chapter 8

TECHNICAL INVESTIGATION

9.1. INTRODUCTION

The chapter documents the structure of the building and the technical requirements. The lecture hall, the library screen and the ramp are investigated.

9.2. STRUCTURAL SYSTEM

Reinforced concrete columns were employed for the building structure. Square columns were specified to be 450 x 450 and the circular columns 450 diameter according to the engineer's calculations, as the building is 4 storeys high and the column grid is 9000 x 7500 (Carl von Geiso, personal communication, 7 September 2011).

9.3. FLOOR STRUCTURE

Reinforced concrete coffer slabs were chosen for the flooring as they are economical in weight (dead loads) and concrete use. It was also selected as the loads from the library on the second floor are approximately 400-500 kg per m². A post-tension slab was also explored as a flooring option, although the engineer advised that the advantages of the coffer slab outweighed a post-tension slab (Carl von Geiso, personal communication, 7 September & 19 September, 2011). 900 x 900 x 225 coffers and 150mm ribs were used for a 340 thick reinforced concrete coffer slab, to engineers specifications.

Owing to the library loads above the lecture hall, it was necessary to have transfer beams in the second and third floor slabs (Ref. to Fig. 8.1.). Beams were also required because of the large floor spans that ranged from 12000-15000mm in the lecture hall (Carl von Geiso, personal communication, 7 September & 19 September, 2011)

9.4. WALL STRUCTURE

Reinforced concrete walls were chosen for the lecture hall as it fulfilled the sound barrier requirements for a "shell" (Rob Davidson, personal communication, 26 September 2011). It also emerged from the structural requirements of the lecture hall's walls and the loads that were imposed on them from the library above. Concrete walls were selected for the workshops on the southern end of the building as the wall consists of a series of openings that simultaneously require a structural element. This approach was informed by the precedent study for the Façade Project by Steven Holl (Chapter 6).

Brick walls and glazed curtain walls were non load-bearing.

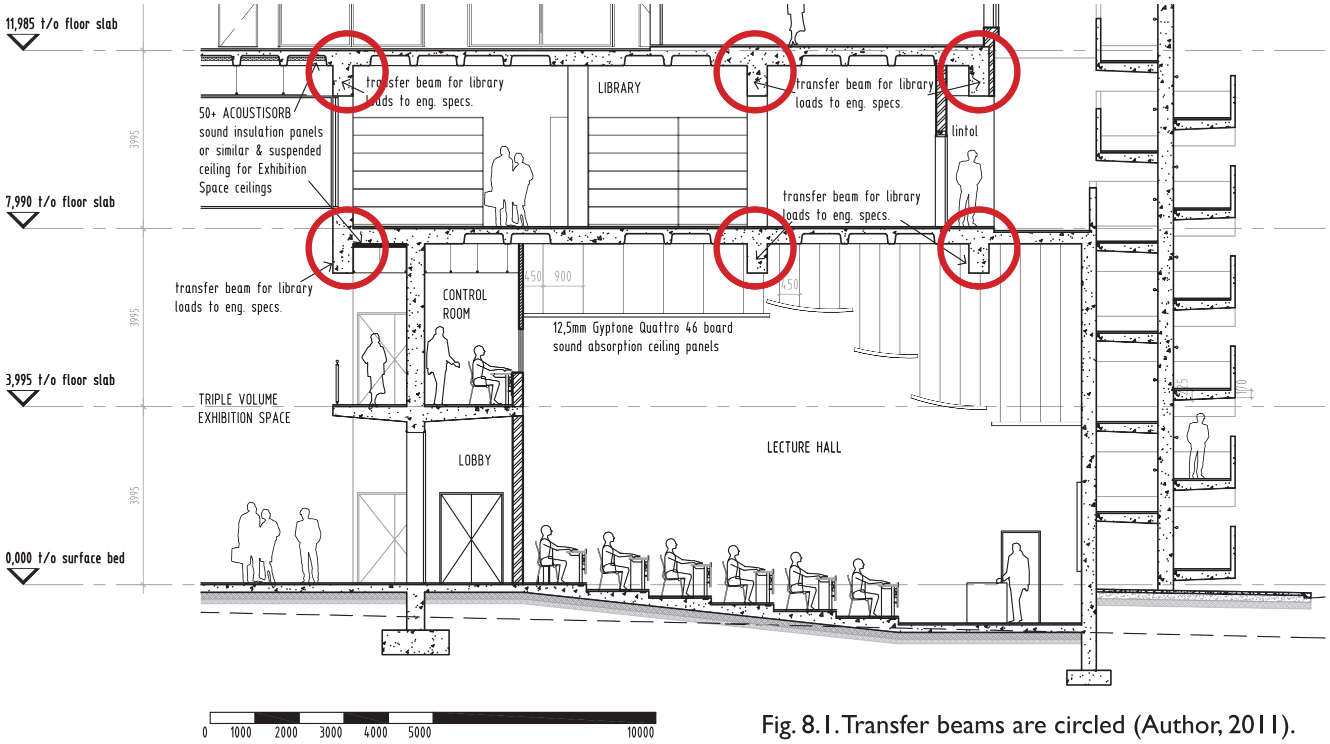


Fig. 8.1. Transfer beams are circled (Author, 2011).

9.5. LECTURE HALL

Once the lecture hall was designed, it was ascertained that an acoustics engineer was required to iron out acoustic issues. Having met with an acoustics engineer (Rob Davidson, personal communication, 26 September 2011), it was suggested that:

- The concave wall behind the speaker should be 'flattened' into straight lines or walls (Ref. to Fig. 8.2.) as a curved wall behind a speaker would cause echoing and create too much noise. Wall panelling on that wall would be an alternative option.
- Possibly consider a lobby for fire escapes as sound can penetrate through this opening.
- For outside sound not to access the lecture hall, openings and entrances must be airtight (no gaps). All entrance doors must be specified to be solid core wooden doors with neoprene/rubber seals around the door frames for sound insulation purposes.
- For the main entrance walls, possibly consider a cavity wall as it is a better sound barrier, provided that it is not a structural wall. Ensure that toilets do not share a wall with a lecture hall, as sounds such as flushing, etc. will penetrate the wall. If this cannot be avoided, create a cavity wall between the WC's/toilets and the lecture hall, to prevent sound penetration.
- Sound absorption panels on the side and back walls of the lecture hall are required so that sound doesn't return to the seated listener (panels are generally between 800-2000mm high).
- Sound absorption panels should be made of an open weave material, with a perforated opening of 25%. Timber slats are a good material.
- The speaker's voice must not echo. If a person's clap echoes but not the person' voice that is fine as speaking is the functional requirement of the venue – not clapping.
- If windows are designed into the lecture hall, window glazing should be double glazed or be 8, 38 - 8,76mm thick and laminated.
- Considering that there is a triple volume exhibition space in front of the lecture hall, sound insulation panels and a suspended ceiling should be used in the walkway ceilings in front of the lecture hall (Ref. to Fig. 8.3.)
- Walls must be built up to floor soffits, as outside noise can travel through the ceilings and over the walls.
- For air-conditioning units, the air ducts should be separate from the rest of the building – they should be individual elements – so that the sound penetration from other programmes does not occur. A splitter type attenuator (either rectangular or circular) should be used for the air conditioning.

Ceilings:

- The lecture hall ceiling should have both sound reflective and sound absorption panels. The sound absorption panels should be above the speaker to prevent echoing. They should also be placed at the back of the lecture hall for this reason (Ref. to Fig. 8.4.)
- The sound reflective panels should be curved, although they should be as flat as possible to ensure good sound reflection (Ref. to Fig. 8.4.).
- Specifications for ceiling panels must have a noise reduction coefficient of 0, 65 and greater.
- Ceiling material should be of fiberglass, black tissue finish or mineral wool. No vinyl for acoustic ceilings.
- Ceiling mass is also important: it should be 8,5kg per m^2. Gypsum board is a good material to use for thickness.

The engineer was satisfied with:

- The concrete shell/walls for the lecture hall, as it created an effective sound barrier from the external programmes and activities.
- The concave wall for the back of the lecture hall, as it reflected sound adequately.

The suggestions from the acoustics engineer are reflected in the final design of the lecture hall (Ref. to Fig. 8.4. - 8.6.).

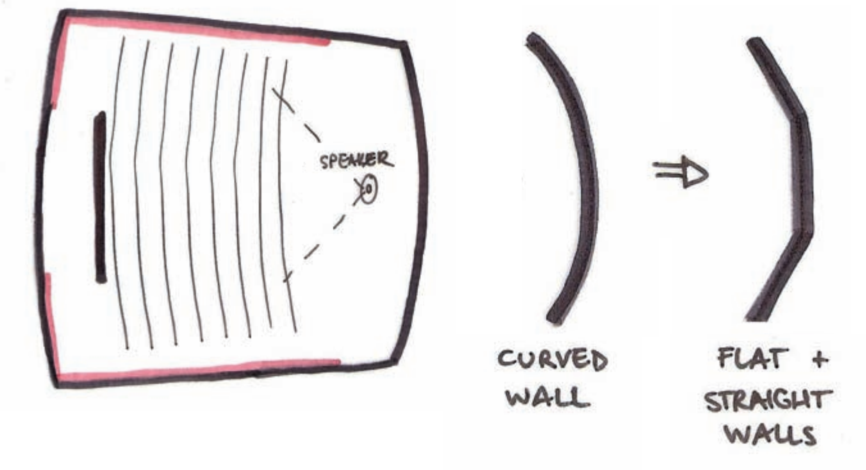


Fig. 8.2. The wall behind the speaker should be flattened (Author, 2011).

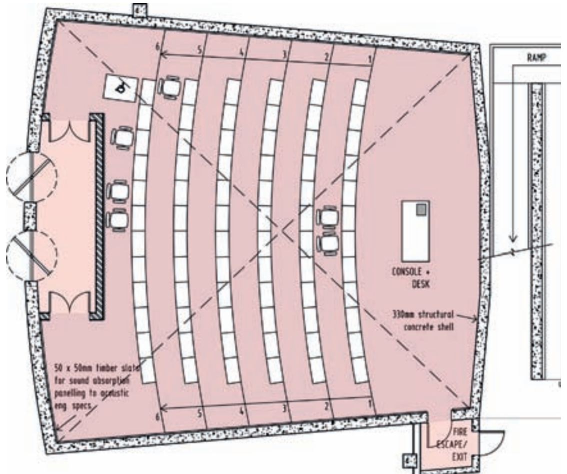


Fig. 8.5. Lecture Hall - final plan design (Author, 2011).

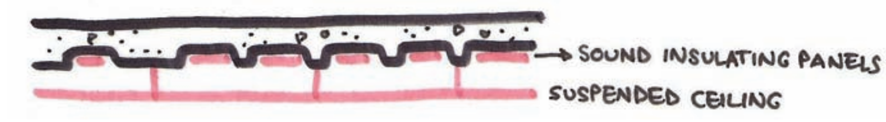


Fig. 8.3. The walkway ceilings in front of the lecture hall should have sound insulation panels and a suspended ceiling (Author, 2011).

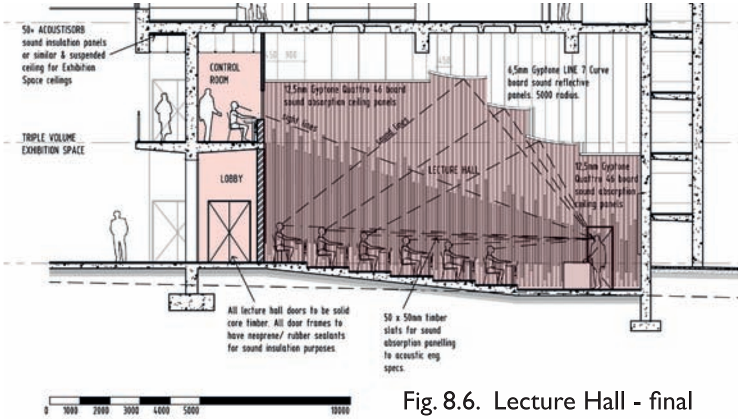


Fig. 8.6. Lecture Hall - final section design (Author, 2011).

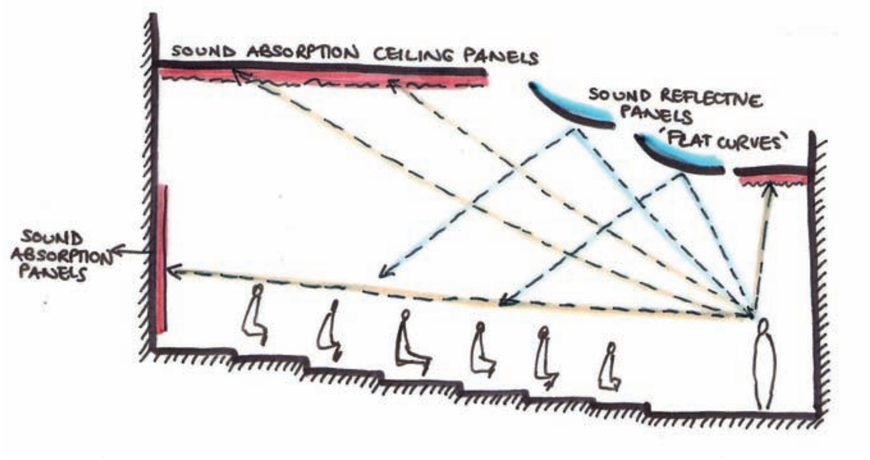


Fig. 8.4. For effective acoustics, the location of the sound reflective panels and the sound absorption panels have been indicated (Author, 2011).

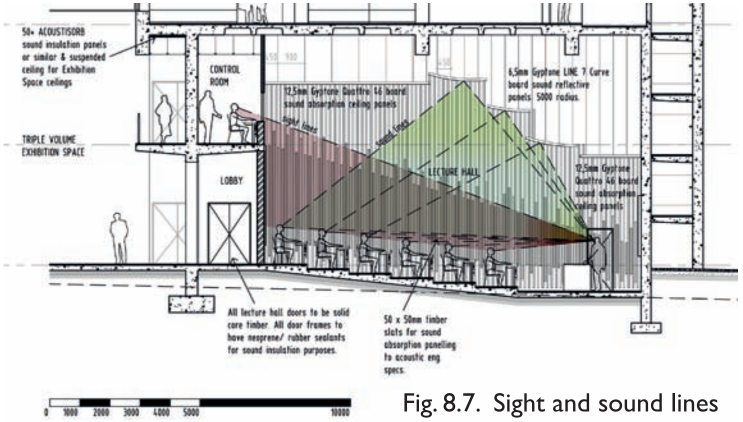


Fig. 8.7. Sight and sound lines (Author, 2011).

9.6. MATERIALITY

All off-shutter concrete surfaces were finished with Dulux AcraTex 964 AcraSilane sealant or similar, as it was felt that the materiality and the texture of the concrete should be exposed as it encouraged visual interaction with its users. A Cor-ten screen for the library was selected owing to the changing nature of the Cor-ten and the rough texture, which encourages a visual dialogue with the viewer.

Plastered brick walls were used for the rest of the building as a visually continuous language that related to the concrete walls was required for the elevations.

Brownbuilt roof sheeting was selected for its low pitch across long spans as well as for its visually stimulating pattern. Exposed I-beams supporting the ceiling, the purlins and the roof sheeting were chosen for this reason too.

9.7. LIBRARY SCREENS

As discussed in Chapter 7, screens for the library elevations were chosen as it was the most suitable option for blocking out direct light while still allowing for transparency. Perforated Cor-ten panels were selected (Ref. to Fig. 8.8. & 8.9.). The 12 thick structural panels are to be welded to manufacturer's specifications onto 100 x 100 x 4 square hollow profiles at 2000 centres. The square hollow profiles are to be welded onto 203 x 133 x 25 parallel-flange I-beams (Ref. to Fig. 8.10.). The Cor-ten panels vary in size but are approximately 2000 (width) x 4000 (length). The weight of the panels is reduced by the perforations: 150 diameter circles at 200 centres (50 spacings).

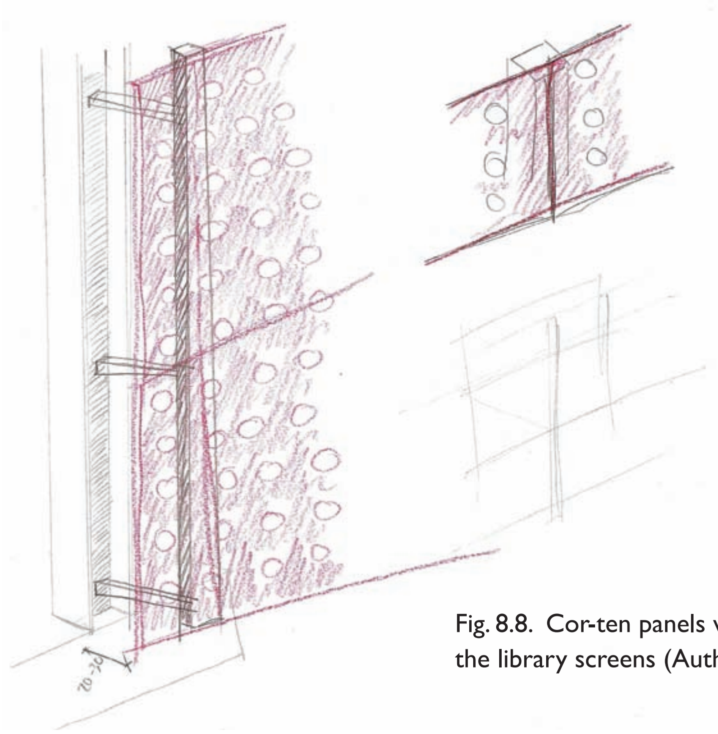


Fig. 8.8. Cor-ten panels were selected for the library screens (Author, 2011).

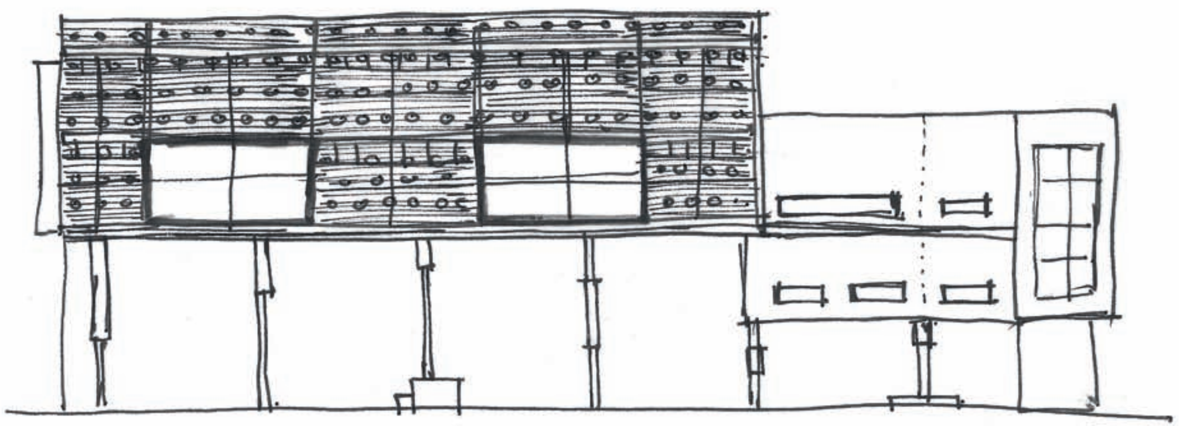
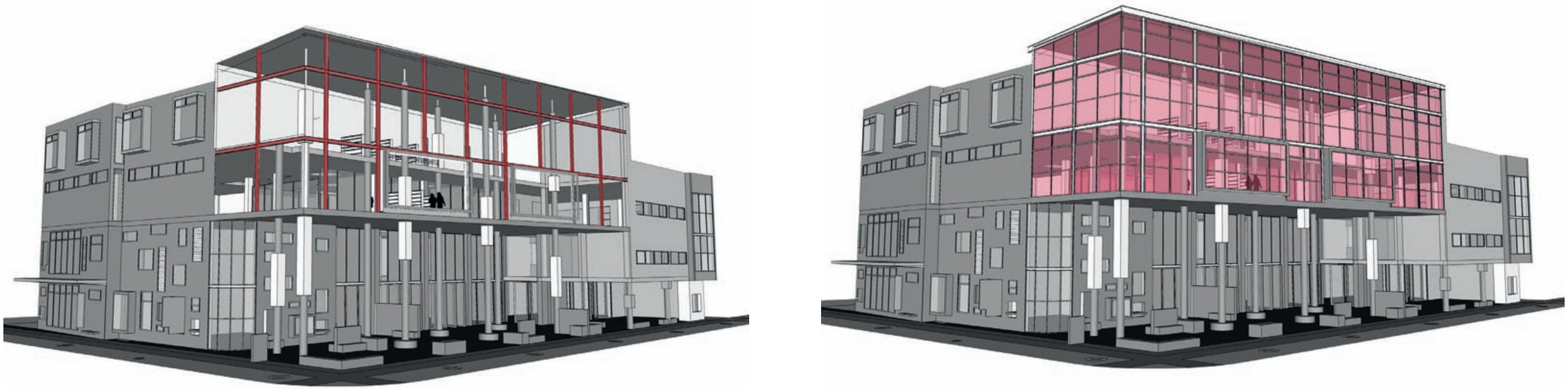


Fig. 8.9. Cor-ten panels were selected for the library screens (Author, 2011).



1 I-BEAM FRAME
203 x 133 x 25 parallel-flange I-beams

2 GLAZING
Aluminium frames fixed onto I-beam frame

3 SCREEN SUPPORT
100 x 100 x 4 square hollow profiles at
2000 centres welded onto I-beams

4 SCREEN
12 thick structural perforated Cor-ten panels
welded onto square hollow profiles

Fig. 8.10. Screen structure (Author, 2011).

9.8. WEST ELEVATION RAMP

The ramp serves as a fire escape to the building. It further emerged as an important design element that reflected the theory and the concept of the dissertation (Ref. to Fig. 8.11.). The ramp allows for visual connections and interactivity. It further alludes to the theory of the *Flâneur*, where one strolls or leisurely explores pedestrian and urban environments. The ramp structure is of reinforced concrete. The 1200 wide cantilevered ramps are supported by and wrap around a 3-storey high, 350 thick reinforced concrete wall fin. The ramps have a 170 tapered edge and have a 1000 high r.c. balustrade upstand (Ref. to Fig. 8.12.).

9.9. CONCLUSION

The structural and technical elements that have been investigated are reflected in the final drawings.

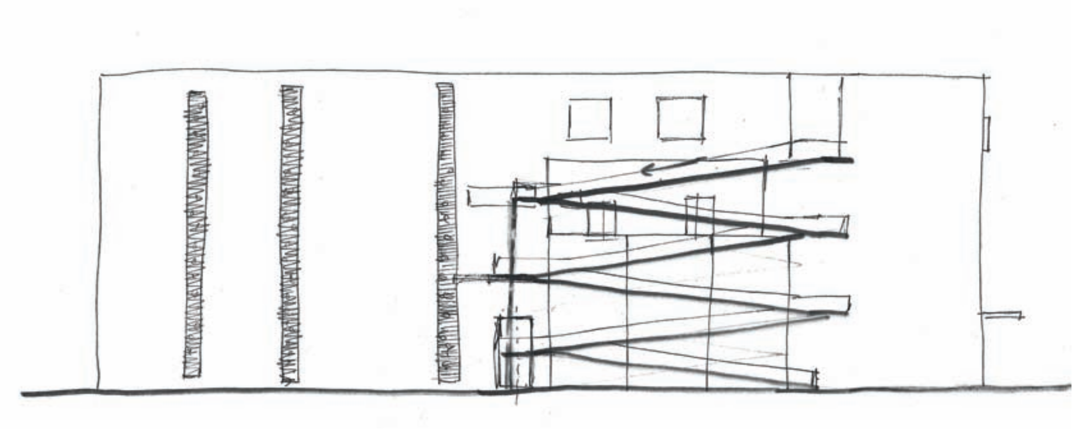


Fig. 8.11. The ramp relates to the theory and the concept (Author, 2011).

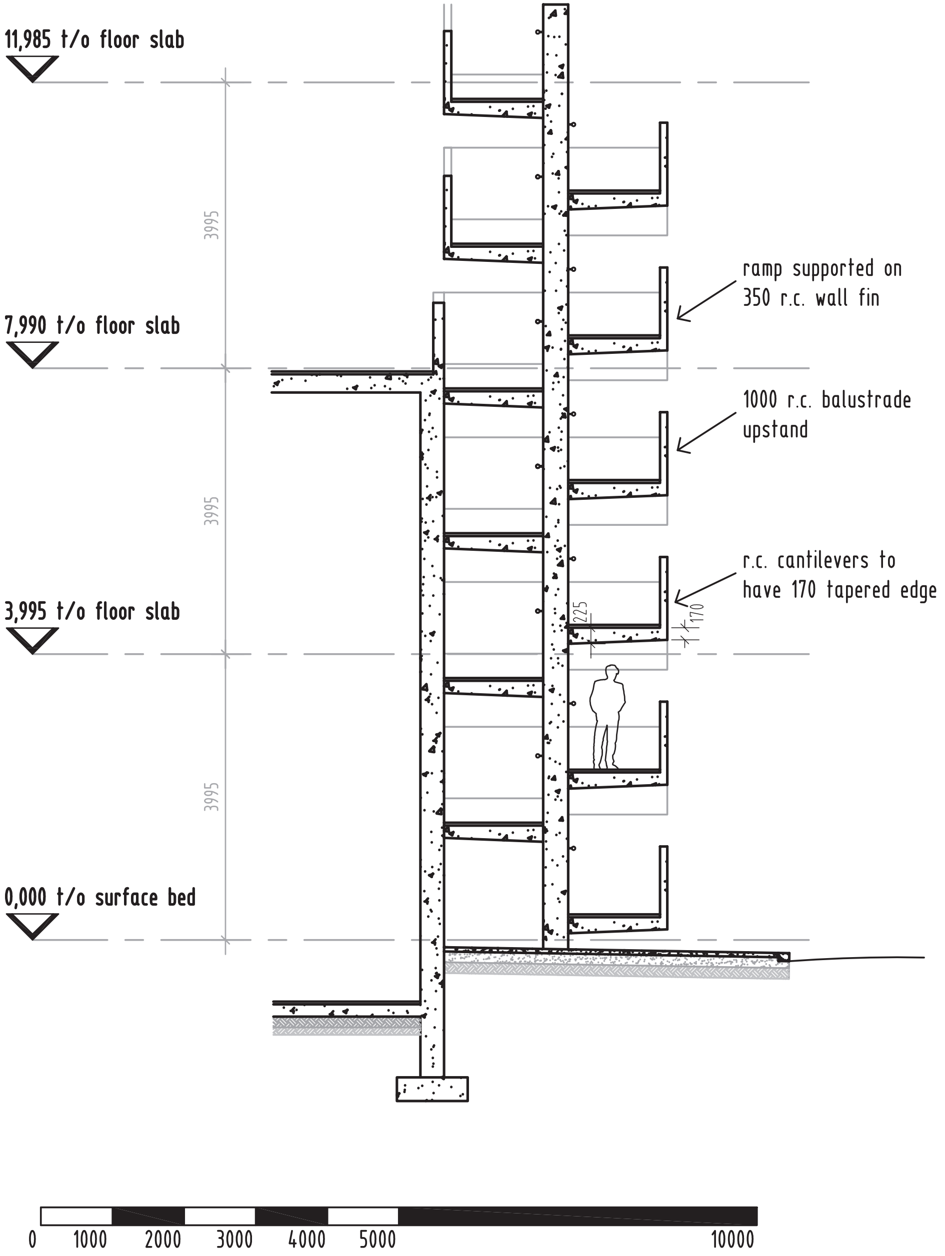


Fig. 8.12. The structural system of the ramp (Author, 2011).