CWCT CURTAIN WALL INSTALLATION HANDBOOK

Chapter 1 The Facade

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University of Bath

Centre for Window and Cladding Technology
November 2001

ISBN 1 874003 96 3

Published by
Centre for Window and Cladding Technology, University of Bath, Claverton Down, Bath BA2 7AY

This handbook was part-funded by the Department of the Environment, Transport and the Regions under research contract number 39/03/272 cc 862.

This handbook was written by the Centre for Window and Cladding Technology (CWCT) as part of its training programme to improve the standard of curtain wall installation.

It will be of benefit to all those installing, or supervising, the installation of curtain walling and other glazed building elements.

This is one of eight chapters from the CWCT Installers' handbook.

Introduction

The installation of facades and façade elements is one of the more complex operations on a construction site. It requires a range of skills and knowledge yet has not been recognised as a particular skill or trade. Façade failure, particularly water leakage, is the most common cause of failure in new buildings.

This handbook brings together advice on installation of curtain walling including all the major components: frames, gaskets, sealants, finishes, glass and fixings. It is based on experience gained by CWCT in setting up training centres for installers and in training main contractors' site supervisors.

The book explains why things should be done and highlights those things that are most critical to the success of curtain wall and window installation.

This Handbook is a guide to achieving better curtain wall installation. However, it is not a substitute for care and diligence, nor should it be a substitute for proper training. Full details of CWCT's training programme are available at http://www.cwct.co.uk/installers.

1 The facade

- **Function**

The facade of a building has to exclude the weather, provide a comfortable internal environment, be safe during construction and use, and retain its appearance throughout its life.

Facades will only do these things successfully if they are correctly designed, planned and installed. This guide gives advice on the correct installation of facades and the components that make up a facade.

Modern facades are often highly technical involving the use of many materials, Figure 1.1.

- **Components**

Facades are made up of components or elements. These are factory-made to high tolerances and quality. However each is designed as a separate self-contained component without full regard as to how it may be built into most forms of facade construction. It is left to the facade designer and the installer to detail and fit the component on any particular contract. The different elements of the facade are each selected to serve a purpose and may not be chosen for ease of installation.

- **Windows**

Window types are selected to provide ventilation, ease of cleaning, ease of operation, appearance, escape in case of fire, resistance to burglary and blast.

- **Doors**

Door types are selected for security, appearance, emergency exits, fire performance, ease of operation, robustness.

- Glass

There are many types of glass to meet the requirements of particular buildings. Glass can provide security, resistance to blast loading, safe failure, strength, reduced sound transmission, reduced glare, reduced transmission of ultra violet, colouration and appearance.

- Panels

Infill panels in glazing frames and panels mounted as rainscreen are selected for their appearance, strength, resistance to abrasion and vandalism, fire rating, strength, ease of installation.

- **Types**

Facades take many forms ranging from heavy forms of construction; brickwork and precast concrete to the lighter forms such as profiled metal sheet, stick curtain walling and glass screens. The form of construction will have been chosen by the client and the architect having full regard for the purpose of the building, the image required, the design life of the building and whole life costing (energy and maintenance costs).

The basic forms of cladding are:

- **Brick and blockwork**

Load bearing masonry is the traditional method of building low-rise buildings without a structural frame. Masonry in medium and high rise construction is normally built as a non-load-bearing wall supported by the structural frame at floor levels. Windows and doors are fitted to holes left as the masonry walls are built. Masonry walls normally have cavities and it is important that factory made components are correctly sealed into the multi-layer masonry wall. The accuracy of construction is at odds with the accuracy required at joints.

- **In-situ and precast concrete**
In-situ concrete may be used to form the exposed surface of a façade but is more commonly concealed by an external cladding or rainscreen. Precast concrete is normally non- loadbearing and may be used to form cladding panels or backing wall panels clad with rainscreen.

Windows and doors may be installed into openings in in-situ concrete walls or precast panels, either at site or, for precast panels, in the factory. In other cases window openings may be formed as spaces between precast units. Components must be correctly sealed into the panels. If windows abut more than one panel then special care is needed to fix both panels and windows to prevent unintentional movement.

- **Panellised curtain wall**
Curtain wall may be constructed as large panels. Each the width of a structural bay and one storey high, they can weigh up to 15 tonnes, Figure 1.2. They may be precast concrete panels or steel trusses to which are attached outer and inner surfaces, insulation, and windows. Components are fitted onto the panels in much the same way that they are fitted into other facades. Panels of this size require very large fixings and anchors to hold them on the building. Special attention should be given to the large panel-to-panel seals that are required.

- **Unitised curtain wall**
Smaller factory-made panels are used in unitised construction. Typically one glazing bay in width and one or two storeys high the units are either:
- stick curtain walling frames that are factory assembled as ladders
- panels of concrete, gfrp, grc, metal skinned insulating composites that are factory assembled and include windows as required

Sealing the joints between units on site often depends on good workmanship and understanding of joint behaviour.

- **Stick system curtain wall**
Curtain wall can be formed from a stick system of site assembled framing members, mullions (vertical) and transoms (horizontal). Glazing and infill panels are fixed into the framing grid by clamping them in to a glazing rebate Figure 1.3. Panels may also be fitted as rainscreen, structural silicone glazing or bolted structural glazing.

Stick curtain walls are usually built from standard systems but they always have non-standard interfaces with adjacent elements (roof, structure, other wall elements). Stick curtain walls can be custom-designed to include accessories such as blinds and brise soleil.

- **Rainscreen**
Rainscreen is constructed as panels with a ventilated cavity between them and an inner air barrier. Rainscreen is either built by mounting support rails and panels on an inner wall of concrete, brick or blockwork (overcladding) or is part of a curtain wall (panellised, unitised or stick) that is self-supporting with integral cavity and air barrier (integral rainscreen) Figure 1.4. The panels may be of any material including metal, gfrp, stone, glass and ceramics.

- **Bolted glass assemblies**
Glass is either bolted directly to a supporting frame or a number of pieces of glass are bolted together to form a structural glass assembly. The installation of these walls may require greater knowledge and skills than are described in this book.

- **Profiled metal cladding**
Profiled metal normally spans between sheeting rails or purlins supported by the structural frame. It may be used in one of two basic forms: single skin and double skin insulated. The second form is used for cladding heated habitable buildings. The fitting of windows and doors requires attention to air and water sealing of joints with complex shapes.

• Durability

All facade components will deteriorate and age. This results from weathering, abrasion, staining, mechanical wear and tear. The useful life of a wall and the period to first repair may be reduced if any component is incorrectly installed or substituted with an inferior product.

Walls are generally required to last in excess of 20 years. A normal requirement would be for the primary framing members to last 40 or 60 years while other components such as hardware are required to last 20 years before refurbishment or replacement. Other components such as sealant joints may be designed to have a shorter life.

Poor installation can reduce the useful life of components to less than half of that intended. In particular inconsistent workmanship can lead to premature failure of a few components across the whole facade or complete failure of a small area of wall. With medium- and high-rise buildings the cost and difficulty of gaining access for remedial work will be far greater than any savings made by using inferior materials or modifying the design at site to simplify installation.

• Interfaces

A wide variety of components and wall elements are brought together in different combinations on every building site to create a unique building. Components are designed by manufacturers to fit into a number of construction forms but the interface between different manufacturers' components and constructed elements such as brickwork is the responsibility of the specialist contractor. Particular problems arise when the work of two contractors meet at an interface and design responsibility is shared.

Late substitution of one component for another, such as a window, will often require the design of an interface to be changed. This guide deals with the principles and practice of installation to ensure that interfaces are properly detailed and constructed at site level.

Cost	Materials	Performance	Quality	Appearance
- Capital cost	- Glass	- Weathertightness	- Methods	- Fit
....	*Annealed*	*Water*	....	....
- Running costs	*Toughened*	*Air*	- Standards	- Finishes
....	*Laminated*	....	....	*Gloss*
- Whole life costs	....	- Wind loading	- Inspection	*Colour*
Energy	- Metals	....	....	....
Maintenance	*Aluminium*	- Thermal	- Testing	- Shape
-	*Bronze*	*U-value*		*Flatness*
-	....	*Solar gain*		*Curvature*
-	- Plastics	....		-
	....	- Condensation		-
	- Stone	....		-
		- Ventilation		
	- Sealants	....		
	Silicone	- Acoustics		
	Polysulfide	....		
	Acrylic	- Fire		
	....	*Resistance*		
	- Gaskets	*Reaction*		
	....	....		
	- Finishes	-		
	....	-		
	-			

Figure 1.1 Some of the aspects of wall performance to be taken into account during design and installation

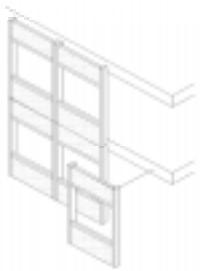

Figure 1.2 Unitised/panelised curtain wall

Figure 1.3 Stick system curtain wall

Figure 1.4 Rainscreen panels