# QANTAS DOMESTIC TERMINAL SYDNEY, LIGHTWEIGHT ARCHITECTURE, IDEA AND EXECUTION

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## Introduction

Idea and execution. These are the two key words that guide the development of the lightweight components of the Qantas Domestic Terminal development at Mascot in Sydney. Idea, the source of inspiration that leads to the concept, and execution, the methodology of developing and reinforcing the idea through technical development and construction.

## Background

The new Qantas Domestic Terminal at Mascot replaces the 1970s terminal designed by Clarke Gazzard Architects in the 1970s. This original terminal became too small for what was in the late 1980,s, Australian Airlines, and HASSELL were commissioned to investigate and develop plans for expansion. With Qantas' merger with Australian Airlines a revised brief was developed and this became the basis for the first Stage of development, Gates 1, 2 and 3, completed in 1993.

Shortly after the completion of this fist component, Qantas decided to develop the further Stages, Stage 2 was the new Satellite building and extensions to the concourse and a new arrivals hall, Stages 3 and 5 continued the concourse and completed a new departures hall, and Stage 4 (out of sequence) completed a new retail foodcourt area.

The major lightweight components of the terminal are associated with Stage 2 (the Satellite) and Stage 5 (the Departures Hall).

## The Satellite

The Satellite was developed to services 6 new gates through a series of 'static links' that lead to aerobridges and aircraft. The structure is three storeys with engineering facilities at ground (Ramp) level, the concourse and gate lounges at first level and future accommodation at second level.

It was important to make the satellite a 'special place' as a hub for containing 6 gates and the associated passengers. The Satellite also terminated the elongated concourse and would be prominent as an end to this vista.

As the first major expressive lightweight structure (some components such as glazing structures and finishes had been developed in the 'seamless transfer' area) the decisions made in the Satellite would affect the design of many future components of the terminal, particularly the departures hall.

With this in mind, the Satellite structure could not be developed in isolation from future stages.

## The Idea

The lightweight roof of the satellite developed as an architectural requirement to deliver a horizontal 'hovering ring' to cap the major space. This was to be reinforced by similar caps to the smaller static links. The roofs would be separated from the base by clerestory lights to emphasise their 'thinness".

The structure was to express the forces in the composition whilst not appearing overtly 'industrial' in appearance. The component parts of the structure were to be used throughout the terminal to connect the various stages and spaces of the overall terminal design.

The inspiration for the structure of the roof came from observing the skiffs racing on Sydney Harbour. The elegant masts are a combination of arms and cable stays. Experimenting with computer models we were able to form a 'web' of these masts laid horizontally to form a roof structure.

## The Execution

To reduce the apparent industrial appearance of a web of structure supporting the roof, it was a very definite decision to design the top truss members to rest above the ceiling line. This meant only the lower members were exposed to view. This gave a unique appearance to the structure.

The metal ceiling pans were painstakingly coordinated to align with the arm penetrations and the surrounding ring supports.

Originally, it was envisaged that many more rods would be required to hold the roof down. The final weight of the structure, however was enough to counteract the wind loads and the final rods are only used to covert the 'masts' into simple assisted beams.

One of the components translated to the departures hall trusses are the tapered arms. The taper was to reinforce the connection with the skiff masts whilst at the same time indicating the forces in the particular parts of structure. They also helped to reduce visual mass as the arms penetrated the metal ceiling grid. Originally it was hoped to 'cone' plate to form these arms, but contractors offered a solution of a standard internal member 'wrapped' by a thinner sheet of metal and this was reluctantly accepted. In future tapered members of the departures hall trusses the tapered arms were true metal structural cones.

The step down on the main CHS beam members also helps reduce the amount of structure reaching the central ring and thus helps retain the elegance of the central termination.

**The Departures Hall**
The departures hall contains the check-in counters and ticketing areas. The elevated entry road brings passengers under the large roof and contains them in a space which, although external, is connected to the departures hall through the glazed south screen wall.
The departures hall is designed in the manner of the great transportation spaces of the Victorian era such as Gare, d'Orsay in Paris, and Waterloo in London. It gives the passenger a sense of excitement about travel whilst providing a calming environment to relax the more nervous traveller.

**The Idea**
The departures hall roof radius is centred on the same datum as the Qantas Club roof. The use of the some originating point ties the two roofs together in section and allows the service spine to pass between in an opposing direction.
The roof was conceived, from the outset, as a lightweight structure, but was not allowed to exhibit overtly industrial tones that may the give the public the wrong impression of the prestigious building. The roof was to reinforce the idea of elegance, quality and technology shown in other parts of the terminal.
The component parts of the roof structure were to connect with the language of the Satellite design to bring the two parts of the building together. The same idea of connecting details had been used in glazing trusses, handrails and internal screens and is an important device to ensure large buildings read as a total composition.
The same ides of tapered arms and hidden secondary structure were to be introduced to provide visual clarity in the same way as the satellite. With the departures hall roof structure, however, there are additional ideas brought to bear.
The layout of structure is somewhat different with trusses spanning 65m from south to north. The truss was chosen due to its remarkable strength to weight ratio and its three dimensional qualities which would help enliven the departure hall space.
The intention was to start with a traditional three-dimensional truss and manipulate its qualities to enhance its sculptural qualities and visual appeal. One of the first decisions was to avoid any overtly diagonal major members. To us, this strengthened an industrial aesthetic that we were trying to avoid.
The introduction of cross bracing by rods assisted this aesthetic. The eye is drawn to the major tapered arms and the diagonal cross bracing takes a secondary visual role.
The shape of the truss was also a major factor. Many previous designs had used straight 'V' shapes. At the Qantas terminal, by expanding the truss in the centre and tapering it at either end a leaf like form was developed which seen from underneath formed an aesthetic similar to foliage. The roof would form a protective canopy over the departures hall. This theme has been further developed in our designs for the Olympic Park Rail Station.
The introduction of secondary structure between these trusses emphasised the modelling of the ceiling. Secondary structure passing east west between the major trusses was composed of simple inverted triangular infill. When these were placed between the modelled major trusses however, and clad with metal ceiling pans, they took on a whole new aesthetic. The solid parts of the ceiling they created became as important as the skylight voids between.
Thus the skylights and ceiling were conceived as a lightweight structure with an undulating underbelly contrasting natural light from skylights with uplighting from artificial lights. The roof as a light structure was further reinforced by treatment at its edges.
The trusses pass through the north glazed wall extending the spatial qualities of the hall outside the constraints of the enclosing fabric. A similar desire to extend spatially beyond the boundaries was repeated on the south wall where, apart from the props under the truss, there is no structural connection with the ceiling and the eye is drawn outside the contained space. Both these aspects, and the projection of supporting legs on the east and west walls, help the roof to 'float' visually over the departure hall.
The support of the roof was an integral part of the composition. The intention was to provide a dynamic penetration of the space to provide movement and modelling similar to, and supportive of, the modelling created in the roof structure.
The diagonal legs contribute to the dynamic nature of the space in the departure hall. At lower arrivals level they provide a dramatic entrance to the city of Sydney.
The idea of lightweight roof structure is reinforced by the geometry of the legs. The last diagonal support at the east and west ends on the south side 'cantilever' the roof and are held back by a 'European truss' member. The idea was to set up a termination to the ends of the roof that was open, and apparently unsupported enhancing the ideas of movement and flight. What also eventuates is a reduction in the amount of foundations with one full support being omitted.

**Execution**
The development of detail in the departure hall roof supports the idea of lightness. One of the important decisions was to avoid all services in the ceiling that may add to the weight and cause servicing complications. The main air supplies are fed from the back wall of the space and through the counter hods avoiding duct work in the ceiling. By raising the steel legs onto precast plinths and providing infra red activated smoke extract we were able to fire engineer out the requirements for sprinklers.
The illumination of the departures hall, as well as PA speakers and thermostats are placed on poles and rely on up lighting bounced off the modelled metal pan ceilings. The light poles, as with the diagonal legs and check in furniture add to the quality of insertions in the departure hall space.

The selection of members and components for the trusses helps to support the visual connection with the satellite. Purpose made clevis castings were fabricated to connect the diagonal cross rods. The exact positioning of tabs was important to allow the rods to pass in close proximity, relatively in each bay.
The tapered arms, unlike the Satellite arms' were actually made of coned sheet steel. The success of the fabrication makes the execution less contrived and proved the viability of the design.
To keep the members of a reasonable dimension, the south wall of the departures hall acts as a prop. The wall truss doubles at this point to form an 'H' support. The bottom truss chord connects at this point, but very discreetly. The introduction of this propped support allowed the trusses to remain as a reasonable delicate assembly.
Other related component parts of the departures hall, such as the south wall, contribute to enhance the lightness of appearance. The tops of the south wall trusses do not connect with the ceiling but are 'trimmed' by a horizontal truss. Only glazing connects the ceiling to the trusses at this point.

**Conclusion**
The development of an idea is the genesis of design. How this idea is reinforced and executed is as important as this original concept. Without a continuity of thought and the support of like-minded consultants, ideas often fail to materialise.
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