

Masonry façade retention

Deborah Lazarus, Associate Director, Arup Research and Development and member of the Institution's Research Panel, outlines a new guide from CIRIA which will become the industry standard

The results of a CIRIA research project entitled *Masonry façade retention: best practice guidance* are due to be published soon. The research has been carried out by Arup, part-funded by the Health and Safety Executive (HSE), and has been guided by a steering group of experts drawn from parties involved in, or with an interest in, façade retention. The original commission was for a good practice guide: the change made during the course of the research is a reflection of the breadth of consultation and input to the guide from a number of parties.

At present within the United Kingdom there is no established guidance or code of practice for the design of façade retention structures. The lack of such guidance was noted as a concern during the course of consultations.

Publication of the output of the research project in late 2002, together with the companion site guide, will provide the industry standard which it is hoped will then be referenced as authoritative guidance by all relevant parties. In addition to covering the technical, contractual and organisational aspects of the subject, the guide also includes a broad selection of case studies and a full set of design calculations for the retention structure in one of the projects reported.

The involvement of the HSE, both in terms of funding and through the chairmanship and membership of the steering group, is a reflection of the concern over the specific health and safety issues associated with façade retention. This is seen in the context of major concern more generally on such issues within the construction industry. The guide covers this topic in some depth.

Within Arup, this project is seen as an important aspect of ongoing work on existing buildings, now being spearheaded through an internal network which brings together all aspects of such work on a cross-discipline, inter-office basis.

Responsibilities

A number of important issues regarding the responsibilities of the different parties are identified.

One of the key recommendations is for the appointment of an appropriately qualified and experienced Temporary Works Coordinator for all façade retention schemes. Identifying also that the design may pass between different parties as the project progresses, it is further recom-

mended that there must be 'ownership' of the scheme at all stages from inception to completion of the whole of the works.

An outline solution and method statement should be provided, generally by the permanent works designer, although it is recognised that often this will be developed, and in some cases revised substantially, by the contractor's temporary works designers.

Where the façade retention is carried out as an advance works contract, procedures should be put in place to ensure that responsibility for the temporary works is clearly maintained and identified at all stages. A particular case is where there is an unplanned delay to the implementation of the permanent works, sometimes by a number of years.

Health and safety issues

Façade retention incorporates a number of activities which may themselves individually present significant hazards. Again, specific recommendations are made, including:

- risk assessments should be carried out to determine the inspection regime;
- inspections should be carried out and recorded by a competent individual in accordance with a site-specific schedule;
- residual hazards should be identified as far as foreseeable in the health and safety plan.

The responsibilities of the different parties under the CDM Regulations are discussed. Of particular significance is the obligation of the client to provide relevant information about the site and 'not to leave it to contractors to discover hazards'. This is a powerful argument for an early and thorough investigation of the existing construction to be carried out. Too often this is not given the requisite importance due to concerns over cost and time, leading to subsequent delay and difficulty once the main works commence.

Design for wind

The guide recommends that wind loads for the design of the façade retention structure should be calculated using BS 6399: Part 2 – although it comments that the current edition of BS 5975 still uses CP 3 Chapter V.

Guidance is given on the application of this code to the design of a temporary façade retention structure. It is noted that wind forces may be calculated using



Above: A dramatic example: retention of second and third floors of 5, Duke Street, Marks & Spencer, Grafton Street, Dublin

Below: a rare collapse of a heritage façade in Sydney, Australia in 1990. There were, fortunately, few injuries and no fatalities





either the standard or the directional method. The former is usually applicable on sites of essentially rectangular plan form, while the latter may offer significant economies for larger buildings of less regular plan form.

Detailed consideration was given to the appropriate value of S_p to be used for the design of the retention structure, looking at it as a temporary structure and therefore considering the possibility of using a value of less than 1.0. However, the working group preparing the wind loading guidance for BS 5973 and BS 5975 has recommended that temporary structures should have a reliability equivalent to that of permanent structures, and that the probability factor should not be reduced unless there were no risks to the public or workers on the site. This view is endorsed by the Building Research Establishment and the recommendation has been adopted within the guide.

Other design parameters for the temporary façade retention system

The different loads that may act upon a retention structure are described. Façade offsets and out-of-plumb generate lateral loading effects have to be considered in combination with wind and other loads. These may be significant.

Recommendations are given for minimum values, together with the principal lateral load combinations to be considered.

It is recommended that the design of the typical temporary façade retention structure should limit its lateral deflection to height/750 under load. The different effects that may contribute to actual deflections on site are discussed.

It is also recommended that protection against impact, wherever possible, should

Above:
A newly completed façade adjoining the Wigmore Hall in London

Top right:
Protecting a conserved façade during building

Right:
The installation of acoustic bearings in the connections between the façades and the new structure at Oxford Circus, Manchester



be provided in preference to designing to resist its effects, although design loads are proposed for cases where this cannot be done.

Monitoring

Information is given on methods of monitoring and the importance of establishing a suitable regime at an early stage. Interpretation of the data is discussed, in particular the need to consider carefully both the underlying causes of recorded movements, and to look at trends.

Illustrations are provided of graphical records of movements, together with interpretation. While design parameters for the retention structure are generally associated with movement due to wind, the measured movements are most often a consequence of thermal effects, which may vary quite significantly on a daily basis, and also ground movement.

Fixings

The guide contains some discussion on the connections between the façade and both the permanent and temporary reten-



tion structures. In the temporary case it is more common to clamp the two structures together using existing openings as far as possible in order to avoid damage to what is often historic fabric.

Given that the vast majority of retained façades are of masonry construction – the specific focus of the guide – the general recommendation for the permanent connections is to use bonded anchors, with an injection system employed in the most common use of resin anchors. Both the system and the method of application are most suitable for use in old masonry, which tends to be inherently variable and may incorporate *inter alia* unbonded skins, an irregular rubble core and voided units.

Concerns over the use of resin have been expressed in relation to both performance in fire and long-term creep of the material. These are reviewed and reassurance given in both cases.

Fixings for retained façades more generally, and the long-term creep performance of resins were both presented in more detail by Arup at the 10th Hilti Fastening Academy held in London at Imperial College on 21 August 2002. More information on the event can be found on the website: (www.hilti.co.uk/editorial).

Industry consensus

Throughout the research period and the production of the final publications there has been widespread support and cooperation for the project, and acknowledgement of the need for it, from both the steering group and other parties who were consulted.

Information has been made readily available; an industry workshop held prior to the issue of the second draft received great support and provided valuable input on specific topics. It is firmly believed that the guide has benefited greatly from this cooperative approach and can be justifiably represented as containing a consensus view from the industry.