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RENOVATION OF BUILDINGS USING STEEL TECHNOLOGIES (ROBUST)

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WP 2.6 Design guidance on energy efficiency strategies for industrial buildings

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WP 2.6 Design Guidance on Energy Efficiency Strategies for Industrial Buildings

1.General

There are many single storey buildings using metallic or other single skin cladding systems that require improvements to their weather-tightness, appearance and thermal performance. For many of these industrial buildings, a long interruption of a production process is frequently not possible, and so over-cladding and over-roofing whilst preserving the original envelope is very cost intensive.

The building owners of industrial buildings mostly accept only very short payback periods . In general, the (projected) lifetime of industrial buildings is shorter than for residential or office buildings, and is typically 30 years. Furthermore, the cost of refurbishment of the building has to be balanced against investments for improving machinery and processes, which is normally the main interest of a company.

In consequence, technical solutions for over-roofing and over-cladding with low capital costs are needed , which are reviewed as follows:

2. Technical solutions for over-cladding of walls of single storey buildings

For the application on concrete or blockwork walls, steel sandwich panels may be used and additional steel profiles for fixing and adjustment of the panels are needed. The achievable heat transfer coefficient is determined by the properties of the sandwich elements, and a U-value of 0.15 W/m² is possible.

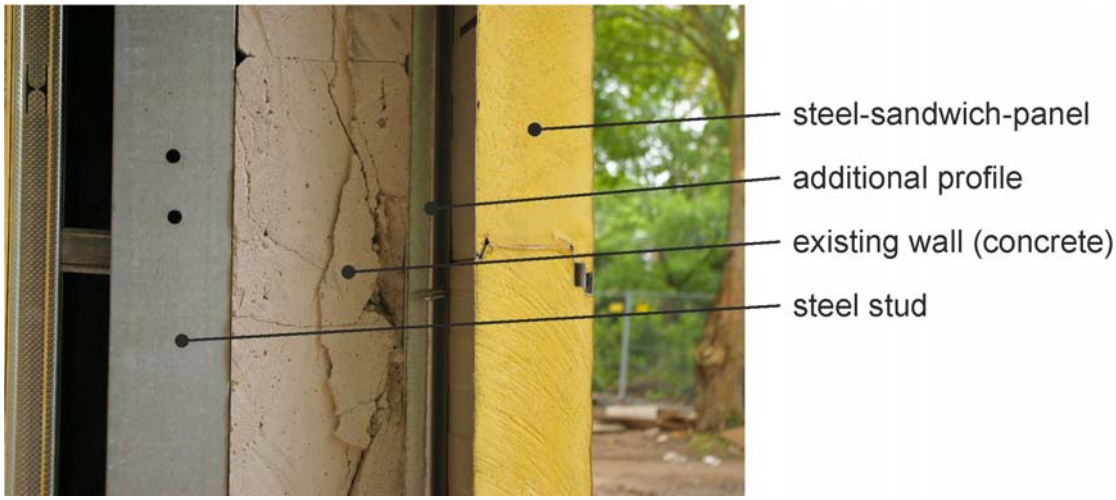

Figure 1: Concrete wall, refurbished with steel sandwich panels

The heat transfer of cassette walls/ built-up-systems is strongly related to the thermal bridging effect. Therefore, additional thermal insulation has to be provided to overcome the effect of these thermally weak points. If the external cladding is removed, two options can be adopted a) additional insulation and covering by trapezoidal sheet (figure 2, left) or b) adding a steel sandwich panel externally (figure 2, right). Depending on the materials of the original wall and the additional insulation, U-Values of less than 0.25 W/m²K can be achieved.


Figure 2: Refurbishment of cassette wall/ built-up-system

3. Technical solutions for over - roofing

For over-roofing, self-supporting elements such as steel sandwich panels are an option for many cases (see Figure 3, left). The existing envelope remains below the new cladding, and so the use of the building is not affected. Another option is shown in Figure 3, right: The brackets supporting new built-up system are attached to the existing purlins and the new insulation and roof sheeting is fixed conventionally.

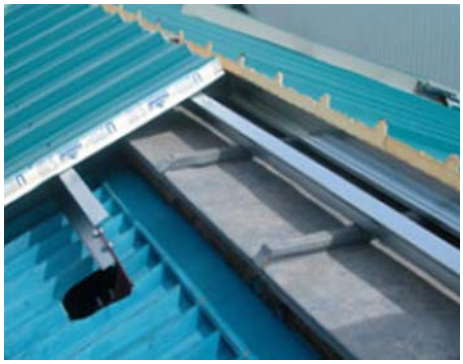


Figure 3: Over-roofing (left), re-cladding (right) for industrial buildings

4. Air-tightness of over-roofing and over-cladding systems

Ventilation losses (cold air infiltration) can occur if the air-tightness of the new building envelope is not improved significantly. The joints and junctions in steel built-up roofing systems are frequently leaky.

The strategy for achieving low air leakage consists of a three stage process, which are at the pre-design, design and construction stages. Relevant details for achieve air-tight construction are:

- Air barrier seal at junction between vapour barrier and gutter assembly
- Air barrier seal to vapour control layer – welded laps
- Installation of air barrier tape seals to laps of internal steel of a built-up system
- Flexible self-adhesive membrane forming an air barrier at wall to roof junction
- Tape seals forming air barrier continuity at joints between sheathing boards
- *Therma-foil Plus* on warehouse gable to ensure continuity of air barrier

- *Therma-foil Plus* seal on the outer side of the internal steel liner forming air barrier continuity of the roof
- Application of *Therma-strip* onto the roof sheet to ensure continuity of air barrier
- Over-cladding of existing brickwall using rain screen system: breathable air barrier to ensure vapour control and limit air leakage
- Acoustic deck: breathable air barrier to ensure vapour control and limit air leakage
- Over-cladding of existing industrial shed using rain screen system: breathable air barrier to ensure vapour control and limit air leakage

5. Improvement of energy performance

The improvement of the energy performance of a building is a result of various measures. For a first estimation, simplified tools (see WP 5) are useful, but for the optimization a broader parametric study is recommended. Figure 4 shows the effect of various measures when 12% and 20% of the roof has roof-lights.

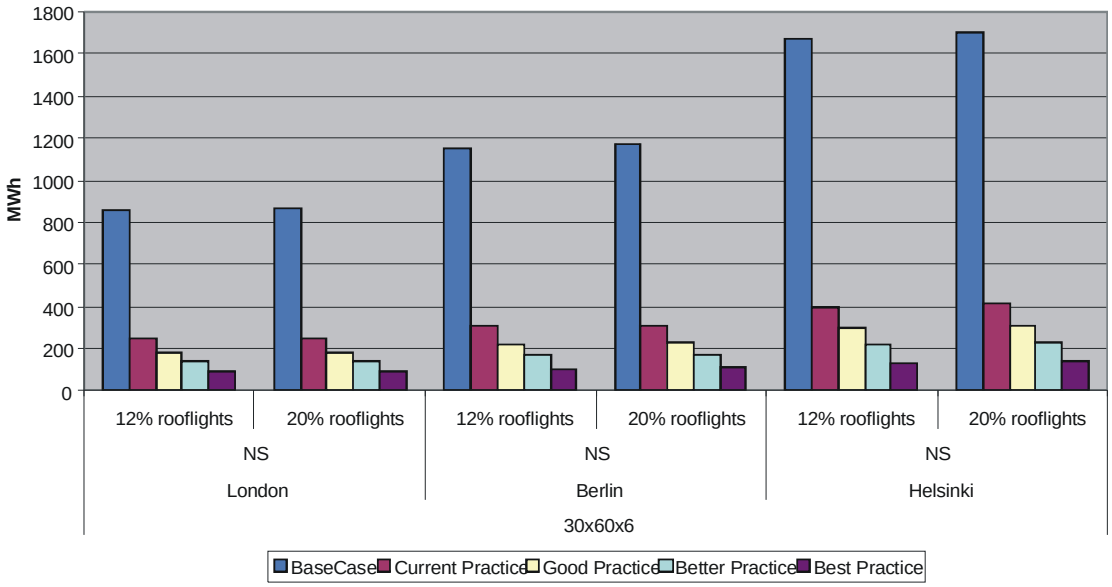

Figure 4: Example: Parametric study for refurbishment