Transport, Engineering and Architecture

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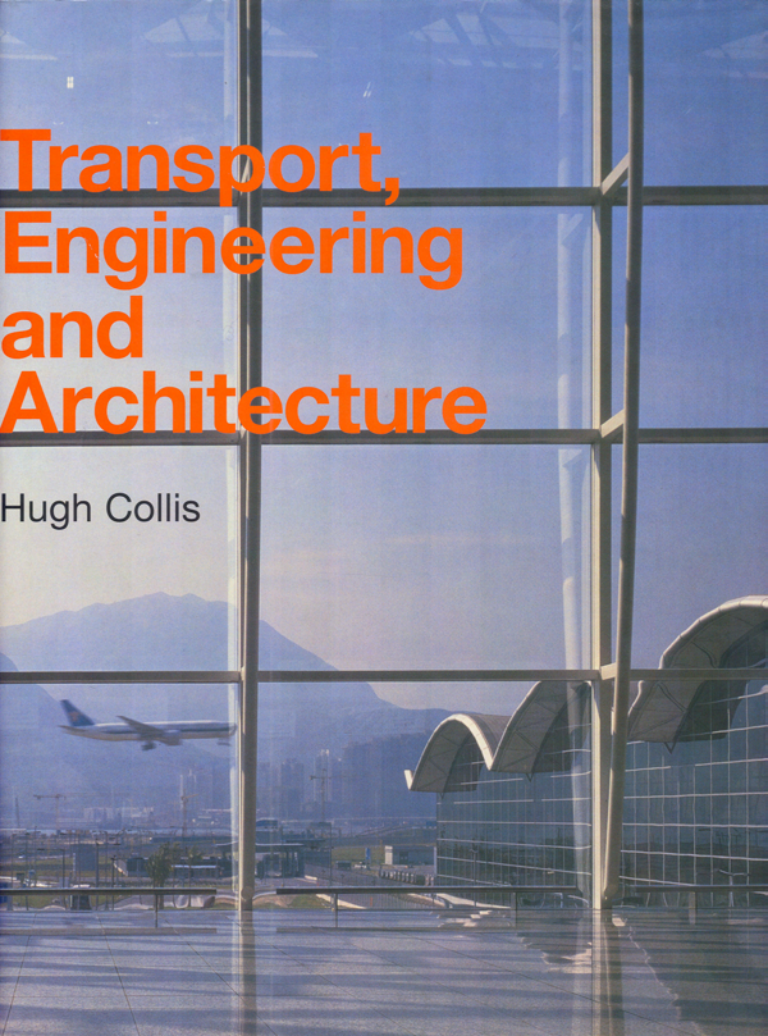

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Picture on page 2 shows Bult station, Hanover Light Rail System, Germany, by Despang Architekten

Contents

'What the engineer sees as structure, the architect sees as a sculpture. Actually, of course, it is both.'

Sir Ove Arup

The last 30 years have seen a revival of interest in the design of buildings both to enhance the experience of the traveller and benefit the business of transport. Collaborations between architects and engineers are now merging the science of new materials and construction methods with the art of architecture, resulting in buildings that are a pleasure to use. This book seeks to document the state of the art in transport design at the turn of the century through the work of Arup in co-operation with various architects of vision and imagination. All fields of transport are explored – buildings, infrastructure and operations. The culture of excellence in design in these fields makes for an exciting period in the development of railways, airports and bridges, and the numerous other buildings and structures that are part of modern systems of transport and communication.

Transport systems present particular challenges to building designers, for the brief is not confined to a single site or locality. Transport infrastructure is part of a network that can span a city, a region, a country or the world. The purpose of such a project is to facilitate movement, not to cater for an activity contained within a single building. With a transport building, therefore, unique dimensions, time and distance are involved, which are not present in a residential or office development. The point of arrival in a city, be it a railway station, airport or bridge, is now part of the defining urban landscape.

Collaborations between Arup and leading architects such as Norman Foster and Renzo Piano – on Stansted and Kansai airports – have placed the firm at the forefront of developments in transport design. However, Günther and Martin Despang's Hanover Light Rail System (see page 148) demonstrates that the transport sector also provides opportunities for imaginative architects in small firms to display their skills and develop their reputations.

Ove Arup, the founder of the practice that bears his name, was one of the first designers of the modern era to recognize the value of the synergy between architects and engineers. Since its formation in 1946 the firm has expanded to work on major commissions with leading designers throughout the world. For most building projects today the architect is the leader, but in the 1990s the fusion of engineering and architecture became the natural process in transport design. The separation of the roles of architect and engineer has diminished as the concept of a design team has replaced the previous practice where one or the other was identified as lead designer.

Previous page: Howrah Bridge, Calcutta, India. Built in the Second World War, it carries 60,000 vehicles and 2 million commuters every day.

Opposite (figure 1): Ove Arup's sketched options for use of shell structures, in an article for *Architectural Design*, 1947.

> Light Rail Stations

Hanover, Germany, 1996–2000

Hanover is a city of over half a million people, with over a million in the Greater Hanover region. In 2000 the city, the capital of Lower Saxony, was host to World Expo 2000, the first world fair to take place in Germany. It was planned for 40 million visitors over five months although, disappointingly, only 18 million attended. In order to cater for the expected visitors, a range of city improvements were carried out. About 85 per cent of the city was destroyed by Allied bombs in the Second World War and the city hall, one of the few buildings to survive, was renovated to celebrate the occasion. In addition, motorways were repaired, the airport given a new terminal, the railway station extensively remodelled and a new train station built at the fair site.

Hanover is well known for the Hannover Messe, the world's largest industrial fair. However, the existing area of the fair was not large enough to provide space for all the pavilions required for Expo 2000, and a new area to the east of the existing site was developed.

Opposite: The light rail system in Hanover had to be extended to accommodate the crowds expected for World Expo 2000.


Zur Veranstaltung in der
Preussag-Arena benutzen
Sie bitte die Linien 6 bzw. 16
bis Messe/Ost

Above: Emslandstrasse station: made with timber.

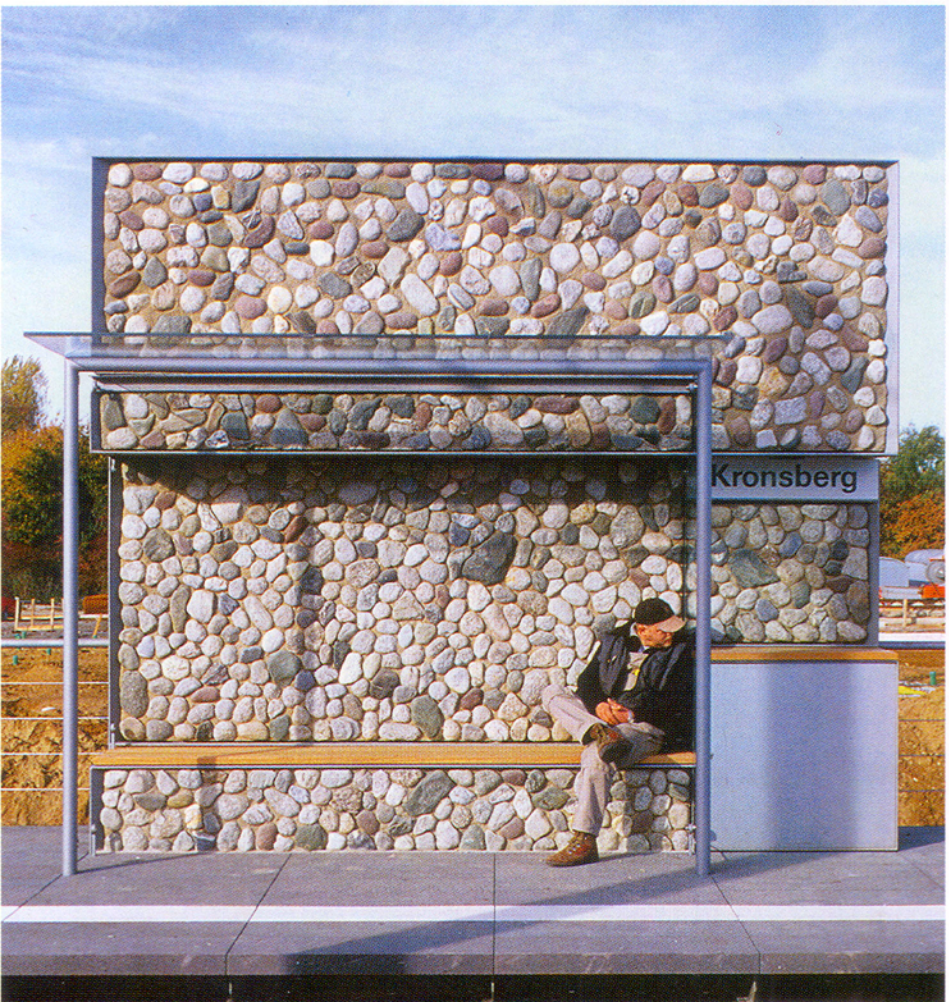
Below: Kerstingstrasse station: made with fine stainless steel mesh.

Above: Freundallee station: made with red brick.

Below: Krügerskamp station: made with glass.

Above: Feldbuschwende station: made with a mix of metal (plates) and timber.

Below: Kronsberg station: made with pebble cladding.



The new light rail line

The number of visitors forecast for Expo was very substantially higher than the number expected to attend an event such as the Hannover Messe. Crucial for the success of Expo 2000, therefore, was the upgrading of the tram service to a modern light rail public transport system. An essential part of it was the Stadtbahnlinie D-Süd, carrying lines 6 and 16, which connects the centre of Hanover with the new eastern development.

While the world fair was seeking the best design talents to display within the site, the Hanover transit agency, Üstra Hannoversche Verkehrsbetriebe AG, sought to emulate Expo's desire for high standards in the design of its new tram line.

New rolling stock was designed by a London industrial design firm, Jasper Morrison Ltd, complementing the new stations and providing the modern image required. The tram was unveiled at the Hannover Messe in 1997, and was awarded the Transportation Design Prize and the Ecology Award of the German Industry Forum.

The local firm of Despang Architekten won the competition for a total of 13 new stations, with Arup commissioned to carry out the structural engineering for all of them.

Below: The granite platform surfaces rest on a grillage of rolled steel I-sections.

The stations

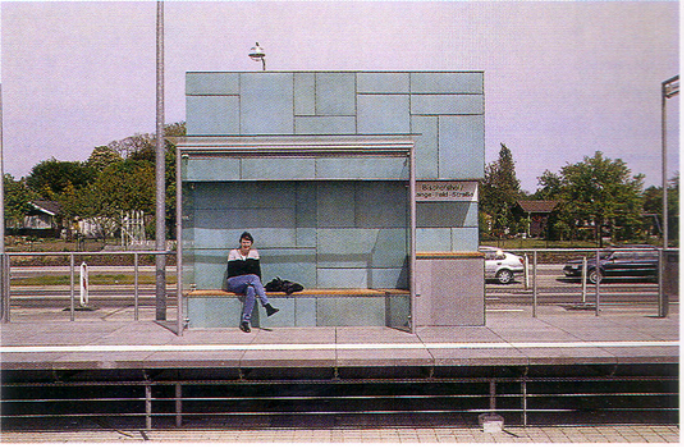
The design of the stations is based on a modular system that is able to reflect the local environment in each of the neighbourhoods through which the light railway passes. With most of the elements prefabricated, the amount of site work was reduced to a minimum. Prefabrication also improved quality and reduced costs.

Each station has the same four elements:

- a platform
- ramps to provide access for disabled passengers
- stairs
- a waiting area

The side walls of the ramp and the stairs are precast-concrete retaining walls. After they had been placed on site, the gap between the side walls of the ramp was filled with gravel or sand. Concrete for the ramp itself was then cast in situ.

The platform itself consists of two main welded-steel segments made of rolled I-sections. The length of these segments is either 5.5 metres (18 feet) or 4.5 metres (15 feet). The longer segment lies longitudinally on the foundations, which are precast concrete blocks. The shorter element is used transversely between the bearers. To take up thermal movement, the connection between these elements was designed as



Above: Bischofshof/Lange-Feld Strasse: made with a patinated-copper finish.

Above: The cladding reflects the texture of local buildings or landscape.

an expansion joint in a longitudinal direction. This creates a grid. Granite slabs form the surface of the platforms.

The waiting shelters are made of shop-welded steel frames which are rigidly built into the concrete foundations supporting the grid of the platform. Each of the concrete blocks is designed to support a 5.5-metre (18-foot) shelter module if required. The length of the shelter on each platform can therefore be adjusted to accommodate the forecast passenger traffic, or extended in future as needed.

The shelters have vertical panels of 19-millimetre (¾-inch) security glass, and there is a glass canopy to provide protection from the elements. The end of the shelter facing oncoming traffic is set back so that passengers can see the trams approaching.

Günther and Martin Despang believe that urban space is not always treated very kindly, so to rectify this they specified various proactive and preventative treatments to deter vandalism: all built-in elements, such as information and advertising boards, fit flush within the structure; finishes are treated with coatings that protect against weather and graffiti; and the construction makes use of smooth, non-adhesive materials.

The cladding of the shelters changes with each station to provide a harmonious relationship with the local urban form. Fixed to prefabricated steel frames are different materials such as steel, copper, glass or hollow-glass blocks, timber or masonry. To keep site work to a minimum, these frames are hung directly onto the steelwork of the shelters.

At the Haltstelle and Freundallee stops, where the prevailing building material in the neighborhood is brick, the facings are of dry-pressed brick. At Bischofshof/Lange-Feld Strasse, the patinated-copper finish oxidizes to reflect the natural colours of the nearby allotments. Kerstingstrasse has a fine stainless-steel-mesh finish, Bünteweg is clad with larch panels in a metal mesh, and pre-cast concrete is the dominant material at Pressehaus. All the materials were laboratory tested, and even satin-finished glass blocks were found to be sufficiently resistant to abuse to be used to provide texture and variety. In this way, each stop is given a different character – what Despang would describe as 'urban punctuation'. Bold exclamation marks, possibly even question marks, can be encountered along the line before arriving at the full stop of the Messe terminus.

Conclusion

Imaginative use of materials has shown that even structures as humble as tram-stop shelters can provide interest and variety. The different character of each stop enhances the sense of place and the distinctiveness of the urban design, as well as enabling the stop to be readily recognized by regular passengers. The stimulus of Expo 2000 in Hanover not only created a number of large pavilions, but also gave rise to a modest and colourful ancillary infrastructure which remains an inspiration to its citizens in their daily lives. The use of modular construction techniques allowed the costs to be kept to a level commensurate with the scale of the buildings. Architecture does not have to be big to be beautiful.

In 1999 the project received one of the Architectural Review Emerging Architecture awards.