

*The Exchange Module is the heart
of one of the most sophisticated
transportation hubs in the world.*

*Exchange Module
Charles de Gaulle Airport
Roissy-en-France
Paul Andreu and Jean-Marie Dulkill
Architects
Peter Rice, Engineer*



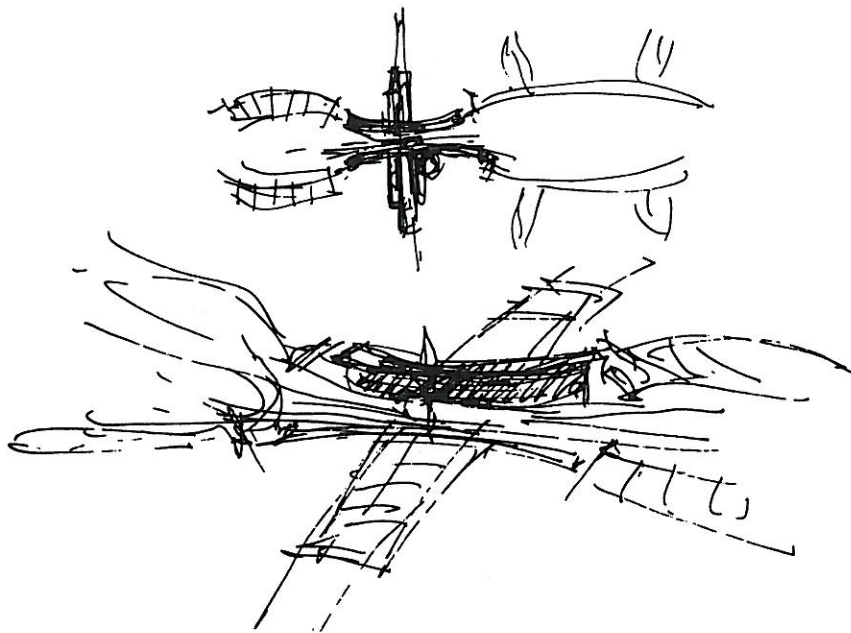
The intersection of a high-speed rail line, airport, and urban transit system occurs at the new Exchange Module at France's Charles de Gaulle Airport. Opened in 1994, the module serves the recently built perimeter TGV (*trains à grande vitesse*) line skirting eastern Paris. Built to circumvent lengthy connections from one inner-city station to another, the new line, and its airport link, renew Paris's competitive edge as an international transportation center.

The exchange module is really two projects in one—a train station, plus the multi-level pedestrianway—and is the latest but certainly not the last element in French architect Paul Andreu's collaboration with the Aéroports de Paris. Andreu has designed the entire Charles de Gaulle Airport, and his new project creates a point of relief in its masterplan. The module uses dramatic structural design to create unencumbered circulation and, although monumental, there is a quality of light and weightlessness about it that contrasts with the density of its concrete neighbors.

For this latest project, Andreu renewed his collaboration with the engineer Peter Rice (who died in 1992), and Rice's Paris office, RFR. Through shared discussions, Andreu and Rice conceived of a space that would stay away "from the simplistic idea," or as Andreu explains, "the tendency in modern architecture for a building to have just one unifying concept." Instead, the elliptical 260-room hotel extends the existing poured-concrete architectural language of Terminal 2—the transparency of the hotel's atrium becomes a skylight for the exchange terminal—and is an elegant counterpoint for the transparency of the train station. The linkage was simplified by the design of the air terminal itself. In plan, Terminal 2 resembles an elongated figure-eight. In choosing the narrow juncture between existing segments and the future loop of Terminal 3, Andreu underlaid the perpendicular axis of the 1,600-foot-long train station.

The winged glass roofs of the train platforms are, from every angle, the focus of the project. Andreu wanted the roof to appear to float, and he wanted users to be able to see out and be bathed in light. RFR developed a cantilevered tubular-support structure, which is quite dense. The visual complexity is diminished by the design of distinct, readable layers. "It was part of Rice's concept," explains RFR project director Hugh Dutton, "to establish a hierarchy, with each element

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Up Close

Andreu the master builder. For French architect Paul Andreu, the evolution of Charles de Gaulle airport has been a 30-year preoccupation. As a young engineering graduate still working on his architecture degree in the 1960s, Andreu took a job with the Aéroports de Paris (ADP) working on the masterplan of the new airport. By the time he was 29 and an architect, he was designing the airport's first terminal. It was a chance he got through luck, long hours and, he admits, by being a little competitive. The design, a segmented circle where passengers move through suspended transport tubes, became a symbol of late-Modern architecture. Coming from nowhere at a time when few French architects were interested in airport design, Andreu found himself in the spotlight, but also on the defensive: reviewers at the time were unsure whether this was architecture or engineering. Isolated by the debate, Andreu opted to stay on with ADP. Now that airport commissions are prized by the world's top architects, Andreu's positions with ADP is enviable. His career in transportation design has not only developed internationally, but with the completion of the Grande Arche at La Défense (after the death of Johann Otto van Spreckelsen), one of Paris's *grands projets*, and his museum in Osaka, Japan, Andreu is finding a new audience for his architecture.

The Crossroads of France



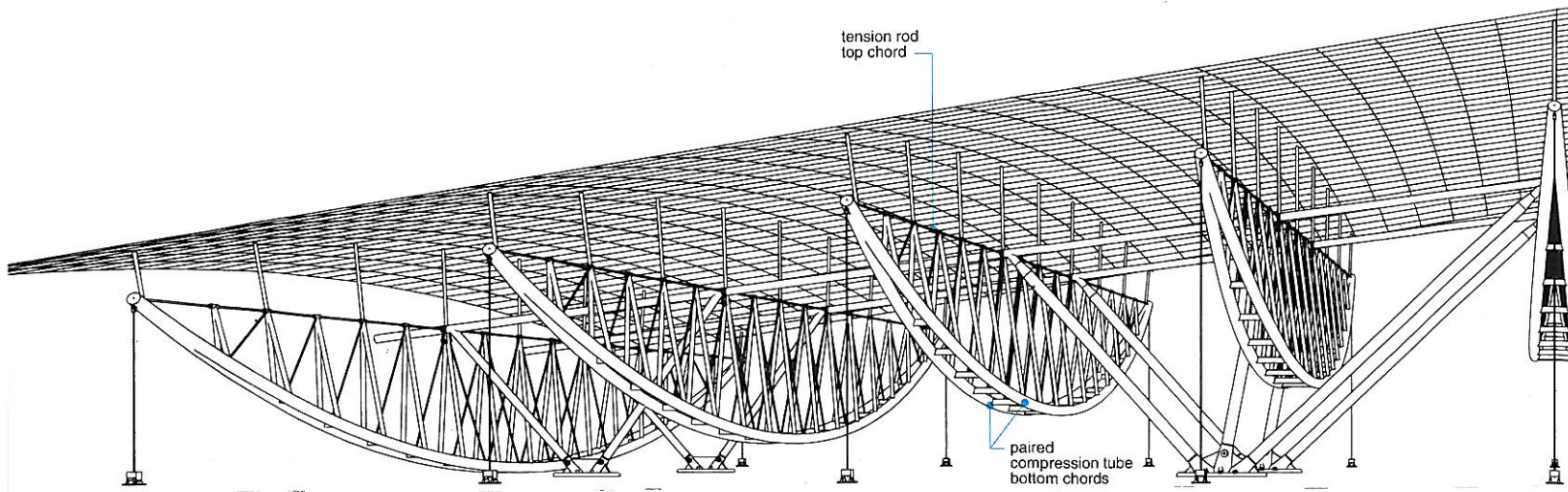
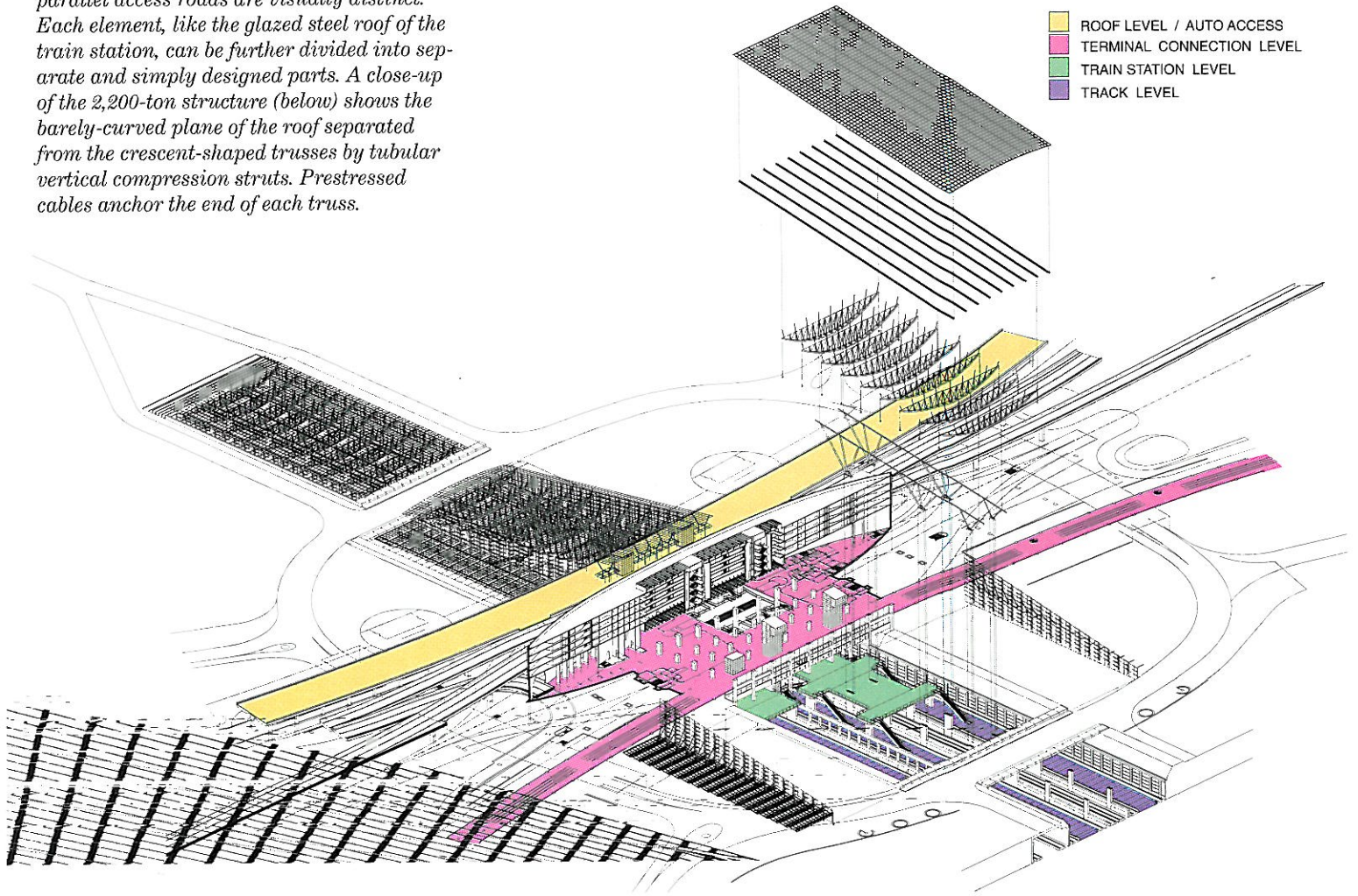




Circulation and structure

The complexity of the exchange terminal and train station was simplified by analyzing each piece separately. The linear train lines, the lobby of the hotel, the inter-terminal transport, the pedestrian concourses, and the parallel access roads are visually distinct. Each element, like the glazed steel roof of the train station, can be further divided into separate and simply designed parts. A close-up of the 2,200-ton structure (below) shows the barely-curved plane of the roof separated from the crescent-shaped trusses by tubular vertical compression struts. Prestressed cables anchor the end of each truss.

- ROOF LEVEL / AUTO ACCESS
- TERMINAL CONNECTION LEVEL
- TRAIN STATION LEVEL
- TRACK LEVEL



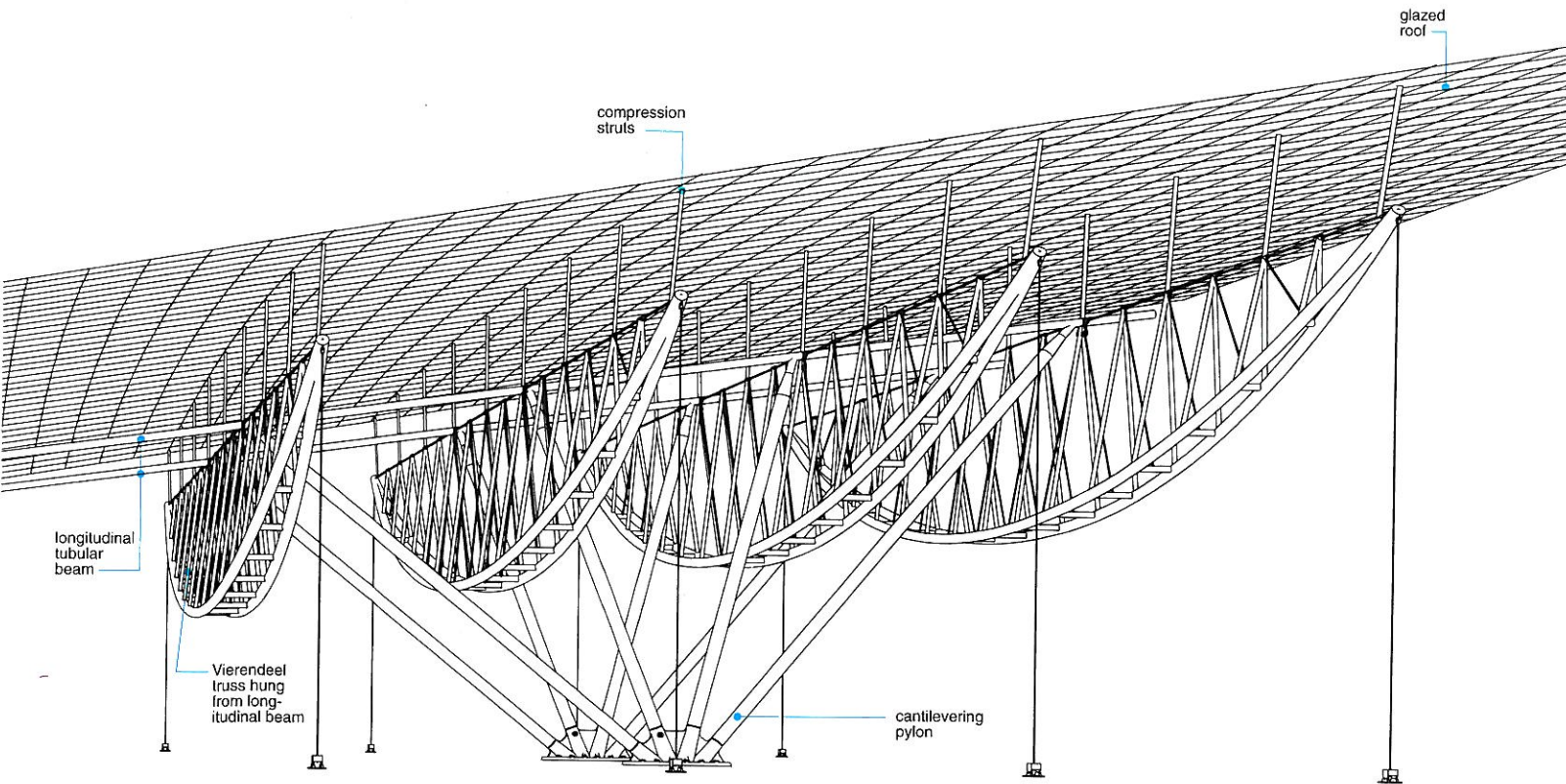
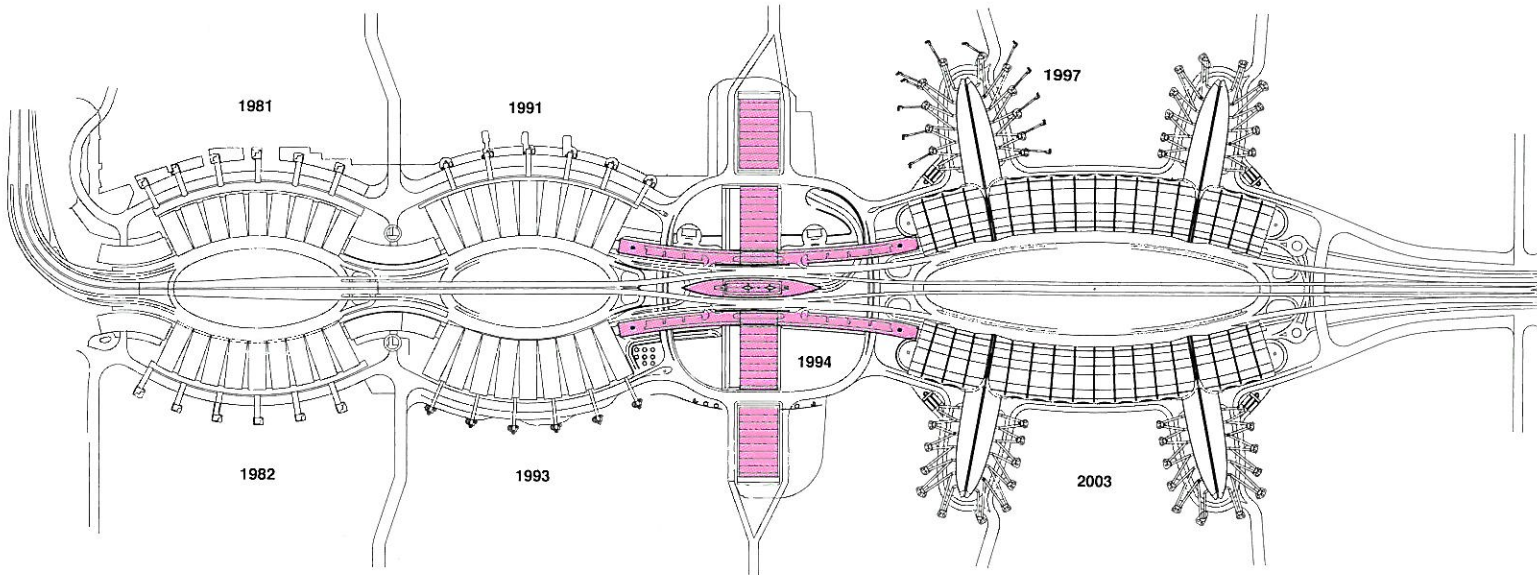
SECTION THROUGH ROOF

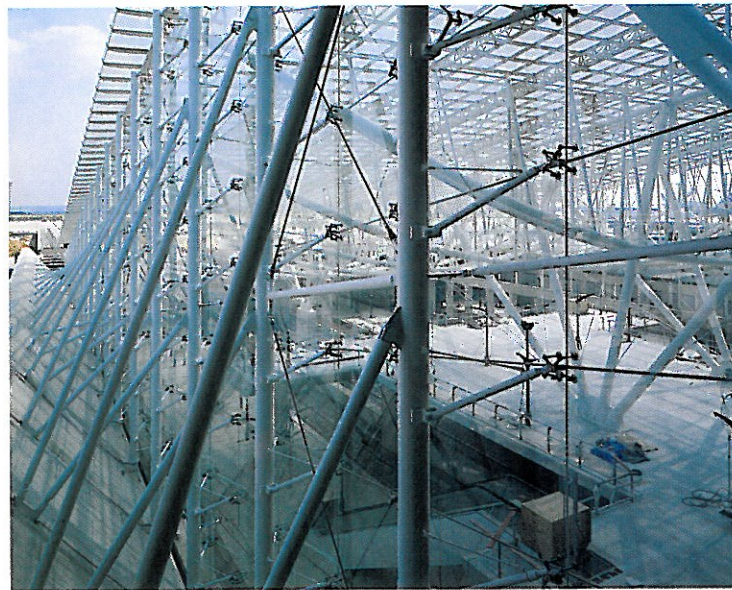
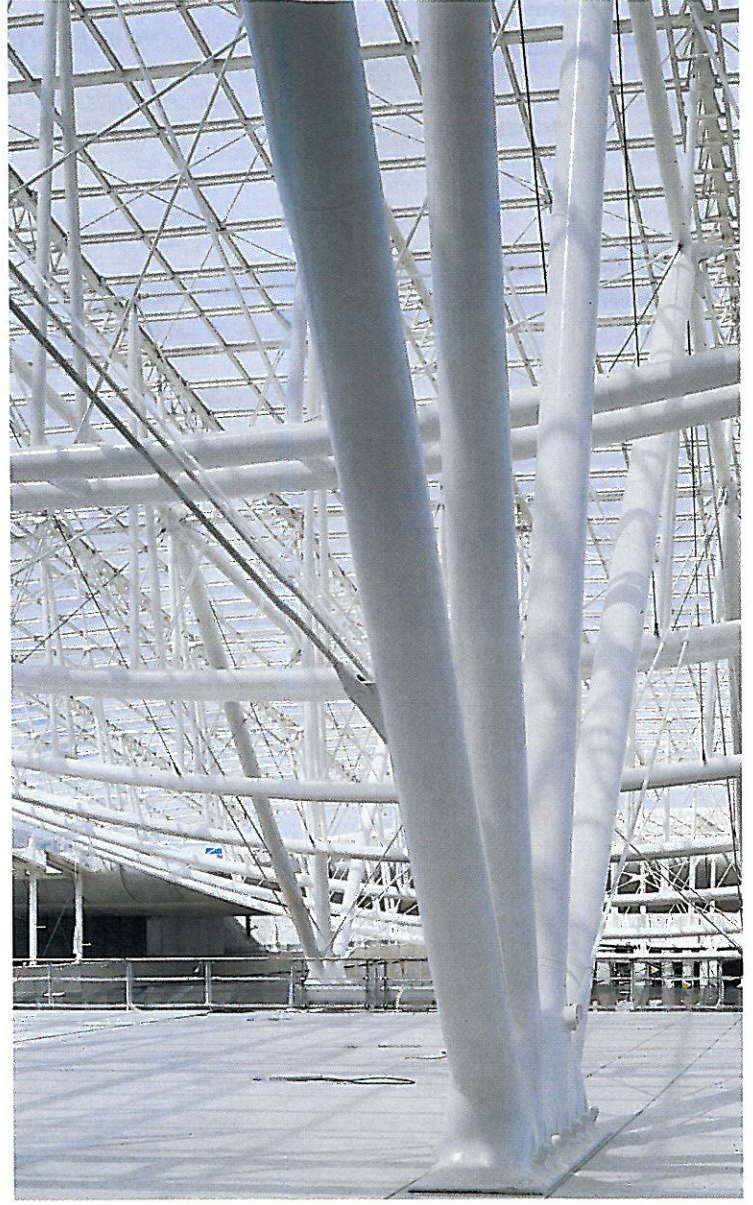
Additional stabilizing cables not shown

A changing master plan

Charged with the master planning of the entire airport, as well as the architecture of its main buildings, Andreu was able to introduce an architecture for the train station that counterpoints the existing parts of Terminal 2 and Terminal 3 (currently under construction). The architecture of the terminals has evolved over time, changing from a one-story plan to a two-story plan for the latest terminal which will handle more

traffic. In addition to the central passenger drop-off road, automated shuttle cars will take voyagers from the exchange terminal to the most distant Terminal 1.





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having its own identity." The sweep of the roof unifies the complex human movements within. Passengers transfer from commuter-rail lines to plane, plane to train, or even Terminal 2 to Terminal 3. Each transport system occupies its own level, and the openness of the scheme gives passengers a clear idea of where they are and where they need to go. Its architecture, punctuated by escalators, seating, and banks of monitors, is almost a blank slate. The eye is not drawn to the open interior space, but outward, either to the animated roof of the train station, or the airplanes on the tarmac. The fact that the glass train-station roofs slope up toward the hotel above allows a protected inside-outside view. Daylight enters from the north and south and, and at night, light levels are kept below the glare threshold so often exceeded in transportation centers.

The openness of the project helps alleviate stress by constantly re-orienting passengers as they move through the Module. Andreu is against all that clutters transportation spaces: advertising, piped-in music; anything that can be referred to as animation. Fortunately, he has included a café and newspaper stand along with the train ticketing counter on Level 2, since the TGV passes infrequently. In terms of train traffic, the suburban train into Paris, whose four lines parallel the TGV, is more important. Still, Andreu has preserved a sense of calm that almost allows this 216,000-square-foot building to seem intimate. *Claire Downey*



Several modes of transport, each with its own distinct path (bottom left), occupies their own level without intersecting the others. Twin concrete overpasses (above opposite) allow passenger drop-off at either side of the boat-shaped hotel. Roads connect the air terminal and parking, while within the exchange module (below opposite) travelers use escalators to descend to their trains.

Credits

*Exchange Module
Charles de Gaulle Airport
Roissy-en-France*

Owner: *Aéroports de Paris;
SNCF*

Architect: *Paul Andreu; Jean-
Marie Duthilleul*

Architecture and Construction Management:

*Dimitri
Georgandélis, project manager;
Michel Vermeulen, deputy
project manager; Anne Brison,
architect (Aéroports de Paris);
Daniel Claris, project manager;
Joël Nissou, Sylvie Guillaume,
Jean-Louis Salama, architects;
Jacques Courvoisier, project
manager (SNCF)*

Engineers: *RFR—Peter Rice,
partner-in-charge; Hugh Dutton,
architect, project manager;
Claire Mazelet, Henry Bardsley,
Kate Purver; Guy Deshayes,
engineers; Alexander Autin,
David Holford, architects*

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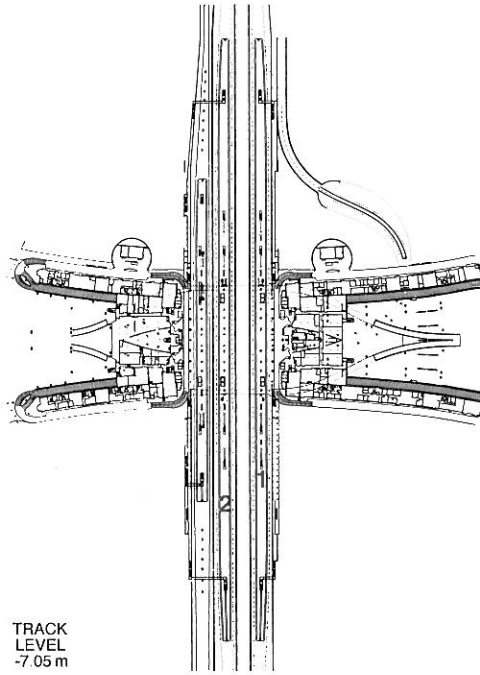
Two rows of spoke-like pylons support the train-station roof (top opposite), one on each side of the crescent-shaped trusses so that their identity is distinct. Each pylon base rests on a pin-joint covered by a steel casting that allows movement while guaranteeing constant compression.

By using fritted glass for the roof, light is diffused, and the sensation of looking into a dark structural underbelly is avoided.

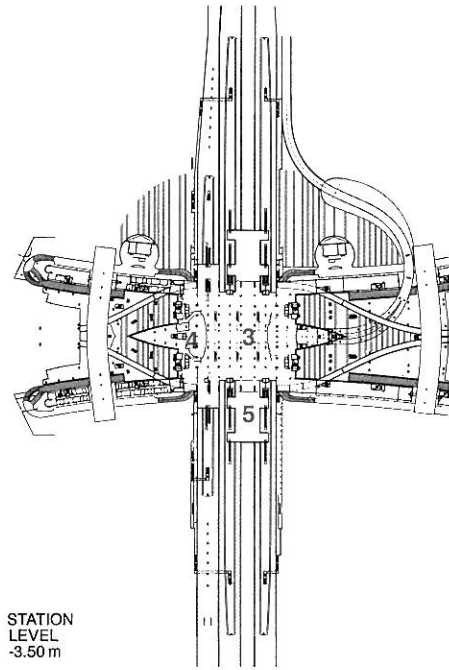
The non-loadbearing walls, separated from the roof by a four-foot air space (bottom left opposite), are transparent, allowing a view of airplanes. The facade system keeps the glass surface free from mullions by using drilled-through fittings on branch-like arms attached to vertical masts.

Plans show the intersection between the train lines and air terminals, the genesis of the Exchange Module. Moving up from the train platforms to the intermediate lobby, then up to level two, the traveler arrives at the main waiting area, shops, and ticketing.

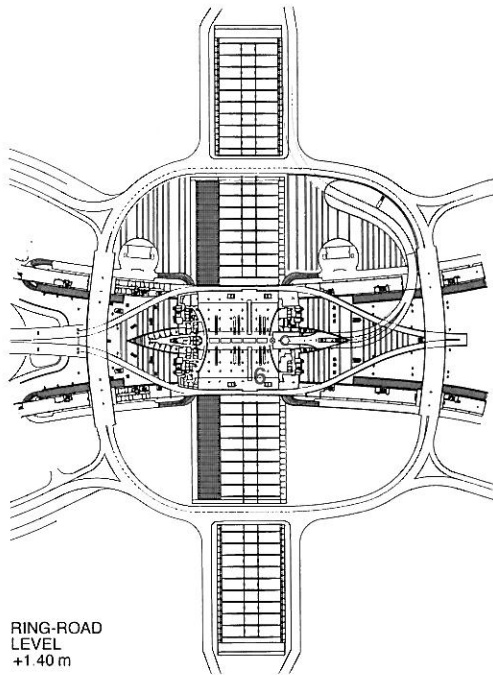
At the upper level, four moving sidewalks take passengers to the adjacent air terminals. Prow-shaped walls support the hotel located above.



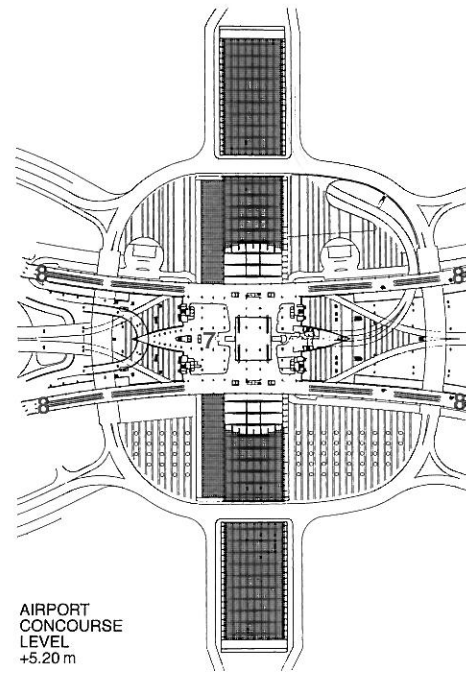
TRACK LEVEL
-7.05 m



STATION LEVEL
-3.50 m

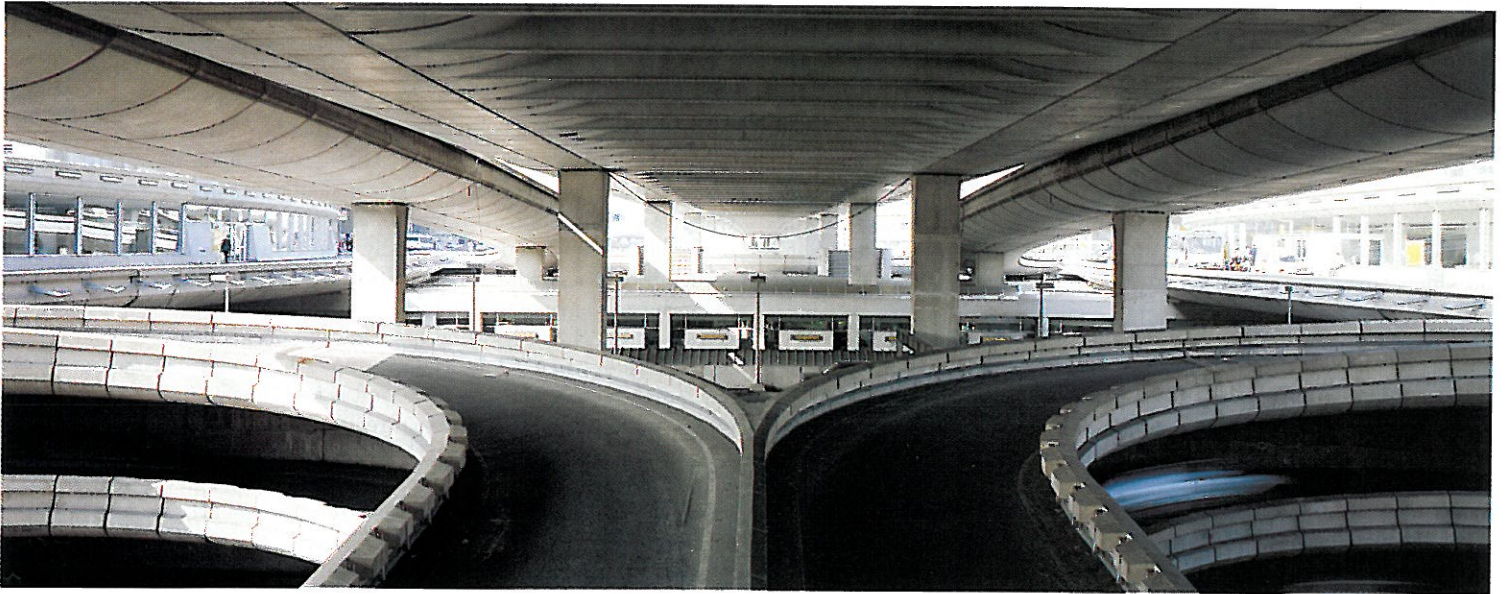


RING-ROAD LEVEL
+1.40 m



AIRPORT CONCOURSE LEVEL
+5.20 m

1. TGV trains
2. Commuter-rail tracks
3. Rail concourse
4. Ticketing
5. Waiting
6. Transport to terminals
7. Hotel lobby
8. Concourse to terminals



Making Affordable Projects Work

By H. Jane Lehman

Money matters, it goes without saying. But the notable lack of it within the affordable housing realm drives nearly every step of the design process. For architects working on affordable housing projects, the challenge, in a nutshell, is: How do you create tight but livable spaces for little money on problem-laden sites for diverse groups of residents? The answer: Carefully, sensitively, and with respect for the particular needs of the people who will be living there.

The faithfulness of the architectural profession to these principles falls to either extreme, says Bill Witte, a partner with The Related Companies of California, an Irvine-based development company that specializes in low-income housing. Much of the public housing built in America during the post-war era failed to provide safe, attractive, or appropriately scaled places to live. While design was hardly the only cause of these problems, the architects involved in these projects and the profession as a whole earned a reputation for being removed from the concerns of the people they were designing for.

Today, more architects recognize the need to listen to clients and end users. "Cost-efficiency is very important, particularly when there are limits on rent," says Witte in explaining a key issue for the organizations that build affordable housing. "But so is sensitivity to the needs of the people who will live there," he adds. "Do architects get it? Some do, some don't."

Tax-credit tangle

Clients ready to start affordable projects often fight long and hard for funds with which to proceed. Some patch together state and local funds, but most rely on the federal low-income housing tax credit. With the demise of the federally funded low-income housing production programs some 15 years ago, tax-credit financing (begun in 1986) is about the only thing that has sustained this market. The National Association of Home Builders estimates that in recent years the credit has enabled the annual construction of 30,000 to 80,000 new low-income rental units and the rehabilitation of about 60,000 existing affordable apartments (graph below shows new construction using the credit).

H. Jane Lehman is a Washington, D.C.-based journalist who specializes in covering real-estate and housing issues.

The federal low-income housing tax credit has played an important role in financing affordable housing over the last decade (chart right). Its fate is now being debated in Congress.

The program works this way: Each state, based on a per capita formula, gets a piece of an approximately \$2.2-billion annual pie. Apartment developers submit proposals, including pre-schematics and site pro-formas, in an effort to win a credit allocation from a state housing finance agency. Apartment rents must be affordable to households earning no more than 60 percent of the area's median income. In this case, affordable means a family spends no more than a third of its household budget to cover the rent. In the Los Angeles area, that translates to around \$6,000 to \$9,000 a year for shelter, reports Witte, whose company has 10 tax-credit projects underway in California.

Developers who succeed in procuring credits from the state then sell them, often in conjunction with a syndicator, to investors who pay a lump sum for the credits. The credits are used by investors for dollar-for-dollar write-offs against tax liabilities. With the investors' cash as an equity stake, developers do not need to borrow as much money to finance the projects, thereby lowering the rents they need to charge.

Credits' fate is in doubt—again

Although the system is working well, there is a fly in the ointment. The program's permanent status is in doubt—again. Two years ago, Congress—then controlled by the Democrats—voted to end the uncertainty associated with year-by-year renewal of the credit by embedding it permanently in the tax code. This fall, the Republican-led Congress agreed to revoke the tax credit's permanent status as of December 31, 1997. If that happens, the program's supporters say, the tax credit will not fare well at a time when federal spending is shrinking. "Sunsetting the tax credit is tantamount to killing it," states John McEvoy, executive director of the National Council of State Housing Agencies. The program's best hope is a Presidential veto with instructions to Congress to return with a new budget reconciliation bill that, among other things, preserves the credit's permanent status, explains Andre Shashaty, the publisher of a San Francisco-based magazine devoted to affordable housing finance. That, he says, would insulate it from the knock-down, drag-out federal budget fights expected in the coming years.

In terms of design, taking a one-size-fits-all approach to affordable housing is destined to fail, given the diversity of the intended occupants. Residents may be single mothers, two parents with lots of kids,

