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TATA STEEL

TATA

Colorcoat® Technical Paper

Refurbishment solutions for non-domestic buildings

www.colorcoat-online.com

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REFURBISHMENT

Tata Steel has been developing and manufacturing the Colorcoat® range of pre-finished steel for metal building envelope systems, for nearly five decades. In conjunction with our supply chain partners we are able to offer a comprehensive range of refurbishment solutions to enable designers and building owners to meet both the technical and aesthetic requirements of a refurbishment.

Working together to provide guidance

The SCI is an independent, member-based organisation. It is probably the world's largest research and technical organisation supporting the use of steel in construction. Since its formation in 1986, SCI has played a leading role in technical innovation and information dissemination; helping the steel construction sector achieve a world-leading market share for steel.

Tata Steel and the SCI have worked together with our supply chain partners, CA Group, Eurobond and Euroclad to evaluate the different pre-finished steel roof and wall cladding systems and the refurbishment solutions that they provide. All the systems offered by these supply chain partners provide a cost effective refurbishment solution for the building envelope.

Contents

Overview

Refurbishment presents building owners with a means of significantly improving the appearance, value and performance of existing buildings without the economic and environmental costs associated with new build construction. In the case of single storey buildings, such as warehouses, industrial premises and retail outlets, pre-finished steel cladding systems provide a cost effective means of refurbishing the building envelope, thereby improving the energy performance of the building as a whole, enhancing its appearance and extending its life. Several refurbishment options exist and the choice of solution will depend on the reasons for refurbishing, the type of building, the state of the existing building fabric, technical and operational constraints, such as not interrupting activities within the building, and the available budget. This technical paper explains the key reasons for choosing to refurbish a building and describes the various options available using pre-finished steel cladding systems. It also presents a series of case studies to illustrate the successful refurbishment of single storey buildings.

The case for refurbishment

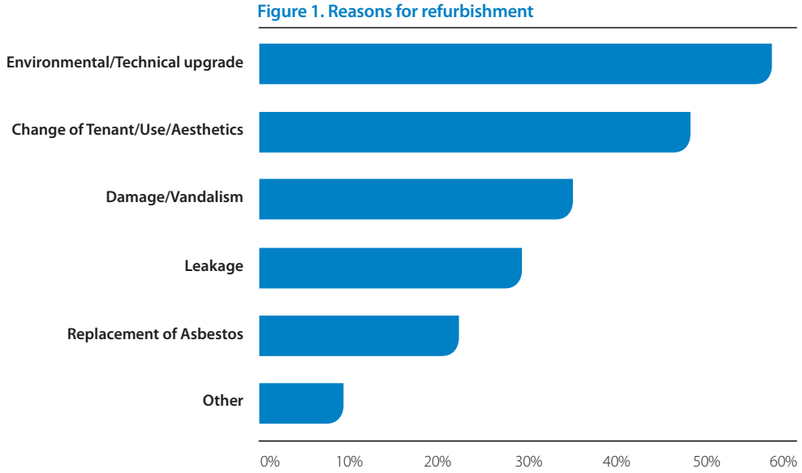
There are a number of reasons why a building owner might choose to refurbish a building, ranging from pure aesthetics to changes in the performance and functionality of the building. In many cases, buildings are refurbished when they change their use or ownership, but this is not always the case. In some cases, refurbishment is prompted by problems associated with the existing building envelope, such as leakage or damage, but these issues tend to be addressed as part of a planned repair and maintenance programme.

An increasingly important reason for refurbishment is to reduce the energy consumption of the building through improvements to the insulation and air-tightness of the building envelope.
The most common reasons for refurbishment are:

- To increase the asset value of the property.
- To improve the working environment for occupants.
- To increase space and/or building configuration.
- To increase rental income.
- To improve aesthetics and company image.
- To improve thermal efficiency and reduce energy costs.
- To replace a building envelope that has become damaged and costly to repair.

Recent research suggests that refurbishment tends to be undertaken for positive reasons, such as technical upgrades, more often than it is used to overcome problems with the building envelope. This is highlighted in figure 1.

Figure 1. Reasons for refurbishment



Source: Research commissioned by Tata Steel in 2001

In many cases refurbishment offers a practical alternative to new build. It has significant benefits in each of the following three dimensions of sustainability:

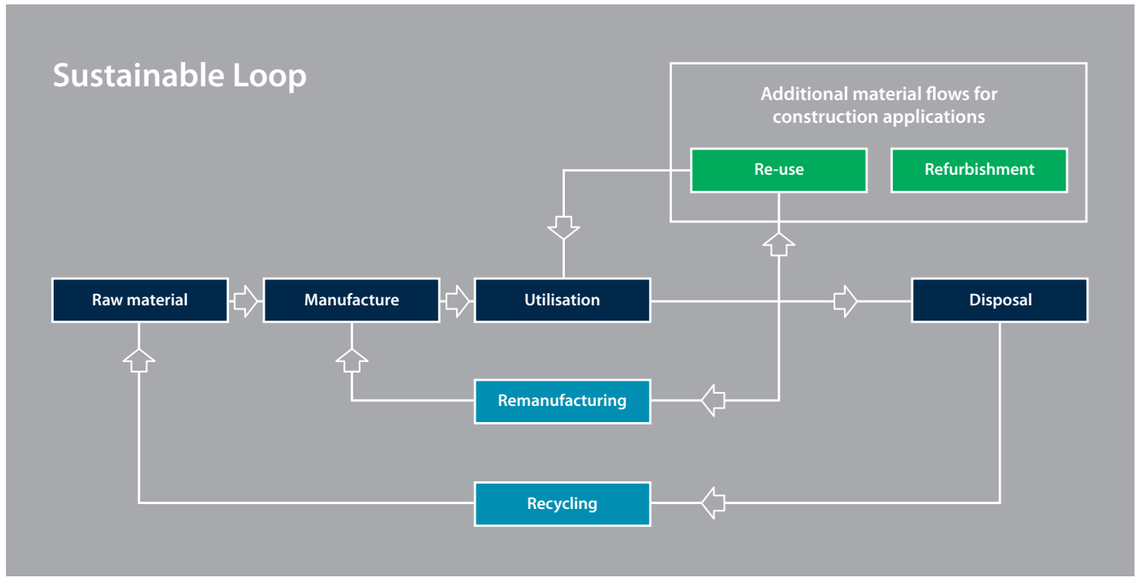
Social – Refurbishment projects minimise disruption, when compared to demolition and rebuild and also significantly improve the aesthetics of the building.

Economic – Even when the building envelope is completely replaced, the majority of the building structure can be retained, with consequent savings in time and money.

Environmental – By re-using functional parts of the building, the impact on the environment from material production and transport is minimised.

In order to maximise the environmental benefits of refurbishment, the materials removed from the building should either be re-used or recycled, as illustrated in figure 2.

Figure 2. Extended sustainability loop for construction materials



Misconceptions about refurbishment

Clients and building owners who are planning the refurbishment of a building consider disruption to production or the workplace during the refurbishment phase a major issue. In many of the refurbishment solutions described in this technical paper, the business operation can continue within the building while the refurbishment work is undertaken. A certain level of disruption will always occur during construction work.

However, with a good understanding of the potential problems, detailed planning and the involvement of an appropriate contractor, most of these difficulties can be avoided.

Owners also consider that cost, standards of workmanship and the time involved in organising and checking on the refurbishment work is also of key importance. These items can be overcome through the involvement of specialist contractors who recognise and understand the issues associated with refurbishment. The cladding contractor will also be able to provide detailed advice about health and safety issues.

Drivers for refurbishment

Refurbishment projects account for approximately 40% of all construction activity in the UK. In the majority of cases, economics and financial implications of undertaking refurbishment or new build are the governing factors. However, situations do occur where the decision rests with planning consent from local authorities. Ultimately, whatever option is chosen, the costs are passed on to the owner of the property, who will need to recover his investment by leasing or selling the property.

Property investment experts predict that, with the increase in energy costs, the trend will continue towards improved energy performance of existing buildings in terms of insulation levels and air-tightness. It is also expected that sustainability issues will be at the core of all development work and that regulations on energy and waste will become more onerous. This will potentially drive designers to develop more innovative and efficient solutions.

With the rapidly changing market and the significant changes in legislation that are currently taking place, it is possible that there will be a shift in balance between building refurbishment and new build. The proposed changes in the Building Regulations[1], the focus on environmental credentials, together with the escalating costs of energy, will certainly impact on the decision-making process in the future and are likely to increase the effectiveness of the refurbishment option.

With the rapidly changing market forces taking place in the single storey sector, and the proposed significant changes to the Building Regulations1, being implemented now and in the next 10 years, future-proofing of warehouse developments could potentially become very important.

Considering future-proofing during new build design enables the building to include various additional features which are considered today to be an important basic requirement in the near future. Possible additions for future inclusion are:

- Mezzanine floors.
- Change from single to multiple-occupancy.
- Change from single to multiple functionality/use.
- Future regulatory requirements e.g. energy and water savings.
- Services.
- Demountability of the building envelope and/or structural frame.

Future-proofing is considered by property investment organisations to a greater or lesser extent depending on the initial brief by the client. In all cases, the extent of future-proofing is considered against the additional costs that will be incurred in the development, which ultimately will have to be met by the client. Cost will always prevail, unless tenant demands override, in which case the landlord will endeavour to recover cost through increased rent.

Sustainable refurbishment

There are a number of reasons why a building owner might choose to refurbish a building, ranging from pure aesthetics to changes in the performance and functionality of the building. In many cases, buildings are refurbished when they change their use or ownership, but this is not always the case. In some cases, refurbishment is prompted by problems associated with the existing building envelope, such as leakage or damage, but these issues tend to be addressed as part of a planned repair and maintenance programme.

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Operational CO_2

To investigate the potential benefits of refurbishment in terms of a building's energy performance, a numerical modelling study was carried out on a 120 m x 60 m medium-sized retail shed. This was modelled using the IES3 thermal analysis software, Dynamic Simulation Model (DSM). Two categories of building were considered:

- Before refurbishment.
- After refurbishment.

As the name suggests, the 'before refurbishment' category represented typical retail sheds whose building envelopes had not been refurbished. Three examples were considered:

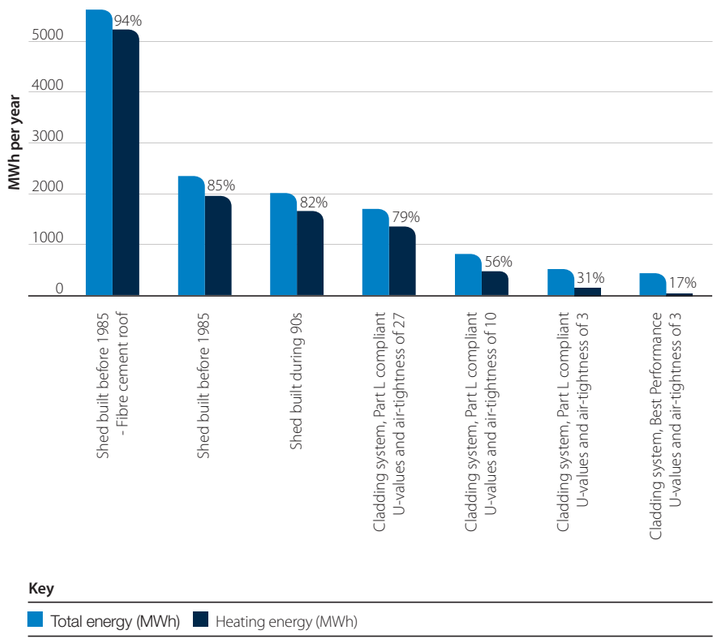
- Un-insulated fibre cement roof built before 1985.
- Pre-finished steel external sheet over a polystyrene insulation board built before 1985.
- Pre-finished steel built–up cladding system incorporating a thin layer of insulation material built during the 1990s.

The 'after refurbishment' category included a wide range of potential refurbishment standards from a 2006 Part L Building Regulation1 compliant building to the best energy performance achievable in terms of air permeability and U-values using current cladding technology.

The heating, cooling and lighting demand remained constant across all cases, as did the efficiency of the building services. Any recorded improvements in energy performance were, therefore, entirely due to the upgrade of the building envelope.

The results for total energy and heating energy, expressed in MWh/yr, are presented graphically in figure 3. The percentage figure shown against each pair of bars in the chart represents the proportion of total energy demand attributed to heating.

Figure 3. Graphical representation of thermal simulation results for a range of as-built and refurbished buildings



Source: SCI[2] Retail warehouse renovation study, March 2009

This study shows that the refurbishment of old buildings, similar to those considered in this study, can lead to significant reductions in energy demand and associated CO_2 emissions. The IES[3] simulations show that for typical retail warehouses built in the 1990s, renovating to the Part L 2006 standards can typically lead to a reduction of 60% in the total energy demand. Renovating the building envelope to the highest energy performance standards possible using current technology can reduce the total energy demand by as much as 80%. This represents a significant reduction in energy bills for the building occupier and is likely to lead to an impressive improvement in the building's energy rating.

The study also highlighted the significant impact that air-tightness has on the energy performance of the building. It is clear from the simulation results that reducing U-values alone, by increasing the insulation thickness, is not sufficient and that a far greater reduction in energy demand is achieved when the U-value reduction is combined with an improvement in air-tightness. In practice, this means a need for improved construction details, especially at interfaces, and a higher quality of construction on site. It is also worth noting that in the 'best performance' scenario, heating energy only accounts for 17% of the building's total energy demand. This implies that further improvements to the building envelope beyond current 'best performance' are unlikely to result in significant improvements in the overall energy performance of the building.

Lighting typically accounts for 20-30% of all energy used in single storey buildings and this percentage is likely to increase as the demand for heating energy is reduced.

Refurbishment provides the opportunity to improve natural daylighting levels by upgrading the rooflights to improve light transmission and distribution of light. However, care is needed to avoid over-heating during the summer months, as this will cause discomfort in naturally ventilated buildings and may actually increase the overall operational CO_2 in air-conditioned buildings. Full guidance on the impact of rooflights to the building envelope is given in the Colorcoat® Technical Paper 'In-plane rooflights for low energy buildings[4]'.

Incorporating renewable energy

Refurbishment of the building envelope also presents building owners and occupiers with the opportunity to install Low and Zero carbon (LZC) technologies such as photovoltaic panels, solar water heating and solar air heating. Such sources of 'renewable' energy may be used to reduce some of the building's operational CO_2, leading in part to the goal of a 'carbon neutral' building.

Furthermore, a minimum of 10% renewable energy is typically required to obtain planning permission, and this requirement is likely to become more onerous as new legislation is introduced to tackle CO_2 emissions.

Several renewable energy sources are readily integrated into the building envelope.

These include:

- Photovoltaics – Lightweight crystalline silicon systems that bond directly onto pre-finished steel cladding systems as shown in figure 4.
- Solar air heating systems use radiant heat from the sun to heat the air within the wall cavity, see figure 5.

Figure 4. PV laminate on factory insulated bonded mineral wool composite panel

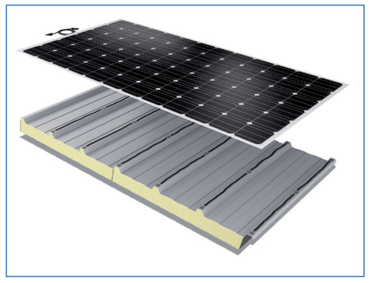
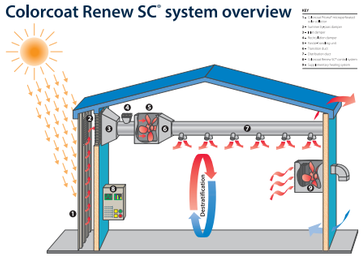


Figure 5. Transpired solar collector



Full guidance on the integration of low carbon technologies into pre-finished steel building envelopes is given in the Colorcoat® Technical Paper 'An approach to the design of cost effective low carbon buildings[5]'.

Refurbishment options

In selecting the most appropriate refurbishment solution for a particular application, specifiers need to consider a wide range of factors to help plan and manage risks which can be associated with a refurbishment.

These factors may include:

- Main reasons for refurbishment – what does the client hope to achieve?
- Budget and timescale requirements.
- Regulatory requirements at the time of the refurbishment.
- Occupancy of the building during refurbishment.
- Health and Safety considerations such as safe access and internal protection for the occupants and contractors.
- Can hazardous materials be left undisturbed?
- What is the condition of the existing substrate and supporting structure?

Some of the associated risks may include:

- Removal and disposal of old and possibly hazardous material.
- Protection of the workforce and surrounding buildings.
- Potential for losses in production and/or stock.

To minimise these risks it is essential that:

- A thorough survey of the building is undertaken.
- Specialist contractors are employed.
- A robust Health and Safety plan is developed.

Information on how to minimise these risks and useful check lists and links can be found on Tata Steel's refurbishment website at **www.beatthewolf.co.uk**

The term refurbishment encompasses a wide range of options, from basic over-painting to the replacement of the entire building envelope. It is important that clients and their design teams appreciate the options available to them and understand the implications of choosing a particular option over another in terms of these factors. When considering costs, clients should consider long-term life cycle costs, including cost savings from improved energy performance, in addition to short-term installation and material costs.

In general, there are two principal categories of building envelope refurbishment: re-sheeting and over cladding. Re-sheeting requires the existing building envelope to be completely removed and replaced by a new envelope system, whereas with over cladding, the existing building envelope is left in place and is used as a base layer for the installation of the new cladding system. The choice between the two options will depend on the individual project requirements and circumstances. To assist in this decision, some of the key items for consideration of both systems are listed below.

	Re-sheeting	Over cladding
Advantages	• Potentially hazardous existing materials can be completely removed. • The internal appearance of the building can be improved. • There is potential to improve the internal working environment for occupants. • It is easy to alter lighting configurations to optimum levels i.e. change pattern of windows and rooflights. • Air-tightness and thermal performance levels similar to new buildings can be achieved. • The existing structure is nearly always suitable for re-sheeting applications. • There is an opportunity to alter the building configuration.	• It is usually less expensive to over clad. • On site installation is fast. • There is minimal disturbance to building occupants. • Insulation can be easily upgraded. • Air-tightness levels similar to a re-sheet or new build can be achieved if considered at design stage. • There is a reduced need for internal protection during installation.
Disadvantages	• The cost of disposal of hazardous waste should be accounted for. • The need for internal protection should be accounted for during the installation phase. • Additional cost will be involved in re-sheeting. • A higher level of disturbance to occupants and operational processes.	• Upgrading of internal appearance and lighting configurations is difficult. • Over cladding relies on the integrity of the existing structure. • The building owner will need to maintain a log of asbestos containing material. • The cost of removal of asbestos containing material will need to be allowed for at building end of life.

Typical pre-finished steel refurbishment solutions

The most commonly employed pre-finished steel refurbishment solutions are:

- Strip and re-sheet with profiled built-up or composite panel system.
- Through fix pre-finished steel profile, insulated over cladding system.
- Pre-finished steel flat profile and trapezoidal profile over cladding wall systems.
- Pre-finished steel composite panels for roofs and walls.
- Pre-finished steel flat to pitch framed roof systems.
- Pre-finished steel standing seam pitched over cladding system.
- Pre-finished steel flat panel façade systems.
- Pre-finished steel rainscreen cladding systems.

All of these solutions employ the use of pre-finished steel. Pre-finished steel is made up of a number of paint layers and treatments applied to the metallic coated strip of steel in an automated and carefully controlled manufacturing process.

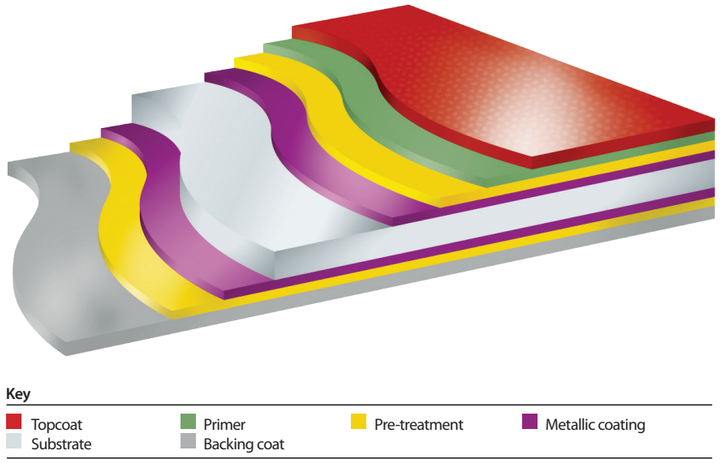
Each layer has a particular function and the performance of a pre-finished steel product is greatly influenced by them.

Colorcoat® pre-finished steel is manufactured within a continuous process, which guarantees high quality standards through controlling the coating thickness, colour and gloss, adhesion and corrosion resistance.

Pre-finished steel, also known as pre-painted steel, is extensively used for the building envelope. Manufacturing to exacting standards provides high quality and cost effective pre-finished steel products that can be processed further into finished systems such as composite panels, roof sheeting and facades.

When re-sheeting or over cladding as part of a refurbishment, it is the choice of the pre-finished steel product that will provide the long-term appearance and function of the building envelope and should therefore be given as much importance during selection as the refurbishment solution itself.

Figure 6. Diagram of the coating layers of a typical Colorcoat® pre-finished steel



Strip and re-sheet with profiled built-up or composite panel cladding systems

This solution is the most comprehensive refurbishment option. Re-sheeting involves the complete removal of the existing envelope materials, and re-cladding with a new pre-finished steel envelope.

As part of the refurbishment, the primary steelwork can be modified, and while it is fully exposed, it is wise to address any signs of wear or corrosion and repaint. The purlins and sheeting rails can then be assessed and replaced if required. Hot rolled angle purlin and sheeting rails would normally be replaced on a like for like basis. If a large number of the purlin and sheeting rails require replacement, it may be wise to consider complete replacement with modern cold rolled sections. Once the secondary steelwork is restored, cladding can progress as for a new build project.

Figure 7. Refurbished portal frame ready for re-sheeting

Re-sheeting, is the most costly refurbishment solution, however the refurbished building will show the greatest long term improvement in internal operating environment and energy performance. It is easy to upgrade the insulation, air-tightness and natural lighting levels up to the current legislative standards. The refurbished building will have the performance and durability similar to a new building.

Through fix pre-finished steel profile insulated over cladding system

This refurbishment option is suitable for the over cladding of failed pitched roofs of any material. The old roofing is retained for use as a liner, with the addition of a new vapour control layer (VCL) to prevent interstitial condensation build up in the new cavity.

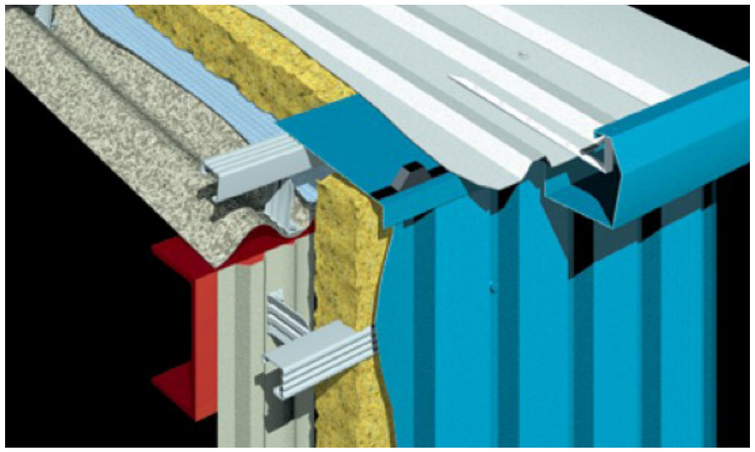


Figure 8. Through fix pre-finished steel profile insulated over cladding system

Support brackets are attached through the old sheeting into the purlins. Spacer bars, insulation and a new external pre-finished steel sheet are then installed, as if installing a built-up cladding system onto a new building. The combination of VCL, thicker insulation and external pre-finished steel sheet will significantly improve the air-tightness and U-value of the roof, while simultaneously enhancing its appearance and life. Furthermore, by leaving the original roof in-situ, these improvements are achieved with minimal disruption to the building occupants and without the need to remove potentially dangerous building materials such as asbestos roof sheets.

This option is only suitable if the existing roof is in good condition. If the original roof contains asbestos fibre, then an inspection log must be maintained.

Pre-finished steel flat profile and trapezoidal profile over cladding wall systems

Over cladding is the most cost effective and the simplest way to transform the aesthetic image of any building. No matter what the existing wall fabric, fibre sheet, blockwork or pre-finished steel profiled sheeting, over cladding makes the building look like new. The new system insulates and protects the old building and the facade can be designed to reflect corporate image and identity.

Wide plank profile can be used to create a flat facade or alternatively a profiled pre-finished steel external sheet can be introduced to create light and shade lines. Interesting architectural features such as cranks and curves can also be incorporated.

The new cladding will usually be installed onto a spacer system, fixed back to the existing structure and insulation can be installed as well to upgrade thermal performance.

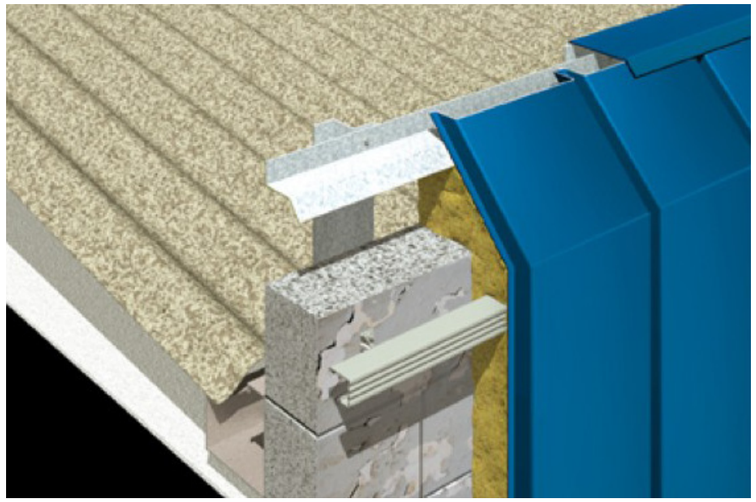


Figure 9. Pre-finished steel flat profile and trapezoidal profile over cladding wall systems

Pre-finished steel composite panels for roofs and walls

Pre-finished steel flat, micro-ribbed and profiled composite panels offer the designer and building owner an opportunity to enhance the appearance and performance of the external building envelope.

It is possible to over sheet roofs with such pre-finished steel composite panel systems however the additional extra weight of a composite panel, when compared to a traditional over cladding system with a single skin sheet and insulation quilt, needs to be considered. Often this additional imposed load is more than the existing structure is capable of withstanding and the added cost of this solution must be considered.

Additional imposed loads are not usually an issue for the over cladding of walls, here composite panels can offer a solution.

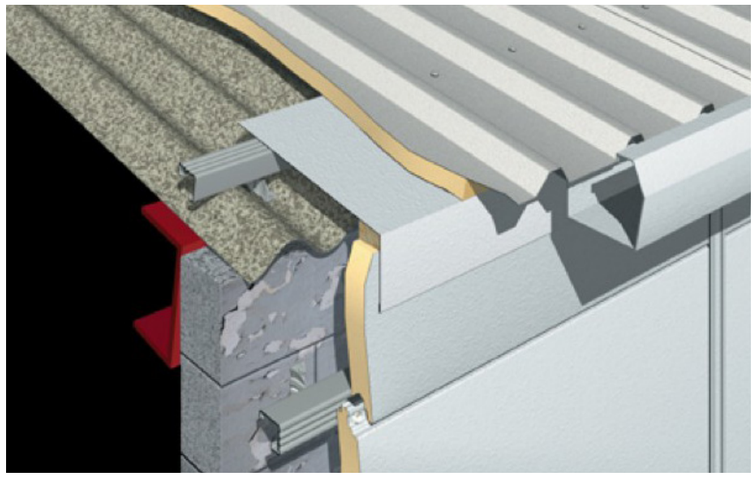


Figure 10. Pre-finished steel composite panels for roofs and walls

Pre-finished steel flat to pitch framed roof systems

Flat to pitch conversions completely transform the appearance of the building and in some cases are the only effective way of waterproofing the existing roof structure and eliminating problems associated with ponding. This type of refurbishment can sometimes incorporate additional habitable space within the new roof structure. This will depend upon the result of the structural survey and the layout of the existing services and access.

Figure 11. Pre-finished steel pitch framed roof system installed on building with a flat roof

In most cases, a completely new lightweight galvanised steel frame superstructure is fitted over the existing flat roof. The framework provides support for a new pitched pre-finished steel roof, which readily drains rainwater from the area. The lightweight structure does not impose a high dead load onto the existing roof, although the supporting structure should still be checked to ensure that it is capable of carrying the additional loads.

A pre-finished steel standing seam system might be chosen for the new roof, especially if the pitch is low. However, for a roof with a greater pitch a simple through fix pre-finished steel trapezoidal profile can be used. Low density mineral wool insulation may be installed on top of the old roof to improve U-values and reduce heat loss from the building.

This system requires a detailed structural survey to be carried out to ensure that the existing roof structure or supporting walls are capable of withstanding the additional dead and imposed load or the loads which are transmitted from the new structure.

Pre-finished steel standing seam pitched over cladding or re-sheeting systems

A pre-finished steel standing seam pitched over cladding system offers high performance, outstanding longevity and requires little or no maintenance. Flexible and lightweight, it provides the ideal solution for the refurbishment of failed roofing systems and in most cases can be installed over the existing roof. Pre-finished steel standing seam profiles can be roll formed to lengths in excess of 120 m. No penetrative fixings and no end laps ensure total weather protection. Even where the original roofing has not failed, over cladding is an excellent way to enhance the building's thermal performance and change its appearance. By increasing the amount of insulation beneath the new pre-finished steel external skin improved U-values can be achieved that provide significant energy savings.

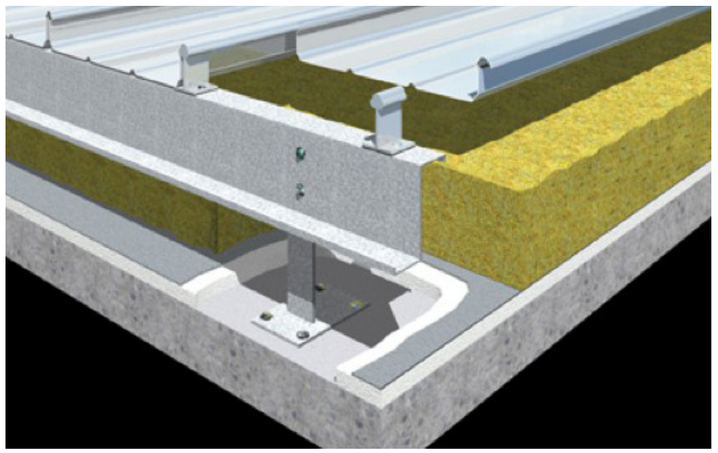


Figure 12. Pre-finished steel standing seam pitched over cladding system

Pre-finished steel flat panel façade systems

Pre-finished steel flat panel façade systems are fully interchangeable and can be used to refurbish or 'reface' conventional brick, stone or concrete walls or existing panel-based cladding systems.

There are two main options: The façade panels can be fixed to a new, lightweight supporting steelwork structure that is fixed to the existing walls. Alternatively, where the original panel system may have failed or where refurbishment is required for cosmetic purposes, the panels can be fabricated to suit the existing supporting steelwork.

Pre-finished steel façade panels are manufactured to the highest standards and they offer outstanding levels of thermal and acoustic performance. They have fully engineered joints to all four edges to ensure a neat watertight detail.

Figure 13. Pre-finished steel flat panel façade system

Pre-finished steel rainscreen cladding systems

Pre-finished steel rainscreen cladding is ideally suited to the refurbishment of façades, especially on commercial buildings. They can be used with conventional built-up cladding systems or composite panels to provide a solution that combines the benefits of modern pre-finished steel cladding systems with the superior appearance required for high-value buildings. Rainscreen panels are factory produced for the specific application and are available in a wide range of pre-finished steels.

Similar to pre-finished steel flat panel systems, rainscreen systems are attached over and spaced away from the outer face of the existing façade. As the name suggests the systems provide the building with a degree of weather screening from the elements, while allowing the façade to breathe. The introduction of additional insulation within the newly formed cavity will improve the thermal performance of the façade.

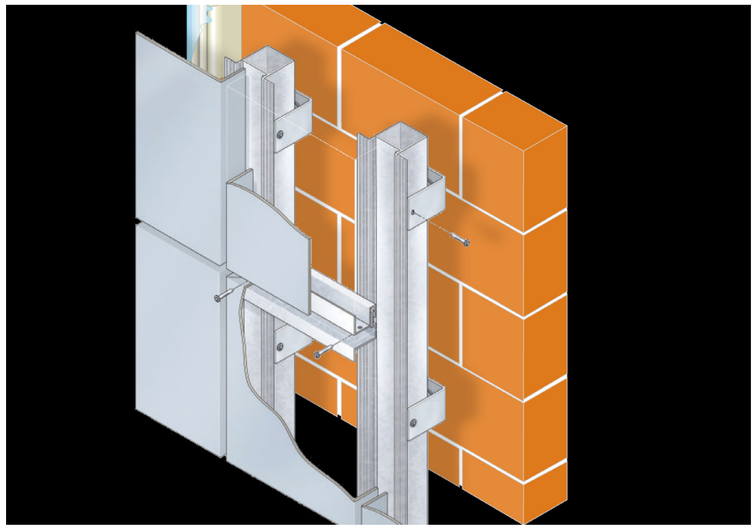


Figure 14. Pre-finished steel rainscreen cladding system

Maintenance and guarantees for typical refurbishment solutions

All of these typical pre-finished steel refurbishment solutions will require some maintenance during the lifetime of the refurbished building but this can be kept to a minimum by incorporating Colorcoat HPS200 Ultra® and Colorcoat Prisma® into the design. These Colorcoat® pre-finished steel products are available with the market leading Confidex® Guarantee, from Tata Steel for up to 40 years.

The Confidex® Guarantee has evolved from over nearly 50 years experience in the manufacture of pre-finished steel and innovative product development. It is based on a proven track record within existing building envelope construction and extensive natural weathering and accelerated testing at independent facilities.

As a result of this experience the guarantee is maintenance and inspection free and covers cut edges for the entire duration of the Confidex® Guarantee period. Additional annual inspections are not required to maintain the validity of the guarantee, reducing on going costs. The average annual inspection costs of a building can amount to as much as £36,000 over a 40 year lifetime. This also helps to achieve the HSE6 Work at Height Regulations[7] requirement to reduce work at heights.

The Confidex® Guarantee is issued directly to the building owner and can easily be transferred if ownership changes: For example when refurbishing a building for resale. Registering the Confidex® Guarantee provides a direct link to Tata Steel.

In the unlikely event of a coating failure, we can be contacted directly and independently of the contractual supply chain. Not only does this save time and money but can also avoid unnecessary legal involvement and the associated costs.

These reduced costs and the durability of Colorcoat® pre-finished steel reduces the associated life cycle cost of the roof and wall cladding systems of which they are a part. The environmental impact of the pre-finished steel coating during manufacture is minimal compared with the overall construction process and the building's full lifetime. The manufacturing processes, and materials used to manufacture Colorcoat® pre-finished steel are the most sustainable available and to demonstrate the environmental impacts, Tata Steel have carried out comprehensive life cycle assessments on a wide range of cladding systems using Colorcoat HPS200 Ultra® and Colorcoat Prisma®. For further details please visit **www.colorcoat-online.com/sustain**

Case studies

The following case studies illustrate how the refurbishment of the building envelope can significantly improve the appearance of the building, enhance its energy performance and extend its life. Between them, the examples feature a variety of building types and refurbishment options, but in all cases, the result is significant improvement in the quality and value of the building. In several cases, the refurbishment activity took place without disturbing the building occupants.

Spa distribution centre, Preston – Strip, re-sheet and extension refurbishment

In this case the roof of the building was leaking and needed to be replaced. However, the building had to remain operational throughout the work. The chosen solution involved retaining the old top sheet as the new liner and over cladding with a new external sheet. The insulation was also up-rated. The new external sheet used 6,000 m^2 of Colorcoat HPS200 Ultra® in Hamlet. From the client's perspective, functionality and cost were more important than appearance, so the refurbishment had to be undertaken within a restricted budget.

The improvement in the appearance of the building is evident from figures 15 and 16. This refurbishment is an example of adjusting the structural steelwork of an existing building to accommodate a new building use.

Figure 15. Before refurbishment of the building

Figure 16. Refurbished building after pre-finished steel roof over cladding and the inclusion of improved insulation

Woking gymnastics club, Surrey - Strip and re-sheet project

The refurbishment of the gymnastics club in Woking required the removal of the old roof sheeting and over purlin lining boards before new roof cladding could be installed. The new roof cladding consisted of pre-finished steel composite panels made from Colorcoat HPS200 Ultra® in Merlin Grey. The difference between the old roof cladding and the new installed cladding is shown in figures 17 and 18.

Figure 17. Before refurbishment showing failed roof cladding

Figure 18. Roof after refurbishment showing pre-finished steel composite panel roof cladding

Pimbo Point, Skelmersdale – Strip and re-sheet

The refurbishment of the industrial manufacturing facility in Skelmersdale is an example of a roof and wall strip and re-sheet. The replacement consisted of extensive re-sheeting on both the wall elevations and on the roof, where the rooflight configuration was also adapted. The corporate branding approach of Spencer Holdings was applied to give the building the appropriate and required aesthetics using 12,000 m^2 Colorcoat® pre-finished steel in Albatross and Sargasso. Internally all existing divisional walls have been removed to provide an expansive space of 110,000 sq ft though the unit is capable of being sub divided to provide individual units from 12,000 sq ft to meet tenants exacting requirements. The results of this refurbishment are shown in figures 19 and 20.

Figure 19. Industrial buildings before strip and re-sheet

Figure 20. Industrial buildings after refurbishment

Primet High School, Colne – Pre-finished steel flat to pitch roof system

This refurbishment, undertaken by Mitie Tilley Roofing, involved the removal of the flat roof of the building which was replaced by a pre-finished steel pitched roof frame system using 4000 m^2 of Colorcoat HPS200 Ultra®. A typical construction detail of the roof cladding and the supporting structure is shown together with the before and after appearance of the roof.

Figure 21. School before refurbishment of the flat roof

Figure 22. School after pre-finished steel flat to pitch roof system refurbishment

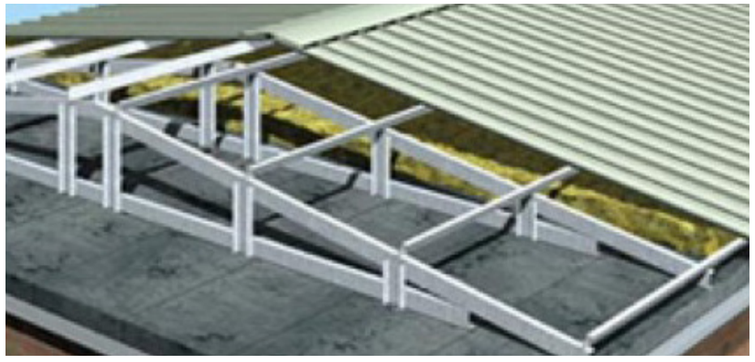


Figure 23. Typical construction detail of roof cladding and the supporting structure

BMW after sales centre, Liverpool – Pre-finished steel rainscreen cladding system

The BMW after sales centre in Liverpool is a great example of how massive improvements in the aesthetic appeal of a building can be achieved with a simple rainscreen over cladding project. The building was refurbished using 500 m^2 of Colorcoat Prisma®.

Figure 24. Building before pre-finished steel rainscreen over cladding system

Figure 25. Building after pre-finished steel rainscreen over cladding system

Conclusions

The purpose of this technical paper is to highlight the need for designers and building owners to address the possibility of refurbishment as an economically viable and sustainable alternative option to new build. There are a number of factors which reinforce this and to summarise are as follow:

1. There are a range of refurbishment options, which can vary from over painting for aesthetic purposes, or cladding durability reasons, through to a complete re-sheet or over cladding with associated thermal performance benefits.
2. Refurbishment, where possible, is a far more sustainable solution than new build.
3. The retention and re-use of the existing floor slab, structure, services and associated infrastructure makes refurbishment more economical than new build.
4. Dramatic improvements in operational energy efficiency, energy costs and CO_2 emissions are all achieved.
5. While refurbishing a building, there are a number of renewable energy technologies, which can easily be incorporated into the project, to reduce building operational CO_2 emissions.
6. Embodied energy for refurbishment projects is usually a fraction of that for new build.
7. Refurbishment provides the opportunity to remove hazardous construction materials from the building.
8. Refurbishment improves the working environment and comfort levels for occupants.
9. By carrying out a refurbishment, the aesthetic appeal of the building can easily be improved.
10. Refurbishing a building improves the market value and rental income of the property.

If you are considering the refurbishment of an existing building it is important to involve a refurbishment specialist to ensure that all the above factors are taken into account to maximise the potentials of the newly refurbished building.

References

The following documents, standards and modelling packages have been used to prepare this Colorcoat® Technical Paper.

1. Approved Document L2B: Conservation of fuel and power (Existing buildings other than dwellings) (2006 edition)
2. Steel Construction Institute, Retail renovation study, document RT1, Version 0.1, March 2009
3. Integrated Environmental Solutions Limited 2009
4. Colorcoat® Technical Paper; 'In-plane rooflights for low energy buildings'.
5. Colorcoat® Technical Paper; 'An approach to the design of cost effective low carbon buildings'.
6. The Health and Safety Executive, (1G) Redgrave Court, Merton Road, Bootle, Merseyside, L20 7HS. www.hse.gov.uk
7. The Work at Height Regulations 2005; Health and Safety Executive. Statutory Instrument 2005 No. 735; ISBN 0110725638

Colorcoat® Supply Chain Partners

1. All Tata Steel supply chain partners supply roof and wall cladding systems, which meet the Part L2 A '2010 notional building' specification for new build.
2. All Tata Steel supply chain partners can provide guidance on the design and specification of the building envelope, to provide a more cost effective solution than the 2010 notional building specification for Part L compliance.
3. All Tata Steel supply chain partners provide building details designed and modelled to reduce the associated heat losses from the building. The use of these details will provide a performance, significantly better than the industry standard. A building designed and built using these high performance details will have a CO_2 emission rate within 1% of one using fully accredited details.
4. Colorcoat Prisma® by Tata Steel is the product of choice for the use in transpired solar collector systems which provide a low carbon heating solution and is an approved substrate for use with Unisolar PV laminate. This combination is registered with the micro generation certification scheme (MCS) and is eligible for feed in tariffs.

For more information on our supply chain partners visit **www.colorcoat-online.com**

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