

جامعة دمشق  
كلية الهندسة المعمارية  
قسم التصميم المعماري  
مشروع تخرج دورة شباط 2005

## المدينة الرياضية على أرض الفيحاء



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تقديم: سامي خليفة طالب

## مقدمة :

نظرا لاهمية الرياضة و الحركة الرياضية في بناء المجتمعات البشرية و اعداد الاجيال الشبابية الصحيحة عقلا وجسما وما ينتج عن ذلك من الارتقاء بالمجتمع الي درجات عالية من الرقي الاجتماعي ولأن الرياضة أصبحت مطلب أساسي لكل مجتمع ولأنها

أصبحت مقياسا للتميز بين دول العالم وفي زمن دخول المادة في مفاصل الرياضة كافة

سواء كانت ادارية او رياضية او تحكيمية من خلال الاحتراف الرياضي كان لابد من دفع الحركة الرياضية في سورية هذه الحركة التي ما زالت حتى هذا الوقت تتراوح في مكانها و تتباعد شيئا فشيئا عن الموكب الرياضي العالمي ولأن البناء السليم لابد له من ارضية خصبة لكي يتم بالشكل المناسب و الطريقة الصحيحة و بالتالي للحصول على طاقات رياضية منافسة كان لابد من تهيئة المناخ الرياضي المناسب عبر المنشآت الرياضية المتكاملة والأدوات اللازمة لممارسة النشاط الرياضي , و مما سبق كانت الدراسة لهذا المشروع الرياضي ( مدينة الفيحاء الرياضية ) لكي تكون صرحا رياضيا متكاملًا يسهم في دفع مسيرة الرياضة السورية الى الامام

## موقع المشروع :

بالنظر إلى واقع المدينة الرياضية على أرض الفيحاء وم  
آلت إليه هذه المدينة من عشوائية في التنظيم و  
تراكم في الأخطاء و تقسيم لها أدى إلى خضوعها  
لعدة

جهات حكومية وغير حكومية نلتمس الحاجة  
الأساسية في أن تكون هذه المدينة  
منظمة ومجهزة تجهيزا تاما بحيث تكون مفرخة  
للأبطال و مصنعا للبطولات عدا عن كونها صرحا معماريا  
فريدا يضاهاى مثيله في أنحاء مختلفة من المعمورة

تم إختيار موقع المشروع على أرض الفيحاء ذات  
المساحة الكبيرة و الطبيعة الزراعية الريفية المناسبة  
للممارسة النشاط الرياضي

جاء موقع المشروع هذا تحت تأثير جملة من العوامل و  
المقومات التي من شأنها الاسهام في تخديم هذا  
المشروع و الوصول الى الغاية المنشودة من وراء  
إقامة مثل

هذه المدن الرياضية التي تساهم بشكل أو بآخر في  
النهوض بهمم الشباب وإبراز قدراتهم ومواهبهم

وتتجلى الفائدة من وجود هذا المشروع ضمن هذا  
الموقع من خلال مجموعة من الاسباب نجملها بالنقاط  
التالية :

- 1- وجود هذا المشروع قريبا من منطقة البارك الشرقي وبالتالي الاستفادة من مشروع البارك في تخديم هذا المشروع من مواقف للسيارات وغيرها من خدمات و بالتالي يمكن اعتبار هذا المشروع كاستمرارية لمشروع البارك الشرقي
- 2- حاجة ملعب كرة القدم الرئيسي إلى ملعب تدريبي ثانوي و المتمثل بملعب الفيحلاء الموجود في المنطقة
- 3- وجود صالة الفيحاء الرياضية وهي صالة ألعاب كرات يمكن ممارسة العديد من الالعاب الرياضية وهي كرة السلة و اليد والطائرة و الريشة..... إلخ هذه الصالة مهمة في أي تجمع رياضي كان
- 4- الطبيعة الخلابة لهذه المنطقة التي تتميز بالطبيعة الريفية والهدوء النسبي
- 5- مرور مجرى مائي في أرض المشروع وهو نهر تورا وبالتالي إمكانية الاستفادة من هذا المجرى في خلق أجواء داخلية للمدينة أكثر حيوية
- 6- وجود شبكة طرق رئيسية هامة مخدمة لهذا المشروع مما يؤمن الربط الطرقي الجيد
- 7- وجود الموقع خارج مركز المدينة وعلى أطرافها تفاديا لحدوث مشاكل الإزدحام وغيرها من المشاكل المتوقع حدوثها كما يحدث الان في ملعب العباسيين ومدينتي الجلاء و تشرين

لم يتم إختيار موقع لهذا المشروع خارج مدينة دمشق وفي الاراضي الحيطه بها لأن ذلك سيؤدي إلى عزلها و هجرها مع الزمن كما حدث في كثير من المنشآت الرياضية كملعب الباسل في منطقة

باب عمر في حمص ومدينة الأسد الرياضية في  
اللاذقية

## برنامج المشروع :

1- ملعب كرة القدم الرئيسي:

-ميدان الملعب 105\*70

-مدرجات الجماهير:السعة 50-60 ألف متفرج وتكون  
هذه المدرجات على طبقتين أو ثلاثة وتتضمن منصة  
الشرف

-صالات رياضية لإلعاب متنوعة كاراتيه -مصارعة-كرة  
طاولة -بلياردو- بمساحة 150م<sup>2</sup>لكل صالة  
-خدمات صحية للجماهير تكون متوضعة تحت  
المدرجات

-مكاتب ادارية للمشرفين على المدينة تتضمن  
مكتب مدير المدينة والسكرتاريا  
ومكاتب الالعاب الفردية و الجماعية والعسكرية  
والفنيين والمشرفين

- كافتريا عدد 2 تتسع لحوالي 200 شخص

- اكشاك خارجية لبيع التذاكر

- عناصر انتقال شاقولي

- مركز إعلامي يتسع لحوالي 150 صحفي مجهزة  
بكافة الاجهزة اللازمة يلحق به الخدمات اللازمة  
وقاعة استقبال و إستراحة

- مركز صحي اسعافي مزود بسيارة اسعاف

- مدخل للرياضيين مع عناصر انتقال شاقولي تؤدي الى القبو
- غرف استراحة للاعبين والمشالح والخدمات الصحية اللازمة مع قاعة مؤتمر صحفي للفرق المتبارية وتكون موجودة في القبو
- مستودعات التجهيزات الرياضية بمساحة 1500م2
- غرف التدفئة والتكييف و الرعاية الزراعية و خزانات مياه الرش بمساحة 1500م2
- 4صالات لبيع الالبسة الرياضية والادوات الرياضية بمساحة 600م2
- مواقف سيارات قسم منها خاص متوضع ضمن القبو 250 سيارة
- والقسم الاخر خارجي 250 سيارة

## 2-صالة مسبح مغطاة: تتضمن

- مسبح ذو أبعاد 50\*25م يلحق به حوض غطس ثلاثي الارتفاع كما يلحق به حوضين صغيرين للاحماء
- مدرج يتسع 2500 شخص
- خدمات صحية للجماهير
- ادواش ومشاجب وخدمات صحية للسباحين
- قاعة تعليم السباحة ل40 متعلم
- مستودعات بمساحة 500م2
- غرفة تدفئة وتكييف 30م2
- غرفة صيانة وفلتر 30م2
- 4غرف ادارية بمساحة 150م2

- كافتريا تتسع ل 250 شخص مع الخدمات الصحية المناسبة

- صالة تنس الطاولة بمساحة 200م2  
- كافتريا ملحقة بالمسبح تتسع ل75 شخص

3- صالة ألعاب القوة البدنية: تتضمن  
- صالة الجمباز وألعاب رفع الأثقال و اللياقة  
البدنية مجهزة بأجهزة الجمباز (حصان القفز -  
المتوازي- الحلق- البساط-الثابت- ...)

- مدرج يتسع 3500 شخص

- خدمات الصالة

4- صالات ألعاب طاولة و بلياردو 4\*100م2

- مستودعات بمساحة 400م2

- صالة مصارعة مع مدرج صغير مع خدمات صحية  
750م2

- صالة ملاكمة مع مدرج صغير مع خدمات صحية  
500م2

- صالة كاراتيه مع مدرج صغير مع خدمات صحية  
500م2

4- مطعم المدينة :

يتسع ل1500-2000 شخص يلحق به مستودع  
مواد+خدمات صحية لازمة لكلا الجنسين+كنتوار  
خدمة

5- ملاعب مكشوفة:

- 4ملاعب تنس

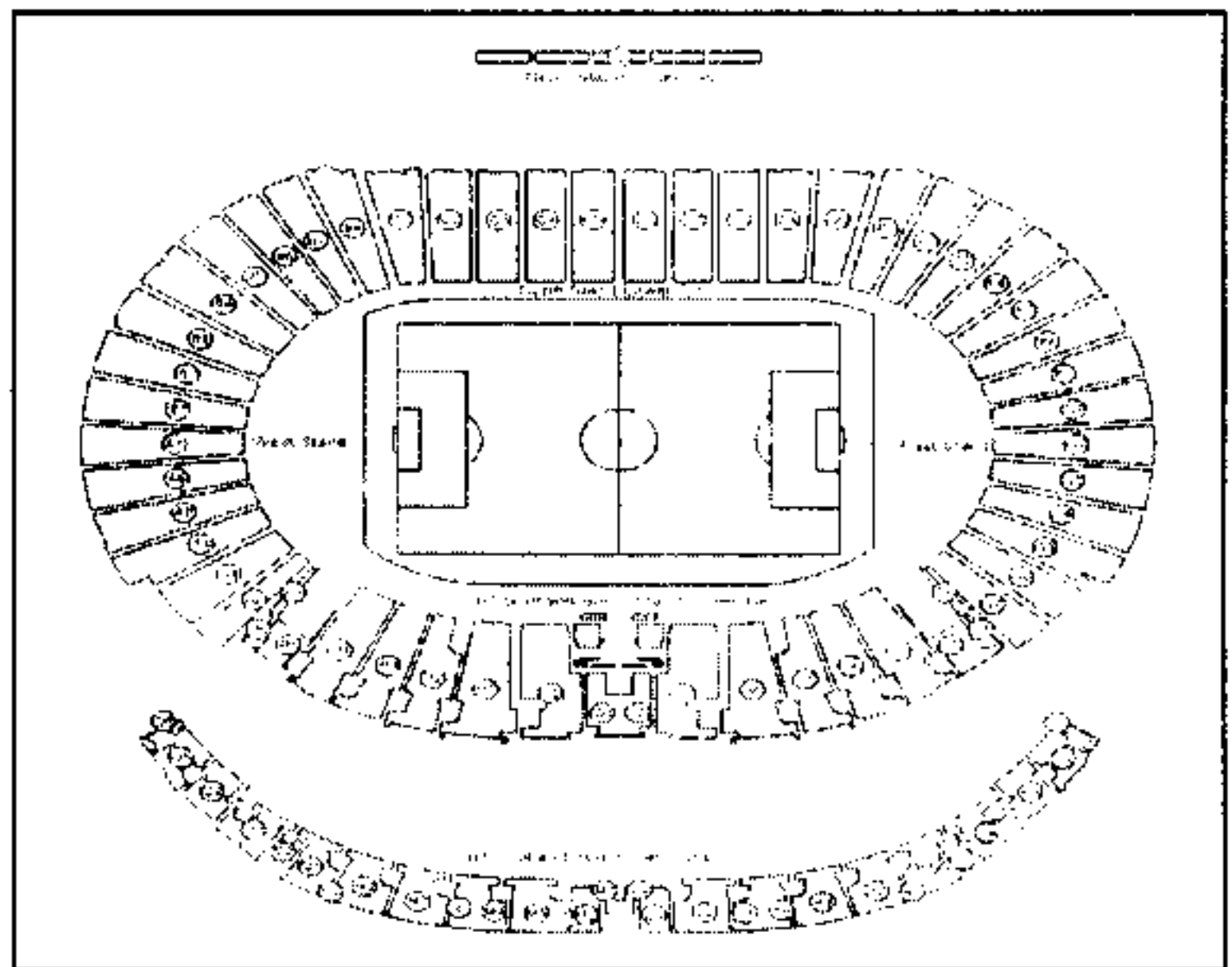
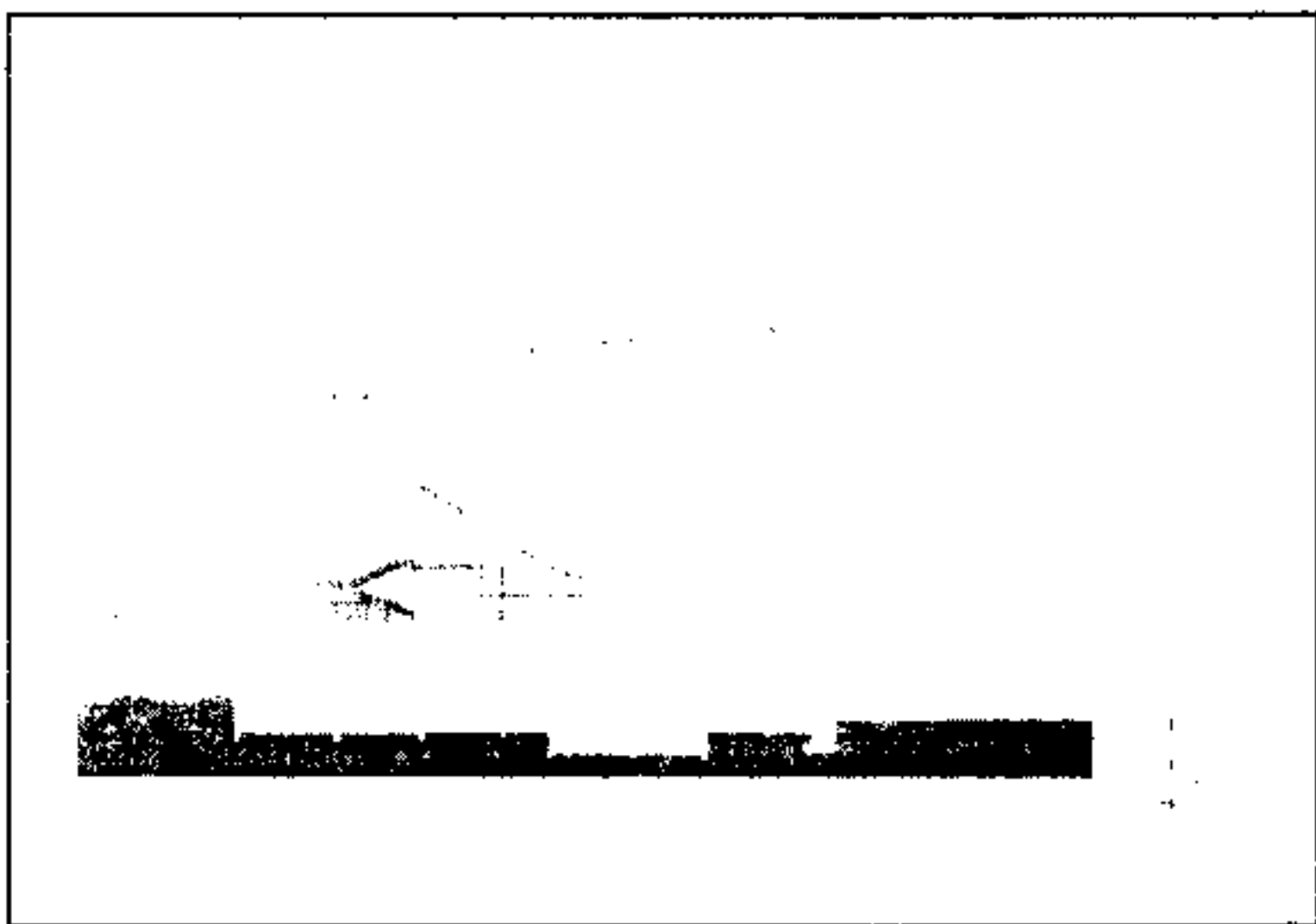
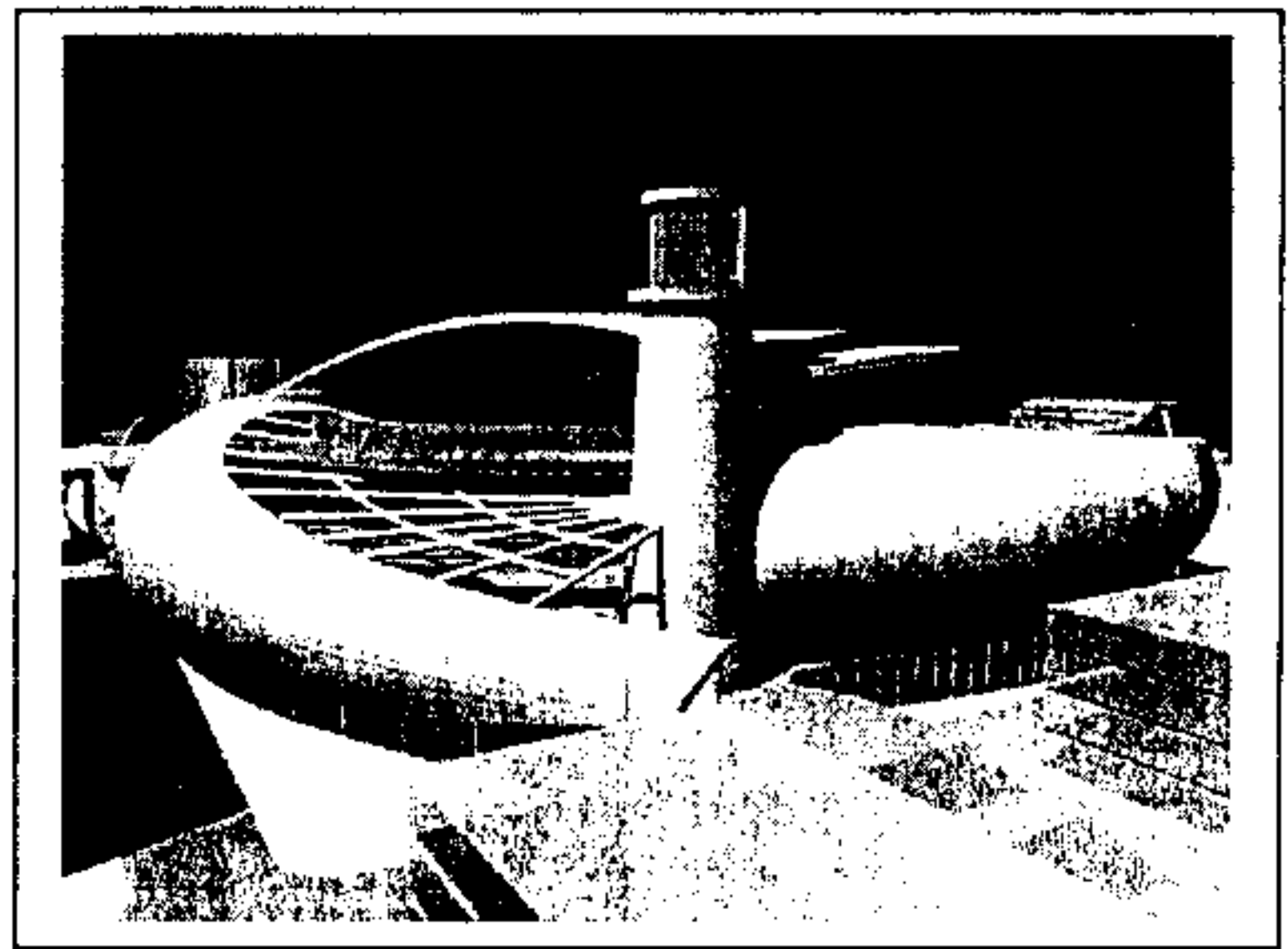
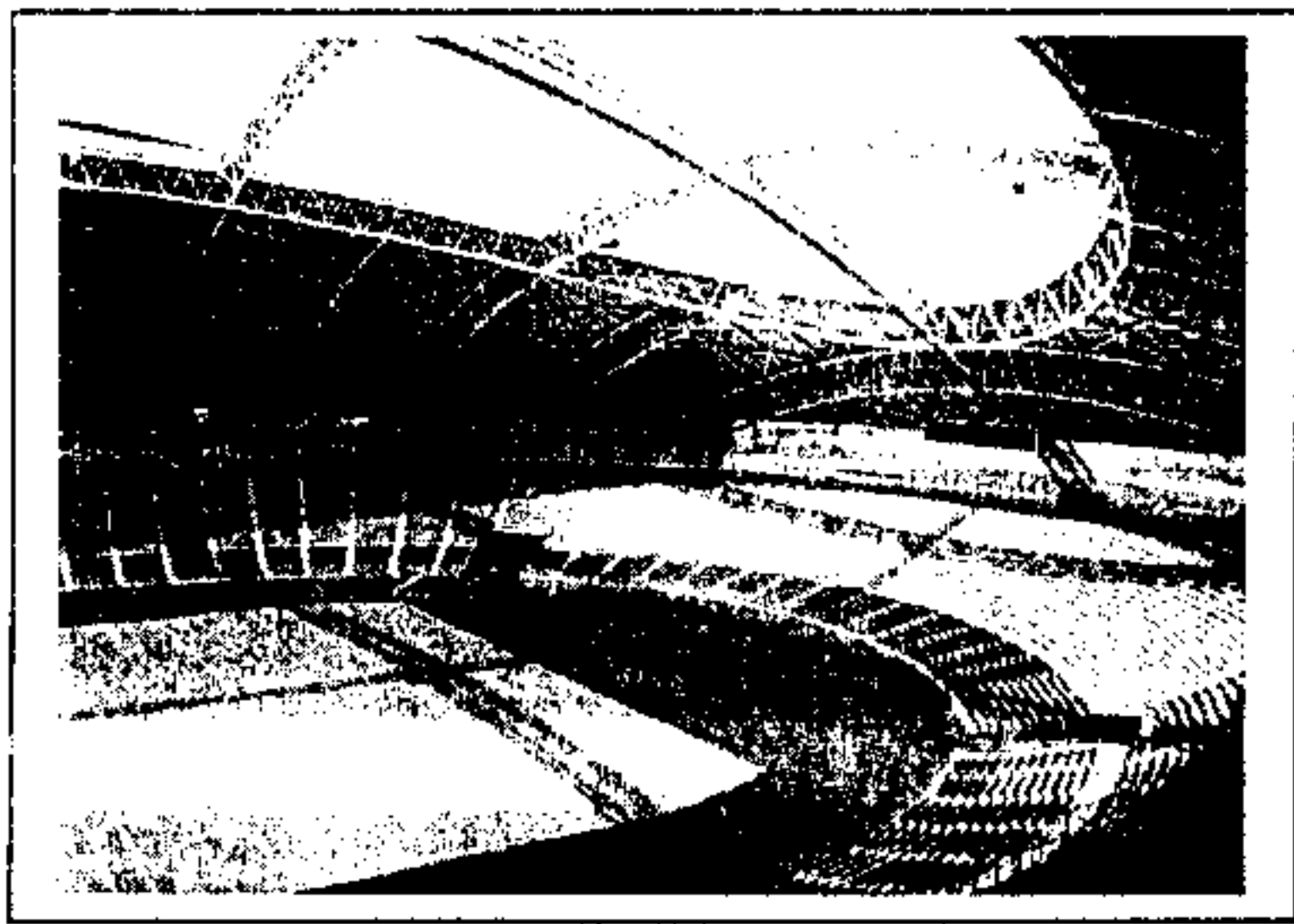
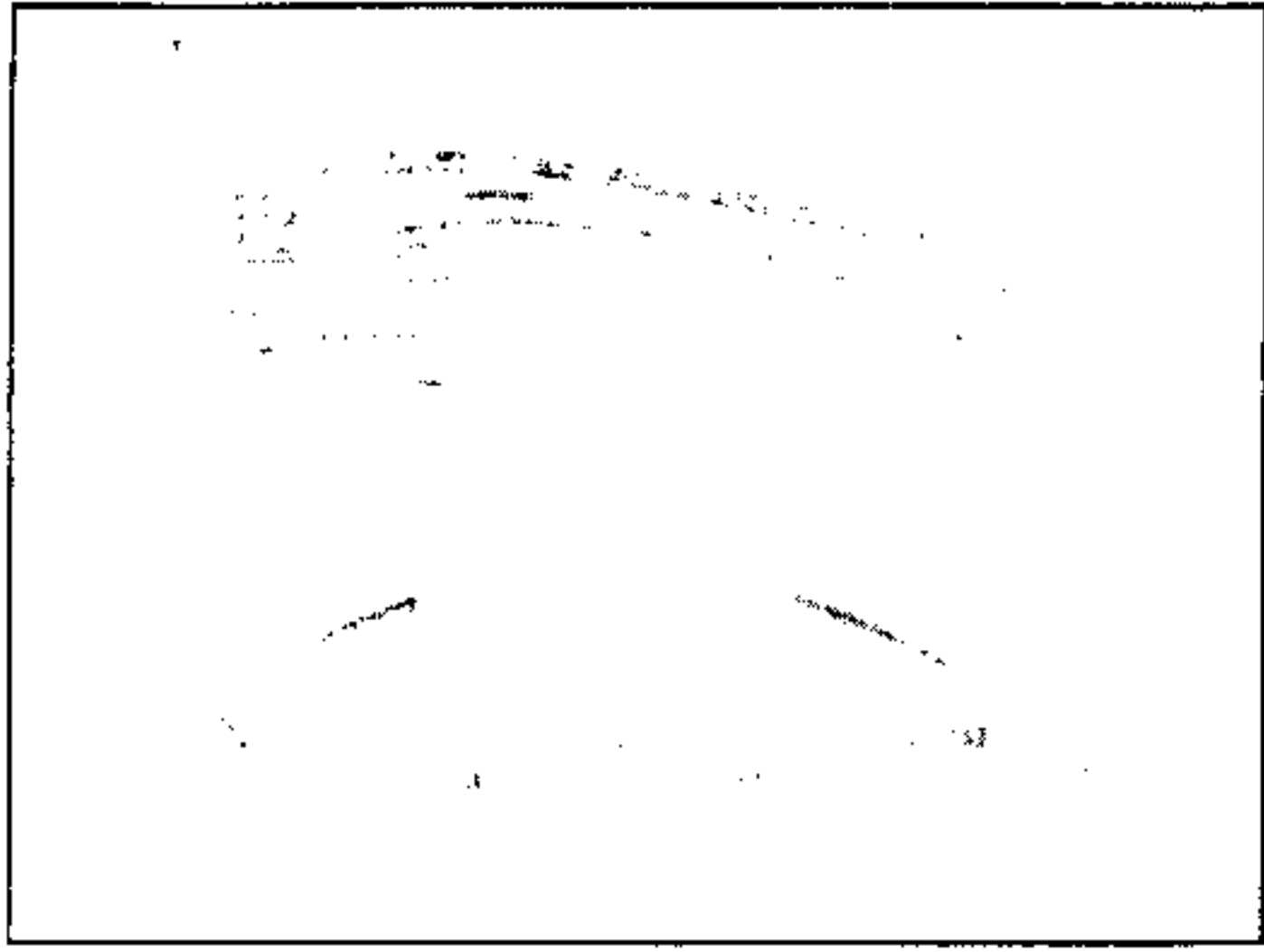
- 4 ملاعب سلة
- مسبح مكشوف
- خدمات ملحقة

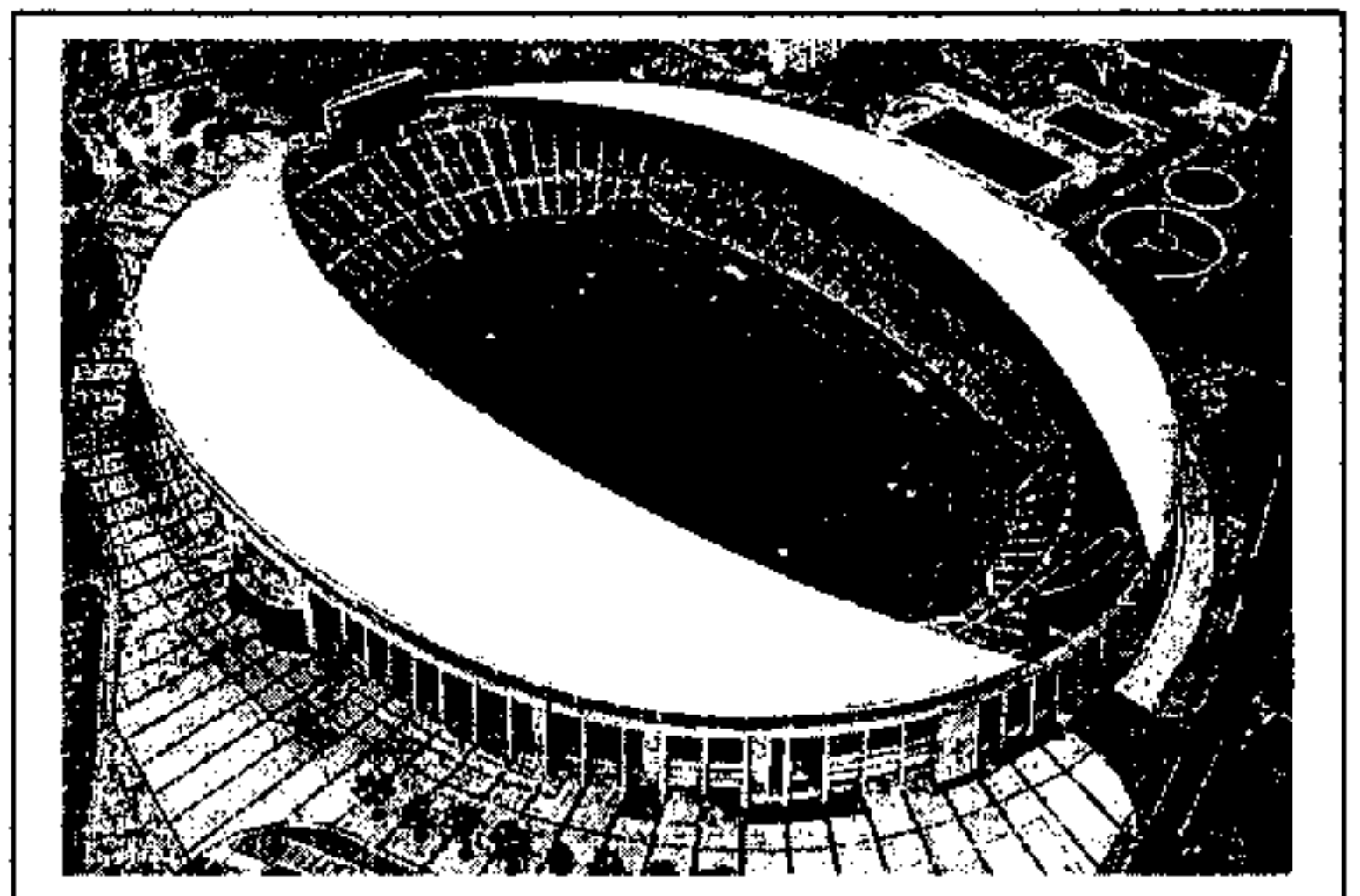
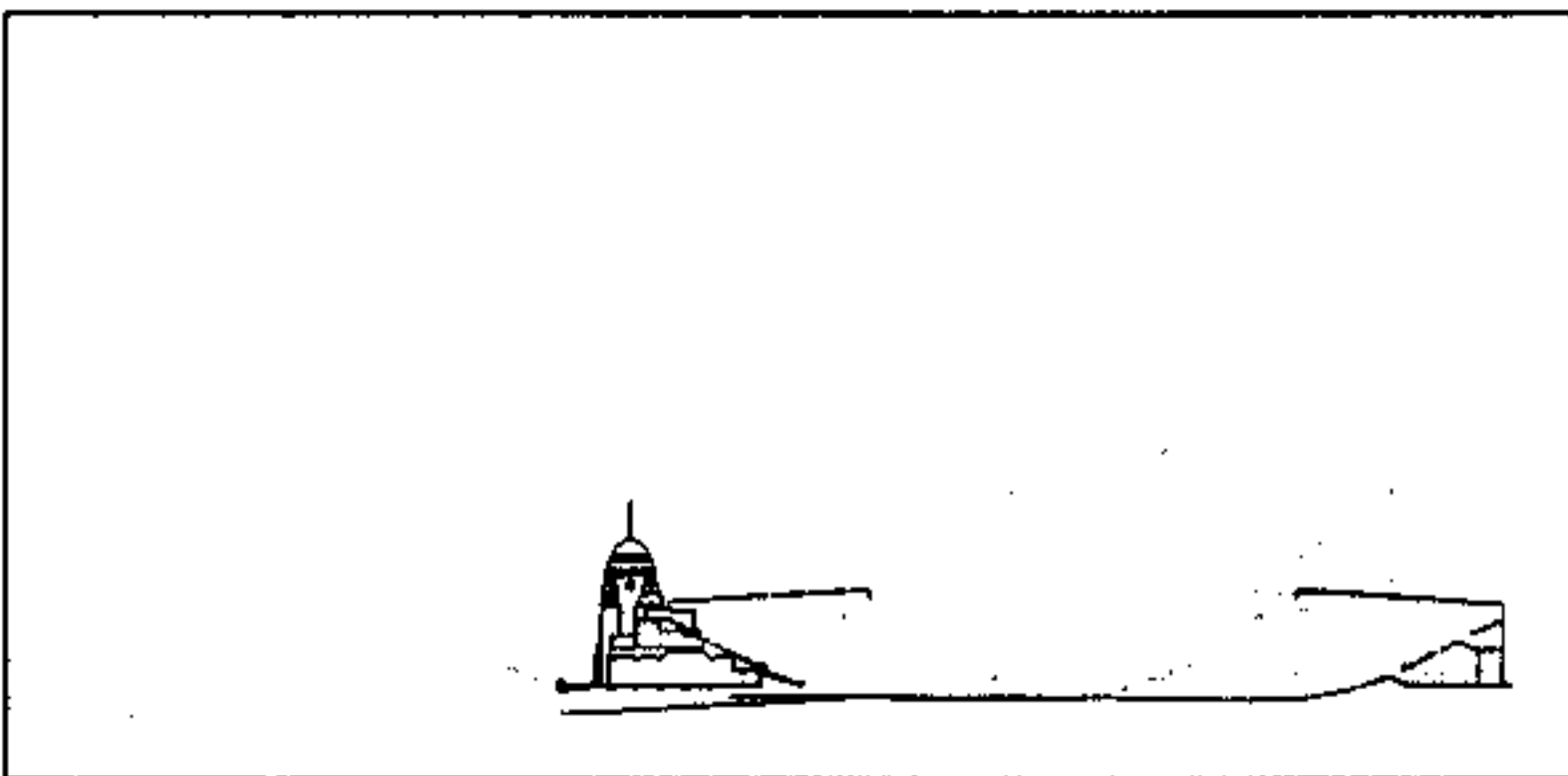
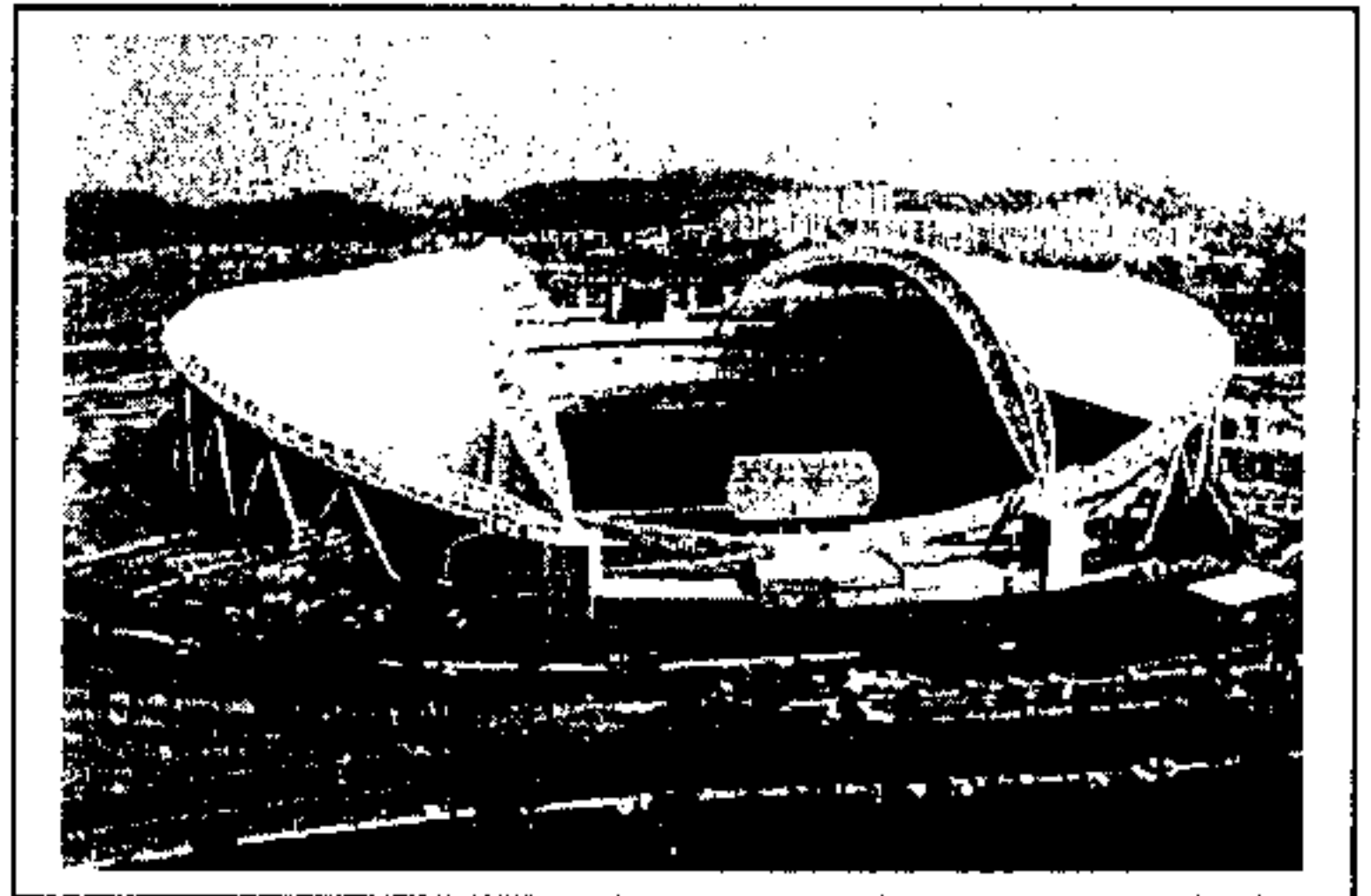
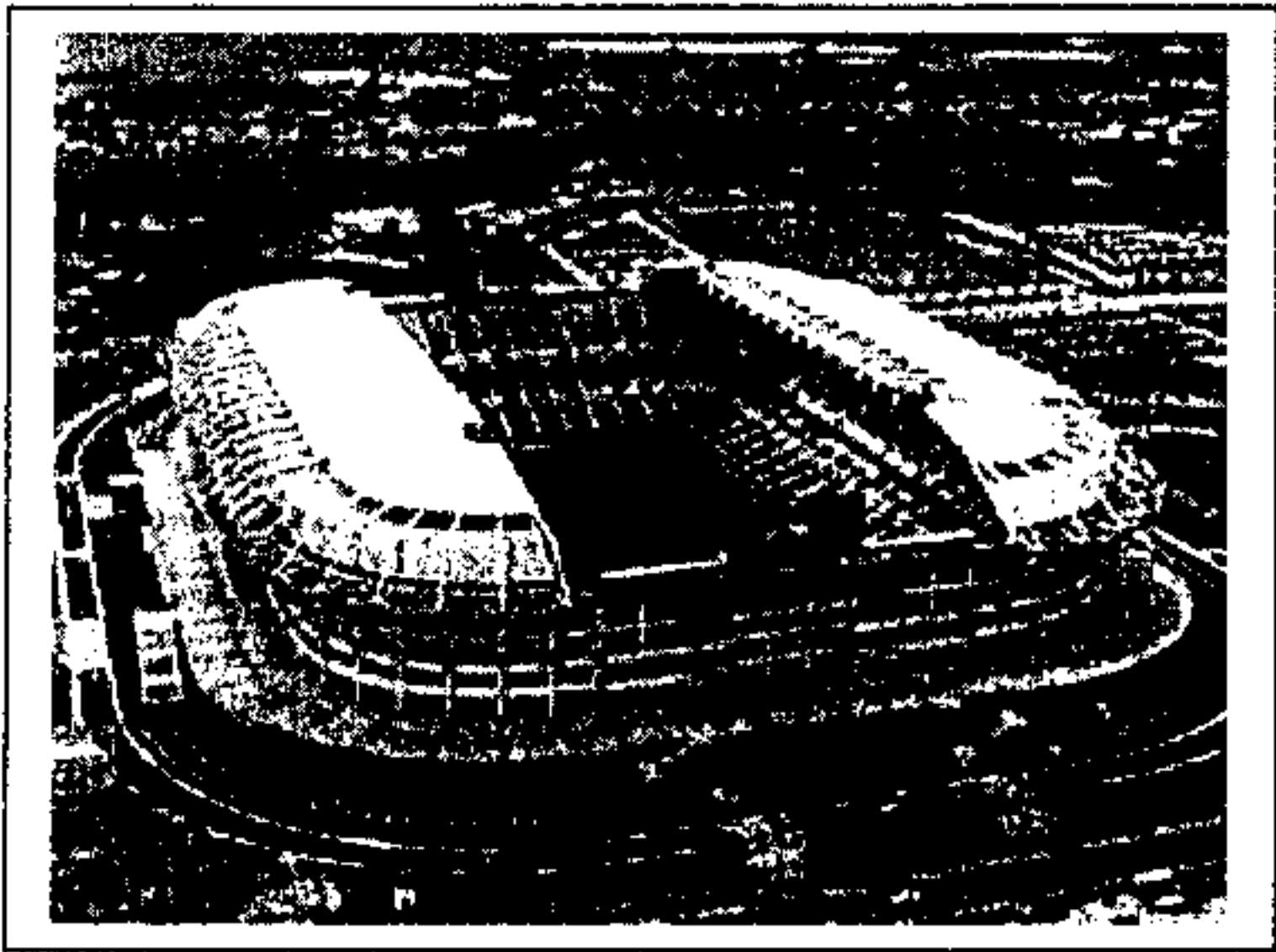
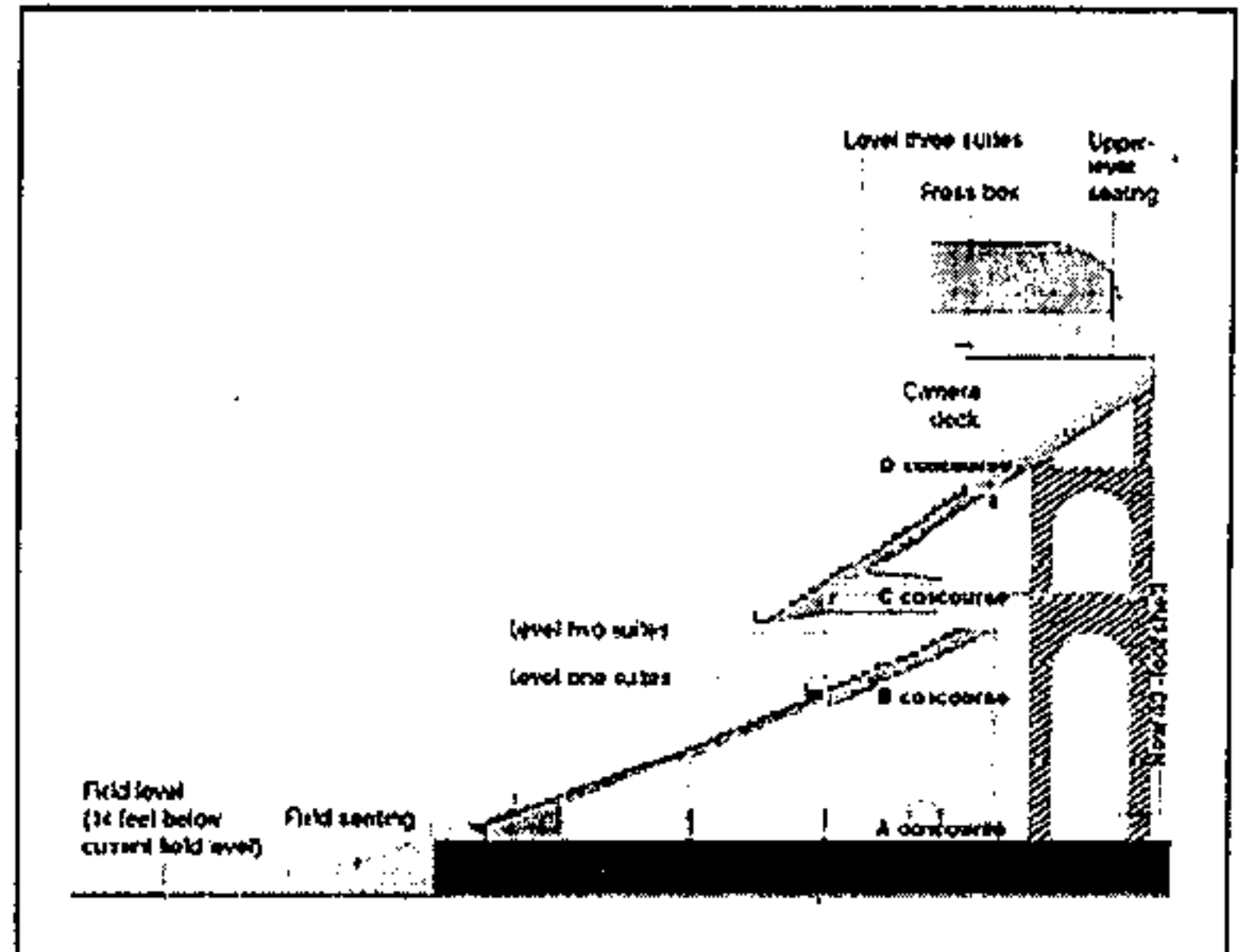
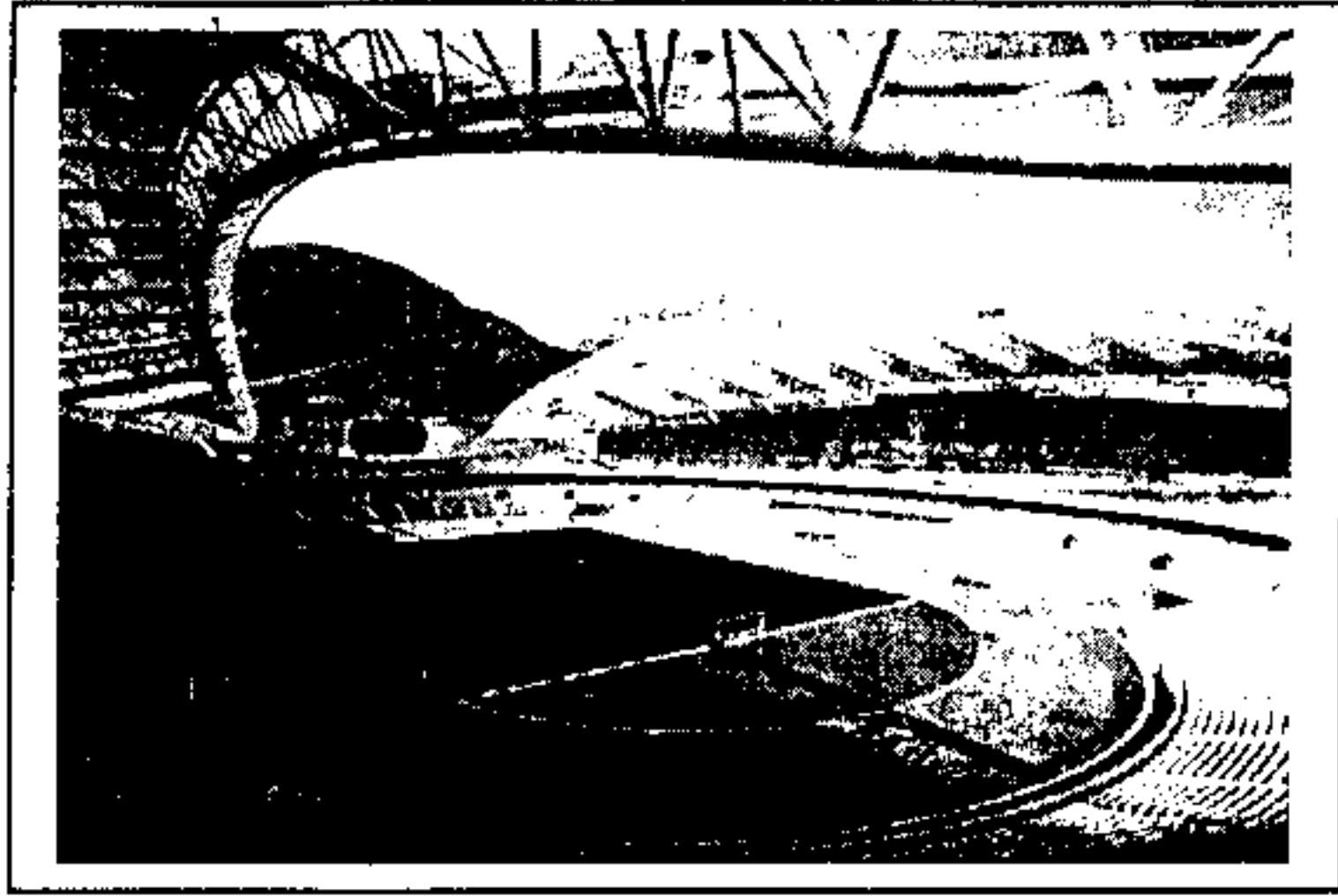
6- مواقف سيارات موزعة على الارض تتراوح بين 700-  
1000 موقف

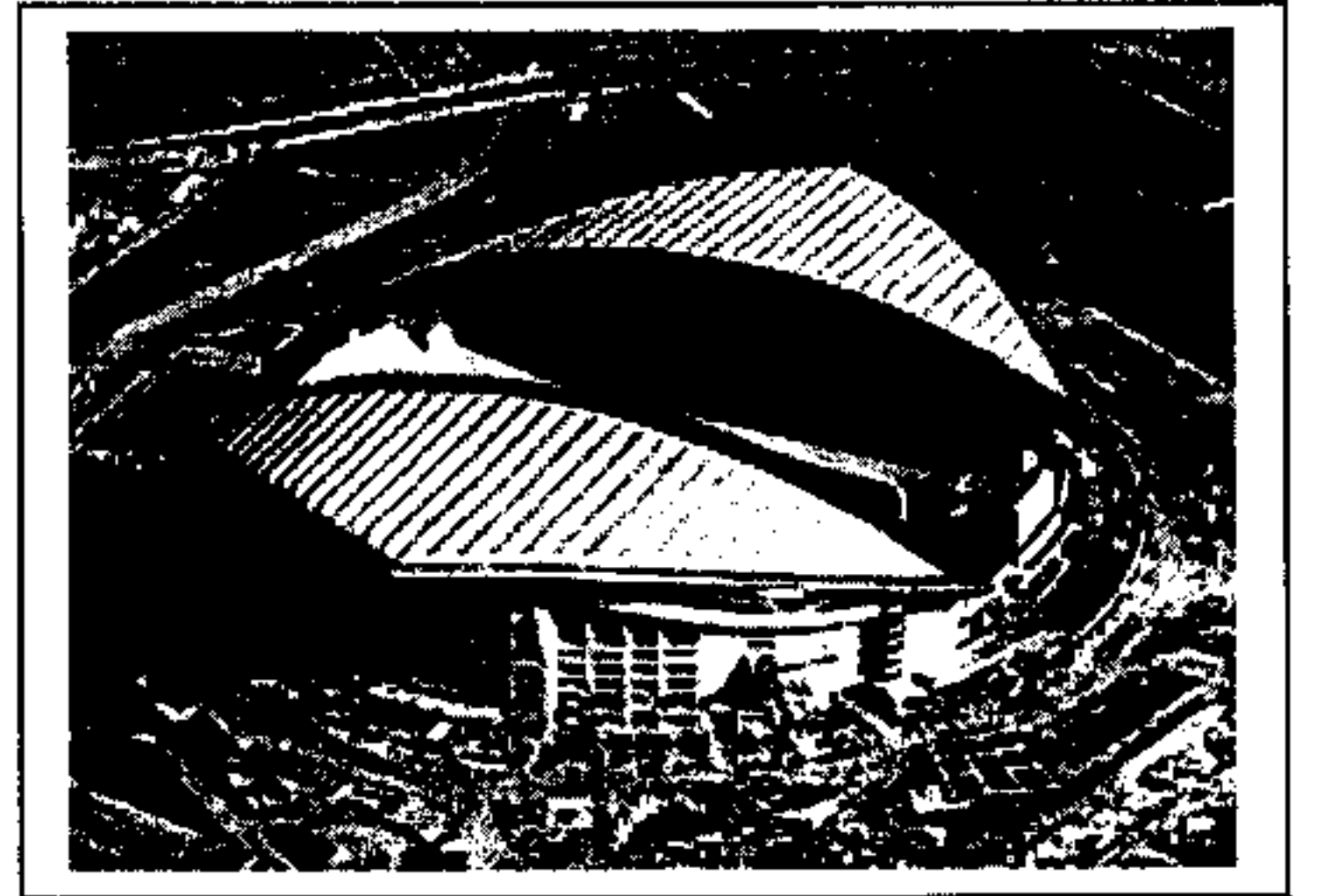
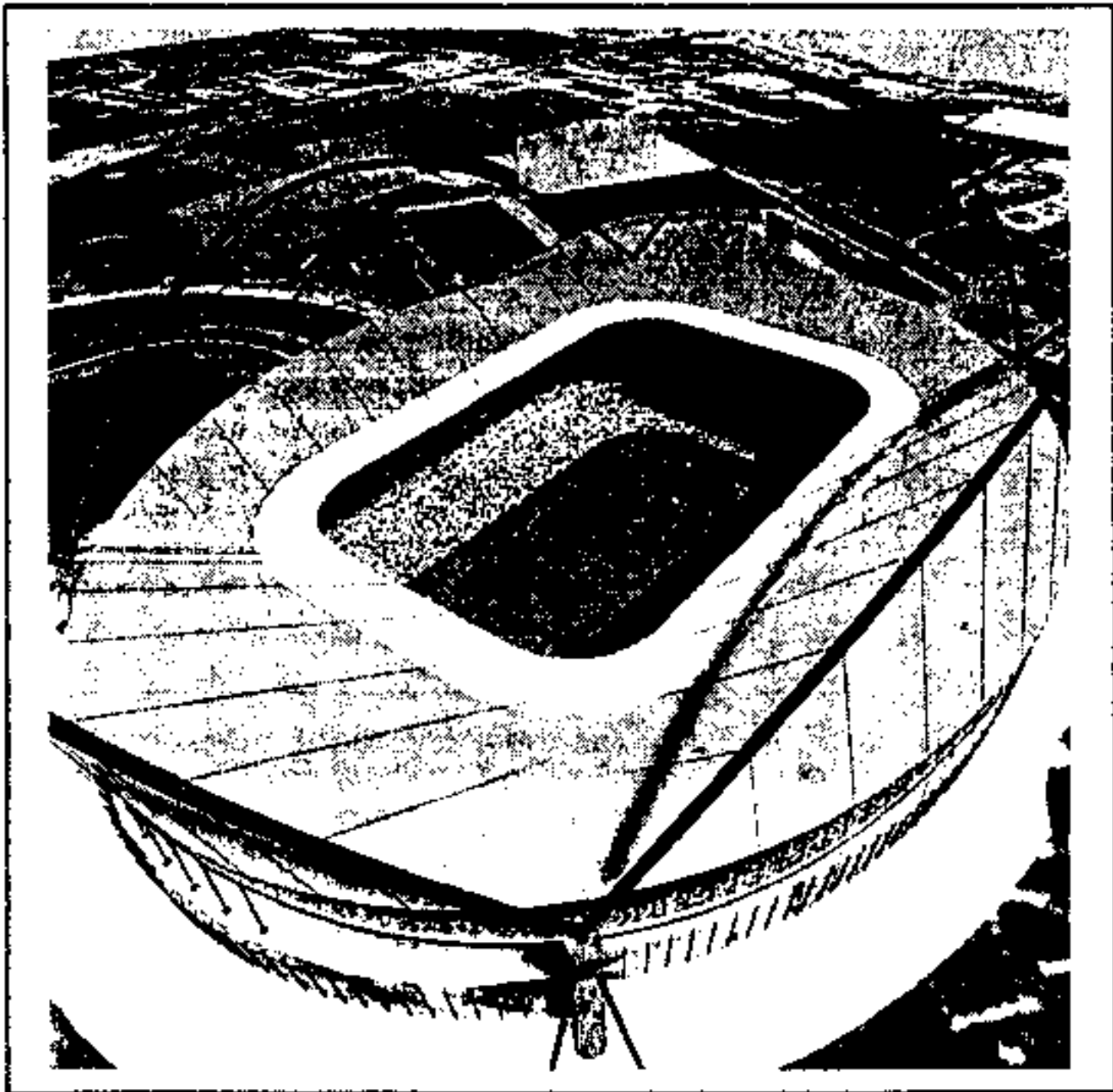
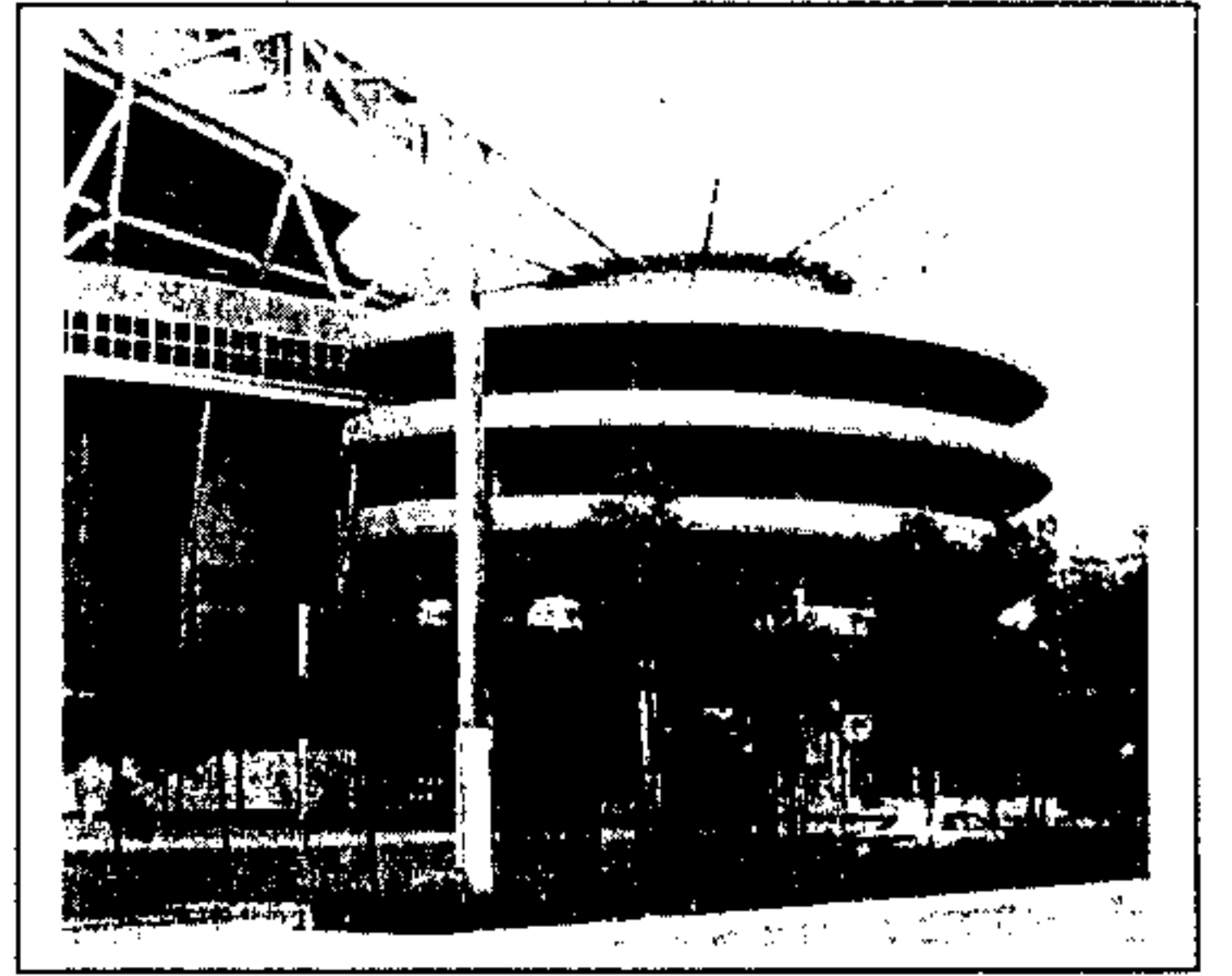
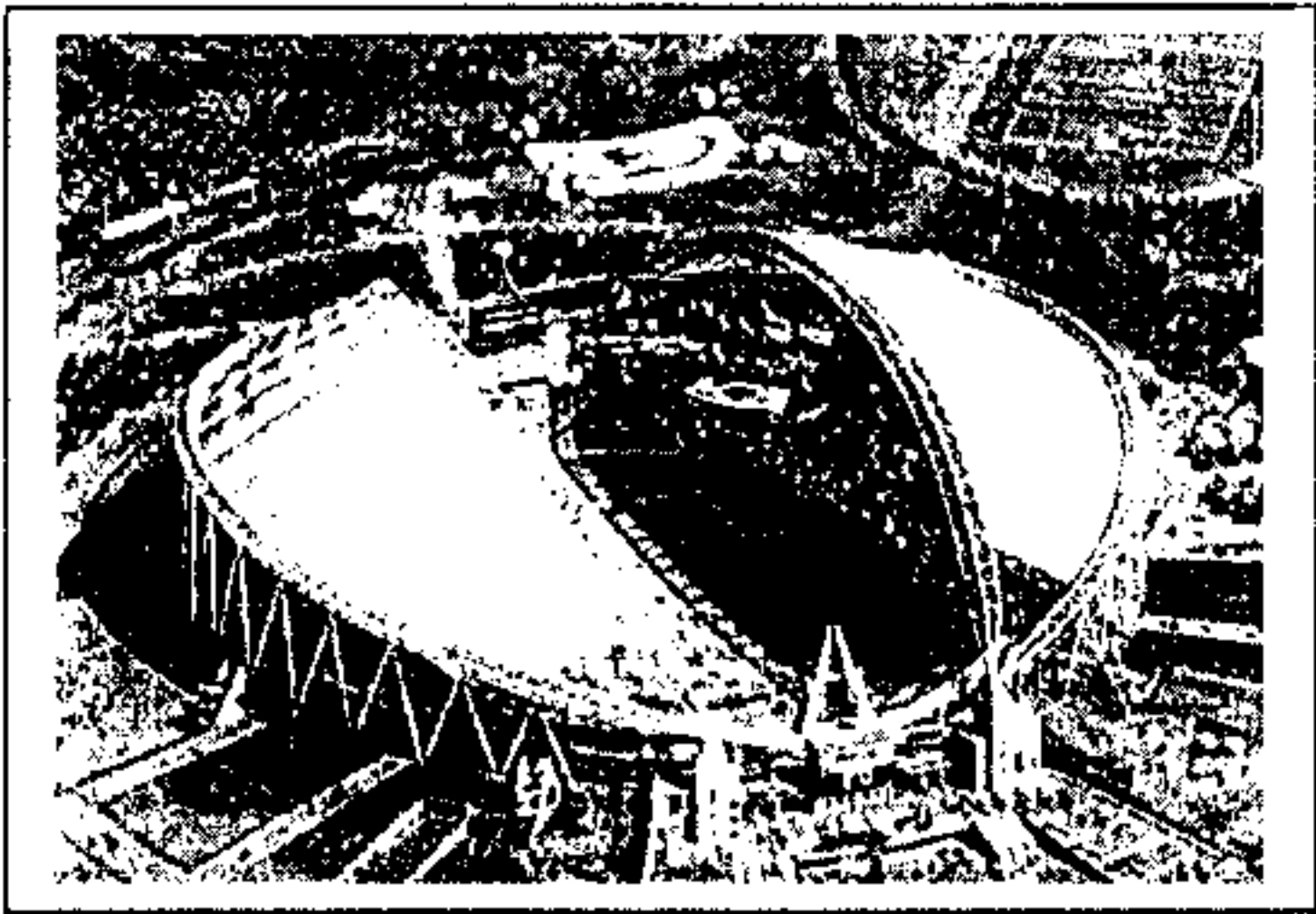
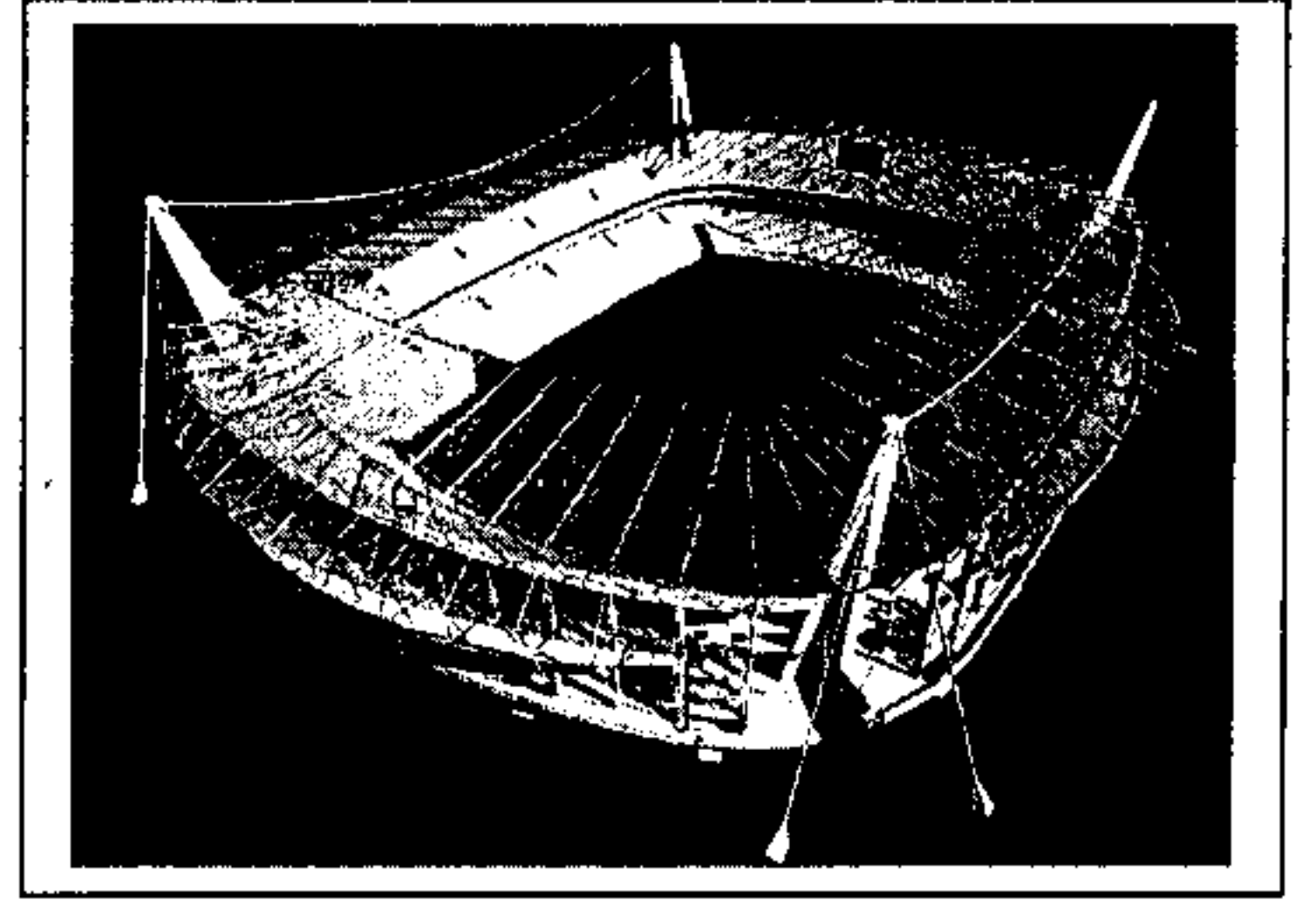
7- اماكن للاستراحة والجلوس و حدائق و مسطحات  
مائة

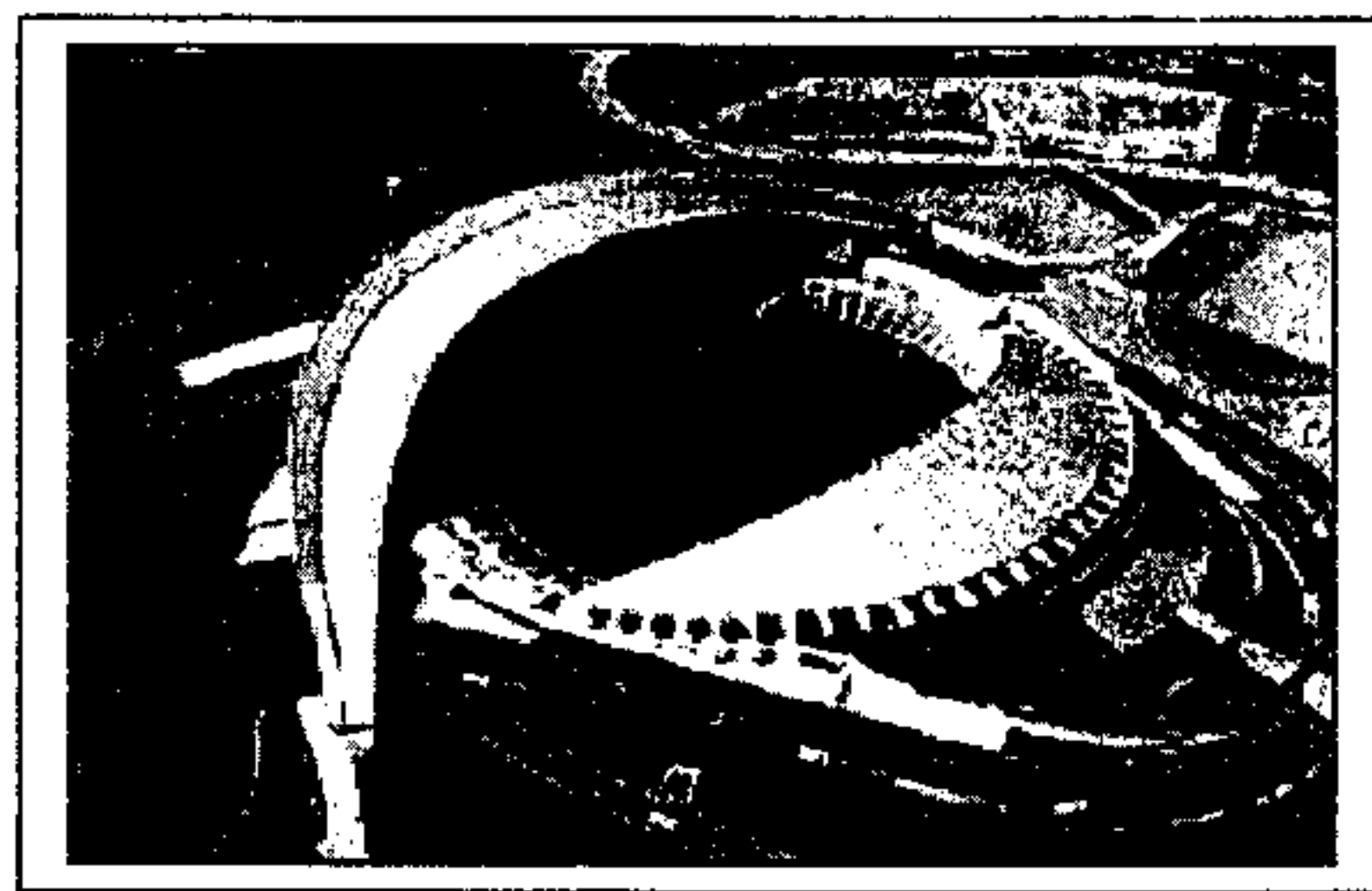
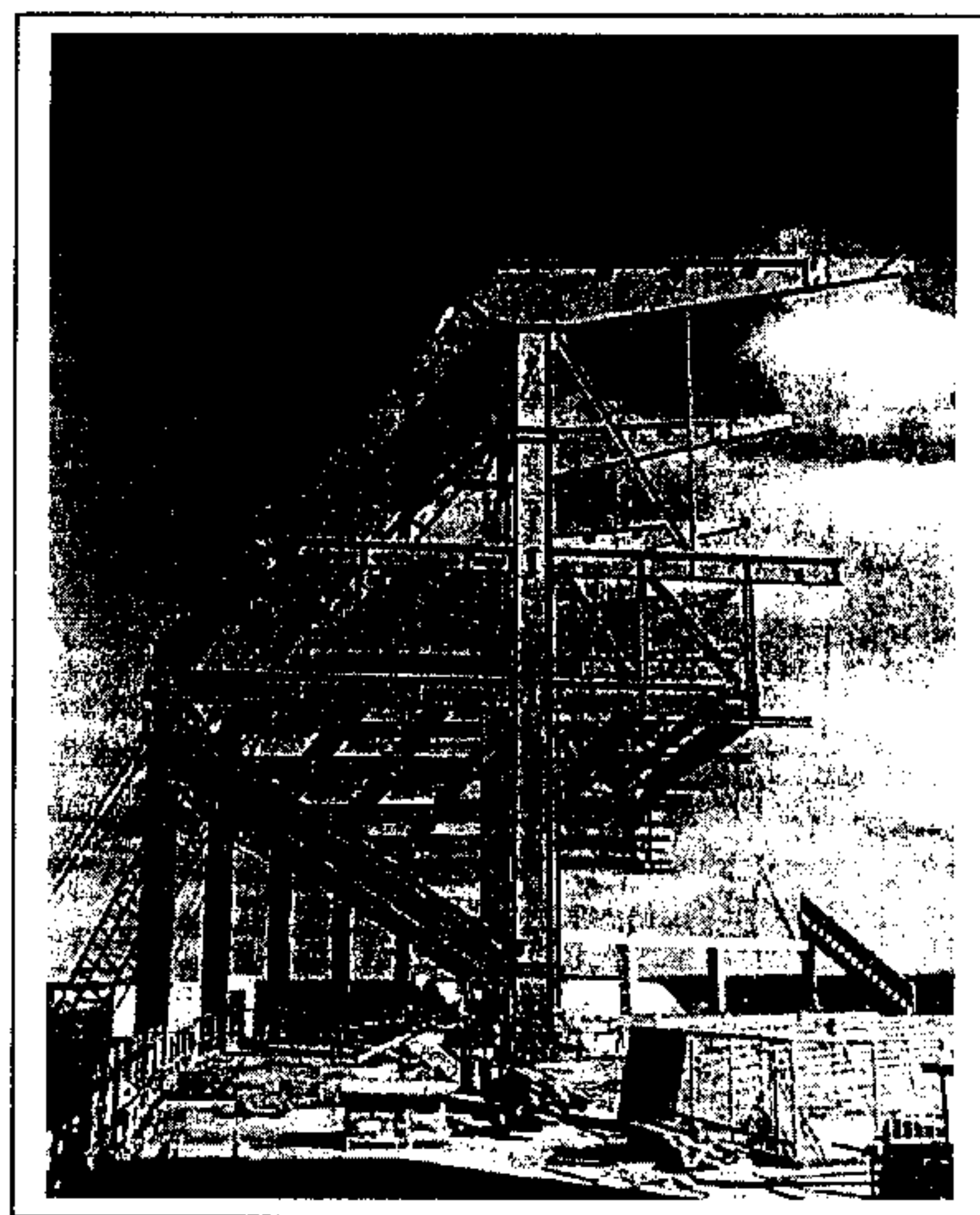
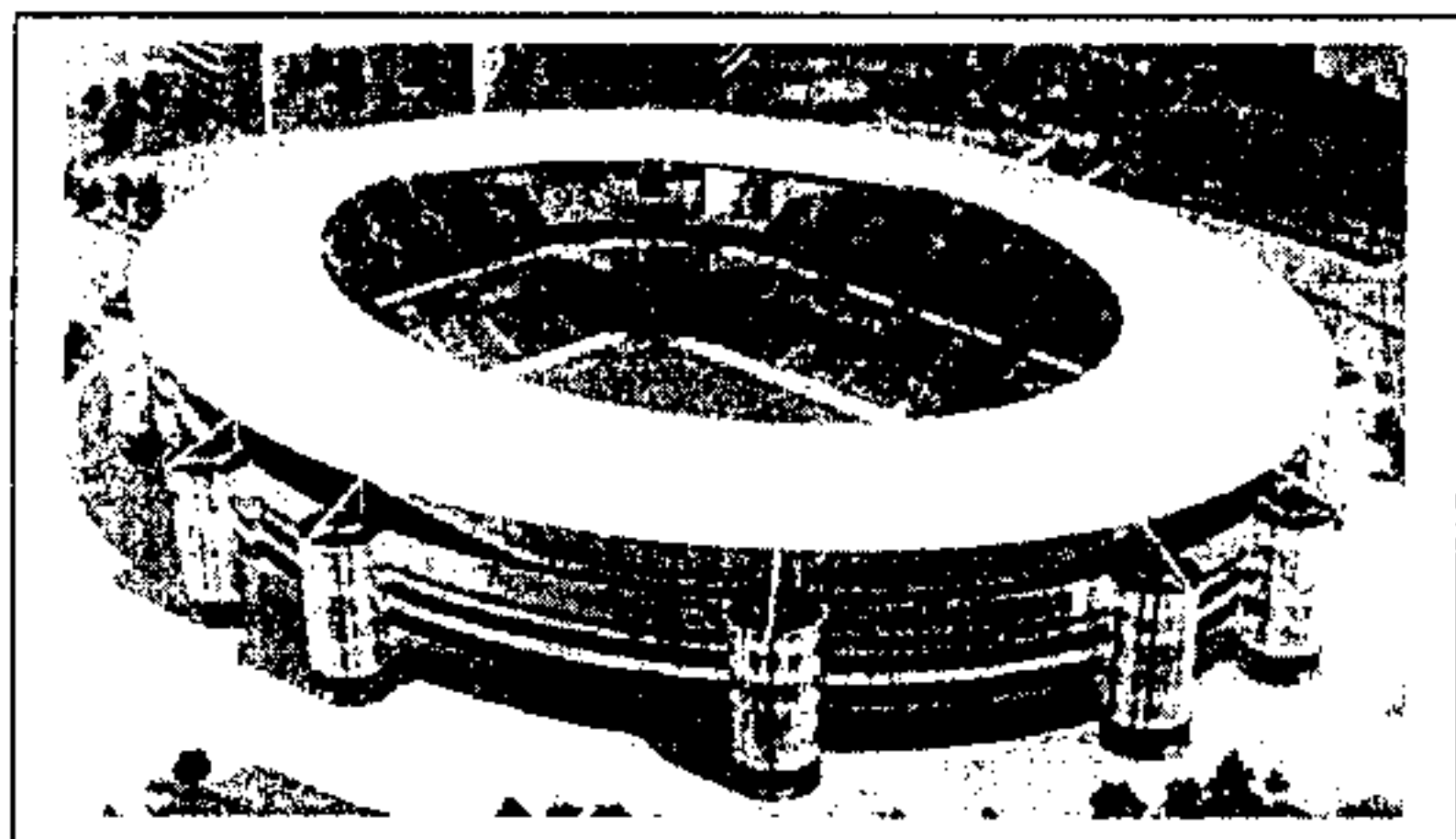
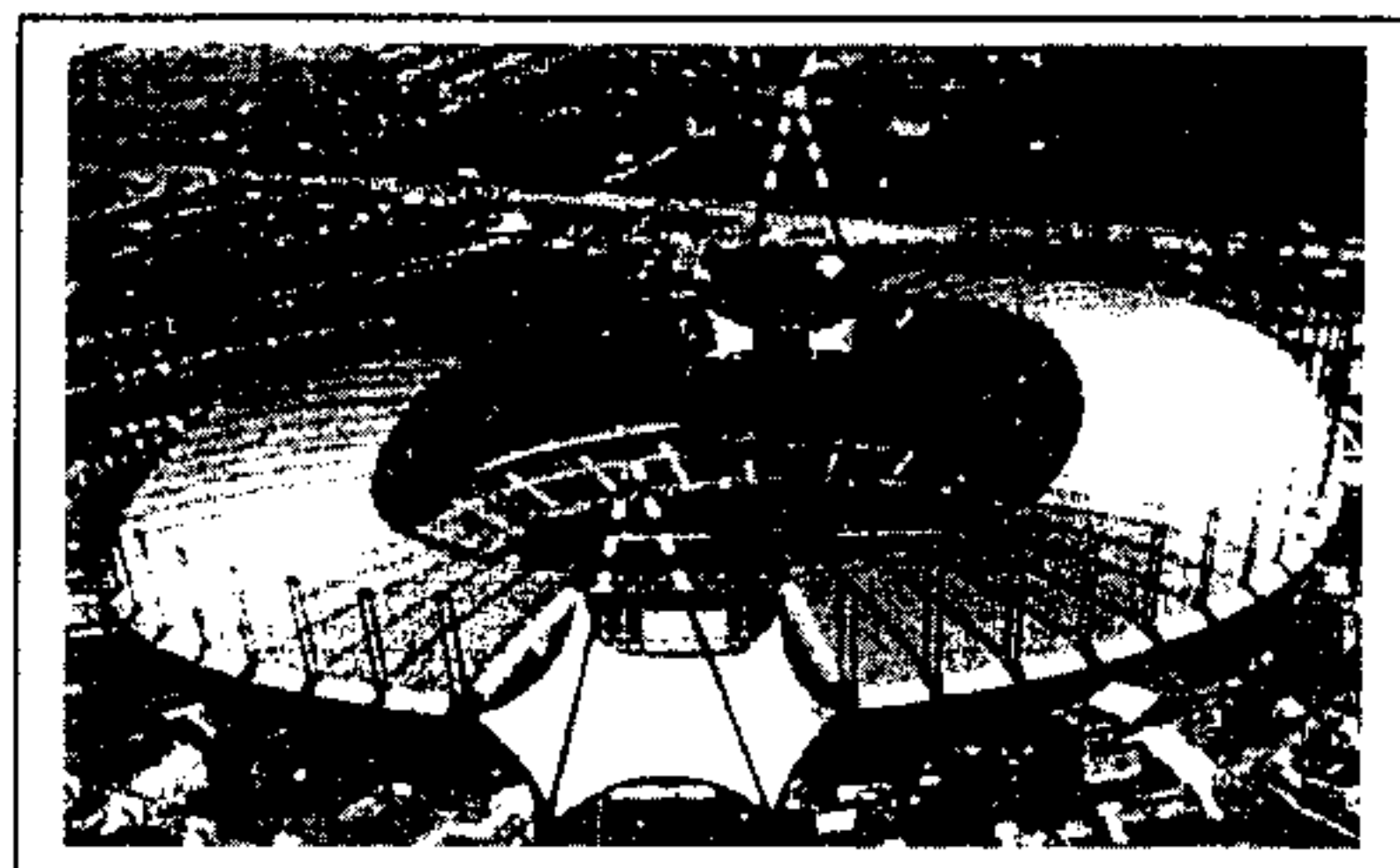
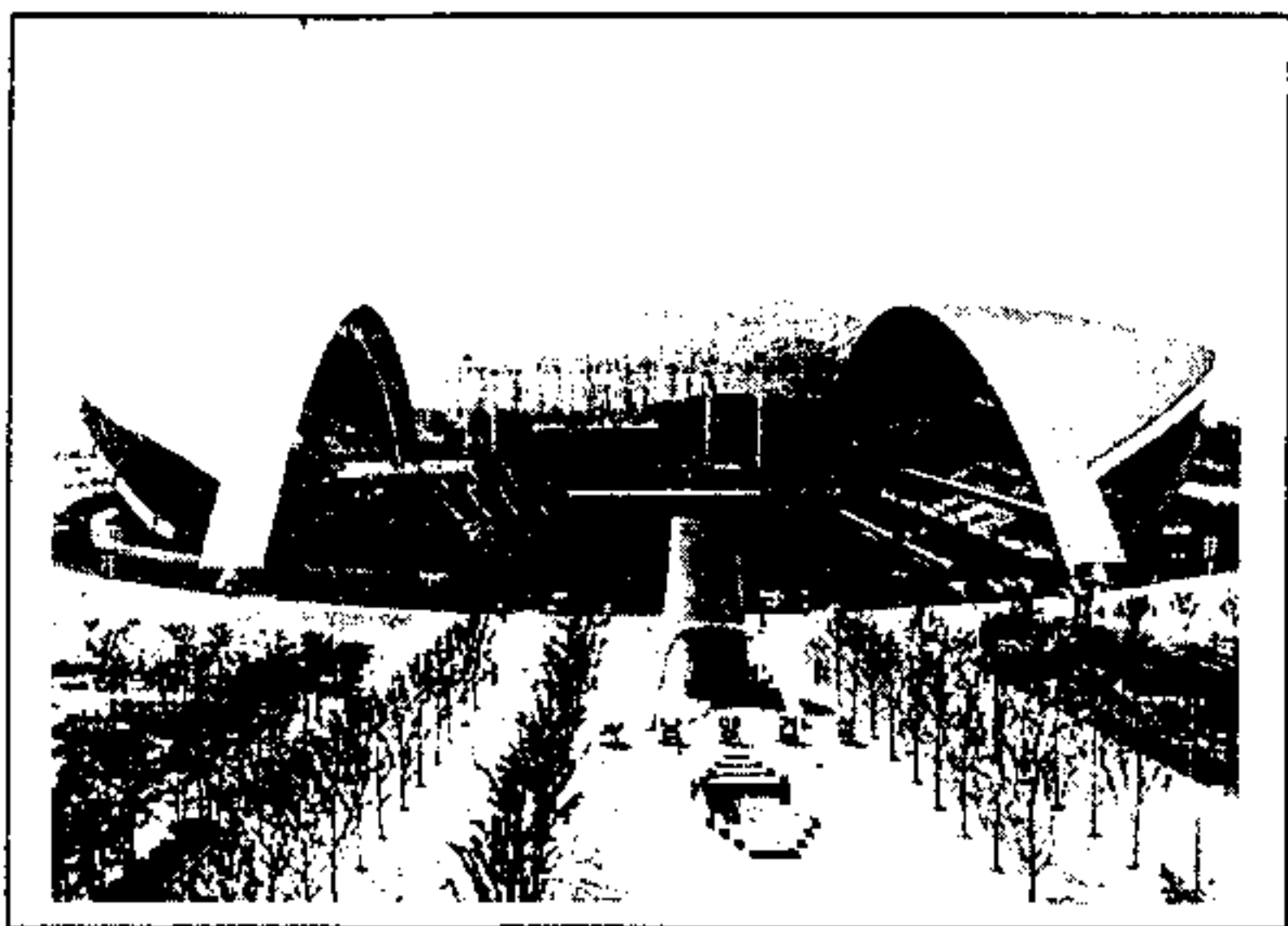
8- اكشاك للبيع الخارجي

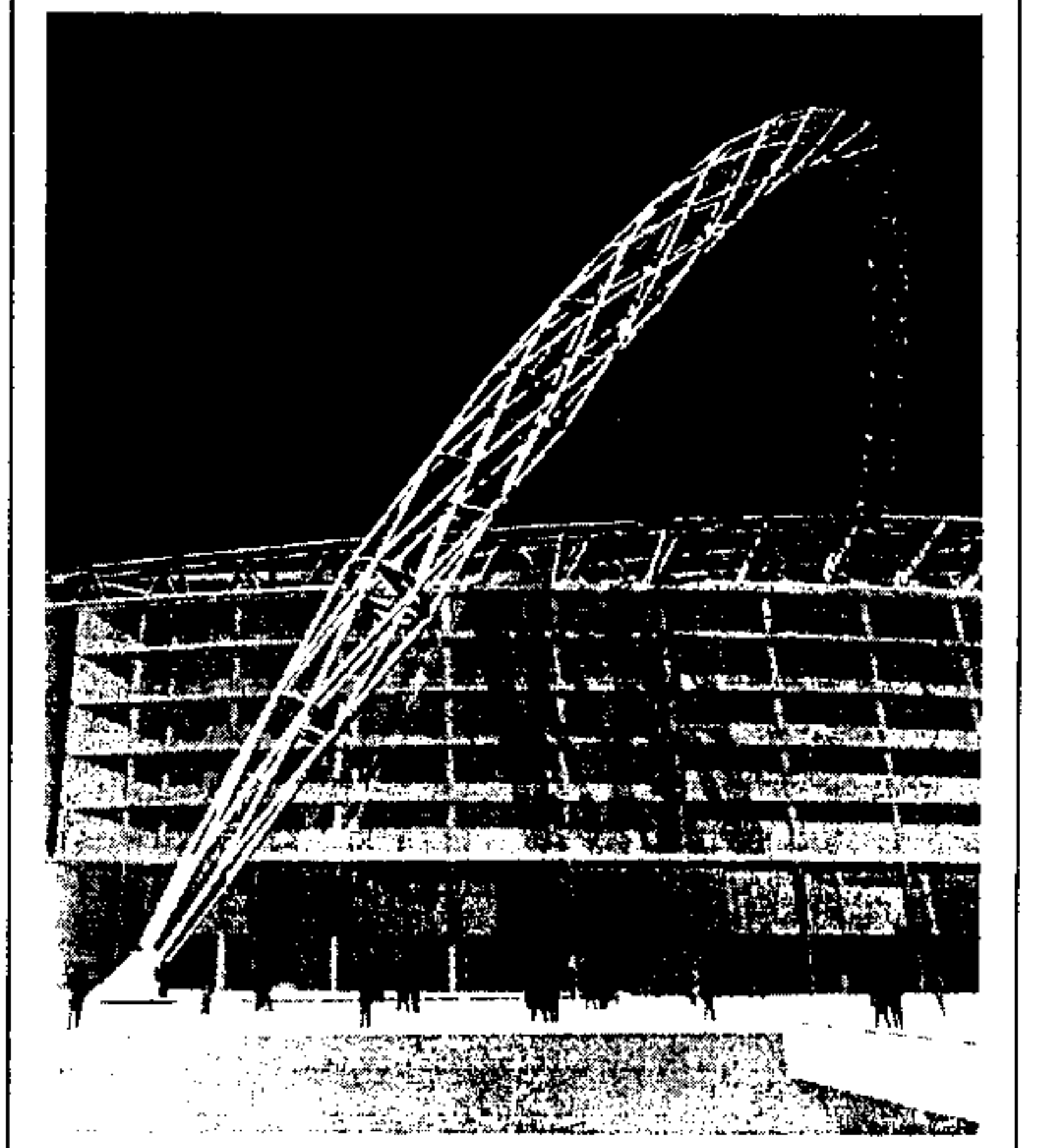
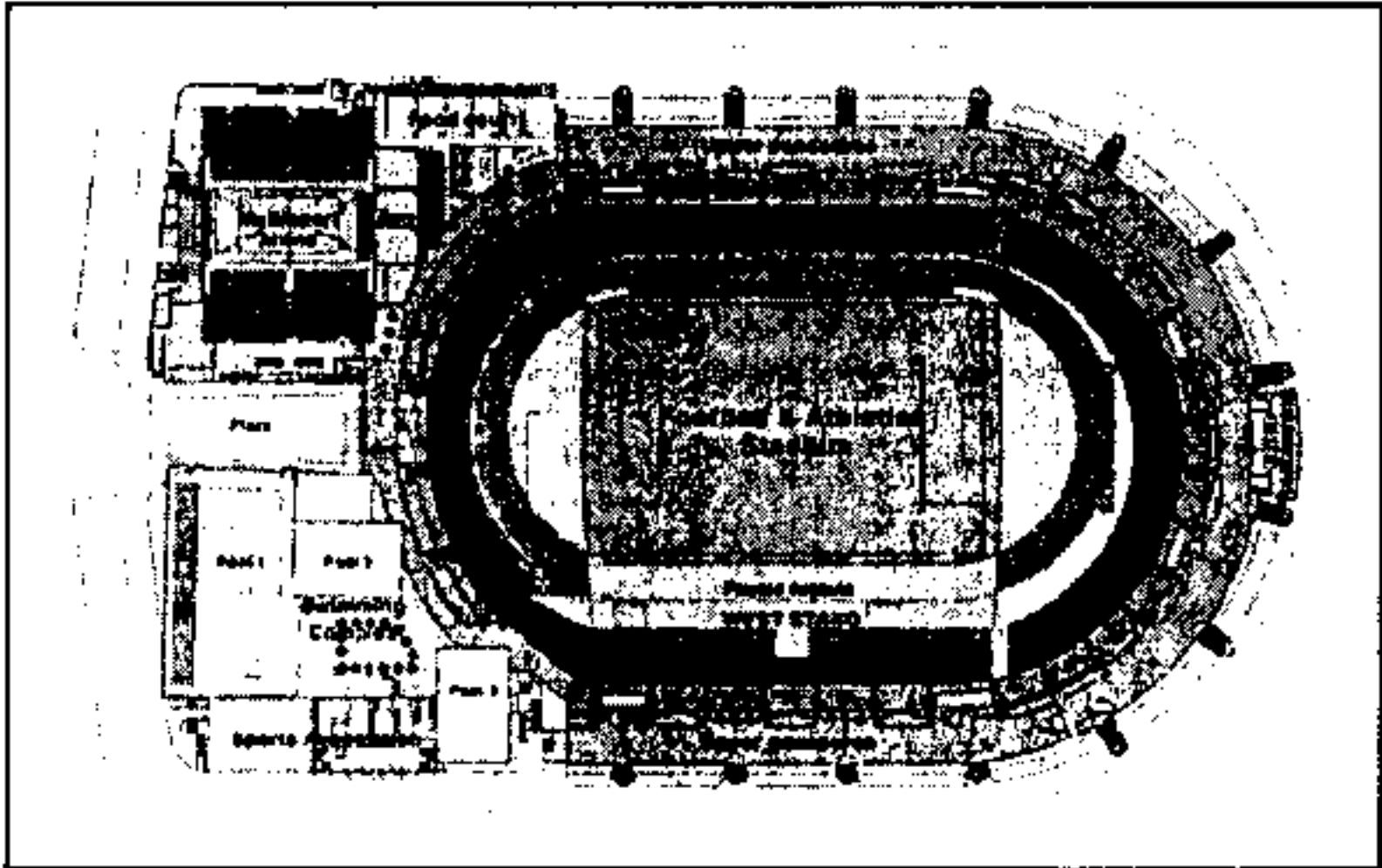
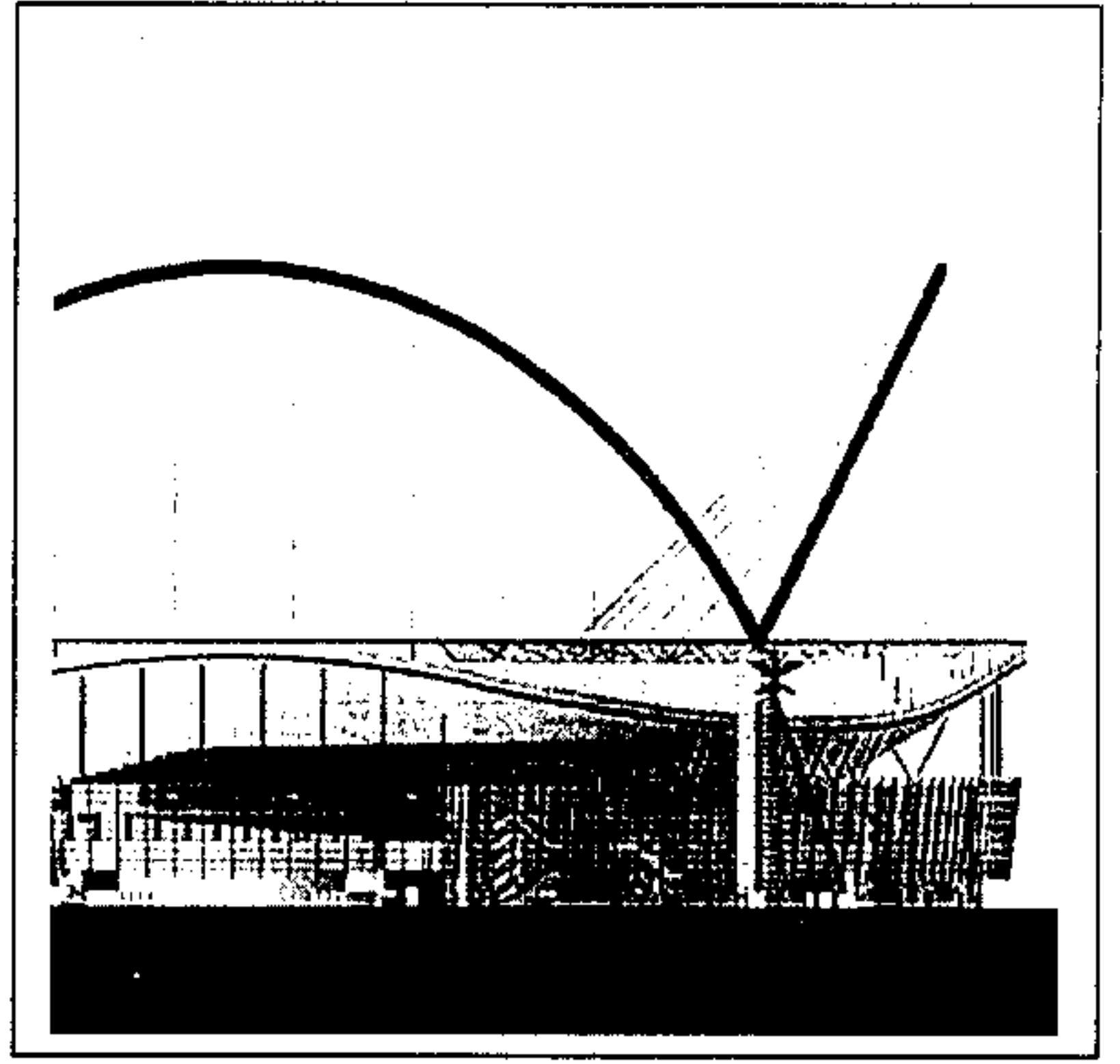
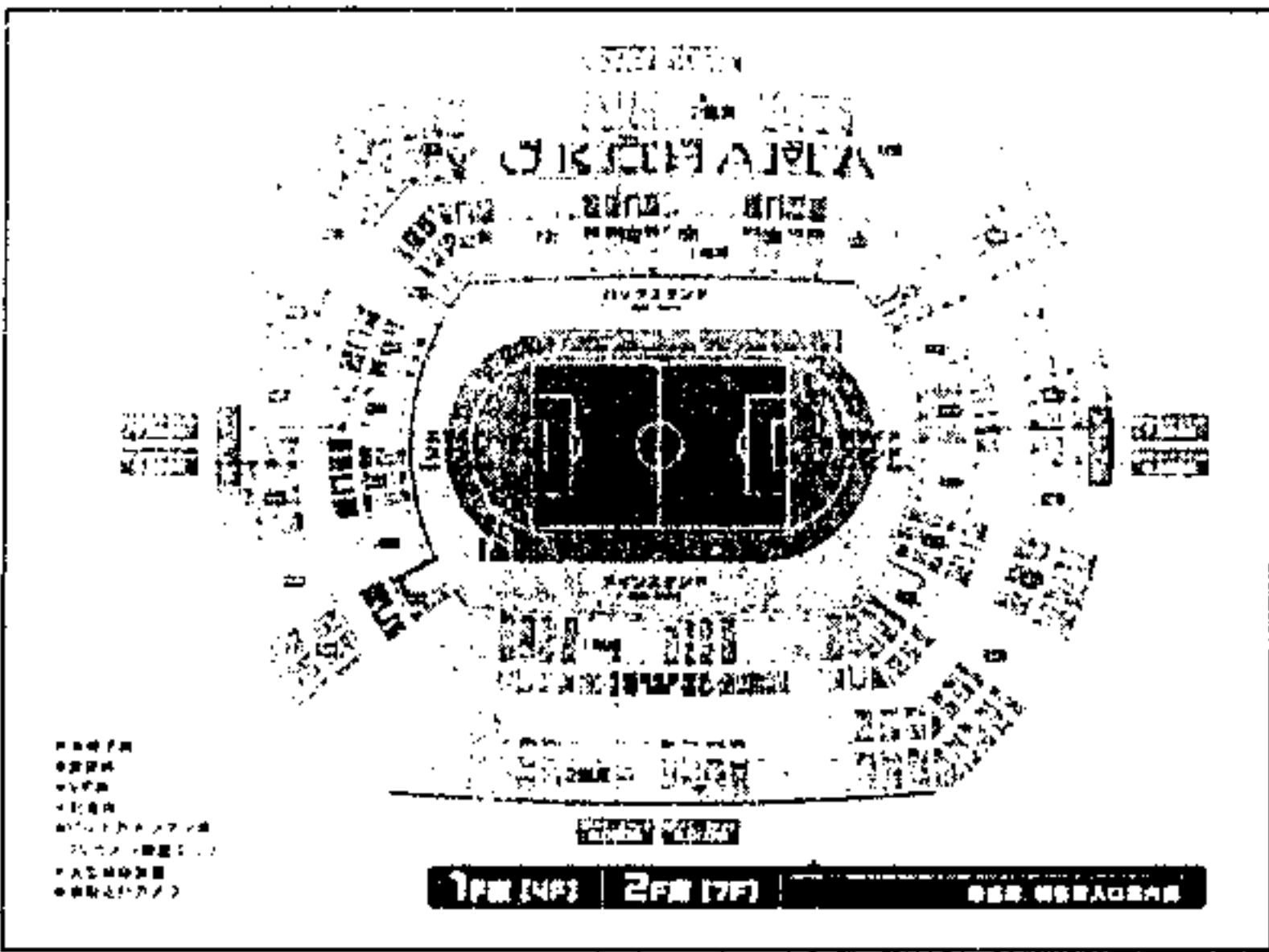
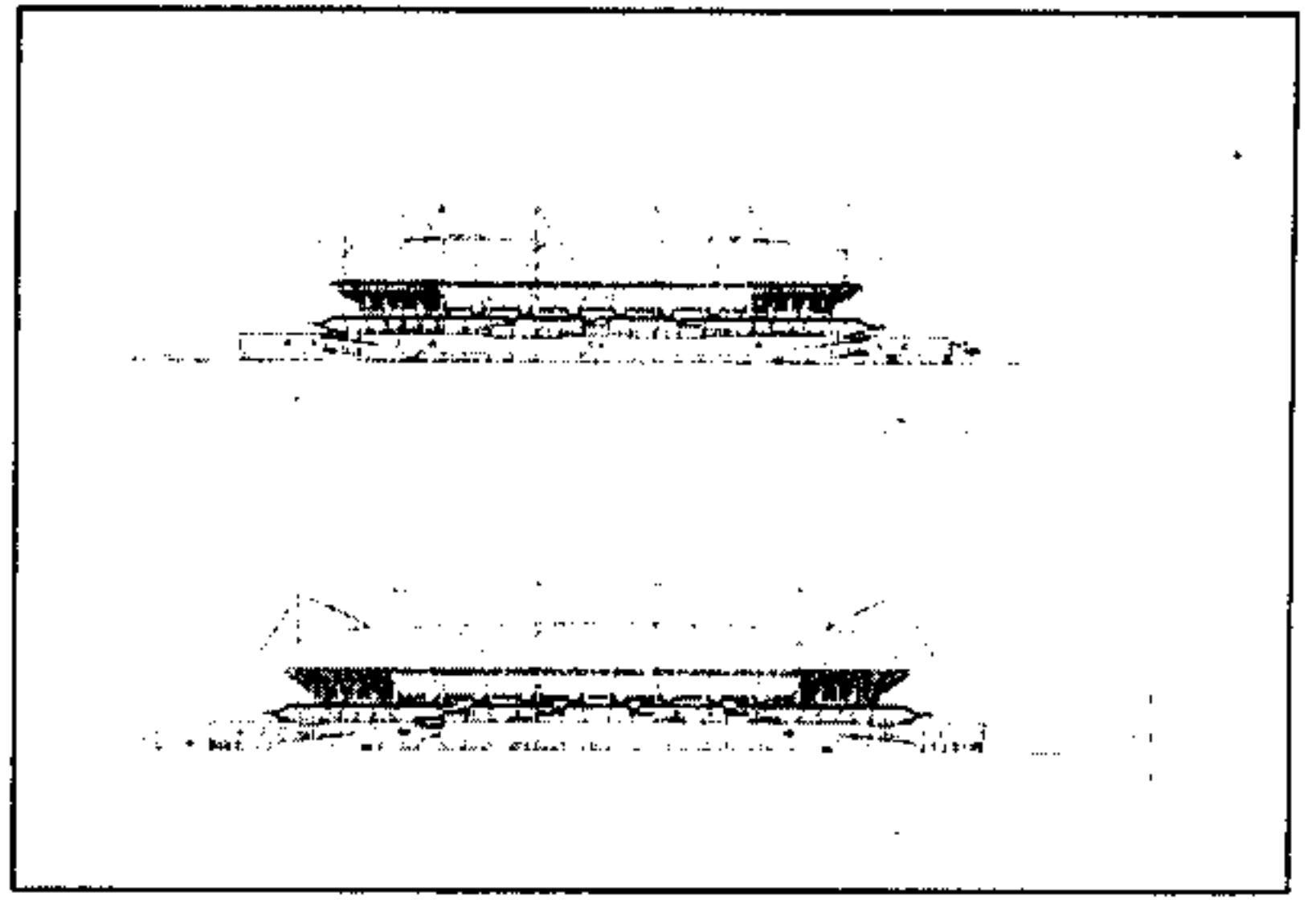
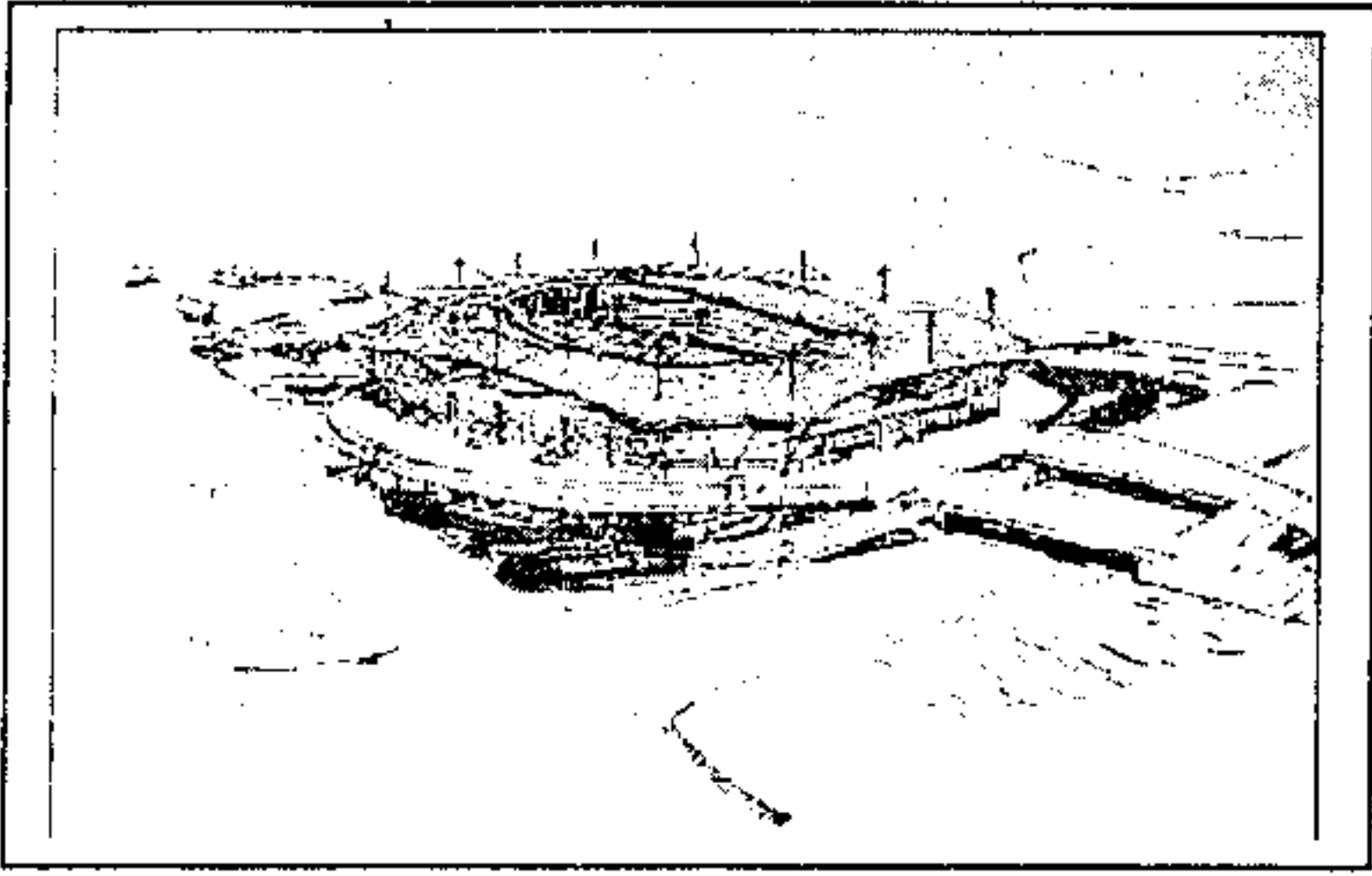














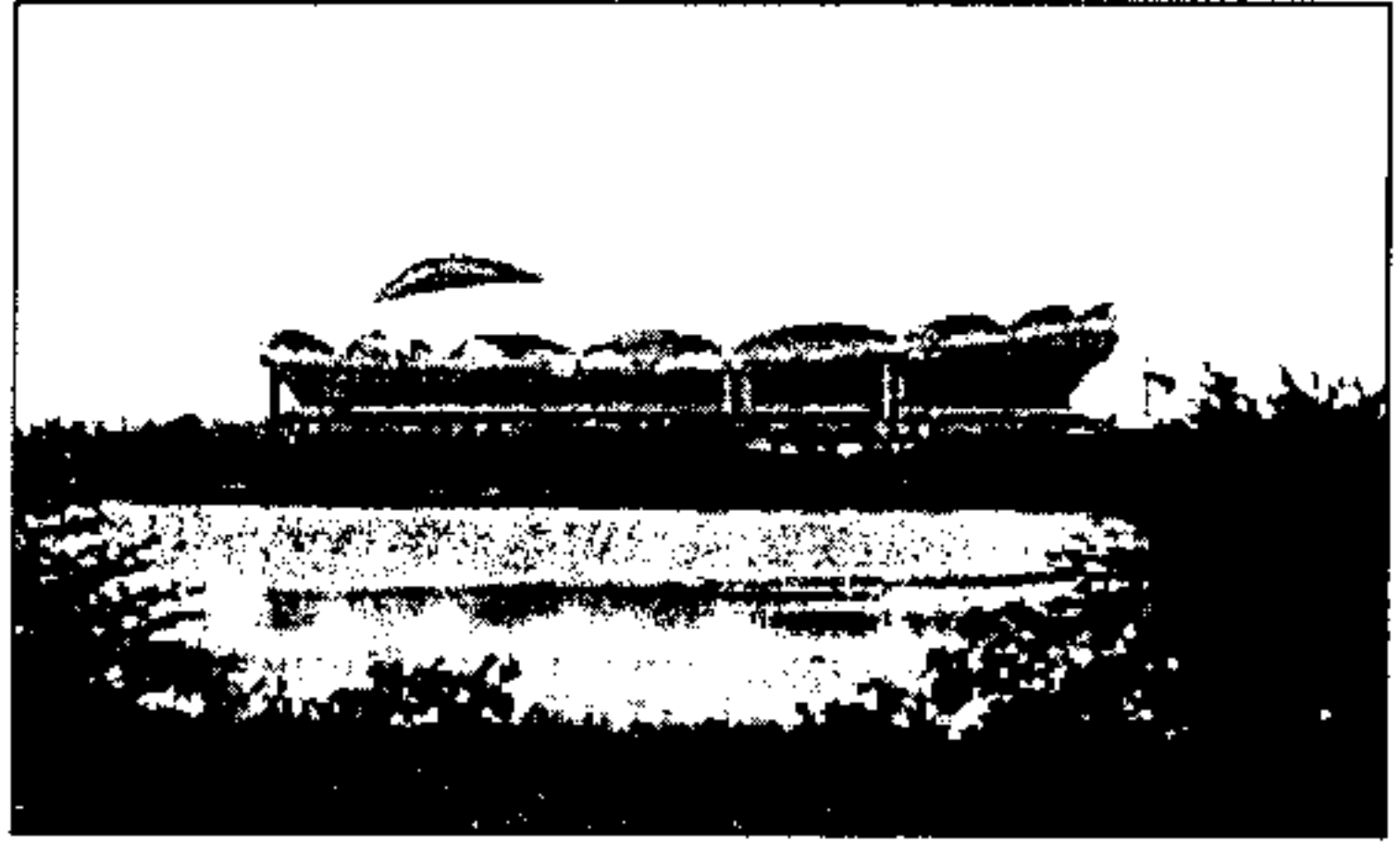
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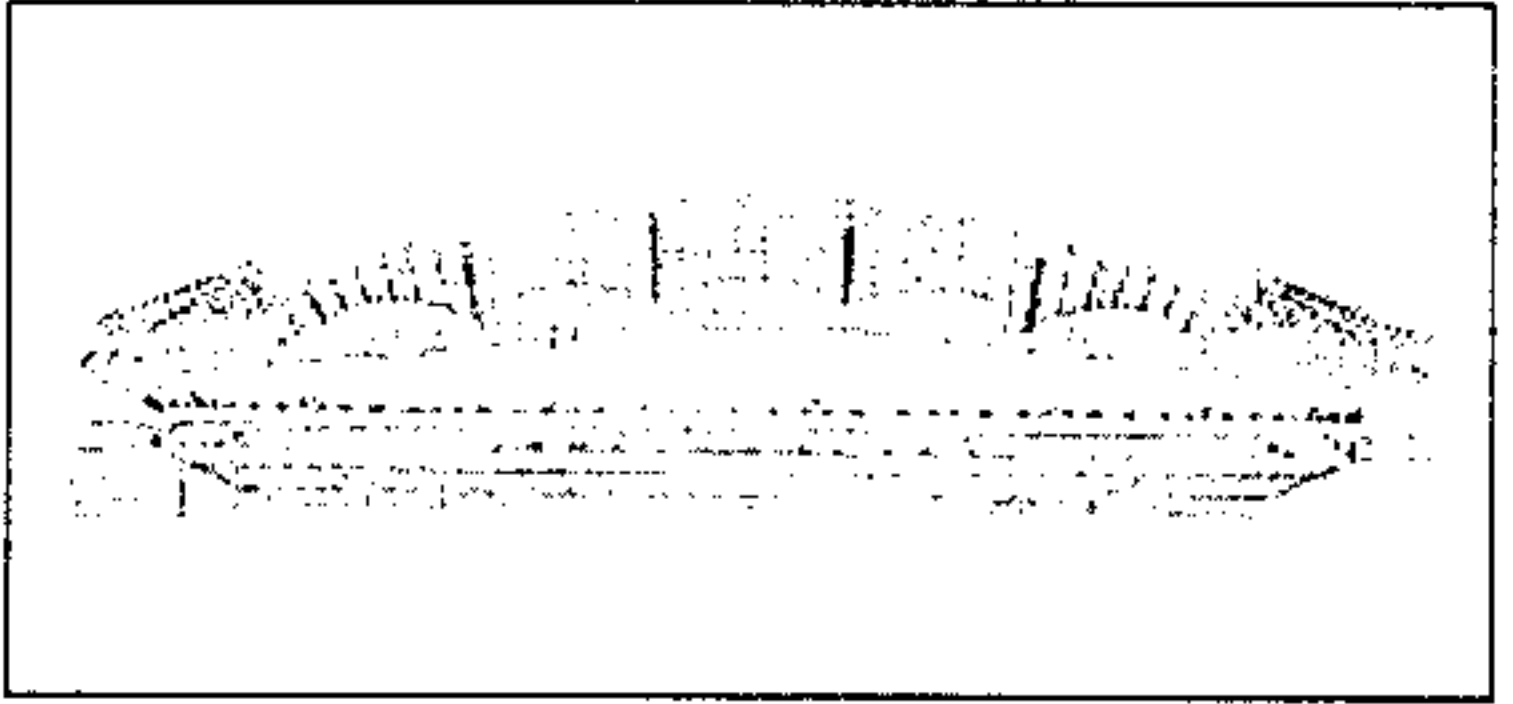
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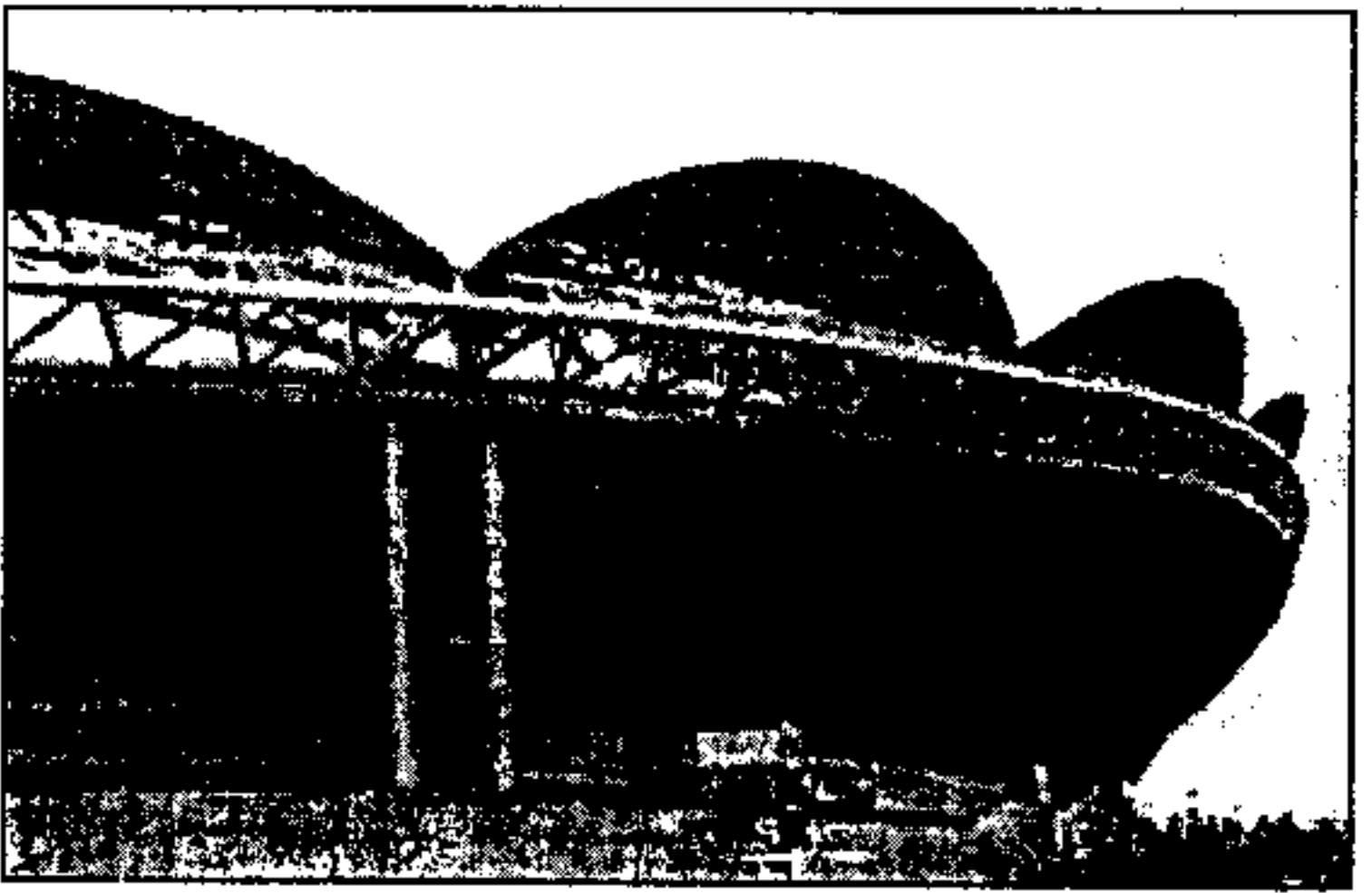
Big Swan. That's how the Niigata Stadium has been nicknamed. The nickname derives from the soft roof that evokes the wings of a resting swan. The Toyano lagoon near Niigata is famous place where many swans trek to during winter times. The stadium has been built the borders of this lagoon.



The stadium is a charming homage to the city and the beauty of its territory. It has been projected by the company Nikken Sekkei and constructed according to a great reticular structure that is laid down on the slightly waved tribunes.



Two pairs of big steel and reticular arches intersect at the four corners of the stadium to form the main structure of the roof together with a reticular ring that follows the course of the tiers going all along the superior border.



The supporting beams that connect the arches and the ring have different lengths in order to connect the rectangular and internal profile with the circular and external perimeter. They define twenty spans including a series of smaller cross-sectional arches and plot as many the form of a shell. The latter determine the final impression of the roof which is completed with a white membrane of semi-transparent teflon.



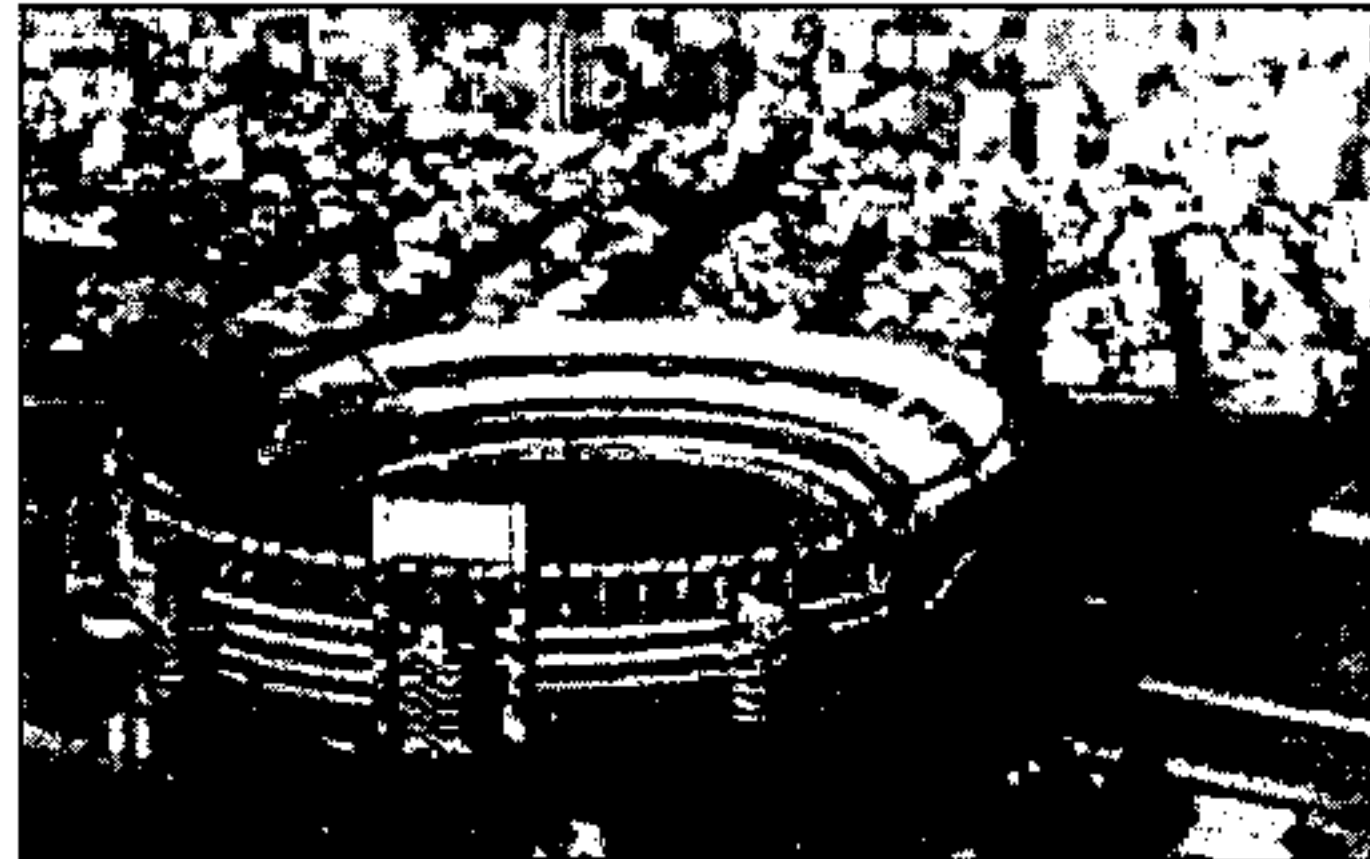
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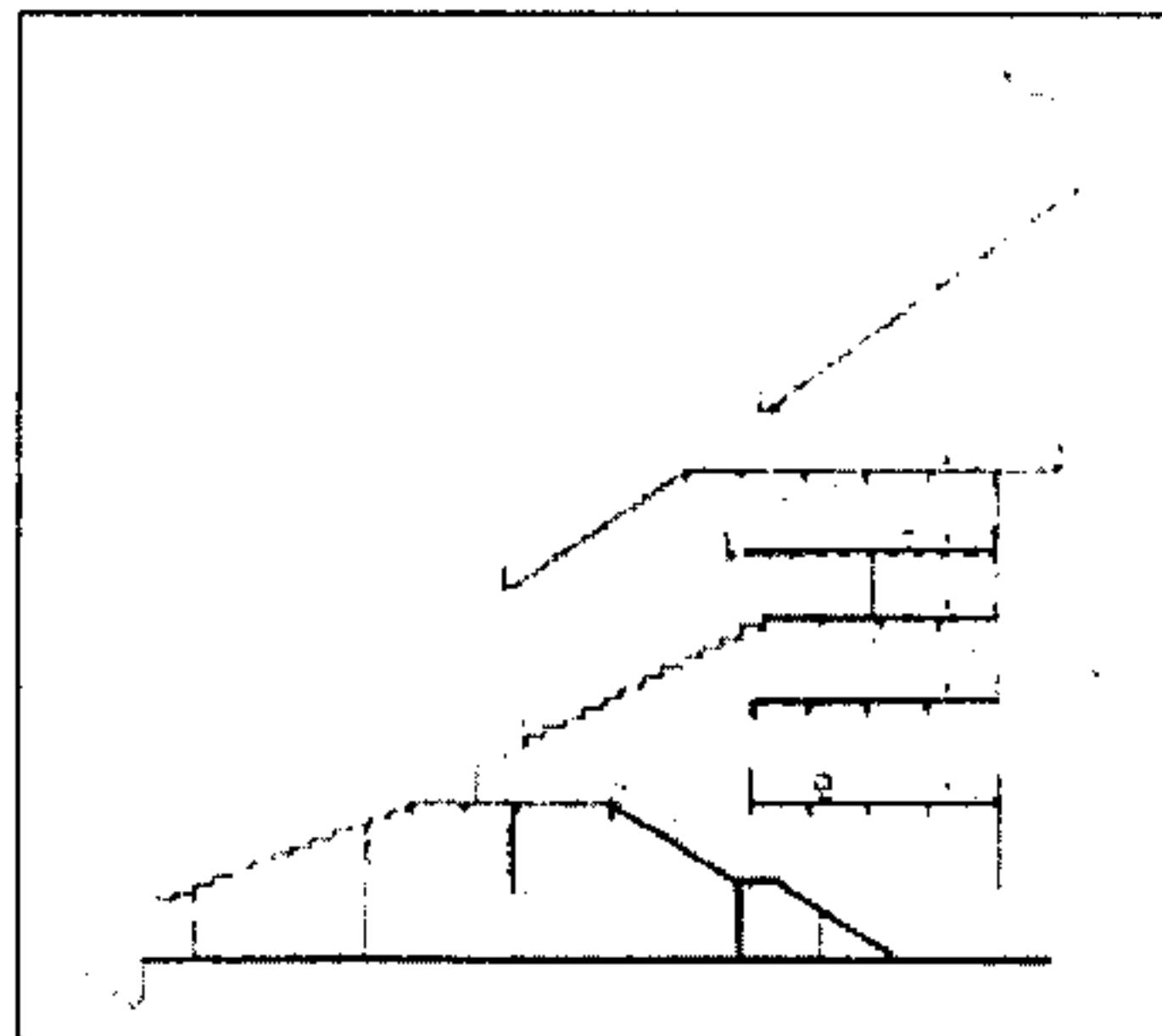
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The [Estadio Monumental](#) as the stadium is popularly called has been inaugurated on 25 M 1938 near the river Rio de la Plata. It has been honoured in the name of Antonio Vespucio Liberti, president of the football (soccer) club River Plate to which the stadium has been dedicated in 1986.

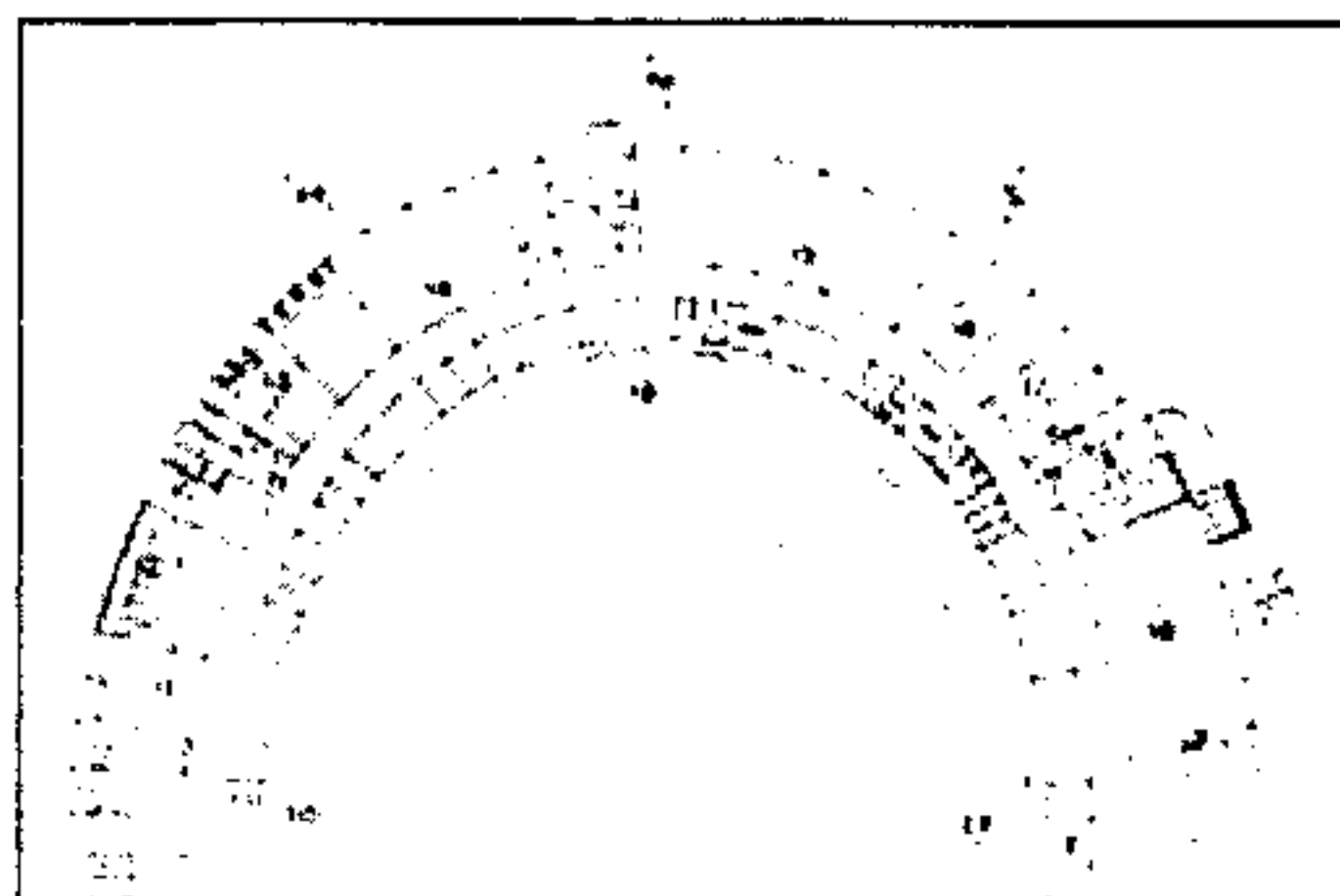
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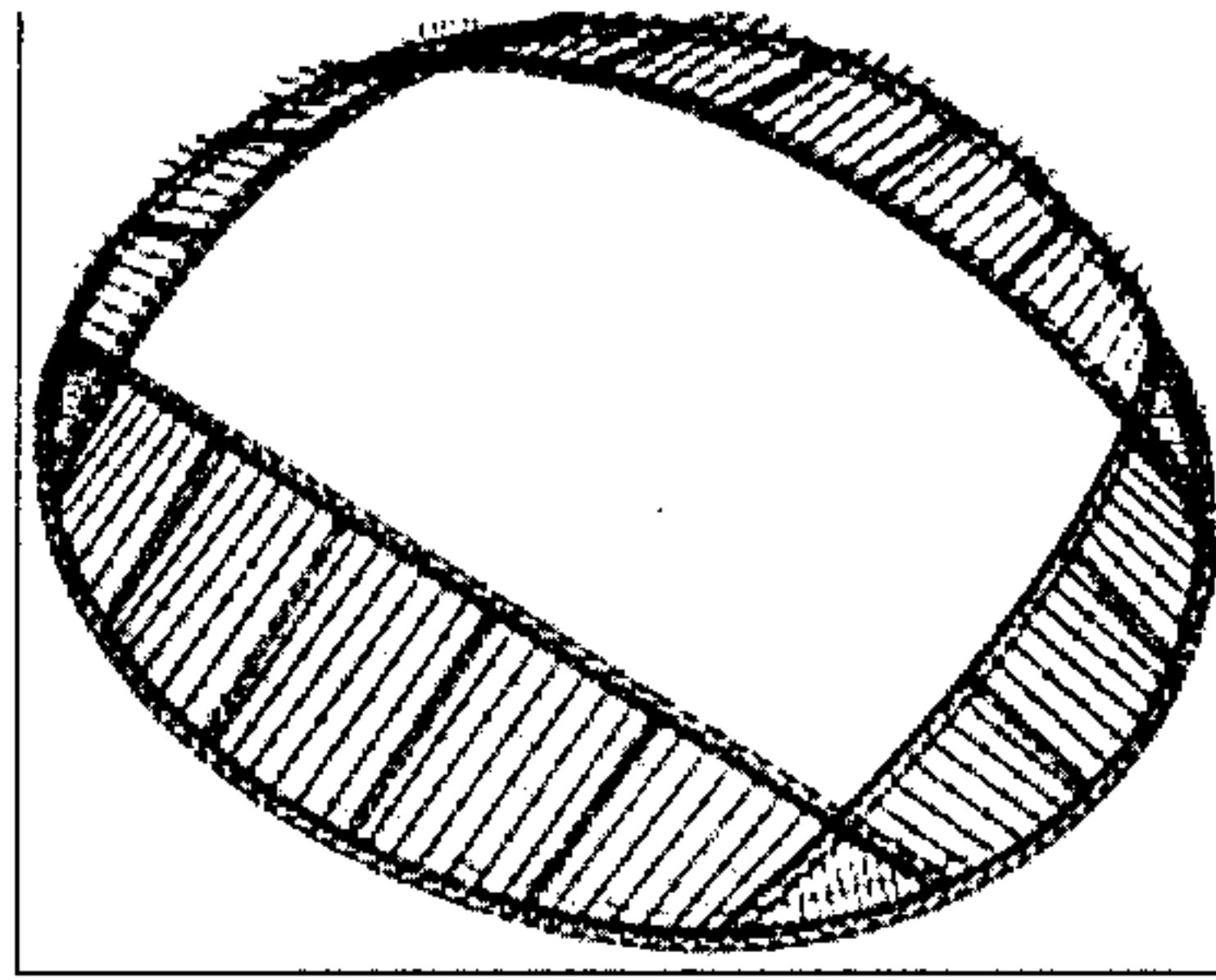


The plan of architects Aslan and Ezcurra contains a good balance between the search geometry and the technical aspects of the construction, namely four curved tribunes placed side by side that define an elliptical framework. This framework follows the geometrical rule of the historical Coliseum in Rome and has taken into account water pressures caused by the nearby river. The stadium contains a foundation of eight meters of depth.

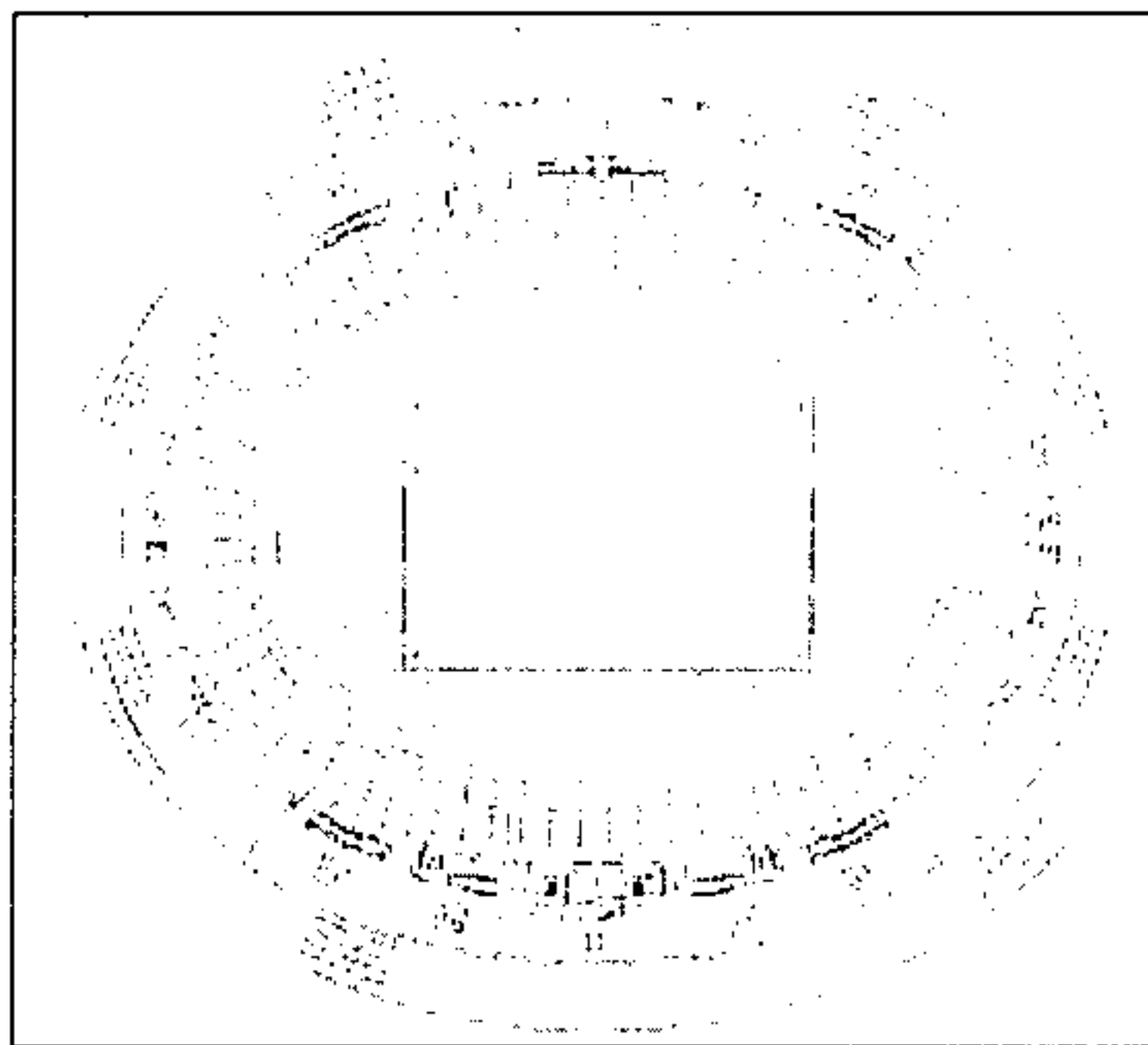


The entire project was finished in the late fifties when the lowest part of the Nord stand was constructed together with a new ring of tiers that were placed on the existing ones. The new look of the stadium involves a continuous ring of concrete based on imposing supports emerging from the base.

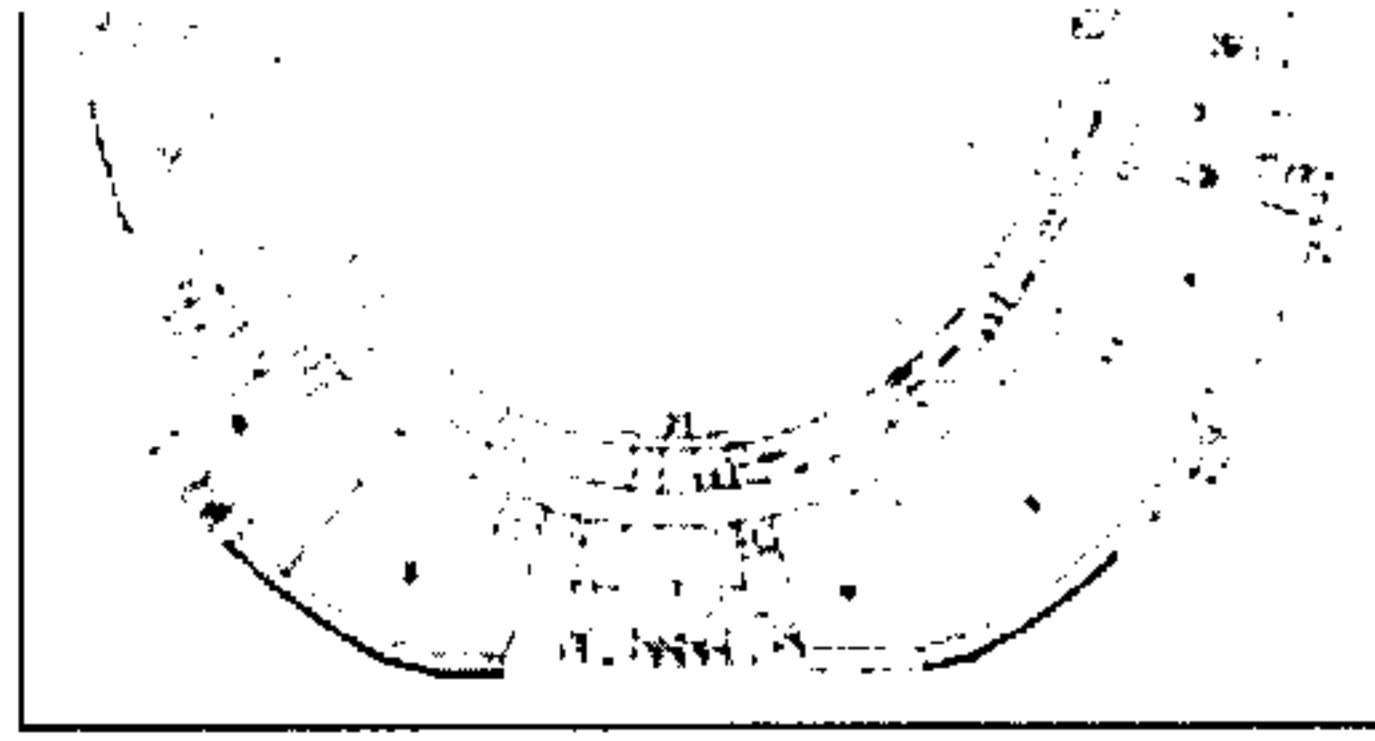




The stadium consists of 42 700 seats divided over two levels of continuous tiers all cover by the wings of the Big Swan.

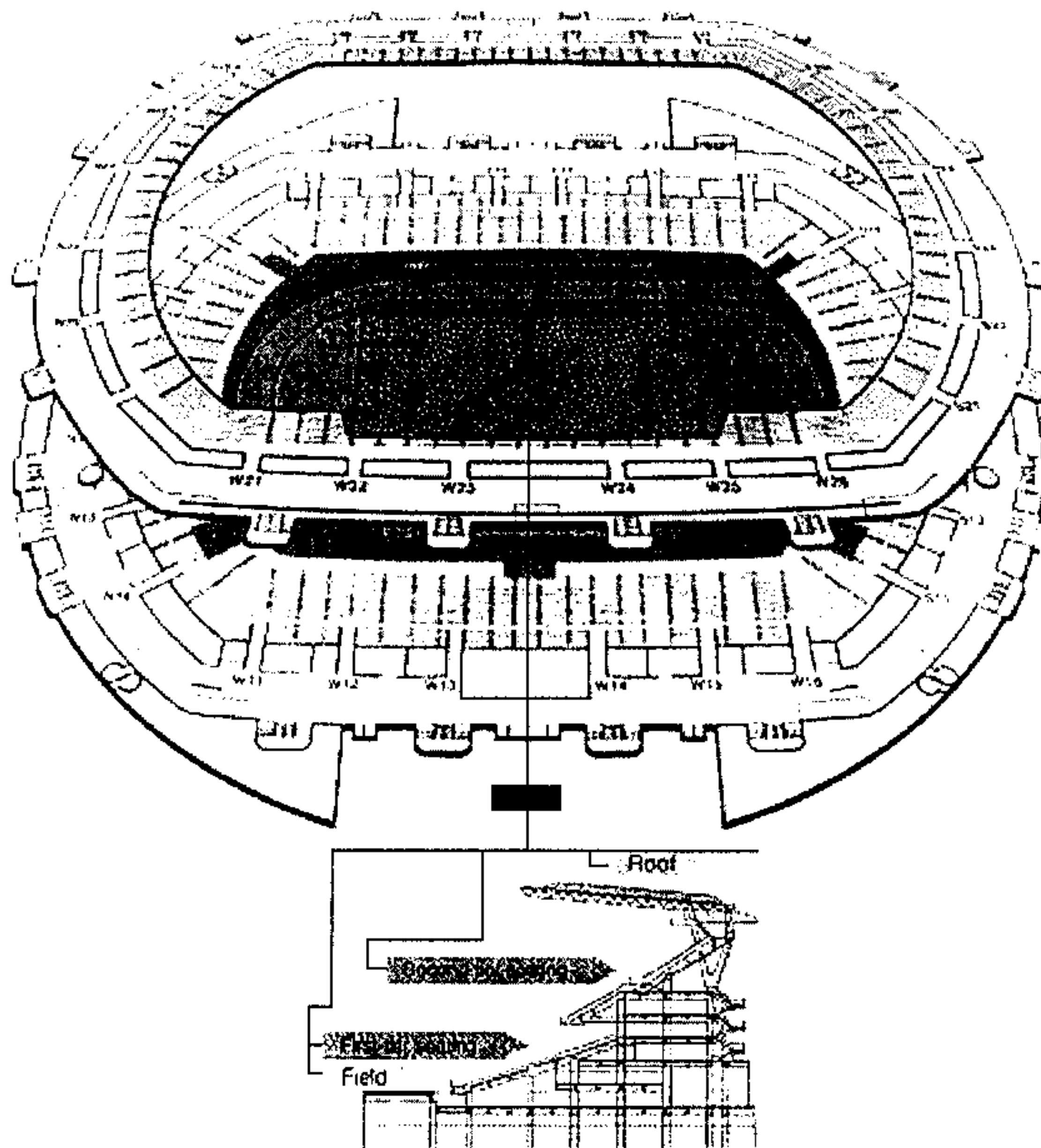






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Advanced, Comprehensive Facilities — Ideal  
for Athletes, Officials, Spectators and Press.



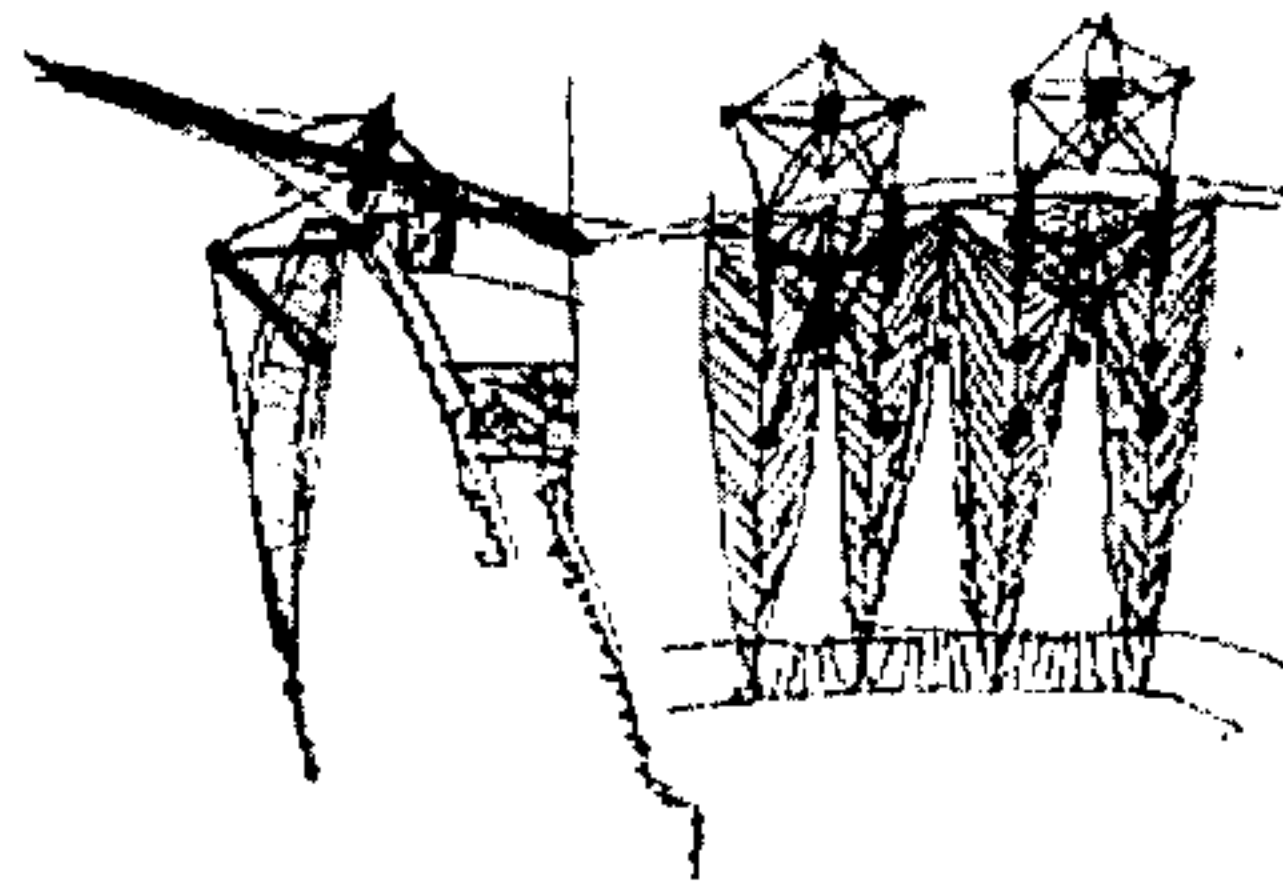
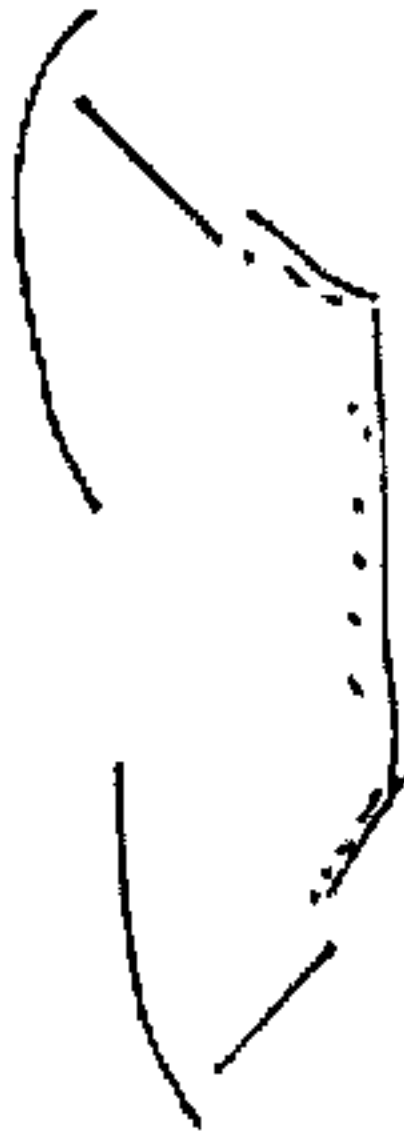
With its modernistic design, practical amenities, advanced technologies and open, inviting atmosphere, this is truly a facility that sets new standards for large-scale athletic stadiums.

**70,000 seats, each with an excellent view.**

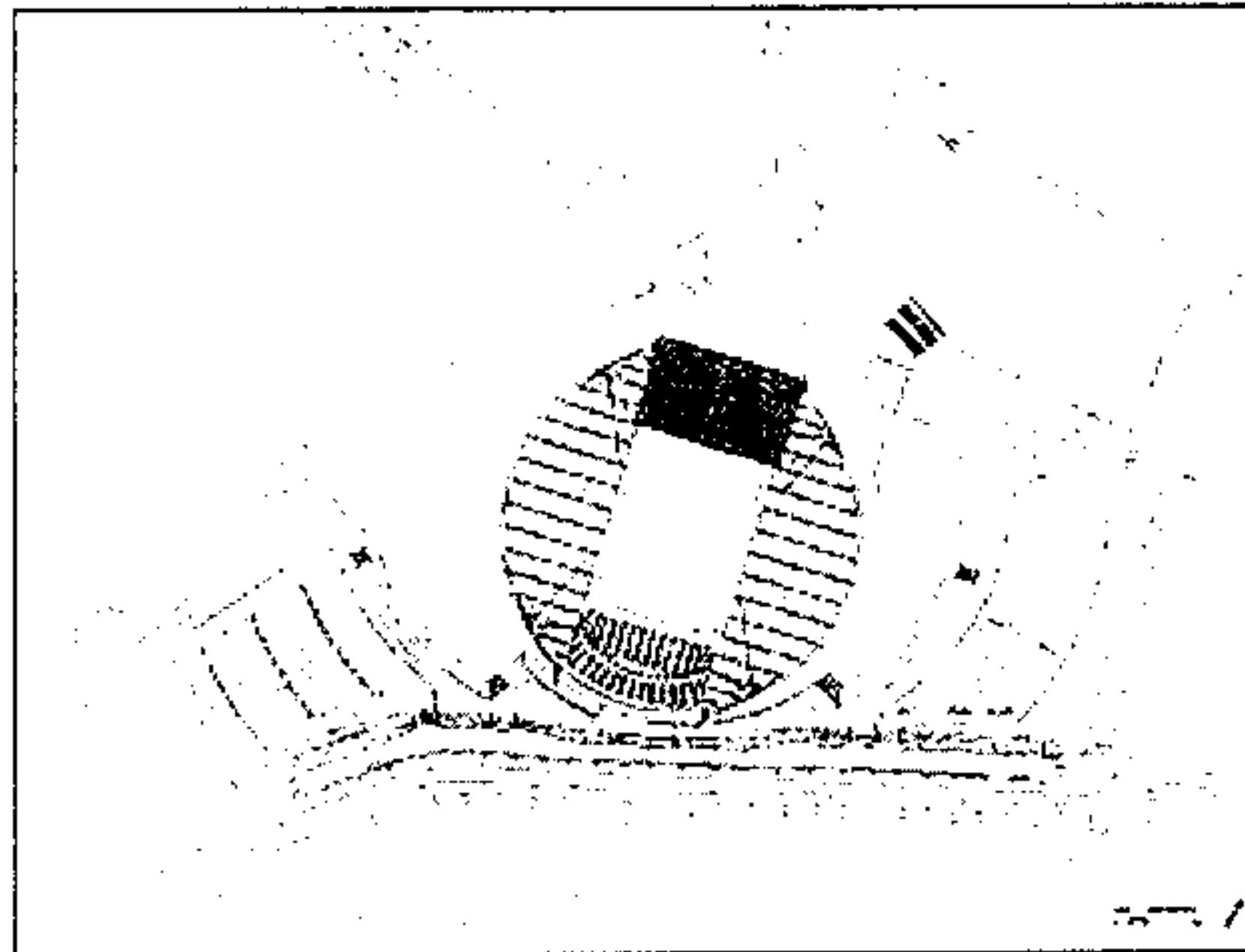
- The two-level grandstand provides a clear view from every seat, with no undesirable, far-away positions.
- Every seat has a comfortable backrest.
- A large roof covers three-fourths of the seats, offering protection from rain and bright sun.
- Giant screens (19 m x 9 m) are installed at both ends.
- Designed to be safe and convenient, with ramps and wheelchair spaces. Walkways from the nearest station are clearly marked.



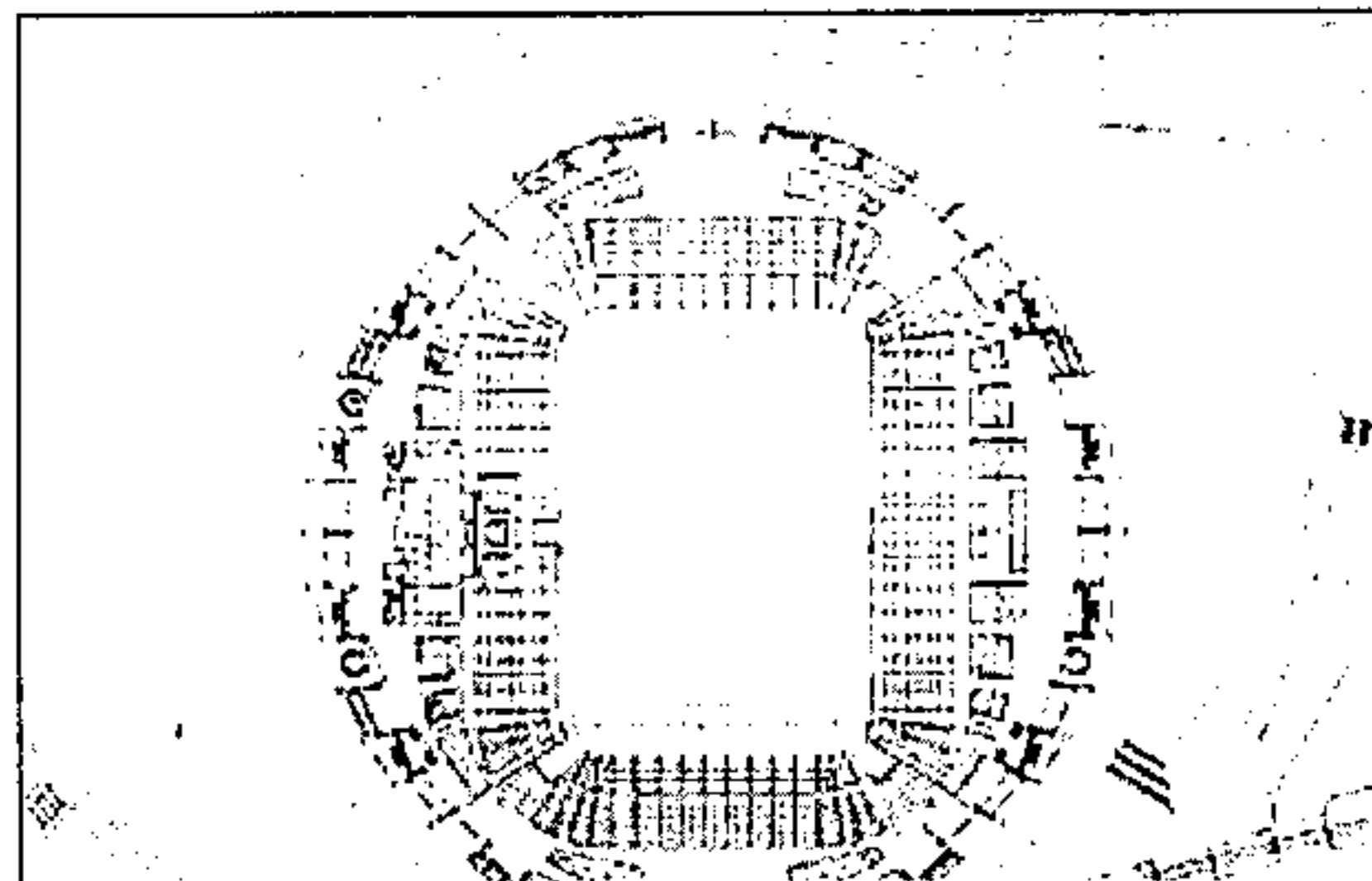
Sketch courtesy Kisho Kurokawa



Sketch courtesy Kisho Kurokawa

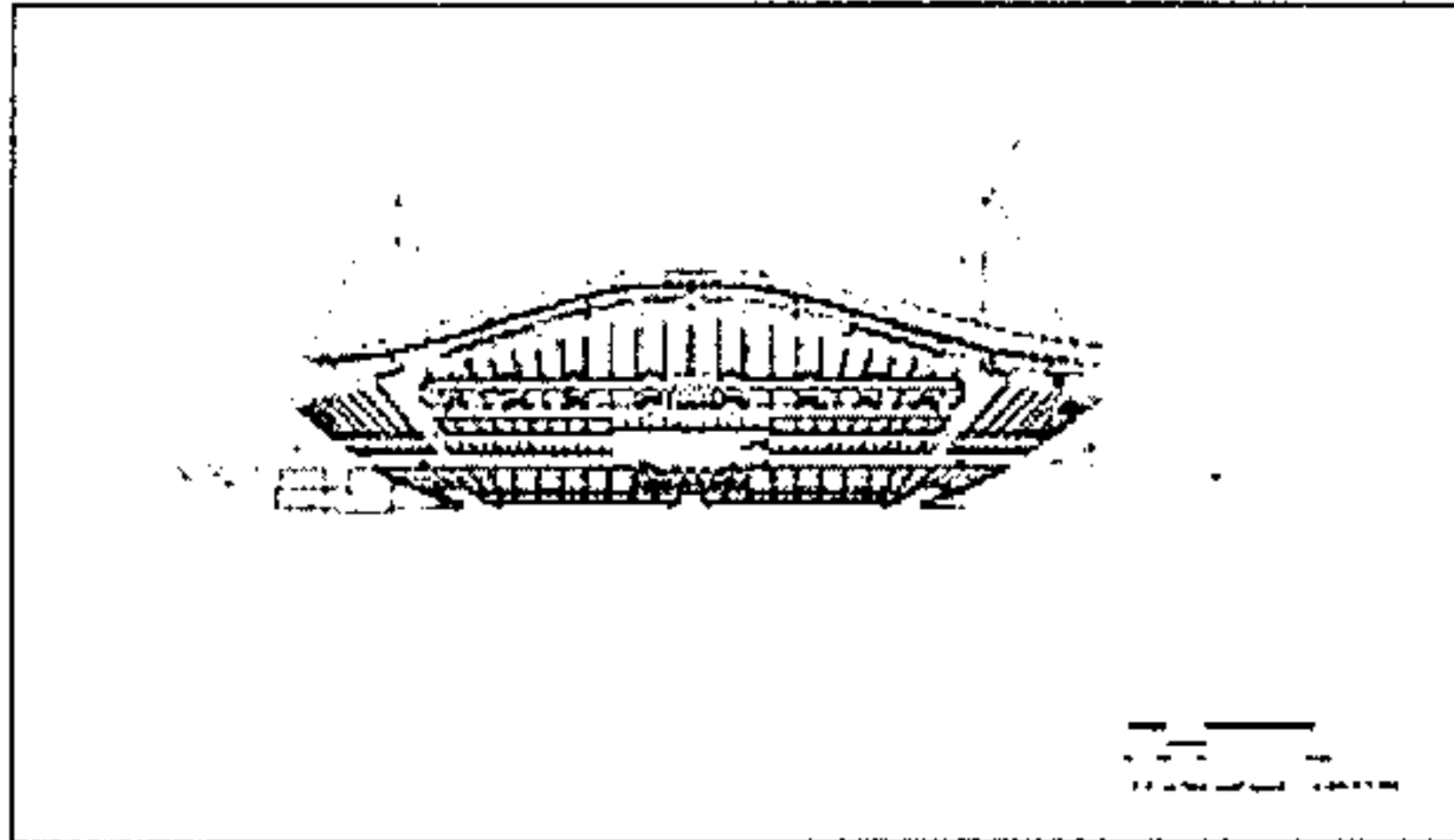


Drawing courtesy Kisho Kurokawa & Associates  
Site Plan  
Section

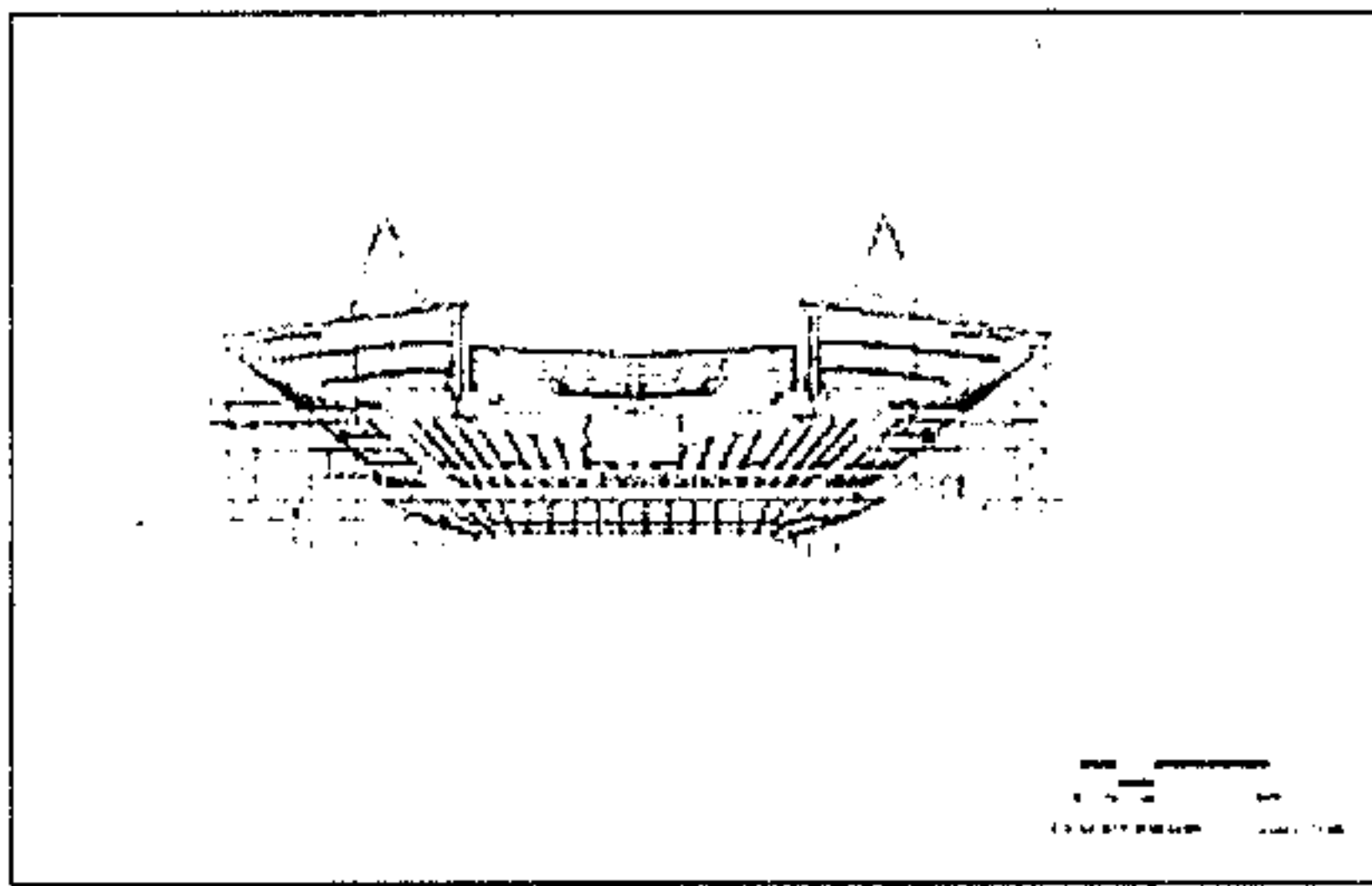




Drawing courtesy Kisho Kurokawa & Associates  
Plan



Drawing courtesy Kisho Kurokawa & Associates  
Section



Drawing courtesy Kisho Kurokawa & Associates  
Section

Client: Kohei Suzuki, Mayor of Toyota  
Design: Kisho Kurokawa architect & Associates  
Structural Engineering: Ove Arup & Partners Japan Limited  
Team:  
Ikuhide Shibata  
Mitsuhiro Kaneda  
Arata Oguri  
Ted Piepenbrock

Mechanical & Electrical Engineering:  
Team:  
Chris Carrol  
Andrew Allsop  
Zigi Lubkowski

Principle Use: Spectator Arena, Multi-function Hall  
SiteArea: 116,777.44 square feet  
Building Area: 40,734.29 square feet  
Total Floor Area 105,830.46 square feet  
Design Period: 1997 - 1998  
Constriction Period: 1998 - 2001

---

Kisho Kurokawa

February 11, 2002

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comments or questions? [kristenkiser@arcspace.com](mailto:kristenkiser@arcspace.com)

## THE WEBSITE FOR THE SPORTS VENUE INDUSTRY

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### ARENA AUF SCHALKE - SOCCER STADIUM, GERMANY

In August 2001 German Bundesliga soccer team, FC Schalke 04, played their first home match in the Auf Schalke Arena against Bayer Leverkusen. The stadium, in the middle of Gelsenkirchen, the heart of the Ruhr industrial district, is a multi-purpose arena with a long span steel frame roof structure, which includes a 6,000m<sup>2</sup> retractable area and a pitch that slides in and out of the bowl. The complex incorporates facilities such as hotels, offices, fitness centres and even television studios.

With a capacity of approx. 62,000 (54,000 for European and international matches), the stadium offers uninterrupted views of the pitch from all areas. In addition to 45,000 seats, the arena also has approx. 17,000 standing places that can be converted to seats for European games and internationals.

It has already played host to an international match, when home nation Germany played Finland in a World Cup qualifying game in October 2001.

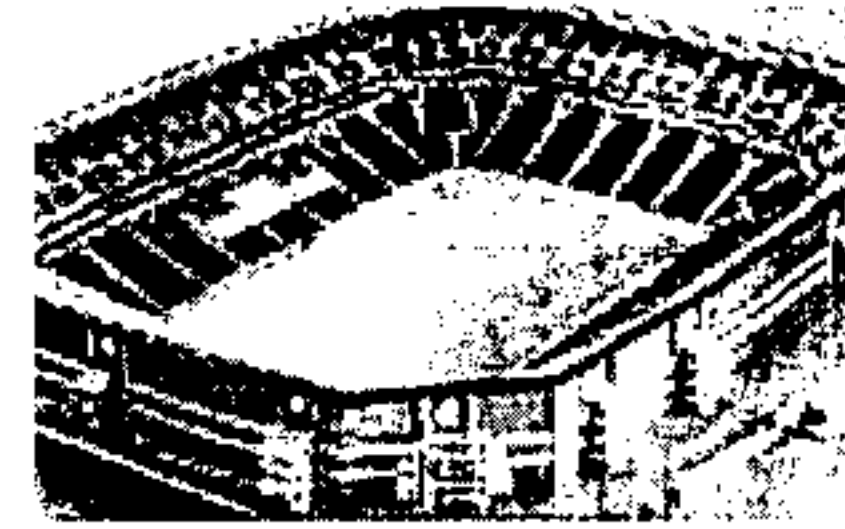
#### STADIUM BACKGROUND

At the beginning of the nineties it was generally accepted that Schalke 04's stadium, the Park Stadium, which was opened in 1973, no longer satisfied the requirements of a modern football stadium. It only had 22,000 covered seats, which had poor views of the pitch. As there were few options for conversion, the club began to start developing ideas for a new multipurpose arena. It was not until the upturn in the club's fortunes on the pitch in the mid-nineties that the Auf Schalke Arena project finally began to take shape and the first pile was hammered into the ground in November 1998.

#### "SCHALKE FIELD" LOCATION

The completion of the Arena Auf Schalke means that all of the Schalke teams, from the juniors through to the charity team, are able to train and play in the same area on the Berger Feld or "Schalke Field". The Arena forms the heart of the site in the north of Gelsenkirchen between the suburbs of Erle, Buer and Schalke.

Click To Expand



Architect's impression of the open stadium.

Click To Expand



Architect's impression of the stadium with the roof closed.

## STADIUM DESIGN

Stadium architect, HOK Sport, moved away from the conventional stadium for Schalke 04 in order to incorporate the possibilities of the digital revolution. Whereas in conventional stadiums the live audience was the main concern, nowadays the audience at home, whether watching via TV or, in the near future, on the internet is also a major consideration.

The main feature of the stadium is the moveable pitch. To accommodate the removal of it a tunnel was built into the south stand. The stand rests on two steel bridges. When separated from this bridge structure, the lower tier of the South Stand can also be pushed underneath the upper tier by a distance of about 16m. The space gained can also provide an optimum position for a stage that can be seen from almost every point of the arena.

## ARENA CONSTRUCTION

Dutch construction company, HBG was contracted to build the 358 million mark privately financed multipurpose arena.

The arena is built on tailings and a mining waste product, made up of predominantly shale with a granulation up to 150mm. Over a six-month period in 1999 some 10,000 to 12,000t of waste was tipped onto the site each day. 1.2 million tons of wash mountain material was used. Owing to the high water table and the poor quality of the ground (marl), a mound some 10m high had to be created to form a foundation for the arena.

A special logistics system was developed to organise the supply of tailings from five local collieries: Prosper Haniel (Bottrop), Blumenthal/Haard (Recklinghausen), Westerholt (Gelsenkirchen), Fürst Leopold (Dorsten) and Auguste Victoria (Marl).

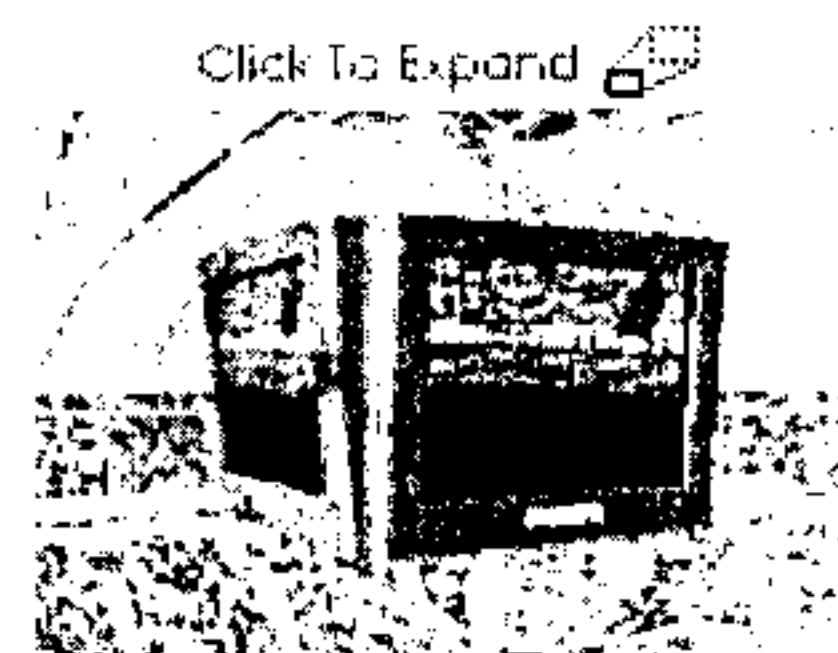
## FAN WALL

Schalke fans were asked to come up with a name for the new fan wall on which the names of everyone who signs a contract to 'purchase' a brick is recorded for posterity.

The jury, made up of the club's Managing Board, opted for the name: "1,000 Freunde – die Fan-Mauer" [1,000 friends – the fan wall].

## ARENA ROOF

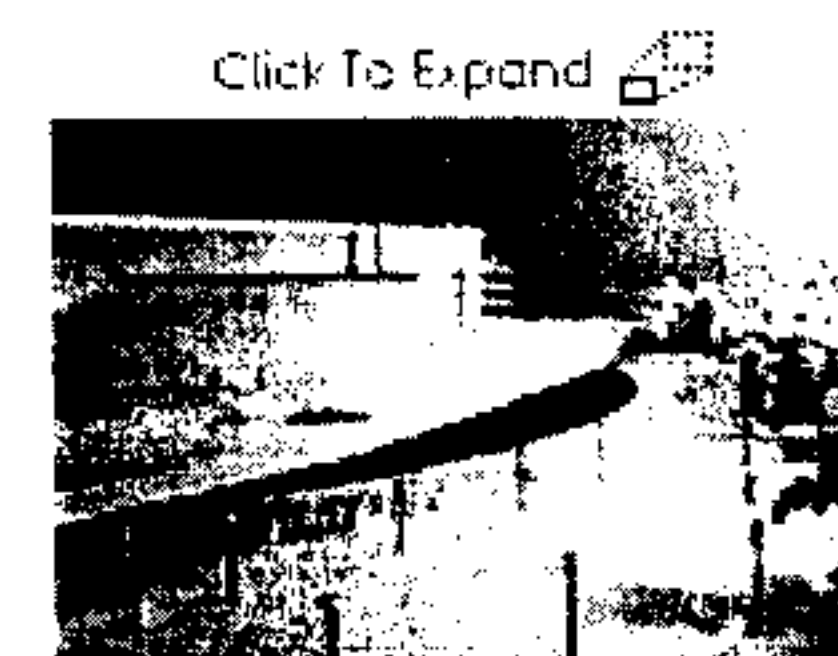
Arena Auf Schalke features a sliding roof weighing 560t that can be opened or closed within 30mins. Regardless of whether the roof is open or closed, the spectators are all under cover. Translucent, Teflon-coated fibreglass fabric is stretched over the steel roof structure, which maintains a light and airy feel to the stadium when it is closed.



The 32t video cube.



The stadium during construction.



Architects model of "1,000 Freunde – die Fan-Mauer", 1,000 friends – the fan wall.

The American company, Birdair built the roof along with Bailey Techno Group. A further eye-catching feature is the rigid steel structure that supports the roof. Weighing 3,470t, it holds the stadium lighting, the floodlights, the loud speakers and the scoreboard.

The outer roof sections were installed in a clockwise direction, and then the gap over the playing area was closed. The sliding roof sections were installed last. The entire process took eight months.

### MOVEABLE PITCH

The new playing area measures 105 x 68m, the same as in the previous home ground, Parkstadion. The moveable pitch in the "Arena Auf Schalke" is situated in a reinforced concrete trough that is slid inside the stadium via the south stands only when a soccer game is being played. This offers several advantages. During the week the pitch is stored outside the arena and thus exposed to the weather, allowing it to recover from its usage.

Although the pitch would also be exposed to the elements through the open roof of the arena, problems that were experienced at similar stadia such as in Dortmund or Amsterdam meant that the preference was to make the pitch mobile.

The pitch can be taken out of the stadium in six hours. Supported by Teflon-coated sliding shoes, the concrete tray is moved along steel rails and out of the stadium through an opening in the South Stand.


The concrete tray (118 x 79m) containing the pitch is about 1m high and weighs 11,000t. It is filled with a layer of sand into which the under-soil heating is installed. Then comes a layer of topsoil for the turf. The tray itself is attached to 60cm high sliding shoes.

### PUBLIC INFORMATION SYSTEMS

The Arena Auf Schalke features the biggest video cube in Europe and is the first to be installed in a football stadium anywhere in the world. The 32t structure is suspended from the arena roof immediately above the centre spot. The unique scoreboard is made by Philips, an official partner to the Arena Auf Schalke.

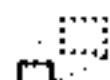
Giant 'Alfresco' video screens from Philips form the core of the multimedia network in the arena. Flexible LED modules permit the creation of screens of all shapes and sizes. There are four giant 'Alfresco' video screens, each measuring approximately 36m<sup>2</sup> that form the cube.

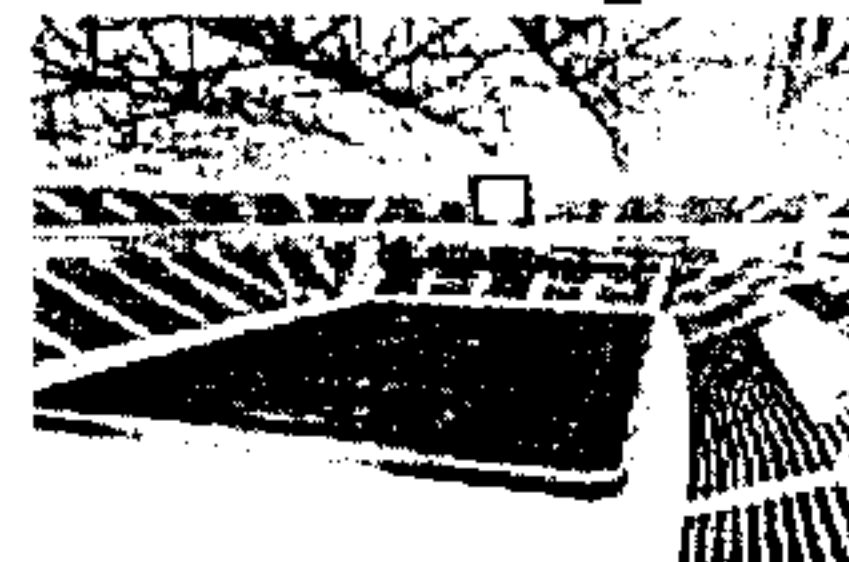
The videwalls offer spectators three-dimensional images boasting superb picture quality and high luminosity. High-resolution screens render fine

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**A map of the overall Schalke 04 sporting complex.**

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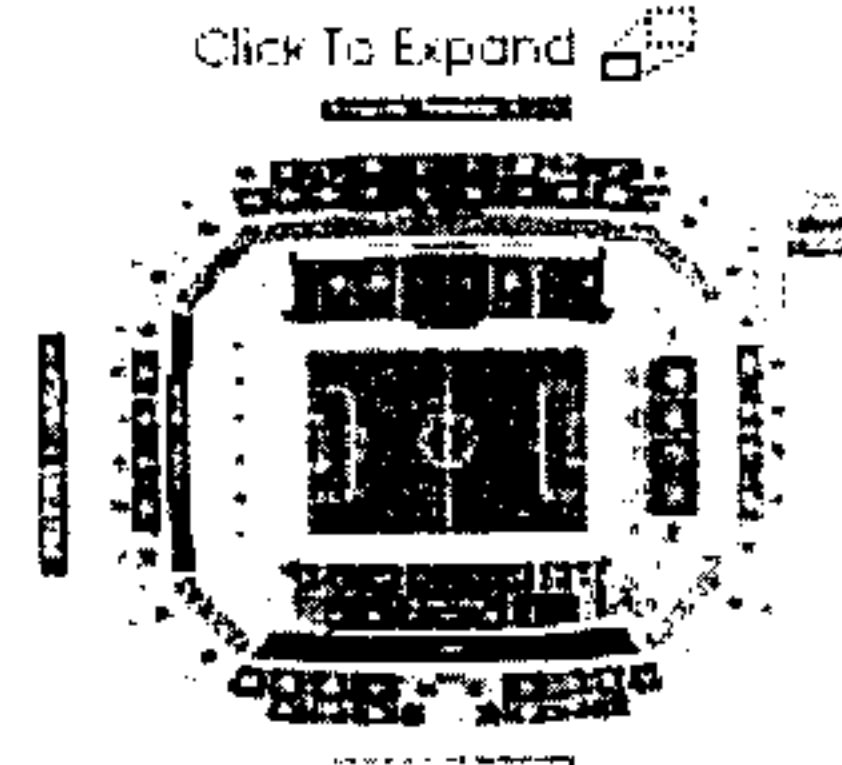


**Artist's impression of the stadium's pitch with the roof closed.**



details, such as lines and text clearly discernible, even at short distances.

As the 'preferred supplier' of television and video broadcasting technology for the Arena Auf Schalke, Philips also supplied a further 500 television monitors throughout the stadium as well as working with Schalke on the content of the club's stadium TV offering, producing the jointly produced entertainment programme -- Philips Event TV.



Seating plan of the stadium.

**TURF**


Although natural grass is used on the Schalke Arena's pitch, AstroPlay has been installed on two training pitches next to the Arena Auf Schalke.

**FINANCE**

The financing of the "Arena Auf Schalke" is unique in Germany mainly because it is the first sports arena to be financed entirely by the private sector.

The company that will own the stadium, FC Schalke 04-Stadion-Beteiligungsgesellschaft mbH & Co. Immobilienverwaltungs-KG, had to put up more than DM20 million for the site. A further DM35 million was invested in the arena infrastructure.

The total investment cost of DM358 million was made up of the company's own money and borrowed funds. The contract was agreed on a fixed price basis with HBG, the main contractor.

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**SPECIFICATION**

SRI Sports - AstroTurf® and AstroPlay® Sports Playing Surfaces (Surfaces Turf and Synthetic)

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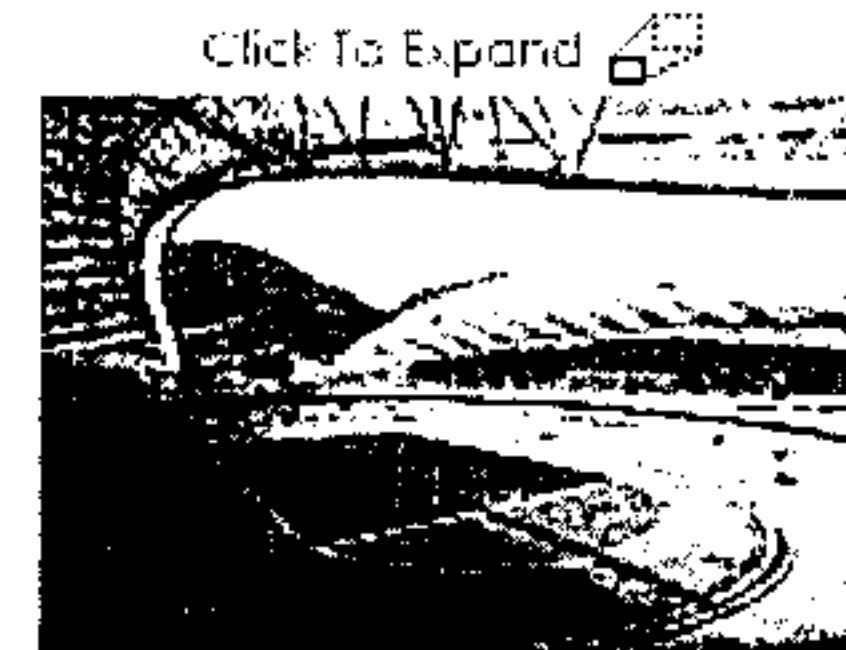
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## **DAEGU SOCCER STADIUM, SOUTH KOREA**

On 20 May 2001, the 70,100-capacity Daegu soccer World Cup Stadium was officially opened. The new stadium was dedicated in a nationally televised ceremony, which was followed by a friendly match between Brazil's Santos FC and South Korea's Songnam Ilhwa Chunma. Santos won 2-1. Almost 70,000 tickets for the soccer match were distributed free of charge throughout the country.



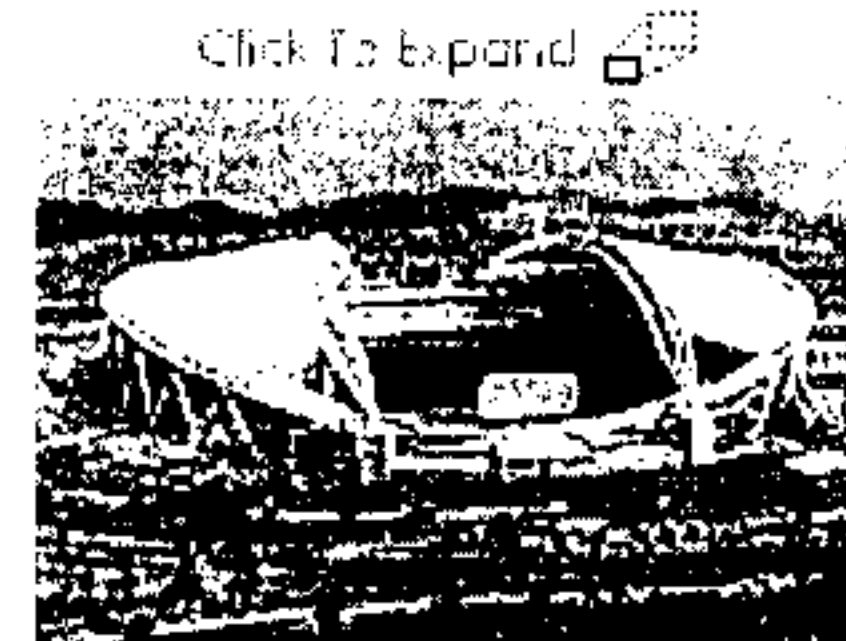
**The athletics and soccer pitch of Daegu World Cup Stadium.**

### **STADIUM LOCATION**

The city of Daegu is located 181 miles south-east of Seoul and 50 miles inland from the east coast. Located 8km east of downtown Daegu, the stadium is inside Daegu Grand Park at Daeheungdong Suseong-gu.

### **DESIGN**

The design of the Daegu World Cup Stadium by architects from British-based engineering company, Atkins, incorporates a high level of symbolism. The stadium's roof, for example, encompasses the shape of a winged eagle and the earth, which represents the embracing of all people in the world. Its side elevation replicates the shape of the nearby Mt. Daeduk as well as the roof of a Korean traditional house.



**The Daegu World Cup Stadium.**

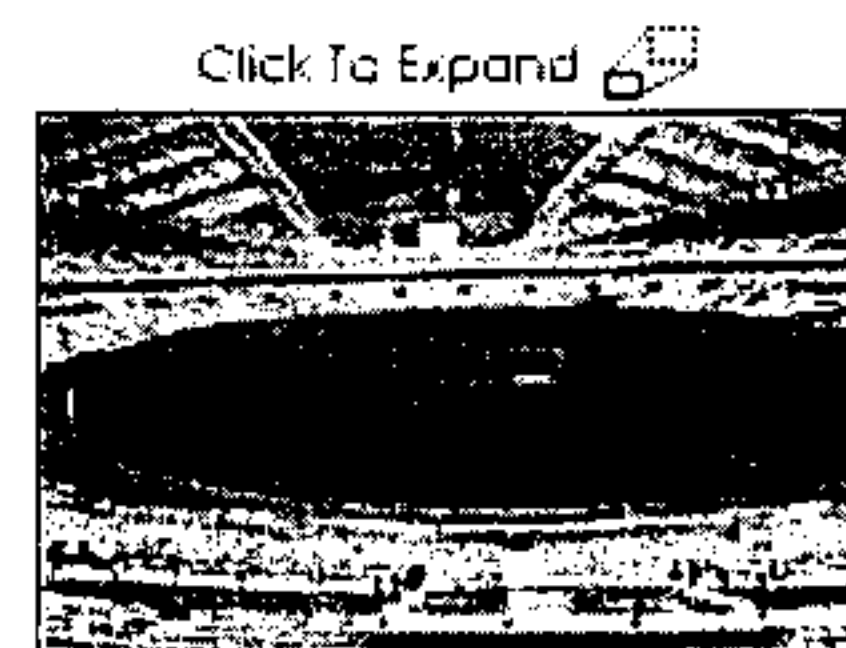
As well as the internal athletics track and soccer pitch, the external outer wall of the stadium can also be used for sporting activities, including artificial rock climbing and bungee jumping. Around the stadium there are restaurants and conference centres, open-air theatres and even an outdoor wedding site situated in the massive complex.

On the west side of the site, facilities for visitors include a western plaza, a World Cup park and an outdoor stage. A temporary World Cup exhibit and recreation structure was built with a 21m high sculpture in front of it.

A Teflon coated roof membrane allows natural light to permeate to the pitch, but protects spectators, covering 75% of the seats.

### **STADIUM CONSTRUCTION**

The Daegu World Cup Stadium has the largest seating capacity in Korea. It was completed in May 2001 at a total cost of \$228 million. Main contractor, Samsung Corporation, began construction work in



**The Daegu World Cup Stadium as it will look for soccer games.**

July 1997, with the aim being to have the stadium ready for the 2001 Summer Universiade. Problems arose in December 1997, when the country was hit by an economic crisis and the building work was delayed. It was, however, completed by May 2001, in time to host the opening game of the Confederations Cup between South Korea and France on 30 May 2001.

There are two giant video screens, an athletics track, three storeys underground and sound equipment that includes 681 speakers and 25A.

Atkins' Geotechnics and Foundations Division undertook the design of four hollow, reinforced concrete towers supporting the 280m-span, hollow steel roof.

The stadium is built so that in a state of emergency the 70,100 spectators can be evacuated in 6mins 40s.

## ROOF

The roof of the stadium, designed by British-based consulting engineers, Atkins, comprises 24 individual PTFE Fabric panels, which are supported on six-tied arch Purlin. These purlins span up to 21m and are designed to rotate to equalise loads during the installation of the fabric.

The Secondary Trusses that span between the front and rear arches vary in span and depth from a maximum of 66m and 41m depth to a minimum length of 25m and 1.5m depth. They are triangular in section with the top boom comprising four rectangular hollow sections connected by a solid plate and a single tubular bottom boom.

The two Primary Arches work in very different ways. The front arch has a clear span of 273m with a maximum rise of 28.7m and is inclined to the vertical by approx. 30°. Horizontal forces developed (due to this inclination) are transferred along the Secondary Trusses and resisted by the rear arch acting in Tension.

The rear arch is 4m<sup>2</sup> in section and in contrast to the front arch is supported along its length by a series of diagonally raking columns.

The cantilever towers that support the front and rear arches are subjected to a horizontal thrust of 3,200t and the total weight for both sides is 4,350t.

## TURF

During March 2001, the 109x72m pitch was planted with its natural turf. Research to ascertain the best mixture of Rye Grass seed was carried out on a 990ft<sup>2</sup> site at Yonsei University.

## OTHER FACILITIES

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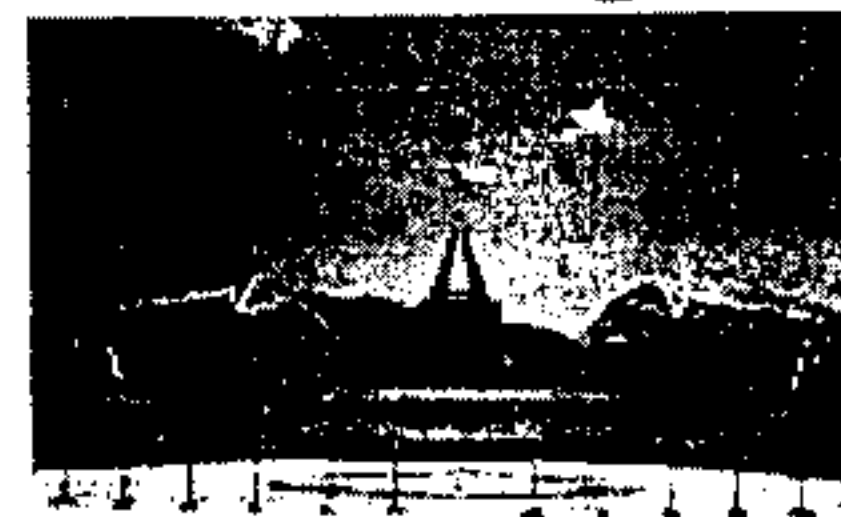
The symbolic roof of the Daegu World Cup stadium encompasses the shape of a winged eagle and the earth.

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The Daegu stadium from the east.

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The north façade of the Daegu World Cup Stadium.

The stadium complex provides a vast array of sporting facilities including a shooting range, archery range, racquetball court, aerobics class, fitness club, squash court, roller-skating ring, rock climbing area, small ice-skating ring, tennis court, basketball court, volleyball court, foot volleyball court and badminton court.

Specialised restaurants, public restaurants, souvenir shops, coffee shops and a shopping mall have also been incorporated.

### 2003 SUMMER UNIVERSIAD

Daegu World Cup Stadium will be the main venue for the 2003 Summer Universiad Daegu in August to September, which will draw 11,000 visitors (6,000 athletes, 4,000 officials and 1,000 journalists) from 170 countries.

### GRAND DAEGU PARK

The stadium is part of the Grand Daegu Park development project and is expected to become one of the major leisure attractions of the city. In accordance with the city's environmental impact report, 204,000 trees of 56 different species, including pines and zelkovas, have been planted around the stadium to form a natural park.


Noting the fact that the ambient environment is closely related to athletic performance, Daegu aims to highlight the city's image as a "Green Forest City" during the World Cup. In 1996, the city initiated a five-year management plan to achieve specific environmental outcomes. Activities included tearing down walls, building parks, strengthening air and water quality monitoring and enhancing public bathrooms. The city also decided to restructure the city landscape and emphasize environment-friendly management throughout the games.

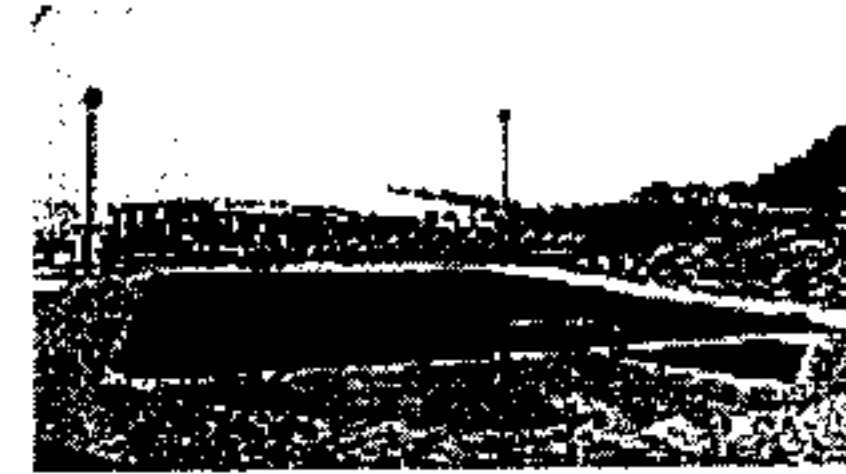
### 2002 FIFA WORLD CUP KOREA/JAPAN™

The XVII FIFA Soccer World Cup took place from 31 May to 30 June 2002 in 20 stadiums throughout Korea and Japan, the majority of which were built specifically for the competition. It was the first time that the soccer tournament had been held in Asia. Started in 1930, the World Cup is seen around the globe as the top prize in soccer.


The responsibility for staging the tournament rested with KOWOC and JAWOC, the Korea and Japan Local Organising Committees set up according to FIFA guidelines specifically for the 2002 FIFA World Cup Korea/Japan™.

As well as being the first World Cup in Asia, it was also the first co-hosting in the history of the World Cup Soccer Games.

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**One of the purpose-built practise pitches outside the Daegu Stadium.**

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**The stadium infield at night.**

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**The stadium at night with Mt Daeduk in the background.**

## DAEJU WORLD CUP STADIUM MATCHES

During the 2002 FIFA World Cup Korea/Japan™ the Daeju Stadium hosted three first round matches, as well as the third place play off between between hosts, Korea Republic and Turkey.

These were:

- June 6: Denmark 1:1 Senegal
- June 8: South Africa 1:0 Slovenia
- June 10: Korea Republic 1:1 USA
- June 29: Third-place match - Korea Republic 2:3 Turkey

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## SPECIFICATION

Philips Lighting - Sports Lighting (Lighting)

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### DAEJEON STADIUM, SOUTH KOREA

Opened on 13 September 2001, the Daejeon World Cup Stadium is a football-only arena, featuring a partially retractable roof, the first of its kind to be constructed in Korea.

#### STADIUM LOCATION

Situated in central Korea, Daejeon is a transportation hub, sitting at the intersection of the Kyungbu and Honam railways and expressways.

The stadium itself is situated 5km northwest of downtown Daejeon at 270, Noundong Yuseong. Daejeon is considered South Korea's second city, with most of the government offices located there.

#### DESIGN

The brief for architects HB Choi/Ubo Engineering Co. was to design the stadium in the form of a traditional Korean house complete with thatched roof. The resultant theme running throughout the stadium is based on an inner court within a Korean traditional house, providing a simple and elegant structural dynamic.

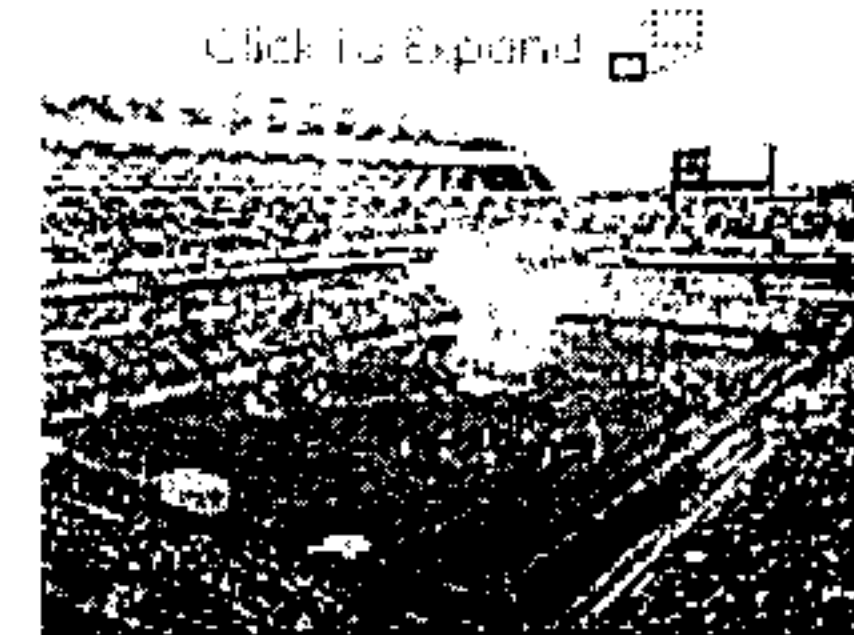
The almost spaceship-shaped stadium with its traditional checked-patterned façade features a retractable roof, which ties in well with the high-tech and scientific image of the city. The roof covers the majority of the spectators when it rains. A sound absorption layer has been installed just underneath the roof to ensure the best sound quality.

The stadium, built over six levels, offers commercial, cultural and leisure facilities, including the sports shop, shopping mall, youth hostel, swimming pool, indoor golf clubs, fitness centre and the performance hall, which are all open to the general public.

#### STADIUM CONSTRUCTION

The main contractor for the stadium project was a joint venture between Hyundai, Geyryong and Geumseong Cons. Co. Ltd. Construction on the stadium began in December 1998 and was completed in September 2001 at a total cost of \$128 million.

Daejeon World Cup Stadium is built one storey underground and five storeys above. Its roof is a semi-closed cantilever structure, which provides the



The opening ceremony of the Daejeon World Cup Stadium.



The infield of the Daejeon World Cup Stadium, said to reflect the inner court of a Korean traditional house.

pitch with natural sunlight.

When in its partially closed state, the roof covers 95% of the seats in the stadium. The stands are two-tiered with two large LED public information boards located at either end of the stadium.

## **PITCH**

The 125m x 88m field has been planted with a modified turf variety called Zenith.

## **DAEJEON CITIZEN**

The stadium is the home field of Daejeon Citizen of the Korean K-League.

## **WORLD CUP PREPARATIONS**

The city improved its road signs and streets to make it easier for international visitors to find their way around the city during the soccer tournament.

Nearly 400 households had offered to make home-stay arrangements for guests who wanted to have a first-hand experience of life in Korea, and up to 20,000 volunteers provided help to foreigners who visited the games in Daejeon.

## **POST WORLD CUP**

The Daejeon World Cup Stadium now serves as a multipurpose sports complex equipped with commercial and cultural facilities.


The basement level combines a number of activities including a golf practice range, an internet cafe, table-tennis court and a discount store.

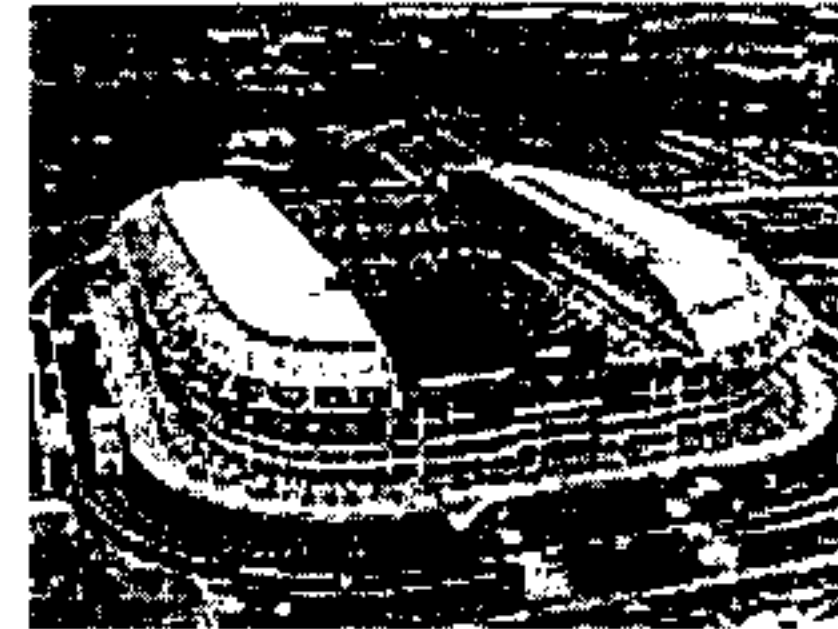
The first and most accessible level includes stores, restaurants, aerobics and weight training area plus squash courts, a swimming pool, a sports equipment store and a gymnasium for children.

The third and fourth levels accommodate a youth hostel, with the third floor also incorporating a nightclub.


The surrounding outdoor area now incorporates an open stage, another golf practice range, a hockey field, snack stands and a souvenir shop.

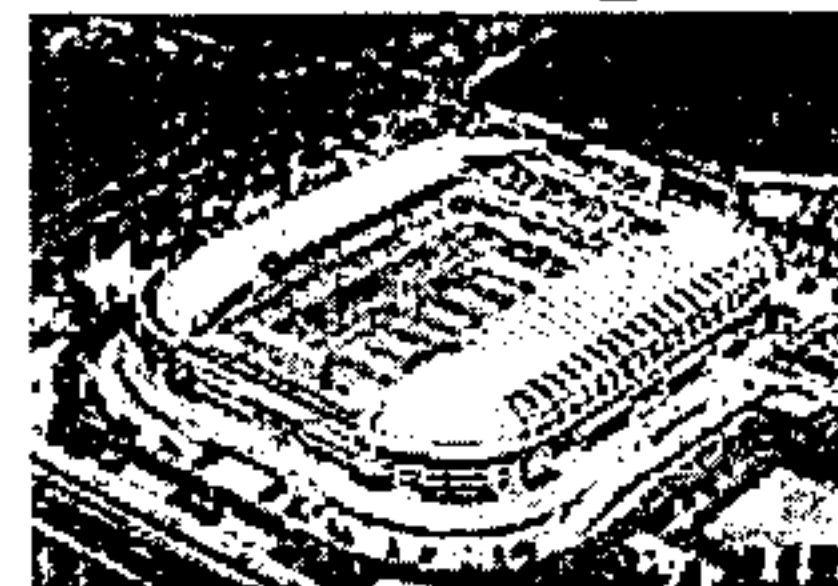
## **2002 FIFA WORLD CUP KOREA/JAPAN™**

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**The 'Thatched' roof of the Daejeon World Cup Stadium.**

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**Aerial view of the Daejeon Stadium.**

The XVII FIFA Soccer World Cup was held from 31 May to 30 June 2002 in 20 stadiums throughout Korea and Japan, the majority of which had been built specifically for the competition. It was the first time that the soccer tournament had been held in Asia. Started in 1930, the World Cup is seen around the globe as the top prize in soccer.


The responsibility for staging the tournament rested with KOWOC and JAWOC, the Korea and Japan Local Organising Committees set up according to FIFA guidelines specifically for the 2002 FIFA World Cup Korea/Japan™.

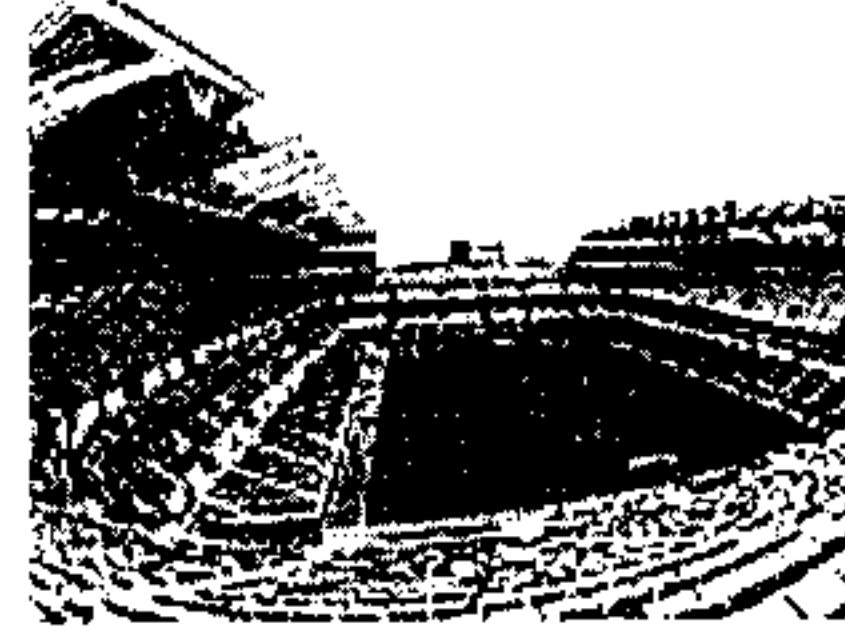
As well as being the first World Cup in Asia, it was also the first co-hosting in the history of the World Cup Soccer Games.

### DAEJEON WORLD CUP STADIUM MATCHES


During the 2002 FIFA World Cup Korea/Japan™ the Daejeon Stadium hosted two first round matches, as well one second round game. These were:

- 12 June 2002: South Africa 2:3 Spain
- 14 June 2002: Poland 3:1 U.S.A.
- 18 June 2002: Second round match - Korea Republic 2:1 Italy

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The roof in open mode.

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### GUANGDONG OLYMPIC STADIUM, CHINA

In November 2001, China's 9th National Games was the first sporting event to be held in the new Guangdong Olympic Stadium. Built with the 2008 Summer Olympics in mind, the new stadium, with its seating capacity of 80,000, is the centrepiece of a 10-million-square-foot (930,000m<sup>2</sup>) complex that includes a hotel and surrounding athletics facilities.

#### LOCATION

The stadium is located in the city of Guangzhou about 100 miles north of Hong Kong. Situated in Da Tong Lu on Ersha Island, the Guangdong Olympic Stadium, is about 5km east of the Guangzhou East Station.

#### DESIGN

Guangdong Olympic Stadium is a 80,012-seat facility located on a 30ha site, with a total building area of around 145,000m<sup>2</sup>. Facilities include a 260m x 200m oval-shaped stadium structure with standard track lanes, a soccer field, an arena and a series of practice gymnasiums.

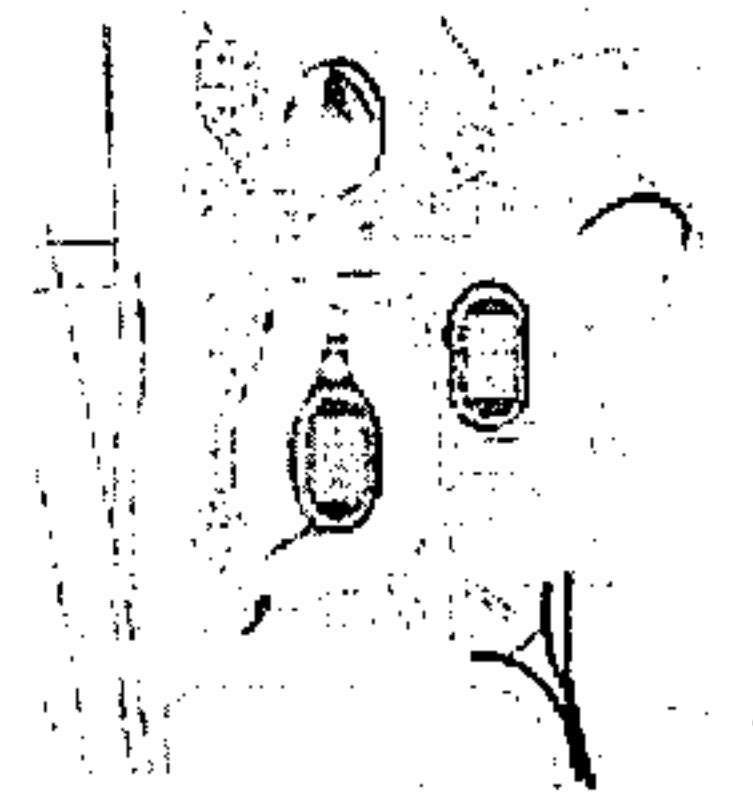
The NEB consortium won the competition to design the \$119 million Guangdong Olympic Stadium. The consortium comprised the Kansas City, Missouri office of Ellerbe Becket (design architect), Oklahoma City firm Nixon & Nixon, Inc. (project architect) and the Architectural Design and Research Institute of South China University of Technology (architect of record).

The stadium will not only play host to track-and-field events, it will also be used for soccer, concerts, and exhibitions.

As well as the sport-related facilities, the stadium has modern revenue-generating features such as a 108,000ft<sup>2</sup> (10,000m<sup>2</sup>) retail space, an athletic club, food and beverage service, a 100-room hotel, and 100 private suites.

The design of the stadium includes numerous

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Masterplan of the Olympic Stadium complex (courtesy of Ellerbe Becket).

symbols evoking the local culture and environment. The design goal was to create an icon that relates to the physical environment and history of the 2000-year-old city.

Guangzhou is known as the "Flower City," which explains the floral theme of the stadium. The architects moved the columns inward to give the stadium's seating bowl the appearance of growing outward from the ground to a sculpted upper edge - resembling the petals of a flower.

The Pearl River flows next to the site of the stadium and the route of the river has been the basis for the shape of the stadium roofline, which almost covers 100% of the seating areas. The roof parts at the ends and holds the Olympic flame, suspended between the two ribbons. A hotel surrounds a circular opening in the roof that forms a vertical tower of light.

### CONSTRUCTION

The main contractor for the stadium project was the Guangdong Construction Group. The construction period allowed for this project was 33 months and was phased over three stages.


The first 16 months was for general foundation works and the stadium structural works fabricated from reinforced concrete. It took another twelve months for the installation of the steel roof structure and related decking works. The remaining period was for final touch-ups, services installation and other external or ancillary works.

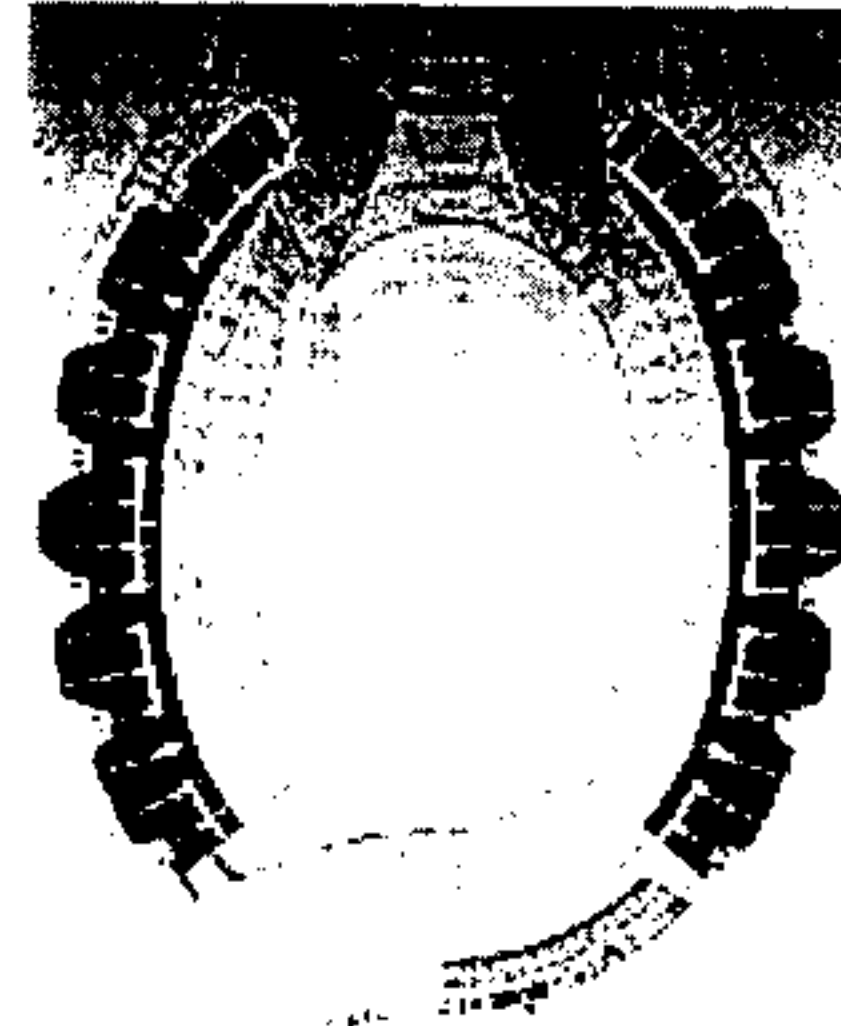
### ROOF

This roof has a covered area of about 32,000m<sup>2</sup> with a total weight of about 9,500t, including the main steel frame and the decking materials. The twin bands of cantilevered roof are each approximately 250ft (75m) long and 52ft (16m) wide. The roof is supported by 21 four-legged column towers, representing the entrance into the 21st Century. To form the main frame of the roof, a pair of cantilever steel truss frames were placed on top of each column tower. Each pair of trusses is further linked up to the adjacent trusses by secondary truss systems to form the 4m-deep roof frame.


The main trusses tilt slightly inward and cantilever above the field side for 52m and outward for 10m. At the outward tip, each pair of trusses is tied down by a pair of 300mm diameter cable stays attached to the lower part of the column tower. Each column tower measures 8m x 4m at the stand level and has a clearance of about 13m from the upper part of the stand to the underside of each cantilevered truss. The column towers are constructed of Grade 35 concrete.

The wave pattern of the roof is echoed in the bowl's seating colours, in the concourse floor tile, and even in the light fixtures outside the stadium.

Click To Expand 



**Design layout of Guangdong Stadium (courtesy of Ellerbe Becket).**

Click To Expand 



**Side elevation of China's 2008 Olympic Stadium (courtesy of**

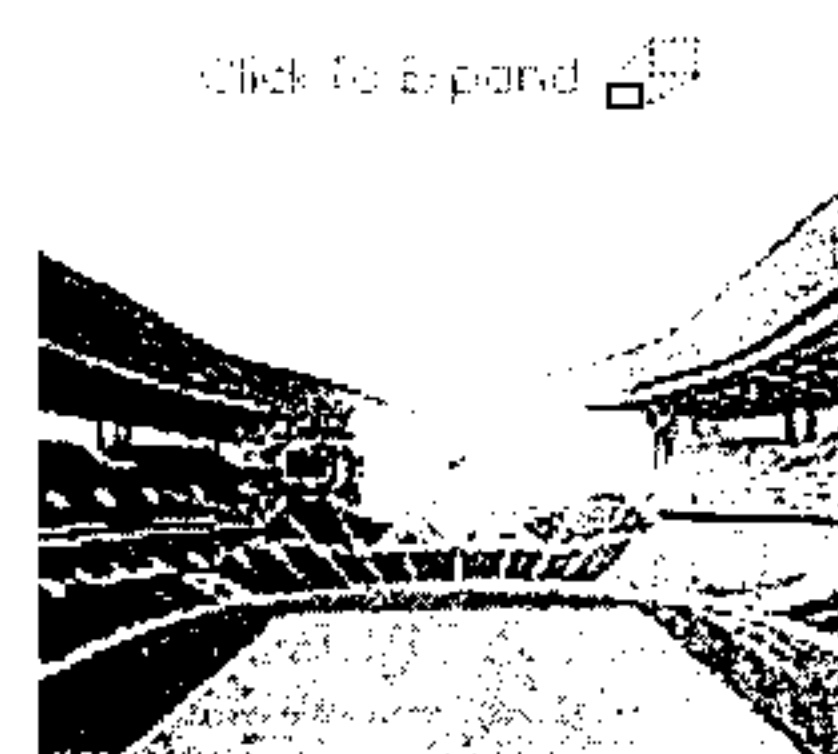
Ellerbe Becket).

Many of the detail elements were constructed by hand, such as the carving on individual floor tiles, made possible by low labour costs. The roof is all hand-welded connections.

Other main features of the stadium structure are the elegantly arched column clusters and rib beams that support the stands. There are altogether twelve sets of column clusters, most of which feature different clearances, shapes and sections. Very stringent quality and dimensional control was thus required during the design and casting process for these columns.

## DESIGN SOFTWARE

To ensure accuracy of the design and dimensional control, all structural elements in the project were surveyed and laid out using computer software such as AutoCAD. Ellerbe Becket used 3D Studio Max from Kinetix to draw two irregular curves shaped by three or more control points for the edges of each ribbon. By adjusting the control points, the architects could tweak the curves until their shape matched the original design concept. The designers then detailed the roof section, which consists of a steel space frame encased in metal cladding. Finally, they used the software to extrude this section along each ribbon's two constraining curves. The steel space frame maintains a constant thickness even as the top and bottom surfaces undulate.



The infield bowl of Guangdong Olympic Stadium.

These 3D architectural forms were passed electronically to Ellerbe Becket's in-house structural engineers. They converted the data into a software package, called Staad, in which they developed a structural analysis model to determine the integrity of the building, the thickness of the concrete pylons and the sizes of all the structural steel roof members. The engineers then exported their model to 2D structural drawings in AutoCAD from Autodesk. Two-dimensional views of the 3D architectural model were also exported to AutoCAD for plan, section, and elevation construction drawings, now under further development by the architects of record.

The 3D images were also useful to the contractor, who may use them with 2D shop drawings to communicate construction information in the field.


The Chinese government required that ground be broken after two months of schematic design, intensifying the need for speed and precision.

## ARCHITECTS

US-based architects Ellerbe Becket also designed the Centennial Olympic Stadium in Atlanta for the 1996 Summer Olympic Games, as well as the award-winning Saitama Super Arena in Japan.

Founded 30 years ago, Nixon & Nixon is headquartered in Oklahoma City and also has offices

in Hong Kong and Guangzhou. Nixon & Nixon is a full-service architecture and engineering firm.

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### SPECIFICATION

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In construction  
**Eduardo Souto de Moura**  
**Braga Stadium**  
Braga, Portugal

For Portugal winning the competition to host the UEFA 2004 international European soccer has meant the construction or remodelling of ten stadiums in different parts of the country.

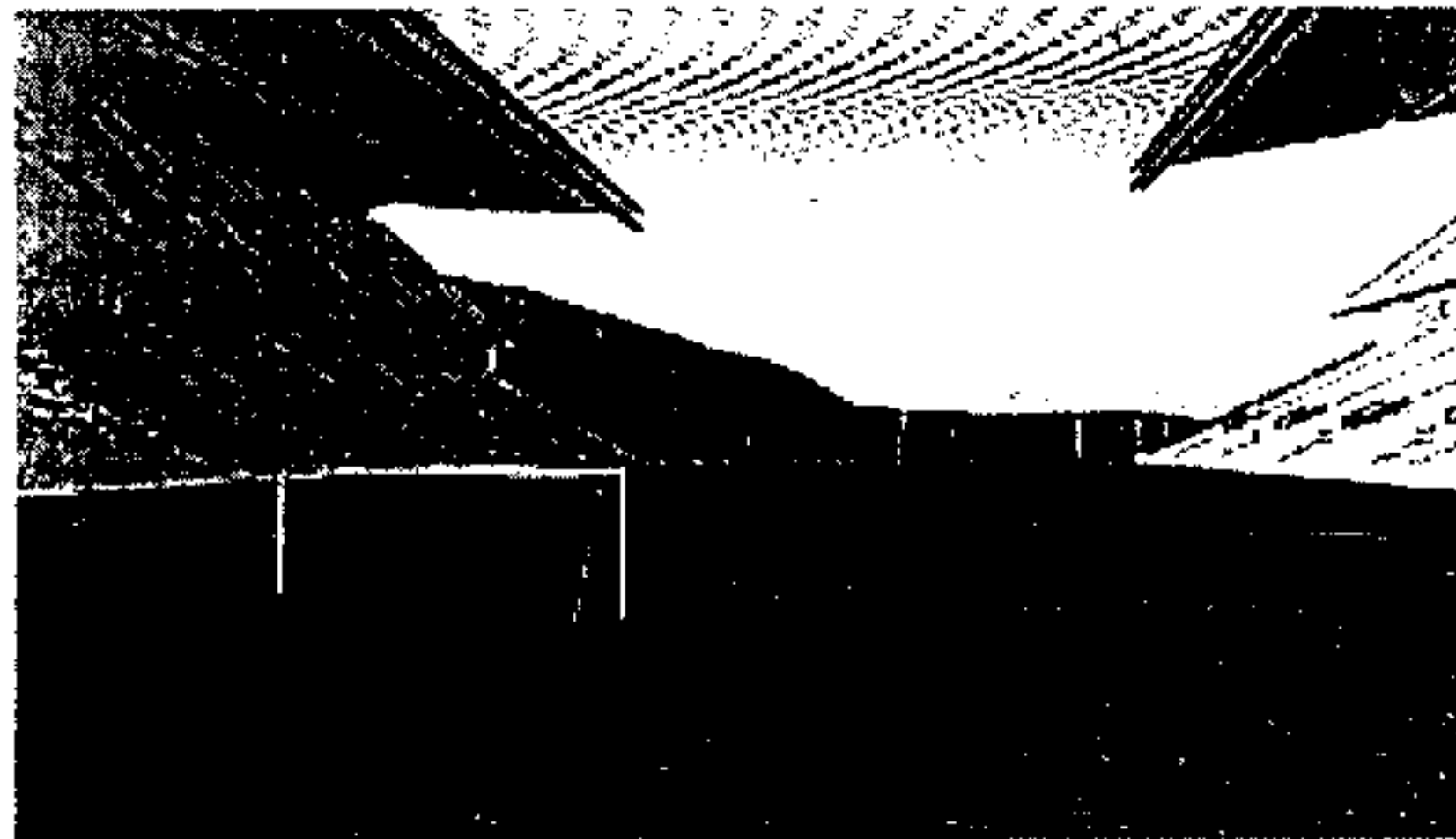
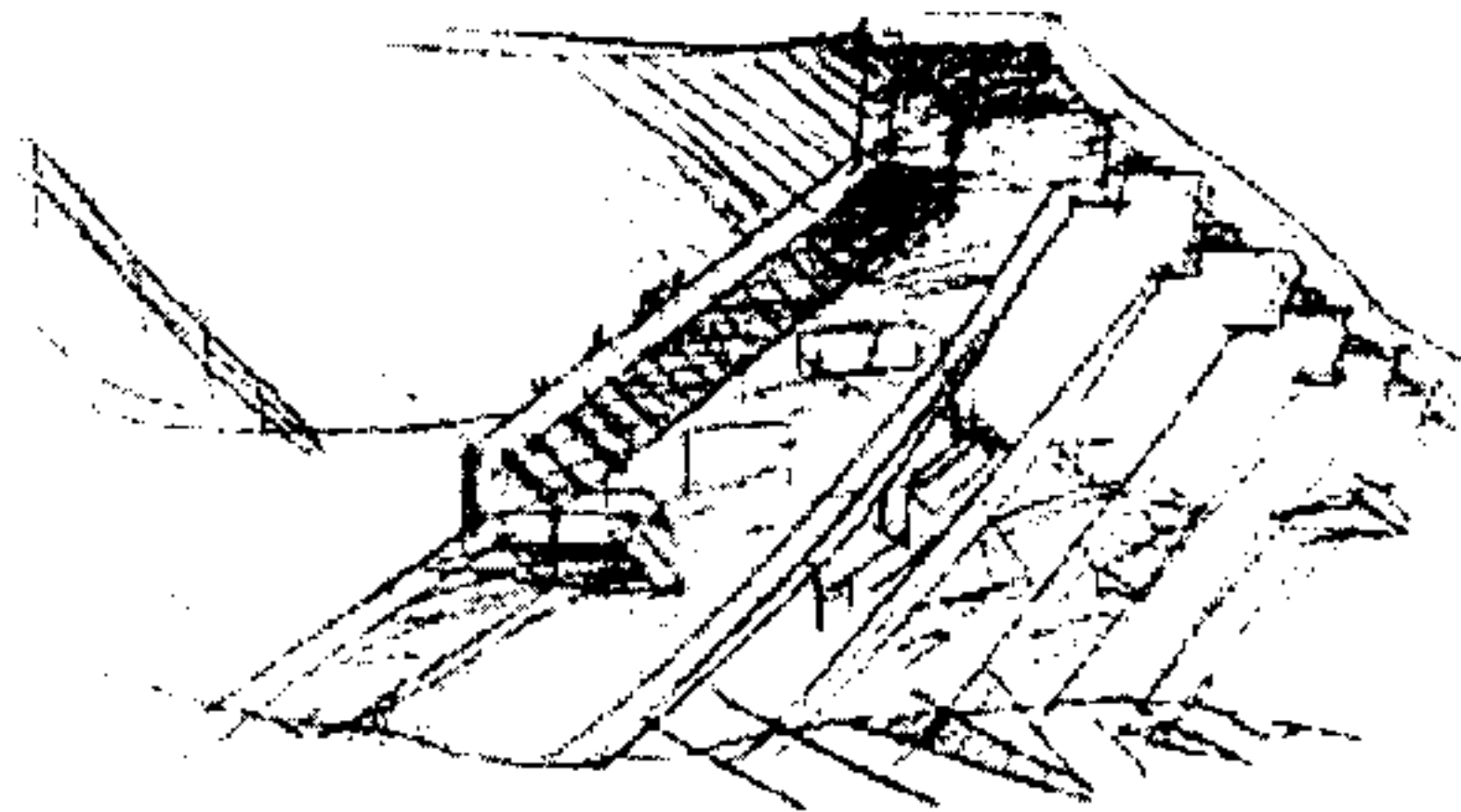


Image courtesy Eduardo Souto de Moura

The Braga Municipal Stadium is situated within the Dume Sports Park on the northern slope of Monte Castro. The location of the Stadium, in the sports zone specified in the Municipal Master Plan, will serve as an anchor point for any future development in the area as the city expands northwards. The location was chosen in order to avoid building a dam along the water's edge in the valley.

The brief called for covered seating sections for 30,000 on either side of the football field.



Sketch courtesy Eduardo Souto de Moura





Image courtesy Eduardo Souto de Moura

The design for the 40 meter tall Stadium consists of two squares with the same degree of sloping.

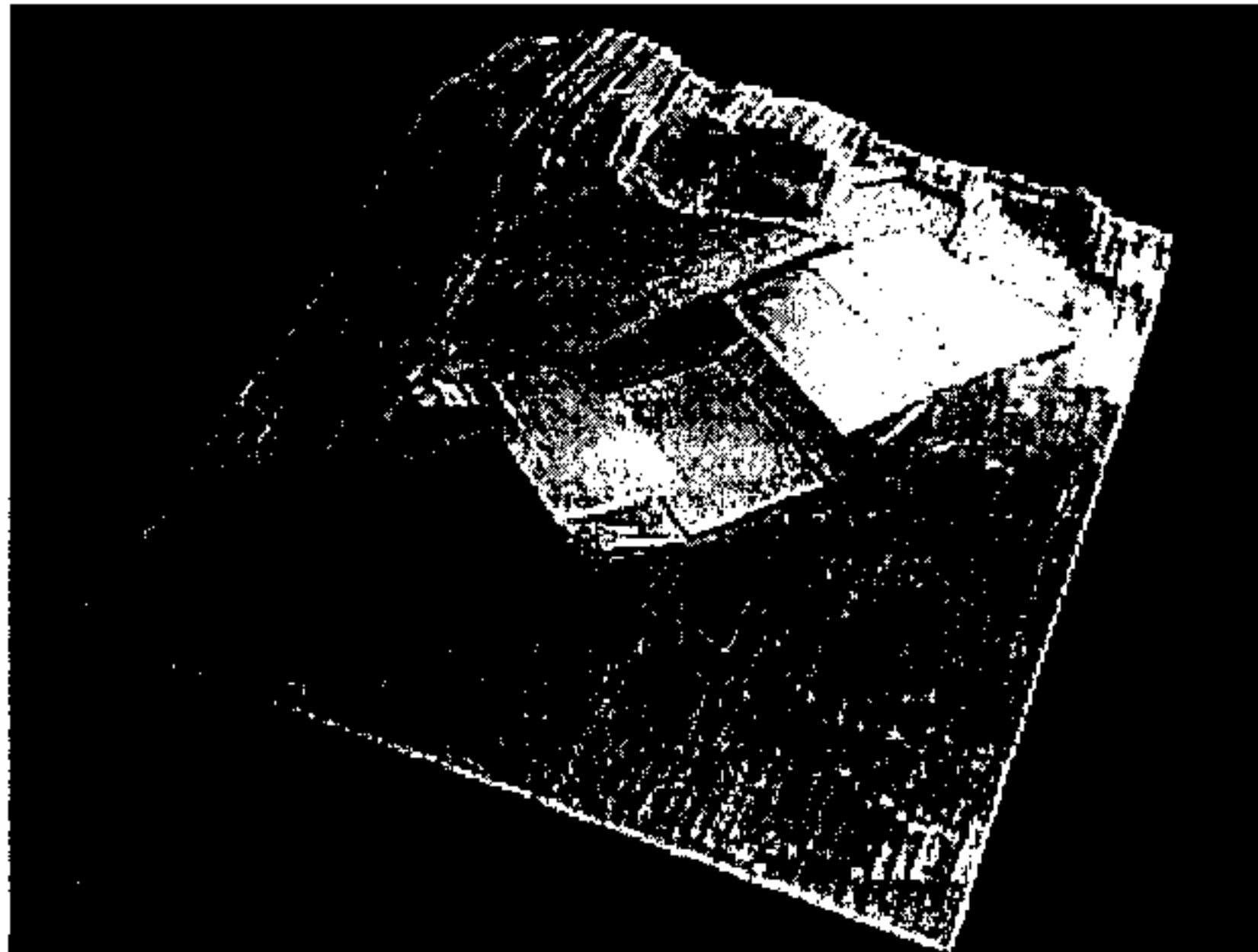
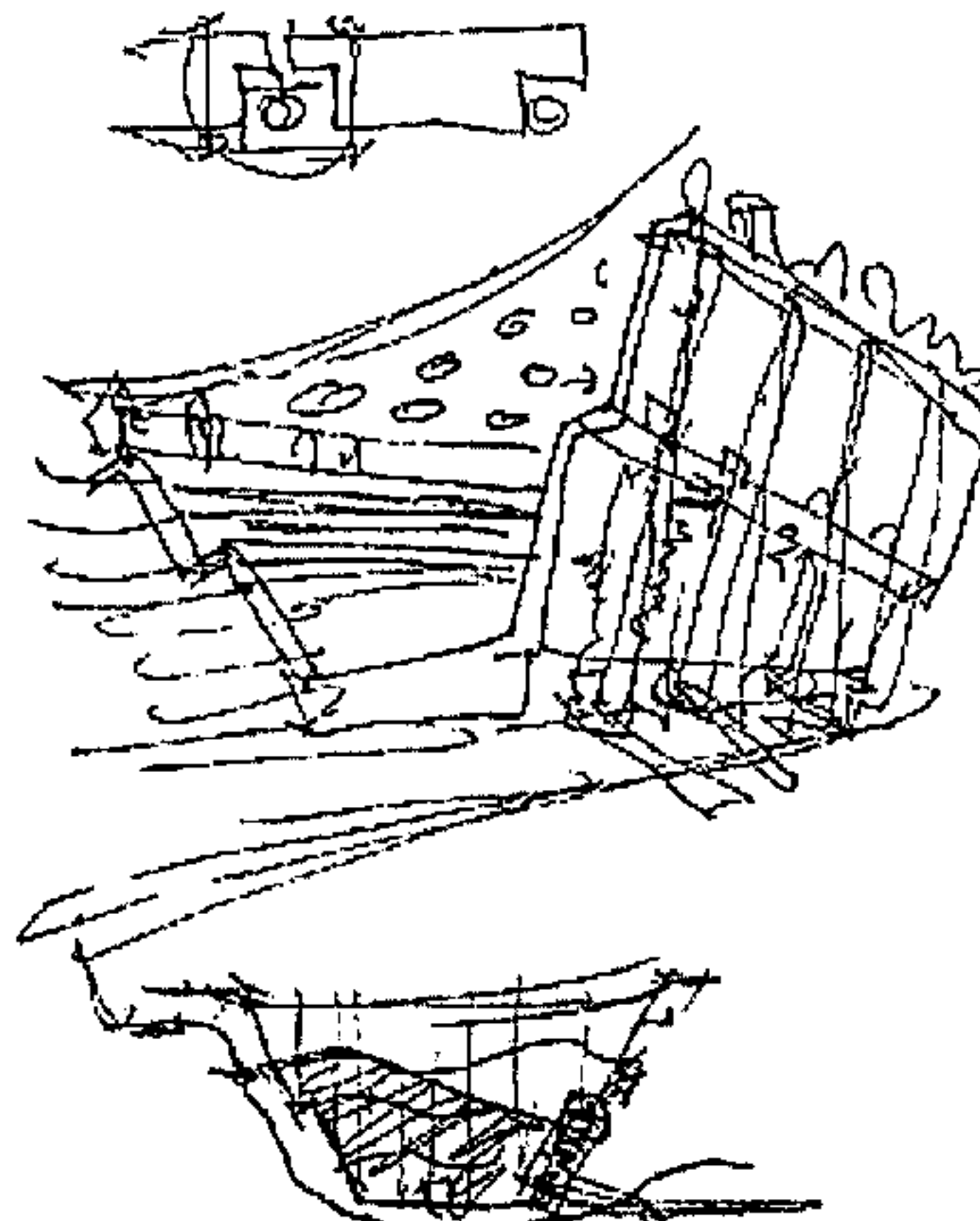
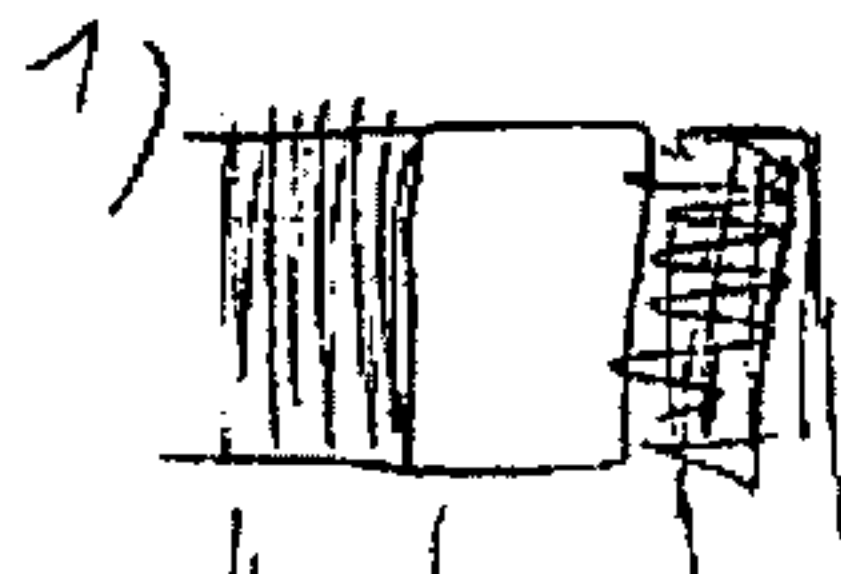


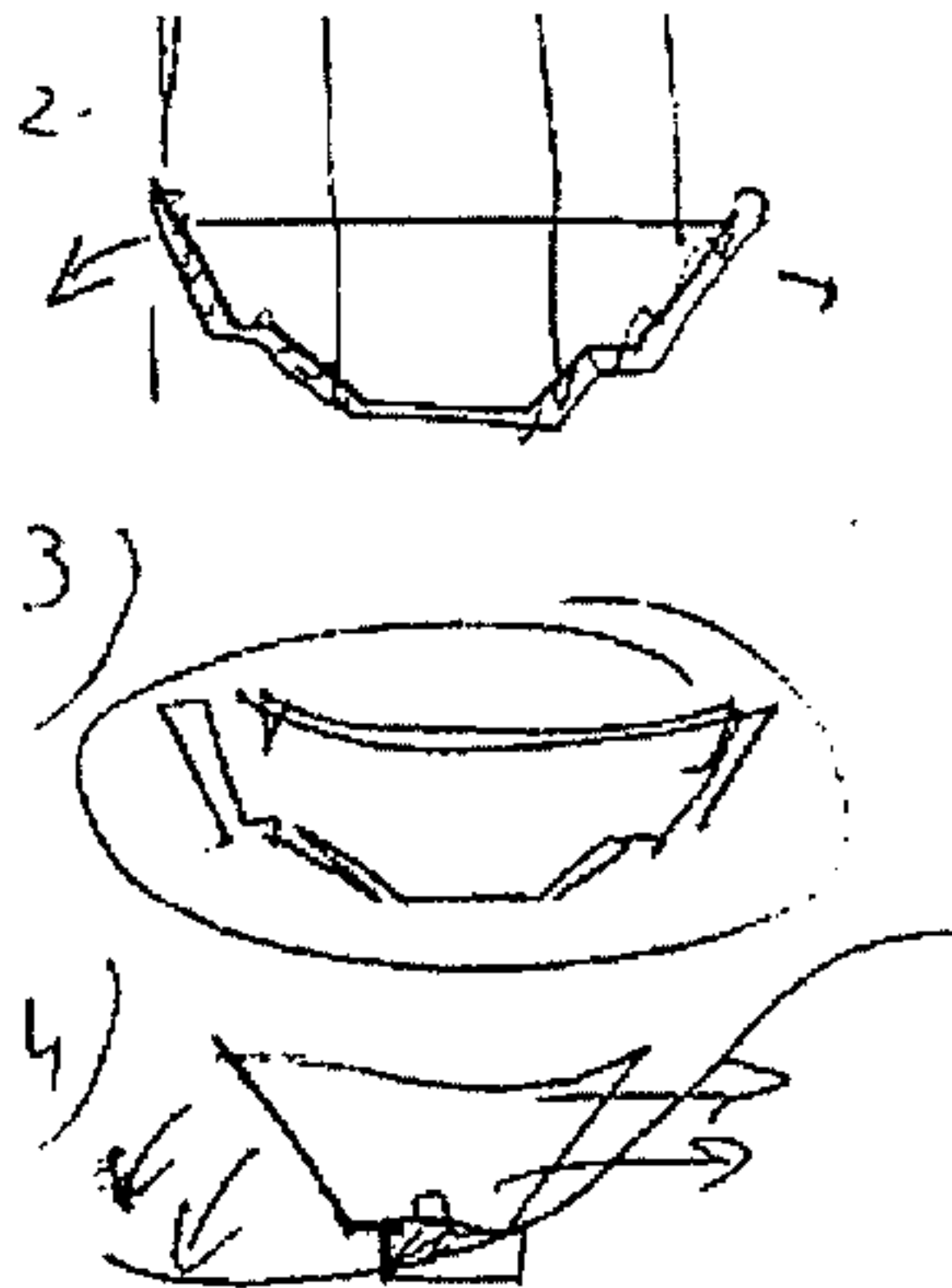
Image courtesy Eduardo Souto de Moura

The sloping roof, originally planned to look like a continuous visor, is modelled on the suspension bridges, marvels of engineering, the Peruvian Incas built to span the deep river gorges that separated the cities.



Sketch courtesy Eduardo Souto de Moura

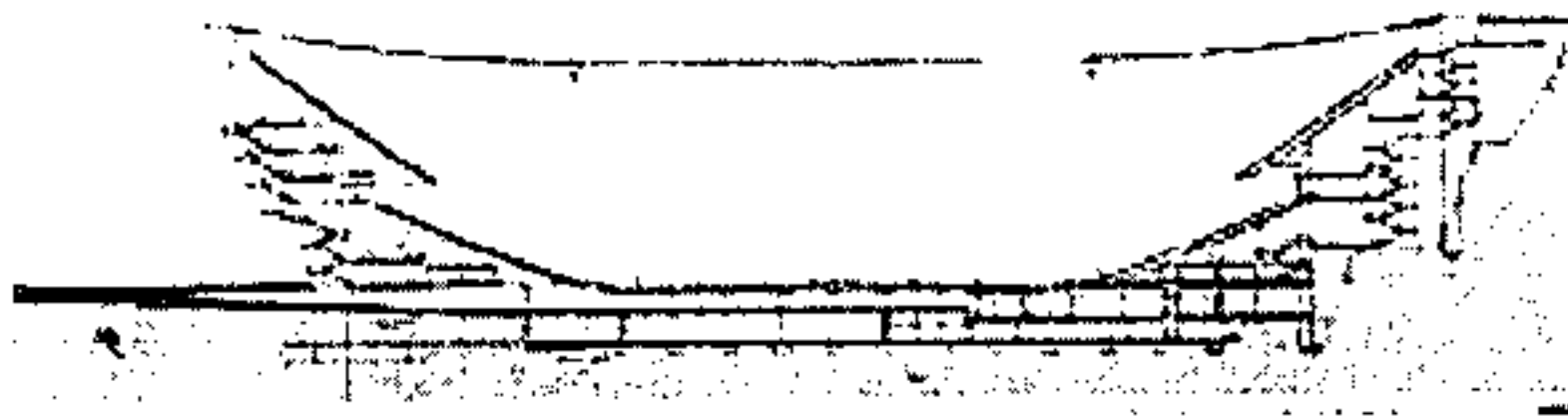




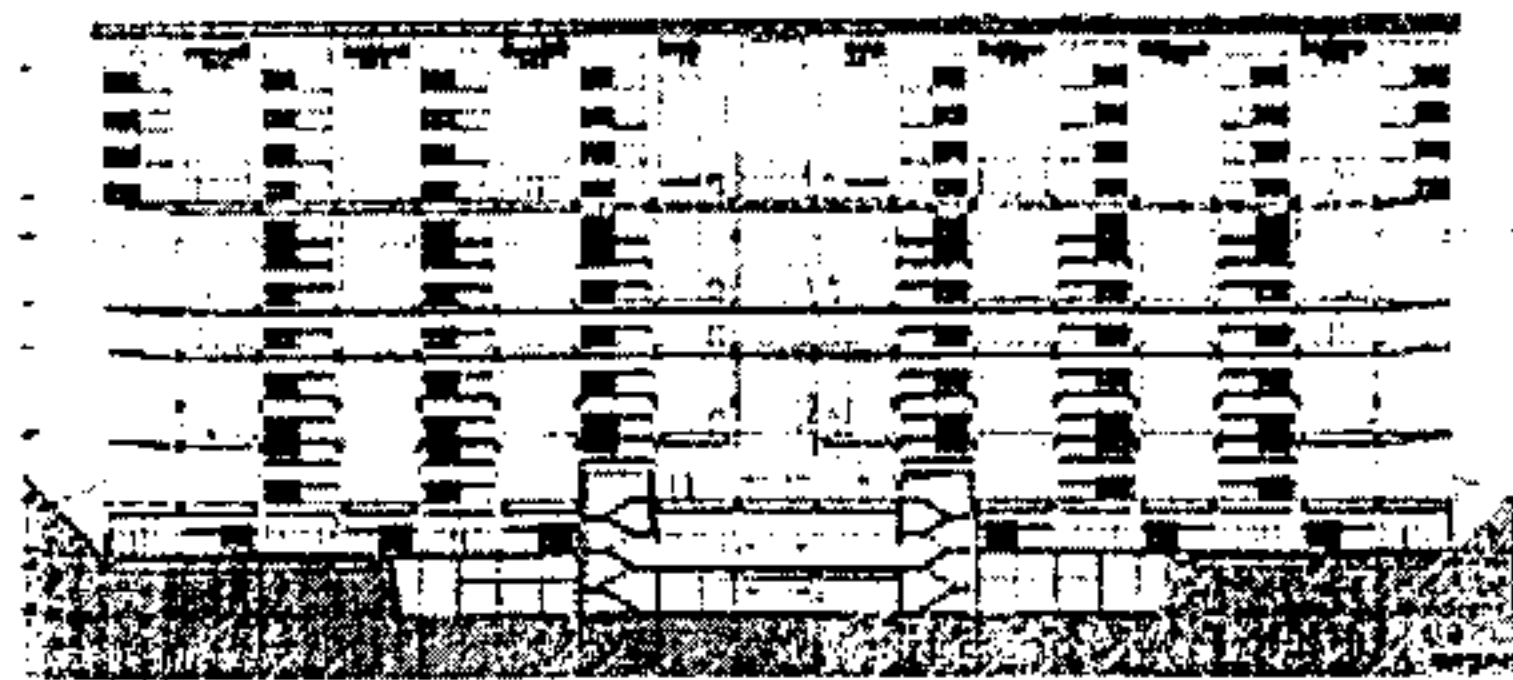
Sketch courtesy Eduardo Souto de Moura



Drawing courtesy Eduardo Souto de Moura  
Site Plan



Drawing courtesy Eduardo Souto de Moura  
Cross Section



Drawing courtesy Eduardo Souto de Moura  
Longitudinal Section

Client Câmara Municipal de Braga  
Architect: Eduardo Souto de Moura  
Collaborators: Carlo Nozza, Ricardo Meri, Enrique Penichet,  
Atsushi Hoshina, Diego Sotelo, Carmo Correia, Luísa Rosas

Architect: Eduardo Souto de Moura, Carmo Pereira, Eugénio Rocha  
Landscape Design: Daniel Monteiro  
Structural consultant: AFA Associados  
Electrical consultants: Rodrigues Gomes & Associados  
Mechanical consultants: Rodrigues Gomes & Associados  
Consultants: Arup Associates London (General Stadium Advice)  
General contractor: Soares da Costa/Assoc/Ace  
Design: 2000  
Construction start: January 2002  
Completion: 2004

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Eduardo Souto de Moura

June 17, 2002

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**Kisho Kurokawa**  
**Big Eye Stadium**  
Oita Prefectural Sports Park  
Oita City, Japan

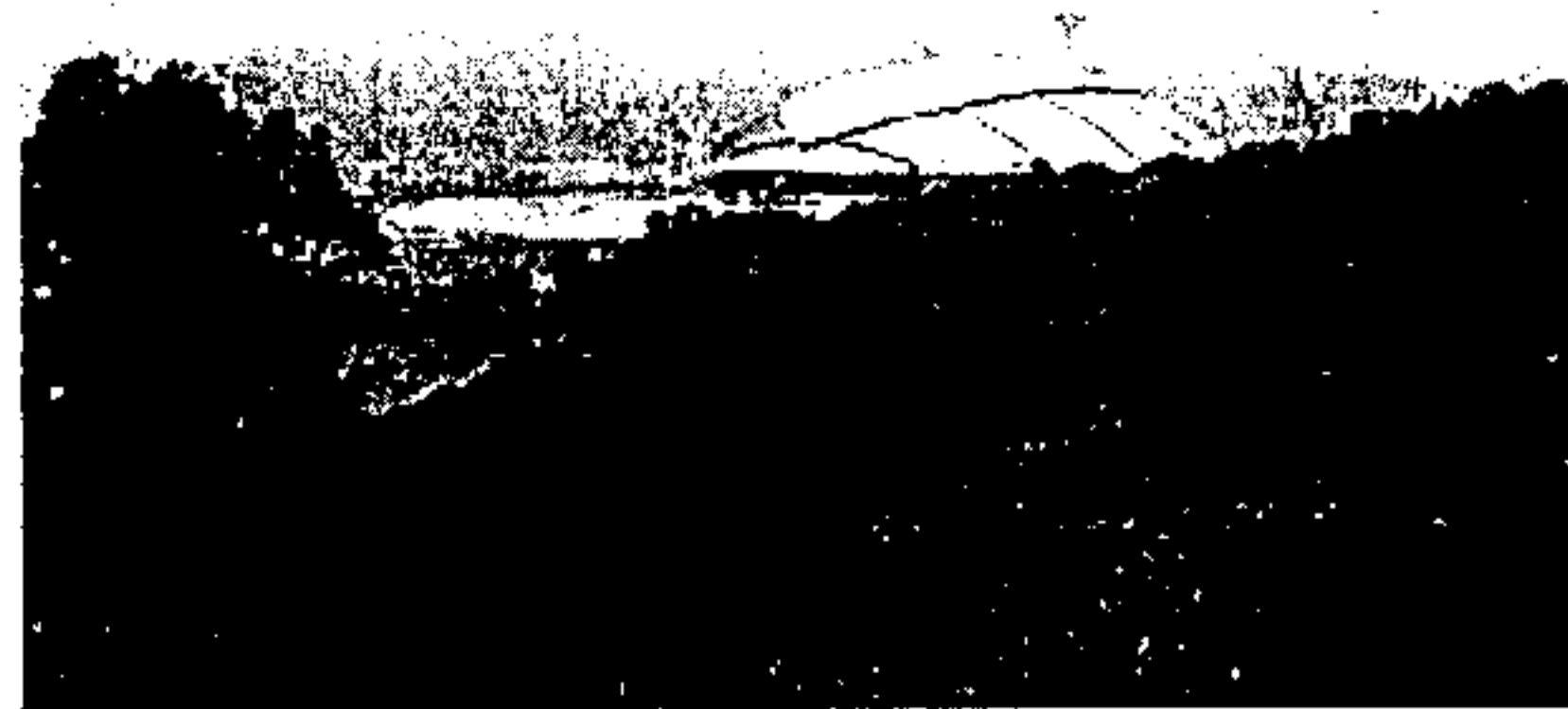


Photo: Koji Kobayashi

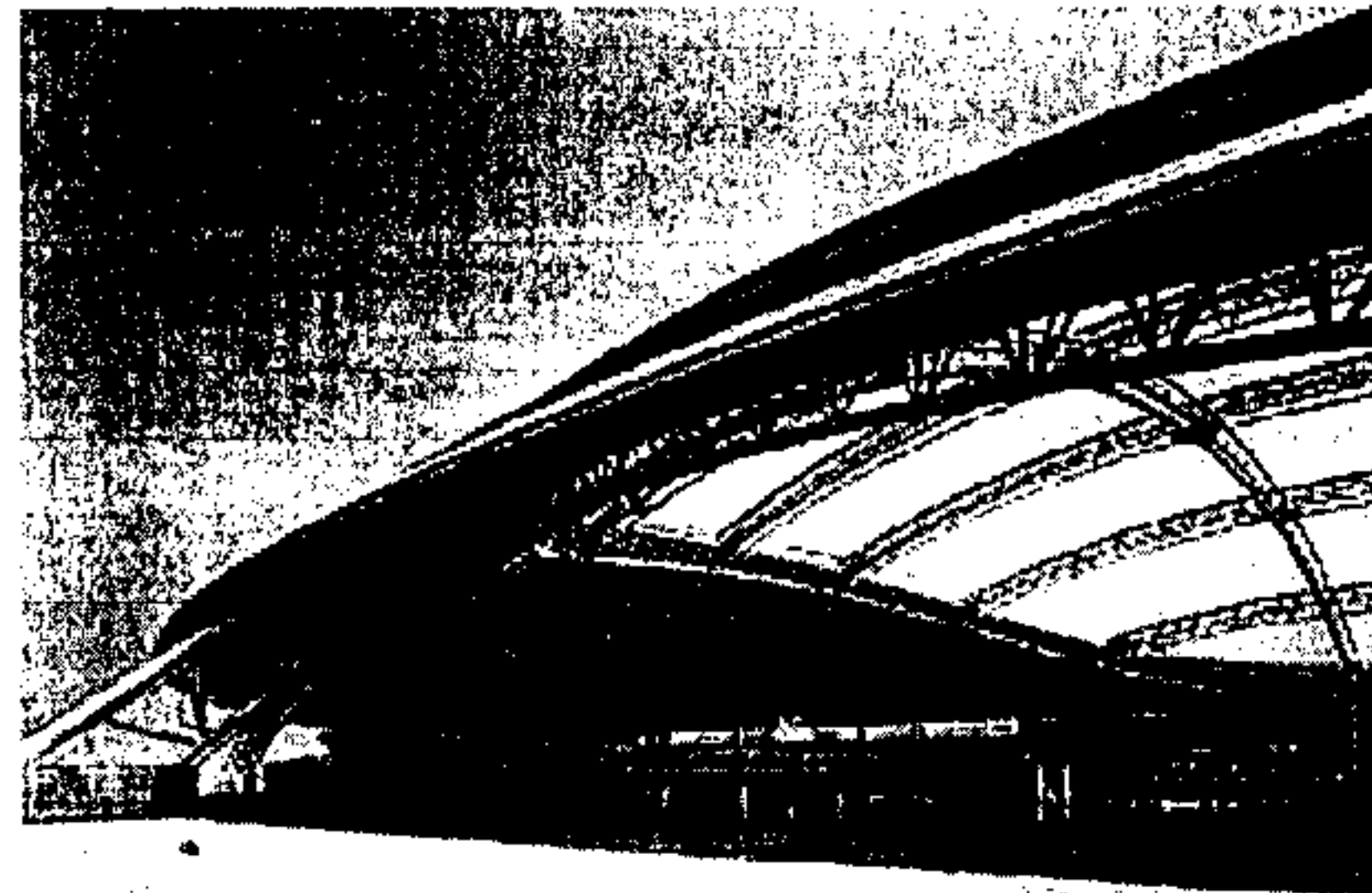
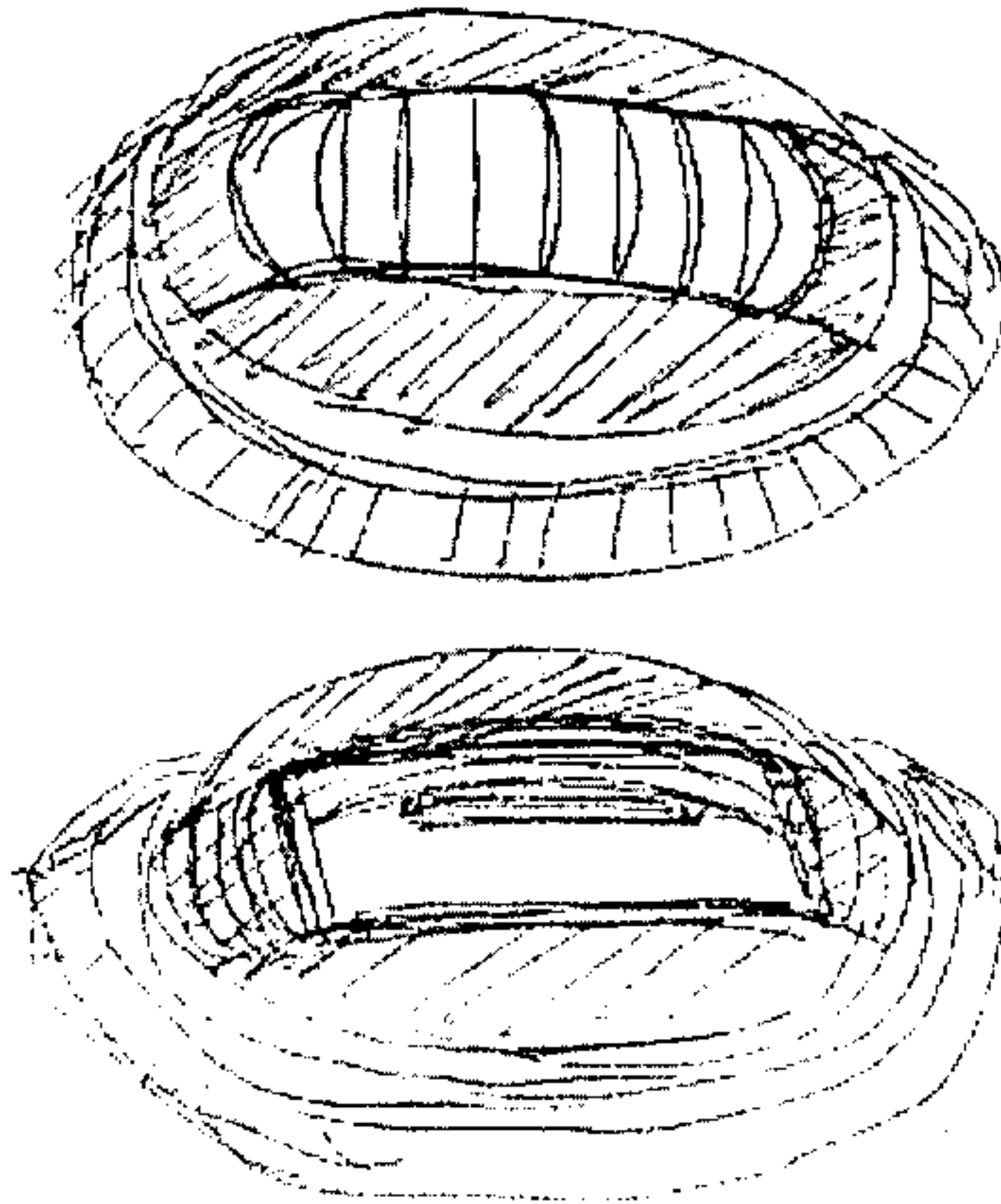


Photo: Koji Kobayashi

*"It might be just coincidence but we have a pineal gland in the brain that is said to be a degenerated eye-like organ. It seems that we had a third eye in our brain to look up the sky, rather than two eyes to see the world on the earth. Since people abandoned the universe to stay on the earth, the third eye became useless and degenerated. Seeing the Big Eye watching only the sky, such a thought came to my mind."*

Kisho Kurokawa  
Interview by Makoto Takahashi



Sketch courtesy Kisho Kurokawa

The gentle curves of the spherical design resemble the curves of the surrounding landscape. The choice of a sphere, an expression of abstract symbolism, enables the retractable roof to move along its surface.

The retractable roofs are closed right above the spine, after gradually moving parallel up to the spine. They are pulled up with wires that have a winch member at the bottom. Each rib has a different curve ratio from the others, and each wire has a different load from the others. The giant's blink is supported by advanced technology that calculates and controls the loads, and by external wires powered by computers.

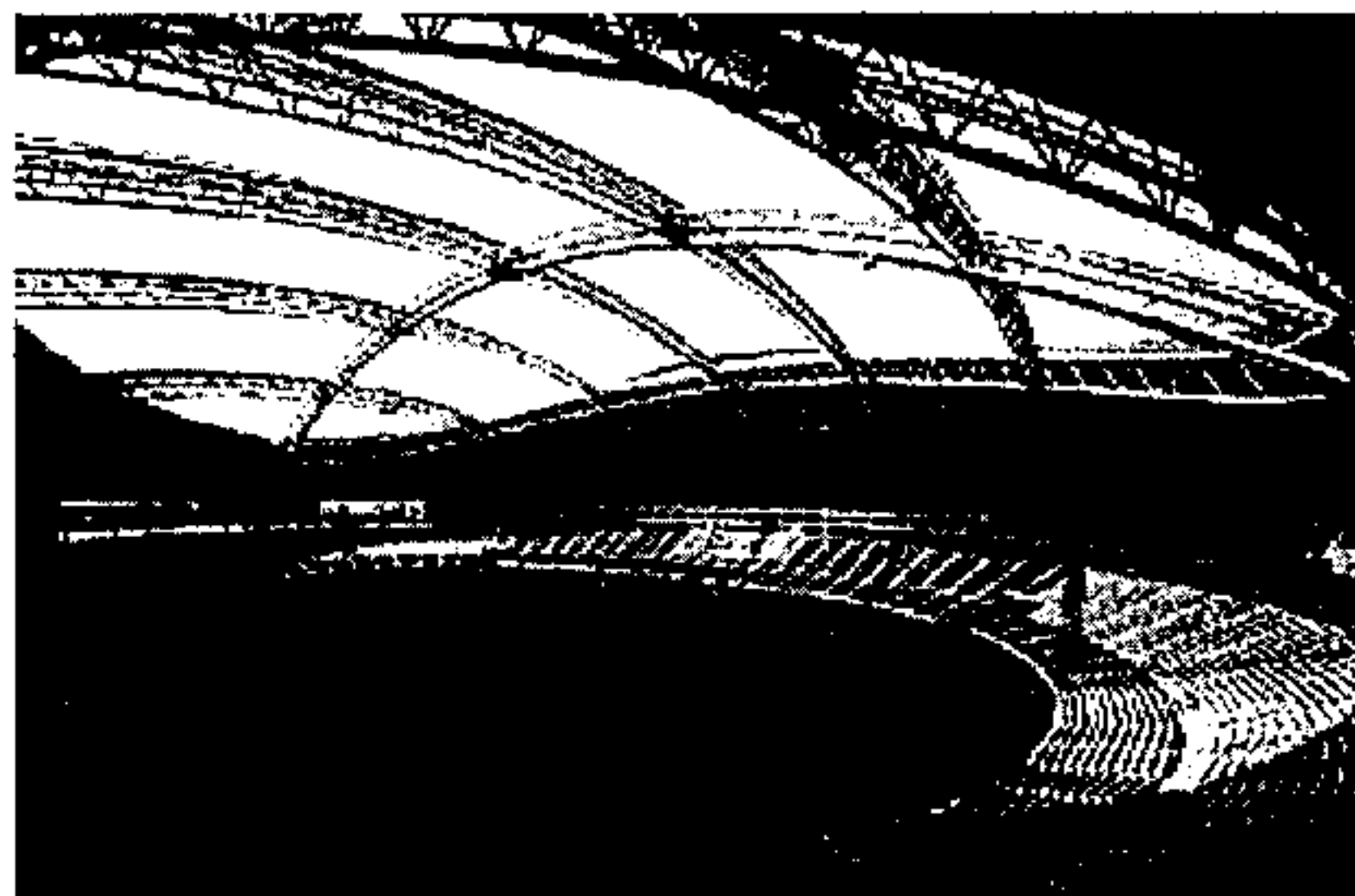


Photo: Koji Kobayashi



Photo: Koji Kobayashi

A retractable seating system removes the seats, that are placed at the edge of the field to enhance the feeling of being part of the soccer arena, to accommodate track events.

The elliptical roof opening runs along the north-south axis for the field to get proper sunlight exposure. The economical structure of the main beam arch, with perpendicular horizontal-running sub-beams, corresponds to the elliptical shape of the roof opening. The vastness of the site made this type of pipe-arch structure possible and also the most reasonable.

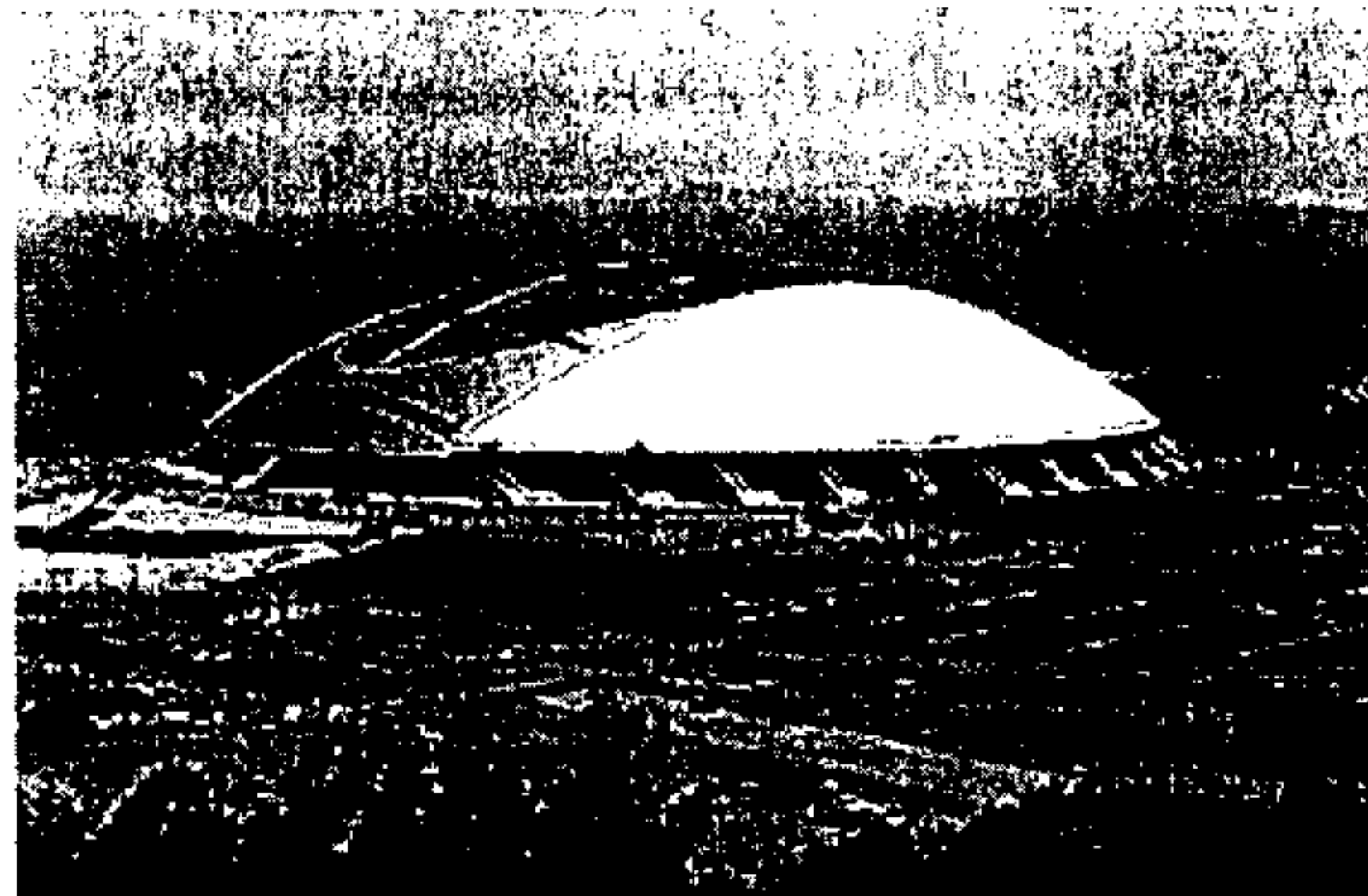


Photo: Koji Kobayashi

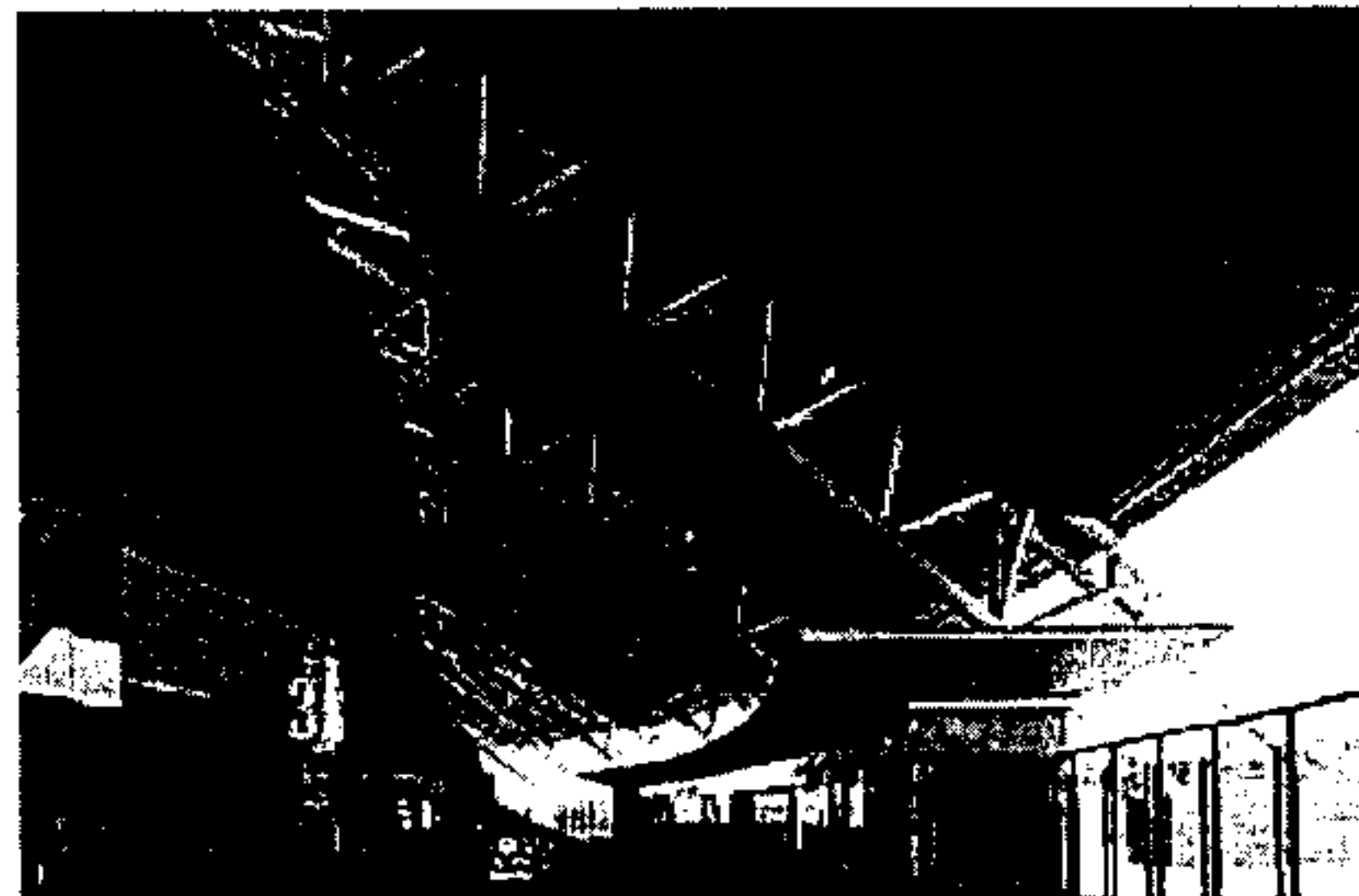


Photo: Koji Kobayashi

A slit is cut between the roof and the spectator seating to allow for natural ventilation in the summer, and to create a feeling of openness and a view of the mountains. The use of ultra-modern teflon

membrane panels with 25% light-permeability removes the need for artificial lighting during daylight hours.

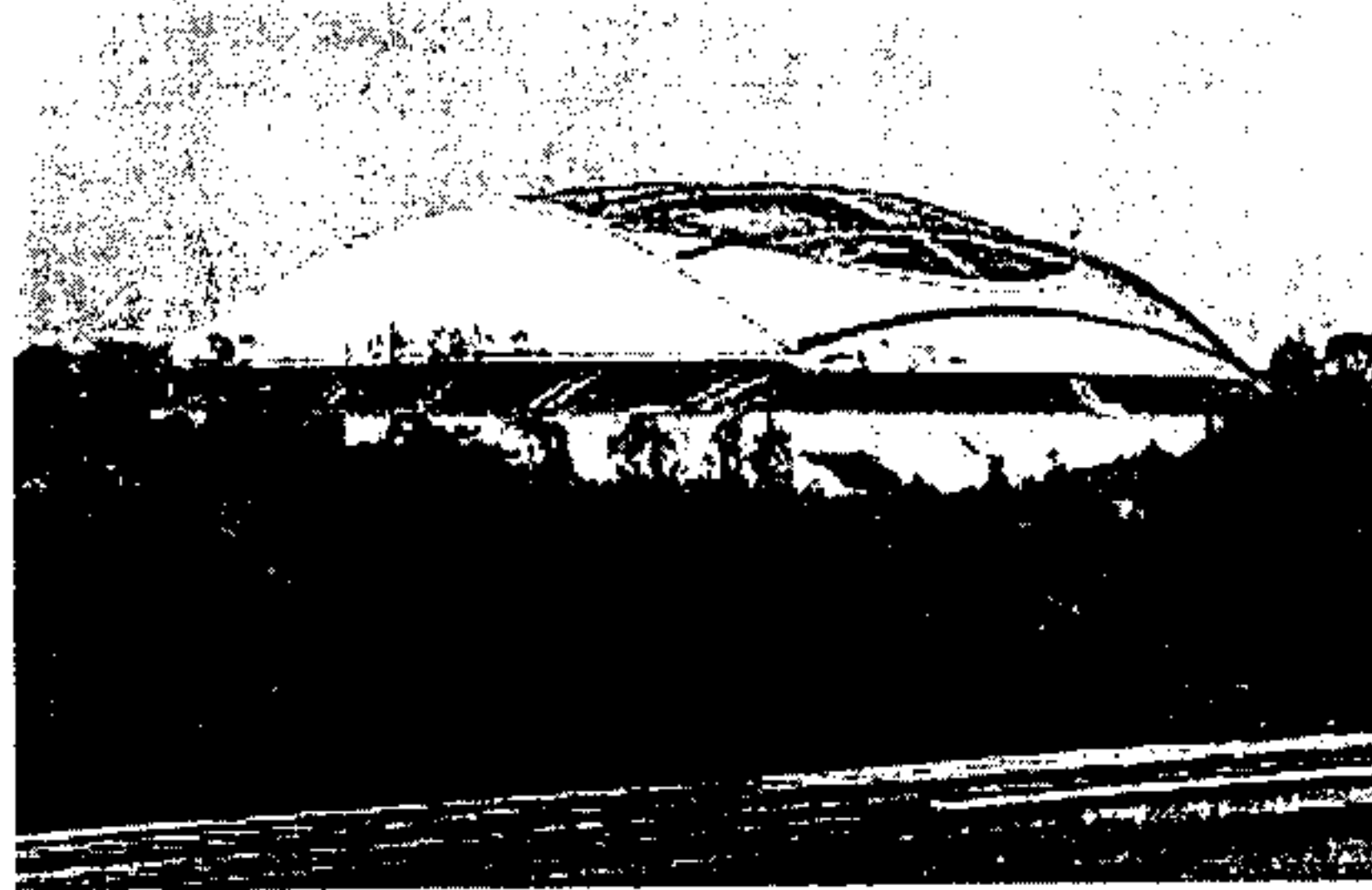


Photo: Koji Kobayashi

A moving camera is placed on the main beam, the world's first, to deliver dynamic images to the rest of the world.

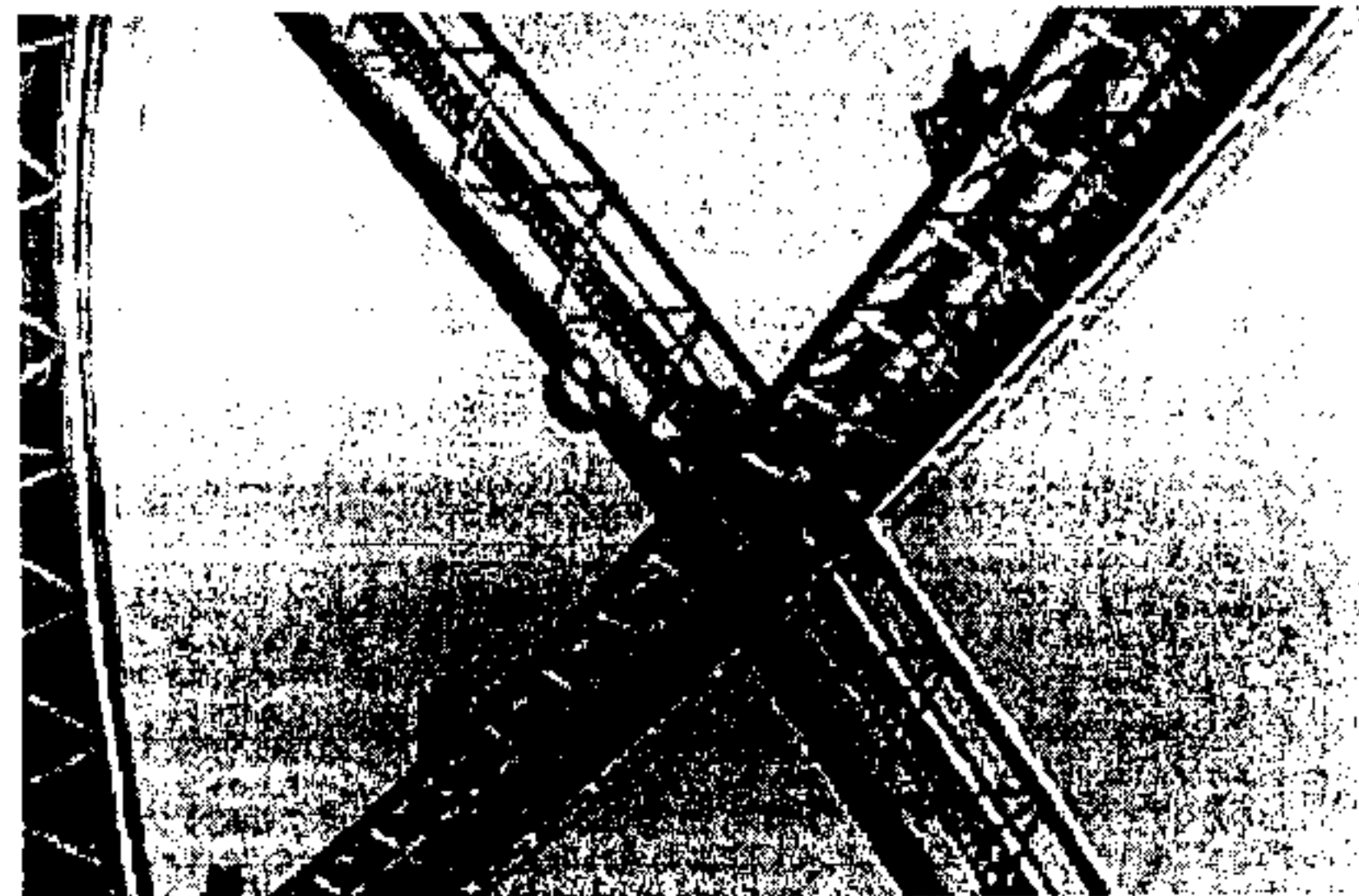


Photo: Koji Kobayashi

Stadium, feature several facilities including a general fitness center, a training and lodging center, a botanical pool, 2 multi-purpose athletic fields, 2 soccer and rugby training fields, a sub-training field, a softball field, a public baseball field, 11 tennis courts, a throwing event practice field, a gate-ball field and an open track that can be used year-round because of the retractable roof feature.

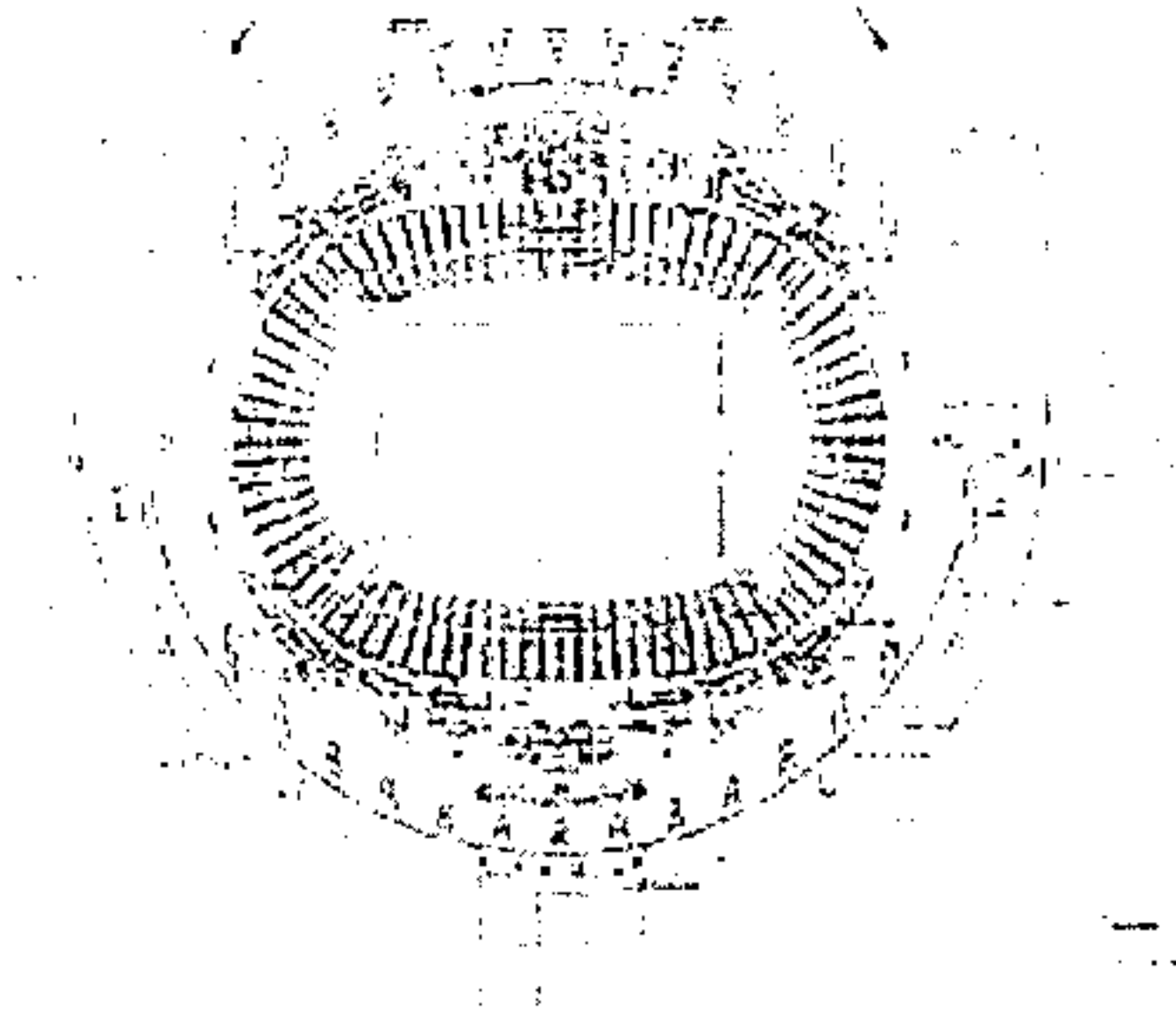


Photo: Koji Kobayashi  
Tea lounge on the first floor



Photo: Koji Kobayashi  
Entrance lobby for the VIP room on the first floor

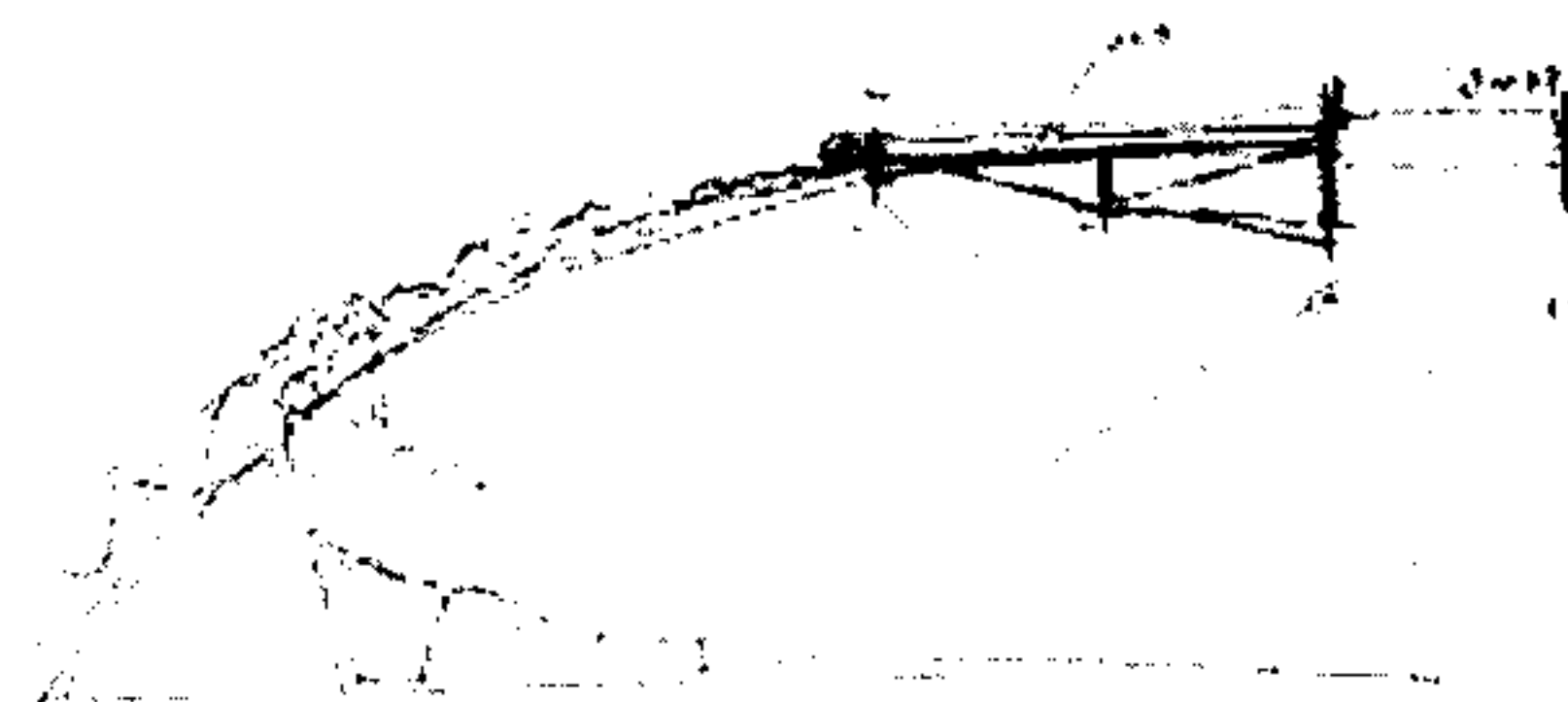
The Oita Stadium, chosen as an arena for the World Cup Games in 2002, will continue to grow striving to become a large-scale and extensive all-purpose sports park ready for the 2008 Second Tour of the Japanese Inter-Prefectural Athletic Competition.



Drawing courtesy Kisho Kurokawa Architect & Associates  
First Floor Plan

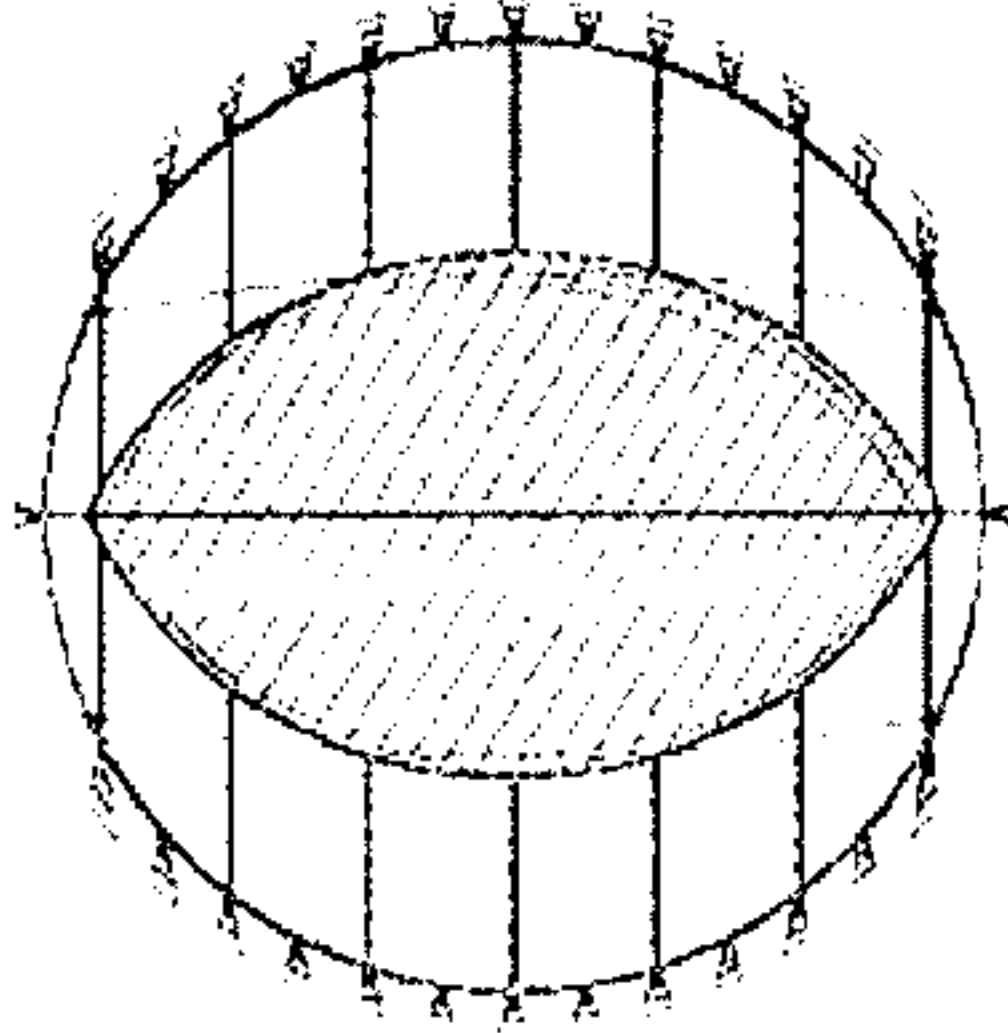


Drawing courtesy Kisho Kurokawa Architect & Associates  
Section





Sketch courtesy Kisho Kurokawa



Drawing courtesy Kisho Kurokawa Architect & Associates  
Ceiling Plan

Client: Oita Prefecture  
Full Postal Address: Yoko Matsuoka Oita-shi Oita  
Prefecture

Principle Use:  
Soccer and Track and Field Arena; Multi-function  
Arena

Kisho Kurokawa architect & associates

KT Group  
Structural Engineering, Mechanical & Electrical  
Engineering

Kisho Kurokawa architect & associates

Led by:  
Kisho Kurokawa  
Naotake Ueki  
Yukio Yoshida  
Ken Nishikawa  
Kenichiro Tomita  
Ken Nishikawa  
Shiori Sugimura  
Hoshina Atsushi  
Kimihiro Ikeda  
Noriko Umetsu  
Eizo Takayama  
Eizo Takayama  
Daisuke Matsui  
Shiori Sugimura

Takenaka Construction Kyushu Branch  
Noriyoshi Arikado  
Takashi Shiraki  
Shoji Nakamura  
Masashi Egami  
Shinichiro Kikuchi

Shinichi Ishida  
Eiji Anan  
Takashi Miwa

Shinichiro Kikuchi  
SATO BENEK  
Takehiko Watanabe  
Takayama Sogo Kogyo  
Hiroyuki Mima

Structural Engineering:  
KT Group  
Hideyuki Yoshiya  
Kazuya Tokitou  
Hideyuki Narita  
Yukihito Uonaga  
Hisato Okuide  
Toshihiro Kiyonaga  
Tetsuya Masui  
Hideyuki Narita  
Uonaga Yukihito

Mechanical & Electrical Engineering:  
KT Group  
Hiromitsu Ogawa  
Yasunari Fukuyama

Area:  
SiteArea (Entire Park): 2,550,000.00  
Building Area: 51,830.36  
Total Floor Area: 92,882.08  
Area for each floor:  
3rd Floor: 6,185.52  
2nd Floor: 10,473.89  
1st Floor: 26,506.39  
1st Level Basement : 8,448.68  
2nd Level Basement: 4,267.60

Construction Schedule:  
Design Period: 1996 - 1998  
Construction Period: April 1998 - March 2001

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Kisho Kurokawa

Monographs  
Kurokawa  
Metabolism and Recent Work  
Editor: Dennis Sharp

October 26, 2001

■ **arcspace**

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**Kisho Kurokawa**  
**Toyota Stadium**  
Toyota, Japan



Photo courtesy Kisho Kurokawa & Associates

The Toyota Stadium was planned adjacent to the Toyota Bridge in commemoration of the 50th anniversary of municipalization of the City of Toyota.



Photo courtesy Kisho Kurokawa & Associates

The Toyota Bridge is a part of the main pedestrian-based road system of the city. This super-modern bridge attaches an importance to pedestrians and not to cars, by giving pedestrians more space than the roadway, and it also provides movable stairs giving direct access to the waterfront. In addition, the bridge provides a direct pedestrian access to the plaza of the stadium for large numbers of people when soccer games or any other events are held.







Photo courtesy Kisho Kurokawa & Associates

The Stadium was originally designed to accommodate 60,000 spectators when Toyota was selected to be one of the fifteen cities for the Japan World-Cup Semi-Final Game. Later as Japan and South Korea cosponsored the World-Cup, the possible venues were reduced to ten cities. Toyota City in Aichi Prefecture was left out of the selection, despite the fact that it has the third largest population density. As a result the design, already in process, was reduced to accommodate 45,000 spectators.

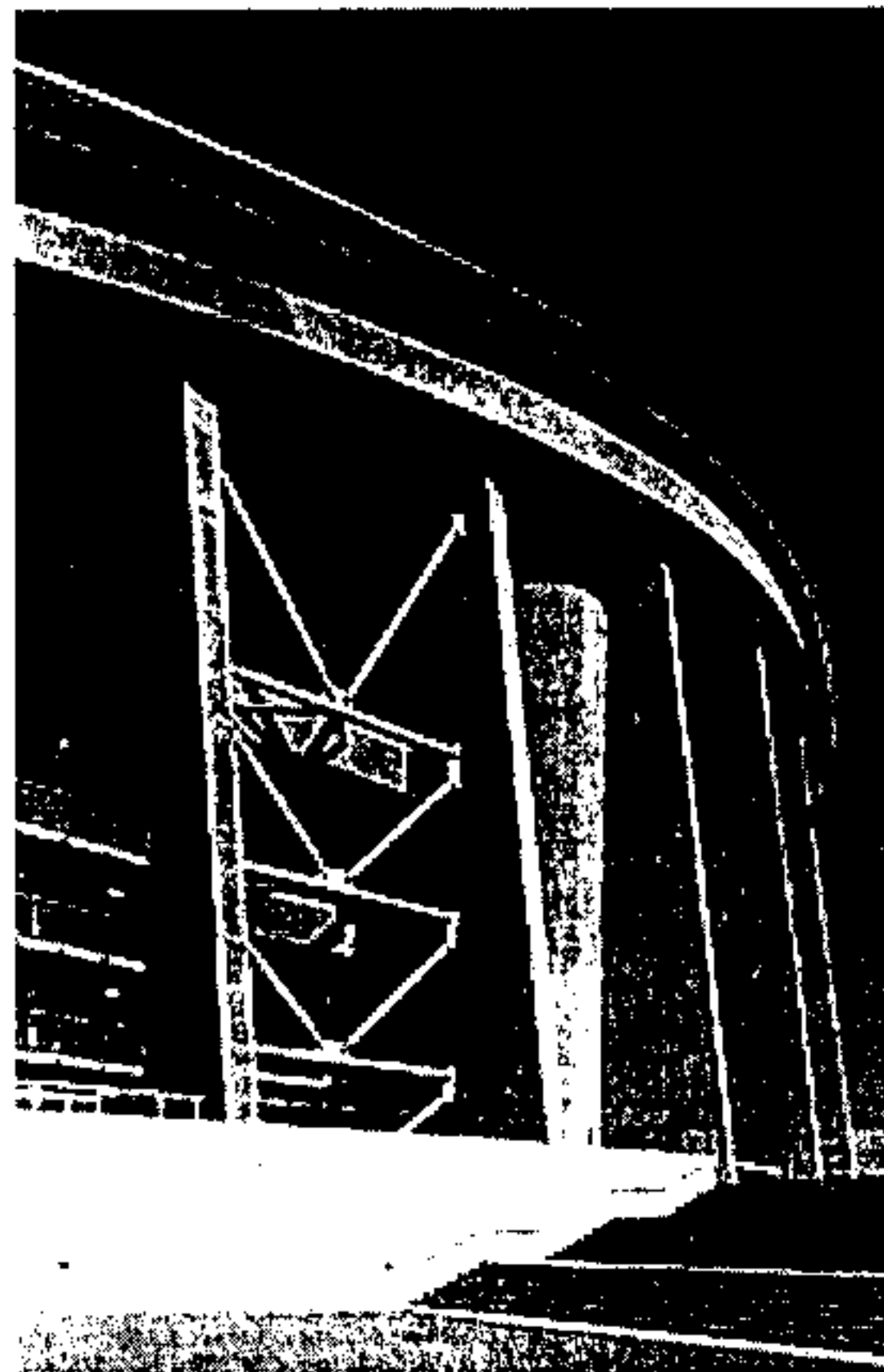


Photo courtesy Kisho Kurokawa & Associates

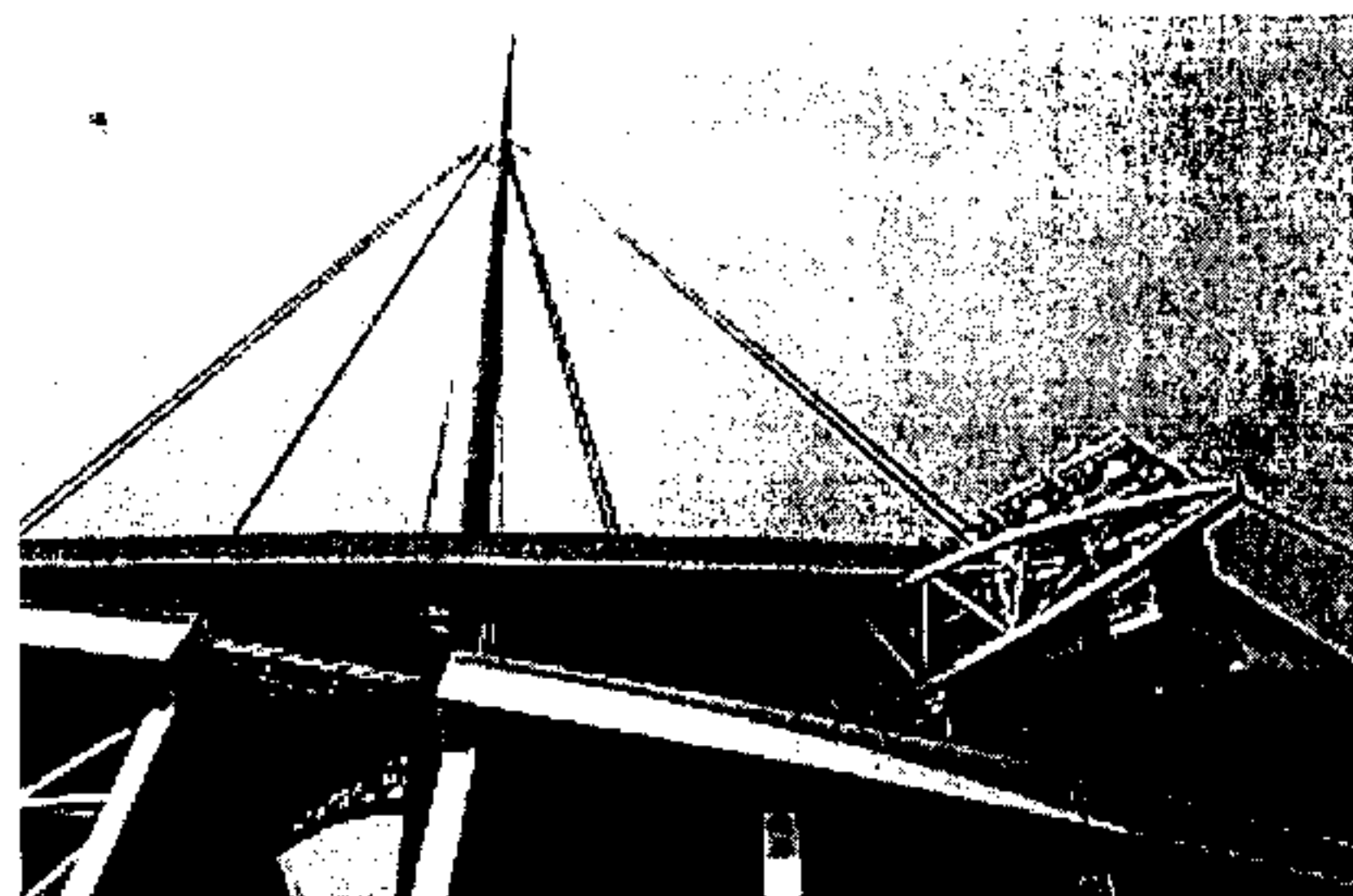


Photo courtesy Kisho Kurokawa & Associates

To accommodate that many spectator on a site, only half the size of the Oita Stadium site, that included a river embankment and an irrigation ditch for the preservation of the area, Kuokawa designed inclined vertical wall pillars to support the seating sections, and four huge independent masts to carry the roof.



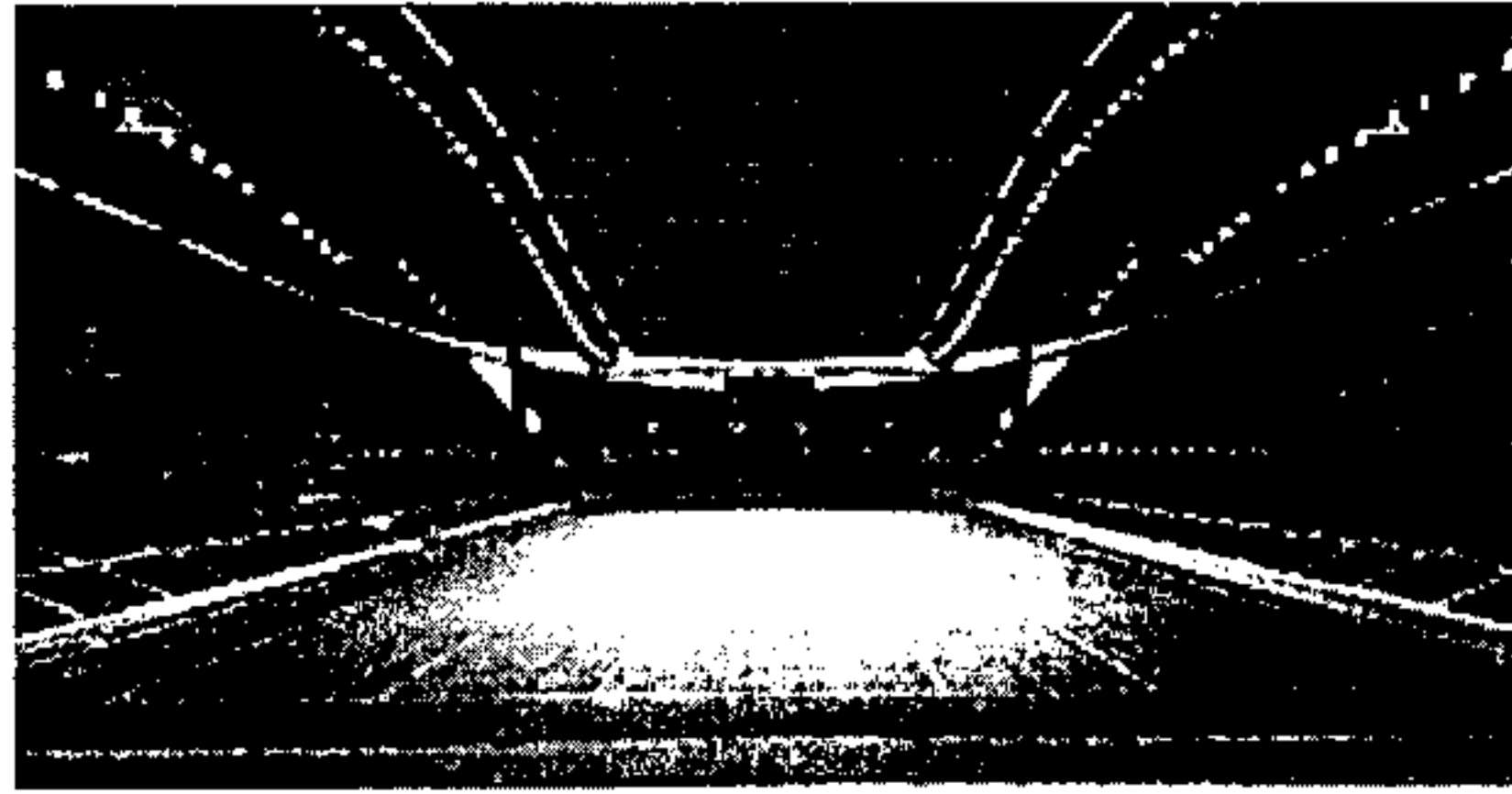


Photo courtesy Kisho Kurokawa & Associates



Photo courtesy Kisho Kurokawa & Associates

In order to enable a multifunctional usage of the facility, a movable roof became an additional condition of the new design. The roof was designed for natural light to reach the lawn on the ground while closed and still cover the main stand seats completely when opened.

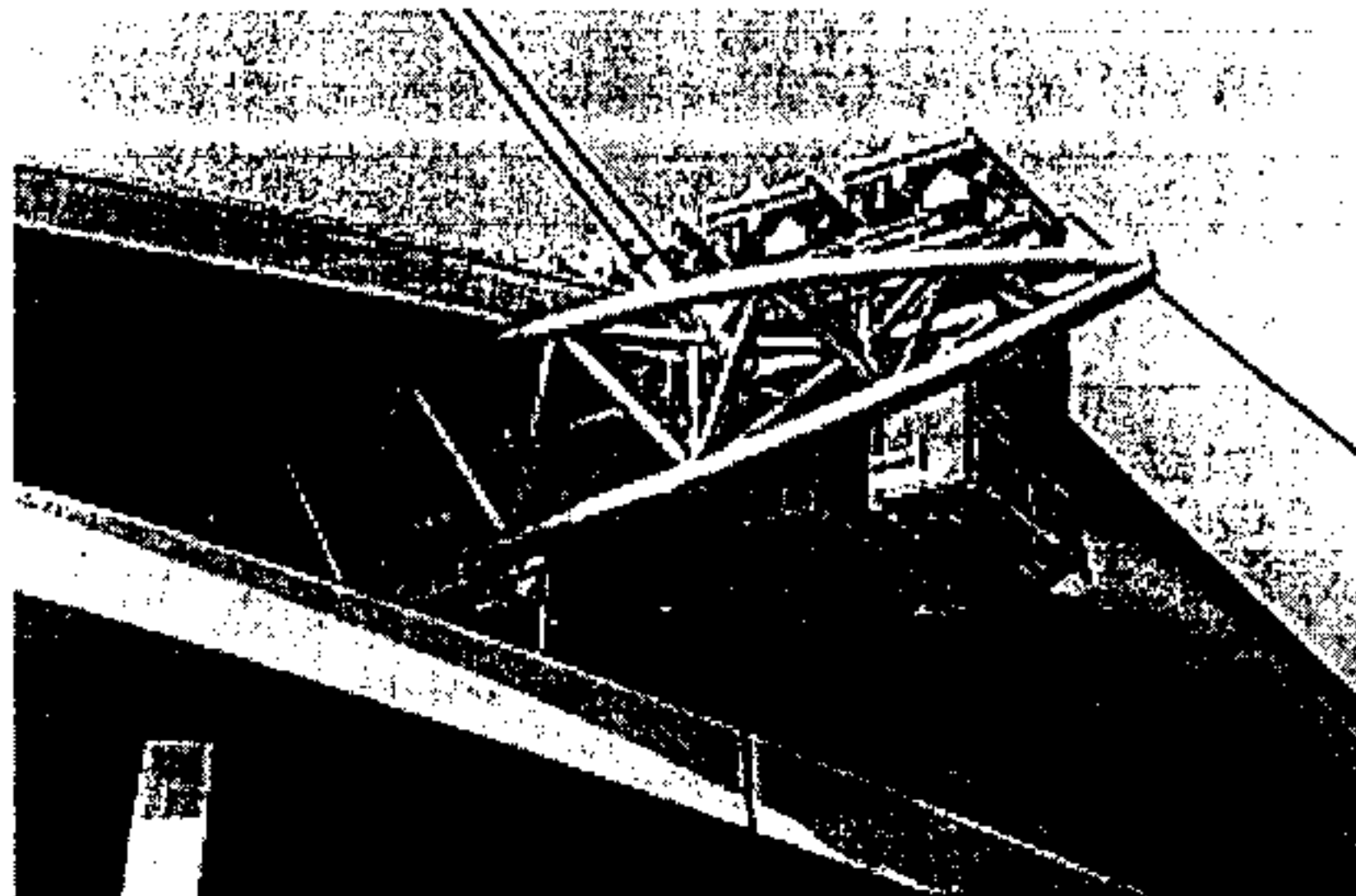


Photo courtesy Kisho Kurokawa & Associates

Both wings of the suspended roof, reminiscent of the traditional shape of the Japanese roof, were designed parallel to each other to enable the light-weight roof to move along the rails, opening and closing like a folding Japanese fan, by an air-pillow method.

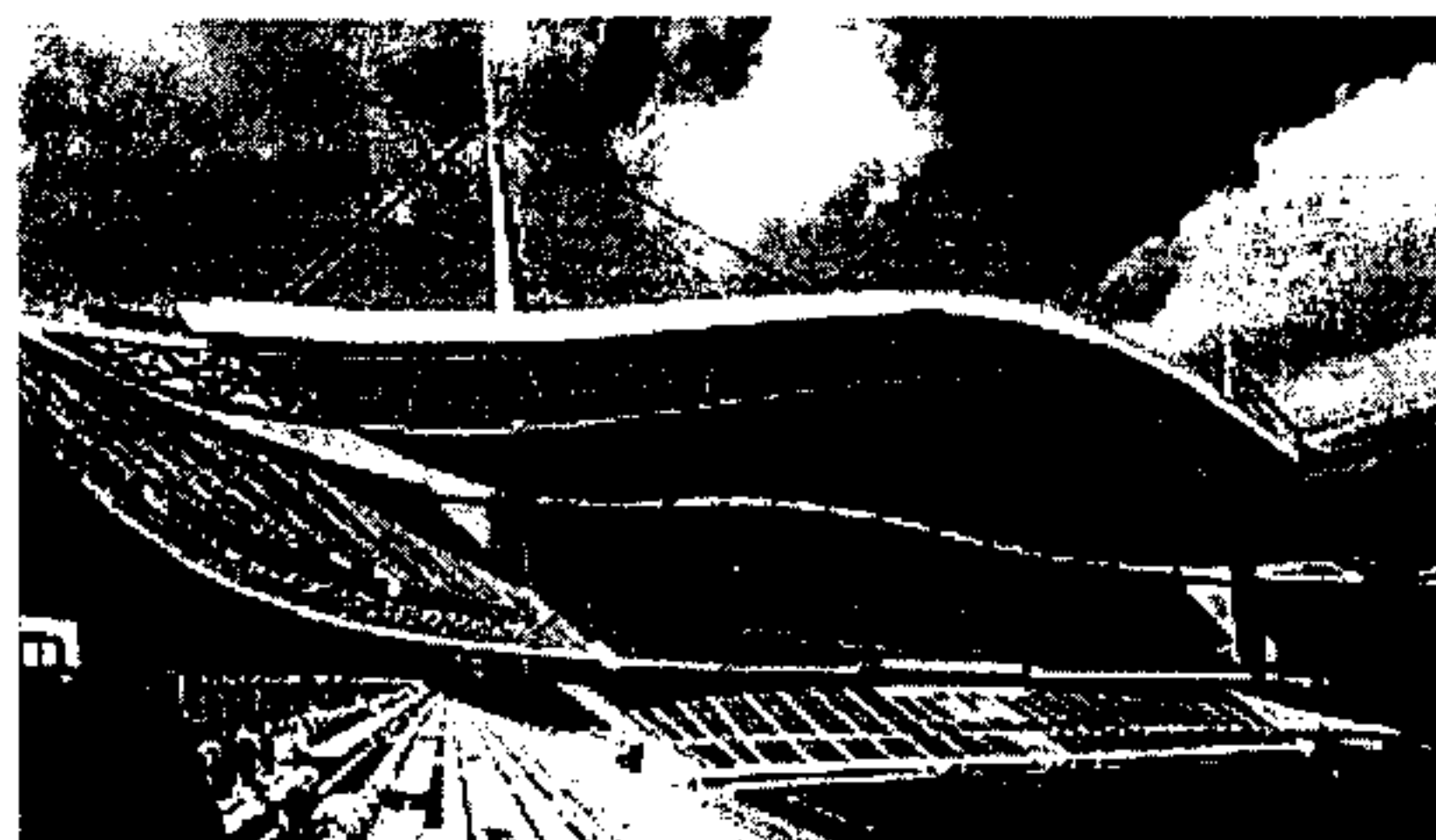




Photo courtesy Kisho Kurokawa & Associates

The spectators' seats in the Toyota Stadium, said to be the "Number One" in the world among experts and professional players, are located up to the very last extension along the line of the stadium field.

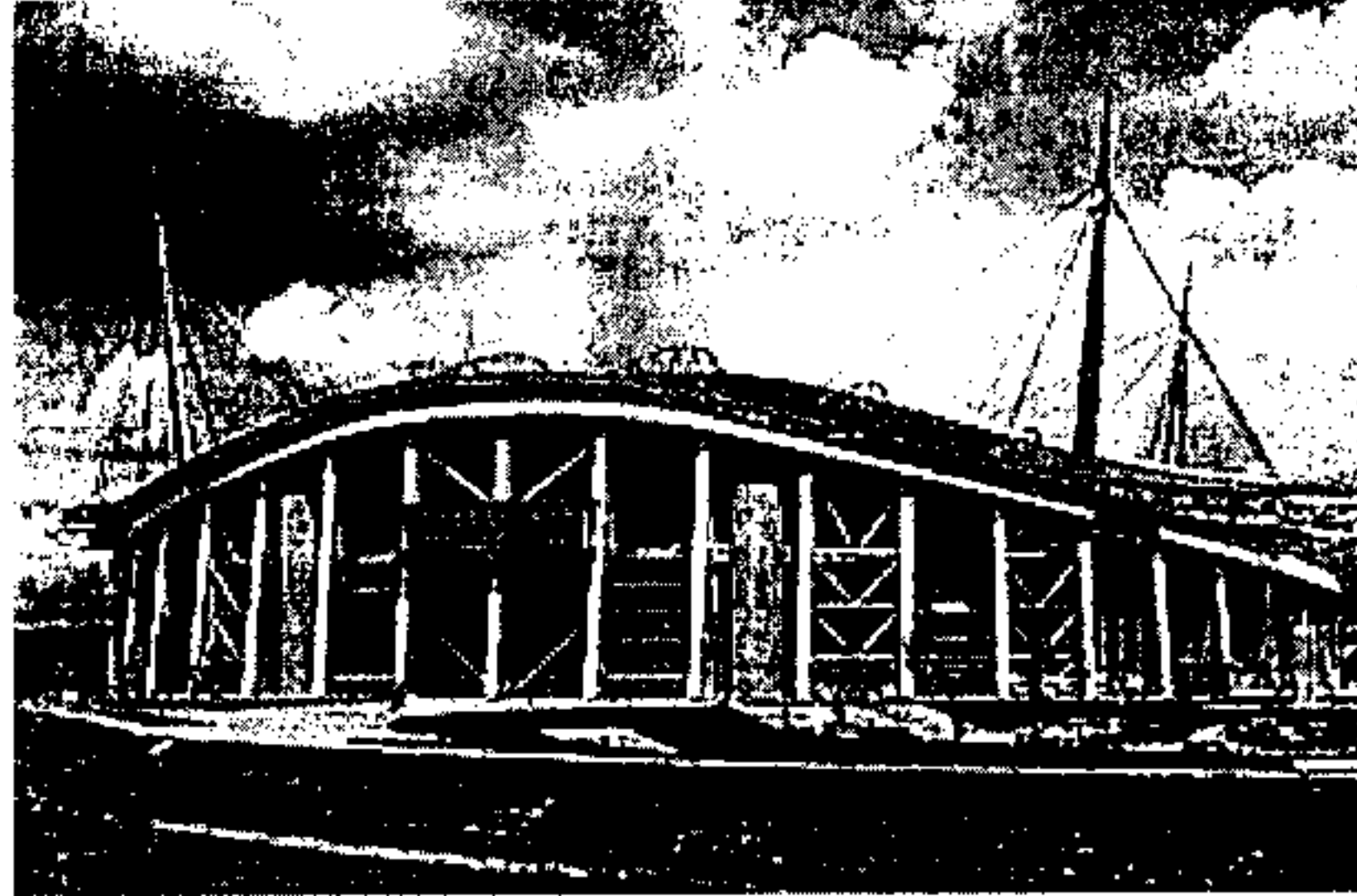


Photo courtesy Kisho Kurokawa & Associates

The entire structure is steel covered with fireproof pre-cast slabs enabling a reduction of the overall weight of the structure. The structural concept of the Toyota Stadium was done in collaboration with Ove ARUP & Partners Japan Ltd.

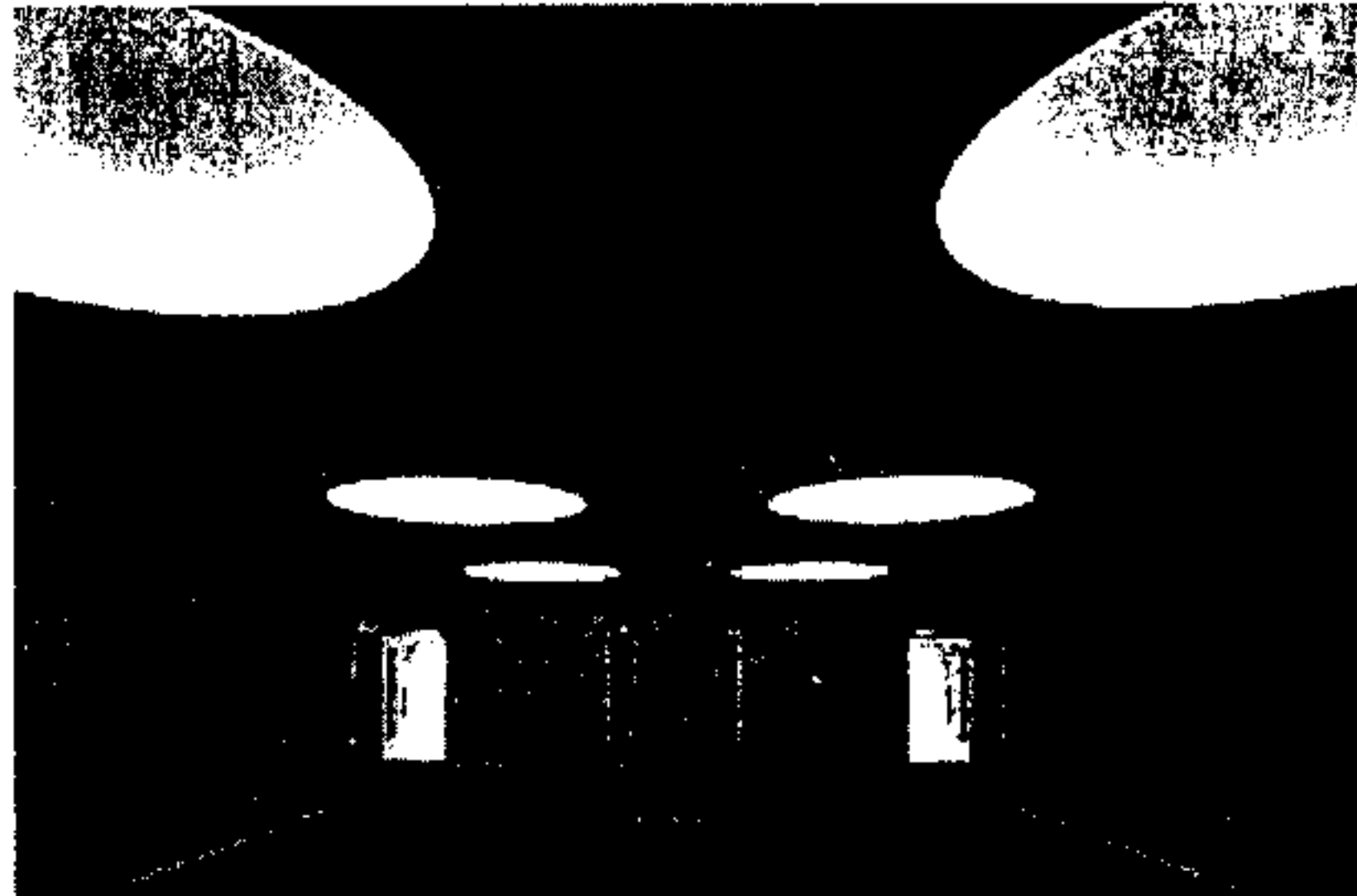


Photo courtesy Kisho Kurokawa & Associates

