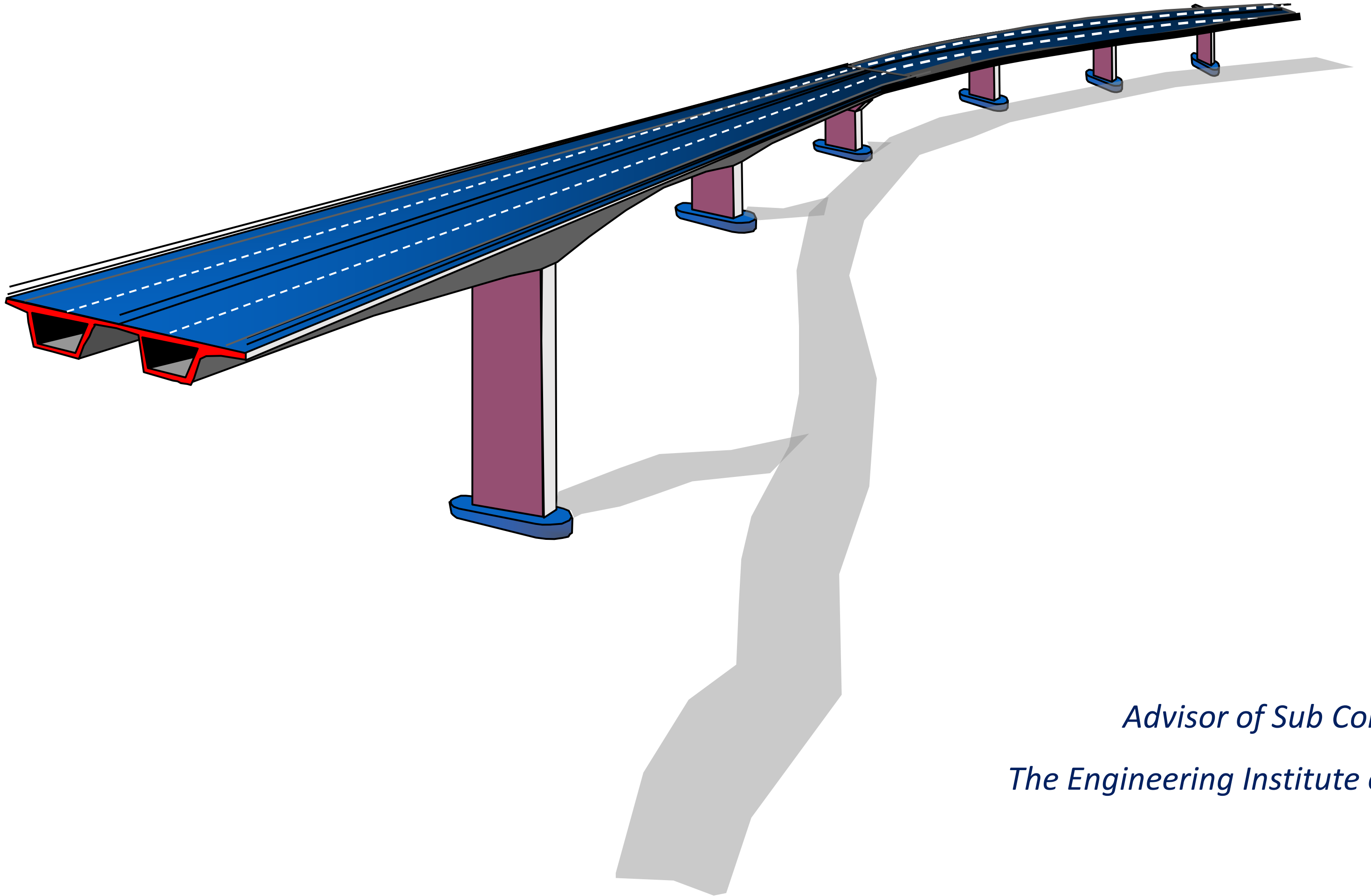
Construction Experience on Bridge/Elevated Structure



Athasit Sirisonthi, Ph.D

Advisor of Sub Committee of structural and bridge engineering

The Engineering Institute of Thailand Under H.M. The King's Patronage

s.athasit@gmail.com

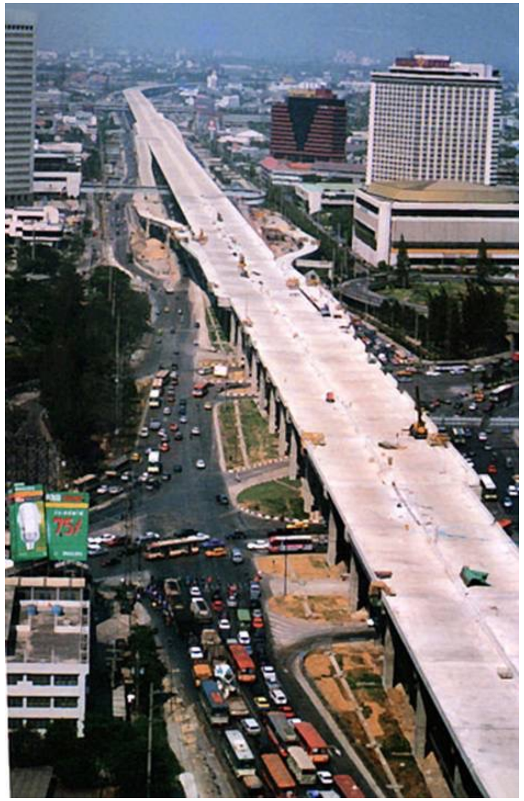
- Introduction to Bridge Design and Construction
- Experience in Segmental Box-Girder Bridge/Elevated Structure

Introduction to Bridge Design and Construction

s.athasit@gmail.com

Introduction to Bridge Design and Construction

- Bridge/Elevated Structure Characteristic
- Bridge/Elevated Construction Concept



Don Maung Tollway @ Lad prao Intersection

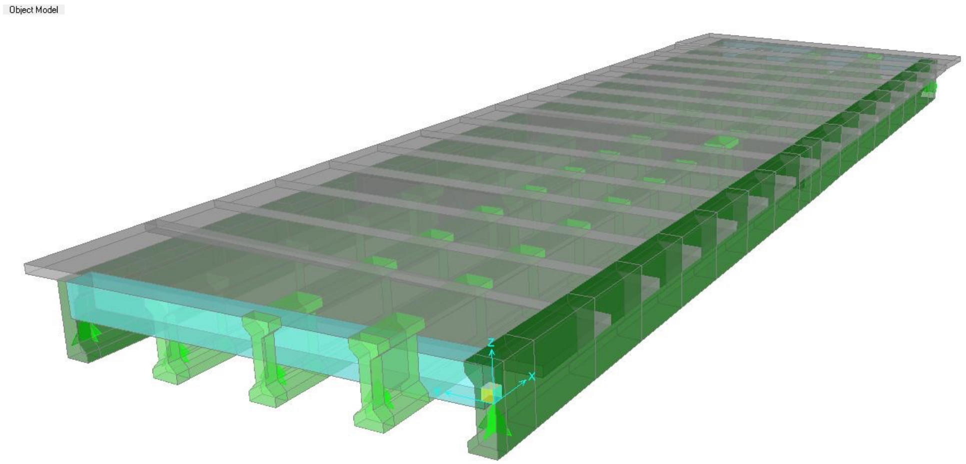
SVB Airport Rail Link @ Soi Soon Vijai

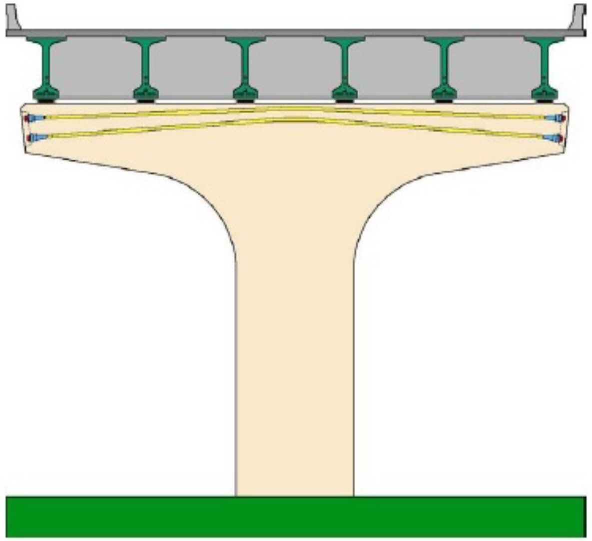
s.athasit@gmail.com

Bridge Superstructure: I-Girder with Deck slab

Bridge/Elevated Structures with I-Girder & Deck slab on Superstructure type, the old school design of bridge structure, this structure is use in many construction project in Thailand such as;

- Don Maung Tollway
- Expressway Stage 3: Section S1
- Elevated Frontage Road NBIA Project
- Overpassed Bridge by DOH, DOR
- Highway Interchange by DOH, DOR
- Etc.





s.athasit@gmail.com

Bridge Superstructure: I-Girder with Deck slab

Elevated Frontage Road NBIA Project – SV Joint Venture

The 3rd Stage Expressway S1: Contract 1 - Vichitbhan Construction Co., Ltd.

The method of erection I-Girder, which suitable for project “Mobile Crane” or “Launcher”

s.athasit@gmail.com

Bridge Superstructure: I-Girder with Deck slab

The 3rd Stage Expressway S1: Contract 1 - Vichitbhan Construction Co., Ltd.

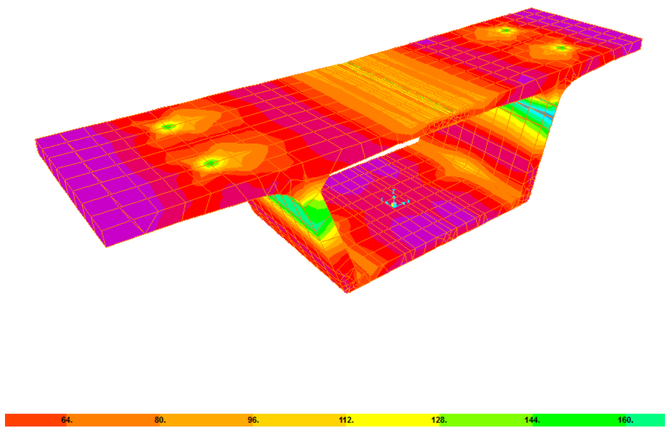
The 3rd Stage Expressway S1: Contract 1 - Vichitbhan Construction Co., Ltd.

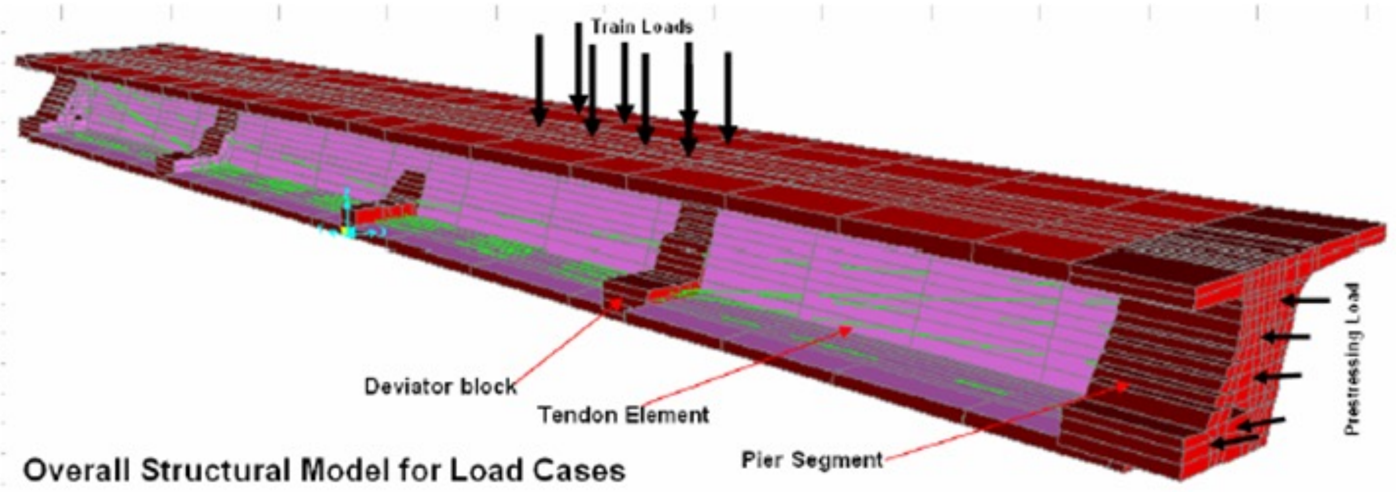
The construction of bridge deck slab can be separated into 2 type, one is composite deck slab with PC.Plank and the other one is Cast-In Placed slab

Bridge Superstructure: Box-Girder

Bridge/Elevated Structures with CIP. Box-Girder/PC. Box-Girder on Superstructure type, the modern design of bridge structure, this structure is use in many construction project in Thailand such as;

- Expressway Stage 2
- BTS Elevated Structure
- Airport Rail Link
- MRT Purple Line/Blue Line
- Sri Rat Expressway
- Etc.



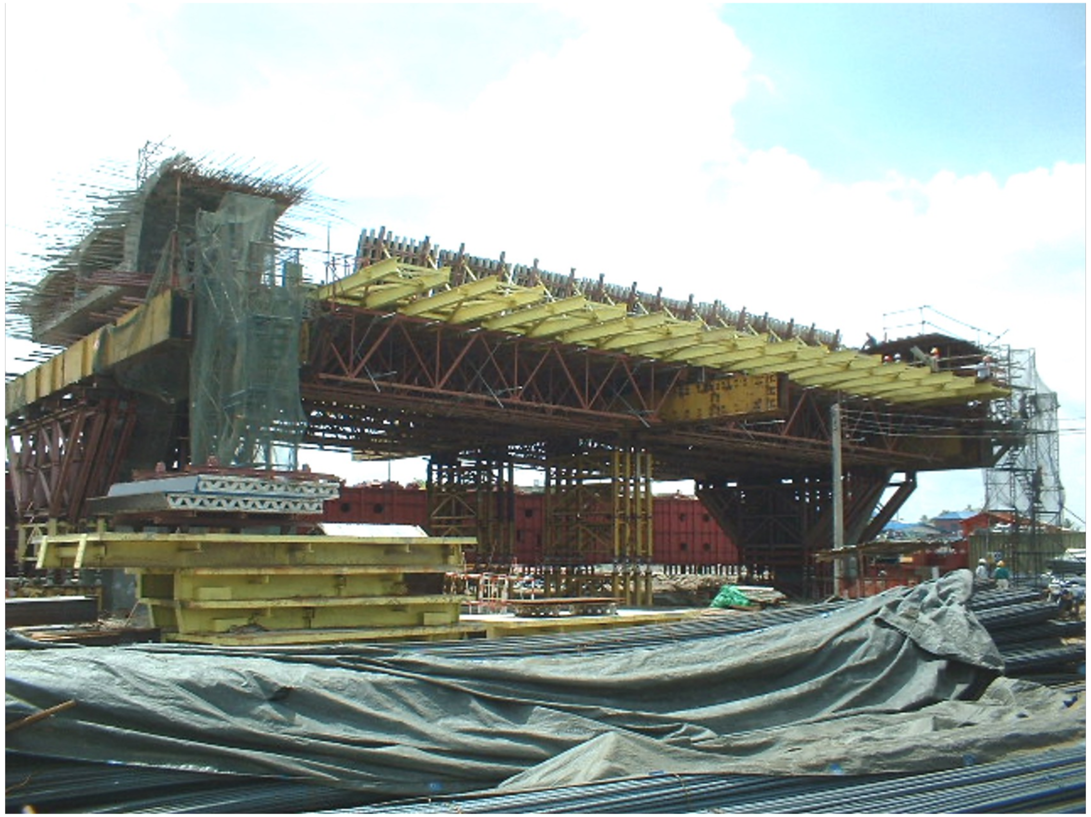


Overall Structural Model for Load Cases

s.athasit@gmail.com

Bridge Superstructure: Cast-In Placed Box-Girder

Industrial Ring Road - STECON



Industrial Ring Road - STECON

The method of construction Box Girder is separated into 2 type, one is by using “Movable Scaffolding System” and the other one is “Conventional Shoring”

s.athasit@gmail.com

Bridge Superstructure: PC. Segmental Box-Girder

SVB Airport Rail Link by Underslung Gantry – STECON & VSL

SVB Airport Rail Link by Overhead Gantry - STECON

The Equipment that use to erection PC. Segmental Box Girder call "Launcher" which can separated into 2 type, one is "USG: Underslung Gantry" and the other one is "OHG: Over Head Gantry"

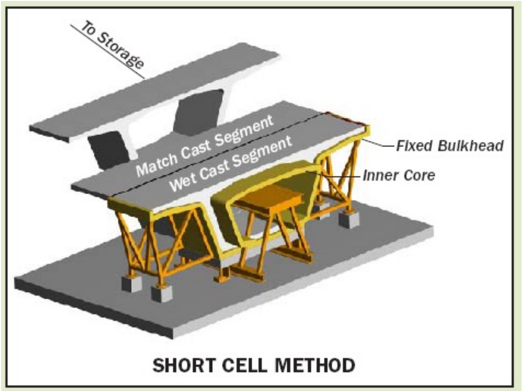
s.athasit@gmail.com

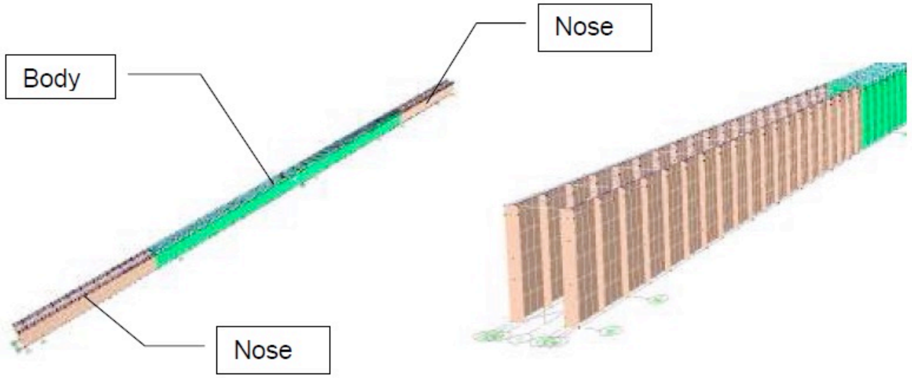
Experience in Box-Girder Bridge/Elevated Structure

s.athasit@gmail.com

Experience in Box-Girder Bridge/Elevated Structure

Construction of Precast Segmental Box-Girder Span by Span Erection



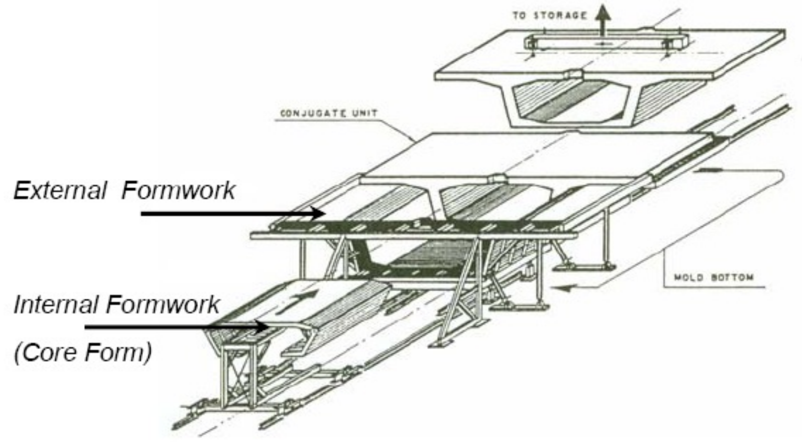


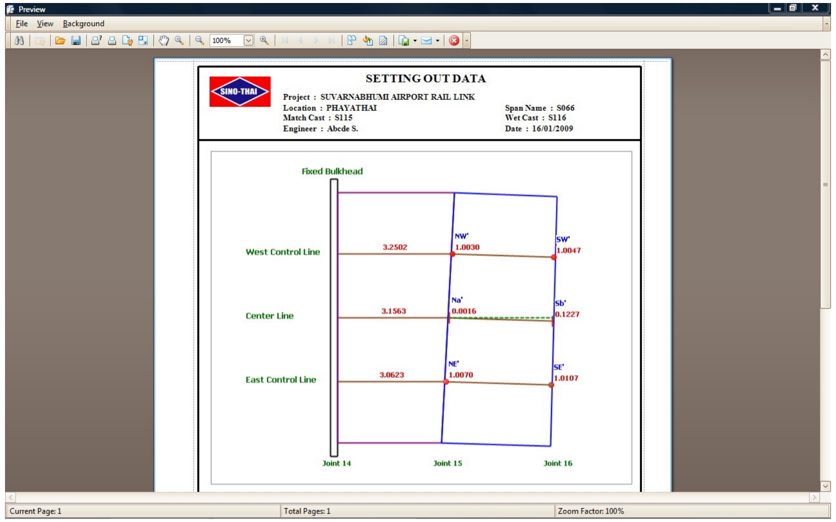
s.athasit@gmail.com

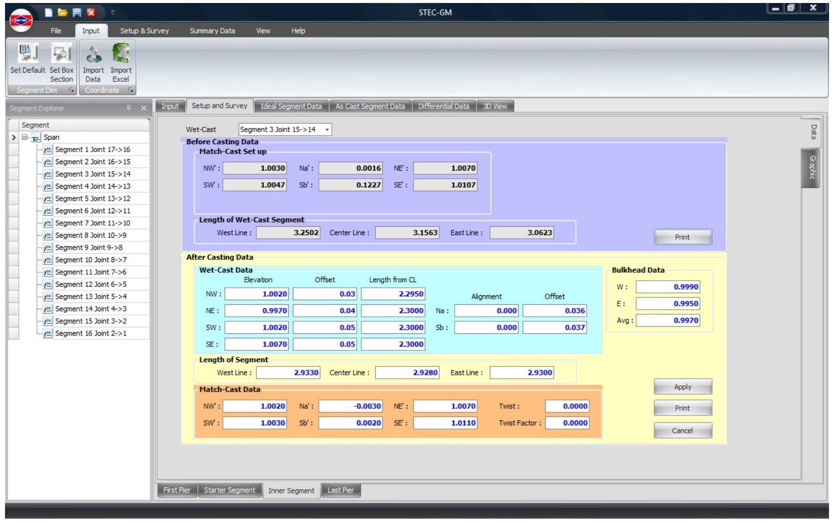
Precast Segmental Box-Girder: Segment Production

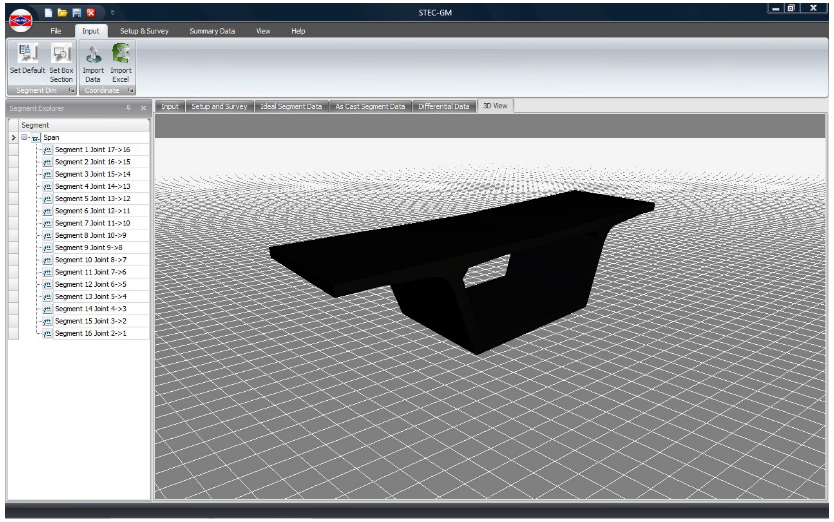
The segments for erection viaduct has produced by Short-Line Casting Method that need the method of Calculation to control alignment and profile of bridge structure call “Geometry Control”

STECON has developed “Geometry Control Software” for use to control our production of precast segmental box-girder erection, STEC-GM can generate Setting Out data for match cast segment and recheck As-casted Data for erection and control error of production in limitation of specification and practice code. It can show casted span in 3 Dimensional and show N,E,Z of As-Casted span compare to Span Layout





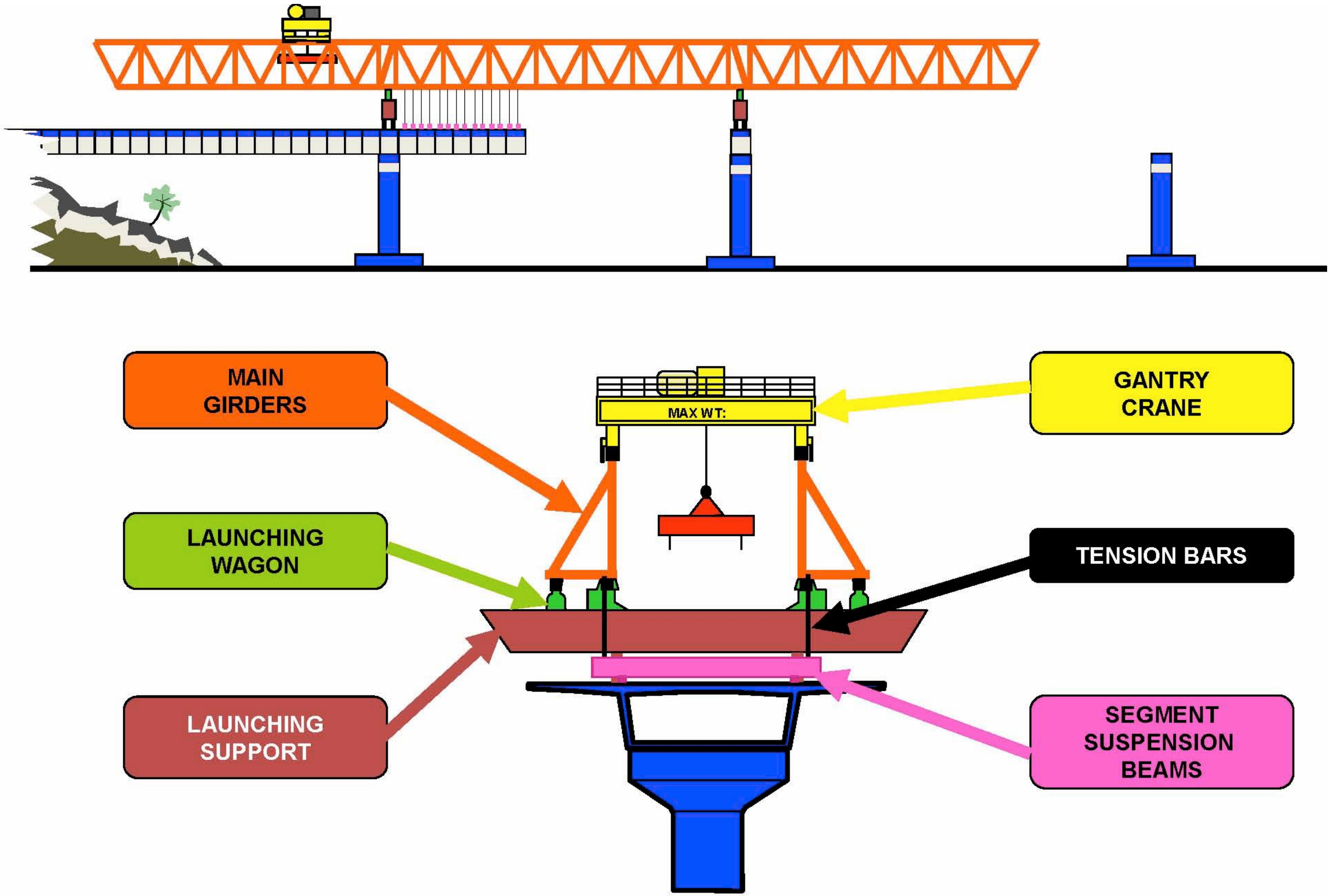




Precast Segmental Box-Girder: Segment Production

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher Component



s.athasit@gmail.com

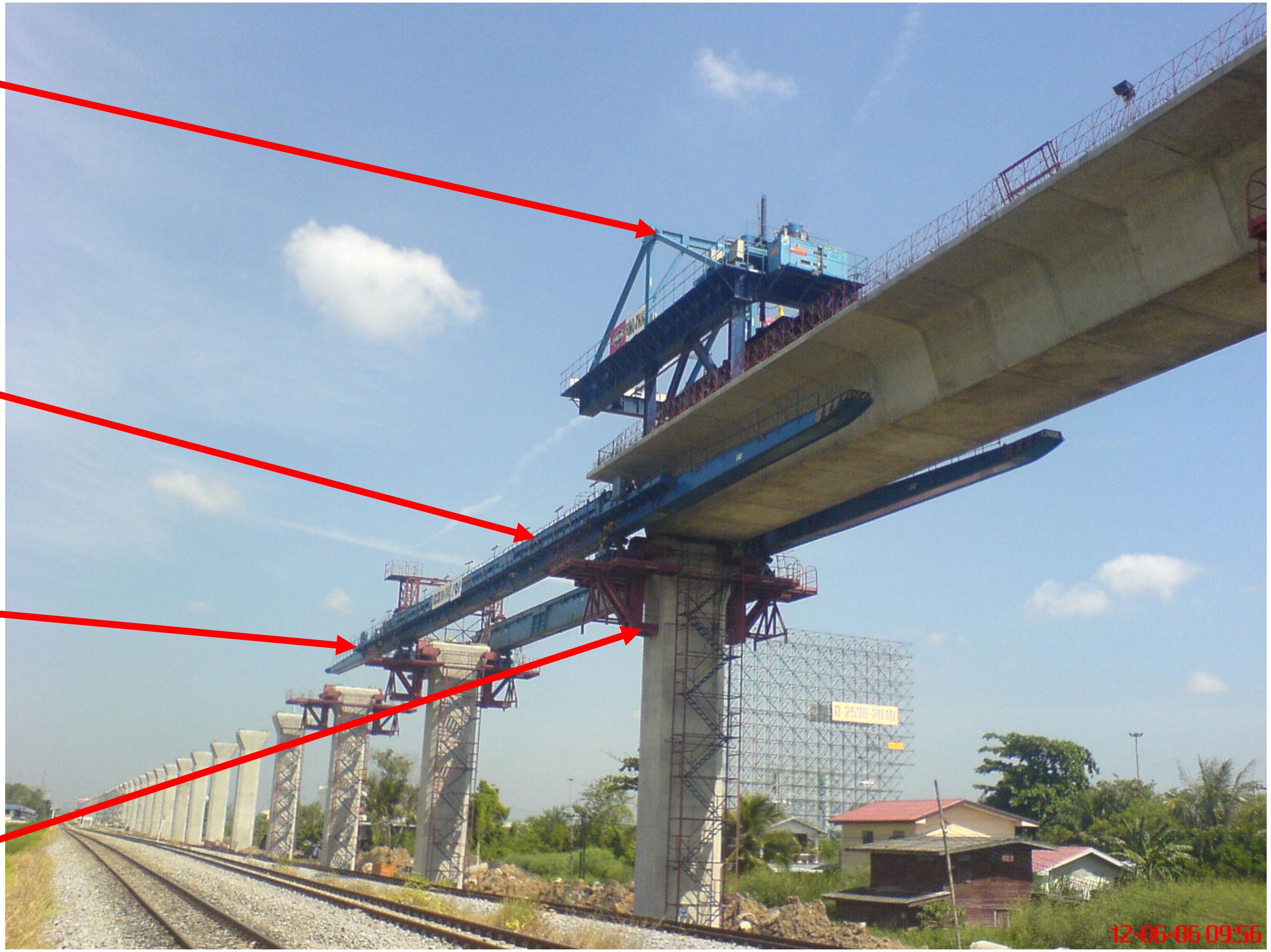
Precast Segmental Box-Girder: Launcher Component

SEGMENT LOADER

MAIN GIRDER

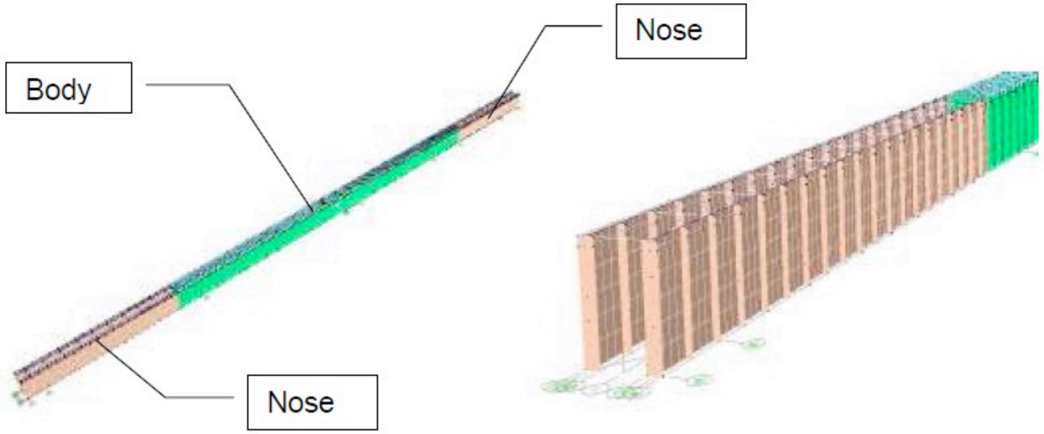
STRESSING PLATFORM

PIER BRACKET



s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept



s.athasit@gmail.com

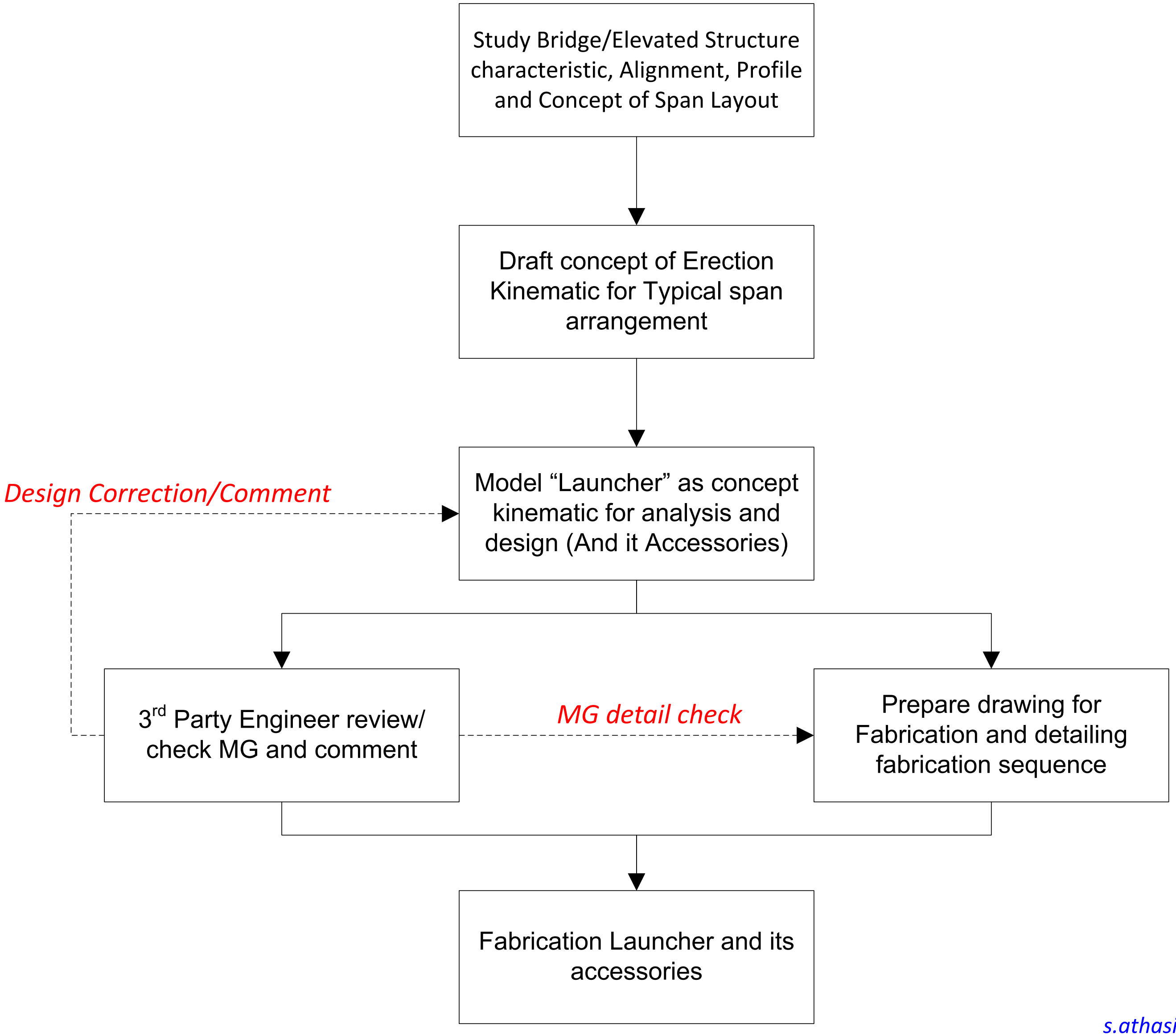
Precast Segmental Box-Girder: Launcher design concept

Design process workflow of "Launcher" for erection works in every project of STECON as shown.

Structural analysis, design and detail of fabrication drawing by STECON engineer will be done and send to 3rd Party design firm to check before start fabrication.

The report of 3rd Party check will be considering into in depth of structural engineering such as review analysis by FEM: Finite Element Model, Local failure analysis, Stability analysis, Dynamic analysis of Free vibration response due to Launcher self weight, Joint connection capacity check, deflection check and Safety Factor check at each stage.

After report review and comment, Launcher Fabrication will be start and witness by Engineering Team & Launching Operation



s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept

DESIGN CRITERIA :

1. MATERIAL PROPERTIES :

Structural Steel ;	Grade A572Gr50	Yield Strength	f_{ySS}	=	345 MPa
		Ultimate Strength	f_{uSS}	=	450 MPa
		Modulus of Elasticity	E_{SS}	=	200,000 MPa
	Grade S45C	Yield Strength	f_{ySH}	=	400 MPa
		Ultimate Strength	f_{uSH}	=	650 MPa
		Modulus of Elasticity	E_{SH}	=	200,000 MPa
Stressing Bar ;	Grade 1050/1200	Yield Strength	f_{yPT}	=	1,050 MPa
		Ultimate Strength	f_{uPT}	=	1,200 MPa
		Modulus of Elasticity	E_{SP}	=	205,000 MPa
Weld Electrode ;	Grade E70	Ultimate Tensile Strength	f_{uE70}	=	480 MPa

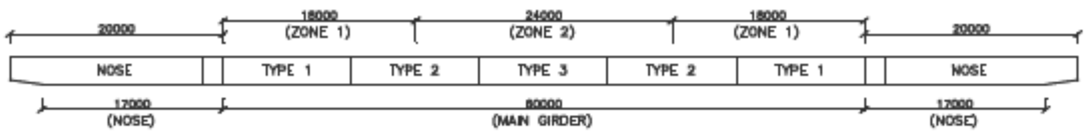
2. DESIGN REFERENCE :

1. American Institute of Steel Construction, Allowable Stress Design, 9th Edition
2. Engineering Institute of Thailand (E.I.T. Standard)
3. Steel Table for Contractor and Engineer (Tee Group of Engineers)

MOVING STEP POSITION FOR CHECK STRESS :

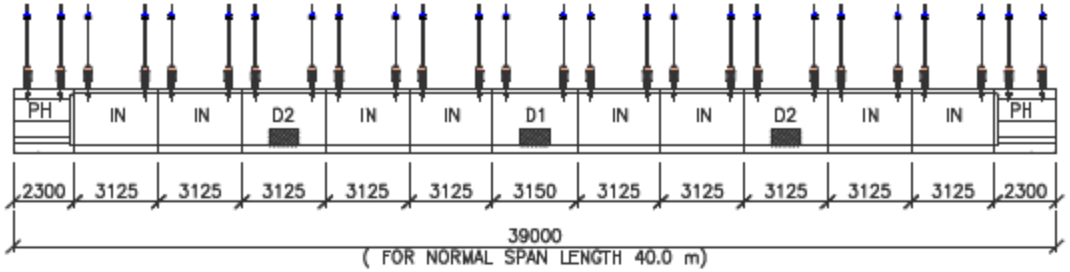
Step-1 for Erection Gantry Installation
Step-2 for Load Segment (By Unimoc)
Step-3 for Lifting & Segment Installation
Step-4 for Lowering Segment
Step-5 for Movement of Erection Gantry (Launching to next Step 1)
Step-6 for Movement of Erection Gantry (Launching to next Step 2)
Step-7 for Movement of Erection Gantry (Launching to next Step 3)
Step-8 for Setup Bracket Type 3 and Remove Bracket Type 1 (Launching to next Step 4)
Step-9 for Remove Bracket Type 1 to Setup on Next Pier (Launching to next Step 5)
Step-10 for Cantilever to next span & Installation of Bracket on next span

Load Case 1 , LC1 : Selfweight of Gantry



Main Girder ;	Main_Zone 1 =	19.72	kN /m
	Main_Zone 2 =	18.73	kN /m
Nose ;	Nose =	9.32	kN /m

Load Case 2 , LC2 : Segment weight Type DH21
(Max.of Segment weight in Purple Line Project)



Example of Calculation detail

- Design Criteria
- Load Case calculation

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept

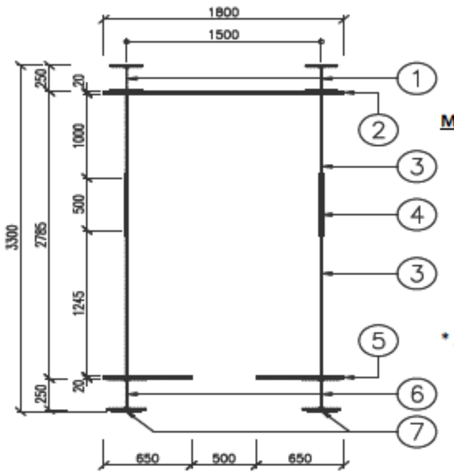
Sections Properties - Erection Gantry_Main Member

X - Axis

NO.	h (cm)	b (cm)	A (cm^2)	dy (cm)	Ix-x (cm^4)	D (cm, ref. N.A.)	$A*D^2$
Member 1	1.40	50.00	70.00	329.30	11.43	162.63	1,851,294.79
Member 2	22.20	1.80	39.96	317.50	1,641.16	150.83	909,023.88
Member 3	1.40	50.00	70.00	305.70	11.43	139.03	1,352,967.18
Member 4	2.00	180.00	360.00	304.00	120.00	137.33	6,788,990.06
Member 5	100.00	2.40	240.00	253.00	200,000.00	86.33	1,788,503.99
Member 6	124.50	2.40	298.80	90.75	385,956.23	75.92	1,722,439.37
Member 7	2.00	130.00	260.00	27.50	86.67	139.17	5,036,077.41
Member 8	1.40	50.00	70.00	25.80	11.43	140.87	1,389,192.82
Member 9	22.20	1.80	39.96	14.00	1,641.16	152.67	931,447.17
Member 10	1.40	50.00	70.00	2.20	11.43	164.47	1,893,629.21
Member 11	1.50	44.00	66.00	0.75	12.38	165.92	1,817,041.00
Member 12							

Total ;	H =	330.00	cm	C.G.(Y) =	166.67	cm
	Ag =	1584.7200	cm^2	Ic.g. =	0.2607	m^4
	r =	1.6451	m			
	Ct =	1.6333	m	St =	0.1596	m^3
	Cb =	1.6667	m	Sb =	0.1564	m^3

W (Ton/m)	W+35%(Ton/m)
1.24	1.68



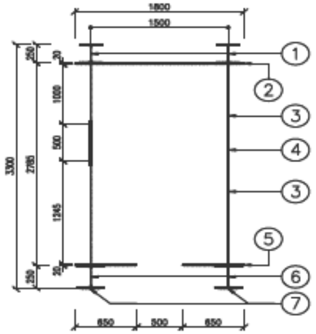
MARK NO.

NO. 1 = H-250x250x9x14, 72.4 kg/m (Top Member)
NO. 2 = PL 20 mm Thk. (Top Plate)
NO. 3 = PL 12 mm Thk. (Web Plate)
NO. 4 = Hole Dia. 500 mm
NO. 5 = PL 20 mm Thk. (Bottom Plate)
NO. 6 = H-250x250x9x14, 72.4 kg/m (Bottom Member)
NO. 7 = PL 15 mm Thk. (Lower Plate)
* All Dimensions are in Millimeters

Example of Calculation detail

- Section properties
- Joint Connection

Design Joint Connection :



Critical Section

Sections Properties :

A =	0.1585	m^2
A_v =	0.0610	m^2
Ix =	0.2607	m^4
St =	0.1596	m^3
Sb =	0.1564	m^3

Moment capacity ;
Use min value of M to control the design

Allowable , Fb =	207.00	Mpa
Top fiber , Mt =	33.04	MN-m
Bottom fiber , Mb =	32.37	MN-m
Thus , Design Moment capacity of Joint =	34.00	MN-m

Shear capacity ;
Use A_v of Section to control the design

Allowable , Fv =	138.00	Mpa
Area , A =	0.06	m^2
Shear , V =	8.42	MN
Thus , Design Shear capacity of Joint =	9.00	MN

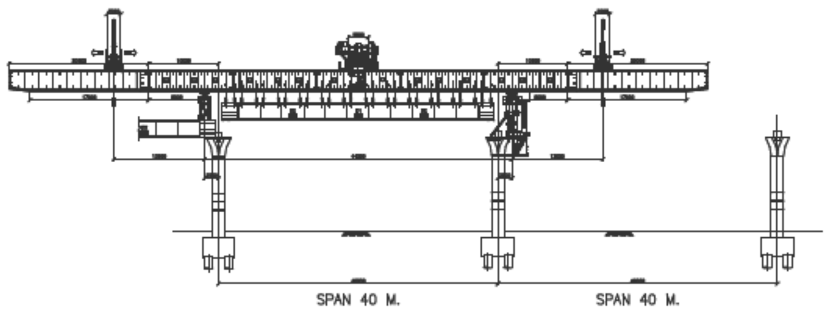
Moment design ;
Use HSTR Bar Tensile Strength Dia. 75 mm

Meterial Properties :	Fy =	1,050.00	Mpa
	Fu =	1,200.00	Mpa
	E =	205,000.00	Mpa
	Elongation =	10.00	%
For Dia 75 mm :	100% Fy =	4,561.00	kN
	70% Fu =	3,649.00	kN (Working Load)
	Prestressing Force (10% of Working Load) =	364.90	kN
	Thus , Remain capacity =	3.28	kN / Bar
	Trial Moment arm , R =	2.40	m
	Force , T =	14.17	MN
	No. of Stress Bar =	4.31	Piece
	Use Stress Bar , No. =	5.00	Piece

s.athasit@gmail.com

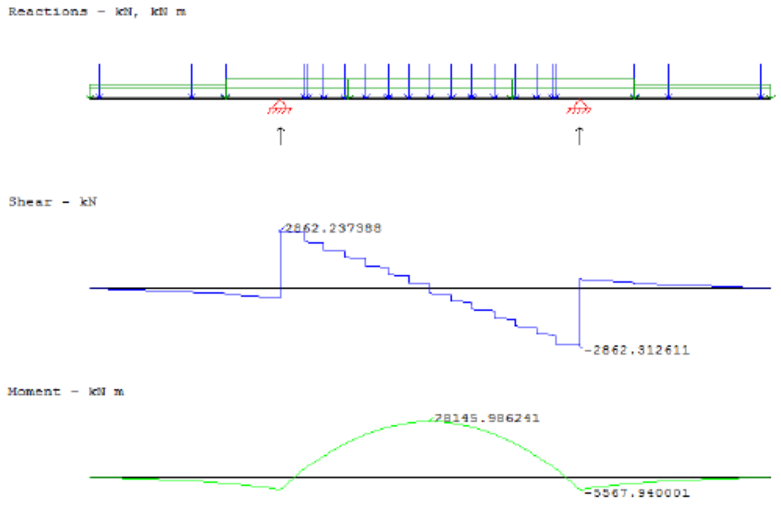
Precast Segmental Box-Girder: Launcher design concept

Check Stage-3 : Launching Span 40.0 m to Span 40.0 m



Stage-3 : Lifting & Segment Installation

COMB3 : LC1 + (1.3xLC2) + LC4 + LC5 + LC6 + (1.3xLC7) + LC9



Summary : Analysis Results_COMB3 (Span 40.0 m to Span 40.0 m)

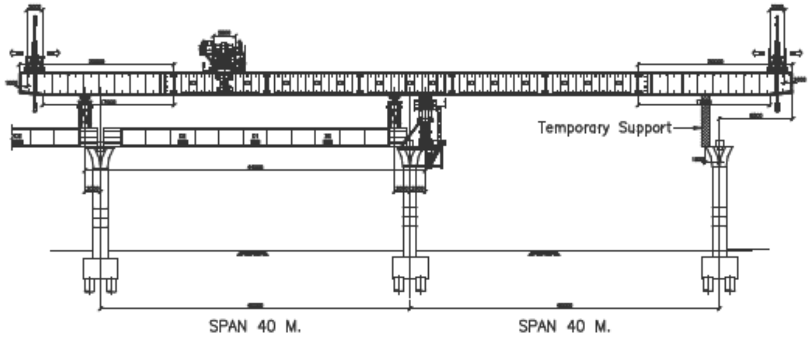
Reaction (kN)		Shear (kN)		Moment (kN - m)	
R1	R2	V-	V+	M-	M+
3,333.38	3,333.38	2,862.32	2,862.32	5,567.94	28,146.00

Max.Deflection : $\Delta_{max.}$ = 103.36 mm

Example of Calculation detail

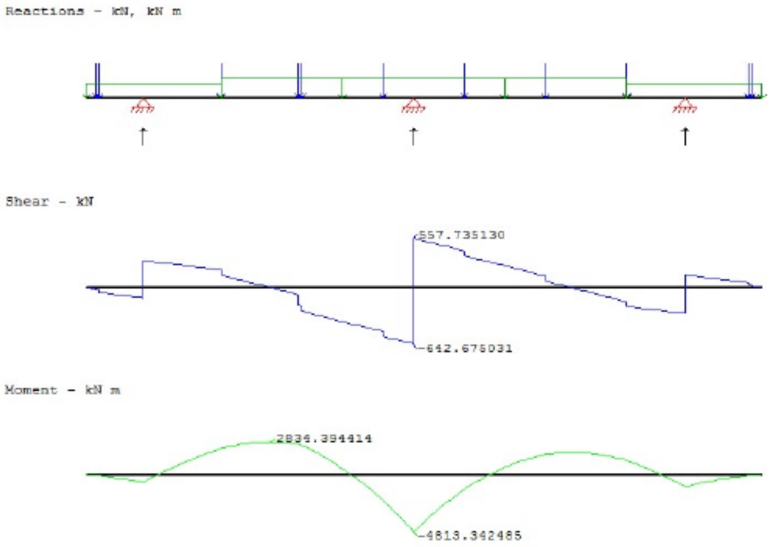
- Erection stage
- Launching stage

Check Stage-8 : Launching Span 40.0 m to Span 40.0 m



Stage-8 : Setup Bracket Type 3 and Remove Bracket Type 1 (Launching to next Step 4)

COMB8 : LC1 + LC4 + LC5 + LC6 + LC9



Summary : Analysis Results_COMB8 (Span 40.0 m to Span 40.0 m)

Reaction (kN)			Shear (kN)		Moment (kN - m)	
R1	R2	R3	V-	V+	M-	M+
423.79	1,200.41	442.42	642.68	557.74	4,813.34	2,834.39

Max.Deflection : $\Delta_{max.}$ = 8.14 mm

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept

Summary : Analysis Results

Launching Span 40.0 m to Span 40.0 m :

Stage	Reaction (kN)			Shear (kN)		Moment (kN - m)	
	R1	R2	R3	V-	V+	M-	M+
Stage - 01	1,091.81	1,091.81	-	620.75	620.75	5,567.94	1,762.86
Stage - 03	3,333.38	3,333.38	-	2,862.32	2,862.32	5,567.94	28,146.00
Stage - 04	3,333.38	3,333.38	-	2,887.28	2,887.28	5,242.94	15,687.04
Stage - 07	482.28	1,241.12	343.23	684.11	557.01	5,185.47	4,018.61
Stage - 08	423.79	1,200.41	442.42	642.68	557.74	4,813.34	2,834.39
Stage - 09	388.08	1,082.73	595.82	555.89	526.84	4,159.33	2,197.15
Stage - 10	390.26	1,070.61	670.75	553.70	516.90	4,071.95	2,234.28

Launching Span 35.0 m to Span 40.0 m :

Stage	Reaction (kN)			Shear (kN)		Moment (kN - m)	
	R1	R2	R3	V-	V+	M-	M+
Stage - 01	1,091.81	1,091.81	-	568.53	568.53	6,748.37	0.01
Stage - 03	3,333.38	3,333.38	-	2,810.20	2,810.20	6,748.37	23,151.60
Stage - 04	3,333.38	3,333.38	-	2,835.06	2,835.06	6,423.37	13,020.02
Stage - 07	570.61	1,125.96	370.05	595.78	530.18	4,214.43	3,181.81
Stage - 08	506.12	1,099.10	461.39	560.34	538.76	4,050.60	2,284.21
Stage - 09	462.57	991.64	612.41	481.39	510.25	3,492.34	2,226.55
Stage - 10	465.26	978.85	687.51	478.70	500.15	3,398.24	2,112.25

Summary Maximum :

Reaction (R) =	3,333.38	kN
Shear (V-) =	2,887.28	kN
Shear (V+) =	2,887.28	kN
Moment (M-) =	6,748.37	kN - m
Moment (M+) =	28,146.00	kN - m
Max.Deflection ($\Delta_{max.}$)=	103.36	mm

Example of Calculation detail

- Summary analysis result
- Design of MG

Plate Girder Design :

● Design Parameters

Yield Stress of Steel (A572Gr50)	F_y	= 345.00	MPa
Modulus Elasticity of Steel	E	= 200,000.00	MPa
Max. Actual Member Length	L	= 60,000.00	mm.
Max. Unbraced Length of Beam	L_{bx}	= 1,000.00	mm.
Bending Coefficient	C_b	= 1.00	
Yield Stress of Electrorode, Grade E70	F_{E70}	= 480.00	MPa

Section Properties

Section Name :			
Width of Section	b_f	= 1,800.00	mm.
Depth of Section	d	= 3,300.00	mm.
Flange Thickness	t_f	= 20.00	mm.
Web Thickness	t_w	= 12.00	mm.
Clear Distance	h	= 2,760.00	mm.
Gross Section Area	A_g	= 158,472.00	$mm.^2$
Moment of Inertia	I_x	= 2.607E+11	$mm.^4$
Section Modulus	S_x	= 156413353	$mm.^3$
Radius of Gyration for X-Axis	r_x	= 1,645.09	mm.
Radius of Gyration of Section	r_T	= 1,645.09	mm.
Area of Flange	A_f	= 36,000.00	$mm.^2$
Area of Web	A_w	= 66,240.00	$mm.^2$

● Designed Force Considered in the Design

Max. Bending Moment	M	= 28,146,000.00	kN-mm.
Max. Shear Force	V	= 2,887.28	kN
Max. Reaction Force at Support	R	= 3,333.38	kN
Max. Vertical Deflection	Δv	= 103.36	mm.

● Determination of Design Criteria and Section Type

Determination of Section Type	$5.76(E/F_y)^{0.50}$ =	138.68		<	h/t_w	= 230.00	PLATE GIRDER DESIGN
Determination of Section Type	$0.38(E/F_y)^{0.50}$ =	9.15		<	$b_f/2t_f$	= 45.00	NON-COMPACT
Computation of L_c	$0.444b_f(E/F_y)^{0.50}$ =	19242.47	mm.				
	$0.690E/(dF_y/A_f)$ =	4363.64	mm.				
Thus; Max. Unbraced Length	L_c =	4363.64	mm.	>	L_b	= 1000	CASE I

● Computation of Allowable Bending Stress; F_b

Case I: $L_b \le L_c$	For Compact Section $F_b = 0.66F_y$	= -	MPa					
	For Non-Compact Section $F_b = 0.60F_y$	= 120000	MPa					
Case II: $L_b > L_c$	For All Section L/r_T	= -						
	$(3.517EC_b/F_y)^{0.50}$ L_{min}	= 45.15	mm.	<	L/r_T			
	$(17.586EC_b/F_y)^{0.50}$ L_{max}	= 100.97	mm.	<	L/r_T			
● IF $L/r_T \le L_{min}$	$0.60F_y$	= -	MPa					
● IF $L_{min} < L/r_T < L_{max}$	$(2/3-F_y(L/r_T)^2/52.759EC_b)F_y$	= -	MPa	-	$0.60F_y$	= 207.00	MPa	
● IF $L/r_T > L_{max}$	$5.862E_sC_b/(L/r_T)^2$	= -	MPa	-	$0.60F_y$	= 207.00	MPa	
Thus;	Allowable Bending Stress F_b	= 120000.00	MPa					
	Allowable Bending Moment $M = F_bS_x$	= 1.87696E+13	kN-mm.	>	M	= 2.81E+07	kN-mm.	PASS

● Computation of Reduced Allowable Bending Stress in Compression Flange; F'_b

$0.6F_{yw}/F_b$	α	= 0.00		<	1.00	= 0.00		
$(12+(A_w/A_f)(3\alpha-\alpha^3))/(12+2(A_w/A_f))$	R_e	= 0.77		<	1.00	= 0.77		
$(1-(0.0005A_w/A_f(h/t_w-5.76(0.6.E/F_b)^{0.5})))$	Rpg	= 0.79		<	1.00	= 0.79		
Reduced Allowable Bending Stress	F'_b	= 125.84	MPa					
Reduced Allowable Bending Moment	$M = F'_bS_x$	= 19682478167	kN-mm.	>	M	= 2.81E+07	kN-mm.	PASS

● Computation of Allowable Shear Stress; Fv

Web Slenderness Limitation :

Transverse Stiffener Requirement	h/t_w	= 230.00		h/t_w	<	260	NOT REQUIRED
Max. Intermediate Web Stiff. Spacing	$3h$	= 8280	mm.				
	$h(260/(h/t_w))^2$	= 3527	mm.				
Intermediate Stiffener Spacing	a	= 500	mm.				
	a/h	= 0.18		<	1		CONTROLLED WITH TENSION FIELD ACTION
● IF $a/h \le 1.50$	$11.74(E/F_y)^{0.5}$	= 282.67					
● IF $a/h > 1.50$	$0.48E/(F_y(F_y+F_r))^{0.5}$	= -					
$(5E/F_y)^{0.5}$ = 53.84 <	h/t_w	= 230.00		h/t_w	<	260	PASS
● IF $a/h < 1$	$4.00 + 5.34/(a/h)^2$ k_v	= 166.711936					
● IF $a/h > 1$	$5.34 + 4.00/(a/h)^2$ k_v	= -					
	$1.55k_vE/(h/t_w)^2F_y$ C_v	= -					
	$1.12(k_vE/F_y)^{0.50}/(h/t_w)$ C_v	= 1.51					
	$(F_y/2.89)(C_v+((1-C_v)/(1.15(1+(a/h)^2)^{0.50}))$ F_v	= 128.23	MPa				
	$C_vF_y/2.89$ F_v	= -	MPa	; when a/h > Min (3.0, $(260/(h/t_w))^2$ and $h/t_w > (5E/F_y)^{0.5}$			
	$0.40F_y$ F_v	= -	MPa	; when $h/t_w \le (5E/F_y)^{0.5}$			

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept

Check Bottom Member form Concentrated Load :

Point Load :	P =	3,333.38	kg	(Max.Reaction)
Material Properties :	Fy =	3,250.00	ksc	
	E =	2,040,000.00	ksc	
Section Properties :	d =	25.00	cm	
	b =	25.00	cm	
	tf =	1.00	cm	
	tw =	1.00	cm	
	r =	1.80	cm	
	k =	3.30	cm	
	N =	3.30	cm	(Use min. = k)

Check Web Yielding ;

A) Load on mid span (> d/2)

$f_{Bearing}$ =	192.68	ksc	<	2,145.00 (0.66Fy)	ksc	O.K.

B) On support

$f_{Bearing}$ =	323.63	ksc	<	2,145.00 (0.66Fy)	ksc	O.K.

Check Web Crippling ;

A) Load on mid span (> d/2)

P max. =	45,467.61	kg	>	3,333.38	kg	O.K.

B) On support (< d/2)

P max. =	22,733.81	kg	>	3,333.38	kg	O.K.

Check Sidesway Web Buckling ;

L =	100.00	cm
dc =	18.40	cm
(dc/tw)/(L/bf) =	4.60	

A) When (dc/tw)/(L/bf) ≤ 2.3 with Bracing

P max. =	762,523.41	kg	>	3,333.38	kg	O.K.

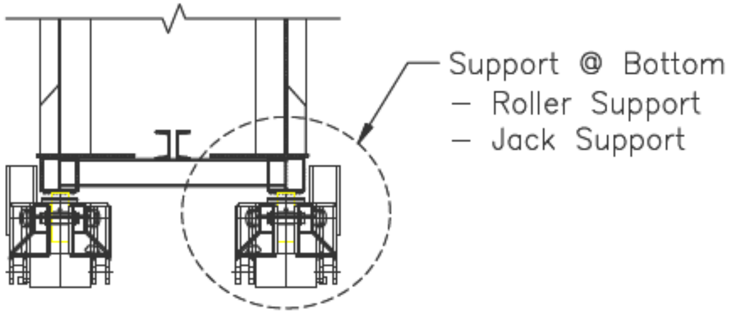
B) When (dc/tw)/(L/bf) ≤ 1.7 with Bracing

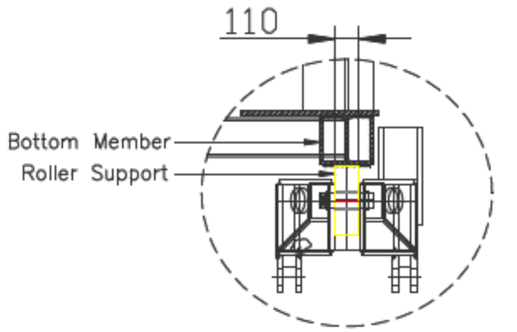
P max. =	743,429.01	kg	>	3,333.38	kg	O.K.

Example of Calculation detail

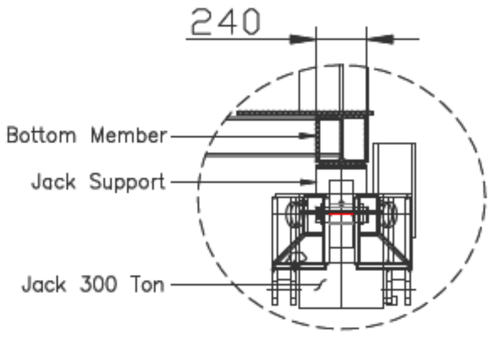
- Check concentrate Load
- Design support

Detail Support @ Bottom Member :





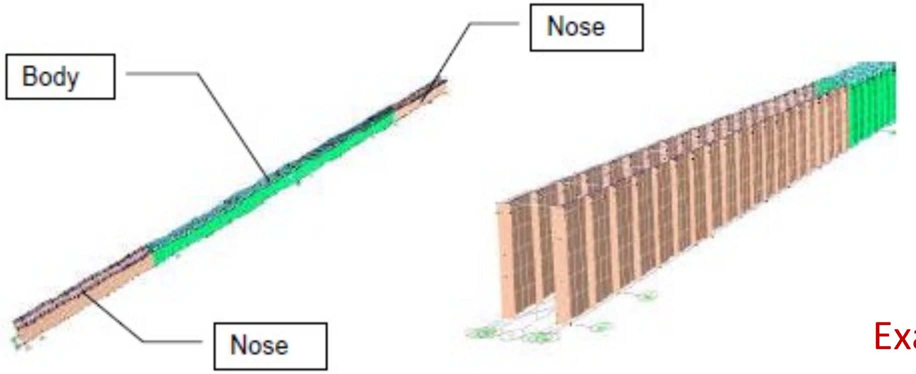
DETAIL SETUP ON LAUNCHING

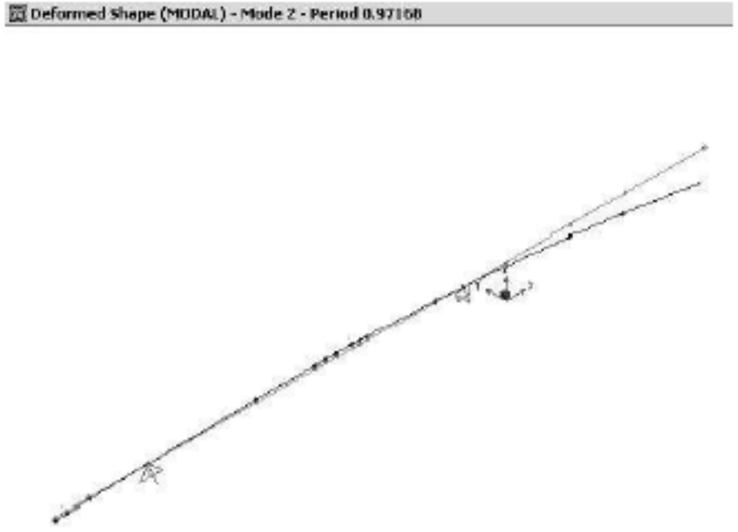


DETAIL SETUP ON STANDING

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher design concept





Example of 3rd Party check

- FEM analysis check
- Dynamic response

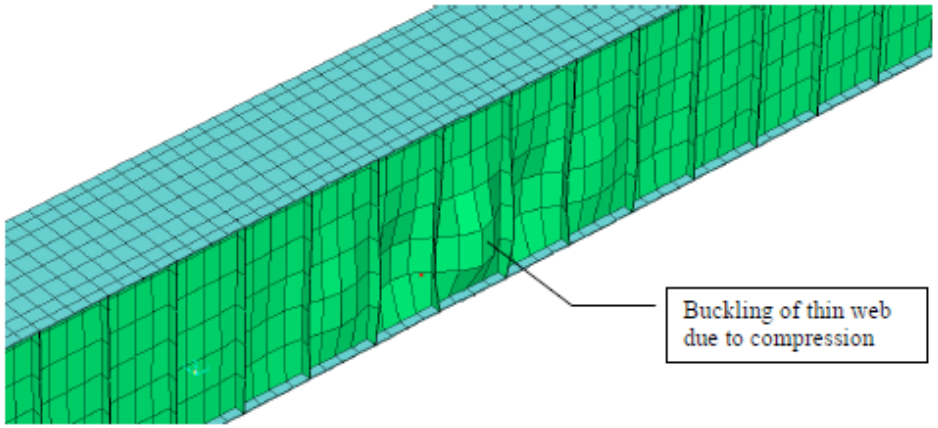


Figure 3.10 Lowest buckling mode: Local bend buckling of gantry web

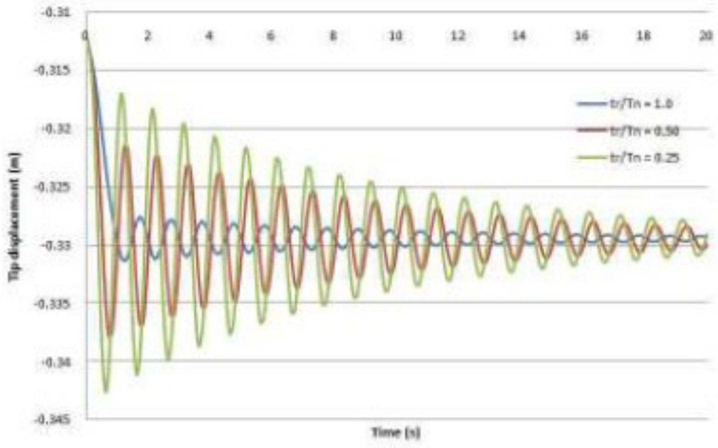


Figure 3.8 Time history of tip displacement for various t_r/T_n (Stage IV.1)

s.athasit@gmail.com

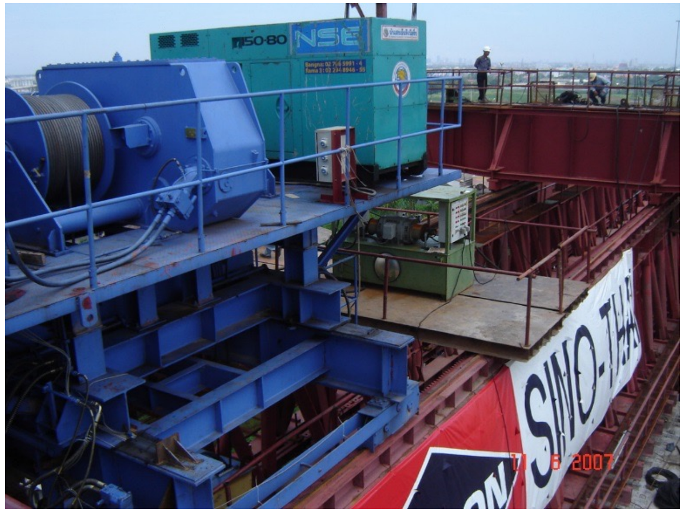
Precast Segmental Box-Girder: Launcher Accessories

RS - Roller Support

LCB – Lower Cross Beam

LSU - Lowering Span Unit

PB - Pier Bracket



WF - Winch Frame

s.athasit@gmail.com

Precast Segmental Box-Girder: Accessories design

SINO-THAI ENGINEERING&CONSTRUCTION PUBLIC COMPANY LIMITED — Engineering Service Section

PROJECT: MRT Purple Line Contract 2
SUBJECT: Roller Support Calculation (RS)
DESIGN BY: DATE: JOB NO. J2346-0-C
CHECK BY: DATE: SHEET 1 OF

1. Design Criteria :

(a) Structural Analysis - Linear Elastic FEM Method.

(b) Structural Steel Code - AISC-ASD 89
- Standard Specification for Highway Bridge AASHTO

(c) Material Properties & Specification

- Structural Steel & Plate	Grade SS400/SM400	fy = 235 MPa
		fu = 400 MPa
- Shaft / Pin	Grade S45C	fy = 400 MPa
		fu = 550 MPa
- Bolt & Nuts	Grade A325 / F8.8	fy = 800 MPa
- Weld Electrode	Grade E70	fu = 480 MPa

2. Analysis Procedure :

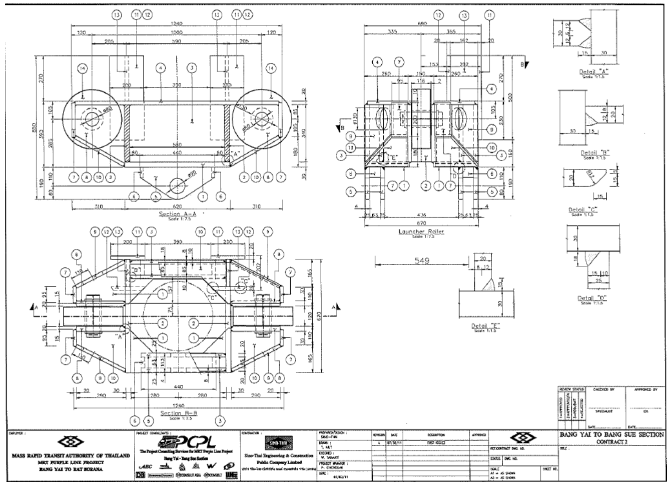
Calculation detail show in "SINO-CAL-C2-E3-TE-0003, 7 Jan 2011" which PCPL grade "Code 1" by "PCPL/C2/SINO-THAI/L-0241-2011, 4 Feb 2011"

(a) Load Combination.

ST01	U1	Erection Gantry Installation.	Erection Stage
ST02	U2	Lifting & Segment Installation	
ST03	U3	Lowering Segment	
ST04	U4	Movement of Erection Gantry	Launching Stage.
ST05	U5	Setup Bracket Type II and Remove Bracket Type I	
ST06	U6	Remove Bracket Type I to setup on next pier.	
ST07	U7	Cantilever the span next & Installation Bracket	

RS – Roller Support Calculation

- Design Criteria
- STR Model and Load Case



SINO-THAI ENGINEERING&CONSTRUCTION PUBLIC COMPANY LIMITED — Engineering Service Section

PROJECT: MRT Purple Line Contract 2
SUBJECT: Roller Support Calculation (RS)
DESIGN BY: DATE: JOB NO. J2346-0-C
CHECK BY: DATE: SHEET 2 OF

(b) Summary Reaction of load Combination :

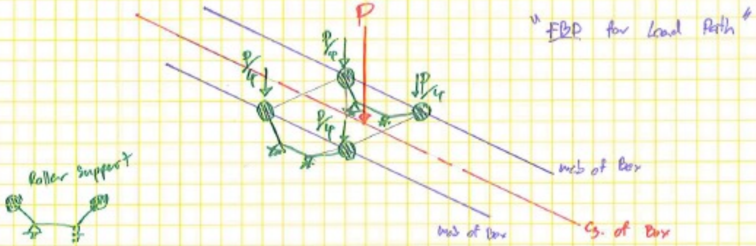
For Roller Support (RS) we only consider load combinations U4, U5, U6 and U7 because other operation at erection stage, The Erection Gantry will be laid down on Hydraulic Jack.

Load Combination	R1 (kN)	R2 (kN)	R3 (kN)
U4	483	1,242	341
U5	424	1,201	443
U6	389	1,083	596
U7	391	1071	671
max.	483	1,242	671

Thus, from table we get max. load for RS design at 1,242 kN

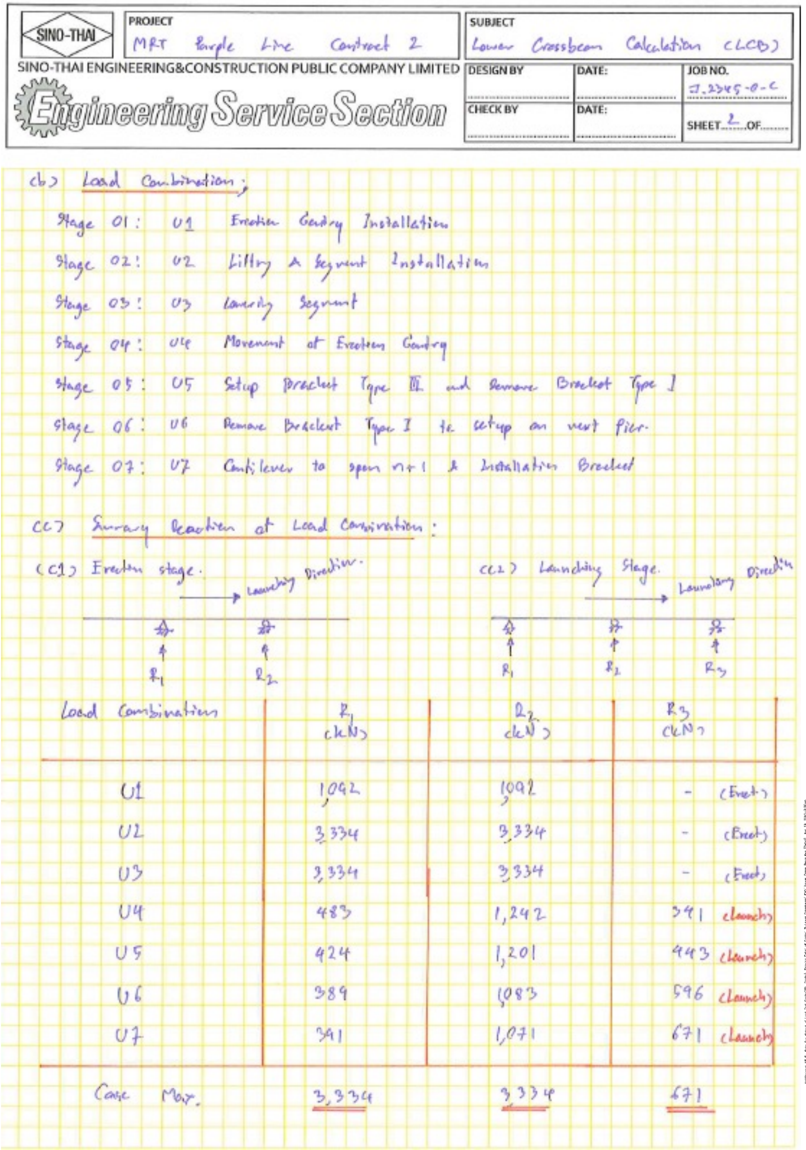
∴ for P that act on 1 Roller = 1,242/4 = 310.5 kN

use "350 kN" for design value



s.athasit@gmail.com

Precast Segmental Box-Girder: Accessories design



SINO-THAI	PROJECT: MRT Purple Line Contract 2	SUBJECT: Lower Crossbeam Calculation (LCB)
SINO-THAI ENGINEERING&CONSTRUCTION PUBLIC COMPANY LIMITED	DESIGN BY / DATE:	JOB NO. J.2345-0-C
Engineering Service Section	CHECK BY / DATE:	SHEET 2 OF

(b) Load Combination;

Stage 01: U1 Erection Gantry Installation
Stage 02: U2 Lifting a Segment Installation
Stage 03: U3 Lowering Segment
Stage 04: U4 Movement of Erection Gantry
Stage 05: U5 Setup Bracket Type II and Remove Bracket Type I
Stage 06: U6 Remove Bracket Type I to setup on next pier.
Stage 07: U7 Cantilever to span n+1 & Installation Bracket

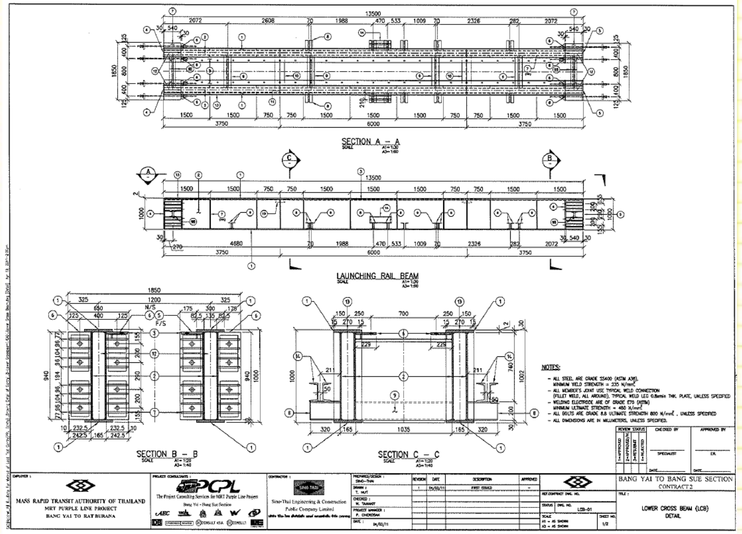
(c) Summary Reaction at Load Combination:

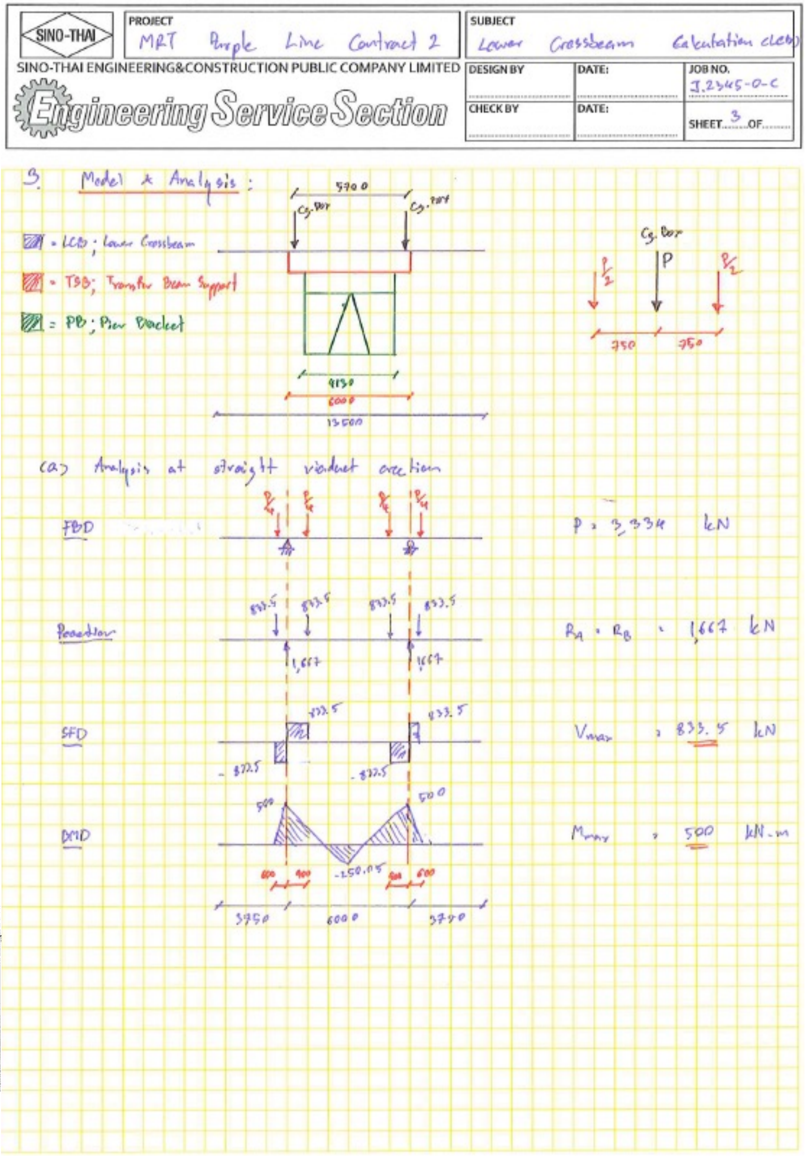
(c1) Erection stage. Launching Direction.
(c2) Launching Stage. Launching Direction

Load Combination	R_1 (kN)	R_2 (kN)	R_3 (kN)
U1	1,042	1,042	- (Erect)
U2	3,334	3,334	- (Erect)
U3	3,334	3,334	- (Erect)
U4	483	1,242	341 (Launch)
U5	424	1,201	443 (Launch)
U6	389	1,083	596 (Launch)
U7	341	1,071	671 (Launch)
Case Max.	3,334	3,334	671

LCB – Lower Cross Beam

- Load Case and Combination
- STR Model and Analysis





s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher Documents

Before Launcher Operation ESS will finished all Engineering Document as follows;

- Design Calculation & Drawing
- Assembly Method
- Launching Kinematic
- Construction stage check of substructure
- Load transfer calculation
- Launcher Method and Load Test Result

All document will be submit to CSC, STECON QA/QC team, Launching Operation Team to do as design procedure from ESS Team

SINO-THAI — บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED
MRT BLUE LINE EXTENSION PROJECT
THA PHRA - LAK SONG SECTION

SUBMITTAL FORM — Contract 4

Submittal No.			Location	Type	No.	Date:
SINO	MST	C4	EWS	TE	0009	30 May 2013

Purpose for: ☐ Review ☑ Approval ☐ Information ☐ Record

Title : Sequence for Assembly and Erection of Overhead Gantry G1 at Span BS13-04
To: Project Manager
CSCBL Consortium 1 Set (Original) + 4 Set (Copy)
Discipline : Temporary Work
Spec. Section/Clause : -
Sub-Contractor/Supplier : -
Ref : -
CC: Project Manager (PMC Index Group) 1 Set (Copy)
Director of Construction Management Division 3 (MRTA)
1 Set (Copy)

Item No.	Description	1-NO	2-NC	3-RR	4-RJ	Remarks
1	Sequence for Assembly and Erection of Overhead Gantry G1 at Span BS13-04 Document No. SINO-MST-EWS-TE-0009					RECEIVED 1 JUN 2013 BY: Fang

(For Contractor Use / For Employer or Employer's Representative Use; Date Received; Review Status)

ได้รับเอกสารเรียบร้อยแล้ว ลงชื่อ Sumit ... วันที่ : 3/6/13 เวลา : 1520

All items submitted have been checked, reviewed and co-ordinated by the Contractor. They are in conformance with the requirements of the Contract Document, except as noted, and are approved by the Contractor for this Project.

Reviewed and Approved by: (Tanchai Wannopas) Project Control Manager Date: 31/05/13

Review Comment Sheet Attached Ref.No.:
Code: 1. NO means "No Objection"
2. NC means "No Objection with Comments"
3. RR. means "Revise and Resubmit"
4. RJ Rejected means "Not approved for use"
Note : Acceptance of ER does not relieve the Contractor of his Contractual Obligations.

Employer's Representative reviewed and consent for release

Reviewed By:	Division Manager:	Confirmed By:
Signature: / Name: / Position: / Date:	Signature: / Name: / Position: / Date:	Signature: / Name: / Position: / Date:

Form No.	Release/Amendment		Page No.
SINO-F-QA-09	Issue No.4	Date : 16 May 2013	1 of 1

Issued by : CSP, SI
File No. : 080/2.2.2 (TE)

SINO-THAI — บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED
MRT BLUE LINE EXTENSION PROJECT
THA PHRA - LAK SONG SECTION

SUBMITTAL FORM — Contract 4

Submittal No.			Location	Type	No.	Date:
SINO	MST	C4	EWS	TE	0016	16 July 2013

Purpose for: ☐ Review ☑ Approval ☐ Information ☐ Record

Title : Launching Kinematic of Overhead Gantry G01 for Erection Segment BS13-01 to BS13-02 (Rev.1)
To: Project Manager
CSCBL Consortium 1 Set (Original) + 4 Set (Copy)
Discipline : Temporary Work
Spec. Section/Clause : -
Sub-Contractor/Supplier : -
Ref : SINO/MST/EWS/TE/0012, CSCBL/C4/SINO/MST/04592
CC: Project Manager (PMCBL) 1 Set (Copy)
Project Manager 4 (MRTA) 1 Set (Copy)

Item No.	Description	1-NO	2-NC	3-RR	4-RJ	Remarks
1	Launching Kinematic of Overhead Gantry G01 for Erection Segment BS13-01 to BS13-02 (Rev.1) Document No. SINO-MST-EWS-TE-0012					RECEIVED 19 JUL 2013 BY: Fang

ได้รับเอกสารเรียบร้อยแล้ว ลงชื่อ Sumit ... วันที่ : 19/7/13 เวลา : 15...

All items submitted have been checked, reviewed and co-ordinated by the Contractor. They are in conformance with the requirements of the Contract Document, except as noted, and are approved by the Contractor for this Project.

Reviewed and Approved by: (Tanchai Wannopas) Project Control Manager Date: 18/07/13

Review Comment Sheet Attached Ref.No.:
Code: 1. NO means "No Objection"
2. NC means "No Objection with Comments"
3. RR. means "Revise and Resubmit"
4. RJ Rejected means "Not approved for use"
Note : Acceptance of ER does not relieve the Contractor of his Contractual Obligations.

Employer's Representative reviewed and consent for release

Reviewed By:	Division Manager:	Confirmed By:
Signature: / Name: / Position: / Date:	Signature: / Name: / Position: / Date:	Signature: / Name: / Position: / Date:

Form No.	Release/Amendment		Page No.
SINO-F-QA-09	Issue No.4	Date : 16 May 2013	1 of 1

Issued by : CSP, SI
File No. : 080/2.2.2 (TE)

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher Documents

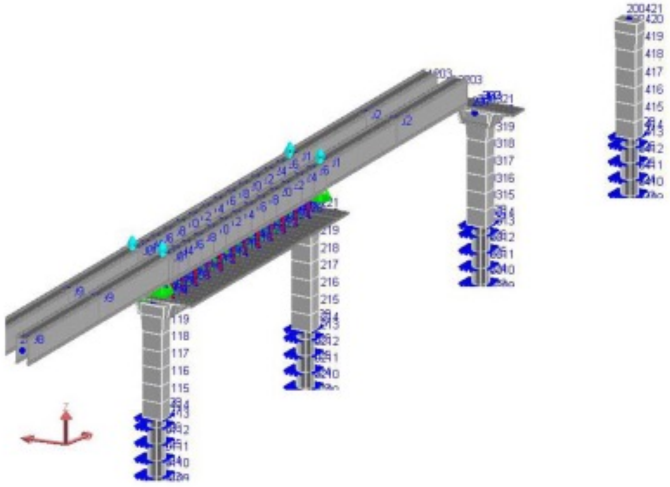
การรถไฟฟ้าขนส่งมวลชนแห่งประเทศไทย

MRTA BLUE LINE EXTENSION PROJECT
CONTRACT 4: ELEVATED CIVIL WORK

CALCULATION OF LOAD TRANSFER BY OVERHEAD GANTRY

CONTINUOUS 3 SPAN (DT 35-35-35) : Follow PT profile at Contract Dwg.

[*DRAFT*]



บริษัท ซิโน-ไทย เอ็นจิเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED

MRT BLUE LINE EXTENSION PROJECT
THA PHRA - LAK SONG SECTION

SUBMITTAL FORM **Contract 4**

Submittal No.			Location	Type	No.	Date:
SINO	MST	C4	EWS	TE	0014	25 June 2013

Purpose for ☐ Review ☑ Approval ☐ Information ☐ Record

Title : Load Test Overhead Gantry G01 at Span BS13-01

To: Project Manager
CSCBL Consortium 1 Set (Original) + 4 Set (Copy)

Discipline : Temporary Work
Spec. Section/Clause : -
Sub-Contractor/Supplier : -
Ref : -

CC: Project Manager (PMCBL) 1 Set (Copy)
Project Manager 4 (MRTA) 1 Set (Copy)

For Contractor Use		For Employer or Employer's Representative Use				
Item No.	Description	Date Received : Review Status 1=NO	2=NC	3=RR	4=RJ	Remarks
1	Load Test Overhead Gantry G01 at Span BS13-01					
	Document No. SINO-MST-EWS-TE-0014					
	ได้รับเอกสารต้นฉบับเรียบร้อยแล้ว ลงชื่อ ... 28/6/13 16.00					RECEIVED 28 JUN 2013 BY: ...
		Review Comment Sheet Attached Ref.No.:				

All items submitted have been checked, reviewed and co-ordinated by the Contractor. They are in conformance with the requirements of the Contract Document, except as noted, and are approved by the Contractor for this Project.

Reviewed and Approved by:
(Tienchai Warnopas)
Project Control Manager
Date: 28/06/13

Code: 1. NO means "No Objection"
2. NC means "No Objection with Comments"
3. RR means "Revise and Resubmit" (No consent for Use)
4. RJ Rejected means "Not approved for use"
Note : Acceptance of ER does not relieve the Contractor of his Contractual Obligations.

Employer's Representative reviewed and consent for release

Reviewed By:	Division Manager:	Confirmed By:
Signature: ...	Signature: ...	Signature: ...
Name: ...	Name: ...	Name: ...
Position: ...	Position: ...	Position: ...
Date: ...	Date: ...	Date: ...

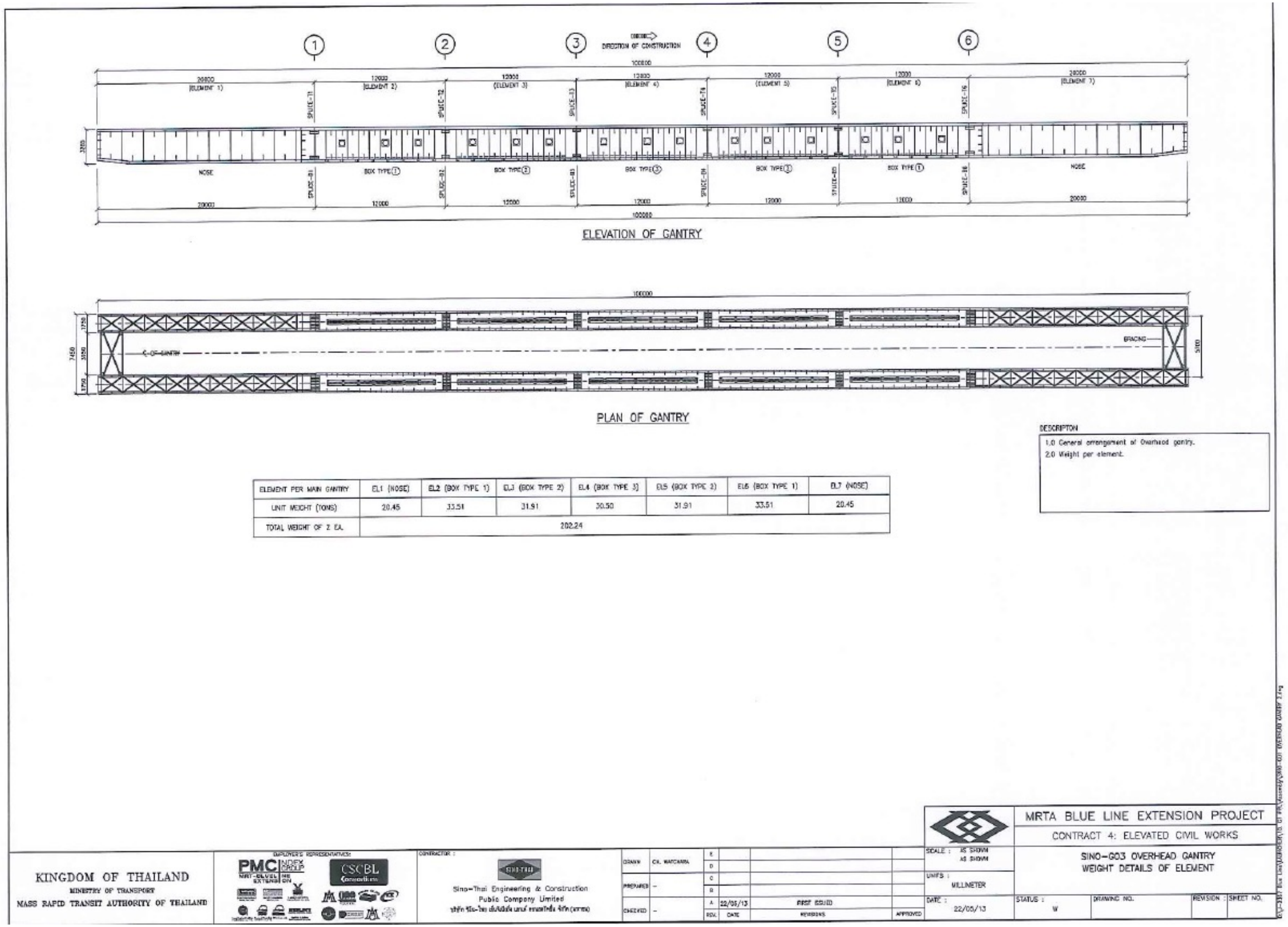
File No. ... (TE-0014)

Form No.	Release/Amendment		Page No.
SINO-F-QA-09	Issue No.4	Date : 16 May 2013	1 of 1

Issued by : CSP, SI

s.athasit@gmail.com

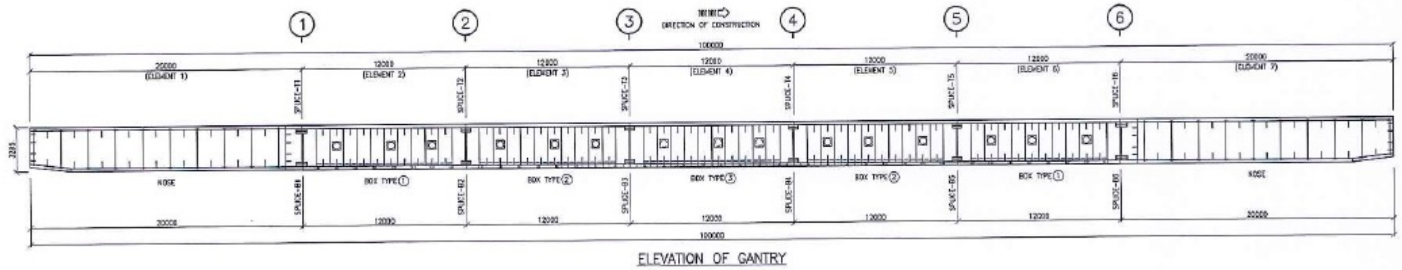
Precast Segmental Box-Girder: Launcher – Assembly



ELEMENT PER MAIN GANTRY	EL1 (NOSE)	EL2 (BOX TYPE 1)	EL3 (BOX TYPE 2)	EL4 (BOX TYPE 3)	EL5 (BOX TYPE 2)	EL6 (BOX TYPE 1)	EL7 (NOSE)
UNIT WEIGHT (TONS)	20.45	33.51	31.91	30.50	31.91	33.51	20.45
TOTAL WEIGHT OF 2 EA.	202.24						

s.athasit@gmail.com

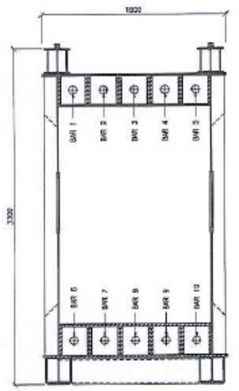
Precast Segmental Box-Girder: Launcher – Assembly



SPLICE NO.	1	2	3	4	5	6
TOP BARS						
NO. OF STESSBARS	5	5	5	5	5	5
LENGTH OF BAR	1500 mm.	1500 mm.	1500 mm.	1500 mm.	1500 mm.	1500 mm.
STESSING FORCE (PER BAR)	365 kN	365 kN	365 kN	365 kN	365 kN	365 kN
BOTTOM BARS						
NO. OF STESSBARS	5	5	5	5	5	5
LENGTH OF BAR	1500 mm.	1500 mm.	1500 mm.	1500 mm.	1500 mm.	1500 mm.
STESSING FORCE (PER BAR)	365 kN	365 kN	365 kN	365 kN	365 kN	365 kN

DESCRIPTION

1.0 Main girder stressing force for stress bar splices



STESSBAR PROPERTIES

TYPE : MACALLOY 1030
ϕ : 75 mm
A : 4,418 mm²
fy : 835 MPa Fy : 3,495 kN
fpu : 1,030 MPa Fpu : 4,311 kN
E : 205 MPa
LOSS IN NUT 1 mm

MAX. STRESSING FORCE 0.7*Pu = 3,017.7 kN

ALL NUTS ARE3 STANDARD NUTS.
EVERY NUT TO BE FITTED WITH SPHERICAL WASHERS.

FOR ACTUAL BAR LENGTH PROVISIONS FOR JACK LENGTH, NUTS AND SPHERICAL WASHERS TO BE TAKEN INTO ACCOUNT. NOTE THAT SOME BARS CAN BE STRESSED FROM BOTH ENDS.

JACK PROPERTIES

TYPE : –
A : –
STROKE : –
WORKING PRESSURE : –

PRESSURE LOSSES IN JACK AND HYRDAULIC SYSTEM TO BE CHECKED ON SITE.

JACK PROPERTIES

SPLICE NO. 1 TO 10

- STRESS BARS (3&8) TO 50% OF REQUIRED FORCE.
- STRESS BARS (2&7) TO 50% OF REQUIRED FORCE.
- STRESS BARS (4&9) TO 50% OF REQUIRED FORCE.
- STRESS BARS (1&6) TO 50% OF REQUIRED FORCE.
- STRESS BARS (5&10) TO 50% OF REQUIRED FORCE.
- STRESS BARS (3&8) TO 100% OF REQUIRED FORCE.
- STRESS BARS (2&7) TO 100% OF REQUIRED FORCE.
- STRESS BARS (4&9) TO 100% OF REQUIRED FORCE.
- STRESS BARS (1&6) TO 100% OF REQUIRED FORCE.
- STRESS BARS (5&10) TO 100% OF REQUIRED FORCE.

KINGDOM OF THAILAND
MINISTRY OF TRANSPORT
MASS RAPID TRANSIT AUTHORITY OF THAILAND

EMPLOYER'S REPRESENTATIVES: PMC, CSCBL Consortium

CONTRACTOR: Sino-Thai Engineering & Construction Public Company Limited

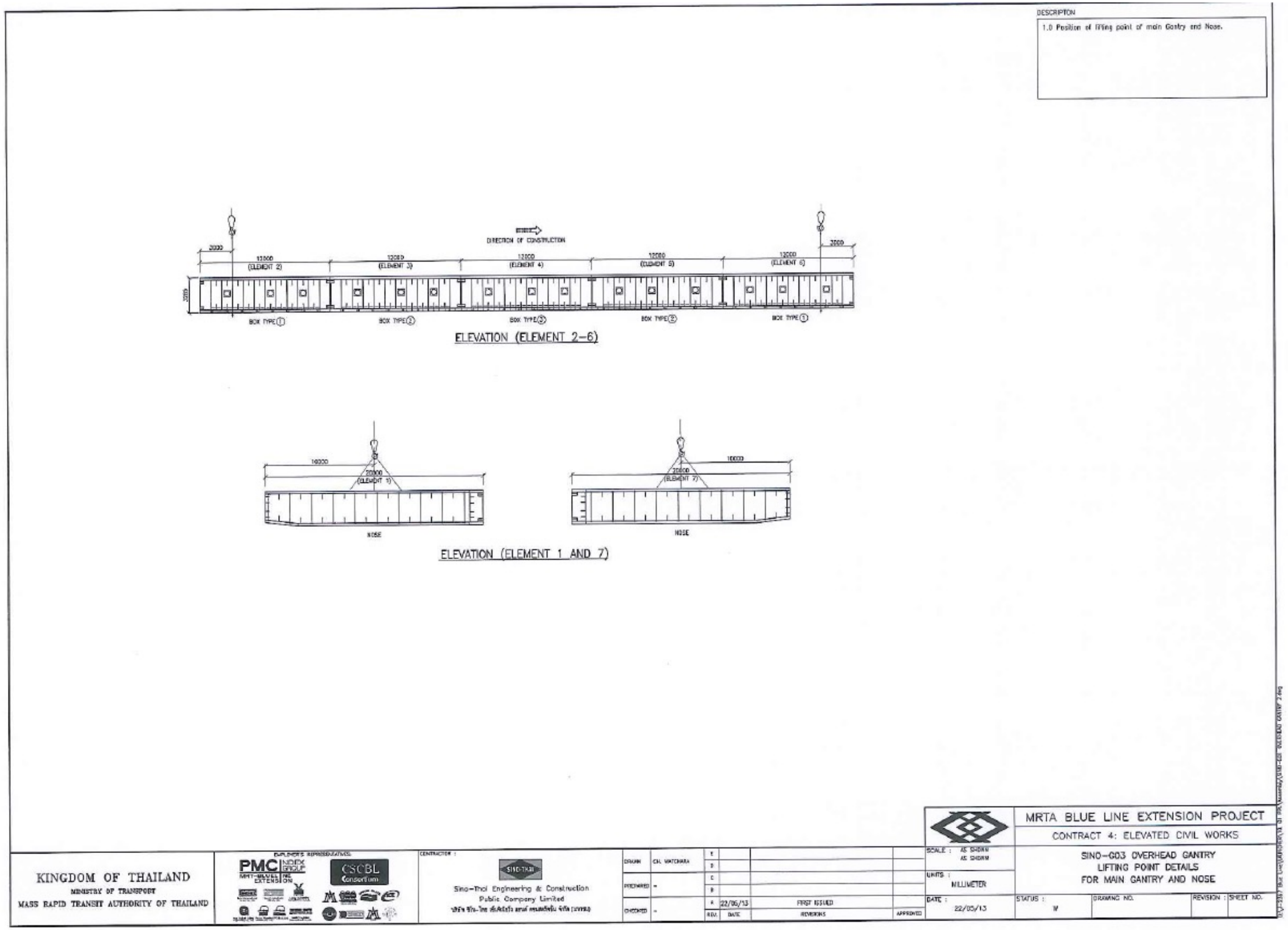
MRTA BLUE LINE EXTENSION PROJECT
CONTRACT 4: ELEVATED CIVIL WORKS

SINO-C03 OVERHEAD GANTRY
STESSING FORCES IN SPLICES

SCALE: AS SHOWN
UNITS: MILLIMETER
DATE: 22/05/13
REV. A 22/05/13 FIRST ISSUED

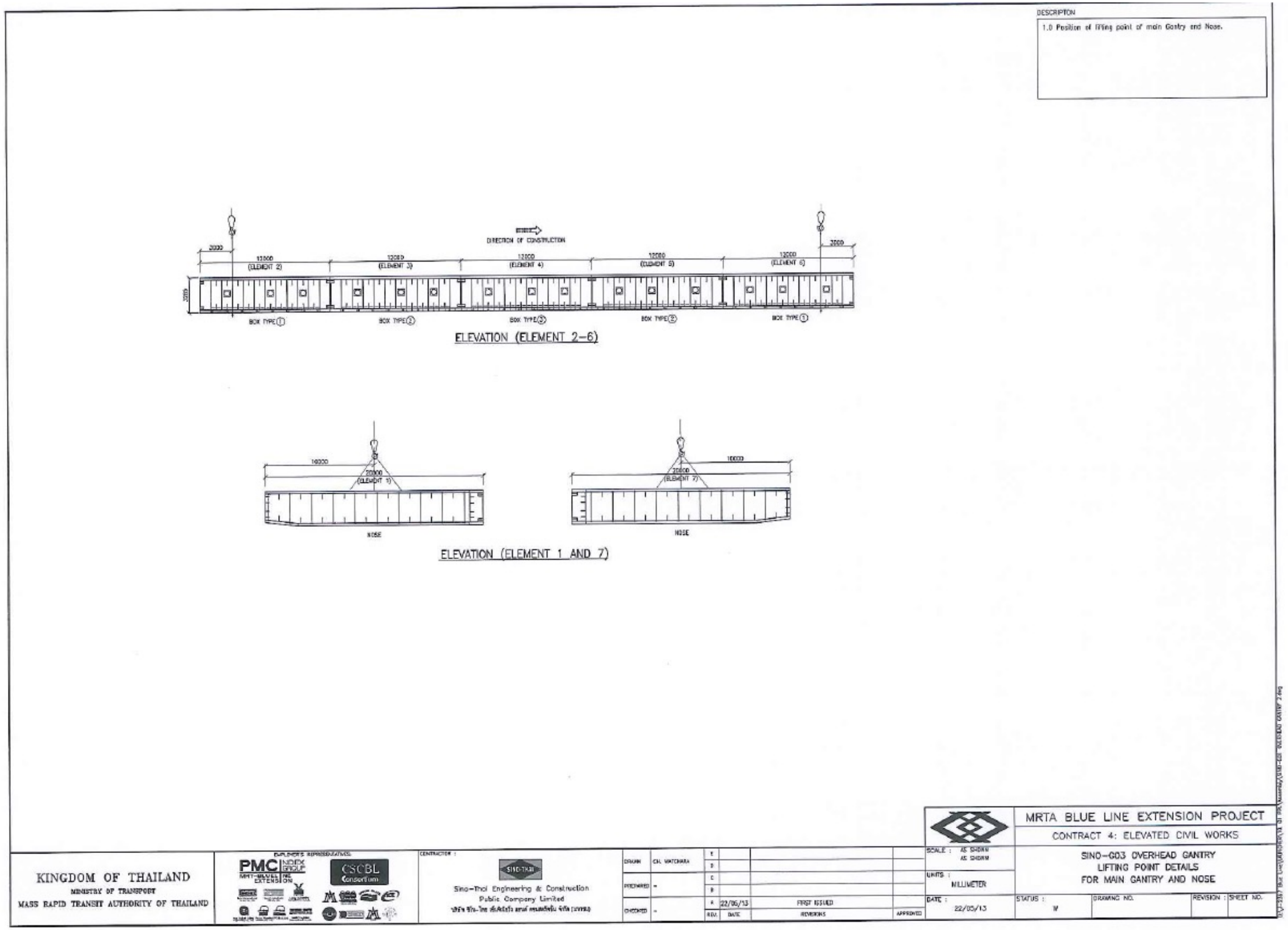
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Assembly



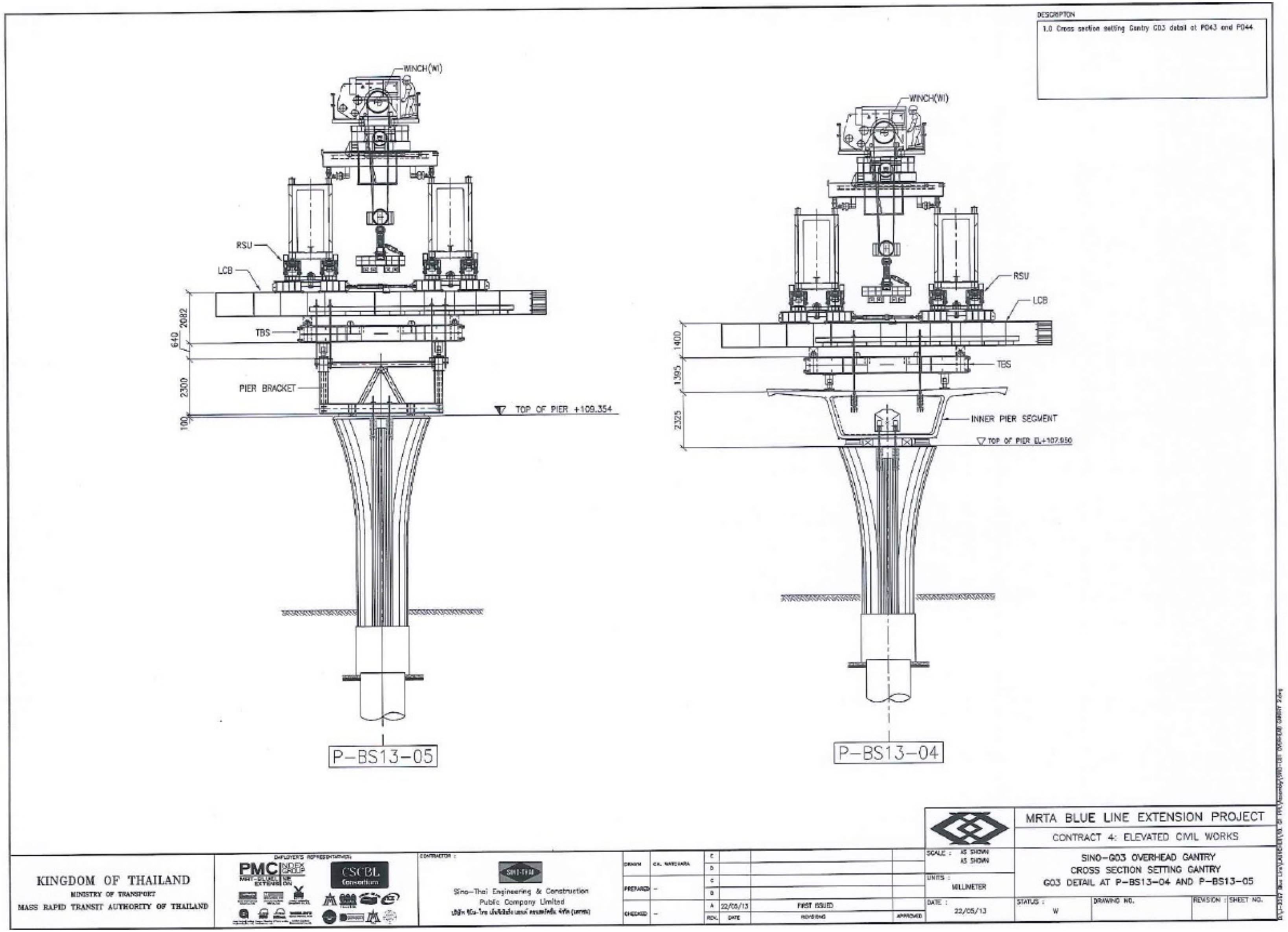
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Assembly



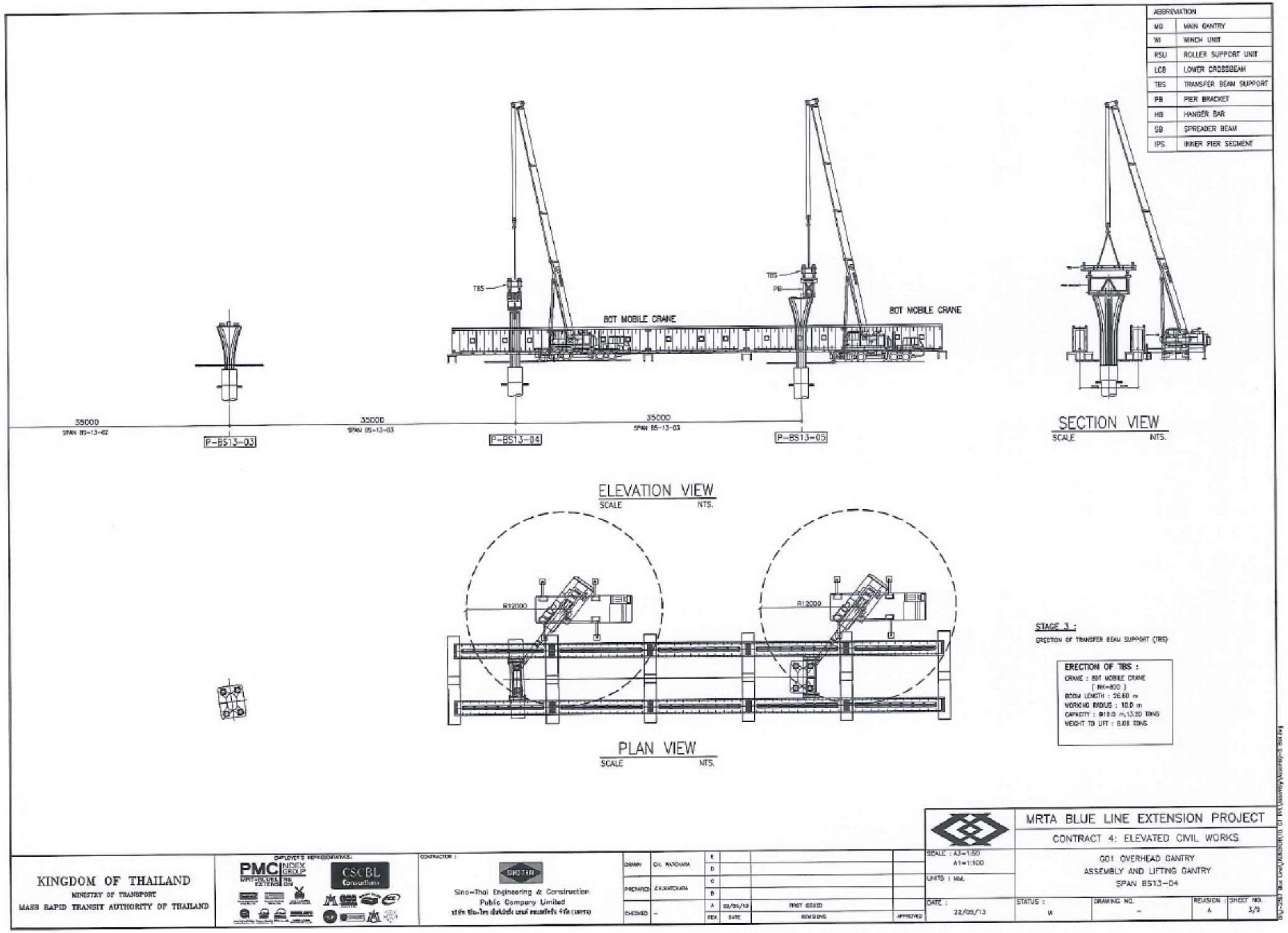
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Assembly



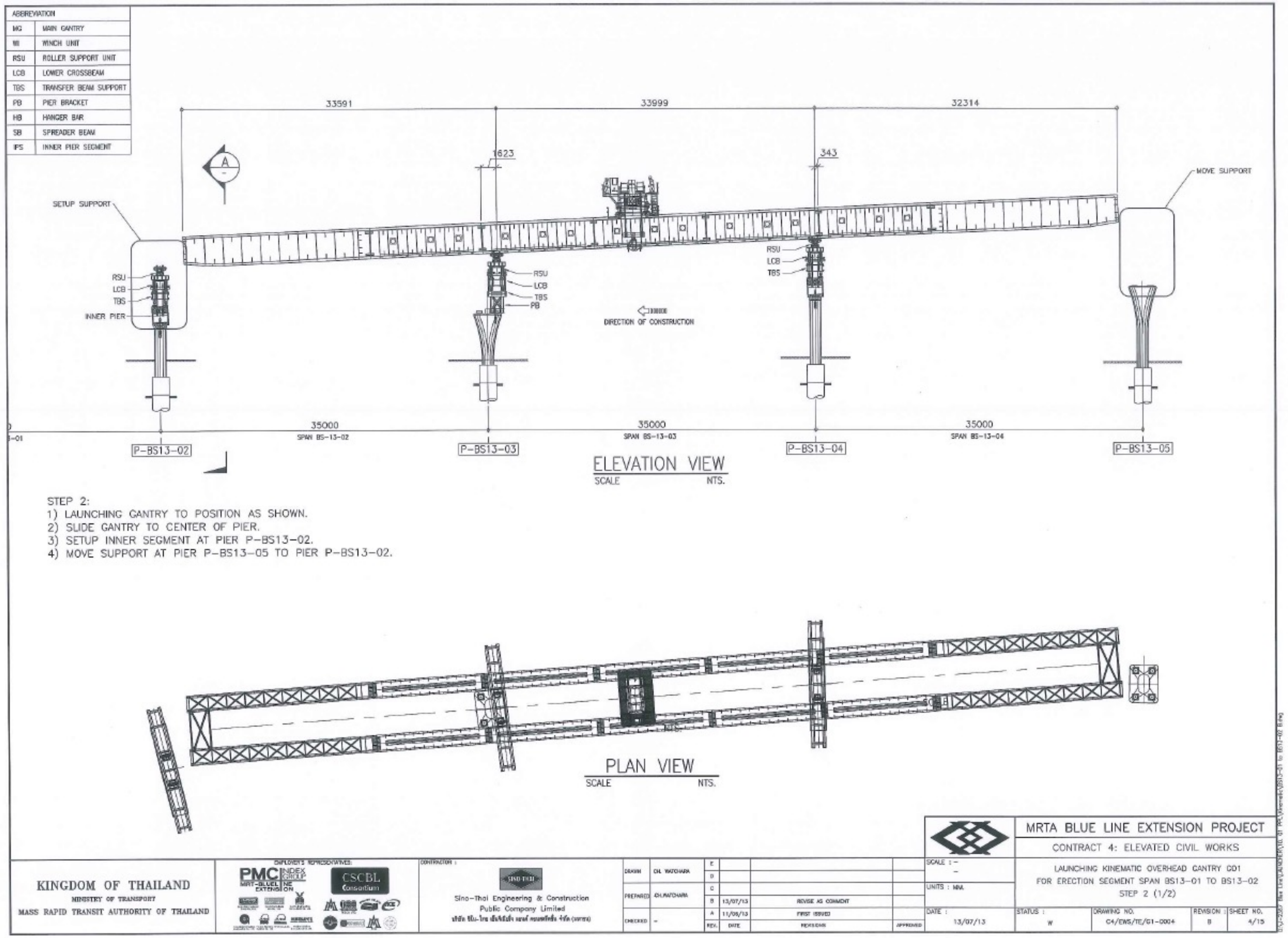
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Assembly



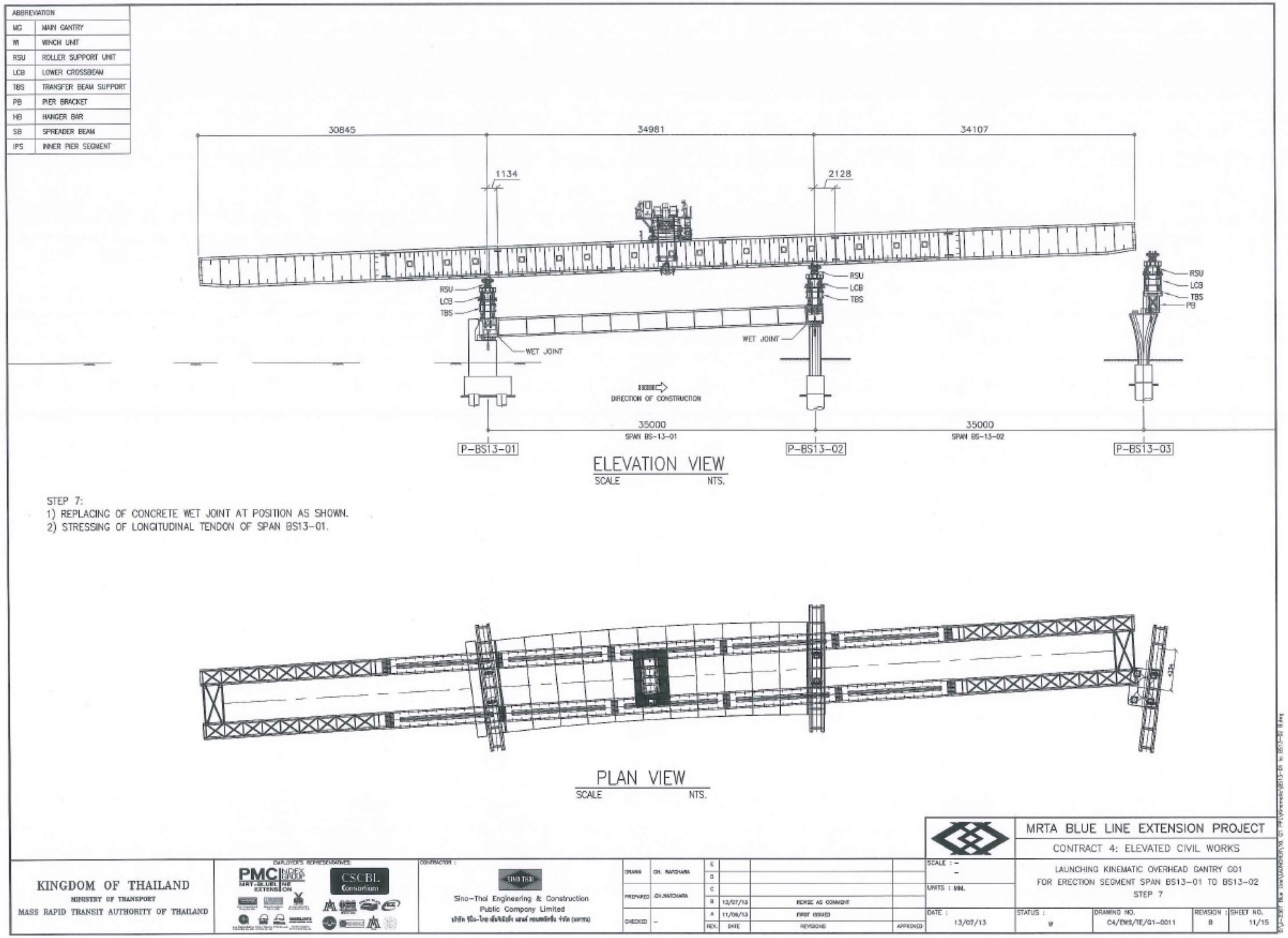
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher - Kinematic



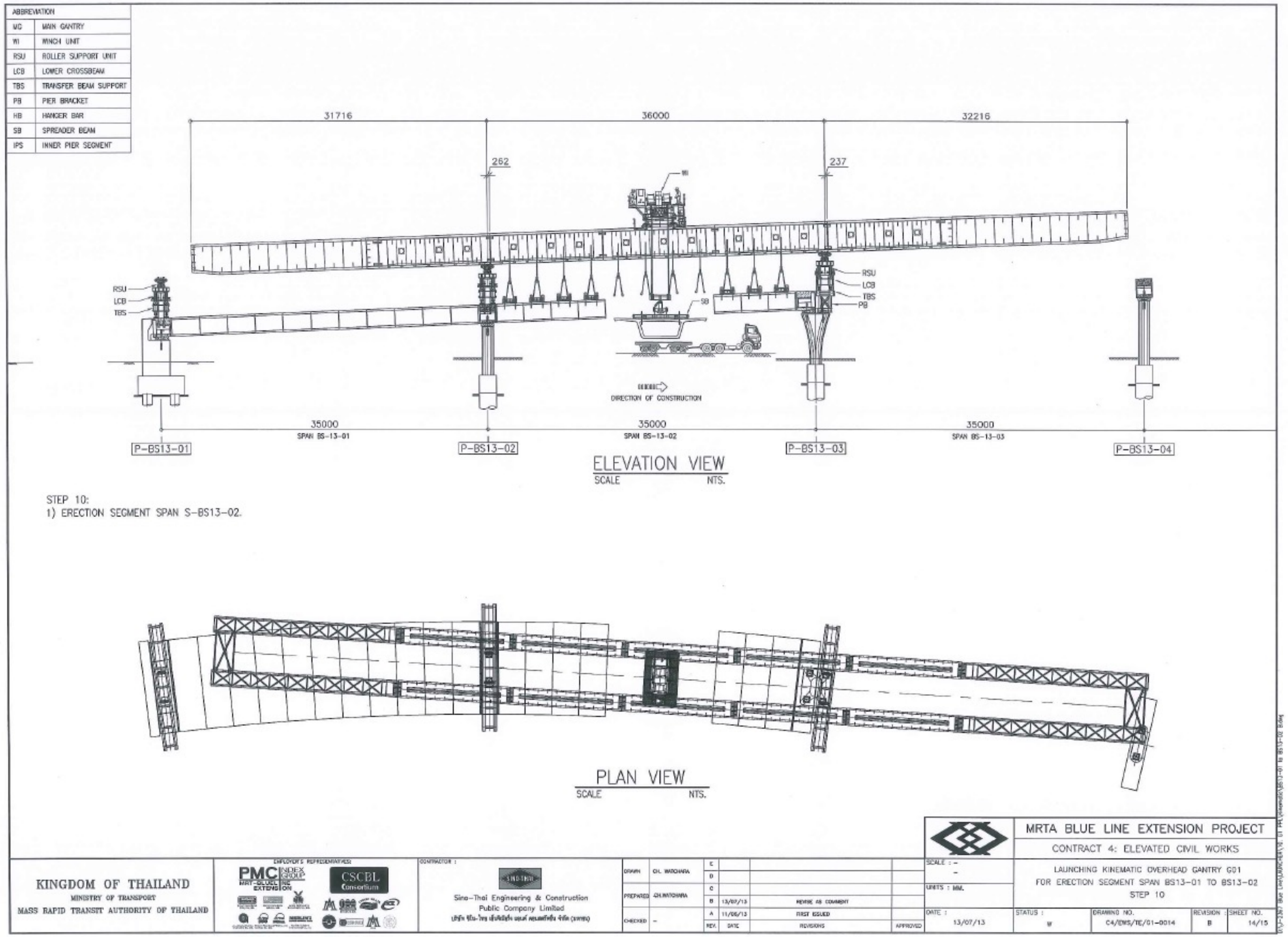
s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher - Kinematic



s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher - Kinematic



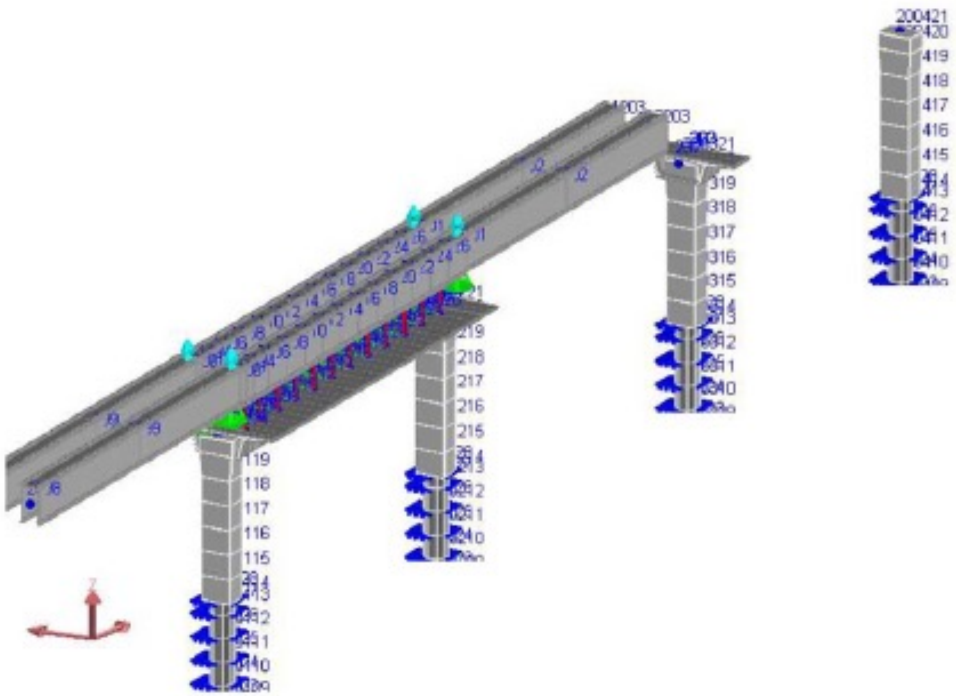
s.athasit@gmail.com

Precast Segmental Box-Girder: Erection Load Transfer

CALCULATION OF LOAD TRANSFER BY OVERHEAD GANTRY

CONTINUOUS 3 SPAN (DT 35-35-35) : Follow PT profile at Contract Dwg.

[*DRAFT*]



Checked Summary

The load transfer procedure was done as recommend step by force on hanger bars and box girder stress result within allowable limit. It shall be notes that, the bottom tensile stress of box girder larger than allowable limit during erecting span 2 . Thus for reducing excessive tensile stress, for erecting span2 we recommend to use temporary PT force anchor between pier axis2 to deviator4 of span 2.

Load Transfer Procedure: SPAN 1 (35 m)

1.1 Lift up segments and hang to suspension bars.
1.2 Aligning and joining segments to final position.
1.3 Apply temporary force to closed segment and the shimming in wet joint.
1.4 Cast wet joint.
1.5 Initial Stressing of tendon T1 to 5% of specified stressing force.
1.6 Release the temporary force and the shimming in wet joint.
1.7 Stressing of tendon T1 to 25% of specified stressing force.
1.8 Stressing of tendon T1 to 100% of specified stressing force.
1.9 Stressing of tendon T2 to 100% of specified stressing force.
1.10 Lower Gantry by release jacks force at each step 10% from record pressure.
1.11 The span is fully load transferred from Gantry on to span support jacks.
1.12 Remove all hanger bars and connection beams.

s.athasit@gmail.com

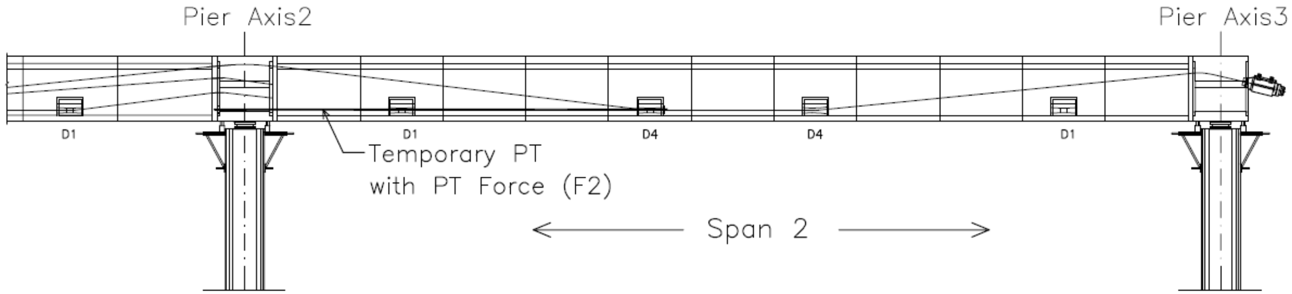
Precast Segmental Box-Girder: Erection Load Transfer

Load Transfer Procedure: SPAN 2 (35 m)

2.1 Lift up segments and hang to suspension bars.
2.2 Aligning and joining segments to final position.
2.3 Apply temporary force to closed segment and the shimming in wet joint.
2.4 Cast wet joint.
2.5 Initial Stressing of tendon T3 to 5% of specified stressing force.
2.6 Release the temporary force and the shimming in wet joint.
2.7 Stressing of tendon T3 to 10% of specified stressing force.
2.8 Stressing of Temporary force(F2) with 2-PT Bar Between Pier Axis2 to Deviator(D2) of span 2 (Apply force on PT-Bar= 800 KN/ EA)
2.9 Stressing of tendon T3 to 50% of specified stressing force.
2.10 Stressing of tendon T3 to 100% of specified stressing force.
2.11 Stressing of tendon T4 to 100% of specified stressing force.
2.12 Lower Gantry by release jacks force at each step +10% from record pressure.
2.13 The span is fully load transferred from Gantry on to both pier segment.
2.14 Remove all hanger bars and connection beams.

Load Transfer Procedure: SPAN 3 (35 m)

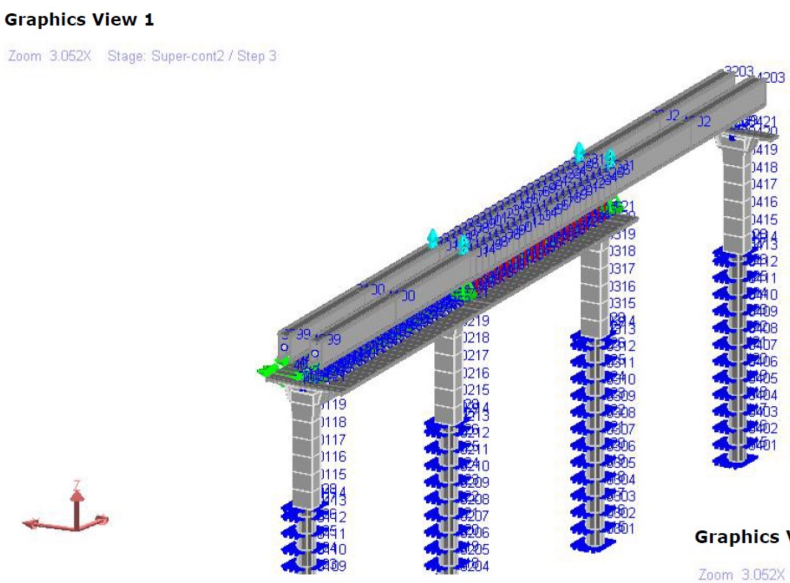
3.1 Lift up segments and hang to suspension bars.
3.2 Aligning and joining segments to final position.
3.3 Apply temporary force to closed segment and the shimming in wet joint.
3.4 Cast wet joint.
3.5 Initial Stressing of tendon T4' to 5% of specified stressing force.
3.6 Release the temporary force and the shimming in wet joint.
3.7 Stressing of tendon T4' to 25% of specified stressing force.
3.8 Stressing of tendon T4' to 100% of specified stressing force.
3.9 Stressing of tendon T2' to 100% of specified stressing force.
3.10 Remove Temporary PT Bar at Span2
3.11 Lower Gantry by release jacks force at each step 10% from record pressure.
3.12 The span is fully load transferred from Gantry on to span support jacks.
3.13 Remove all hanger bars and connection beams.
3.14 Stressing of tendon T1', T3' to 100% of specified stressing force.
3.15 Completed span Erection.

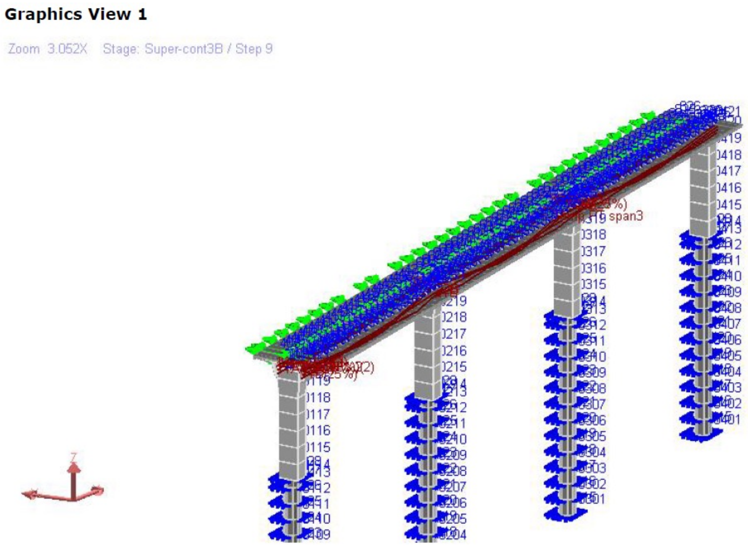


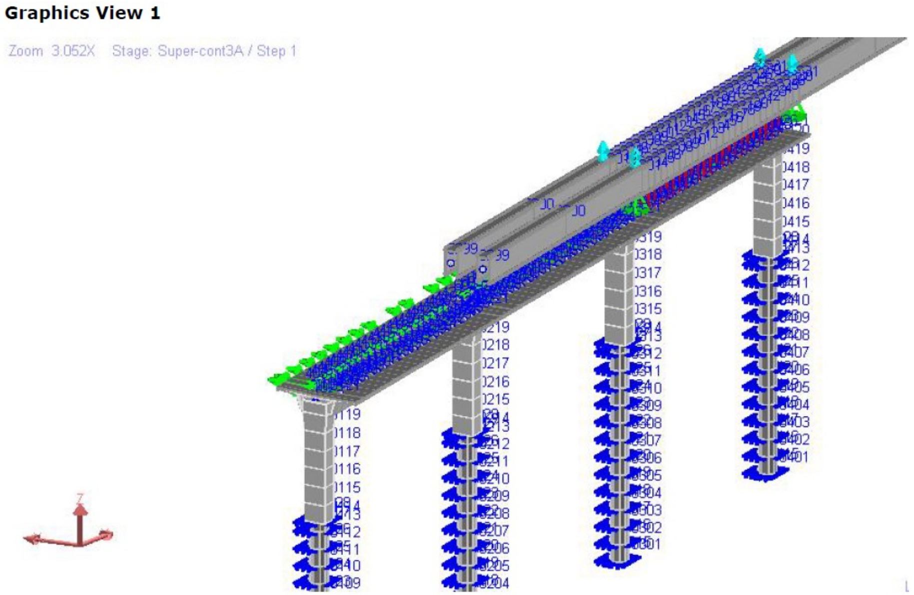
Temporary PT during Erecting Span 2

s.athasit@gmail.com

Precast Segmental Box-Girder: Erection Load Transfer







s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Load Test

บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์ คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED

Summary Report

Load Testing of Erection Gantry G01 for MRT

Purple Line Project [P044, P043]

4/29/2011

Figure A.2 Installing segment 1,2,3

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Load Test

Figure A.5 Install segments 1, 2, 3, 10, 11, 12 then 4,5 (opposite side)

Figure A.6 Complete span assembly

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Load Test

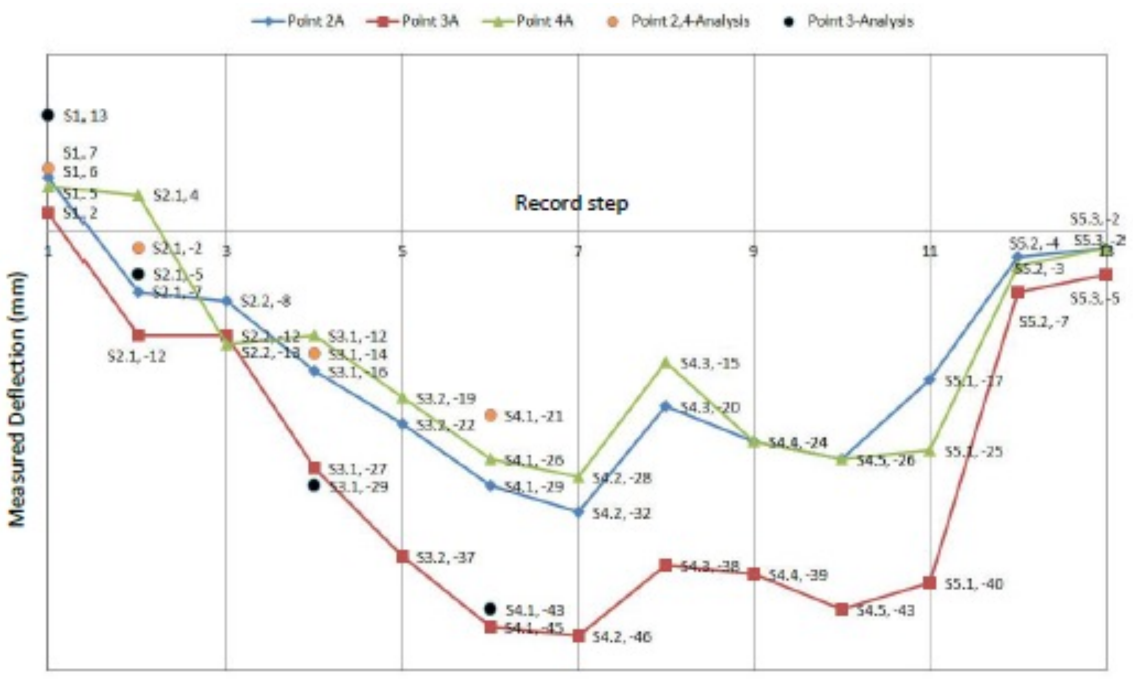


Figure 3.7 Plots of measured deflection and analysis results for each construction stages for Main gantry A

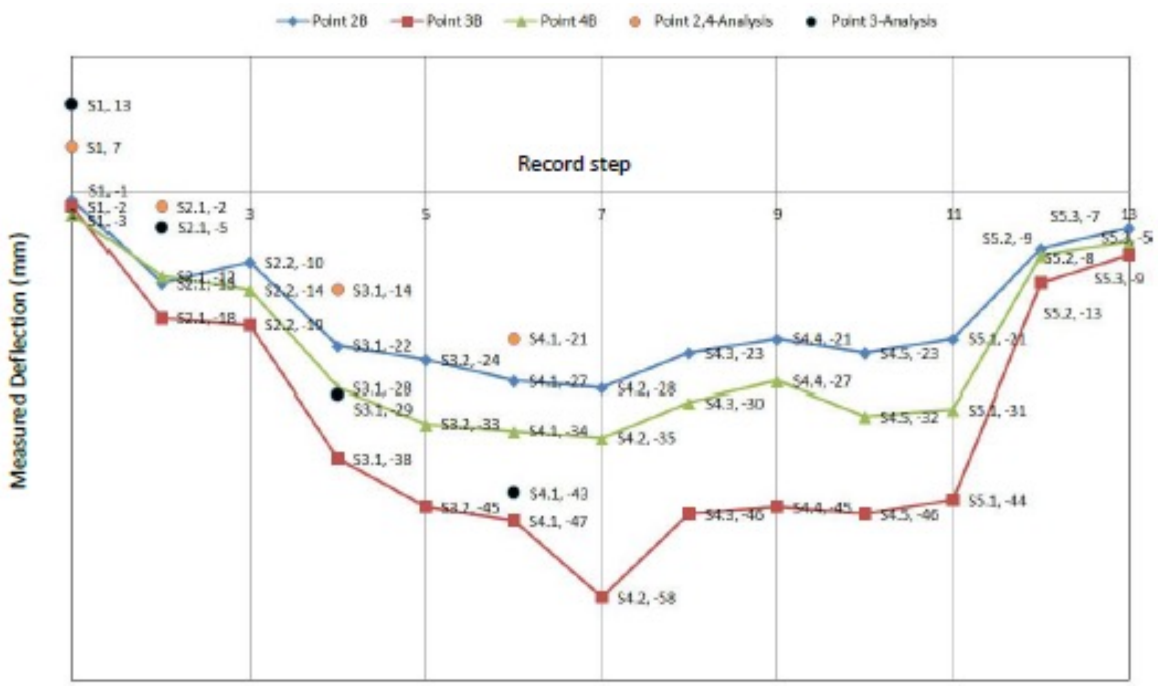


Figure 3.8 Plots of measured deflection and analysis results for each construction stages for Main gantry B

Deflection measurement at each Load Step of Gantry A & Gantry B

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher – Load Test

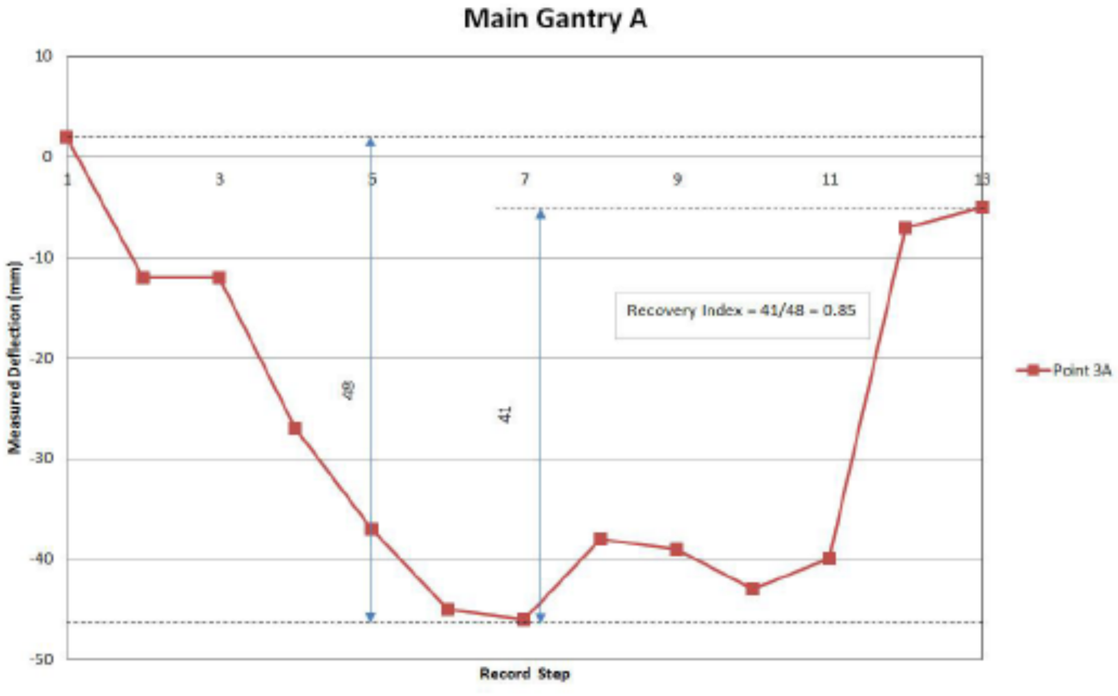


Figure 4.1 Calculation of recovery index for gantry A

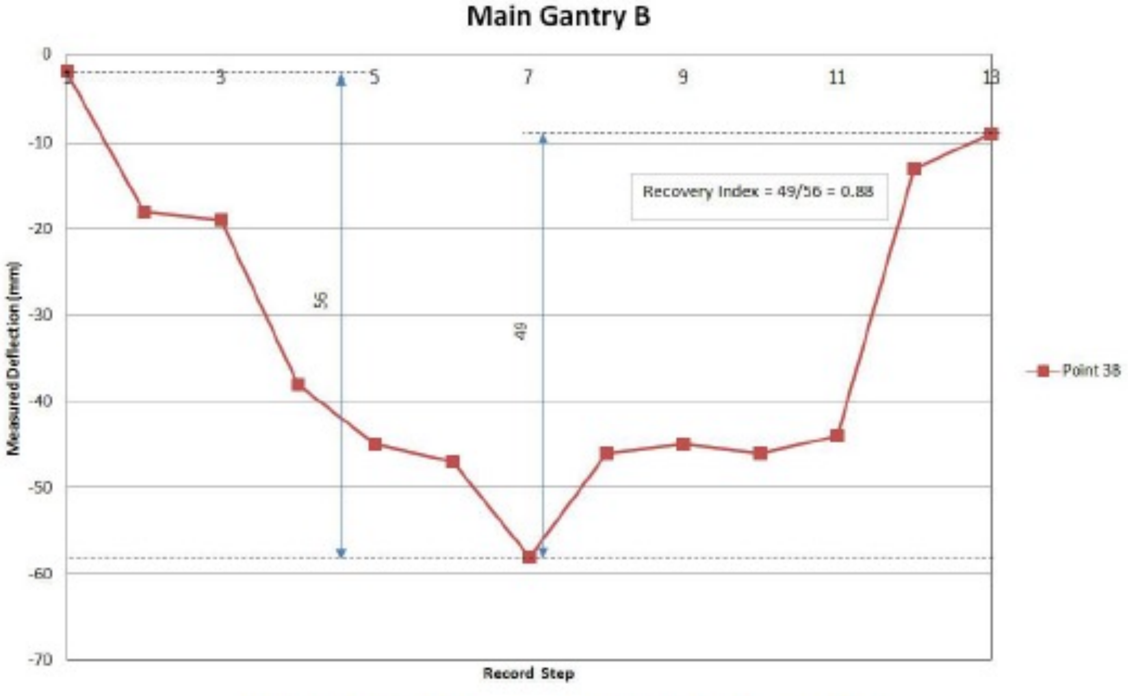


Figure 4.2 Calculation of recovery index for gantry B

$$\text{Recovery Index} = \frac{\text{Maximum deflection amplitude referred to final loading state}}{\text{Maximum deflection amplitude referred to initial loading state}}$$

Calculation of recovery index for main gantry A and B can be shown in Figs. 4.1 and 4.2, respectively. According to the testing results, the recoverty index for both main gantry is greater than 0.85 (85%).

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher Operation

When start operating Launcher STECON has process to check and corrective missing and human error of erection works by using 3 separated team with witness point of work to cross check and review process of works before 3 main step of erection works

SINO-THAI บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED
MRT PURPLE LINE PROJECT BANG YAI TO RAT BURANA
BANG YAI TO BANG SUE SECTION : CONTRACT 2

การตรวจสอบก่อนช่วงการติดตั้งSegment

Name of Launcher : G1 Location : P032 - P031 (SPAN 031R) Check Date : 10 / 10 / 2554

ลำดับ	รายละเอียด	ผลการตรวจสอบ ผ่าน	ไม่ผ่าน	ลายเซ็น ผู้ตรวจ	ข้อคิดเห็น
1	Main girder				
	- ตรวจสอบช่องว่างระหว่าง Main girder ที่ประกบติดกัน (connection joint)	/			
	- ตรวจสอบการโก่งตัวของ Main girder	/			
2	Winch Unit				
	- ตรวจเช็ครอยรั่วไหลของระบบไฮโดรลิก	/			
	- ตรวจเช็คสภาพสายไฟ ตู้คอนโทรล	/			
	- ตรวจเช็คสลักตามจุดข้อต่อต่างๆ	/			
	- ตรวจเช็คสภาพลวดสลิง & wedge socket	/			
	- ตรวจสอบสภาพและตำแหน่งของชุดล้อWinch unit	/			
	- ตรวจสอบสภาพรอกและชุด	/			
3	ชุดปรับระดับSegment				
	- ตรวจสอบข้อต่อ จุดยึดและสายของระบบไฮโดรลิกของชุดปรับระดับSegment	/			
	- ตรวจสอบสลักต่างๆของชุดปรับระดับSegment	/			
4	Hanger Bar				
	- ตรวจสอบสภาพและการโก่งของBarex bar	/			
	- ตรวจสอบสภาพและการประกอบชุดกระโหลก(Suspension device)	/			
	- ตรวจสอบสภาพของลวดSling โดยเฉพาะรอยที่เกิดจากการArc	/			
	- ตรวจสอบสภาพปลอกอะลูมิเนียมและหัวใจของชุด Sling	/		10/10/54	
5	Spreader Beam				
	- ตรวจเช็คสภาพโครงสร้างและรอยเชื่อมของยูก	/			
	- ตรวจเช็คสภาพLifting bar(B-B bar) & Anchor Nut	/			
6	Lower Cross Beam				
	- ตรวจสอบB-B barที่ยึดระหว่างLower cross beamกับTower support:Type-2 ติดตั้งแน่นหรือไม่(ชุดSupportติดตั้งบนEnd pier segment:Single track)	/			
	- ตรวจสอบ B-B bar ที่ยึดระหว่าง Lower cross beam กับ Transfer beam และ Beam Support Frame ติดตั้งแน่นหรือไม่(ชุดSupportตั้งบนเสาCrossBeam)	/			
	- ตรวจสอบ B-B bar ที่ยึดระหว่างLower Cross Beamสองท่อนที่ต่อชนกัน	/			
7	Bracket Support : Type-2 (ชุด Support ติดตั้งบนเสา Cross Beam)				
	- ตรวจสอบ B-B bar ที่ยึด Bracket Support กับ Cross Beam ติดตั้งแน่นหรือไม่	/			
8	Beam Support Frame (ชุด Support ติดตั้งบนเสา Cross Beam)				
	- ตรวจสอบความมั่นคงของBeam Support Frame				
	- ตรวจสอบLock nutของไฮโดรลิกแจ็คที่ค้ำLCBถูกขันล็อกแล้วหรือไม่				

	Launcher Engineer	QC Engineer	Project Engineer
Sign			
Name-Surname			
Date	10/10/54	10/10/54	10/10/54

จุดสำคัญ รายการด้านบนได้รับการตรวจสอบและดำเนินการครบถ้วน พร้อมกับลงนามครบทุกช่อง

Check before erection

SINO-THAI บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED
MRT PURPLE LINE PROJECT BANG YAI TO RAT BURANA
BANG YAI TO BANG SUE SECTION : CONTRACT 2

การตรวจสอบก่อนช่วงการLaunch Main girder

Name of Launcher : G1 Location : P032-P031 (To span 031R) Check Date : 8 / 10 / 2011

ลำดับ	รายละเอียด	ผลการตรวจสอบ ผ่าน	ไม่ผ่าน	ลายเซ็น ผู้ตรวจ	ข้อคิดเห็น
6	Tower Support (ชุดSupportติดตั้งบนEnd pier)				
	- ตรวจสอบสภาพข้อต่อและสายของระบบไฮโดรลิกที่ต่อเข้าแจ็คของชุดTower support	/			
	- ตรวจสอบ Lock nut ถูกขันล็อกระดับความสูงของแจ็ค Tower support แล้วหรือไม่	/			
	- ตรวจสอบการขันติดตั้ง Stud bar ยึดระหว่าง Tower support กับ End pier segment (ในกรณี Tower support วางติดตั้งบน End pier segment)	/			
7	Transfer Beam : Type-2 (ชุด Support ติดตั้งบนเสา Cross beam)				
	- ตรวจสอบสภาพข้อต่อและสายของระบบไฮโดรลิกที่ต่อเข้าแจ็คของชุดTower support	/			
	- ตรวจสอบ Lock nut ถูกขันล็อกระดับความสูงของแจ็ค Tower support แล้วหรือไม่	/			
	- ตรวจสอบ B-B bar ที่ยึดระหว่าง Transfer Beam กับ Bracket Support ติดตั้งแน่นหรือไม่	/			
8	Transfer Beam : Type-3 (ชุด Support ติดตั้งบนเสา Cross Beam)				
	- ตรวจสอบ B-B bar ที่ยึด Transfer Beam Support กับ Cross Beam ติดตั้งแน่นหรือไม่	/			
	- ตรวจสอบฐานของ Transfer Beam Support วางแนบสนิทกับชุดShimหรือ Cross beam	/			
	- ตรวจสอบ Lock nut ถูกขันล็อกระดับความสูงของแจ็ค Transfer Beam Support แล้วหรือไม่	/			
	- ตรวจสอบ B-B bar ที่ยึดระหว่าง Transfer Beam กับ Lower Cross Beam ติดตั้งแน่นหรือไม่	/			

Note :

	Launcher Engineer	QC Engineer	Project Engineer
Sign			
Name-Surname			
Date	8/10/54	8 Oct 2011	8/10/54

จุดสำคัญ รายการด้านบนได้รับการตรวจสอบและดำเนินการครบถ้วน พร้อมกับลงนามครบทุกช่องจึงสามารถเดินLauncherได้

Check before Launching

SINO-THAI บริษัท ซิโน-ไทย เอ็นจีเนียริ่ง แอนด์คอนสตรัคชั่น จำกัด (มหาชน)
SINO-THAI ENGINEERING & CONSTRUCTION PUBLIC COMPANY LIMITED
MRT PURPLE LINE PROJECT BANG YAI TO RAT BURANA
BANG YAI TO BANG SUE SECTION : CONTRACT 2

การตรวจสอบก่อนช่วงการSlide Main Girder

Name of Launcher : G1 Location : P033 - P032 (SPAN 032R) Check Date : 4 / 10 / 2554

ลำดับ	รายละเอียด	ผลการตรวจสอบ ผ่าน	ไม่ผ่าน	ลายเซ็น ผู้ตรวจ	ข้อคิดเห็น
1	Main girder				
	- ตรวจสอบเก็บสายไฟขึ้น Main girder ให้เรียบร้อย	/			
	- ตรวจสอบจัดเก็บสิ่งของหรืออุปกรณ์บน Main girder ที่อาจล่วงหล่นลงสู่ด้านล่าง	/			
2	Winch unit				
	- ตรวจสอบตำแหน่งจอดของ Winch Unit อยู่กึ่งกลางช่วง Span	/			
3	Roller Support				
	- ตรวจสอบจะต้องมีสลักยึดระหว่าง Brake Launching jack หรือ Main Launching jack ยึดกับ Launching rail อย่างใดอย่างหนึ่งเป็นอย่างน้อย	/			
	- ตรวจสอบสลักและสภาพของชุด Spindle ที่ยึดระหว่าง Roller Support	/			
	- ตรวจสอบ Main girder นั่งอยู่บนล้อของชุด Roller Support ในทุกๆจุด	/			
	- ตรวจสอบสภาพกระบอกไฮโดรลิก รวมถึงสภาพข้อต่อและสายที่ใช้ในการเลื่อน Slide ตัว Main girder	/			
	- ตรวจสอบสภาพหูและ B-B bar ที่ใช้ในการดึง Slide ตัว Main Girder	/			
	- ตรวจสอบแผ่นTeflonแนบสนิทกับแผ่นStainlessของLCBทุกจุดรวมถึงสภาพของแผ่นTeflon	/		4/10/54	
	Lower Cross Beam				
	- ตรวจสอบความสะอาดของแผ่นStainless รวมถึงการชโลมน้ำมันหล่อลื่น	/			
	- ตรวจสอบจุดรอยต่อและสภาพความเรียบของแผ่นStainless		/		
	- ตรวจสอบ B-B bar ที่ยึดระหว่าง Lower cross beam กับ Tower support ติดตั้งแน่นหรือไม่(ชุด Support ตั้งบน End pier)	/			
	- ตรวจสอบ B-B bar ที่ยึดระหว่าง Lower cross beam กับ Transfer beam และ Beam Support Frame ติดตั้งแน่นหรือไม่(ชุดSupportตั้งบนCrossBeam)	/			
	- ตรวจสอบความมั่นคงของชุดราวกันตกตัวLower cross beam	/			
	- ตรวจสอบจัดเก็บสิ่งของบนทางเดินบน Lower cross beam ที่อาจกีดขวางช่วงเวลาทำงาน		/		
	- ตรวจสอบ B-B bar ที่ยึดระหว่างLower Cross Beamสองท่อนที่ต่อชนกัน	/			

	Launcher Engineer	QC Engineer	Project Engineer
Sign			
Name-Surname			
Date	04/10/54	4/10/54	4/10/54

จุดสำคัญ รายการด้านบนได้รับการตรวจสอบและดำเนินการครบถ้วน พร้อมกับลงนามครบทุกช่องจึงสามารถเดินSlideได้

Check before sliding

s.athasit@gmail.com

Precast Segmental Box-Girder: Launcher Operation

Launching

Span Alignment & Profile check

Concrete wet joint

Erection

Post-Tensioned works

s.athasit@gmail.com

Thank you
Question & Answer

s.athasit@gmail.com