

CE 410 Guidelines to Structural Design Drawings

As an essential part of your structural design projects all groups in CE 410 are going to develop their designs in reference to simplified architectural drawings either in paper or digital format – provided by the project coordinator. You are responsible to generate a set of drawings of your own in digital format that you will use during class and on your final report. This set is required to illustrate your progress and present your final structural design. Here is the guideline to every “structural design drawings” set.

1

The set must convey as much information as possible to explain all details of your building and structural design. Do keep in mind that these drawings are inter-disciplinary communication documents.

2

In general 1:200 or 1:100 scale is good enough for the class purposes. However for your structural details you can easily go up to 1:20 or 1:10. The scale of each drawing is to be stated on the drawings and your print outs should be at correct scale.

3

The drawing set basically consists of plan views, section views, elevations and at some projects the site plan.

4

Always position your drawings with the north direction to be the top of the drawings unless there is an important size problem to fit the drawing in that manner. Include a north arrow on the drawing to indicate orientation.

5

You will be dealing with very simplified architectural elements. It is required to define each room or space and their functions within the building and to name them as well. In the drawings you will be showing:

- Exterior walls with door and window openings.
- Interior partition walls with door and window openings.
- Staircases, elevators, chimney and service shafts.
- All structural members: Columns, beams, shear walls, slabs, roofs, bracings, footings.

6

The plan views include:

- 1 Entrance – Ground Floor Plan (elevation ± 0.00)
- 1 Typical Floor Plan (Multi-storey buildings)
- 1 Roof Floor Plan
- 1 Foundation Plan

Plans must have an axis system to identify structural members of the building. It is a means of coordination and aims error free communication through all phases of a project. This axis system is composed of lines passing through the centerlines of every structural member cross-sections both in x and y axis. X axes - every horizontal axes are given letters and Y axes - every vertical ones are given numbers. So at the end, you will have a matrix system showing all parts of your plan. Sometimes there can be offsets between the centerlines of members on the same axis, make a note if you propose such.

All wall thicknesses, column sizes and orientations, bracing locations and beam routes are shown in plan views.

7

The section views include:

- 1 X axis section
- 1 Y axis section
- 1 Partial system detail section

There are basically two section types, cutting through the plan views in both x and y axis. The section line location, along which you cut the plan view, is determined by the amount of information that location will provide, pick the location which will enable you to show the most information possible. Section views show total height of the building and similar to plan views are parts of the axis system. On X axis section drawing, Y axes numbers are shown and on Y axis section drawing, X axes letters are shown. In addition to this system, every floor is labeled with elevation marks from each slab top. These numbers show the total height of the floor from ground level that is ± 0.00 meters. "+" sign indicates the floor is above, - sign indicates the floor is below such meters from the ground floor.

All slab thicknesses, top of slab to top of slab heights, beam cross-sections and lengths, bracing cross-sections and lengths, roof cross-sections, foundation types and sizes are shown in section views.

Partial sections of 1:50 and 1:20 scale are used to identify system details: the detailing of the slab and roof, slab and column, slab to bracing, slab and exterior wall, slab and foundation connections. It is one of the most important drawings.

8

You are not required to show any furniture or equipment unless stated.

9

Your drawings are best visible when printed in black and white and some gray tones if necessary. Adjust your pen thickness settings – go thicker, to make your structural members stand out in the drawing. Use a different line type for the axis lines, usually a dashed one.

10

Adjust your dimension line locations so that they do not interfere with the drawing with not over sized but visible text height.

CE 410 Guidelines to Structural Design Materials

While designing your structure, you need to take into consideration the materials to be used at different parts of the building. Material characteristics such as strength, durability, response to climatic conditions and pollution, behavior when used with other materials, availability and size limitations, ease of application and cost, are some of the most important aspects when deciding which material to work with. Novel technologies and continuous research and development efforts enable the manufacturers to offer a very broad range of construction and decoration materials many of which are designed for specific needs. Architectural decisions therefore require a good awareness of materials in the market and then a skillful understanding of how to combine them both in aesthetic and structural means.

You will be dealing with very basic materials, picked by the architect. However do investigate well to learn their characteristics and potentials, together with their application methods and costs.

Building Elements and Materials:

1 Exterior Walls

Gas-beton units. Gas-beton is lightweight and has good insulation coefficients. It is easy to cut it with a saw. Typical finishes are 1.5 cm of gypsum plaster on interior face; 3 cm cement based, water proof façade plaster on the exterior face. They may be *coated* with insulation on the exterior face. Consider a 30-35 cm. of total wall thickness.

Links: www.akg-gazbeton.com
www.ytong.com.tr

Cement based masonry units. Mostly employs pumice stone as an aggregate which is porous and lightweight. These masonry units are hollow inside with single, double or triple air gaps which provide heat and sound insulation. They are designed to interlock and produced in varying dimensions. Typical finishes are 1.5 cm of gypsum plaster on interior face; 3 cm cement based, water proof façade plaster on the exterior face. They may be coated with insulation on the exterior face. Consider a 30-35 cm. of total wall thickness.

Links: www.blokbims.com.tr
www.dengebims.com.tr
www.ymprefab.com.tr

Klinker based masonry units. These units are typical bricks; hollow or pressed. Exterior wall units are interlocking with maximum amount of air pockets. Typical thicknesses are 19 cm. and 14.5 cm. They require an insulation material either in between two rows of bricks or on the exterior face of one row of bricks. Typical finishes are 1.5 cm of gypsum plaster on interior face; 3 cm cement based, water proof façade plaster on the exterior face if no insulation material is applied. Consider a 30-35 cm. of total wall thickness.

Links: www.kilsan.com
www.yukseltuglakiremit.com
www.bloksan.com.tr

2 Insulation Materials for Exterior Walls – Façade

The most effective method is to cover the whole façade with the proper insulation panels to avoid any cold bridges. These panels are directly attached to exterior walls (no plaster needed on the wall) and treated with several layers before the final paint is applied. They can be left bare if there is another material covering them such as stone, tile, wood or metal. Typical final thickness of the insulation application is 6 cm.

Links: www.mardav.com
www.filliboya.com.tr
www.alsecco.com.tr
www.knauf.com.tr

3 Interior Partition Walls

Gypsum board. An easy and dry construction system of gypsum boards attached to a metal skeleton with special screws. The metal skeleton provides a certain wall thickness and a space in between two boards for heat or sound insulation and for running pipes or cables if needed. Typical thickness is 12.5 cm. typical finish is 0.5 cm of gypsum plaster on each face. It has different board types such as for wet areas (bathrooms) or for fire proof walls.

Links: www.knauf.com.tr

Aluminum frame - glass. Widely used in office spaces where visibility and light penetration is needed. Typical wall thickness is 6 to 10 cm. All components are shop manufactured and installed on site.

Links: www.estetis.net
www.trimline.com.tr
www.schueco.com.tr

4 Roof and Terrace

Roofs are sloped surfaces to direct and collect rain and snow water. Generally 40% slope is required. At heavy snow regions they need to be steeper. Terraces on the other hand are flat surfaces, designed with 1-2 % slope. Both roofs and terraces must be properly insulated against water and heat. Roofs generally have a super structure which transfers the roof load to the main structure. This super structure can be a metal or wooden truss or frame system. Below are the widely used roof-covering materials. Terraces are covered slab surfaces and their loads are directly on the main structure. On terraces the finished surfaces can be wood, ceramic tiles, or stone.

Klinker based roof tiles.

Links: www.kilicoglu.com.tr
www.braas.com.tr
www.basakkiremit.com.tr
www.onduline.com.tr

Metal based roof sheets.

Links: www.rheinzink.com.tr
www.ymprefab.com.tr
www.izocam.com.tr

Bituminous based roof sheets.

Links: www.onduline.com.tr
www.yalteks.com
www.su-yapi.com

5 Insulation Materials for Roofs and Terraces

Under roofs covering materials heat, water insulation and humidity control takes place. Some roof covering materials help to increase heat insulation potential. It is always advisable to leave an air gap or attic space between the super structure of the roof and the slab.

Links: www.izocam.com.tr
www.mardav.com
www.braas.com.tr
www.kilicoglu.com.tr
www.tyvekhome.com

Terrace treatment is far more detailed and needs careful application at every detail. Allow for 15-20 cm of thickness from slab.

Links: www.mardav.com
www.filiboya.com.tr
www.tyvekhome.com

6 Exterior Windows and Glazing

Window frames can be of aluminum, stainless steel, PVC and wood. The larger the dimension of the windows, metal becomes preferable as its strength is higher. Windows that are designed as openings on the exterior walls are carried by that wall. In general the total thicknesses of the frames (double glazed) are in between 7 to 10 cm. Some firms produce shutter systems integrated into the window frame. If whole façade is glazed and glass units replace exterior solid walls, these units are carried by a metal skeleton system which is specifically designed to carry façade loads including lateral forces.

Links: www.rehau.com.tr
www.pimapen.com.tr
www.schueco.com.tr
www.sisecam.com.tr

7 Floor Finishes

The flooring materials need a leveled, rather smooth surface to be applied. If the slab surface is rough, it is leveled by the leveling concrete app. 3 - 4 cm. thick depending on the irregularities of the surface. Wood flooring esp. parquet and carpets are very common for domestic use. For heavy use; stone, cement based artificial stone or metal are best. Ceramic tiles and natural stone are preferred in wet areas.

Links: www.abantparke.com.tr
www.kale.com.tr
www.granitas.com
www.mangan.com.tr