

Roof-top extension of an existing 4 storey concrete framed residential building using light steel framing. that provide 2 new floors of apartments and was achieved without having to move the occupants during the construction process.

HIGH QUALITY ROOF-TOP EXTENSION IN ROTTERDAM



Two four storey buildings in Rotterdam, dating originally from 1961, have been extended to create two new floors without having to move the occupants during the construction process. This remarkable achievement was made possible by use of light steel framing which was not only pre-fabricated and lifted into place as large elements, but also was sufficiently light that the light steel framing did not over-load the existing concrete structure.

The buildings are located on Kramerstraat in Rotterdam and the installation work had to be carried out subject to the continued use of the building.

Cross-walls are located at 7.5 m spacing and the new 6.5 m high structure was supported on steel beams positioned on stub columns over the cross-walls in order to avoid excessive penetrations through the existing roof.

Light steel C section floor joists spanned between the beams and the floor surface was created by a self levelling gypsum screed placed on shallow steel decking attached to the joists. The 50 mm deep gypsum screed provided a flat, stiff and fire resistant floor. The overall floor depth was only 325 mm. The floors were pre-fabricated as large panels to speed up the installation process.

The two new floors of apartments, each of approximately 140 m² floor area, provide high quality open plan living at the top floor with 3 or 2 bedrooms configurations on the lower floor.

The overall construction cost of 1000€ per m² gross area of the new parts of the building is lower even than new building on a 'green field' site and demonstrated the efficiency of this lightweight construction technology in renovation projects.

Sustainability Benefits:

- Rapid construction system with minimum disruption on site
- Lightweight steel frame with gypsum screed flooring does not over-load the existing building
- Stiff, fire resistant and acoustically excellent floor construction
- Occupants are not displaced during the construction work
- Two new floors of apartments each of 140 m² area are created cost effectively



Roof-top extension during construction

Construction Details:

The new steel beams placed at roof level consist of 260 mm deep Parallel Flange Channel (PFC) sections in pairs that are themselves supported by HE200A stub columns attached by resin anchors to the 185 mm deep existing flat slab. The 220 mm deep C section floor joists are supported by Z sections attached to the top flange of the PFCs, in order to minimise the overall construction depth. The 50 mm deep gypsum screed is placed on 16 mm deep × 0.55 mm thick profiled decking (Lewis profile by Reppel).

The separating walls were pre-fabricated and are also supported by the PFC sections and use 100 mm deep light steel C sections with 2 layers of 12 mm thick fire resistant plasterboard to achieve 60 minutes fire resistance. The width of the separating walls is 300 mm. The overall weight of the new floor and wall construction is less than 1.8 kN/m², and so the two new loaded floors

Project Team:

- Client:** Woningstichting PWS, Rotterdam
- Architects:** Kolpa Architecten
- Project Manager:** PWS Vastgoedontwikkeling
- Contractor:** Janssen de Jong Bouw
- Steel framing:** MAT Afbouw



Light steel floor joists

add only 20% to the weight of the existing 4 storey concrete building, which is within the structural capabilities of the concrete cross-walls and foundations.

Large windows and balconies were created in the front and rear façades by continuing the external columns vertically. The roof consisted of deep profiled decking spanning between the cross-walls on which rigid insulation boards and a water-proofing membrane are placed.

The NL research agency TNO carried out physical tests on the completed building and measured the natural frequency of the completed floors as 14 Hz which is much stiffer than the design value. The airborne sound reduction of the floors and separating walls was over 60 dB, which demonstrates the excellent in-service performance of this lightweight construction.