cork institute of technology

Institiúid Teicneolaíochta Chorcaí

RÍSAM UILE

ARCHITECTURAL TECHNOLGY

AT3

SEMESTER 2

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28th MAY 2012

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Façade detailing and thermal envelope (handed up separately on A1 sheets)

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Classification of building:

Group 3: Office (Table 0.1)

Office	3	Premises used for the purpose of administration, clerical work (including writ keeping, sorting papers, filing, typing, duplicating, machine calculating, drawing editorial preparation of matter for publication, handling money (including ban building society work), telephone system operation).

Occupancy loads:

Table 1.1 **Occupancy load factor**

	Accommodation (1)	Occupancy load factor
1.	Standing area in assembly and recreation building	0.3
2.	Bar, lounge bar	0.5
3.	Restaurant, dining room, meeting room, committee room, staff room	1.0(2)
4.	Factory production area, open plan offices	5.0
5.	Bedroom or study bedroom	8.0(3)
6.	Offices, kitchen	7.0
7.	Storage building, car park	30.0(4)

Ground floor:

Café: 50

Kitchen: 9

Reception: 11

Meeting room: 85

First/Second floor:

Office: 94

Third floor:

Office: 80

Fourth floor:

Office: 80

Table 1.5 **Minimum width of escape stairways**

	Situation	Maximum number of persons(1)	Minimum width (mm)(5)
1	In any building, and serving an area which can accommodate more than 100 people.	150 220 More than 220	1000 1100 5 mm per person(2)(3)
2	In a building of Purpose Group 2(a), Residential (Institutional), (unless it will be used only by staff).		1150 (4)
3	In a building of Purpose Group 5, Assembly and recreation, serving an area which can accommodate less than 100 people.	100	900
4	Any stairway not described above.	50 100	800 900

5	Assembly and recreation (a) areas with seating in rows (b) other areas (c) buildings primarily for use by disabled persons	15 18 9	32 45 18

Part B: Fire and Safety

B3- Compartmentation:

The areas I choose to compartmentalise are the:

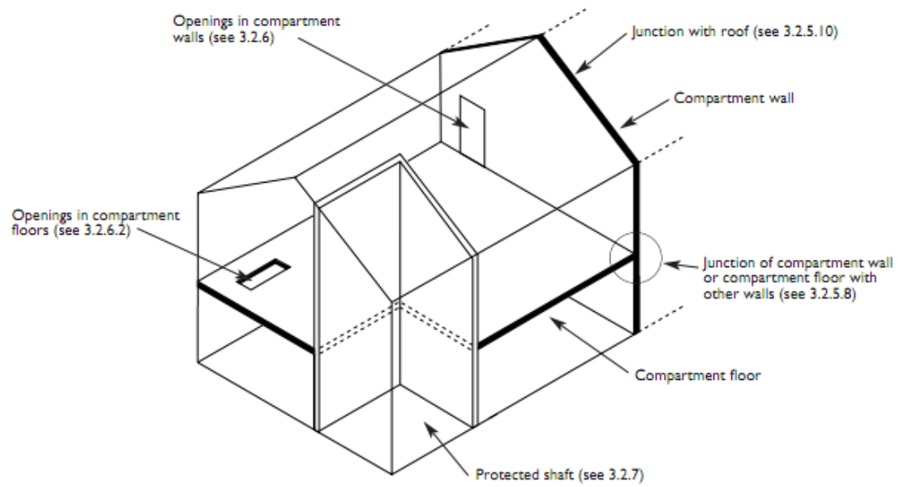
- Stairs/ Lobby/ Lift area on each floor.
- Café
- Car park/ Basement

Reason for compartmentalising the Stairs/ Lobby/ Lift area: in order to allow each person safe passage out of the building in the case of a fire developing elsewhere. The compartments in these instances are going to be compartments inside compartments (stairs is compartmented within the compartmentation of the overall office).

Reason for compartmentalising the café: to eliminate the threat of a fire spreading from the café on the ground floor and therefore allowing everybody to escape the building safely.

Reason for compartmentalising the basement/ carpark: the basement is again another high risk area as there is a lot of services passing through it as well as all the cars parked there and it therefore must be separated. In the case of a fire starting in the basement this would again give all persons in the building a warning and allow them to exit safely.

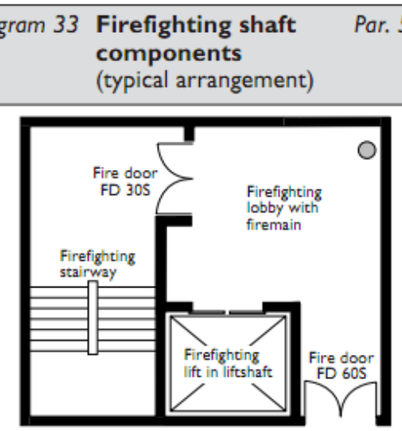
Diagram 11 **Compartment walls and compartment floors** *Par. 3.2.4*



NOTE
The paragraph references indicate the location of the relevant provisions in Section B3 of TGD B.

Note: All compartmentation walls and floors should have at least 30 minute fire resistance in accordance with the technical guidance documents

Diagram 33 **Firefighting shaft components** (typical arrangement) *Par. 5.3.1*



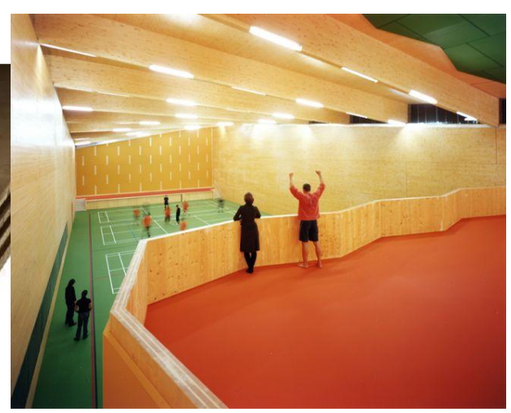
NOTE
Design and construction of firefighting shafts to be in accordance with recommendations contained in BS 5588: Part 5: 1991 (see par. 5.3.4).

Investigation of structural system:

Cross laminated timber:

Cross-laminated timber provides an innovative massive building system for single- and multi - family residential buildings, multi-storey residential and commercial buildings. It also provides structure for buildings for business and industry in structural timber constructions. Cross-laminated timber can be used throughout the structure. You can use it for the floors walls and roofs. An added bonus to using the cross laminated timber is the fact that you are able to leave it exposed either internally or externally and give that timber finish which can be very aesthetically pleasing. Cross laminated timber is constructed in a factory off site by gluing planks of timber together horizontally and vertically. It is a multiply and completely solid material made from wood. It is constructed of timber between 3 to 7 in thickness. Before the factory can construct the planks for any one project it must receive plans and sections indicating the required size of each plank. It is then delivered on site where each piece is slotted into position accordingly. All pieces are prefabricated and have been designed in the factory to fit perfectly into each section on site. When the cross laminated timber is delivered on site it is hoisted into position using a crane and bolted into position. However before any of the cross laminated timber can be delivered on site the foundation and all ground works must be complete. Although the construction of the cross laminated timber in the factory is quite a lengthy one, the process of putting it together and constructing it on site is very quick and easy. When it is delivered on site it is just a matter of putting each piece together like a jigsaw puzzle.

There are many advantages to using cross laminated timber such as ,air tightness, fire resistance, thermal insulation and acoustic insulation and of most importantly sustainability. A major question asked when talking about cross laminated timber is how it reacts to fire. The fact that CLT is so compact and airtight it means that it has a burning rate of 0.67mm per minute. This is very good for a timber product and will allow a building to be safely exited before the structural integrity is threatened.



Investigation of structural system:

Tilt up concrete:

Tilt up concrete unlike most modern, green and environmentally friendly materials has been around for a long time. It was first used in construction around the 1940's. It can be used for all types of construction but is most commonly used in larger buildings. Not only is it an efficient method of constructing a building but it also very aesthetically pleasing.

The materials used in making tilt up concrete are water, sand, gravel and cement. The concrete is usually produced a few miles off the job site (depending on the size of the construction.) and the panels are manufactured on-site. If you wanted to make the concrete even more environmentally friendly you can use waste materials in the concrete such as fly ash in order to displace some of the cement. Tilt up concrete also provides a good insulating layer. It works best in moderate climates, as the concrete takes in the solar energy during the day and releases it at night. In order to satisfy the building regulations you will however need to add some insulation. Although it will require insulation this is far less than what would be required for other forms of construction. Tilt up concrete is also recyclable. Unlike most materials it can be removed and be reused for other purposes such as buildings, foundations and roads. Another reason tilt up is a sustainable form of constructing is because of the lack of waste. In fact there is virtually no waste when using this system as the concrete is ordered in the amount required to construct the panels. In the case of any miss calculations, miss measurements there will be moulds on site to allow for the construction of emergency blocks.

Tilt up concrete like all concrete forms of construction is very rigid and durable. They are one of the best building materials for resisting the elements (wind, waves, fire). It has a very low maintenance. When the panels have been complete they are hoisted into position using a mobile crane (as can be seen in the photo above). This allows sections of the building to go up very fast and once the walls start to form the building will follow in very quick succession compared to other forms of construction.

Tilt up concrete has a very low embodied energy. It again like CLT may use quite a bit of energy in processing the finished product but when compared to other building materials it is in fact quite low. The reason tilt up concrete has such a low embodied energy is due to the components that make it up. The four components of tilt up concrete are water, cement, gravel and sand. Water, sand and gravel are three of the most readily available materials in the world and is available almost anywhere you go. This keeps extraction and transportation costs low which in turn leads to low embodied energy.

Choice of structural system:

The structural system I have chosen to go with will consist of cross laminated timber, steel beams and hollowcore slabs.

Main structure:

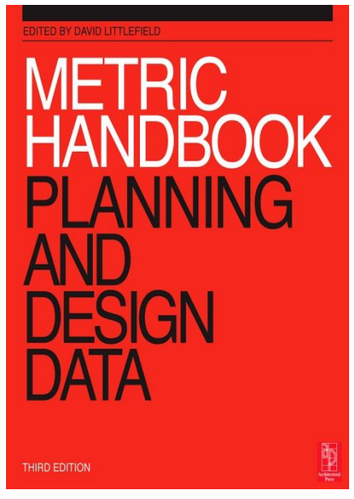
The main form of construction throughout the building will be cross laminated timber. I choose this form of construction as it has many advantages. It has great thermal properties and is also made from a sustainable and renewable material. I will be using CLT panels for the construction of most of the building. The walls will consist of a 156mm thick CLT panels consisting of 5 layers and the floors will consist of 309mm thick CLT panels consisting of 9 layers. The floor slabs will be supported off the walls where possible but at some point's steel will be required to support the floor panels. The panels are easily installed using a crane. They are hoisted into position and are then bolted and screwed together. The CLT panels are placed into position according to their location on the drawing. The building all slots together piece by piece like a jigsaw puzzle.

Space requirements:

Space requirements are a crucial factor that must be taken into account when designing a building. The main areas I am concerned with in this particular building are:

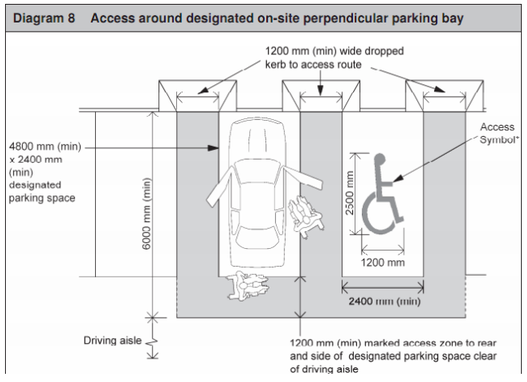
- Basement car park
- Basement lift shaft, stairs and lobby area
- Ground floor café
- Ground floor lift shaft, stairs, toilets and lobby area
- First floor lift shaft, stairs, toilets and lobby area
- Second floor lift shaft, stairs, toilets and lobby area
- Third floor lift shaft, stairs, toilets and lobby area
- Fourth floor lift shaft, stairs, toilets and lobby area

I must look at the amount of people that are going to be using these areas on any given day.
We must then design these areas to suit.
In order to do this I am going to use the metric hand book as guidance.



Basement:

The first area I am going to look at is the basement car park.



I have provided sufficient car spaces for the office building which can be seen in the following drawings. I have also provided 2 wheel chair accessible spaces which are located directly across from the lifts and stairs entrance.

The next area I looked at is the lift and stairs shaft in the basement area. I used a combination of both the building regulations and the metric handbook to design this area