



Construction of Steel structures

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historic overview

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round 800 B.C.	the general use of iron
16th-19th century	wrought iron / cast iron (in Europe)
round 1870 A.D.	the first production of modern steel
late 19th century	multi-storey iron structure buildings
early 20th century	the application of tower and mobile cranes in construction

material

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cast iron: iron-carbon alloy with 2,1-3,6 wt% carbon content (used for cast building elements)



wrought iron: in consequence of the fabricating process inhomogeneous iron-carbon alloy (likely to found in 19th century buildings)



modern steel: homogenous iron-carbon alloy with 0,002-2 wt% carbon content

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steel structures

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main categories



hall structures



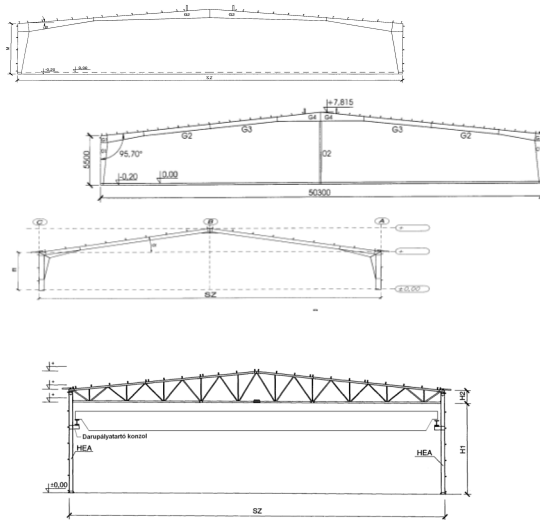
high (multi-storey) buildings

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steel hall structures – static models

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structures with I/H-girders

structures with truss-girders

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basic characteristics

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- prefabricated structural elements
- in situ assembled frame structures
- welded or mounted joints
- relative rapid construction process

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preparatory work phases

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1. Design of the building
2. Preparation of element consignment
3. Planning the transport route
4. Planning the site arrangement
5. Selection of the temporary structures of the assembly
6. Planning the lifting sequence of the elements and the temporary bracing



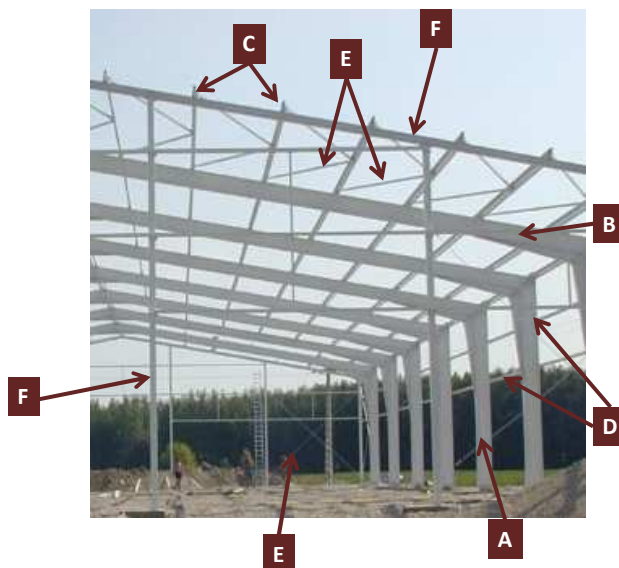
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hierarchy of the structure

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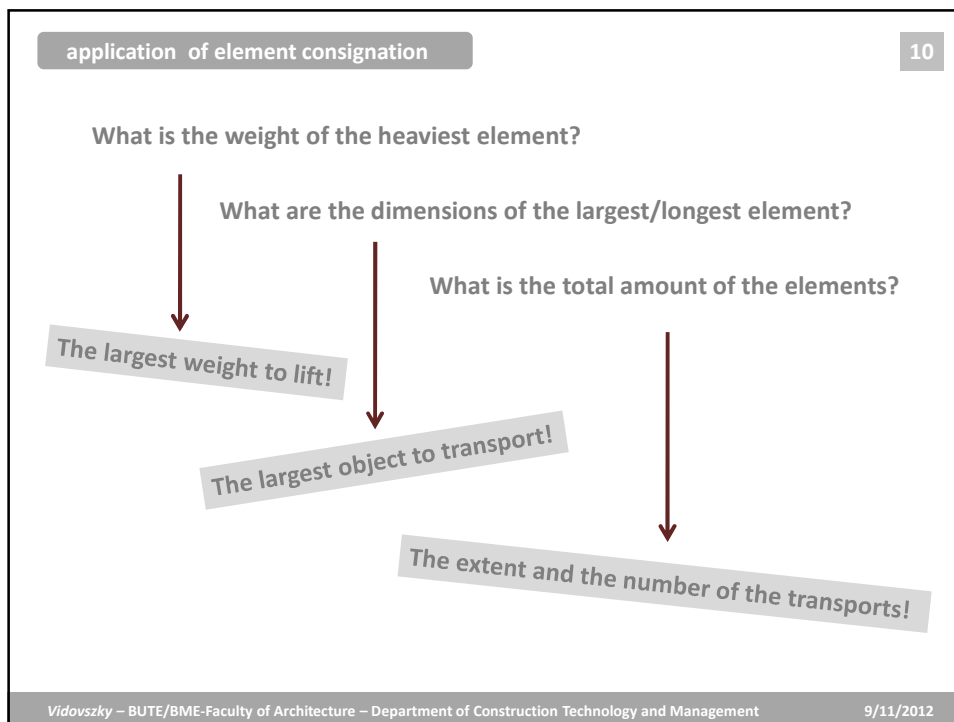
- A. columns/pillars
- B. girder
- C. roof joists
- D. wall studs
- E. bracings
- F. front frame



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element consignment					
9					
	ID	Figure (drawing)	Geometry (mm)	Weight (kg)	Amount
1.	P-001a		4000x500x300	300	2
2.	P-001b		5000x500x300	350	2
3.	G-001		6000x500x300	420	3
...					
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work sequence of the assembly

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1. set up the site (layout)
2. foundation
3. installation of the temporary structures
4. transportation
5. lifting process
6. preparation of the structural joints
7. bracing
8. corrosion protection
9. disassemble temporary structures

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1. Transportation - site logistic

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Organizational questions:

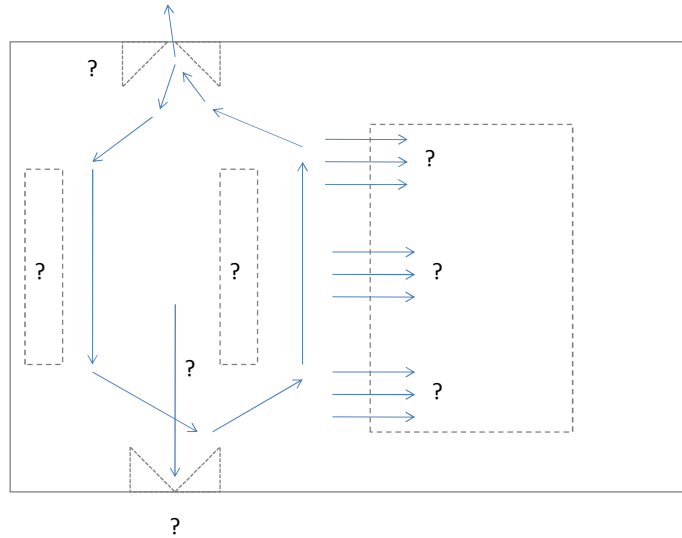
- Do structural elements have to be stored on the side? (Avoid if possible!)
- Is it possible to lift the elements directly from the trailer to their final place or a part of the structure have to be assembled on the ground before lifting?
- How can the shipments enter and leave the site? (Drive routes in case of a long-vehicle)
- What is to be considered as main equipment?

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1. Transportation - site logistic

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1. Transportation - tracks, trailers

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Organizational questions:

- How long trailer is required?
- What is the required load capacity of the trailer?
- What is the maximum vertical extension of the shipment?
- Is route permission required?



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2. Site layout

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Site set up (layout):

- I. preparatory (row) set up – before the foundation is placed
- II. fine set up – mark the exact place of the pillars on the foundation pads

3. Site layout, foundation

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Usual foundation types:

- A. prefab reinforced concrete pad foundation
- B. prefab concrete pad foundation
- C. monolithic concrete pad foundation
- D. composite cases (e.g. monolithic concrete pad + prefab reinforced concrete elements)



4. installing temporary structures

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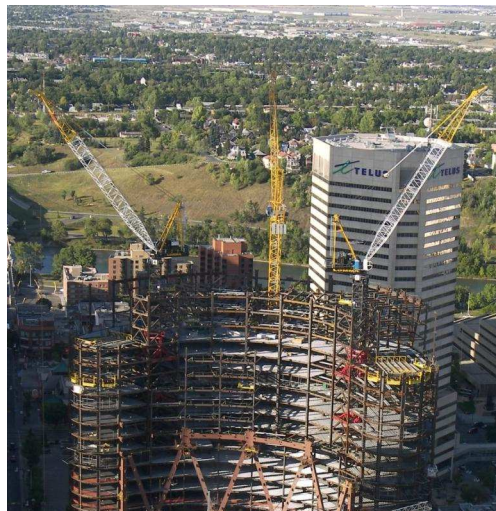
5. lifting

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tower crane:

accustomed application:

above 3 floors



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5. lifting

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mobile crane: optimal in case of relative low building height and huge vertical extension



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5. lifting

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lifting columns/pillars



1. lifting the elements
2. place the elements onto foundation
3. mounting at the joints with screws or wedges
4. setting temporary bracing

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5. lifting

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lifting (truss) girders

1. lifting the elements
2. placement of the elements onto their final place
3. mounting with screws or welding at the joints
4. assemble bracing



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5. preparing structural joints

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- welding
- mounting (with screw)
- temporary
- final



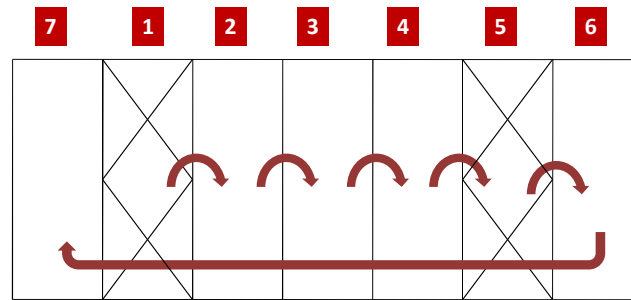
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6. bracing + work sequence

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- rod (for pressure and tension) or cable (for tension only)
- K, V or X shape
- in the predefined places



work sequence

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7. corrosion prevention

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painting of the surface with a painting system:

primer + fire protection layer + cover painting

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8. disassemble of temporary structures

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remove scaffolding / temporary bracings

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equipments

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cranes:

- mobile crane
- tower crane



lifting tools:

- spreader beams
- wire rope slings



rigging tools:

- lifting tounge
- eye bolt
- shackles
- clips
- hooks
- clamps

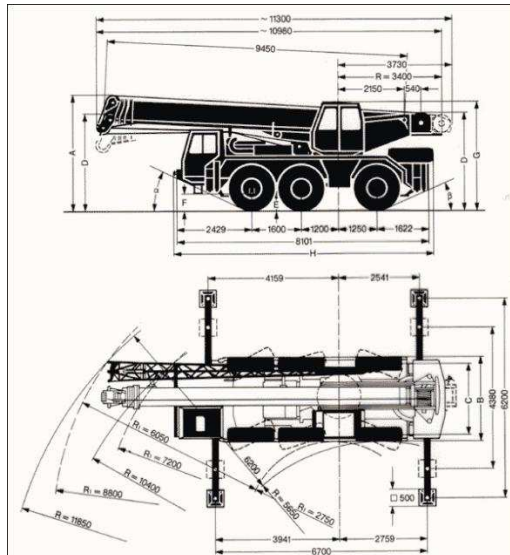


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selection of mobile crane

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selection of mobile crane

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relevant parameters:

1. Lifting heights =

= the level of the final location of the element +

the height of the highest element +

+ the height of the equipment (lifting and rigging tools) +

+ 1m

2. Lifting weight =

= the weight of the heaviest element to lift

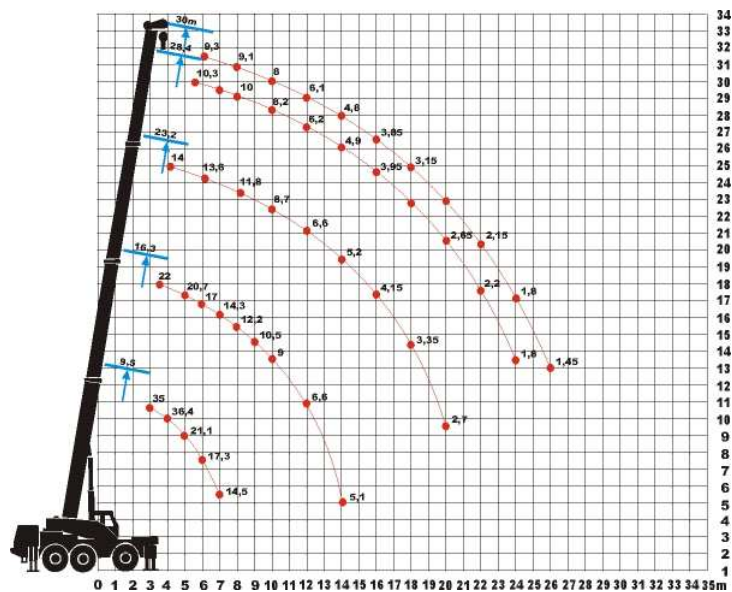


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selection of mobile crane

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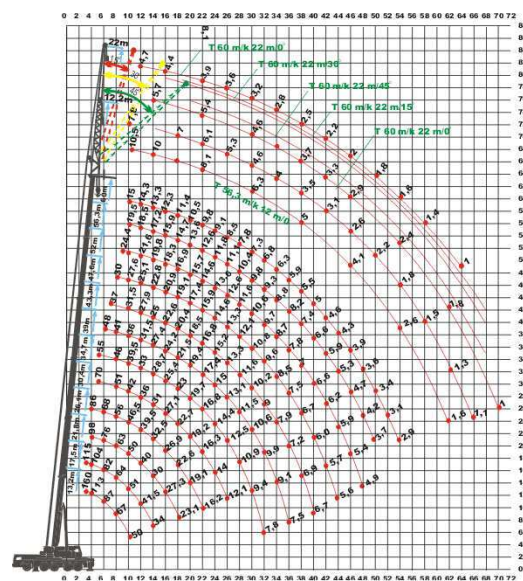
35t

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selection of mobile crane

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160t

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equipments

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temporary structures:

- rolling scaffolding
- lifting platforms



tools

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hand tools: snips, hand seamer, hammer, screw driver, measuring wrench,
hand swagger, wire rope cutter

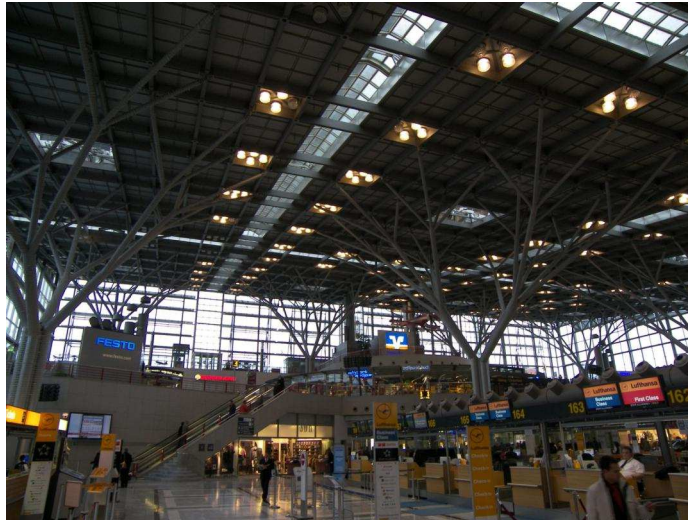
power tools: screw gun, cordless drill, electric shear, angle grinder

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examples

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Airport, Stuttgart, Germany

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examples

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Calgary, Canada

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examples

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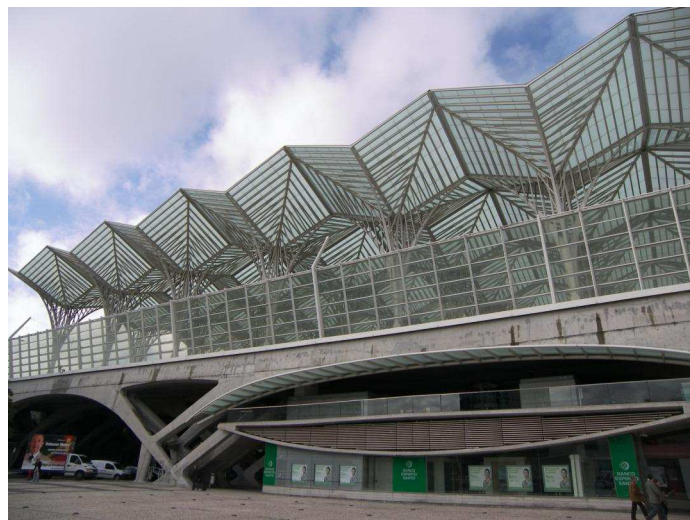
Beijing National Stadium, Peking, China

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examples

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Oriente, Lisbonne, Portugal

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examples

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Divatcsarnok, Budapest, Hungary

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examples

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Street decoration, Calgary, Canada

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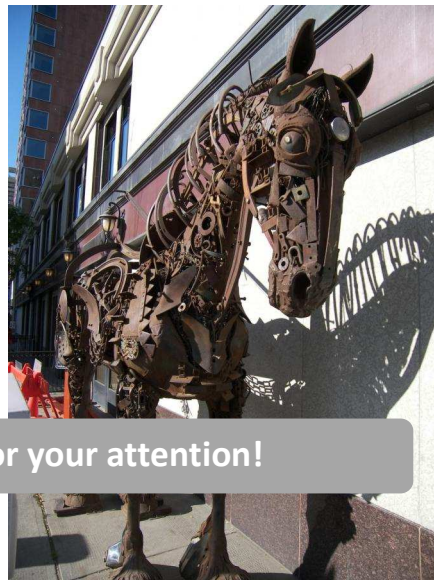
special examples

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References

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