

Assignment

A bridge – necessiated by increasing traffic at an industrial center – is to be constructed. The structure of the bridge is of post-tensioned reinforced concrete box structure on monolithic piers, constructed in way of "Incremental Launching" method.

Your job is to elaborate estimates for accomplishment (schedule, bill of quantities, cost estimate) and to describe your ideas in a written form detailed as listed below:

- Bill of quantities, Bill of works (See: technical specifications)
- Periodic layout of site
(foundation works, erecting piers, pre-casting and launching, finishes)
- Master schedules of performance (PERT + Bar chart) indicating tasks of great importance
- Detailed schedule of constructing blocks of bridge
(one-week period of pre-casting a block)
- Technical Report
- Traffic management suggested during construction - if considerable

For to elaborate Detailed- and Master schedules you may accept traditional principles of building structures of this kind (See: Phases of construction).

Documents to be elaborated	Responsible	Assessed
Bill of quantities, bill of works		
Site layout		
Master schedule		
Detailed schedules		
Technical Report		
Introduction / Performance		

Phases of construction :

Pre-Casting Plant is located on one or both of the abutments constructed in advance. It consists of a monolithic reinforced concrete slab (workbench), outer formwork sidings (can be tilted up and down), inner formwork (can be pulled in and out) and rear shuttering. (See drawings attached)

The bridge is constructed in more segments (blocks) each of them pre-cast in weekly periods. New-cast block is attached to the last finished one. They are pressed to each other by post-tensioning bars. At the end of a casting period (one week), all blocks constructed (that is the segment of the bridge completed) are launched (pushed through) over the piers. Size of blocks are chosen some 10 to 40 m, so the span of arches must be some integer times (2-3x) the length of them. If an arch has a span longer than 3 blocks, auxiliary temporary supports are needed for construction.

When constructing the bridge, segments completed approach the piers like a cantilever. For to decrease moments at supports they apply temporary structures, such as Temporary Supports and Steel Nose (See drawings attached). For launching they apply two pieces of synchronized hydraulic presses of pushing power of 170 tons each. For to decrease friction during launching they use special-coated temporary bearings manipulated from light scaffolds suspended from the piers.

Post-tensioning is performed in two phases. At first, blocks are pressed to each other by straight tensioning bars and wires during the "Incremental Launching" period, while in the second phase post-tensioning means pressing the whole structure together using high-capacity tensioning cables. In some cases, when double-box bridges are to be constructed, both of the parallel bridges are cast on the same casting plant, after each other. That case first-made bridge must be shunted a-cross onto piers of the "parallel" bridge using temporary structures ("cross-beams") and power-hoists, while second-made bridge can be constructed after that, in the same (previous) track.

When tensioned lifting the whole structure temporary bearings are changed to permanent ones. Finishing works can be performed after that as usual.

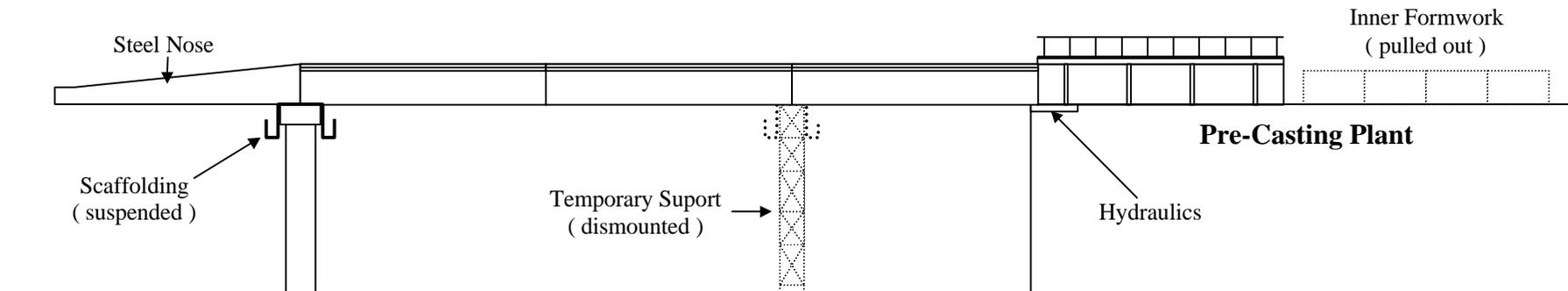
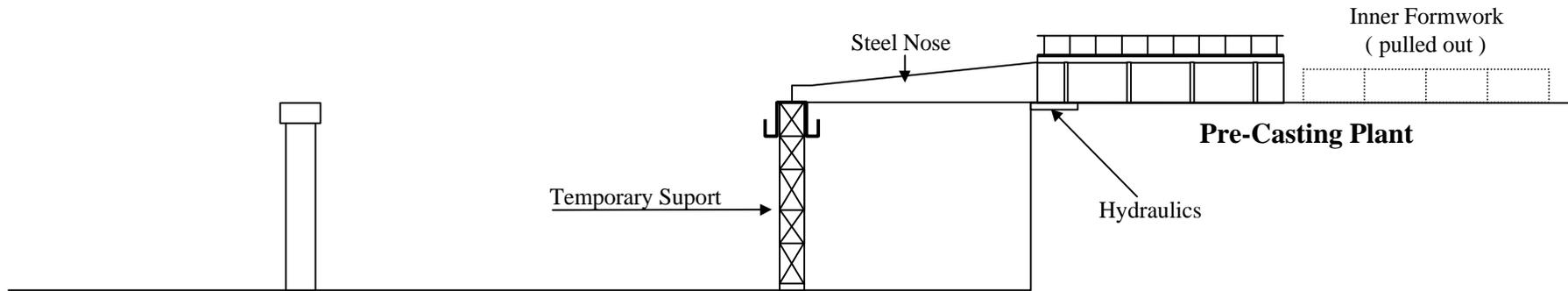
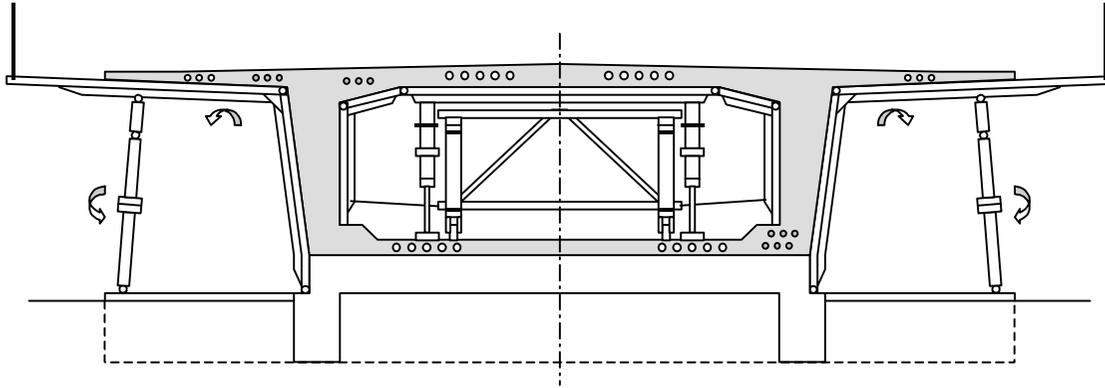
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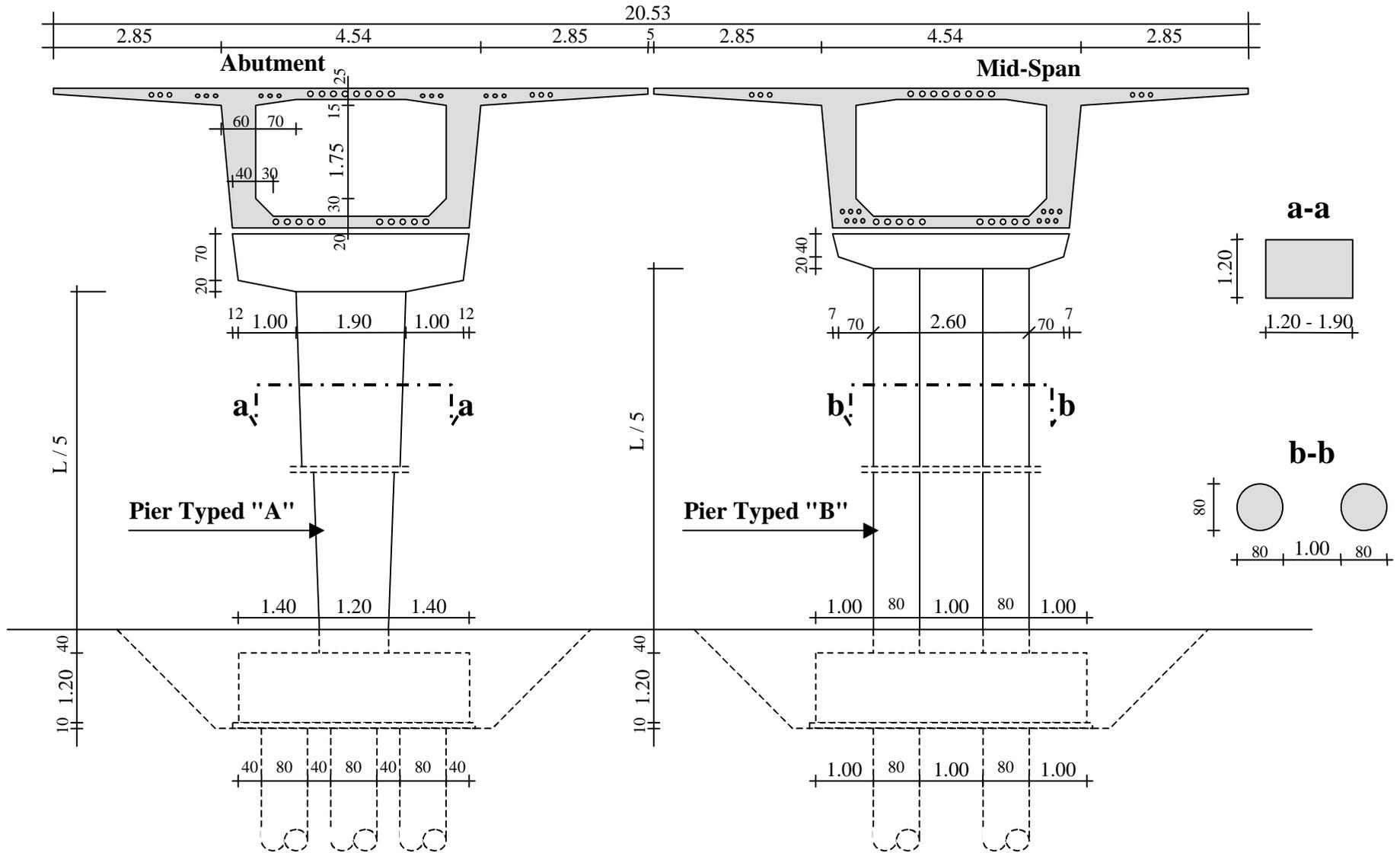
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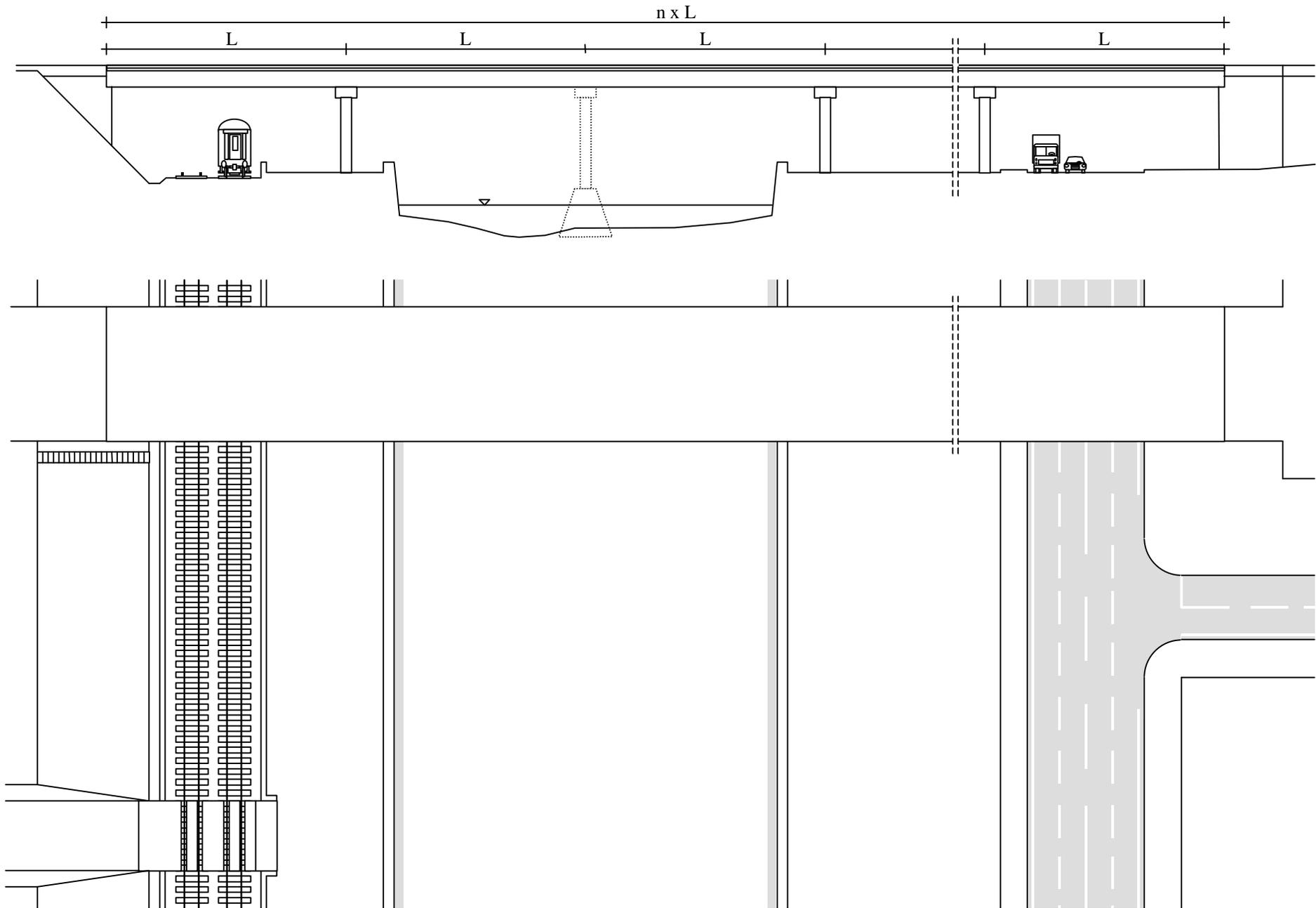
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Pre-Casting Plant Cross-Section



Cross-Section, Twin-Bridge





QUANTITIES PER PIER							
ID	Activity	Unit	Width				
			12.16 m		20.53 m		
			Pier		A	B	
			A	B	A	B	
1	Piling	pcs	3 A 1000 Franki (8m) 2 A 1200 Soil-Mec (14m)		6 A 800 Franki (8m) 4 A 800 Soil-Mec (14m)		
2	Excavation, Ditch, Rough	m ³	79,5	96,8	105,8	111,9	
3	Excavation, Ditch, Refinery	m ²	16,8	21,8	28,0	30,2	
4	Opening pilehead (Demolishing loose upper sections)	m ³	Franki: 3.7 Soil-Mec: 3.6		Franki: 3.9 Soil-Mec: 2.6		
5	Blinding (10 cm)	m ³	1,7	2,2	2,8	3,0	
6	Formwork, Foundation	m ²	20,4	25,8	27,8	29,8	
7	Reinforcement, Foundation	Ton	1,6	2,2	2,1	2,3	
8	Concreting, Foundation	m ³	13,5	18,4	17,3	19,0	
9	Refill, Ditch, Including Compaction, Temporary	m ³	30,0	36,8	35,2	37,3	
10	Formwork, Pier	m ²	24 m span	30,7	36,2	48,0	48,3
			30 m span	38,4	45,2	60,0	60,3
			36 m span	46,1	54,3	72,0	72,4
11	Scaffolding, Heavy, Pier & Head Beam	Gross m ³	24 m span	170,8	177,5	227,8	252,4
			30 m span	206,1	214,1	260,8	304,6
			36 m span	241,4	250,9	314,9	356,9
12	Reinforcement, Pier	Ton	24 m span	1,7	1,7	2,3	1,6
			30 m span	2,1	2,2	2,9	1,9
			36 m span	2,5	2,6	3,5	2,3
13	Concreting, Pier	m ³	24 m span	10,6	10,9	14,4	9,7
			30 m span	13,2	13,6	18,0	12,4
			36 m span	15,8	16,3	21,6	14,5
14	Formwork, Head Beam	m ²	23,8	16,4	22,8	22,3	
15	Reinforcement, Head Beam	Ton	1,5	0,9	1,3	1,2	
16	Concreting, Head Beam	m ³	9,3	5,6	8,1	7,2	
17	Bearing's Bed	pcs	2,0	2,0	4,0	4,0	
18	Refill, Ditch, Including Compaction, Final	m ³	36,0	41,6	53,3	55,6	
19	Scaffolding, Light, Suspended	Man-Hour	24,0	24,0	24,0	24,0	
20	Temporary Structures, Shunting (a-cross), Mounting & Dismounting	Man-Hour			100,0	100,0	
21	Bearings, Final	Man-Hour	44,0	44,0	33,0	33,0	
22	Scaffolding, Light, Demolish	Man-Hour	24,0	24,0	24,0	24,0	
WORKS PER BRIDGE							
23	Preparing Pre-Casting Plant	Carpenter Black Smith Steel Fitter Building Labourer	Man-Hour / m	8,0		6,0	
				4,0		3,0	
				4,0		3,0	
				21,0		9,0	
24	Temporary Support, Mounted On Test Piles	Carpenter Steel Fitter Building Labourer	Man-Hour / m	1,6		2,4	
				2,2		3,3	
				5,4		8,1	
25	Adjustable Formwork, Mounting	Black Smith Building Labourer	Man-Hour / m	1,4		1,1	
				0,6		0,5	
26	Steel Nose, Truss, Mounting	Black Smith Building Labourer	Man-Hour / m	1,4		1,0	
				0,6		0,4	
27	Pre-Casting + Launching (a-long)			Scheduled Individually			
28	Temporary Support, Dismounting	Carpenter Building Labourer	Man-Hour / m	0,6		0,9	
				0,8		1,2	
29	Post-Tensioning	Steel Fitter Building Labourer	Man-Hour / m	3,6		5,4	
				5,2		7,8	
30	Injection, Conduits	Steel Fitter Building Labourer	Man-Hour / m	3,6		5,4	
				5,2		6,0	
31	Steel Nose, Dismounting	Black Smith Building Labourer	Man-Hour / m	0,7		0,5	
				0,3		0,2	
WORKS PER BLOCK							
32	Formwork, Side, Tilt-Up		Man-Hour / m	0,8		0,8	
33	Reinforcement, Rear Slab (40 % pre-fabrication)		Man-Hour / m	1,8		1,4	
34	Conduits, Rear Slab		Man-Hour / m	0,8		0,6	
35	Concreting, Rear Slab		Man-Hour / m	1,8		1,4	
36	Formwork, Inner, Pull-In		Man-Hour / m	0,4		0,4	
37	Reinforcement, Upper Slab & Sidewalls (40 % pre-fabr.)		Man-Hour / m	6,0		4,5	
38	Conduits, Upper Slab		Man-Hour / m	3,6		2,7	
39	Conduits, Temporary Fixing		Man-Hour / m	1,6		1,2	
40	Formwork, Front, Mounting		Man-Hour / m	1,6		1,6	
41	Concreting, Upper Slab & Sidewalls		Man-Hour / m	5,4		4,1	
42	Temporary Fixings, Pull-out		Man-Hour / m	0,4		0,3	
43	Curing		Man-Hour / m	1,2		0,9	
44	Formwork, Front, Dismounting		Man-Hour / m	0,8		0,6	
45	Post-Tensioning Wires, Pull-In		Man-Hour / m	3,6		2,7	
46	Tensioning		Man-Hour / m	3,6		2,7	
47	Formwork, Inner & Side, Pull-Out & Tilt-Down		Man-Hour / m	2,8		2,0	
48	Launching (a-long)		Man-Hour / m	2,4		2,4	
49	Formwork, Cleaning		Man-Hour / m	1,6		1,2	