

ANNEX 5-B

Case study

SMART HOUSE IN ROTTERDAM

A novel steel-intensive construction system has been developed for residential buildings, small offices and health centres. It is based on a tubular structure and pre-fabricated light steel floors and walls.

SMART HOUSE IN ROTTERDAM



Architect Robert Winkel has developed a new form of 'open' building system called *SMART HOUSE*, based on Rectangular Hollow Sections (RHS) as beams and Square Hollow Sections (SHS) as columns. The RHS beams support a light steel floor cassette that is pre-fabricated using light steel C sections, and there are no downstand beams. It is based on IFD or **I**ndustrial **F**lexible **D**emountable technology, which is promoted by the Dutch Government.

An innovative 'hidden' connection detail is used to connect the RHS beams to the SHS columns, so that the beams can be visually exposed for architectural effect. The light steel wall panels are attached between the SHS columns to produce a wall of minimum width. Any type of façade material may be attached to the outside, and one or two layers of plasterboard are required internally, depending on the fire resistance required.

A demonstration building was constructed in the suburbs of Rotterdam using this technology. The developer, BAM wished to demonstrate the flexible configuration for a mixed office-house. All services are located in a central 'core' and the open usable space is placed around it. A high level of glazing can be provided. The building is clad in a mixture of board materials.

The demonstration building is 3 storeys high, but can be extended up to 5 storeys, depending on fire resistance and stability requirements. It can be used for many applications, such as residential or commercial and health buildings. Spans are based on a 5.4 m grid, but in principle the system can be extended in span range. The structure is installed as a 'dry' construction process and is very fast and efficient, and can be assembled and dismantled easily.

Application Benefits

- Flexible space use
- Exposed steel structure
- Shallow floors and walls
- Adaptable to future uses
- Fast construction process
- Good acoustic insulation
- Easily disassembled

Project Team

| | |
|--------------------|----------------|
| Developer: | BAM |
| Architect: | MEI Architects |
| Contractor: | BAM |



Hidden connection detail in RHS beams



Central service core in Smart House

Construction Details

The floor beams use 200×100 RHS sections which have a span capability of 5.4 m, which is the preferred grid for residential buildings and small offices in the Netherlands. The columns are 100×100 SHS. The 'hidden' connection uses a single bolt placed from above, so that the beams and columns can be exposed (see Figure). The steel thickness of the tubular members can be increased depending on the loading and building height, without changing their external dimensions.

The pre-fabricated floor cassette consists of 200 mm deep C sections in pairs at 400 mm centres that also span up to 5.4 m. The cassette is manufactured in 2.7 widths for ease of transportation, and is suspended from the top of the RHS beams. Two layers of fire resistant plasterboard are placed below the joists and a resilient floor covering provides the necessary acoustic insulation. The overall floor depth is 300 mm. The span range can be increased by using deeper RHS members and floor joists without affecting the basic system.

Services are concentrated in a central core at ground and first floor. The walls are insulated and externally weather-proofed, so that any

type of façade material may be used. In the demonstration project, marine grade painted plywood was used on the walls with metallic cladding for the roof. The stairs were also pre-fabricated in steel.

Stability is provided by X-bracing in the walls, which can be strategically placed to avoid windows. Walls may be fully glazed if required. All floors and walls can be removed easily to adapt to future uses. The service core houses the bathrooms, kitchen and major equipment and services from which the electrics, data comms and pipes are distributed. The structure can be easily dismantled and re-used.