



PERI Construction Exercise

Requirements for the 9th International Competition 2012|2013

Who can participate?

All educational institutions for civil engineering and construction management.

Last date of entry of the exercise is July 31, 2013.

Conditions of Participation

- All educational institutions for civil engineering and construction management can participate.
- PERI staff and their family members cannot participate in the contest.
- Every person that sends in an exercise and therefore participates will receive a certificate. The participants of the top ten groups will receive a certificate with their ranking in the exercise.
- If you have already participated in a previous PERI construction exercise then it is not possible to participate again.
- The work must be based on the given layout. Groups of up to five students are accepted.
- Submitted entries will not be returned as they become the property of PERI which also receives the publication rights by mentioning the name of the authors.
- All entries must be postmarked no later than July 31, 2013.
- An exercise submitted for evaluation must concentrate on the specified tasks only. Working on extra tasks provided by the participants will lead to a downgrading of the exercise.
- For the formwork and scaffolding planning, PERI software (ELPOS or PERI CAD) is to be used whenever suitable. It will be made available to all educational institutions and participants in the form of school-licenses free of charge. The software is for non-commercial use only.
- Time needed to complete the exercise is estimated to be about 75 hours per person (for a team of five), depending on the team's background knowledge. Special value will be placed on a brief and concise presentation of your work.
- The submitted exercise must not exceed 100 pages including all appendices and plans (A4 or letter format, font at least 10 pt, for charts at least font 8 pt). Exceeding the page limit will result in a points deduction in the evaluation.
- The project must be handed in as a printed version (no electronic file). Additional binders or models will not be accepted. Photos of models and computer-animations will not be evaluated.
- Should there be more than one solution for a given exercise, an explanation for the selection of a particular solution should be documented in an easily understandable way. Cross-references are to be given if necessary.
- Please complete the enclosed form with your contact details including full address.
- Additional information for the exercise, e.g. downloadable plans in DWG format, FAQ for the exercise, can be found on the internet at "www.peri.de". Prospects and brochures in PDF format can be found on the CD enclosed. If a printed version is needed it can be ordered from our website "www.peri.de".
- The exercise may be completed in English or German whereby preference will not be given in the evaluation.
- The exercise is based on European and German standards and may be modified or replaced by the respective standards of other countries. Please give a short explanation if this is the case, and include a copy of the standards being used.

- PERI GmbH is responsible for the organization and realization of this construction exercise. For this purpose, we also store personal data electronically on suitable data media. In this connection, PERI GmbH guarantees compliance with all relevant data protection regulations. Through your participation in the construction exercise, you agree to this provision.
- The judges' decision is final.

Information on PERI Software:

- PERI programs available for the formwork planning are **ELPOS** and **PERI CAD**.
- Please decide which software you want to use for the exercise. Your choice of software will not be evaluated. We will be pleased to answer questions concerning the use of PERI software. However, we will not accept any questions related to insufficient CAD knowledge, or offer ELPOS or PERI CAD training in the context of the construction exercise.
- **ELPOS** is faster and easier to use but only offers less professional drawings. **ELPOS cannot be installed** in addition to another Autodesk product on the same computer.
- **PERI CAD** is an extension of AutoCAD Architecture by Autodesk. This means you must own a licensed AutoCAD version. You can get according free-of-charge Autodesk Architecture licenses at www.autodesk.com/edcommunity or www.autodesk.de. For PERI CAD, you should have AutoCAD knowledge and be aware that a longer period of familiarization is necessary.

The current PERI CAD 19 is available for Architecture 2012. Earlier Autodesk Architecture products are not supported. Should you own earlier Autodesk Architecture products, please contact us so that we can make the suitable version of PERI CAD available to you.
- **ELPOS and PERI CAD cannot be installed together on one PC!**
- **Note: You can find the according system requirements for ELPOS or PERI CAD at <http://www.peri.de/ww/de/produkte/service/software.cfm> .**

How to order or license PERI Software:

For ordering or licensing the software without cost, please send the following information to **angelika.hoff@peri.de** :

- Remark that you are participating in the PERI Construction Exercise
- Matriculation certification or a copy of your student ID
- Contact telephone number

If licensing **ELPOS**, please add:

- Request code

In addition, for the ordering and licensing of **PERI CAD**:

- Postal address
- Specification concerning the existing Architecture version

Only then will you receive the PERI price list which is necessary for the exercise. For this reason, we have to know that you are going to participate in the PERI construction exercise.

Project Information

- A consortium of companies will carry out the construction work. An agreement has been reached that all required equipment will be rented. The equipment costs should be acquired from the register of construction equipment (without surcharges). Formwork material is exempt from this, its rental rates are given in the task.
- A sub-contractor will do the reinforcement work.
- The time to complete the concrete shell is maximum 20 weeks. The average working time per week is 40 hours. All excavation and drainage work will be done by sub-contractors. It has been agreed to allow a 3-week period for the excavation and drainage of the building site. This adds up to a total construction time for building site set-up, excavation, drainage and structural work of 23 weeks.
- Missing information must be carefully selected (by shortly indicating the reasons) and/ or should be taken from appropriate specialist literature (including the source).
- The exercise is based on a real project that has actually been completed. The geometry of the building and the basic conditions have been modified to simplify the exercise and reduce the time to be invested. Thus, it no longer corresponds with the demands of the actual building (e.g. sewers, drainage, etc.).
- Printouts from bidding or invoicing programs will not be accepted in Task 2 "Bid Documents". Construction drawings or implementation plans should be drawn only if these have been explicitly requested.
- Wall heights are to be taken from the section drawings.
- The supporting walls to the adjacent buildings only have to be taken into consideration for the construction site set-up plan.
- The public pedestrian underpass has an unlimited load-bearing capacity and can be used for the planning of the construction site set-up.
- The top ground surface can be taken from the elevation levels. The highest ground water level is -5.20m. This level will remain the entire time during the construction of the building. The present ground composition consists of 15cm top soil and below that a mix of gravel and sand down to a level of -8.00m. For all other details of the ground composition, you will make an assumption and take it into consideration for all the tasks carried out.

The Tasks

1. Construction site set-up

- 1.1. Determine the necessary parameters.
- 1.2. Choose all necessary equipment items.
- 1.3. Draw a plan of the construction site setup.

2. Bid documents for concrete and reinforcement work

- 2.1. Create a list with all positions titled concrete and reinforced concrete work with hourly estimates and material costs with reference statements.
- 2.2. Create a list of specifications for the concrete and the reinforced concrete work.

3. Choice of procedure / calculation

- 3.1. Comparison of wall formwork systems:
TRIO 270 - MAXIMO 270
- 3.2. Comparison of slab formwork systems:
MULTIFLEX - SKYDECK

4. Formwork solutions

- 4.1. Create all necessary formwork solutions for the walls with the formwork system TRIO 270 (left side of the building) and MAXIMO 270 (right side of the building).
- 4.2. Create all necessary formwork solutions for the slabs with the preferred formwork system from your solution in Chapter 3.2 Choice of procedure/ calculation.

5. Details of construction implementation

- 5.1. Create a solution for a central waste storage room (about 18 m²). Make sure that it is easily accessible.
- 5.2. Plan a ground and wall structure of the waste storage room. Make a sketch and give reasons for your solution.
- 5.3. Create different options of wall fastenings for the stair landings. Give reasons for your choice.

6. Construction development plan

- 6.1. Create a rough draft.
- 6.2. Create a detailed plan for the first floor [British English: ground floor] of the office building.

1. Construction site set-up

General information details should be taken into consideration.

1.1 Determine the parameters that are necessary.

1. Determine the amount of personnel required.
2. Determine the amount of cranes needed.
3. Determine range, lifting capacity and hook height.
4. Describe and explain the positions of the cranes.
5. Dimension the needed storage area.
6. Create the site traffic logistics including entrance and exit.
7. Dimension the required containers.
8. Select a method for water drainage when necessary and its lining. Describe it with a few words and a sketch.
9. Consider all other important elements for your construction site set-up plan. Selection of other equipment, as well as site equipment, may be decided according to on-site needs as long as the rules are being observed. Reasons for selections must be given. The basis here should be applicable registers of construction equipment and/or current information from the equipment manufacturer. It is important to pay attention to economic principles.

1.2 Select all other equipment elements required.

Create a complete material list, including all required information, all pieces of equipment for your construction site.

1.3 Draw a construction site set-up plan with all necessary elements.

Boundary construction site conditions:

- Half of the public sidewalk can be used during the set-up of the site.
- The neighbouring plots on the north, east and west sides are not at your disposal.
- The main street can be used for loading or unloading vehicles.
- The main street must not be blocked permanently.
- The public pedestrian underpass can be used for the construction process.
- The access to the rear part of the construction site can be fully used.

2. Bid documentation

The bid details should show a precise performance description and have the same calculation basis. The items must be compiled in separate production cost statement. All other work has to be calculated using separate positions. "Forming" and "Concreting" have to be shown separately.

All walls and columns are to be produced with a standard concrete finish. All the reinforced concrete walls must be made with C30/37 and BSt 500 concrete when they are not noted differently in the plans. All the reinforced concrete slabs must be made with C30/37 and BSt 500 concrete when they are not noted differently in the plans.

Steel percentage for the various applications:

Application	Steel: kg per m ³ concrete
Walls	100
Slabs	150
Columns	200
Bottom plate and foundations	80

2.1 Create a list with volumes, material costs and working time for all positions.

Volumes for the items in the bid are to be calculated without too many details according to the simplified values in the drawings. Calculation of volumes is not to be included in the work. Please specify your sources.

2.2 Create the bid.

Preliminary remarks have to be kept to a minimum.

3. Choice of procedure / calculation

Unit costs of the slab and wall formwork must be compared on a total cost basis. The following values are to be used:

Rental rates for formwork:

- Basic costs	one-off 5.0 %
- Rental costs	4.5 % per month

Striking times:

- for MULTIFLEX	14 days
- for SKYDECK panels and beams	2 days
- for SKYDECK re-shoring	14 days
- for wall and column forms	36 hours

Recycling costs:

- Plywood	255 € per ton
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Material costs:

- new plywood	15 € per m ²
- number of reuses	20-30
- cut out plywood waste	10 %

Average wage rate: 32.50 € per hour

Calc. values* (per m² forming area):

- slab forming with MULTIFLEX GT24 / GT24	0.50 h/m ²
- slab forming with SKYDECK	0.30 h/m ²
- forming of rest areas SKYDECK	1.00 h/m ²
- wall forming with TRIO 270	0.40 h/m ²
- wall forming with TRIO 270 stacked incl. stacking	0.55 h/m ²
- wall forming with MAXIMO 270	0.35 h/m ²
- wall forming with MAXIMO 270 stacked incl. stacking	0.45 h/m ²

* (Figures drawn from past experience of a medium-size construction company that take the distinctive features of this building into consideration)

The formwork expenditure is divided into shuttering and striking with a ratio 2/3 shuttering and 1/3 striking of the given values.

Due to the similarity of the distances between the construction site and the construction company yard as well as the construction site and the rental warehouse, the construction companies have agreed to the following transport costs:

Transport costs (one way):	- machines up to 4 tons	25 € / ton
	- large machines over 4 tons	750 € / machine

For comparison purposes, the required areas should be reasonably formed with PERI software if at all possible.

Please indicate which software (PERI CAD, ELPOS, CAD etc.) you used to solve the task.

The construction company is planning to buy new wall formwork. Therefore they would like to carry out a direct comparison. So the left side of the building is formed with TRIO 270 and the right side of the building with MAXIMO 270. Additionally, the influence of the slab formwork systems is to be evaluated.

3.1 Create a wall formwork comparison:

For the procedure comparison, all wall areas of the basement should be reasonably formed.

The following systems are available:

1. PERI TRIO 270 (left side of the building)
2. PERI MAXIMO 270 (right side of the building)

Note:

Divide the building reasonably between axis 4 and axis 5.

3.2 Create a procedure comparison for the slab formwork of the whole building. Choose the most suitable system each for the left or right side of the building:

For the procedure comparison, all wall areas of the whole building should be reasonably formed.

The following systems are available:

3. PERI TRIO 270
4. PERI MAXIMO 270

The construction company will use your comparison and your reasoning concerning your favourite formwork combination when making a decision later on what formwork to purchase.

Note:

The work is carried out by two independent, equal work teams and thus runs in parallel.

Please indicate which software (PERI CAD, ELPOS, CAD etc.) you used to solve the task.

4. Formwork solutions

All values and other details from the previous tasks are to be considered in this section.

4.1 Create all necessary formwork solutions for the walls with TRIO 270 (left side of building) and MAXIMO 270 (right side of building).

For the formwork solution, the required areas should be cyclicled and formed reasonable using the formwork system. Apart from the drawings, all necessary material lists must be included.

4.2 Create all necessary formwork solutions for the slabs with the slab formwork from Chapter 3.2., which you have selected.

All slab areas have to be formed. Apart from the drawings, all necessary material lists must be included. Bulkhead formwork and guardrails are to be shown in the drawings.

Please indicate which software (PERI CAD, ELPOS, CAD etc.) you used to solve the task.

Details of construction implementation

5.1 Create a solution for a central waste storage room (about 18 m²). Make sure it is easily accessible.

A waste storage room is to be created subsequently. Design a solution and create a plan for the solution. Make sure that it is easily accessible. In addition, explain the most important points that need to be considered when designing the solution.

5.2 Plan a ground and wall structure of the waste storage room. Show this in a sketch and give reasons for your solution.

Indicate the ground and wall structure and draw the corresponding cross-sections. Produce a sketch and give reasons for your solution.

5.3 Create different options for the wall fastening of the stair landings. Give reasons for your choice.

Work out different solution options for the fastening of the stair landings (see section A). Explain your choice with a sketch and a short description of the procedure.

5. Construction development plan

The values from all previous tasks are to be considered in this task. Forming time is divided as follows:

- $\frac{2}{3}$ of the given values for forming.
- $\frac{1}{3}$ of the given values for striking.

Cycle planning for slab and wall formwork must be done with PERI software if at all possible.

The duration of each individual process must be systematically determined on the basis of volume along with time and cost values.

6.1 Create a rough draft.

The rough draft must be done for the construction of the complete shell. Consideration should only be given to the most important production segments.

1. A rough estimate of the time required for other work, not covered in this task in any detail, will be sufficient. The results from the calculations must be shown in a table.
2. The process must be shown in a rough outlay. Please keep it clear and simple.

6.2 Create a detailed plan for the first floor [British English: ground floor] of the building.

The detailed schedule for the first floor [British English: ground floor] is to be subdivided into work segments (cycling segments), components and work sequences (e.g. column forming, reinforcement of columns, pouring of columns). The cycling segments and cycle order must be precisely established.

The schedule must clearly show the amount of personnel actually required for each particular job. Choose a reasonable time planning method and draw up the detailed plan.

PERI Construction Exercise 2012|2013

Form



Dear Ladies and Gentlemen,

in order to list the entry of your written work correctly, we would like to ask you to complete the following form (if applicable). Please use block letters and enclose the form to your solution. Thank you very much.

School Address

Name*: _____

Area of expertise: _____
Address*: _____
Zip Code / City*: _____
Country*: _____

Contact Person at School

Form of address*: _____
Title: _____
First Name / Last Name*: _____
Phone* | Mobile: _____
Fax: _____
E-Mail*: _____

Team Speaker

Form of address*: _____
First Name / Last Name*: _____
Address*: _____

Zip Code / City*: _____
Country*: _____
Phone* | Mobile: _____
E-Mail*: _____

* to be completed

PERI GmbH is responsible for the organisation and realisation of this construction exercise. For this purpose, we also store personal data electronically on suitable data media. In this connection, PERI GmbH guarantees compliance with all relevant data protection regulations. With your participation in the construction exercise, you agree to this provision.

Other Team Members:

Form of address: _____

First Name / Last Name: _____

Address: _____

Zip Code / City: _____

Country: _____

Phone | Mobile: _____

E-Mail: _____

Form of address: _____

First Name / Last Name: _____

Address: _____

Zip Code / City: _____

Country: _____

Phone | Mobile: _____

E-Mail: _____

Form of address: _____

First Name / Last Name: _____

Address: _____

Zip Code / City: _____

Country: _____

Phone | Mobile: _____

E-Mail: _____

Form of address: _____

First Name / Last Name: _____

Address: _____

Zip Code / City: _____

Country: _____

Phone | Mobile: _____

E-Mail: _____