Performance datas

Content

The division in chapters in appendix 2 is organized so that the chapters are referring to the corresponding chapters in [Civil Works Technique 1 – Equipment and executionmethods, 2010]. To cover the whole aspect, chapter 9 – various works are included. The chapter contains performance datas for completion trades.

Roadworks and paving works are placed in chapter 2 – soilwork.

1. Building site
2. Soilwork
3. Sewage work
4. Foundation work
5. Concrete work
6. Formwork
7. Reinforcing
8. Prefab construction
9. Various works
    - 9.1 Masonry work
    - 9.2 Carpenter work
    - 9.3 Plumber work
    - 9.4 Floor construction
    - 9.5 Painting work
    - 9.6 other works
10. references to literature

Introduction

The following performance datas are achieved from [Jørgensen, 1993], agreements between 3F and Danish Contractors, [List of time for piecework (a)] including [List of time for piecework (b)] and also information given by MT-Højgaard A/S, NCC-Danmark A/S and Per Aarsleff A/S.
Part of the performance datas collected from [Jørgensen 1993], are based on Swedish investigations and work time studies, but are anticipated to be comparable to Danish conditions.
The stated time is operation time, which is a sum of method time and additional time.
Method time is the time it takes to execute a job using a specific method, where there are no interruptions, e.g. the time for the direct productive work.
The additional time is often up to 25-30% of the operation time are used for preparation of the job, repair and maintenance of equipment and machines, extended breaks, waiting, searching for equipment and machines and breaking down of machinery. All interruption of this kind less than one hour, are incorporated in the additional time, and by that, also in the stated operation time.

1. Construction site

This chapter gives some examples of datas for execution time related to arrangement and demounting of a construction site.

Work description	Time usage
Handrails: Setting up handrails per running meter Taking down handrails per running meter	 10 man minutes 5 man minutes
Pipescaffolding: Setting up light facadescaffolding (class 1, 2 & 3) Until height of 18 m. Workcrew of 2 men per 100 m^2 covered facade, straight wall. Allowance for heights 18 – 22 m Allowance for heights 22 – 26 m Allowance for heights 26 – 30 m Allowance per 5 m over 30 m Setting up heavy façade scaffolding (class 4, 5 & 6). Workcrew of 2 persons per 100 m^2 covered façade, Straight wall. Taking down scaffolding in percentage of setting up time	 2 hours 20 % 35 % 50 % 5 % 3 hours 50 %
Fencing in: 2 m high, wooden sections of length 2,5 m. setting up Taking down Mesh wire on concrete pads. Sections of 3 m Setting up Taking down	 1 man hour ½ man hour ½ man hour 0,3 man hour
Cranes: **Large towercrane, 200 tm** Setting up using specialist company Taking down using specialist company	 5 days 4 days

Work description	Time usage
Large semi-mobile crane, 90 tm Setting up Taking down **Small semi-mobile crane, 20 tm** Setting up Taking down	 2 days 2 days 4 hours 3 hours
Shed town: Setting up cabin unit, incl. connections, Taking down cabin unit	 2 man hours + 1 hour Truck with crane
Execution of winter lighting: Executed by electrical contractor. Per 1000 m^2	 12.000 kr
Cutting and bending area: Arrangement incl. laying out sleepers for storagearea. Setting up cutting- and bending machine. Area appr. 200 m^2	 16 man hours
Mortar mixing plant: System mixing plant Optiroc – Megamix, incl. Levelling and laying out of steel plate or timber	 2 man hours + 1 hour Back hoe

Soilwork and construction of temporary site roads related to arrangement of the building site is planned by help of performance datas, and stated in chapter 2 in [Civil Works Technique 1, 2004].

2. Soil work

Performance datas for soil work is determined only based on performance datas for the machines used to solve the assignment. Look into [Civil Works Technique 1, 2004].

Usage of man hours are mostly not interesting, but the numbers of workers for the specific assignment, should be assessed, (handmen).

Performance datas for handsoil is stated in chapter 3 – Sewage works.

Concrete paving stones

Width of area (laying direction) in m	**Basictime in minutes / m^2**	
	5 cm Levelling layer	8 cm SF-stone
6 – 30	2,9	7,5
Lay out 8 cm SF-stone side stone		1,0 min./r.m.
Lay out 8 cm SF-stone end stone		0,8 min./r.m.
Adjustment around manhole wells		47 min./pcs
Adjustment around gully traps		29 min./pcs
Adjustment along sides		11,13 min./r.m.
Aftercare (sprinkle sand)		0,4 min/m^2

The work volume is anticipated to be 2000 m^2. by 500 m^2, add 25%.

Tilework

Type	**Minutes/m^2**
Concretestones of size 0,5 m^2 and more to set in gravel:	
Thickness until 7,5 cm	15,4
Thickness more than 7,5 cm until 10 cm	22,9
Thickness more than 10 cm	26,1
Concretestones of size less than 0,5 m^2 to set in gravel:	
Thickness until 6,5 cm	16,6
Thickness more than 6,5 cm until 10 cm	21,4
Thickness more than 10 cm	30,8

Above mentioned time is indicating only laying out at regular work. By cutting, laying in concrete and laying in curves, allowance is added.

Kerbstone works

Minutes/r.m.	Setting of kerbstone in gravel	Setting of kerbstone in concrete
Foldkerbstone 17 DS 138	10,8	18,3
Anglekerbstone 15 DS 139	8,8	15,0
Chopped kerbstone 12-13 DS 140	6,9	13,2
Chopped kerbstone 10-12 DS 140	6,9	13,2
Bordurstone 30 or 32,5 cm wide	10,9	19,0
Paving stone as edge, 1 course	6,1	11,4
Concreteberbstone, heigth 20 cm	6,9	12,5
Concreteberbstone, heigth 25 cm	8,5	14,5
Concreteberbstone, heigth 30 cm	9,7	16,2

Side gutter works

Minutes/r.m.	1 course	2 courses	3 courses	4 courses
Gutter alongside kerbstone in gravel	9,0	16,5	24,4	31,2
Gutter alongside kerbstone in concrete	10,3	18,7	27,3	35,2
Gutter without kerbstone in gravel	10,0	18,1	26,0	33,1
Gutter without kerbstone in concrete	11,7	20,6	29,5	37,6

3. Sewage work

Generel

Determination of man hour's usage for sewage work is uncertain because the following topics have an impact on the result:

- choice of machines etc. for soilwork
- choice of equipment for measurement and setting out
- problems caused by water in soil and watertable
- choice of shoring equipment
- demand for quality assurance and documentation

It is further rather important whether it is completely new sewage-systems, if consideration has to be taken to existing systems or it is a renovation project of the pipes.

It is the habit that the executing companies, the contractors, do have datas based on experience from former projects with: manning, manhours and machine hour's incl. the driver. These numbers are the most confident, but depend on company matters. Here we will try to focus on man hour usage only – machine hours have to be added separately.
The coming stated datas must be considered as taken from experience during "ordinary conditions" and must therefore be adjusted up or down if it is considered that "special conditions" do justify this. For not mentioned dimensions, interpolation can be used.

Excavation work

By usage of machines, reference is made to the chapter regarding soilwork, together with "Guiding time usage" elaborated by Danish Contractors and the union for semi-skilled workers. Without the usage of machines, following can be stated:

Hand-soil to excavate and load:

Soil-class	mh/m^3
1	0,7
2	1,3
3	1,8
4	2,4

Filling up with gravel delivered in crane bucket

Service	mh/m^3
Delivery and levelling	0,15
Compacting	0,04

Sewage-pipes and –wells

Dimensions are stated for concrete-pipes. These are not always the exact dimension of the similar plastic pipes.
The specific service “delivery, laying down and assembling” of the following pipes and wells (considered sufficient machine capacity) can be stated as:

Dimension of pipe	mh/r.m. concrete pipe	mh/r.m. plastic pipe
Ø 100 – Ø 200	0,15	0,10
Ø 250 – Ø 300	0,20	0,15
Ø 400 – Ø 500	0,25	0,20
Ø 600 – Ø 800	0,30	0,25
Ø 900 – Ø 1000	0,35	0,35
Ø 1200	0,40	0,40

Dimension of well	mh/pcs concretewell	mh/pcs Plasticwell
Gully Ø 300, d=0,7 m	1,00	0,75
Road well Ø 400, d=0,8 m	1,25	0,85
Culvert well Ø 600, d=2,5 m	1,50	1,00
Inspection well Ø 1000, d=2,5 m	3,00	2,00
Manhole Ø 1250, d=2,5 m	3,50	2,50

By assessment of the total service for a sewage pipe project, one should pay attention to the fact that usage of plastic components, sometimes cause supplementary or higher demands to the backfilling materials and by that, more resource usage for machines (excavator, vibrator, dumpers).
By choice of pipe materials reference is made to the described advantages/disadvantages which the trade organisations state in their brochures and catalogues.

Water-, district-heating- and gaspipes

As by sewage pipes, only the man hour usage is stated in the following.

Water pipes	**mh/r.m. pipe**
Ø 75 PVC	0,10
Ø 160 -	0,15
Ø 250 -	0,20
District heating pipes	
2 * Ø 48/110 preisol. steel	0,30
2 * Ø 114/200 -	0,60
2 * Ø 355/500 -	2,00
Gas pipes	
Ø 40 PEM	0,10
Ø 90 -	0,20
Ø 200 -	0,30

Relining

Services regarding stocking lining of pipes are stated. In top of the stated manhours, 1 operator in the servicevihicle should be added. Junction openings are excl. Cracking and other methods must be assessed individually.

Dimension of pipe	**mh/r.m. pipe**
Ø 200 – Ø 300	0,1
Ø 400 – Ø 600	0,2
Ø 700 – Ø 1000	0,4
Ø 1200	0,6

Cross-under drilling, tunnel boring etc.

These specific services have to be calculated separately in the individual case.

4. Foundation works

Some performance datas for planning of foundations works are stated in the following tables. The datas should be used carefully because circumstances regarding the work, incl. conditions of the soil, can be difficult to determine. When these numbers are used, they have to be adjusted to the actual work- and soilconditions.

Work description	**Time usage**	**Manning incl. machine-operator**
Setting up pile driver from arrival on flatbed truck until it is ready for ramming:		
- big pile driver	4 hours	2 men
- small pile driver	2 hours	2 men
Ramming of concretepiles:		
- in hard soil	10-15 m/hour	2 men
- in ordinary soil	15-25 m/hour	2 men
- in light soil	25-35 m/hour	2 men
The problems by ramming on water correspond to the easier "ramming work" through water		
Coupling of piles	5 min.	2 men
Foundation with minipiles:		
- setting up	3 hours	2 men
- downpressing e.g. hours/m.	2-4 m/hour	2 men
Ramming of sheet piling:		
- in hard soil	6-10 m^2/hour	3 men
- in ordinary soil	11-18 m^2/hour	3 men
- in light soil	19-25 m^2/hour	3 men

Work description	**Time usage**	**Manning incl. machine-operator**
Vibration of sheet piling: - in hard soil - in ordinary soil - in light soil	 8-12 m^2/hour 13-24 m^2/hour 25-36 m^2/hour	 3 men 3 men 3 men
Downpressing of sheet piling: - in hard soil - in ordinary soil - in light soil	 3-6 m^2/hour 7-8 m^2/hour 9-20 m^2/hour	 3 men 3 men 3 men
Predrilling of sheet piling and piles:	15 min. per pile of 10 m	2 men
Taking up sheet piling: - in hard soil - in ordinary soil - in light soil	 8-12 m^2/hour 13-24 m^2/hour 25-40 m^2/hour	 3 men 3 men 3 men
Establishment of copenhagen sheet piling: With steelprofiles and filler plates/ Planks	1-2 hours/m^2	1 man
Taking up copenhagen sheet piling: With steelprofiles and filler plates/ Planks	1-2 hours/m^2	1 man
Establishment of traction on sheet piling Incl. joints.	2-3 hours/r.m.	1 man
Establishment of shoring of sheet piling walls on excavation side:	2-3 hours/r.m.	1 man
Establishment of shoring of sheet piling walls with anchors:	1-3 hours/anchor	2 men
Drilled piles. Setting up equipment: - for big piles (diameter more than 100 cm) - for medium and small piles (diameter between 1 m and 30 cm).	 3-6 days 1-2 days	 3 men 2 men

Work description	Time usage	Manning incl. machine-operator
Drilled piles. Drilling incl. casting of concrete but without transport of excavated soil:		
- of big piles (diameter more than 100 cm	2 m/hour	3 men
- of medium piles (diameter between 1 m and 30 cm)	6-12 m/hour	2 men
Establishment of suction pipe plant:		
- with 20 suction pipes	2-3 hours	2 men
- with 40 suction pipes	3-4 hours	2 men
- with 60 suction pipes	5-6 hours	2 men
Establishment of wet well:		
- setting up	1 hour	2 men
- establishment of well	0,5 r.m./hour	2 men
Establishment of filterdrilling:		
- setting up	1 hour	2 men
- establishment of filterdrilling	4 r.m./hour	2 men
Cutting of concretepiles:		
- 20 x 20 cm and 25 x 25 cm	15 min./pile	1 man
- 30 x 30 cm, 35 x 35 and 40 x 40 cm	20 min./pile	1 man
Execution of slitwalls:		
- setting up	10 days	4-5 men
- excavation/production	50-70 m^2/day	4-5 men

Soilwork in connection to foundation-work is planned based on performance datas for the machines, which are used to solve the specific assignment, see [Civil Works Technique 1, 2004].handsoil are dealed with in chapter 3 of this appendix.

5. Concretework

The following services are incl. making ready, cleaning and vibration. The crane operator is not included by casting with crane. It is anticipated that the concrete are delivered on site, but by pumping concrete, operation of pumping plant are calculated separately. Operation of mobile pumps and conveyor belts from the concretesupplier, are included in the price.
If deliverysilo are used for temporary storage, the manning of this has to be included and with own mixing plant, the manning of this should be included as well.

Blinding layer

mh/m^2	
Casting of blinding layer	0,07-0,15

Foundations

mh/m^3	**Width of foundation 250 mm**	**Width of foundation 500 mm**
Casting with crane	1,0	0,7
Casting with pump	0,5	0,4
Casting with conveyor belt	0,7	0,4

The volume of the work is anticipated to be 200 m^3. by 25 m^3, add 17%.

Walls

mh/m^3	**Width of wall 150 mm**	**Width of wall 250 mm**
Casting with crane 500 l. bucket	0,6	0,47
Casting with crane 750 l. bucket	0,45	0,37
Casting with pump	0,45	0,30
Casting with conveyor belt	0,45	0,30

The volume of the work is anticipated to be 1500 m^3. by 200 m^3, add 17%.

5. Concretework

Beams

mh/m^3	**Width of beam 150 mm**	**Width of beam 500 mm**
Casting with crane	0,9	0,5

The volume of the work is anticipated to be 200 m^3. by 25 m^3, add 17%.

Columns

mh/m^3	**Circumference 1,2 m**	**Circumference 1,8 m**	**Circumference 2,4 m**
Casting with crane	2,1	1,3	0,8

The volume of the work is anticipated to be 200 m^3. by 25 m^3, add 17%.

Storey partition rough casting

mh/m^3	**Thickness of storey partition 160 mm**	**Thickness of storey partition 250 mm**
Casting with crane 500 l. bucket	0,44	0,37
Casting with crane 750 l. bucket	0,33	0,28
Casting with pump	0,21	0,21
Casting with conveyor belt	0,30	0,30

The volume of the work is anticipated to be 2000 m^3. by 250 m^3, add 17%.

5. Concretework

Subfloor (blinding)

Guiding time usage for determination of fixed time/unit

Thickness of Concrete mm	**Basictime min./m²**		
	Workteam 3 men	Workteam 4 men	Cleaning handtools, silo and cranebucket
50	2,6	3,5	
80 or 100	2,3	3,2	42 min./time
Addition for craneoperator	31%	23%	--
Laying out pvc min./m²			0,4
Brush surface with broom min./m²			0,6

Basictime is excluded recesses, stirrups etc.
Basictime is valid for bucketsizes from 400 liter up to 750 liter.

Concretefloor 150 mm

Guiding time usage for determination of fixed time/unit

Width in m/ per casting lane	**Basistime min/m²**			**min/m² surface**	
	Concrete direct from concretetruck	Concrete with dumper	Concrete direct with pump	machine finishing	Vacuum-treatment
0,5	8,7	10,5		9,9	
1	7,3	8,8		8,2	5,5
2	5,5	6,6		5,6	
3	4,4	5,3		3,8	
4	3,7	4,4			
5	3,2	3,8	4,1	3,5	
6	2,8	3,3			
7	2,5	3,0			2,2
Setting up and taking down guiding rails 7,0 min/r.m.					

5. Concretework

Problems at sides, columns and external wall 1,9 min/r.m.
Polystyrene at columns and external wall 1,8 min/r.m.
Laying out mesh wire 0,7 min/m^2
Cleaning handtool, vibrator and concrete surface finisher 42,0 min/time

Work volume is anticipated to 4000 m^2. By casting with dumper the operator is included. Basictimes for widths of casting lane, between the mentioned, are calculated proportional. The basictime is excluded recesses, insulationmaterial etc. The basictime for concrete with dumper is included operator of dumper and transportlength until 10 m.
The stated basictimes are per workteam.

Laying out plastering layer

Guiding time usage for determination of fixed time/unit

Average Size of room In m^2	**Basictime min/m^2**		Insulationplates Min/m^2
	Transport-length until 75 m		
	With motortrailer	With wheelbarrow	
10-20	14	15	1,6
20-100	13	14	1,2
Mix concrete (100 liter mixer manual) 4,7 min/m^2			
Mix concrete (300 liter mixer with lift) 4,7 min/m^2			
Cleaning handtool, mixer and transportequipment 45 min/time			

Work volume is anticipated to be 1000 m^2. Basictime are valid for straigth floor, with thickness from 50 to 70 mm. The basictime is excluded reinforcement, drain, recesses etc.
The stated basictimes are per workteam.

5. Concretework

Stairs

mh/m^3	
Casting with crane	1,5

Work volume is anticipated to 100 m^3. By 25 m^{3,} add 17%.
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Concretetransport

Mh/m^3	
Wheelbarrow 30 m	0,6
Dumpers 30 m	0,15

Final repair ready for painting

mh/m^2	
After woodboard formwork	0,15
After plywood formwork	0,11

6. Formwork

Unless stated otherwise, the services include: setting up, taking down, cleaning and greasing.

Where there is a marking with a NB, the times are for single dwelling, at more complicated constructions, the durations are increased up to 50%.

Stripfoundations max. height 0,4 m, traditional formwork

mh/m²	**Traditional formwork**
Workvolume 100 m2	0,5
Workvolume 1000 m2	0,4

Walls max. height 3,25 m

mh/m²	**Traditional formwork***	**Element formwork**
Work volume 400 m²	1,0	0,7
Work volume 3000 m²	0,85	0,6

* By one side formwork, the durations should be increased by 40%

mh/m²	**Form element system 5 m² elements**	**Form element system 15 m² elements**
Work volume 1000 m²	0,38	0,26
Work volume 10000 m²	0,26	0,18

mh/m²	**Climbing formwork 5 m² elements**	**Climbing formwork 15 m² elements**
Workvolume 1000 m²	0,40	0,30
Workvolume 4000 m²	0,30	0,22

6. Formwork

Columns max. height 3,25 m, traditional formwork

mh/m2	**Length of side 200*200**	**Length of side 800*800**
Work volume 30 m^2	2,0	1,2
Work volume 200 m^2	1,7	1,0

By using pre-fabricated form plates, the working time is decreased by 30%

Columns form element system

Mh/m^2	**square**	**Round**
Work volume 30 pcs	2,3	3,3
Work volume 100 pcs	2,0	2,8

That means that the working time is not dependant of the number of m^2/column

Prefabricated form plates, form elements, recess boxes etc.

mh/m^2	**fabrication**
Prefabricated form plates	0,15
form elements 1,5 m^2/pcs	0,30
form elements 3,0 m^2/pcs	0,22

mh/pcs	**fabrication**	**Mounting**
Recess boxes Perimeter 0,6 m	0,06	0,25
Recess boxes Perimeter 1,5 m	0,10	
Recess boxes Perimeter 3,0 m	0,24	
Inserts, nail block etc.		0,09

6. Formwork

Beam form traditional

mh/m²	**Work volume 50 m²**	**Work volume 400 m²**
2,8 m above ground level	1,4	1,2

By using pre-fabricated form plates, the working time is decreased by 30%

Deck form deckthickness 180-300 mm

mh/m²	**Work volume 400 m²**	**Work volume 3000 m²**
Traditional 2,8 m above ground level	0,8	0,7
Traditional 2,8 m above ground level	1,2	1,0
System girders 2,8-4,0 m	0,7	0,6

Deck form with shutter trestle

Mh/m²	**Work volume 1.000 m²**	**Work volume 10.000 m²**	**making-up**
shutter trestle 15 m²	0,36	0,24	10 mh/pcs
shutter trestle 30 m²	0,25	0,17	15 mh/pcs

By using heat insulation an addition of 0,16 mh/m² is needed

Buttom up formwork stair landing traditional formwork

mh/m²	**Work volume 15 m²**	**Work volume 100 m²**
	1,0	0,9

6. Formwork

Step formwork stair flight traditional formwork

mh/m²	**Work volume 15 steps**	**Work volume 100 steps**
stair width 1,2-1,5 m	1,5	1,3

By sideformwork an addition of 0,25 mh/step/side is needed
By twisted stair flight an addition of 1,4 mh/step is needed

Kupoldeck[1]

mh/m²	**Deckheight in meter**			
	2,8	3,5	4,0	5,0
K20-K30	0,30	0,33	0,40	0,56
K40-K50	0,33	0,35	0,42	0,60

The work volume is anticipated to be 3000 m². By 300 m² add 18%

Filigree-elements

mh/m²	0,10

The service consists of: Mounting, joint-reinforcing, jointing, setting up- and taking down support.

[1] Kupoldeck is a cross-ribdeckconstruction where the dead load is reduced by using recesses. The recesses are made by self-carrying plastic kupoles which are functioning as formwork during the casting and later taken out again.

7. Reinforcing

Crane or other lifting equipment for transport and cutting- and bending machine, are anticipated to be available in the following activities.
By manual transport add 1 mh/t/25 m transportdistance. (t=tons=1000 kg)

Cutting and bending

mh/t	Cutting	Bending
8-10 mm	6,0	8,5
12 mm	4,5	12
16-25 mm	2,5	12,5

The work volume is anticipated to 200 t, by 25 t add 25%
By manual cutting (up to 12) add 30%
By manual bending add 50%

Walls steel fixing on the spot

kg/m^2	mh/t	kg/m^2	mh/t	kg/m^2	mh/t
5	26	11	19	18	15
7	23	13	18	22	14
9	21	15	17	26	13

The work volume is anticipated to 5000 m^2, by 500 m^2 add 25%. Normal weight of reinforcing for single-reinforced walls is 5 kg/m^2, for double reinforced walls 12 kg/m^2.

Deck steel fixing on the spot, reinforcing in top- and bottom side

kg/m^2	mh/t	kg/m^2	mh/t	kg/m^2	mh/t
5	28	12	14	45	8
7	20	22	11		
9	17	35	9		

The work volume is anticipated to 13000 m^2, by 1500 m^2 add 25%. Kg/m^2 is calculated for each side.

7. Reinforcing

Slab pre-fixed (or welded) mesh wire in the bottomside

kg/m^2	mh/t	kg/m^2	mh/t	kg/m^2	mh/t
2	24	4	15	10	9
3	19	5	13	12	8

The work volume is anticipated to 13000 m^2, by 1500 m^2 add 25%
Normal quantity of reinforcing for a house is 4-5 kg/m^2

Slab pre-fixed (or welded) mesh wire in the bottomside and steel fixing on the spot of top side reinforcing

kg/m^2	mh/t	kg/m^2	mh/t	kg/m^2	mh/t
5	15	8	13	20	10
6	14	11	12		

The work volume is anticipated to 13000 m^2, by 1500 m^2 add 25%

Beams and columns steel fixed on the spot

kg/m	mh/t	kg/m	mh/t	kg/m	mh/t
5	15	8	13	20	10
6	14	11	12		

The work volume is anticipated to 1000 m, by 125 m add 25%

Beams and columns steel fixture of pre-fabricated units

kg/m	mh/t	kg/m	mh/t
5	0,19	25	0,50
15	0,28	50	0,90

The work volume is anticipated to 1000 m, by 125 m add 25%

7. Reinforcing

Beams and columns mounting of units in formwork

kg/m²	**mh/t**	**kg/m²**	**mh/t**	**kg/m²**	**mh/t**
25	0,26	100	0,41	400	0,90
50	0,33	200	0,55		

The work volume is anticipated to 100 pcs, by 10 pcs add 25%

Stairs and ramps steel fixed on the spot

kg/m²	**mh/t**	**kg/m²**	**mh/t**	**kg/m²**	**mh/t**
9	35	15	20	30	10
10	29	17	18		
13	23	21	14		

The work volume is anticipated to 100 m²., by 10 m² add 25%
Normal weight of construction is 13 kg/m²

8. Mounting of elements

Unless others are mentioned, the mounting is executed by crane, and the crane operator is not included in the durations. Following symbols are used:

T= transport of elements to intermediate bunker
M= Mounting, coupling, support and adjustment of the elements
F= Jointing e.g. casting out the joints with concrete incl. reinforcing or stopping by mineralwool along the sides
U= reconditioning of internal damages

Slab-elements of wood

Size of element	T	M
4 m^2	0,1 mh/pcs	0,26 mh/pcs
8 m^2	0,1 mh/pcs	0,30 mh/pcs
16 m^2	0,2 mh/pcs	0,37 mh/pcs

The work volume is anticipated to 800 pcs, By 100 pcs add 24%

Slab-elements of wood manual mounting

Size of element	T	M
4 m^2	0,1 mh/pcs	0,23 mh/pcs
8 m^2	0,1 mh/pcs	0,46 mh/pcs

The work volume is anticipated to 800 pcs, By 100 pcs add 24%

Slab-elements of concrete

Size of the element	T	M	J
2 m²	0, 09 mh/ pcs	0, 14 mh/ pcs	0, 10 mh/ pcs
4 m²	0, 12 mh/ pcs	O, 17 mh/ pcs	0,17 mh/ pcs
6 m²	0,16 mh/ pcs	0,20 mh/ pcs	0, 24 mh/ pcs
8 m²	0, 20 mh/ pcs	0,22 mh/ pcs	0,32 mh/ pcs
10 m²	0,23 mh/ pcs	O,25 mh/ pcs	0,39 mh/ pcs

The work volume is anticipated to 5000 pcs, by 700 pcs, add 24%

8. Mounting of elements

Slab-elements of light weight concrete

Length of element	T	M	J
until 4 m	0 ,09 mh/ pcs	0,15 mh/ pcs	0, 07 mh/ pcs
more than 4 m	0, 09 mh/ pcs	0,16 mh/ pcs	0, 10 mh/ pcs

The work volume is anticipated to 2000 pcs, by 250 pcs, add 24%

Roof elements of light concrete

Length of elements	T	M	J
Length up to 4,5 m	0,07 mh/pcs	0,20 mh/p	0,10 mh/pcs
Length more than 4,5	0,07 mh/pcs	0,25 mh/pcs	0, 14 mh/pcs

The work volume is anticipated to 2000 pcs, by 250 pcs, add 24%

External walls of wood manual mounting incl. inferior purlin, one family houses

Size of the element	T	M
1,5 m^2	0,11 mh/ pcs	0,27 mh/ pcs
2,5 m^2	0,12 mh/ pcs	0,36 mh/ pcs
5,0 m^2	0,15 mh/ pcs	0,80 mh/ pcs
7,5 m^2	0,19 mh/ pcs	0,80 mh/ pcs

The work volume is anticipated to 2500 pcs, by 250 pcs, add 24%

External walls of wood manual mounting by crane

Size of the element	T	M	F
6 m^2	0,20 mh/ pcs	1,20 mh/ pcs	0,40 mh/ pcs
9 m^2	0,20 mh/ pcs	1,30 mh/ pcs	0,50 mh/ pcs
12 m^2	0,20 mh/ pcs	1,50 mh/ pcs	0,60 mh/ pcs
15 m^2	0,20 mh/ pcs	1,70 mh/ pcs	0,70 mh/ pcs

The work volume is anticipated to 1000 pcs, by 100 pcs, add 27%
The durations are valid for simple construction of dwellings. By industrial houses add 20%

8. Mounting of elements

Internal walls of concrete

Size of element	**T**	**M**	**J**
2,5 m²	0,15 mh/ pcs	0,60 mh/ pcs	0,50 mh/ pcs

The work volume is anticipated to 3000 pcs, by 500 pcs, add 21%

External walls of concrete

Type	**T**	**M**	**F**
External wall 7 m²	0,19 mh/ pcs	1,0 mh/ pcs	0,38 mh/ pcs
Parapet 4 m²	0,19 mh/ pcs	1,0 mh/ pcs	0,38 mh/ pcs
Gablecovering 5 m²	0,19 mh/ pcs	1,0 mh/ pcs	0,20 mh/ pcs
Sandwichelement 7 m²	0,19 mh/ pcs	1,0 mh/ pcs	0,55 mh/ pcs
Sandwich (parapet)	0,19 mh/ pcs	1,0 mh/ pcs	0,90 mh/ pcs

The work volume is anticipated to 3000 pcs, by 500 pcs, add 21%
The durations are valid for simple construction of dwellings. By one-family houses and industrial houses add 20%

In- and external walls of light concrete (erected by crane)

Type of elements	**T**	**M**	**F+ U**
Vertical B = 0,60 m	0,10 mh/pcs	0,35 mh/pcs	0,09 mh/pcs
Horizontal H = 0,60	0,15 mh/pcs	0,60 mh/pcs	0,60 mh/pcs
Parapet	0,18 mh/pcs	1,20 mh/pcs	1,15 mh/pcs
Bigelements < 0,15 m	0,20 mh/pcs	1,00 mh/pcs	1,00 mh/pcs
Bigelements > 0,15 m	0,20 mh/pcs	1,20 mh/pcs	1,20 mh/pcs

The work volume is anticipated to 4000 pcs, by 500 pcs, add 24%

Beams and columns

Type of element	**T**	**M**	**J**
Beam l = 4,75 m	0, 18 mh/pcs	0,57 mh/pcs	0,13 mh/pcs
Column l = 2,75 m	0,12 mh/pcs	0,90 mh/pcs	0,10 mh/pcs

The work volume is anticipated to 150 pcs, by 25 pcs, add 21%

8. Mounting of elements

Ventilation- garbage chute

T	M	F
0,20 mh/pcs	0,80 mh/pcs	0,20 mh/pcs

Stairselements

Type of element	T	M	J
Straigth flight	0,20 mh/pcs	0,80 mh/pcs	0, 60 mh/pcs
Curved flight	0,20 mh/pcs	1,05 mh/pcs	0, 60 mh/pcs
Steps in form	0,15,mh/pcs	0,48 mh/pcs	0, 12 mh/pcs
Loose steps	0,06 mh/pcs	0,48 mh/pcs	0,12.mh/pcs

Mounting durations (cranehours) widespan building

Type of element	Mounting time
Columns	15 – 20 min. min/ pcs
Beams	10 min/ pcs
Wallelements	15 min / pcs
Hollowcore slab	8 min / pcs
Roofplates	15 min/ pcs
Wooden cassettes 1. Hoisting by crane to the roof (in bundles) 2. distribution and tigthening (without crane)	 1,5 min / pcs 10 min / pcs

9 Various works

9.1 Masonry work

Bricking up brick and limestone normal size

mh/m²	¼-stone	½-stone	1-stone	1½-stone
Making of mortar	0,03	0,05	0,12	0,21
Transport	0,16	0,17	0,29	0,42
Wall prepared for plastering	0,41	0,42	0,55	0,68
Wall prepared for jointing	0,51	0,53	0,71	0,87
Jointing simultaneous with laying of masonry	0,15	0,15	0,15	0,15
Jointing after laying of masonry	0,35	0,35	0,35	0,35
Insulation with mineralwool	0,04	0,04	0,04	0,04

Vertical interruptions are included in the bricking up time and anticipated to 0,2 m/m² wall. By 0,6 m/m² wall, the time should be increased with 10%.
The work volume is anticipated to 3000 m², by 400 m², add 10%

Bricking up gas- and light clinker concrete blocks

mh/m²	t=100 mm	t=200 mm	t=300 mm
Making of mortar	0,02	0,02	0,02
Transport	0,12	0,12	0,12
Setting up	0,24	0,28	0,33
Making ready for painting	0,03	0,03	0,03

Bricking up blocks of concrete

mh/m²	t=100 mm	t=200 mm	t=300 mm
Making of mortar	0,04	0,04	0,04
Transport	0,16	0,16	0,16
Hollow blocks	0,32	0,37	0,46
Massive blocks	0,34	0,39	0,48

The work volume is anticipated to 2000 m², by 200 m², add 28%

9. Various works

Plastering

mh/m²	**External 2 layers treatment more than 6 mm**	**External 3 layers treatment more than 6 mm**
Cleaning and watering	0,07	0,07
Manual plastering (facade)	0,43	0,72
Spray plastering (facade)	0,39	0,56
Manual pastering of plinth	0,67	0,80

1,0 m edge is anticipated per m² wall. By 0,2 m/m² the times are reduced by up to 22%.
The volume of work is anticipated to 5000 m². By 500 m², add 11%.

mh/m²	**Internal manual 1 layers treatment ready for painting**	**Internal manual 2 layers treatment up to 6mm ready for painting**
Cleaning and watering	0,04	0,04
Plastering	0,20	0,23
Cement washing	0,10	0,10

0,5 m edge is anticipated per m² wall. By 0,1 m/m² the times are reduced by up to 15%.
The volume of work is anticipated to 5000 m². By 500 m², add 11%.

mh/m²	**Internal 2 layers treatment more Than 6 mm ready for painting**
Cleaning and watering	0,04
Manual plastering	0,40
Spray plastering	0,28

0,5 m edge is anticipated per m² wall. By 0,1 m/m² the times are reduced by up to 20%.
The volume of work is anticipated to 5000 m². By 500 m², add 11%.

Cement washing

Cement washing of basement wall 1 time	0,07 mh/m²

The volume of work is anticipated to 500 m². By 50 m², add 11%.

9. Various works

Sprinkle plastering

mh/m^2	Plastering external Sprinkle plastering 1 layer
Cleaning and watering	0,07
Manual	0,11
Machinery	0,08

The volume of work is anticipated to 5000 m^2. By 500 m^2, add 11%.

Tile works

mh/m^2	Tile work included glue
Wall tiles 150 x 150 x 5 mm	1,1
Pin mosaic tile	2,0
Floor tiles 150 x 150 x 10 mm	1,2

9.2 Carpenter work

External walls - light facade pillar frame

mh/m^2	4 m^2	7 m^2	15 m^2
Pillar distance 0,4 m	0,34	0,27	0,22
Pillar distance 0,6 m	0,30	0,23	0,18
Pillar distance 0,9 m	0,26	0,20	0,15

The volume of work is anticipated to 5000 m^2. By 500 m^2, add 27%.

Floors

mh/m^2	Laying out beams
Span less than 4,2 m	0,13
Span 4,2 m	0,12
Span more than 4,2 m	0,11
Allowance for cross shoring	0,14

Distance between beams are anticipated to 0,4 m. by 0,6 m, the time should be decreased with 20%.
The volume of work is anticipated to 5000 m^2. By 500 m^2, add 27%.

Pitched truss – composition and setting up

mh/m^2	7 m^2	12 m^2	17 m^2
Assembling	0,45	0,50	0,55
Setting up manually	0,40	0,55	0,60
Setting up with crane	0,40	0,45	0,50

Cutted materals are anticipated (semi-manufactured).
The volume of work is anticipated to 200 pcs by 25 pcs, add 24%.

Wall covering

mh/m^2	Plates of asbestos cement, Plastic laminate or similar
Setting up pre-drilled plates 1 m^2	0,08
Setting up pre-drilled plates >1 m^2	0,30
Allowance for not drilled plates	0,08
Allowance for fastening of wood frame	0,12
Allowance for fastening on steel frame	0,30
Allowance for contactgluing	0,35
Allowance for narrow plates with height up to 0,4 m	0,10

The volume of work is anticipated to 1000 m^2. By 100 m^2, add 27%.

9. Various works

Roofcovering

mh/m²	Boards and base felt
Boards with tongue and groove	0,12
Form panels	0,10
Base felt	0,06

The volume of work is anticipated to 4000 m². By 500 m², add 24%.

Roofworks

mh/m²	Tiles
Setting up battens	0,06
Transport	0,04
Laying out	0,10
Allowance for grooved tiles	0,02

The volume of work is anticipated to 4000 m². By 500 m², add 24%.

Setting up ceilings

	mh/m²
Boarding (16 and 22 mm)	0,52
Support for suspended ceiling (battens)	0,27
Ceiling plates (8-12 and 15 mm)	0,25
Suspended acustic ceiling included hangers	0,61

Laying of floors

	mh/m²
Joists per 0,60 m on concretebase 63 x 63 mm	0,17
Joists per 0,60 m on concretebase 75 x 75 mm	0,21
Floorboards rough sanded 22 mm	0,26
Parquet floor 22 mm	0,38
Douglas pine plywood with groove and tongue (16 and 19 mm)	0,17
Chipboards with groove and tongue (22 mm)	0,17

Windows and doors

	mh/pcs
Skylights 1,14 x 1,18	2,3
Toplight globe 1,20 x 1,20	2,0
Gate 2,50 x 2,50	12,2
Window 1,20 x 1,20	7,4
Window (factory) 1,20 x 1,20	1,4
External door 1,50 x 2,10	4,0
Internal door 1,00 x 2,10	2,7

Roof covering

	mh/m^2
Asbestos cement waweplates (B5 and B6)	0,23
Asbestos cement slates	0,48
Ridge for waweplates	0,29
Ridge for slates	0,22
Plasticplates (pvc)	0,20
Steelplates (Robertson)	0,67
Aluminium plates	0,23

9.3 Plumbing work

	mh/r.m.
Gutters zink	0,45
Gutters plastic	0,32
Downpipes zink	0,70
Downpipes plastic	0,29

9.4 Laying of floor

	mh/m^2
Linoleum, cork and vinyl	0,16
Carpet	0,20

9.5 Painting work

	mh/m^2
External walls, concrete and plastering washing down, priming and 1+2 time painting	0,26
2 times whitewashing	0,10
Internal wood, priming, sanding, 1+2 times painting	0,18
Ceiling plates, priming, sanding, total fill and 1+2 times painting	0,25
Wallpaper	0,25

9.6 Other works

Setting up insulation

	mh/m^2
Mineralwool	0,07
Woodwool and cork	0,12
Gas concreteblocks t=100-150 mm	0,35
Lecablocks t=100-150 mm	0,45

The volume of work is anticipated to 1000 m^2. By 100 m^2, add 19 %.

Laying out insulation in deck formwork

	mh/m^2
Mineralwool, woodwool, cork, foamplastic	0,025

The volume of work is anticipated to 2000 m$^{2.}$ By 250 m^2, add 17 %.

9. Various works

Jointing

mh/m	10 mm width	15 mm width	25 mm Width
Stopping depth of joint 50 mm	0,025	0,030	0,030
Stopping depth of joint 50 mm – 100 mm	0,025	0,035	0,040
Stopping depth of joint 100 mm – 150 mm	0,025	0,040	0,055
Jointing (1 component)	0,065	0,075	0,100
Jointing (2 components)	0,085	0,100	0,120

The volume of work is anticipated to 5000 m^2. By 500 m^2, add 19 %.

Scaffolding for masonry works

	mh/m^2 covered façade
Steel pipe scaffolding	0,17
Wood scaffolding	0,25

The volume of work is anticipated to 5000 m^2. By 500 m^2, add 27 %.

Scaffolding for plastering-, joining-, repairing- and plate work

	mh/m^2 covered façade
Steel pipe scaffolding	0,12
Wood scaffolding	0,11
Stepladder scaffolding	0,08

The volume of work is anticipated to 5000 m^2. By 500 m^2, add 27 %.

10 Reference to literature

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