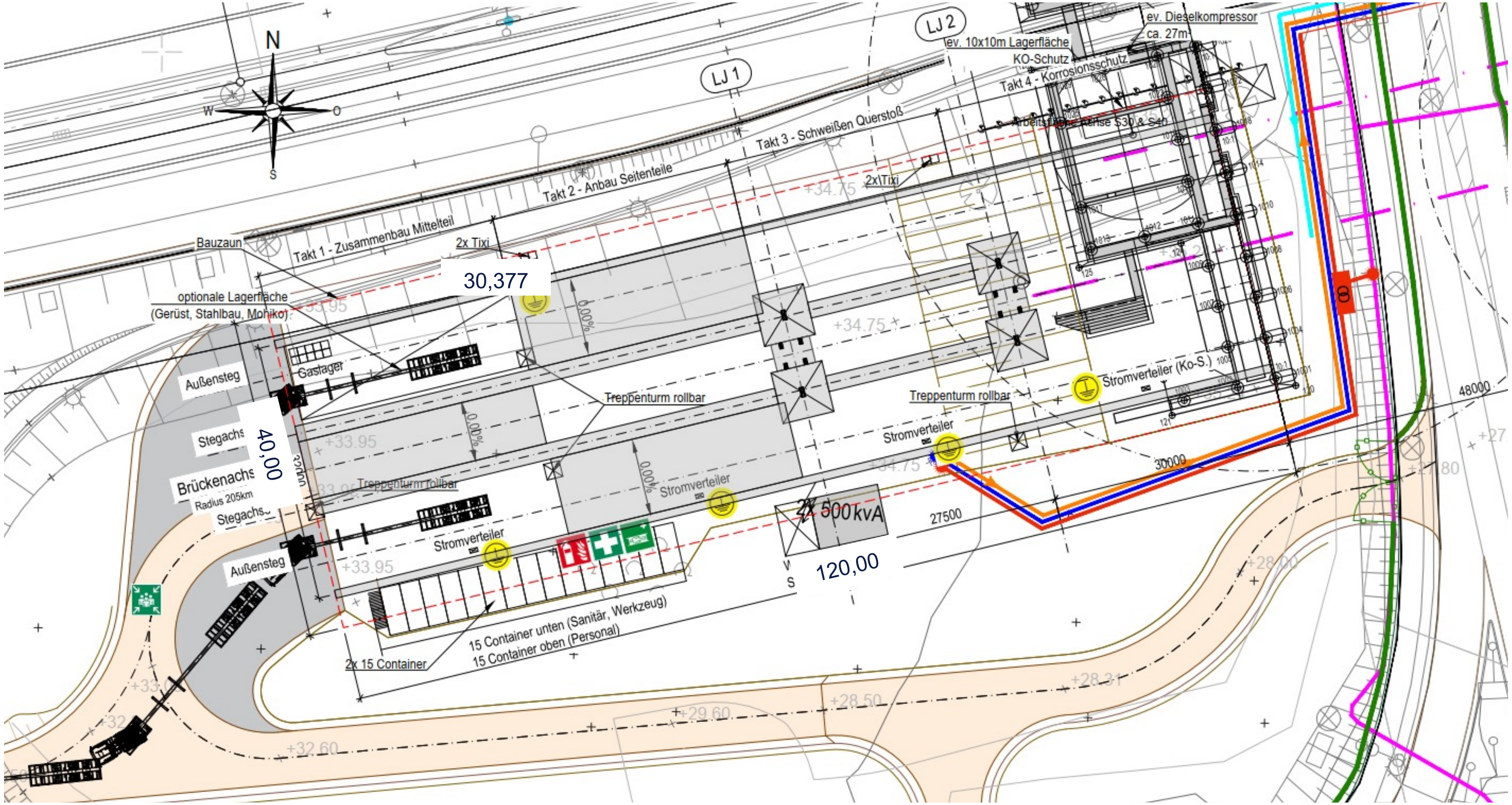
Zařízení staveniště | Předmontážní plocha osa 10 | Konstrukce Jih /

Site Establishment | Assembly yard Axis 10 | Southern Bridge



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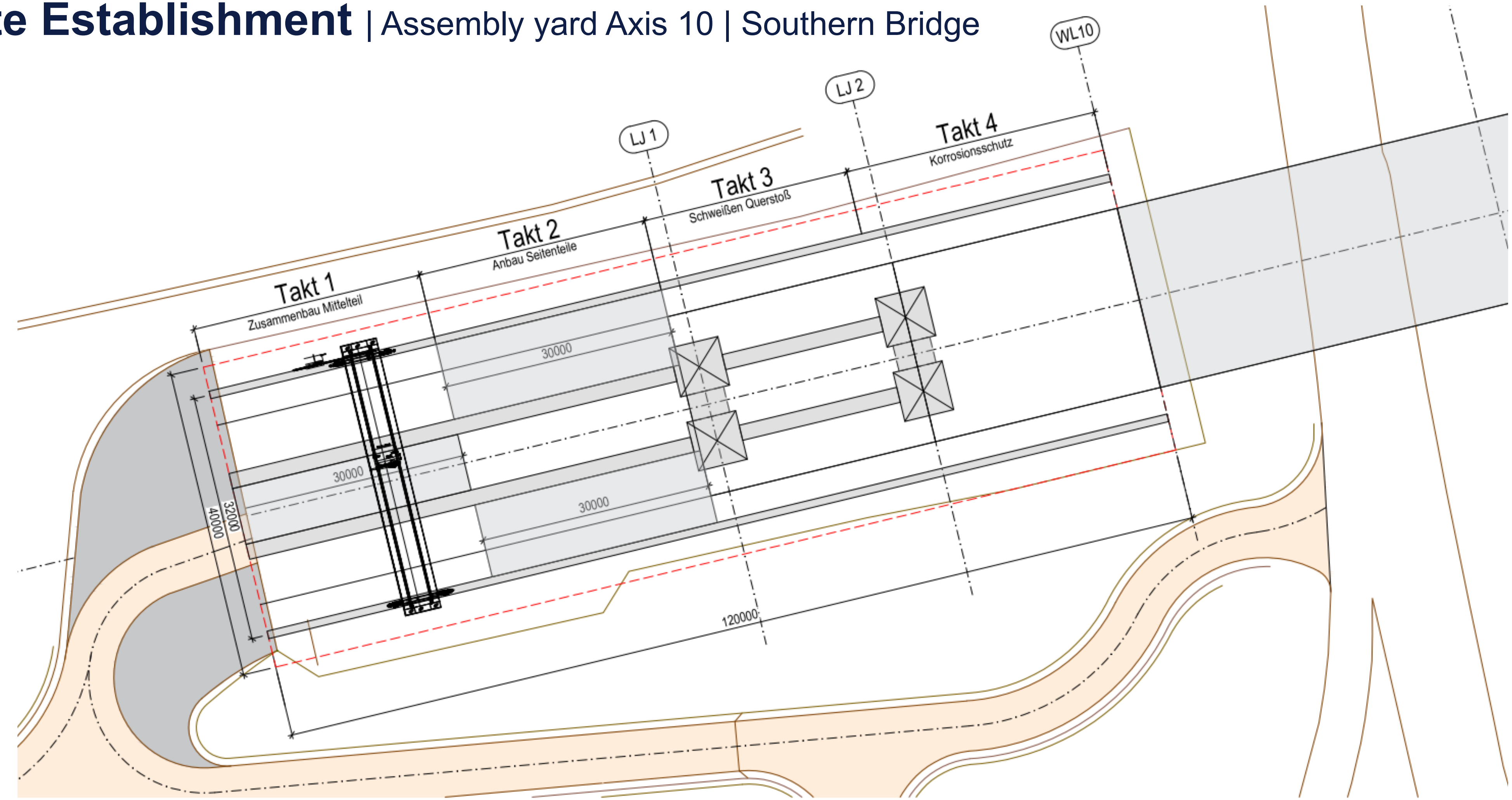
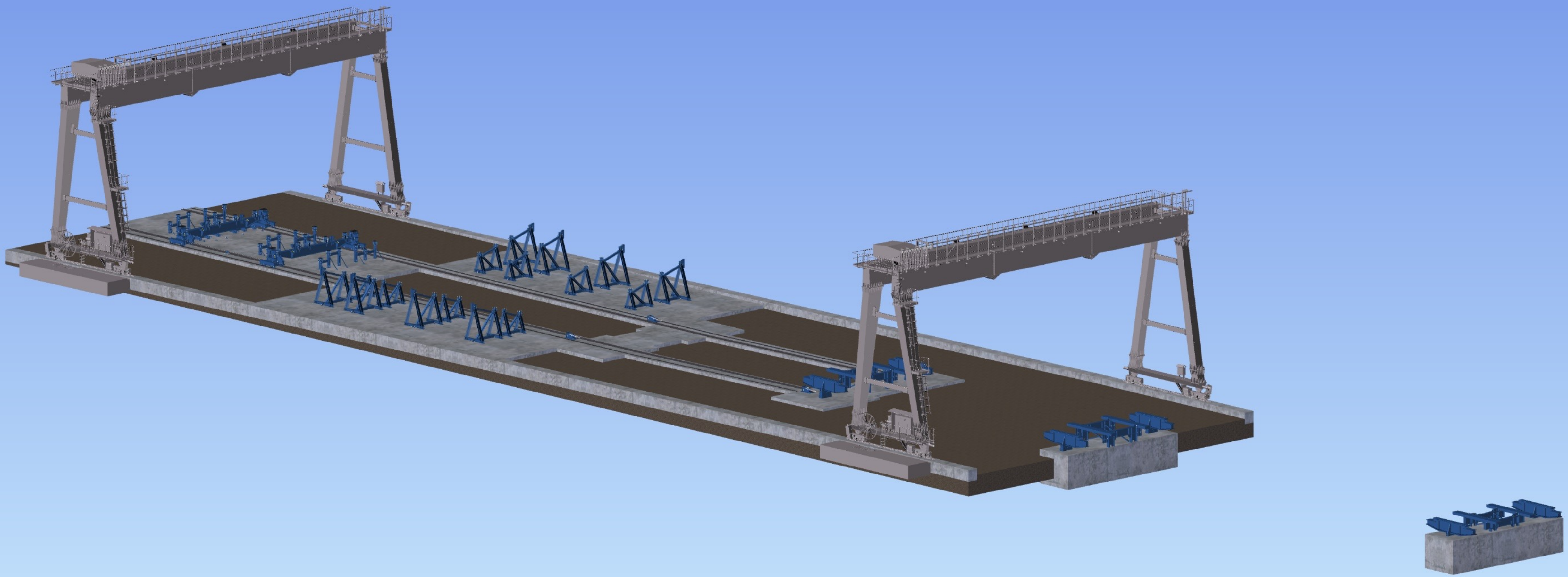
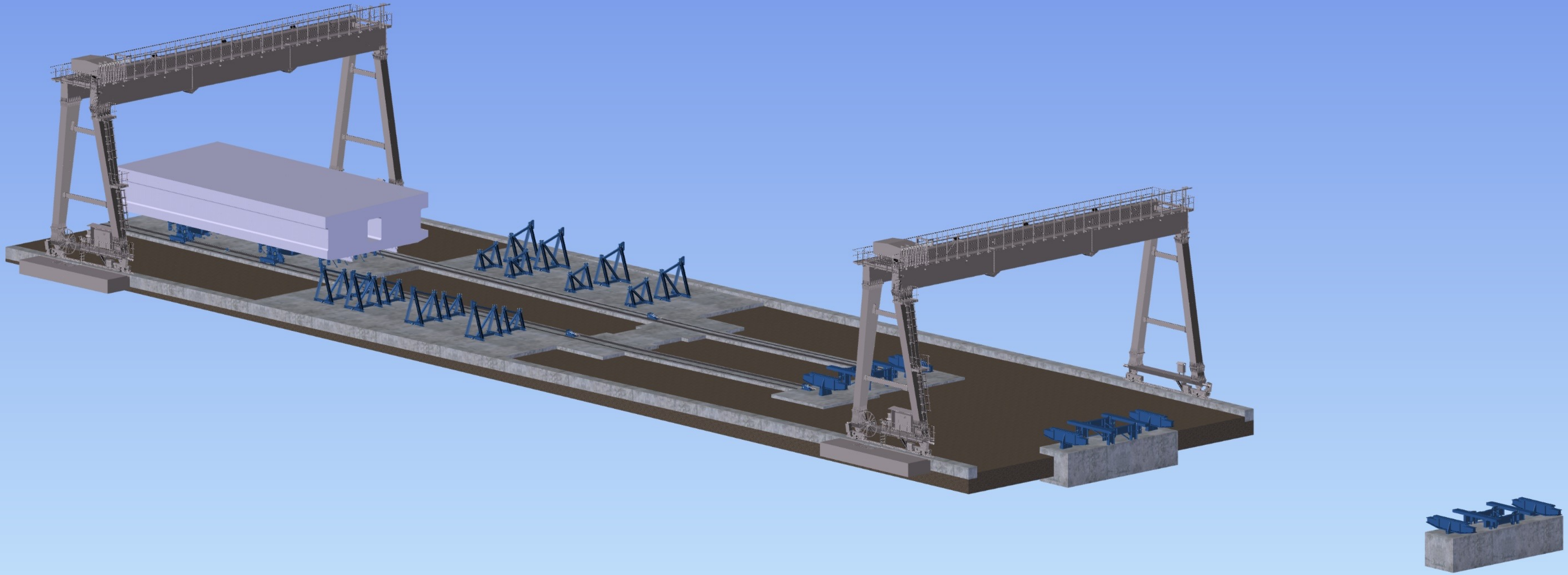
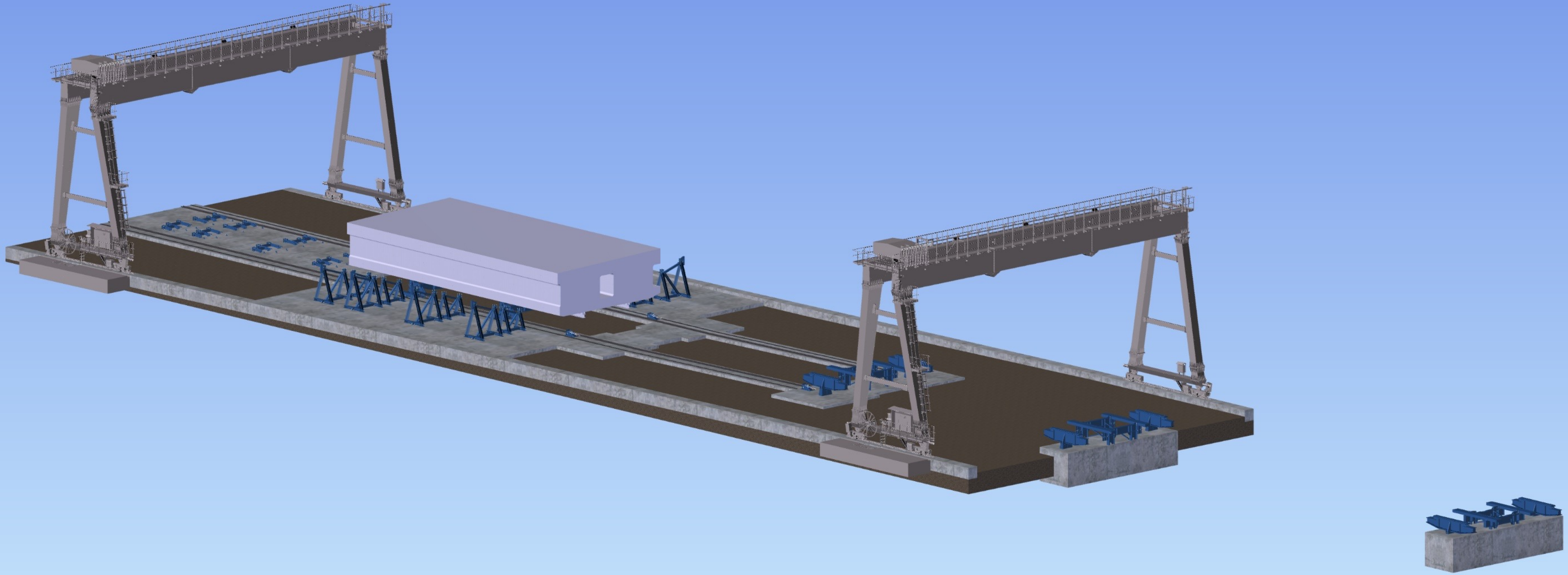
Zařízení staveniště | Předmontážní plocha osa 10 | Konstrukce Jih /

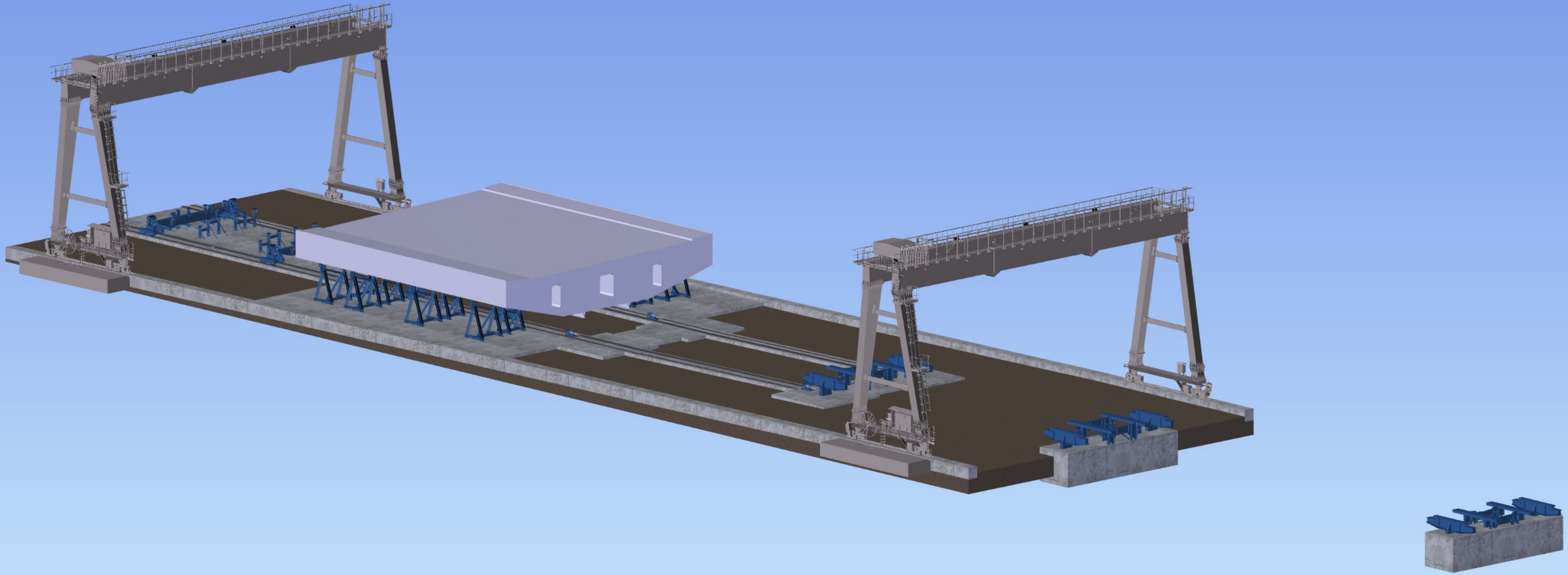
Site Establishment | Assembly yard Axis 10 | Southern Bridge

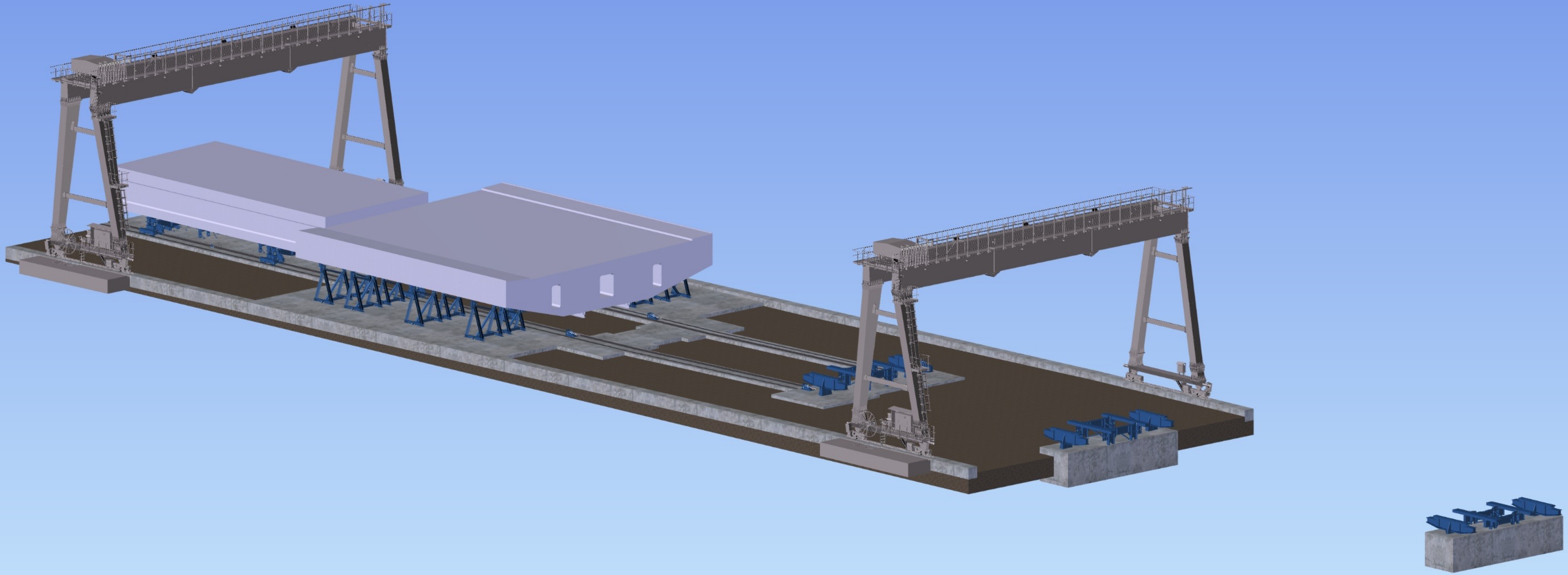


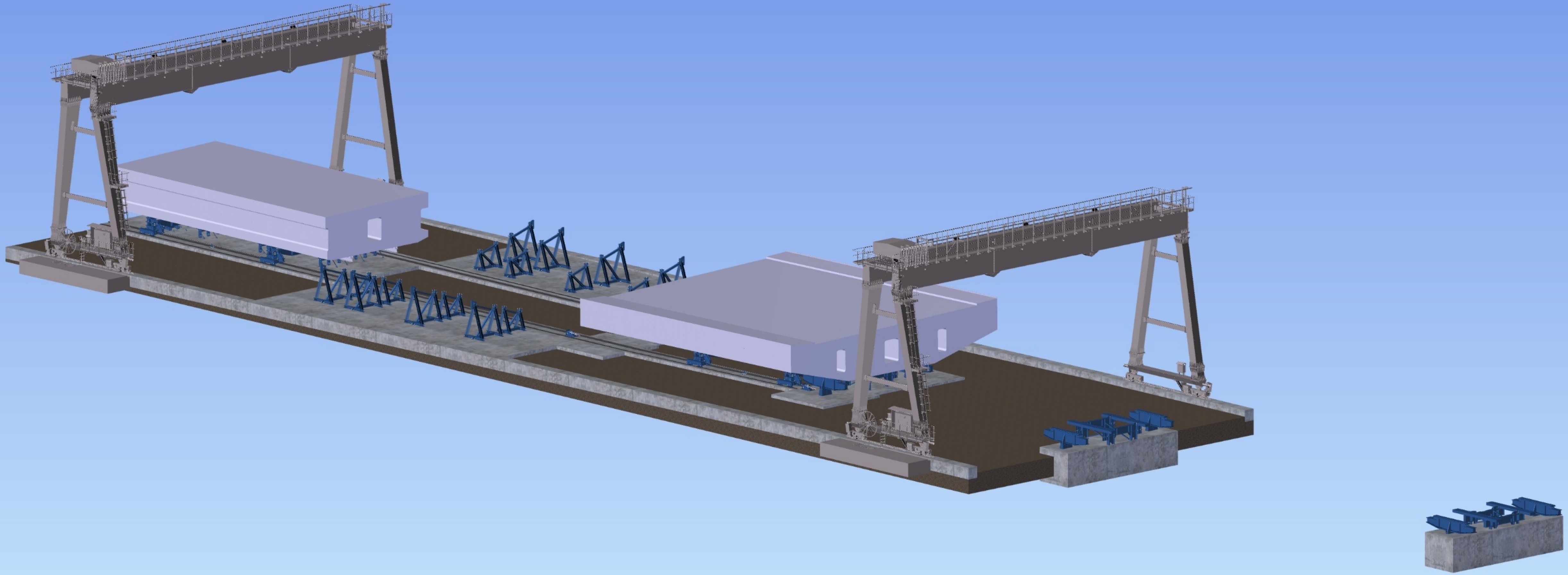


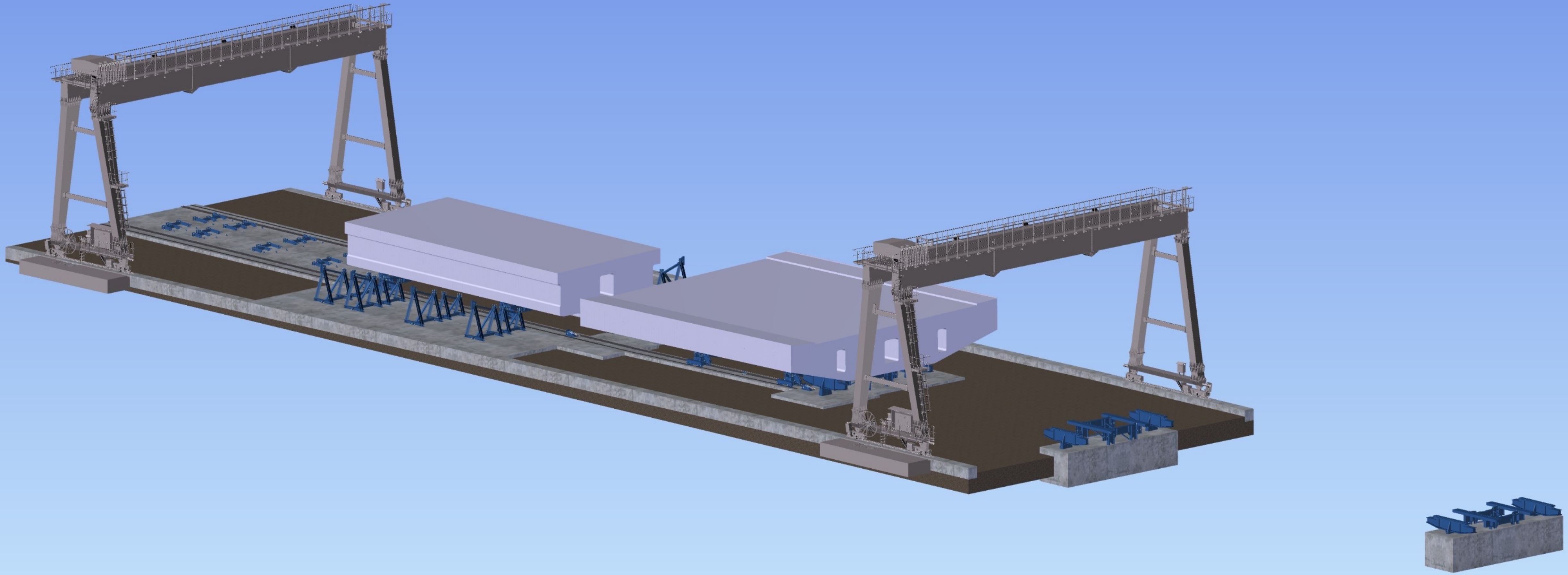


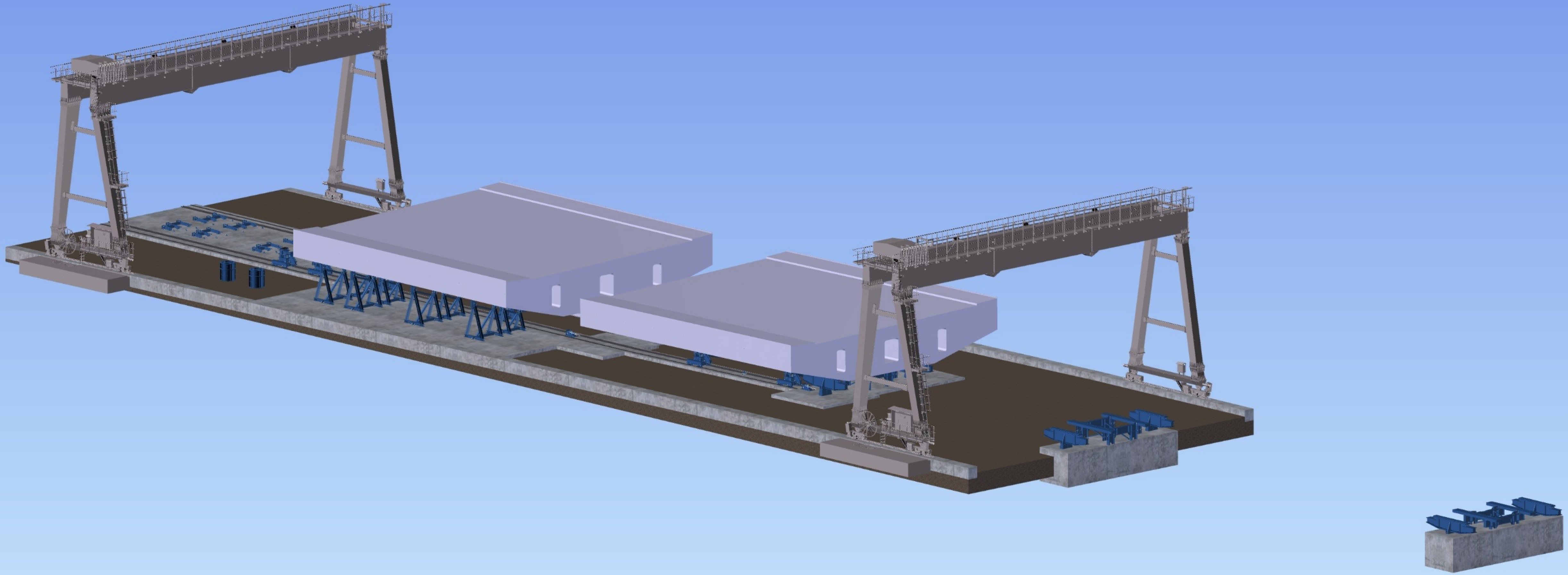


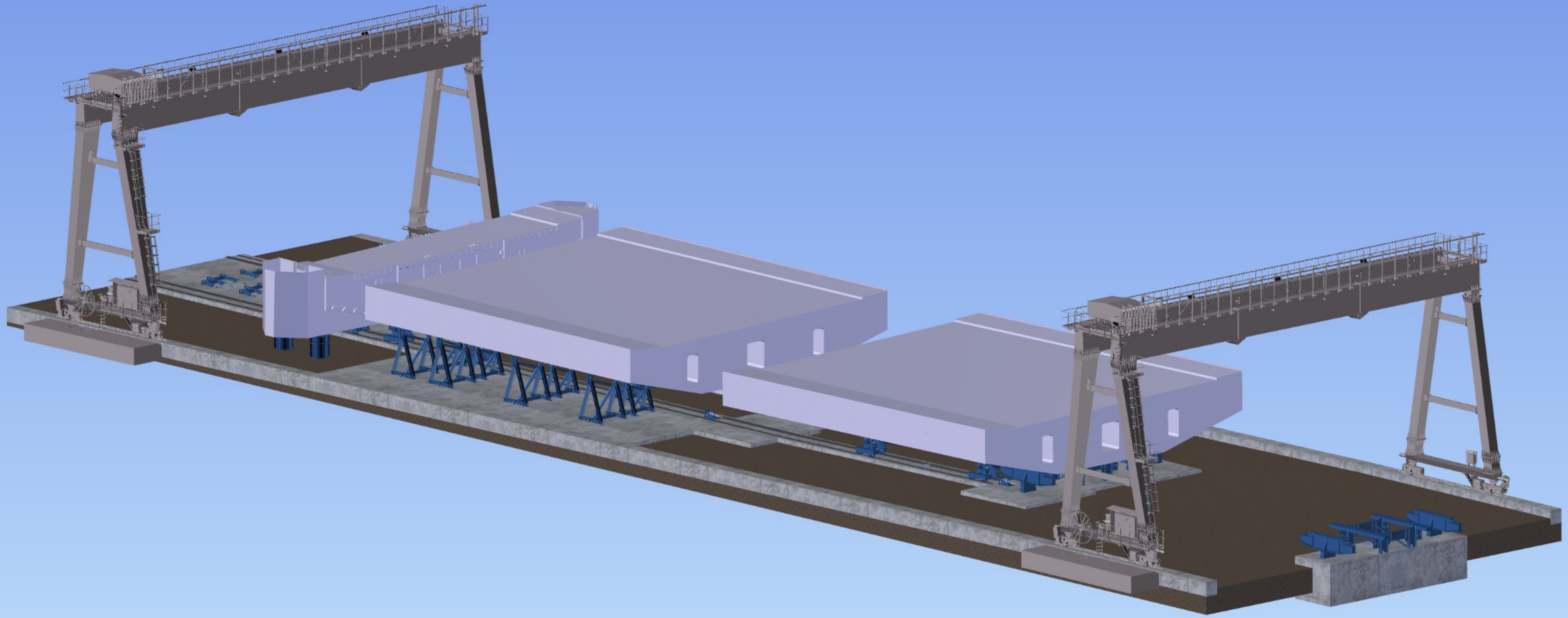


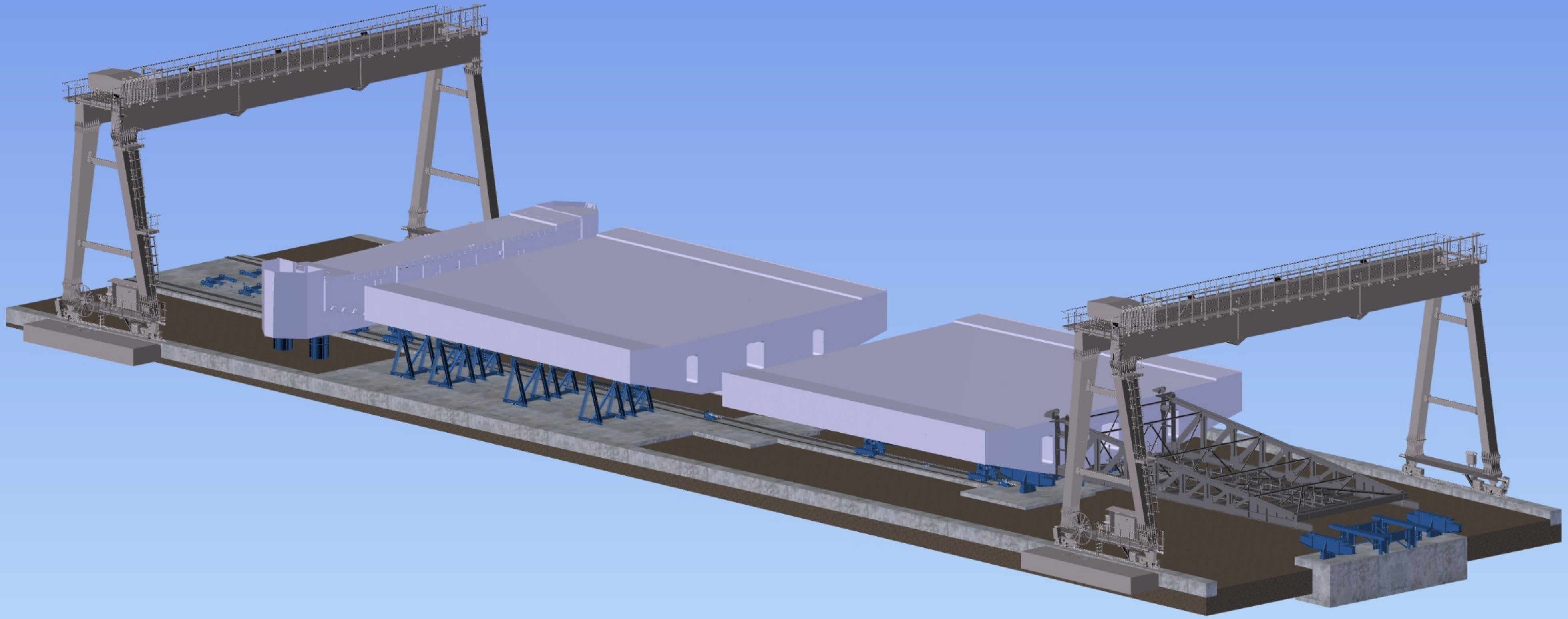


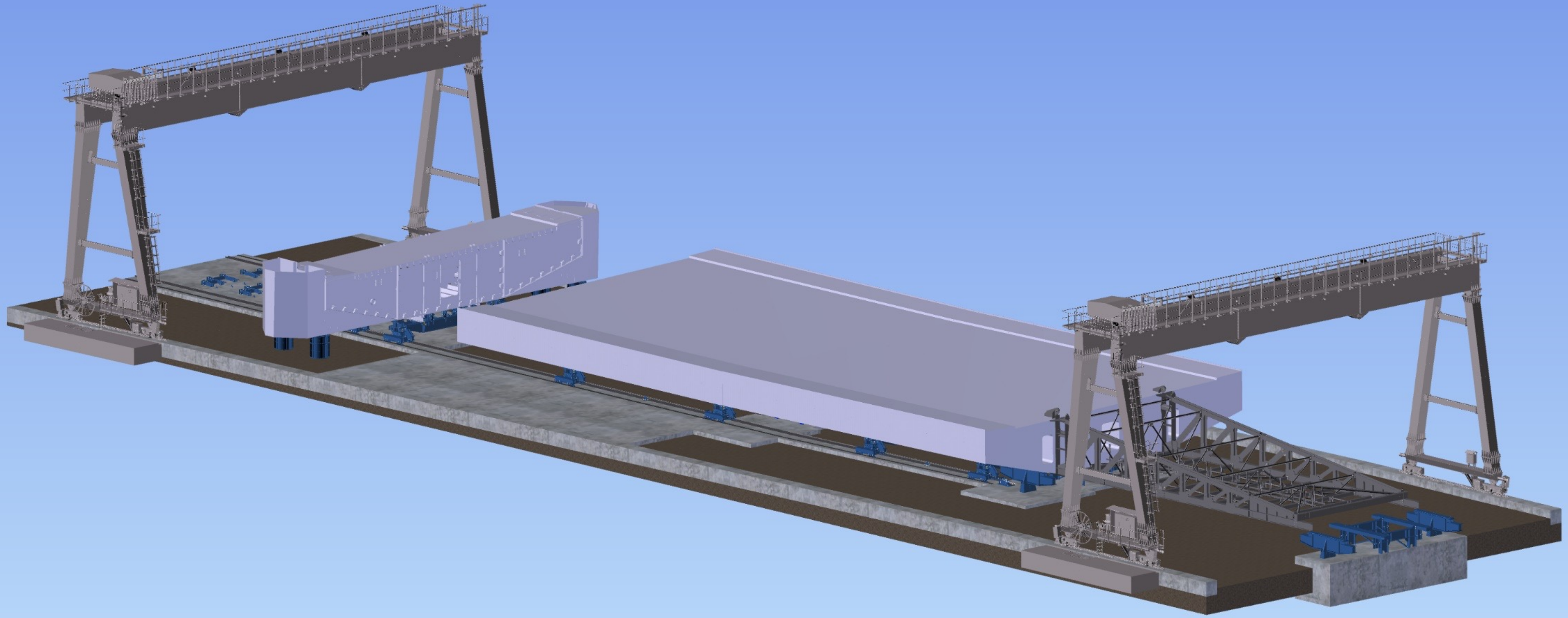


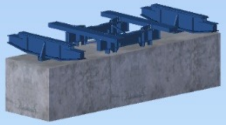


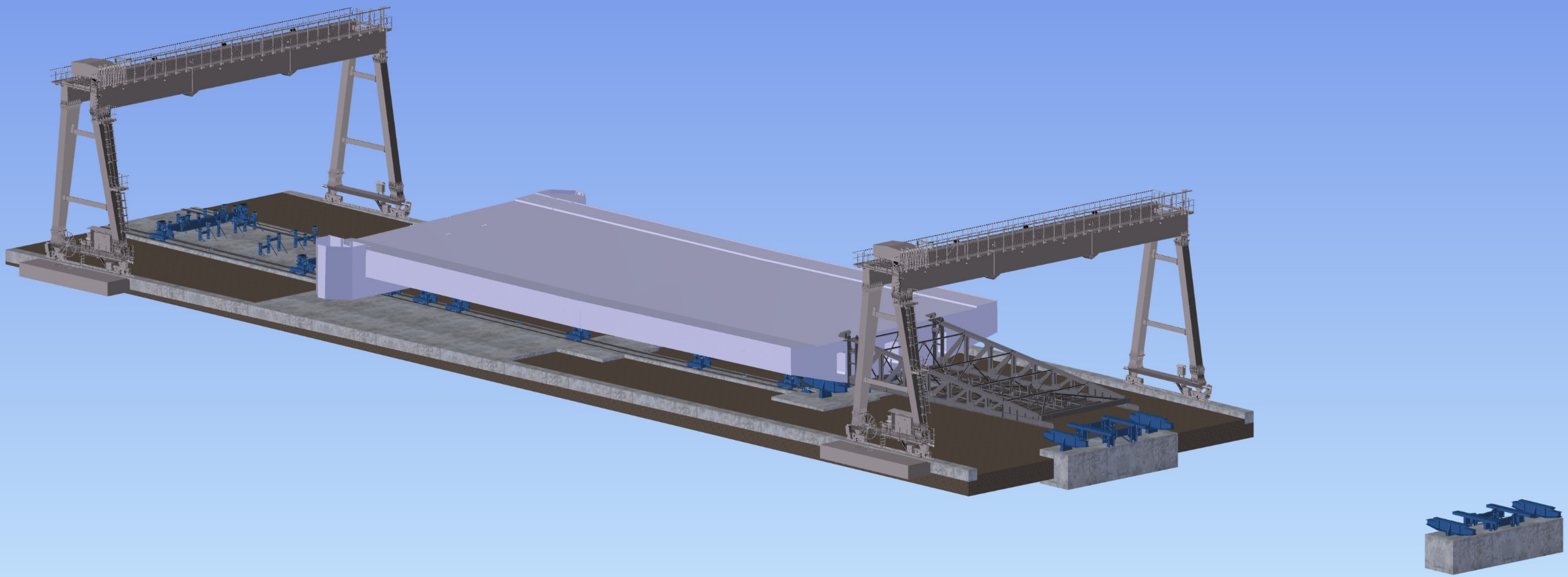












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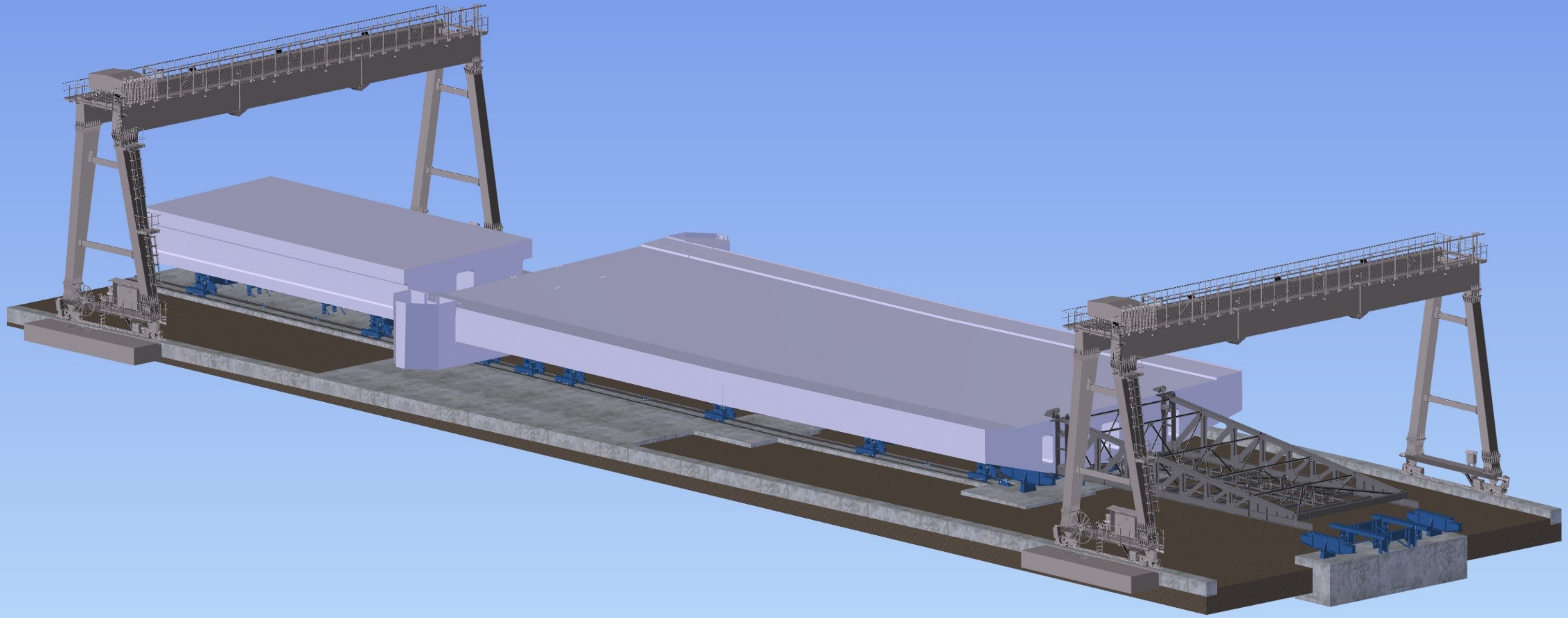

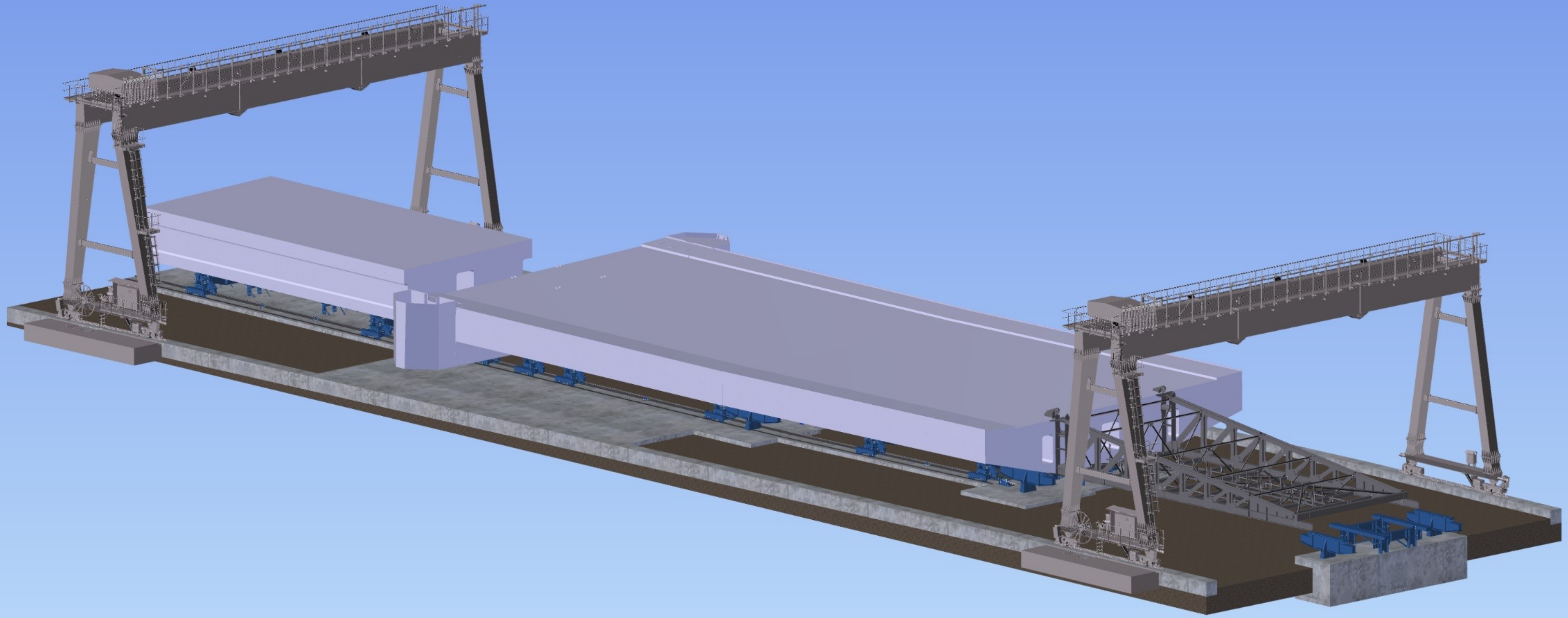

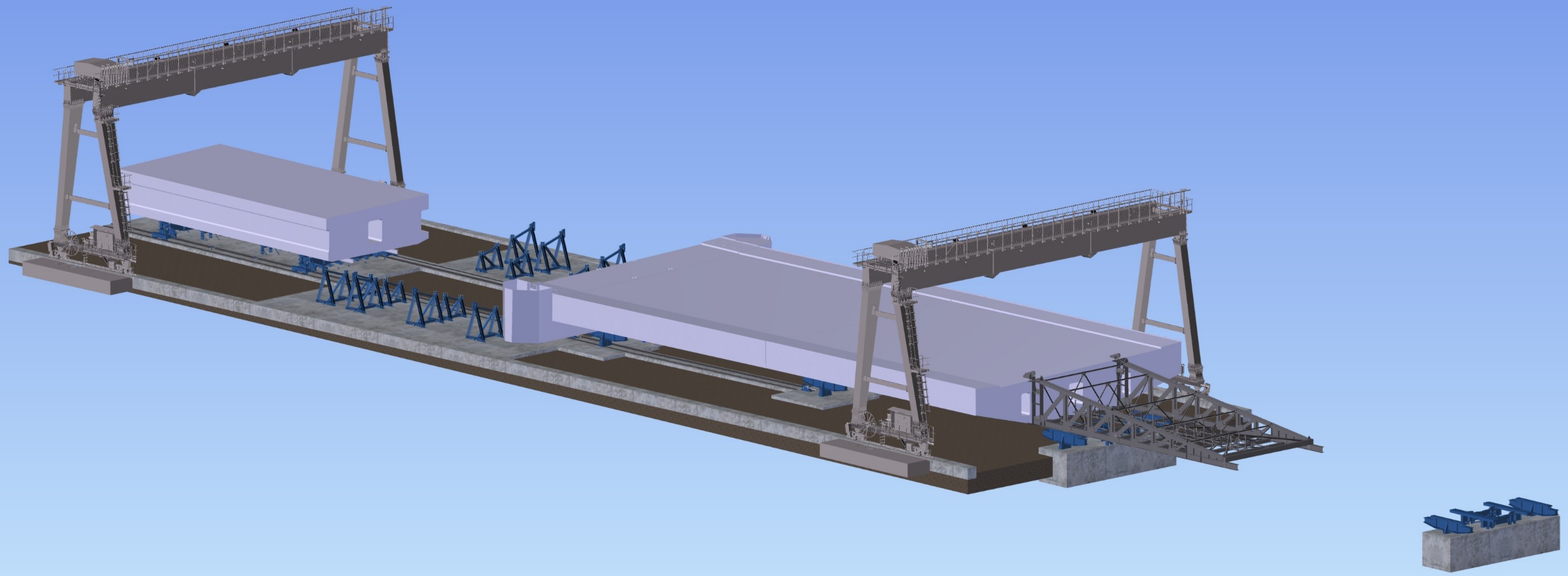

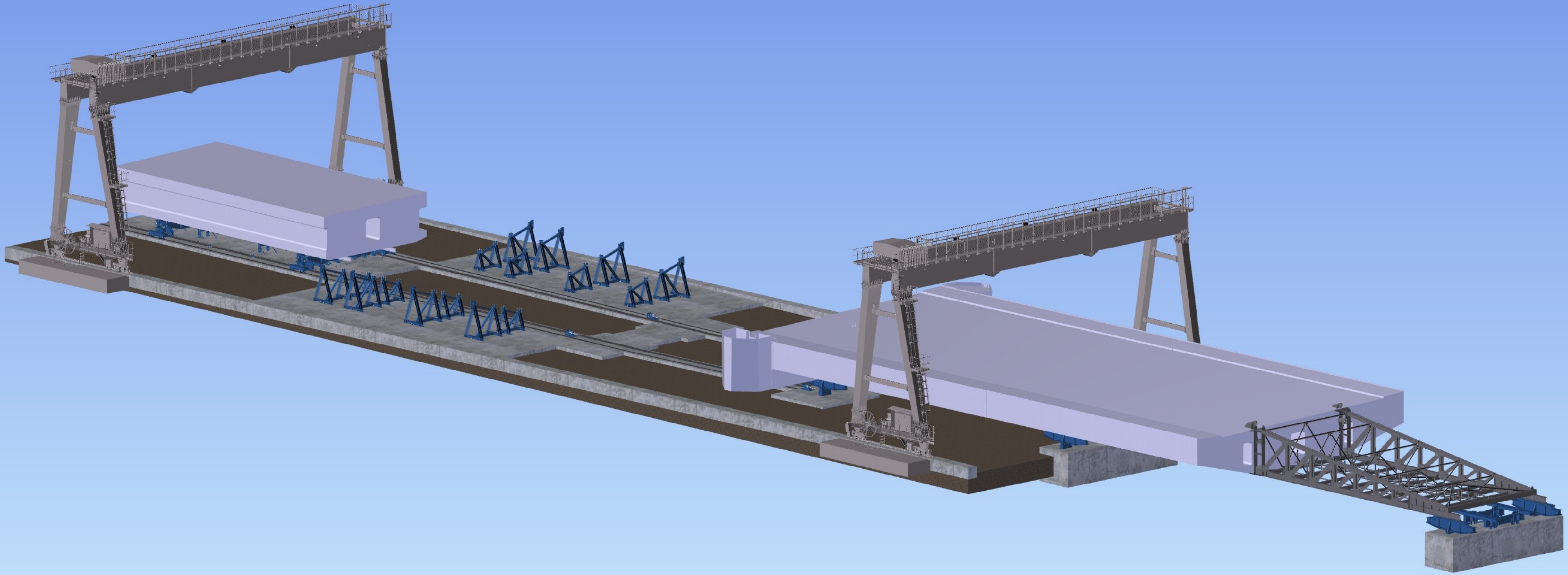

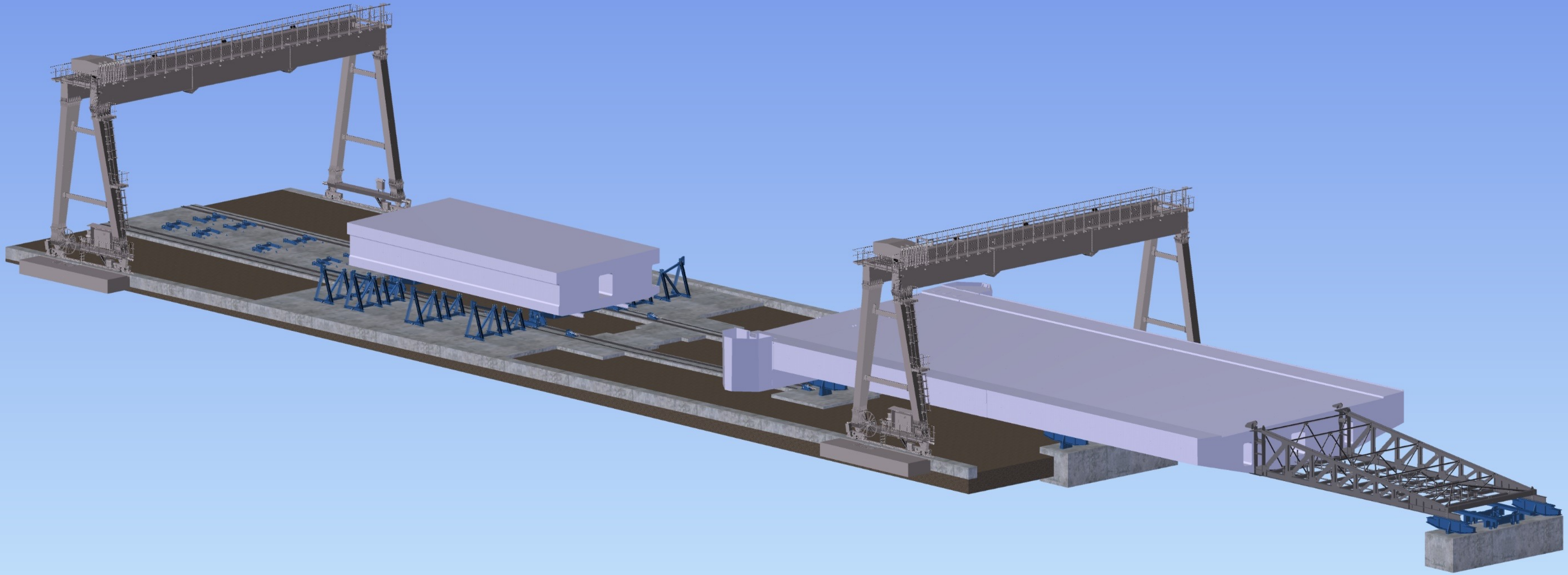

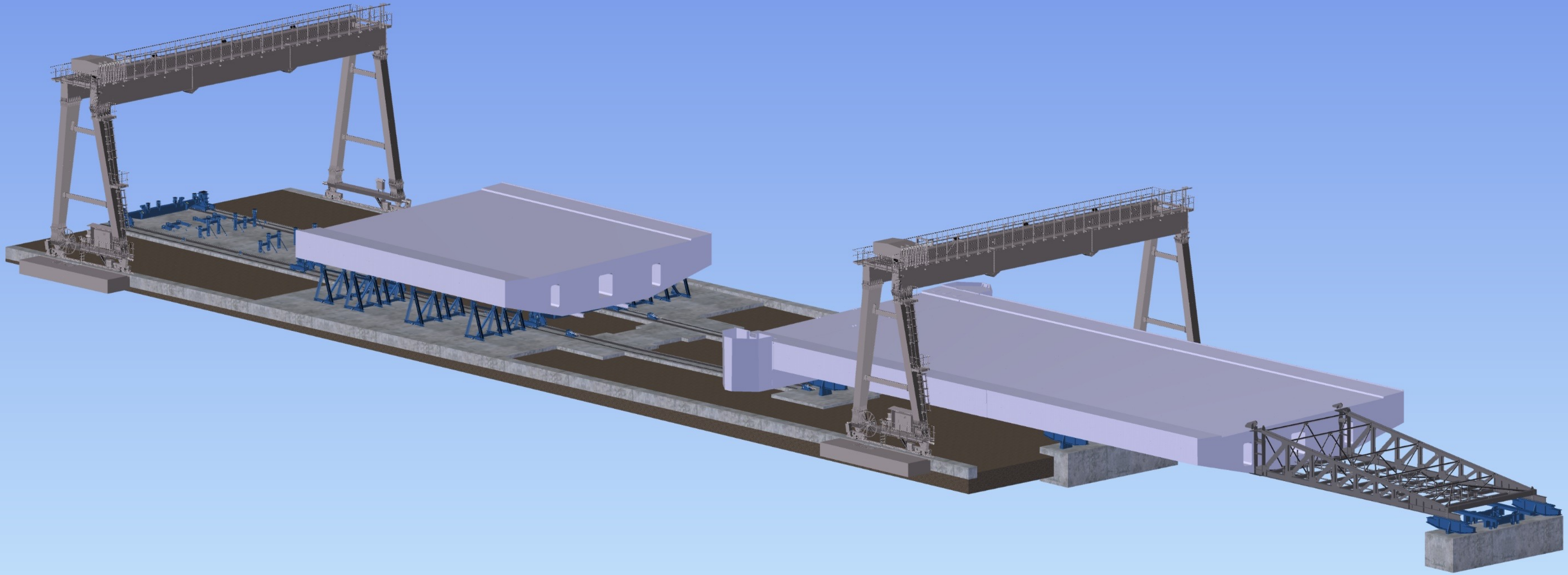

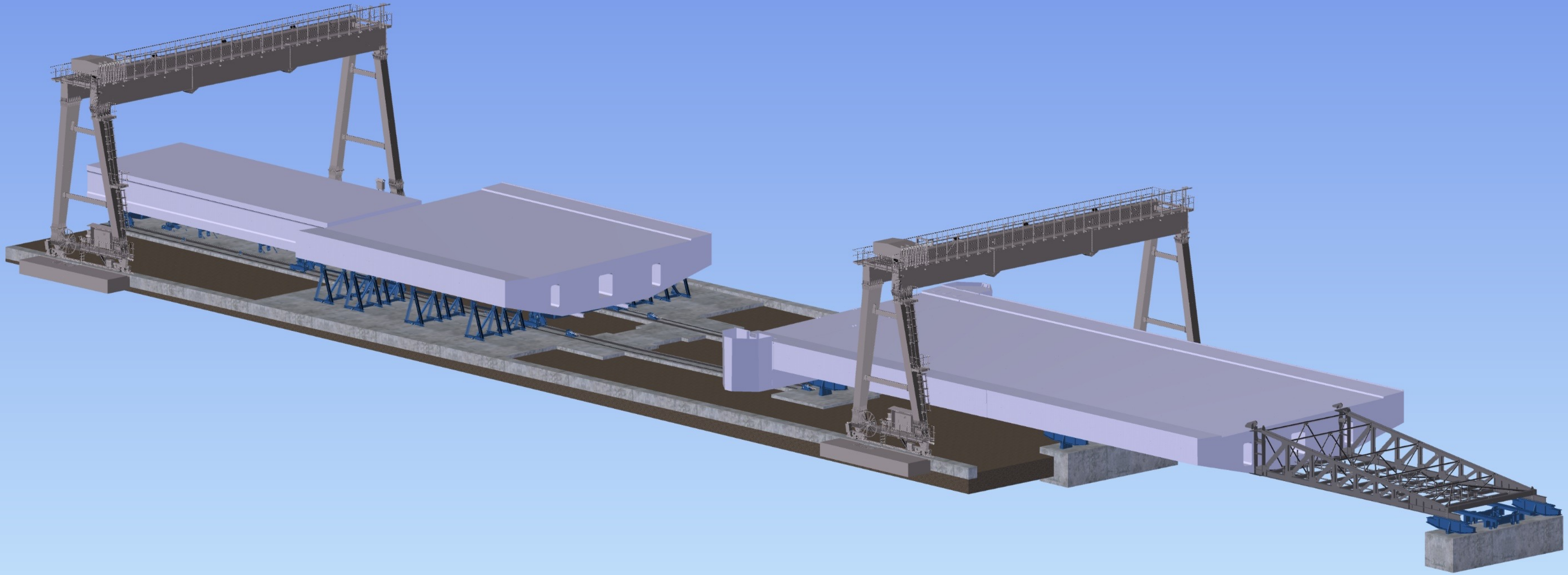

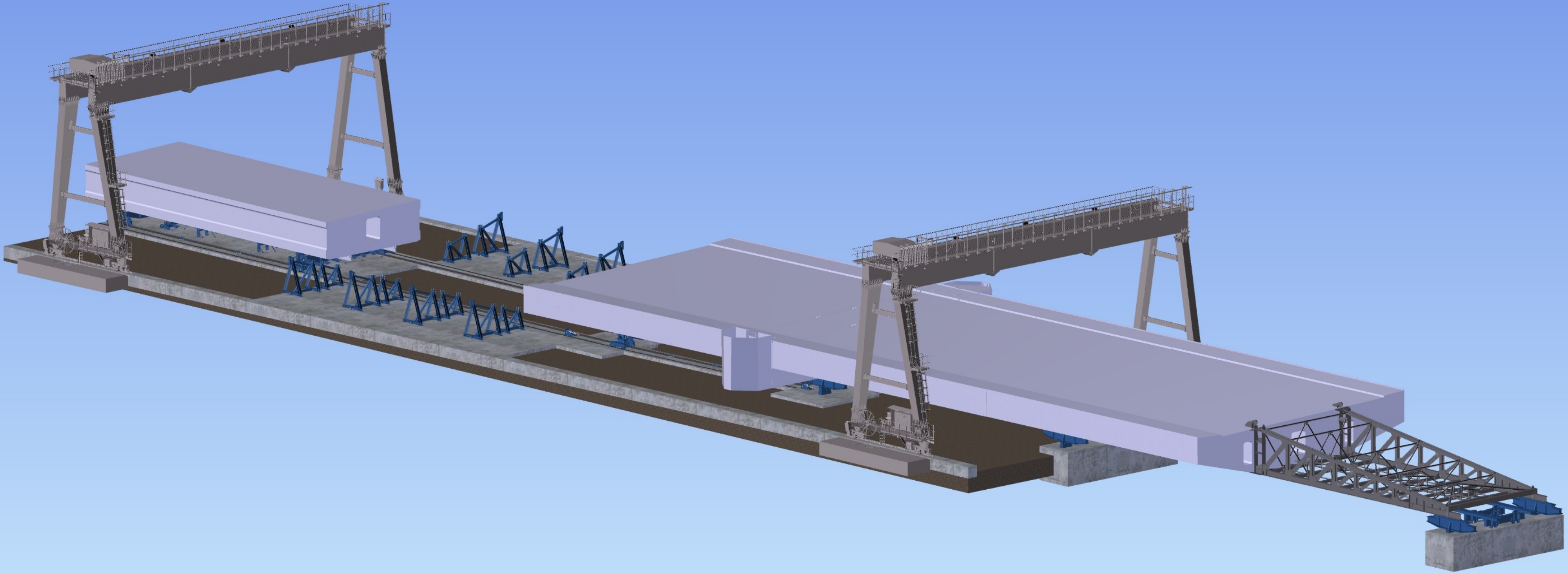

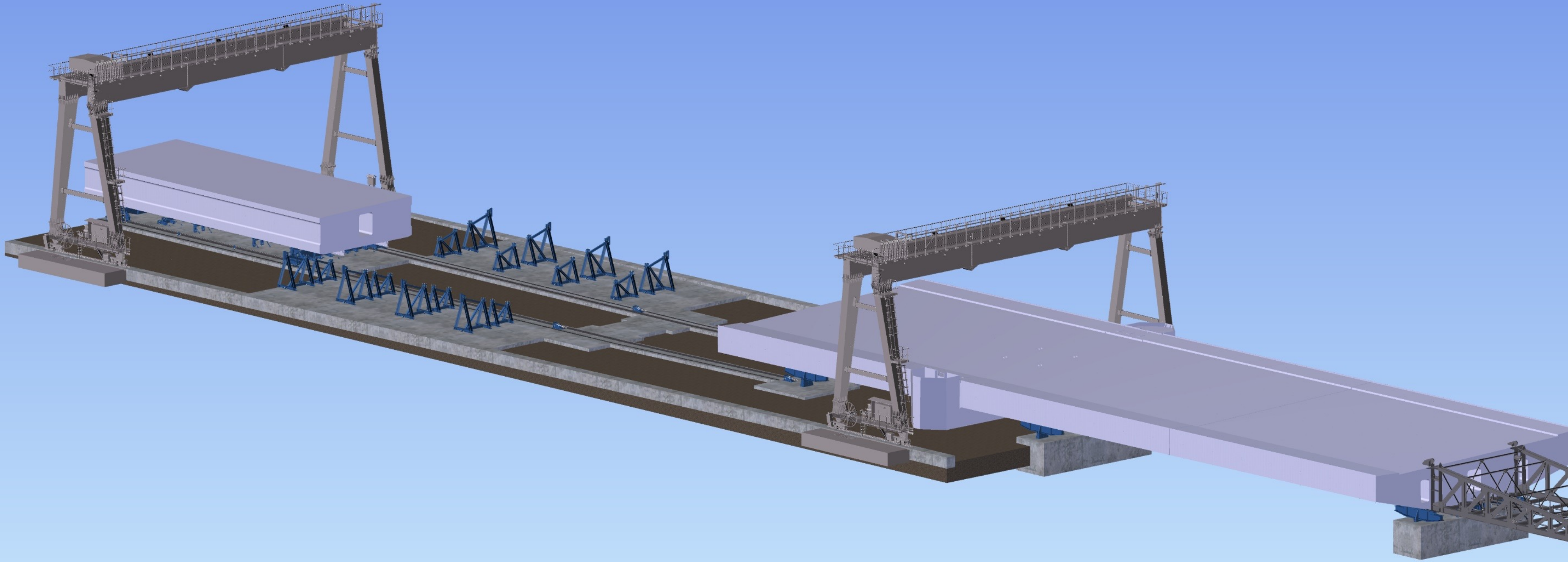

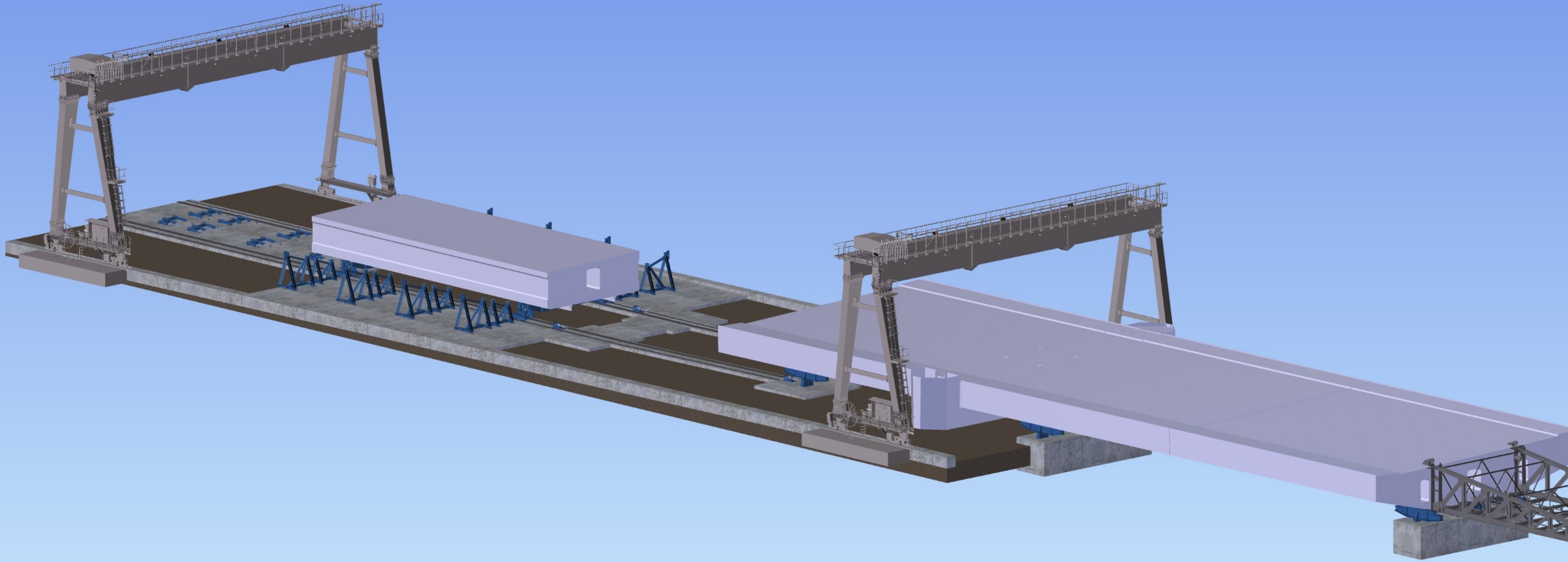

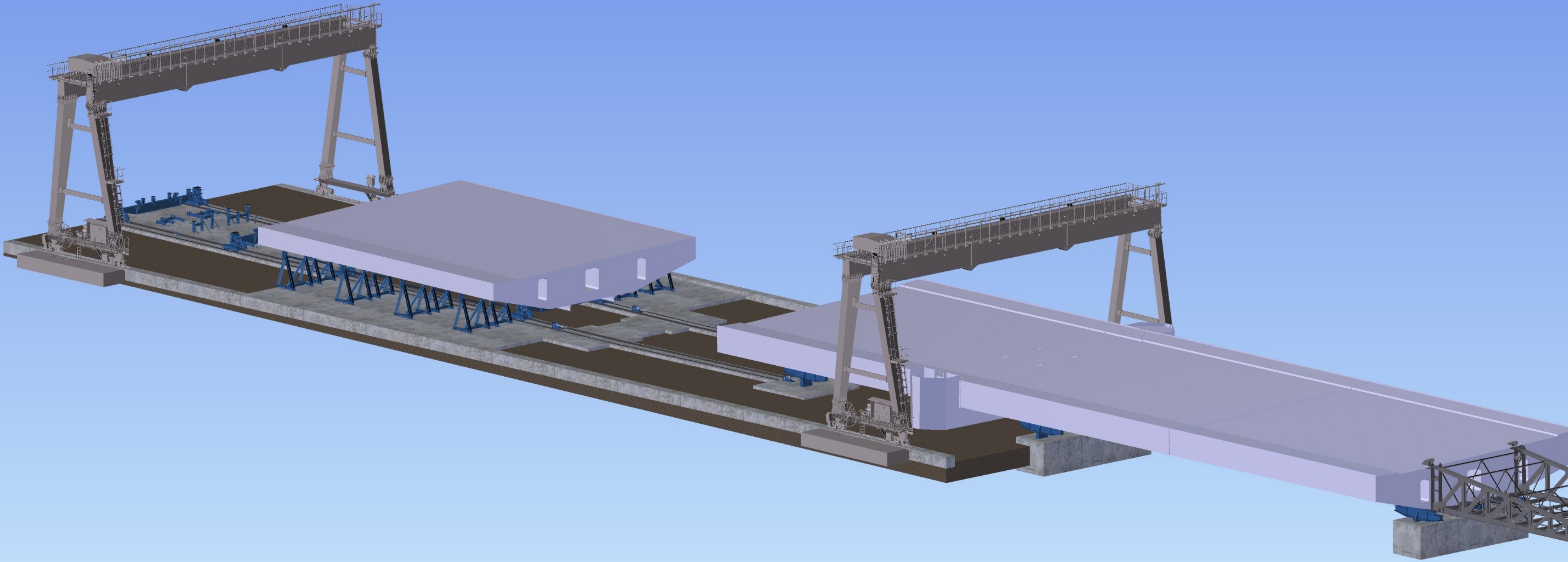

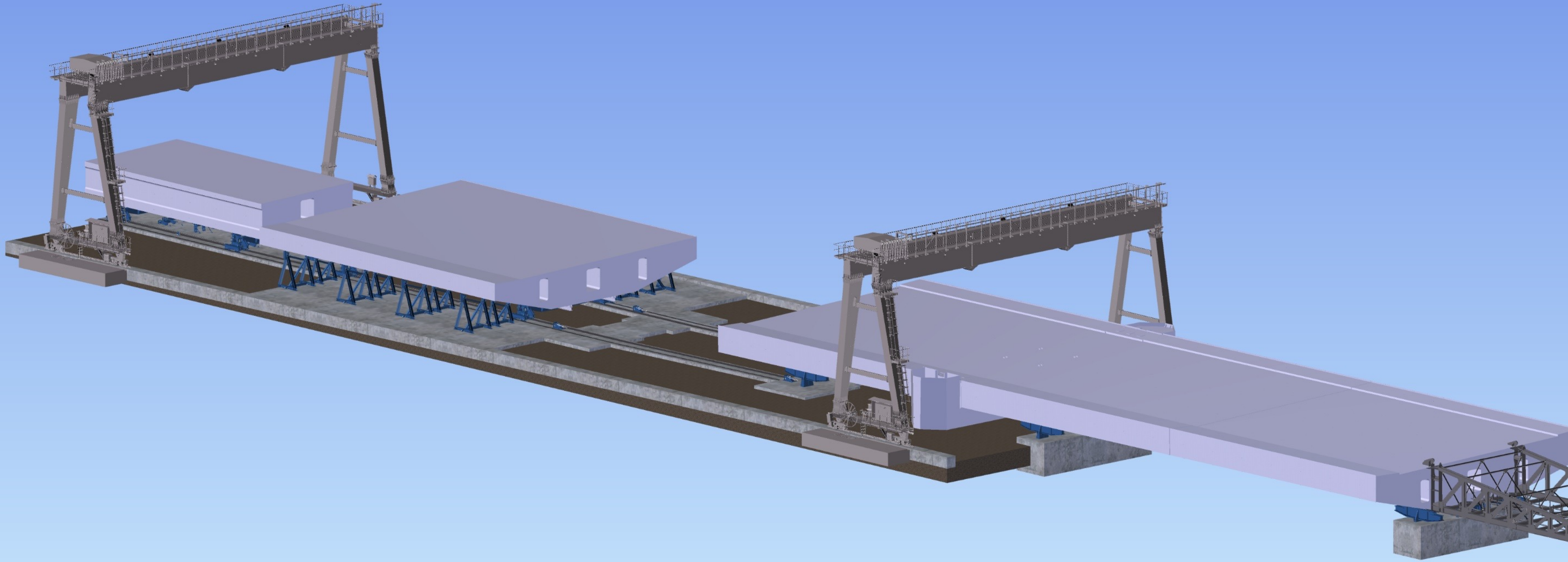

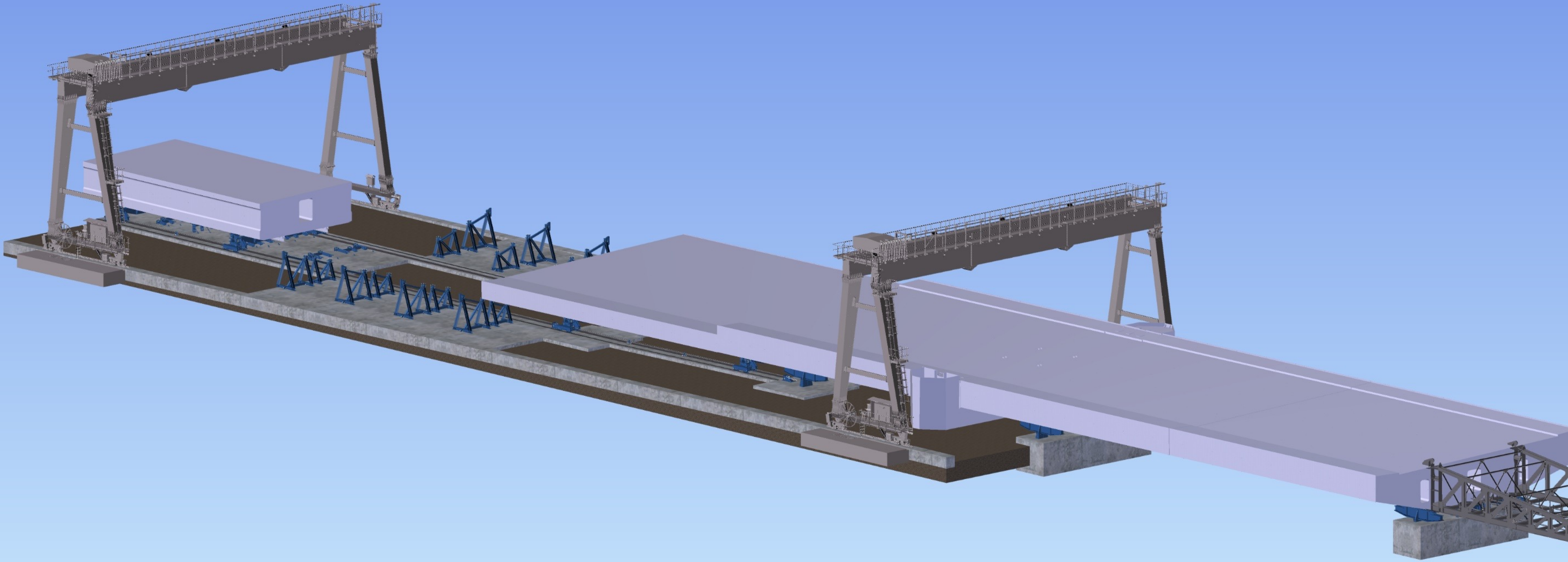

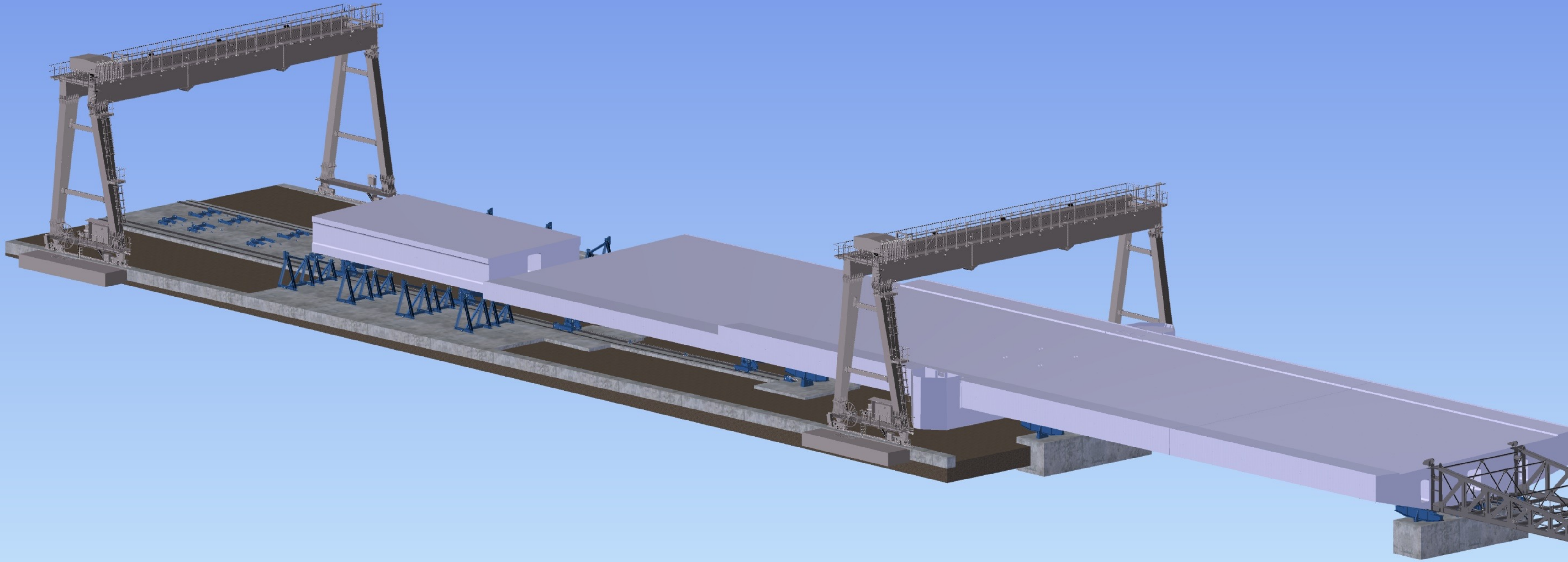

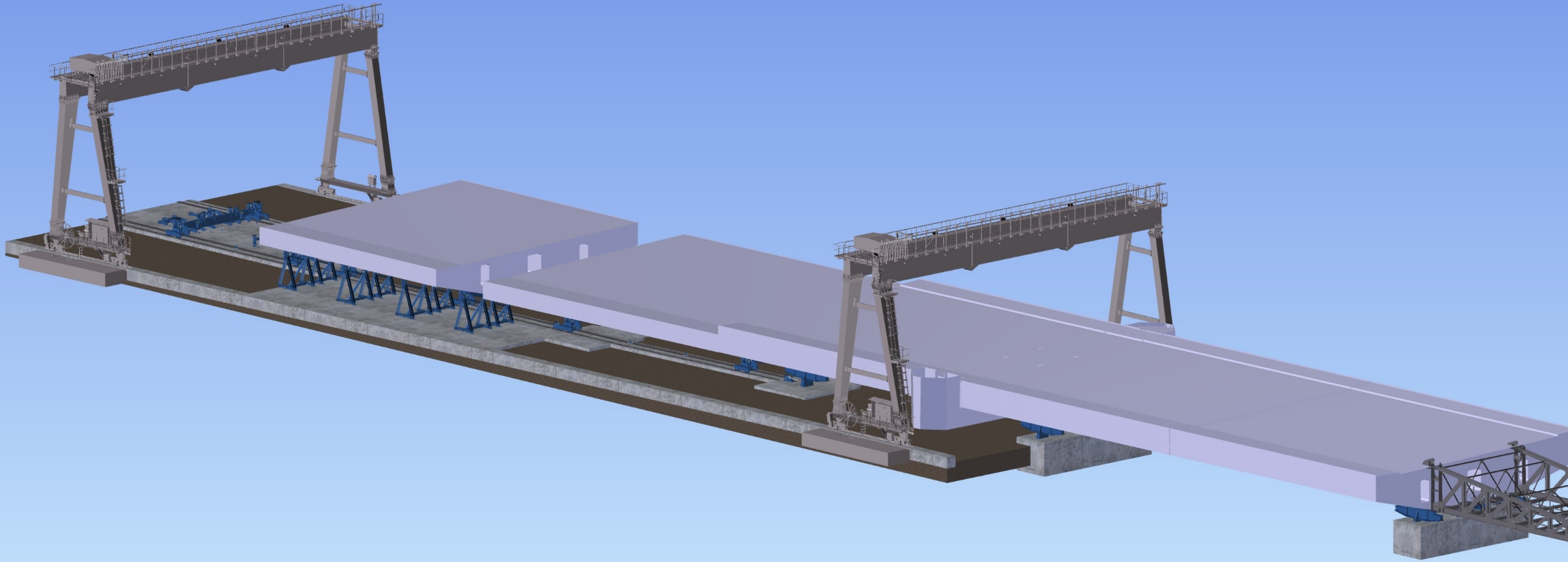

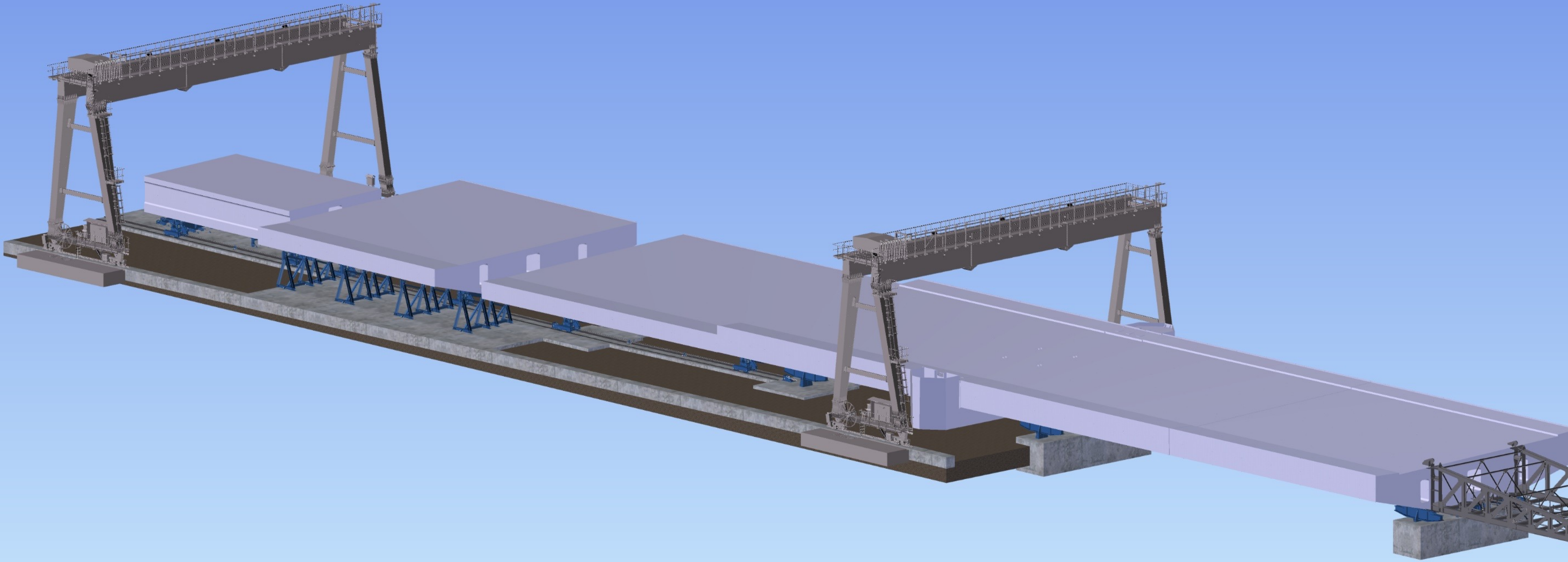

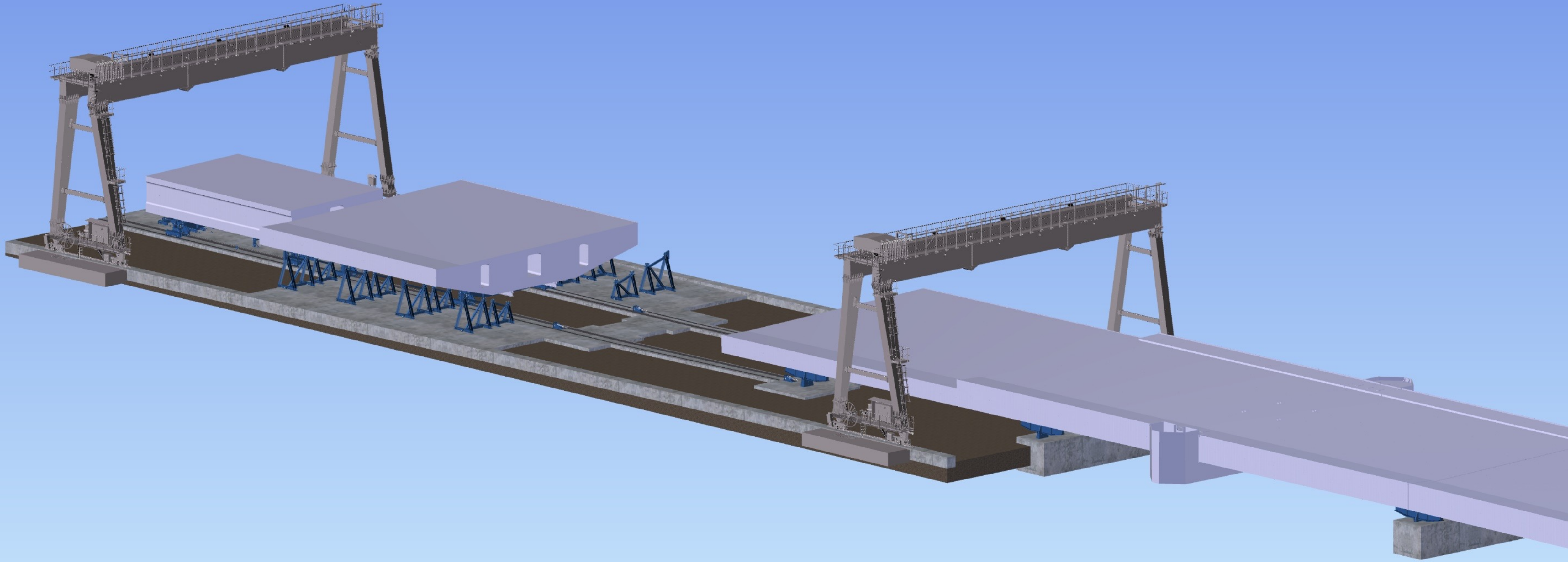

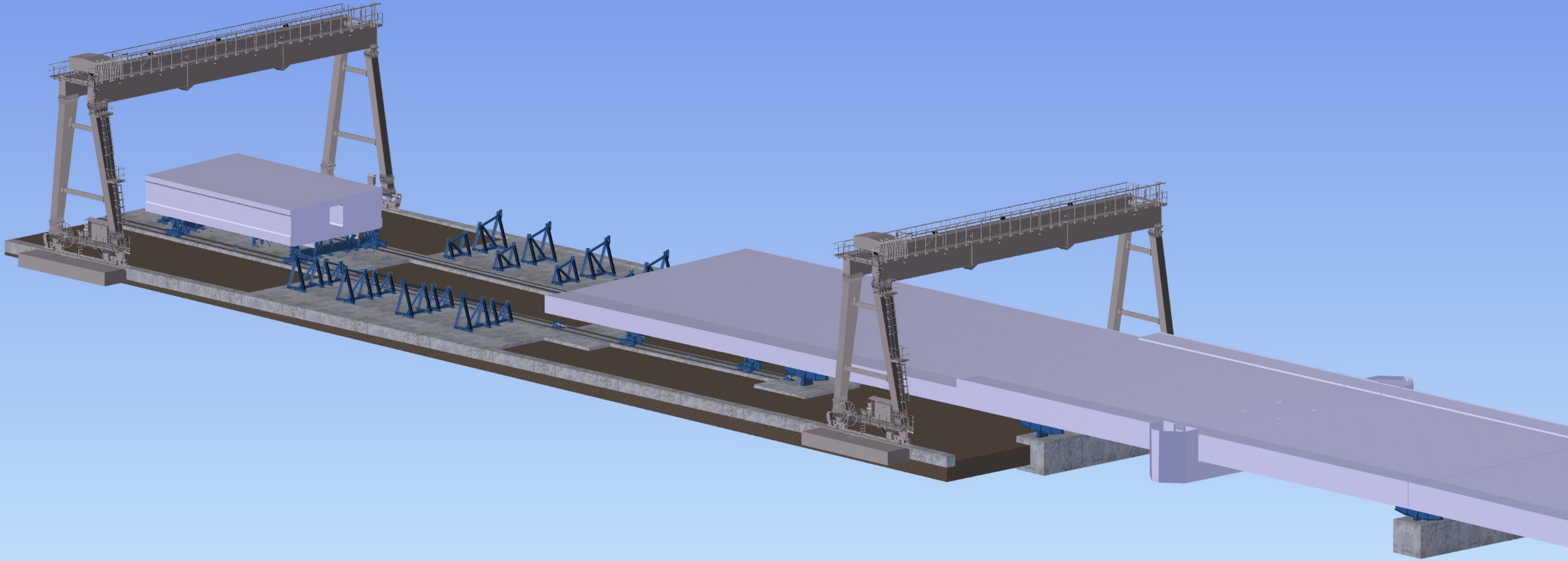

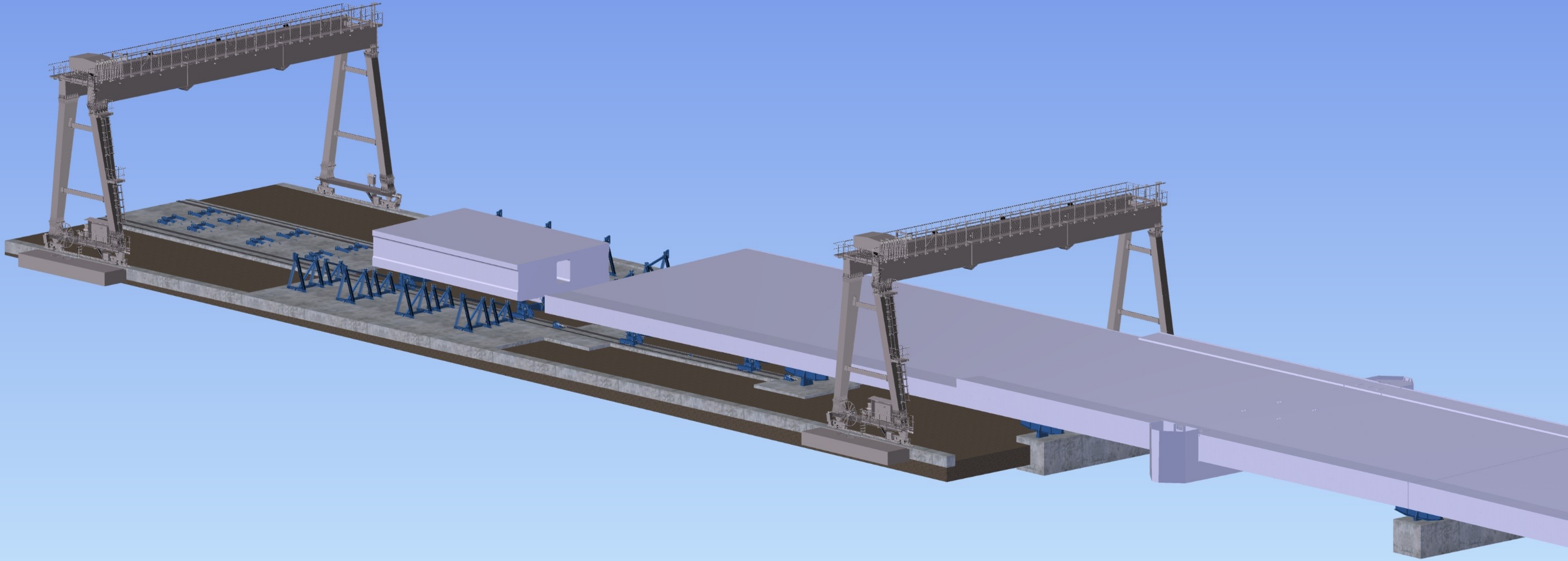

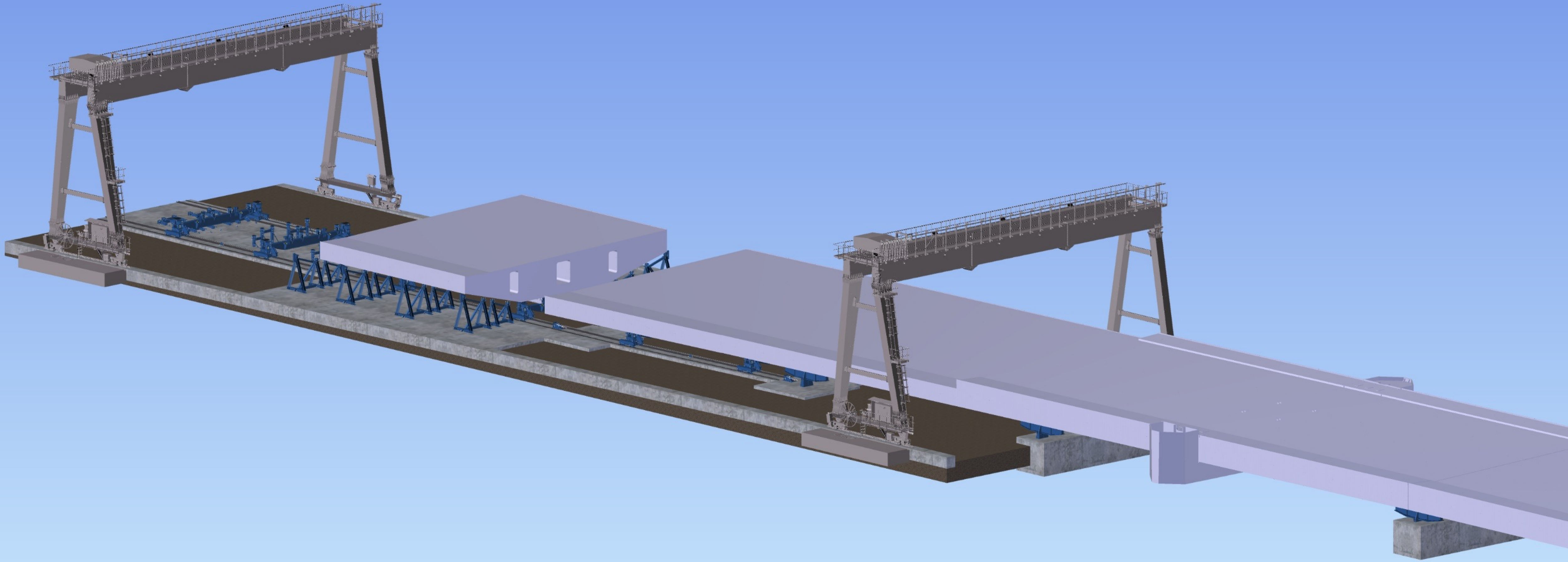

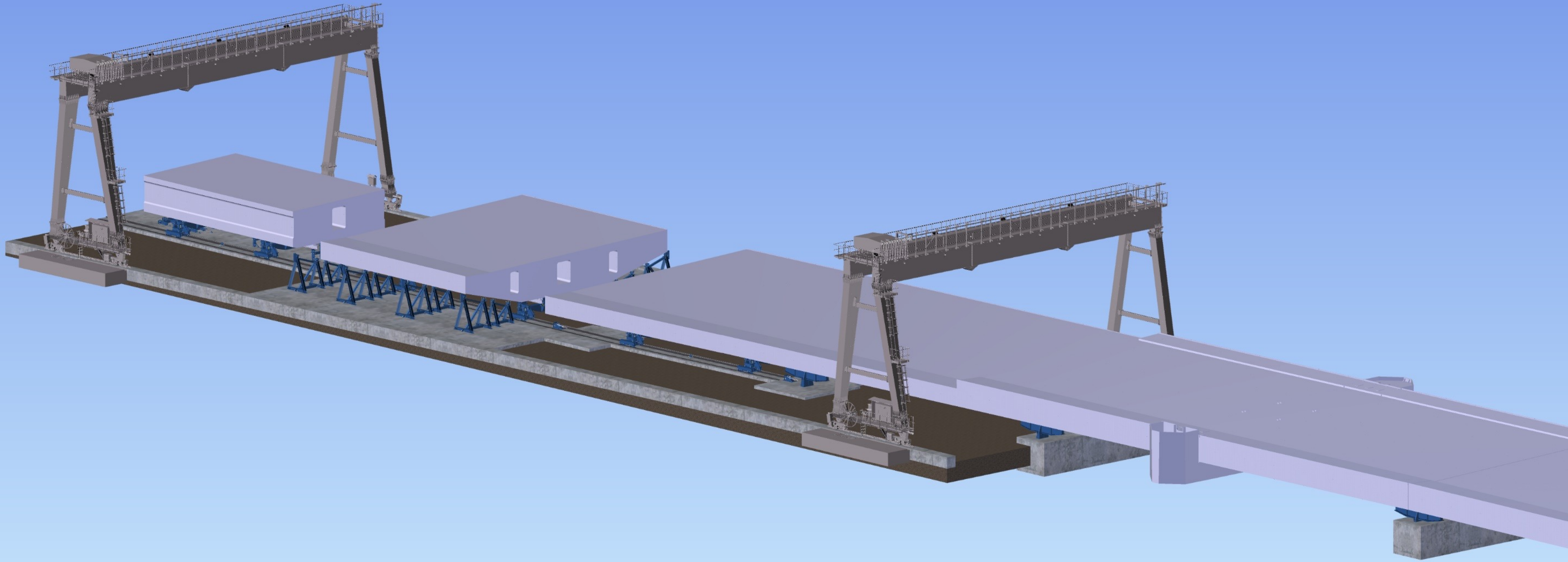

Transport | Sekce S45-47 | Dodávka dílce „f“

Transport | Segment S45-47 | Delivery of Part „f“

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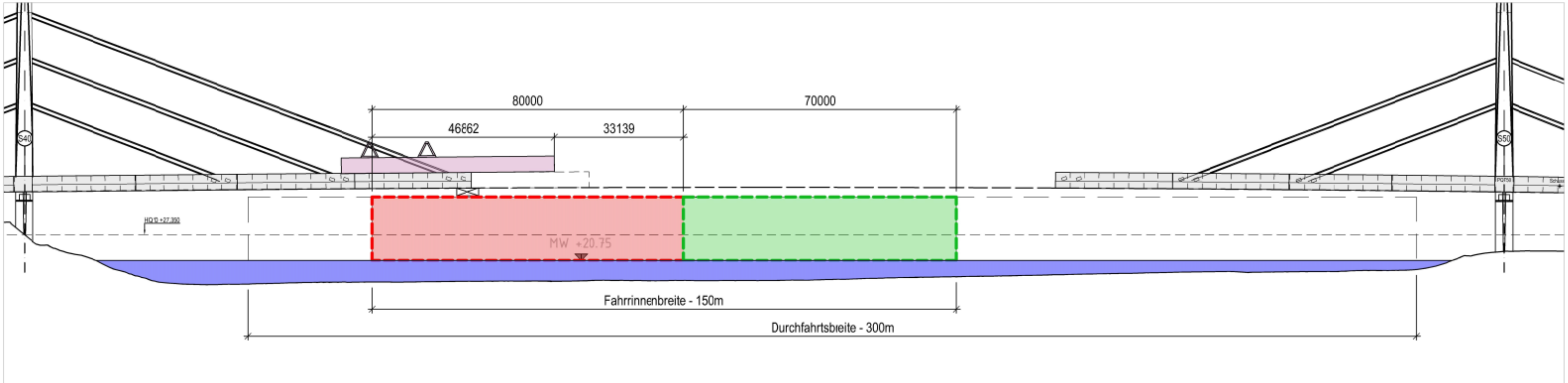
Nutnost zachování vodní cesty/ Waterway safety



Smluvní podmínky

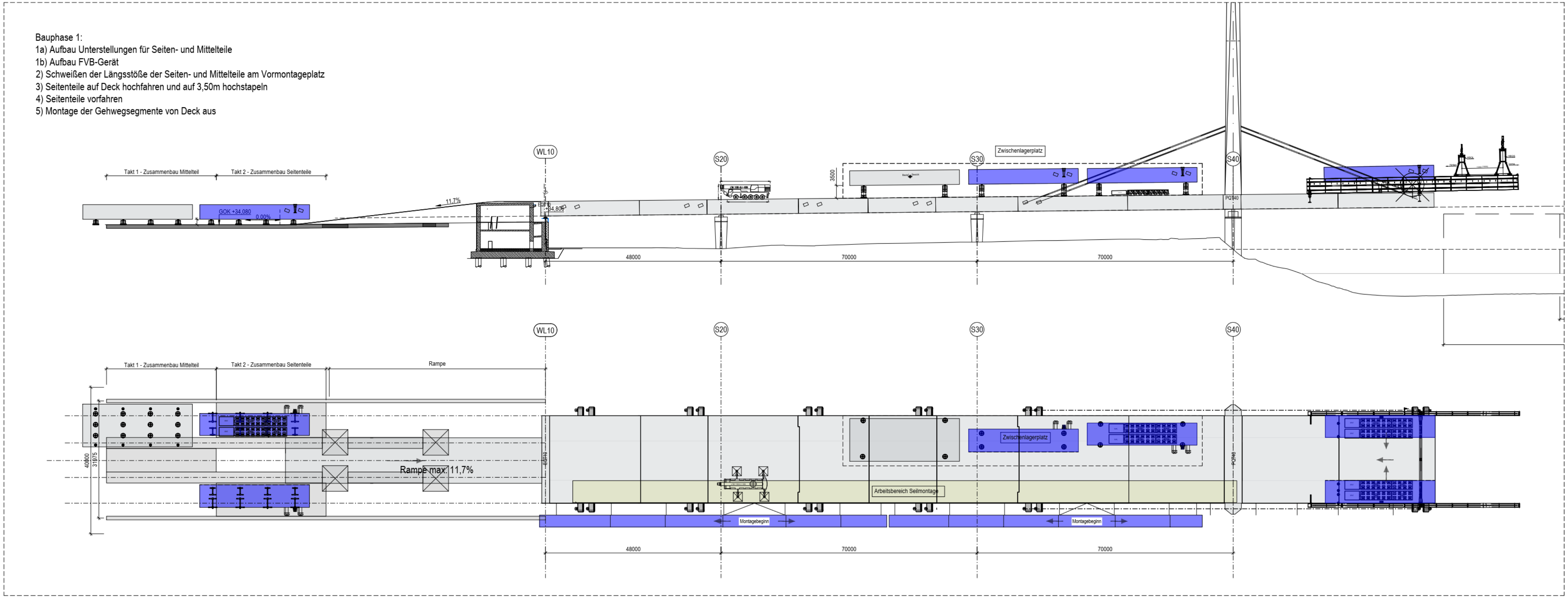
Stavba musela být prováděna technologií „shora“, protože bylo nutno zachovat minimálně 70 metrů širokou vodní cestu. Proto se nedalo použít zavážení dílců na pontonech a jejich následné zvedání do polohy.

Contractual conditons

Bridge construction must be conducted from above. Transporting bridge segments on the waterway and lifting them into position is not allowed.
Minimum remaining width of shipping channel: ≥ 70 m

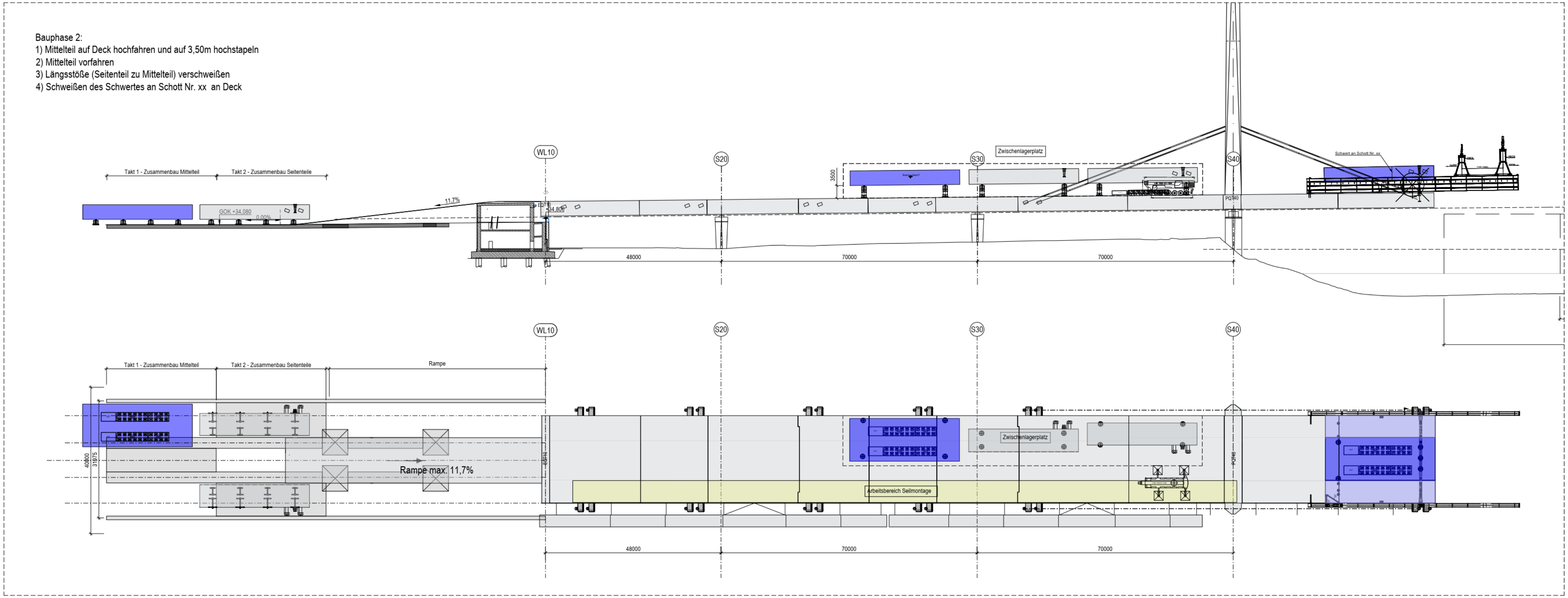
Montážní postup | Letmá část - fáze 1 /

Assembly process | Cantilever construction – Phase 1



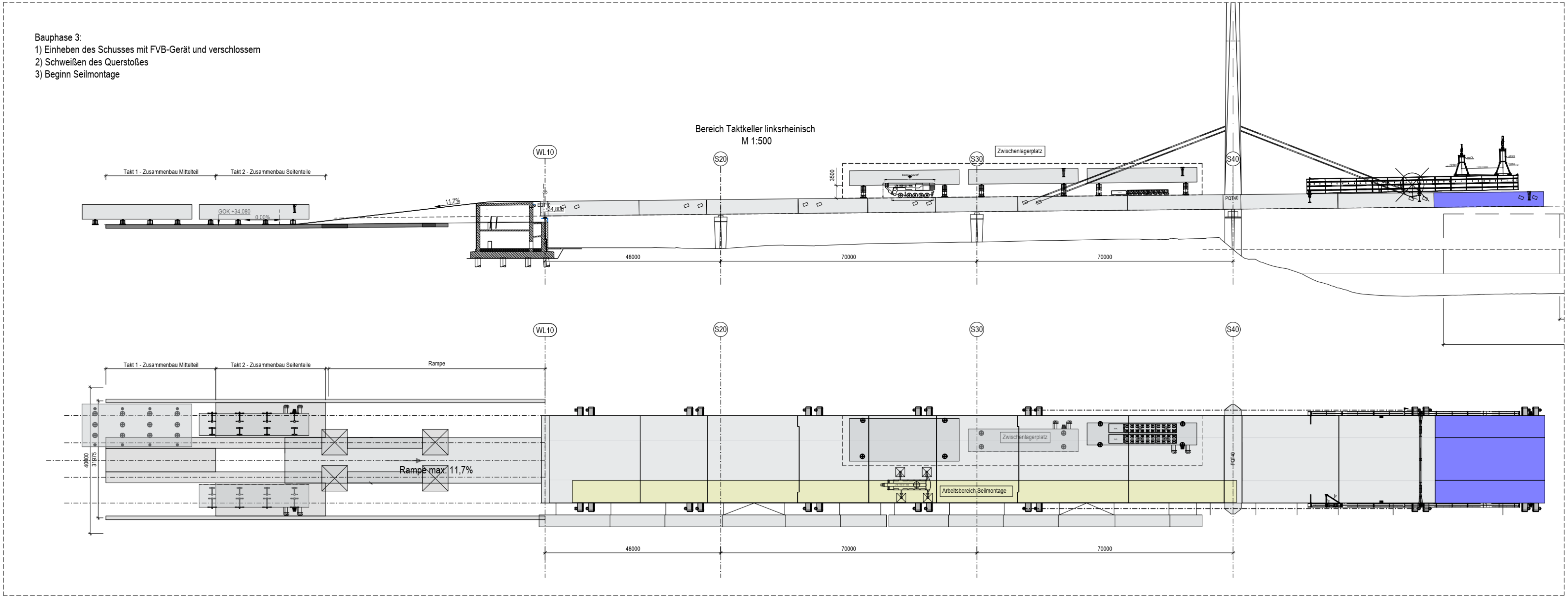
Montážní postup | Letmá část - fáze 2 /

Assembly process | Cantilever construction – Phase 2



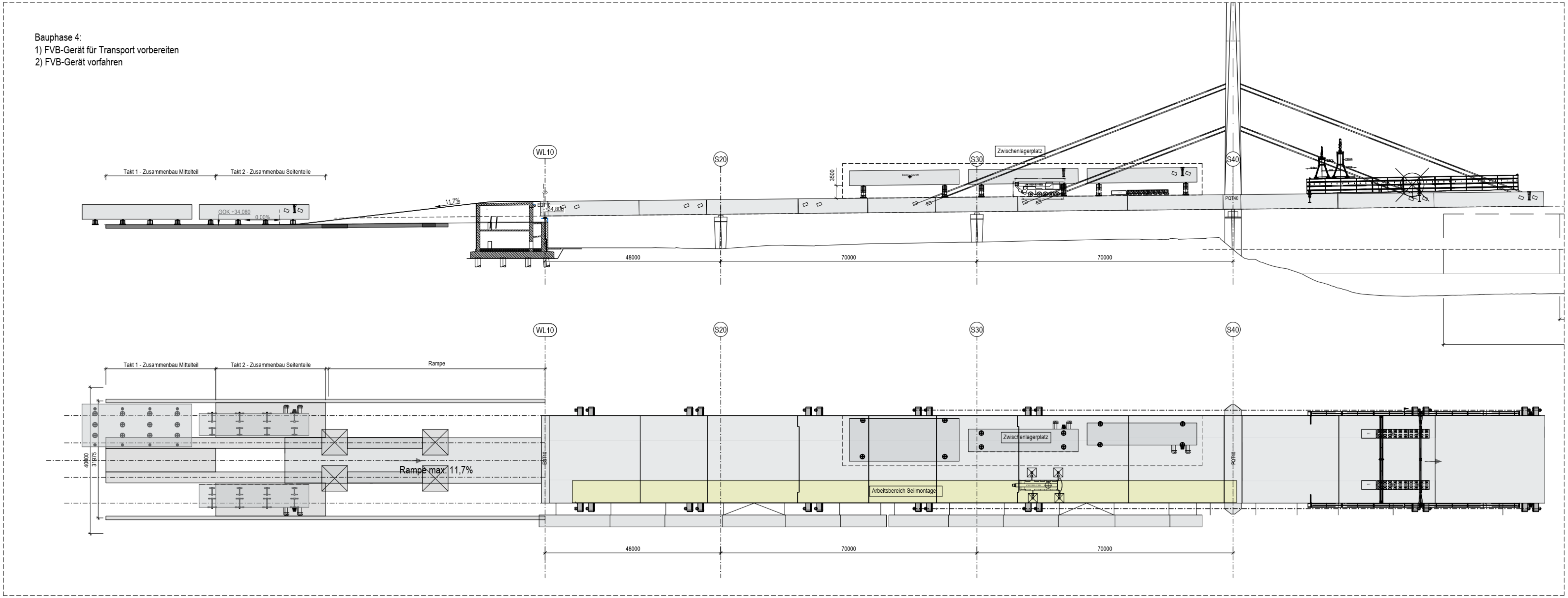
Montážní postup | Letmá část - fáze 3 /

Assembly process | Cantilever construction – Phase 3



Montážní postup | Letmá část - fáze 4 /

Assembly process | Cantilever constrution – Phase 4

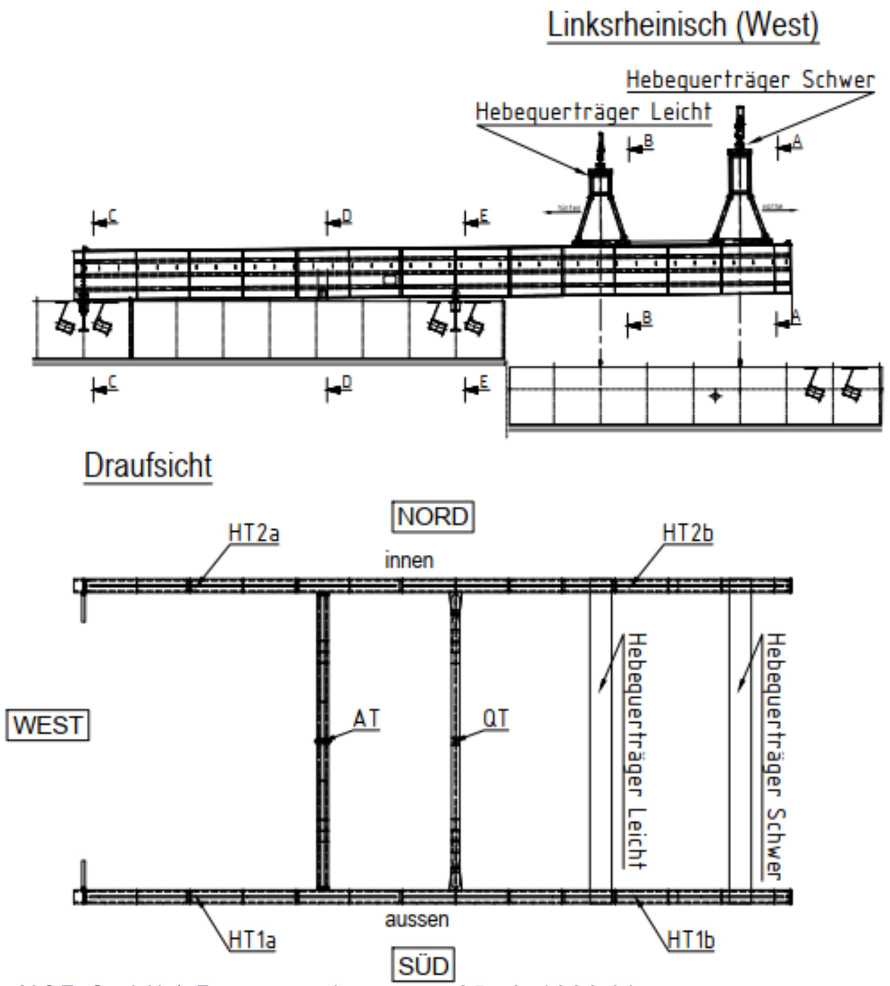


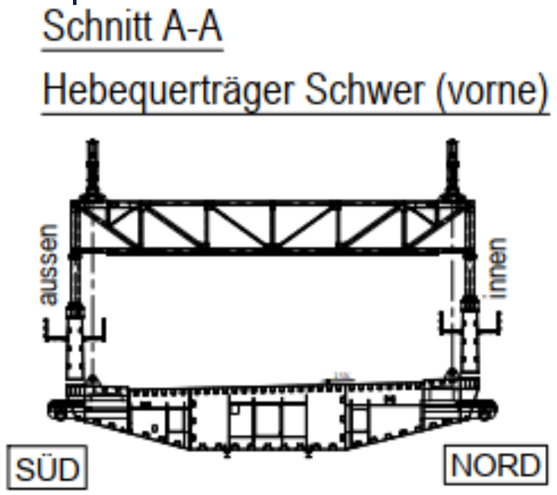
Montážní postup | Transport velkých dílců pomocí autonomních těžkých podvozků z meziskládky na místo finální montáže

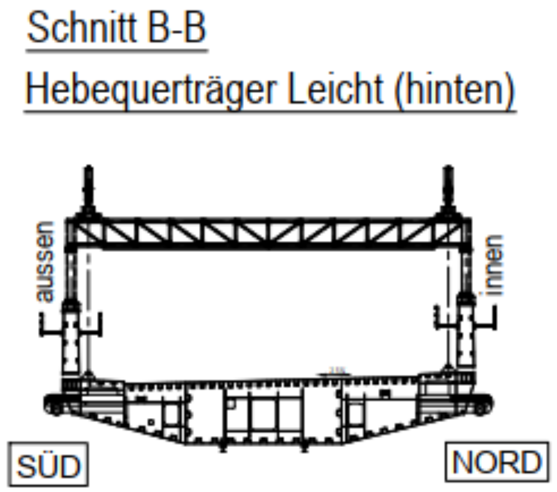
Assembly process | Transportation of large bridge parts with SPMTs to the interim storage area on the bridge

Pomocná konstrukce pro letmou montáž | Základní přehled /

Cantilever construction - Installation device | Overview







Montážní postup | letmá montáž /

Assembly process | Cantilever constrution

Montážní postup | Letmá montáž /

Assembly process | Cantilever constrution

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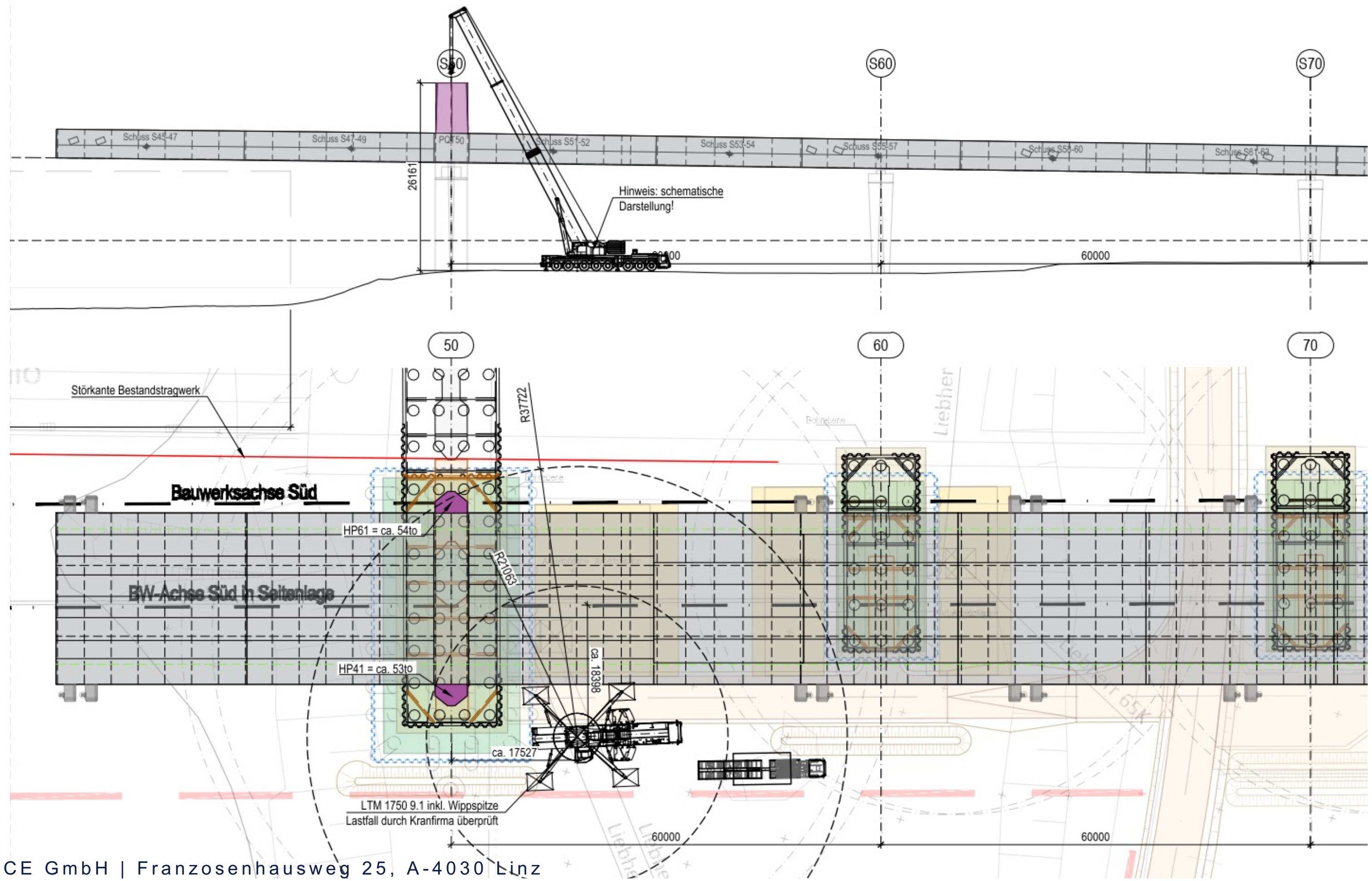
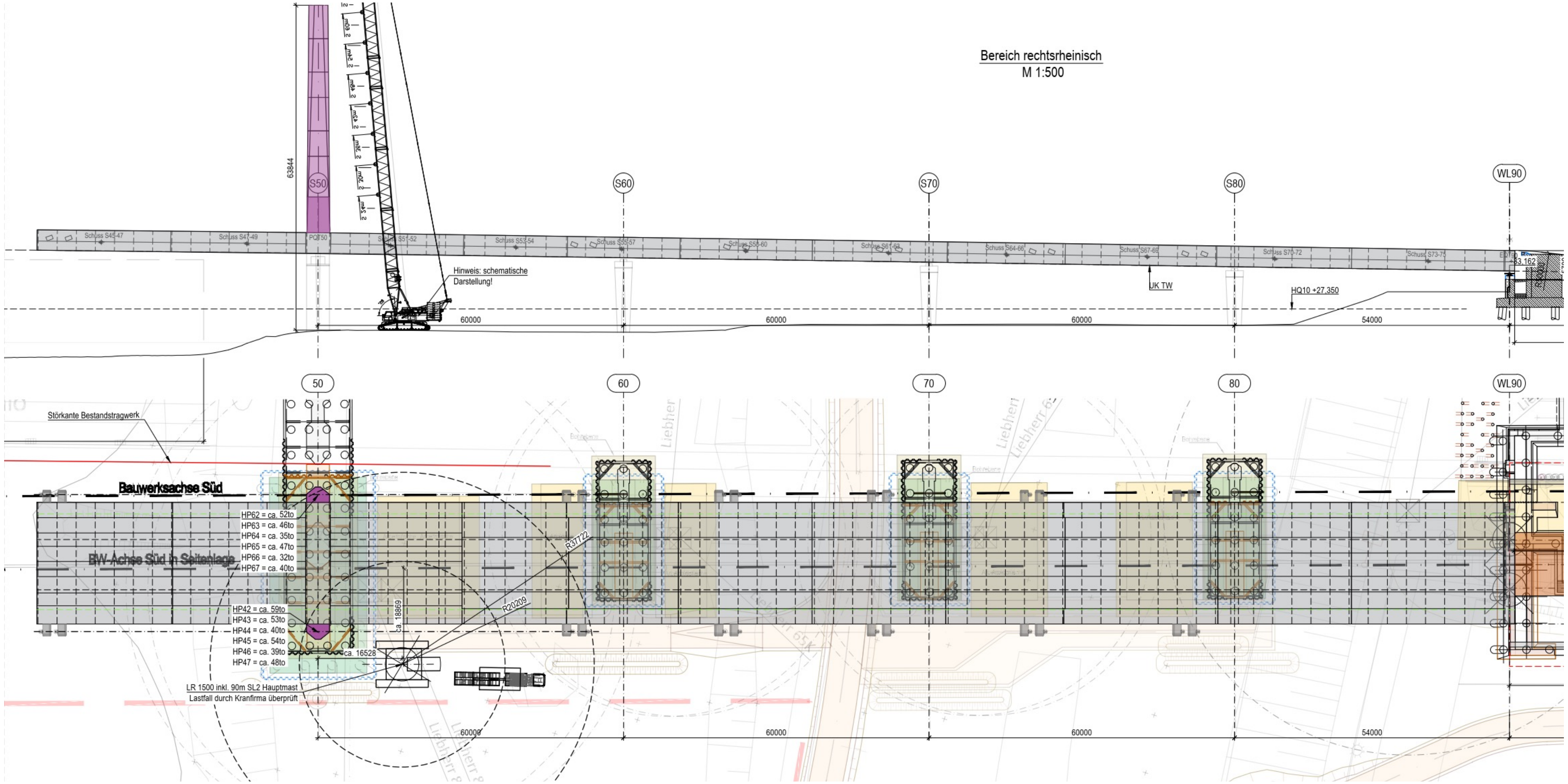
Montážní postup | Pylon – Sekce 1 | Hmotnost ≤ 53 t /

Assembly process | Pylon – Section 1 | Lifting weight ≤ 53 t



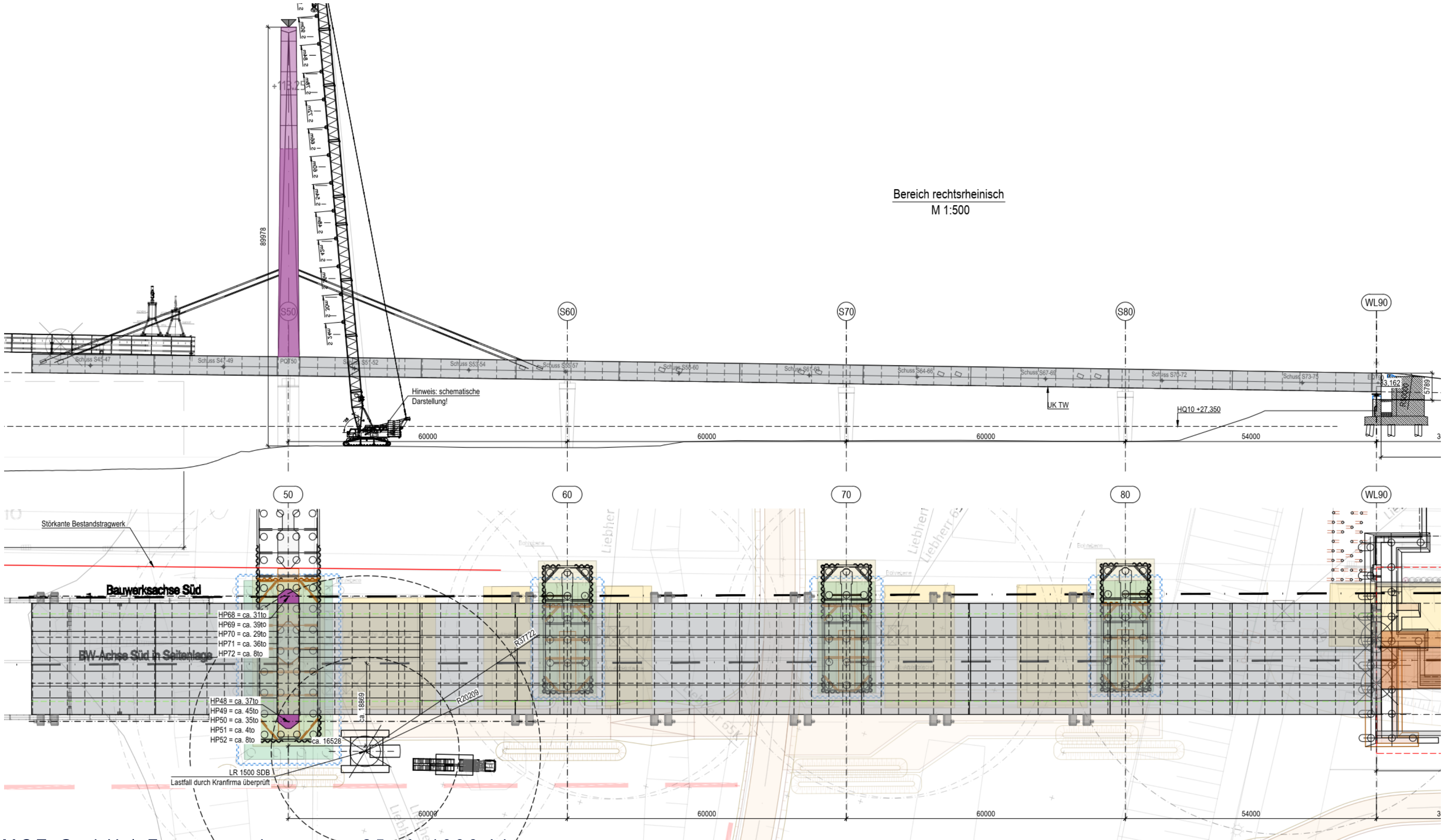
Montážní postup | Pylon – Sekce 2 – 7 | Hmotnost ≤ 58,8 t /

Assembly process | Pylon – Sections 2 - 7 | Lifting weight ≤ 58.83 t



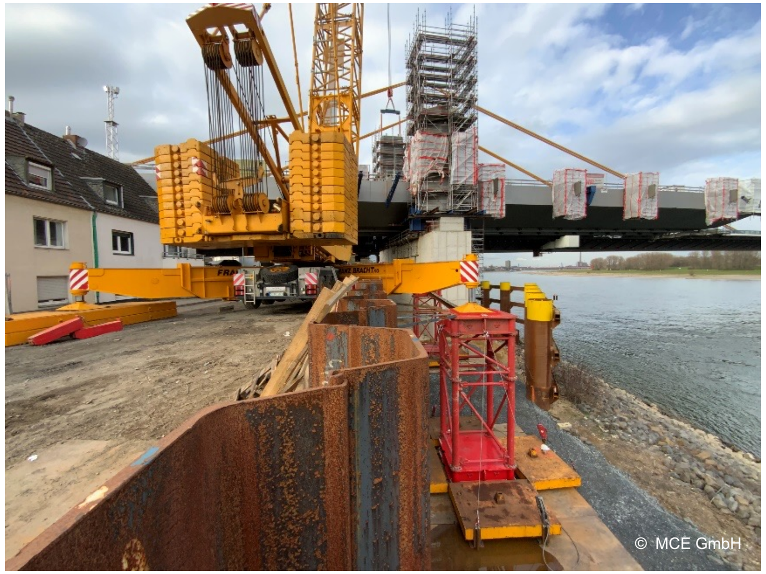
Montážní postup | Pylon – Sekce 8 – 12 | Hmotnost ≤ 45 t /

Assembly process | Pylon – Sections 8 - 12 | Lifting weight ≤ 45 t



Montážní postup | Pylon (Sekce S2 - S6) Osa 40 /

Assembly process | Pylon assembly (Sections S2 – S6) Axis 40



Montážní postup | Pylon (Sekce S7 – S12) Osa 50 /

Assembly process | Pylon assembly (Sections S7 – S12) Axis 50

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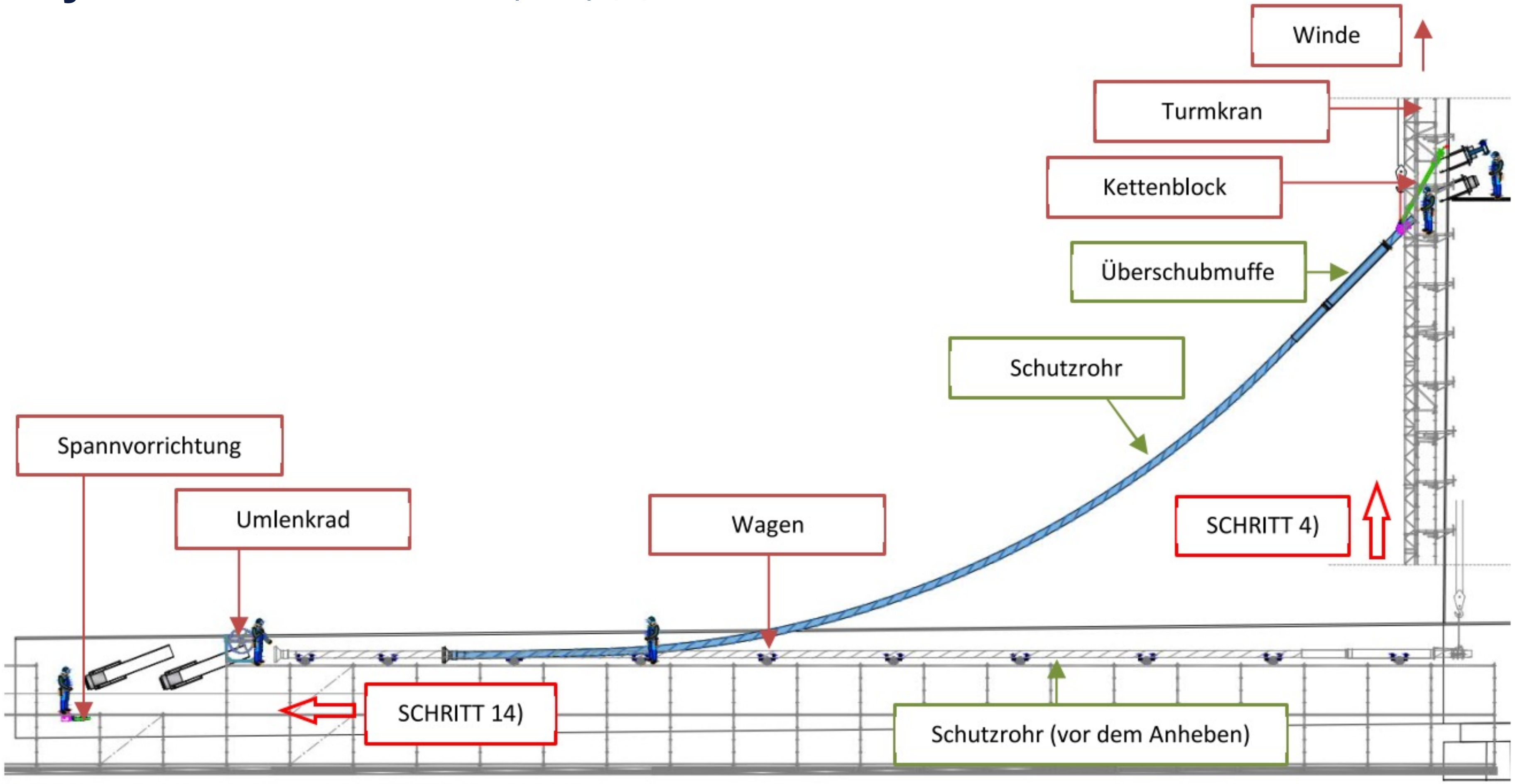
Instalace závěsů | osazení roury /

Stay cable installation | Stay pipe installation



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Instalace závěsů | Zatažení, spletení kabelů /

Stay cable installation | Strand installation

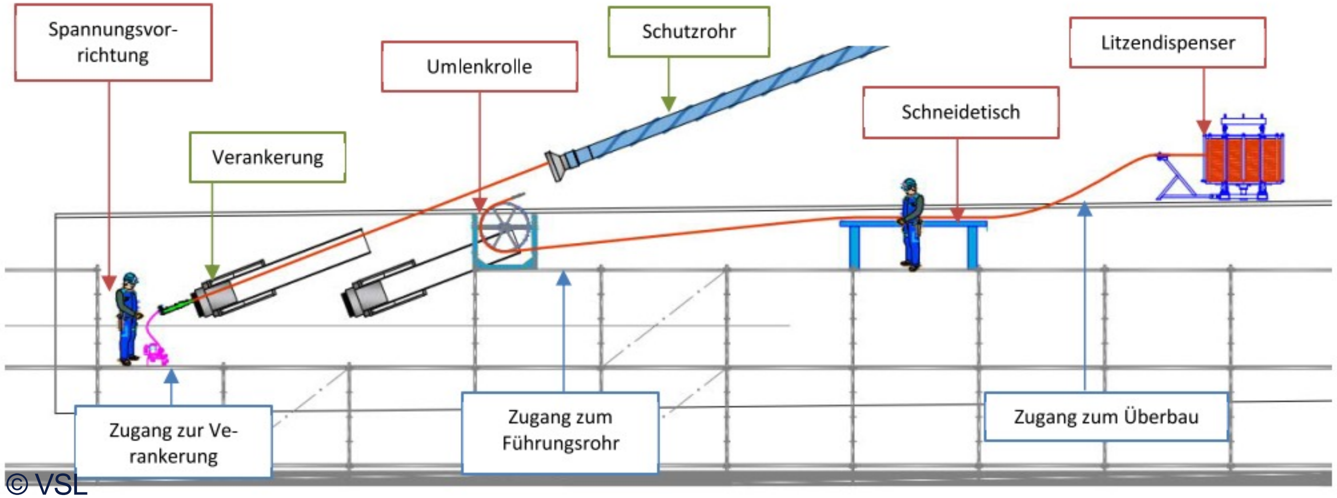

Abbildung 1 – Fahrbahnplatteplan

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Bild 1 – Beispiel einer Umlenkrolle

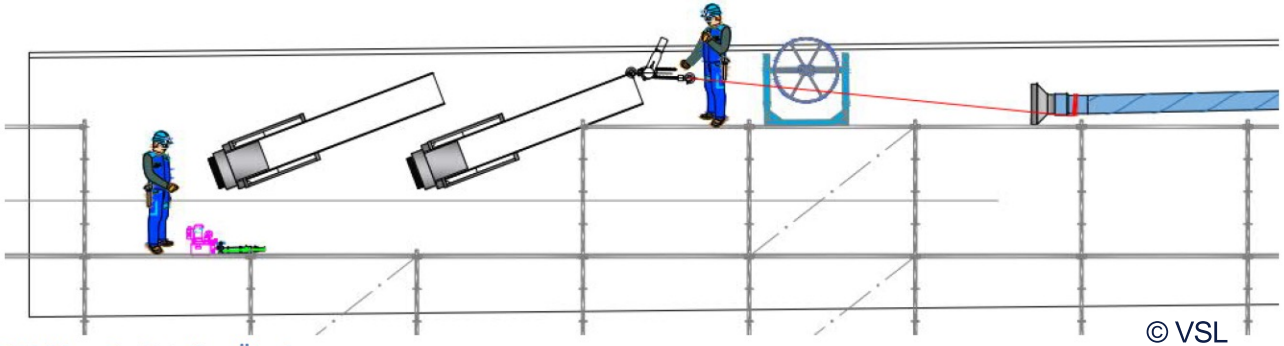

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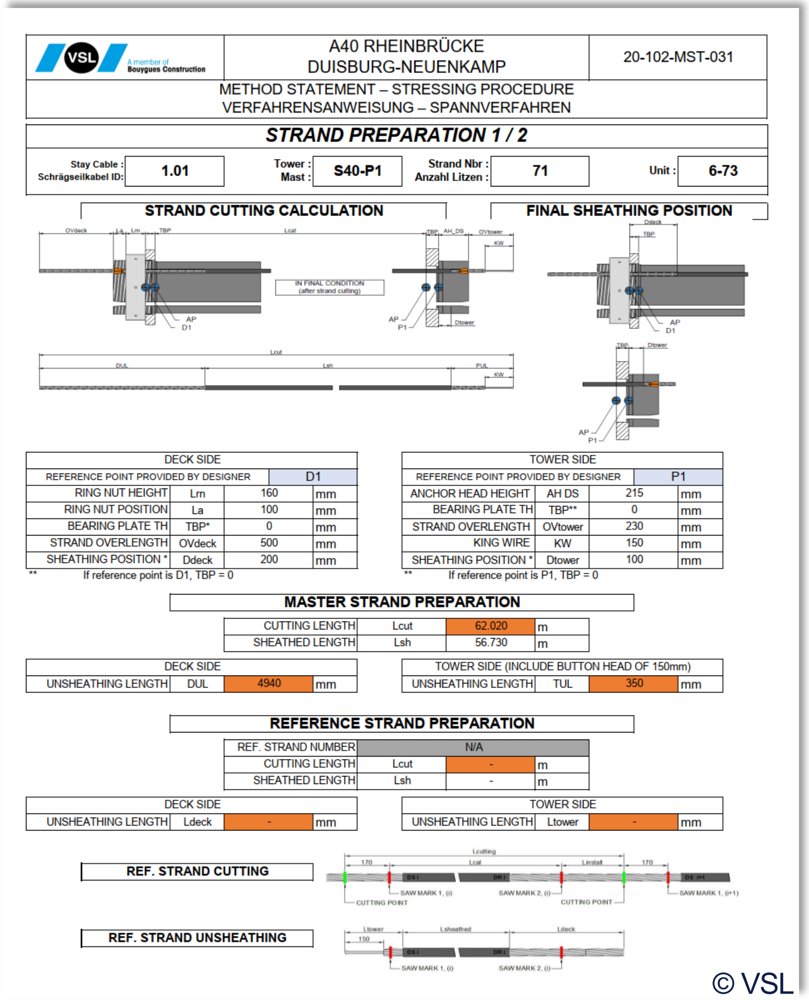
Abbildung 4 - Detail an Überbau

Instalace závěsů | Příprava jednotlivých kabelů /

Stay cable installation | Preparation for individual strand installation



A40 RHEINBRÜCKE DUISBURG-NEUENKAMP	20-102-MST-031
METHOD STATEMENT – STRESSING PROCEDURE VERFAHRENSANWEISUNG – SPANNVERFAHREN	

STRAND PREPARATION 1 / 2

Stay Cable : Schrägseilkabel ID:	1.01	Tower : Mast :	S40-P1	Strand Nbr : Anzahl Litzen :	71	Unit :	6-73

STRAND CUTTING CALCULATION | **FINAL SHEATHING POSITION**

DECK SIDE			
REFERENCE POINT PROVIDED BY DESIGNER		D1	
RING NUT HEIGHT	Lrn	160	mm
RING NUT POSITION	La	100	mm
BEARING PLATE TH	TBP*	0	mm
STRAND OVERLENGTH	OVdeck	500	mm
SHEATHING POSITION *	Ddeck	200	mm

** If reference point is D1, TBP = 0

TOWER SIDE			
REFERENCE POINT PROVIDED BY DESIGNER		P1	
ANCHOR HEAD HEIGHT	AH DS	215	mm
BEARING PLATE TH	TBP**	0	mm
STRAND OVERLENGTH	OVtower	230	mm
KING WIRE	KW	150	mm
SHEATHING POSITION *	Dtower	100	mm

** If reference point is P1, TBP = 0

MASTER STRAND PREPARATION

CUTTING LENGTH	Lcut	62.020	m
SHEATHED LENGTH	Lsh	56.730	m

DECK SIDE			
UNSHEATHING LENGTH	DUL	4940	mm

TOWER SIDE (INCLUDE BUTTON HEAD OF 150mm)			
UNSHEATHING LENGTH	TUL	350	mm

REFERENCE STRAND PREPARATION

REF. STRAND NUMBER		N/A	
CUTTING LENGTH	Lcut	-	m
SHEATHED LENGTH	Lsh	-	m

DECK SIDE			
UNSHEATHING LENGTH	Ldeck	-	mm

TOWER SIDE			
UNSHEATHING LENGTH	Ltower	-	mm

REF. STRAND CUTTING

REF. STRAND UNSHEATHING

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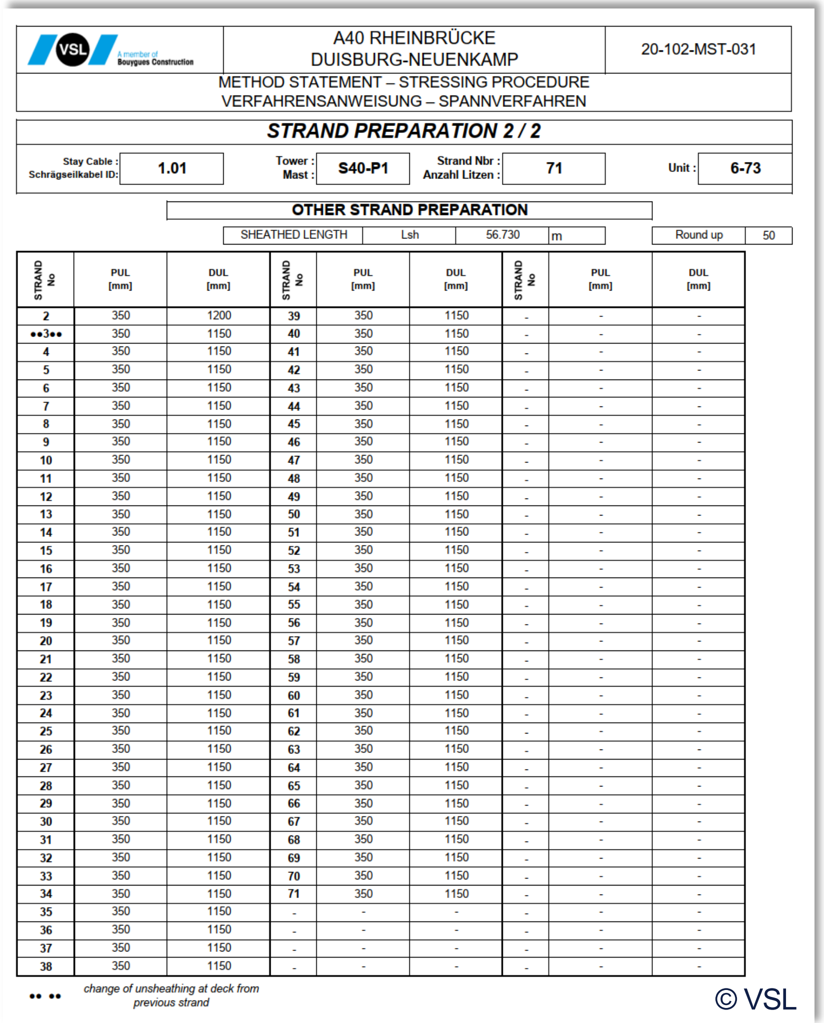

A40 RHEINBRÜCKE DUISBURG-NEUENKAMP	20-102-MST-031
METHOD STATEMENT – STRESSING PROCEDURE VERFAHRENSANWEISUNG – SPANNVERFAHREN	

STRAND PREPARATION 2 / 2

Stay Cable : Schrägseilkabel ID:	1.01	Tower : Mast :	S40-P1	Strand Nbr : Anzahl Litzen :	71	Unit :	6-73

OTHER STRAND PREPARATION

SHEATHED LENGTH	Lsh	56.730	m	Round up	50

STRAND No	PUL [mm]	DUL [mm]	STRAND No	PUL [mm]	DUL [mm]	STRAND No	PUL [mm]	DUL [mm]
2	350	1200	39	350	1150	-	-	-
••3••	350	1150	40	350	1150	-	-	-
4	350	1150	41	350	1150	-	-	-
5	350	1150	42	350	1150	-	-	-
6	350	1150	43	350	1150	-	-	-
7	350	1150	44	350	1150	-	-	-
8	350	1150	45	350	1150	-	-	-
9	350	1150	46	350	1150	-	-	-
10	350	1150	47	350	1150	-	-	-
11	350	1150	48	350	1150	-	-	-
12	350	1150	49	350	1150	-	-	-
13	350	1150	50	350	1150	-	-	-
14	350	1150	51	350	1150	-	-	-
15	350	1150	52	350	1150	-	-	-
16	350	1150	53	350	1150	-	-	-
17	350	1150	54	350	1150	-	-	-
18	350	1150	55	350	1150	-	-	-
19	350	1150	56	350	1150	-	-	-
20	350	1150	57	350	1150	-	-	-
21	350	1150	58	350	1150	-	-	-
22	350	1150	59	350	1150	-	-	-
23	350	1150	60	350	1150	-	-	-
24	350	1150	61	350	1150	-	-	-
25	350	1150	62	350	1150	-	-	-
26	350	1150	63	350	1150	-	-	-
27	350	1150	64	350	1150	-	-	-
28	350	1150	65	350	1150	-	-	-
29	350	1150	66	350	1150	-	-	-
30	350	1150	67	350	1150	-	-	-
31	350	1150	68	350	1150	-	-	-
32	350	1150	69	350	1150	-	-	-
33	350	1150	70	350	1150	-	-	-
34	350	1150	71	350	1150	-	-	-
35	350	1150	-	-	-	-	-	-
36	350	1150	-	-	-	-	-	-
37	350	1150	-	-	-	-	-	-
38	350	1150	-	-	-	-	-	-

•• •• *change of unsheathing at deck from previous strand*

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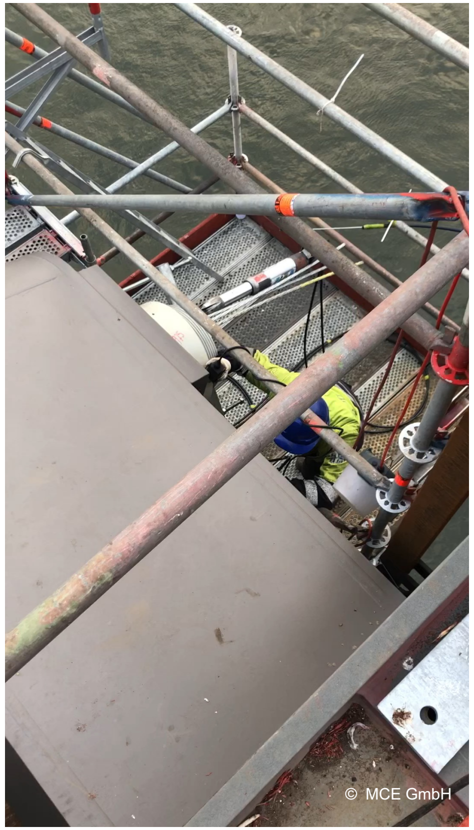
Instalace závěsů /

Stay cable installation



Stavební progres | Červenec 2023 / *edit 3/2024 provoz již převeden na novou konstrukci Jih, aktuálně probíhá demontáž staré konstrukce Sever

Construction progress | July 2023

https://youtu.be/6-9lIw2cAqM

Účastníci projektu / Project participants (extract)

Zákazník / Client:	**DEGES GmbH**
Stavebník / Contractor:	**ARGE A40 Rheinbrücke Duisburg-Neuenkamp** HOCHTIEF Infrastructure GmbH – MCE GmbH – MCE Nyiregyhaza Kft. – MCE Slany s.r.o. – ZSB Zwickauer Sonderstahlbau GmbH – Plauen Stahl Technologie GmbH
Základní návrh / Conceptual design:	**Leonhardt, Andrä und Partner** Beratende Ingenieure VBI AG
Realizační dokumentace/ Design Bridge - Superstructure:	**Leonhardt, Andrä und Partner** Beratende Ingenieure VBI AG
Hlavní vedení stavby a dozor/ Consultants/Site supervision:	**Ingenieurgemeinschaft A40 Rheinbrücke Duisburg** EHS – LAVIS – BUNG
Dozor zákazníka/ Design verification - Superstructure:	**PSP - Professor Sedlacek & Partner** Prof. Dr.-Ing. Ungermann, Dr.-Ing. Hensen

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