CIVIL ENGINEERING CONSTRUCTION

SBC2253

AIRPORT AND RUNWAY

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KUALA LUMPUR INTERNATION AIRPORT (KLIA)

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- KLIA is ideally located between forested mountains to the east and coastal lowland to the west. The trees selected for KLIA had to fit with the constraint of the building.
- The landscaping used fast growing trees to create a forest ambience. There's a whole canopy of leaves on the ceiling with tree trunks, branch and all.
- The wall is beautifully decorated with a painting of a scenic forest background.

KLIA

- The finisher and motifs have been designed and chosen to reflect local heritage. The conical **column** supporting the massive keel trusses are reminiscence of the oil palm trees, the ceiling feature the 'timber effect' finish while granite flooring is patterned based on an Islamic geometry.
- The result is dynamic roof composed of hyperbolic shells supported by a structure evocative of the ubiquitous palm oil tree.

The new Kuala Lumpur International Airport (KLIA) is one of the largest and most advanced airports in the world. It is positioned to be the transit point linking the world to the rest of Southeast Asia and the Asia Pacific.

THE LOCATION

The new KLIA is located at Sepang, state of Selangor, about 50km south of Kuala Lumpur. It also forms the southern tip of the future Silicon Valley of Malaysia - *Multimedia Super Corridor* (MSC).

Being one of the facilities within the MSC, it is nearby the new Federal Government administrative center - Putrajaya and the heart of MSC - Cyberjaya

THE PROJECT

It's not merely an airport." described by the Malaysia Airport Sdn Bhd. The development which sprawls over an area of 10,000 hectares, will consist of Formula One race track, golf course, theme park etc in the future. This is the first phase of the project, the following 4 phases will be commence on 2003 and complete on 2025. It will eventually serves more than 100 million passengers annually.

THE CONCEPTS

It is a evidence of Malaysia's rich natural heritage. The structure, which combined of environment and mankind, is designed by a Japanese philosopher-architect Dr Kishor Kurokawa. It's aimed to convey the significant impression of tropicality Malaysia to foreign visitors. Here, the advance technology and modern architecture are interwinded with glimpses of the Malaysian rainforest. The intentional use of indigenous flora in the airport landscaping (a "forest in the airport"), combined with real forests surrounding KLIA (an "airport in the forest"), creates a green spectacle, soothing and calming tired travelers.

THE FOREST IN THE AIRPORT

The forested elements and landscaping in KLIA, eg. the palm-tree-trunk-like columns, the roof in leaf shape etc are showing the natural heritage Malaysia. Perhaps the most interesting of all is the artificial rainforest stuck in the a huge glass drum at the middle of the satellite building.

It is a rainforest with its own microclimate that wouldn't pose any hazard to the flight paths. eg. the vegetation planted do not bear any edible fruits that may attract birds. Besides, its hyperbolic paraboloid elements such as conical column and lifelike roofing are apparently in a rainforest scenario.

THE FOREST IN THE AIRPORT

The enclosure for the building is not conventional wall again, it is a geometric steel frame supporting the glass skin that enable a non-obstructed view from the inside of building, thus providing an integration of environment and building.

The Building

AIR TRAFFIC CONTROL TOWER

The 130m high air traffic control tower is one of the tallest of its kind in the world. It looks like a giant torch, but they name it 'the slim lady' as its shape self-explain the name.

MAIN TERMINAL BUILDING

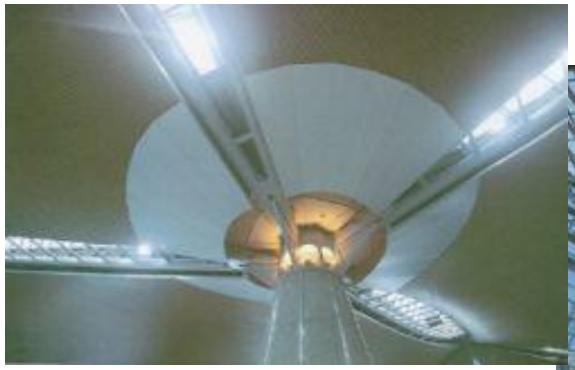
This is the first Main Terminal Building (MTB) if KLIA and eventually there will be two MTBs when the whole project completed on the next century to serves the increasing number of passengers.

It is a five storey building with the main entrance located at the fifth floor. Customs and immigration counters, duty free and retail outlets and restaurants etc. will be housed here.

As mentioned earlier, the design of the MTB is to integrate the environment elements into the building. As you can see on the picture on the left side, the columns are shaped into conical - apparently like the trunk of palm trees. All the columns surface are finish with granite. But the light fittings on the top of the column remind me about the light house, don't forget that light house also is an essential element for a 'port'.

Moreover, the parabolic ceiling in timber finish is somehow shaped like surging waves. It also looks like the leaf of the 'column palms'. The floors are also finish with granite in Islamic geometric pattern.

Compare to these elements, another feature of KLIA might be not so interesting. That is, the ceiling with down lighters placed into it arbitrarily reflecting the myriad of stars in the night sky. However these down lighters only placed on part of the MTB's ceiling



AEROTRAIN

These two aerotrains connecting the MTB to the satellite building. It operating at three to five minute intervals, this two-car 250-passenger capacity train will take passengers from MTB to satellite building or the other way round within two minutes.

THE FACTS

- The KLIA will eventually comprise two main terminals and four satellite buildings. These will have a total capacity of 100 million passengers annually.
- The airport can now cater 25 million passengers annually. By 2020, this is expected to reach 60 million. The annual cargo-handling capacity is presently 650,000 tones. This will be increased to 1.2 million tones.
- The KLIA has 46 aerobridge gates, two state-of-the-art runways and 106 aircraft stands compared to the Sultan Abdul Aziz Shah Airport (former Subang Airport) which has 14 aerobridge and 44 aircraft.
- About 1,300 security television cameras are installed all over the airport.

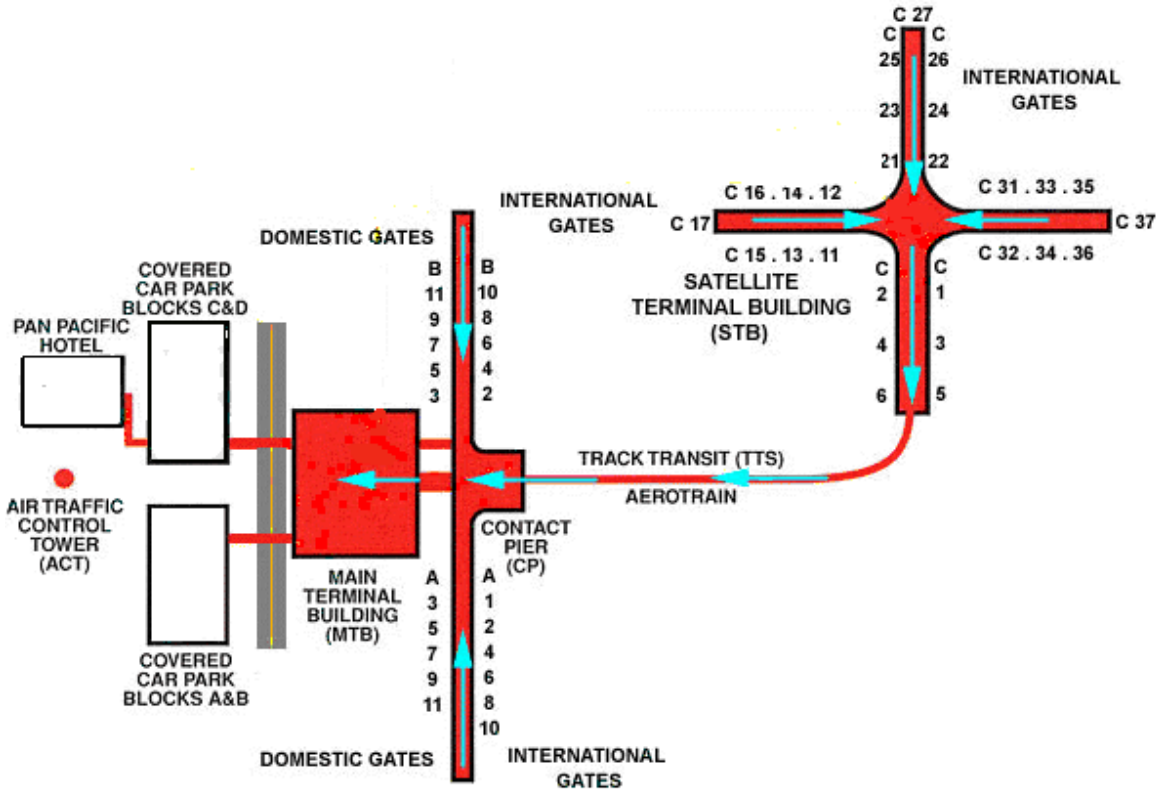
THE FACTS cont'd

- Each of two aerotrains connecting the main terminal to Satellite C for international departures can carry at most 80 people. They are remote controlled.
- The KLIA has 216 international and domestic check-in counters. There are 48 immigration counters for arriving passengers, 61 for departing passengers and 16 for transfer passengers.
- This 'Airport in the Forest' is also a 'Forest in the Airport'. There are more than 100 species of plants including the bougainvillea and manila palm.
- It took 25,00 workers from 50 countries 36 months to build the KLIA at a cost of RM10 billion.

Sponsor	Malaysian Government
Lead Contractor	KLIA Bhd, Malaysia Airports Bhd (MAB)
Contractors	Sapura Poweraid
Employer	KL International Airport Berhad, Malaysia

Contract Value	RM 136.20 million
Contract Period	11 October 1995 – 01 December 1997
Scope of Work	4,000m long runway x60m wide with two parallel taxiways each 45.2m wide

PLAN of KLIA


C 27
C 25
C 26
INTERNATIONAL GATES
23
24
21
22
C 16 . 14 . 12
C 31 . 33 . 35
C 17
C 37
C 15 . 13 . 11
C 32 . 34 . 36
SATELLITE TERMINAL BUILDING (STB)
C 2
C 1
4
3
6
5
INTERNATIONAL GATES
DOMESTIC GATES
B 11 9 7 5 3
B 10 8 6 4 2
COVERED CAR PARK BLOCKS C&D
PAN PACIFIC HOTEL
TRACK TRANSIT (TTS)
AEROTRAIN
AIR TRAFFIC CONTROL TOWER (ACT)
CONTACT PIER (CP)
MAIN TERMINAL BUILDING (MTB)
A 3 5 7 9 11
A 1 2 4 6 8 10
COVERED CAR PARK BLOCKS A&B
DOMESTIC GATES
INTERNATIONAL GATES

Main Terminal Building (MTB)

CONSTRUCTION OF RUNWAY

1. Site Preparation
2. Flexible Pavement
3. Runway Marking

Site Preparation

1. Site Clearance
2. Setting Out
3. Earthworks

Site Clearance

Clearance included the clearing and grubbing works using dozer or rake dozer

SETTING OUT

- It is very important to ensure that the excavation level for runway leve and also it's alignment.
- Normally carried out after the top soil has been removed using the dimensions given on the layout drawings

EARTHWORKS

- Very large scale earthworks
- Removal of topsoil together with any vegetation, scraping and grading the required area down to formation level plus the formation of any cuttings or embankments

Environment of KLIA


THAILAND
SOUTH CHINA SEA
KANGAR
Kuala Perlis
Pulau Langkawi
PERLIS
Kuah
ALOR SETAR
Pulau Payar
KEDAH
KOTA BHARU
Pulau Perhentian
GEORGETOWN
Butterworth
PENANG
Pulau Redang
KUALA TERENGGANU
PERAK
KELANTAN
Pulau Kapas
Rantau Abang
Pulau Tenggol
IPOH
TERENGGANU
Pulau Pangkor
Lumut
Kerteh
PAHANG
Cherating
STRAITS OF MALACCA
KUANTAN
SELANGOR
Pekan
SHAH ALAM
KUALA LUMPUR
Port Klang
Pulau Tioman
Sepang
NEGERI SEMBILAN
SEREMBAN
Pulau Rawa
Pulau Pemanggil
Pulau Aur
Pulau Tinggi
Port Dickson
Mersing
MALACCA
JOHOR
MALACCA
Pulau Besar
Pulau Sibu
Senai
JOHOR BAHRU
Desaru
Tanjung Piai
SINGAPORE
N


Pulau Layang-Layang
SULU SEA
Pulau Banggi
Kudat
Pulau Jambongan
Tunku Abd. Rahman Park
Turtle Islands Park
Pulau Tiga Park
Sandakan
KOTA KINABALU
LABUAN
Keningau
Lahad Datu
SABAH
BRUNEI DARUSSALAM
Miri
Long Seridan
Long Pasia
Semporna
Tawau
Pulau Sipadan
Marudi
Bareo
Bintulu
CELEBES SEA
Mukah
Belaga
Sibu
SARAWAK
Kapit
KUCHING
Bandar Sri Aman
KALIMANTAN (INDONESIA)
CHINA
MYANMAR
LAOS
PHILIPPINES
THAILAND
VIETNAM
CAMBODIA
BRUNEI
MALAYSIA
SINGAPORE
INDONESIA

EARTHWORKS FOR RUNWAY

- Very large scale earthworks were required to produce a platform for two 4km runways, taxiways and aprons, as well as embankments and cutting for 30km of landside roads, nearly all dual carriage way.
- It involves over 100 millions m^3 of excavation and 65 million m^3 of fill. Extensive soft clay and peat deposits required treatment with surcharges and wick drains, of which over 20 million linear metres were used.
- The project comprises 4 x 400m runways with parallel taxiways, on an apron area of 500,000 m^2 and main passenger terminal of over 300000m^2 on a 10km^2 site together with rail link to Kuala Lumpur and access to Malaysia's North-South Expressway.

- Runway means an area, whether or not paved, which is prepared for the take-off or landing run of aircraft

COMPONENTS OF RUNWAY

1. Runway
2. Taxiway
3. Drainage System
4. Approach Light
5. Runway Marking

Runway construction

Components:

a) Runway (Landasan)
b) Drainge system (Sistem saliran)
c) Approach light (Lampu Landasan)
d) Runway marking (Penanda Landasan)

KLIA - RUNWAY

4000m long runway x 60m wide with 2 parallel taxiways each 45.2m wide

Runway

Runway Width	B	60 ft 18 m	60 ft 18 m	75 ft 23 m	100 ft 30 m	150 ft 45 m
Runway Shoulder Width		10 ft 3 m	10 ft 3 m	10 ft 3 m	20 ft 6 m	25 ft 7.5 m

CONSTRUCTION OF RUNWAY

Pavement

4000m long runway x 60m wide with 2 parallel taxiways each 45.2m wide

Rigid Pavement

MATERIAL	THICK	
ACW	50mm	Wearing course/premix
ACB	75mm	
ACB	75mm	
2” Ø DCR	300mm	Crusher run
2” Ø DCR	500mm	
sand	2000mm	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Taxi Way

One of the most important factors in determining and maintaining the operational safety of an airport.

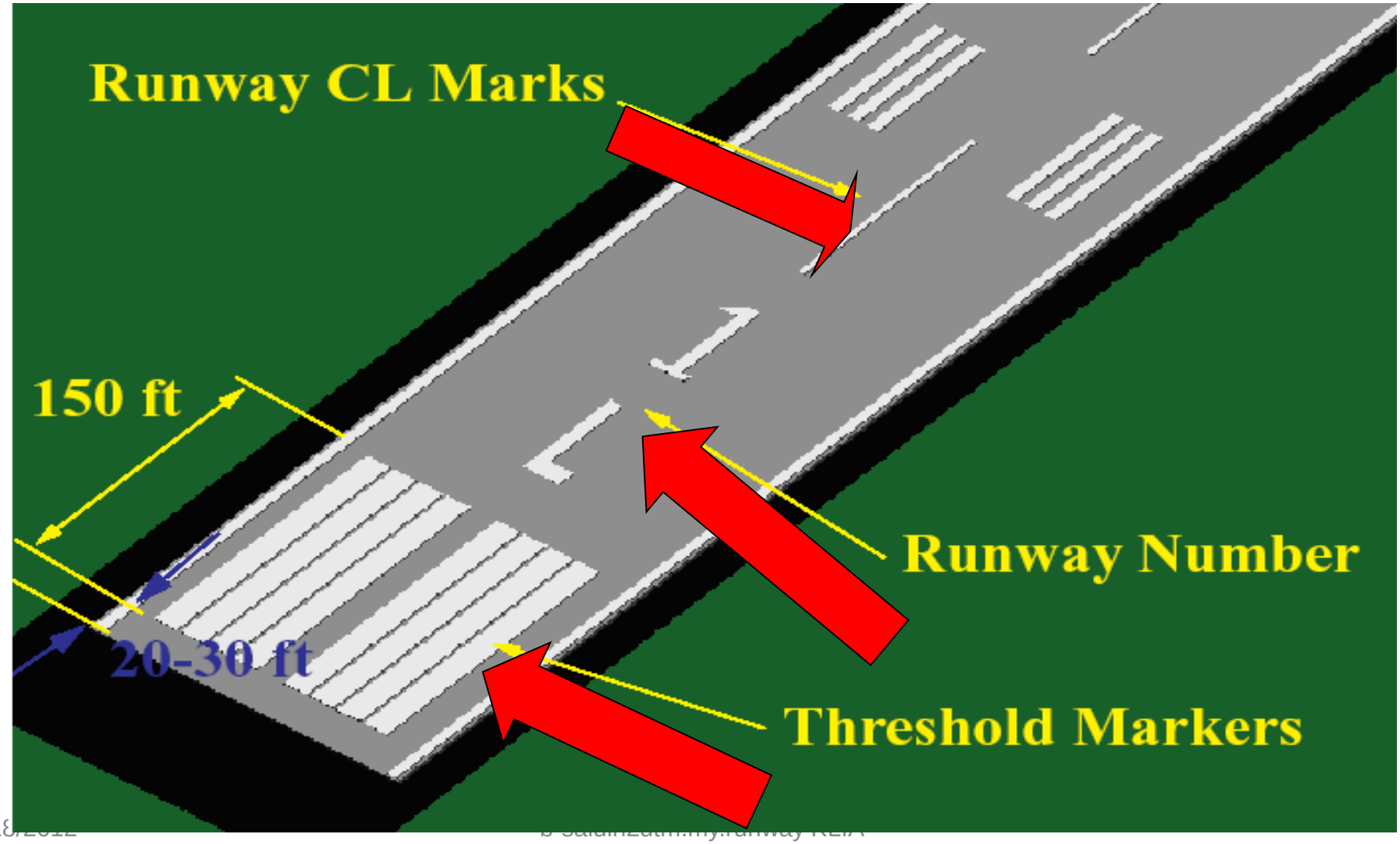
Taxiways are considered critical areas, they should be constructed to the same pavement strengths as the runways they serve.

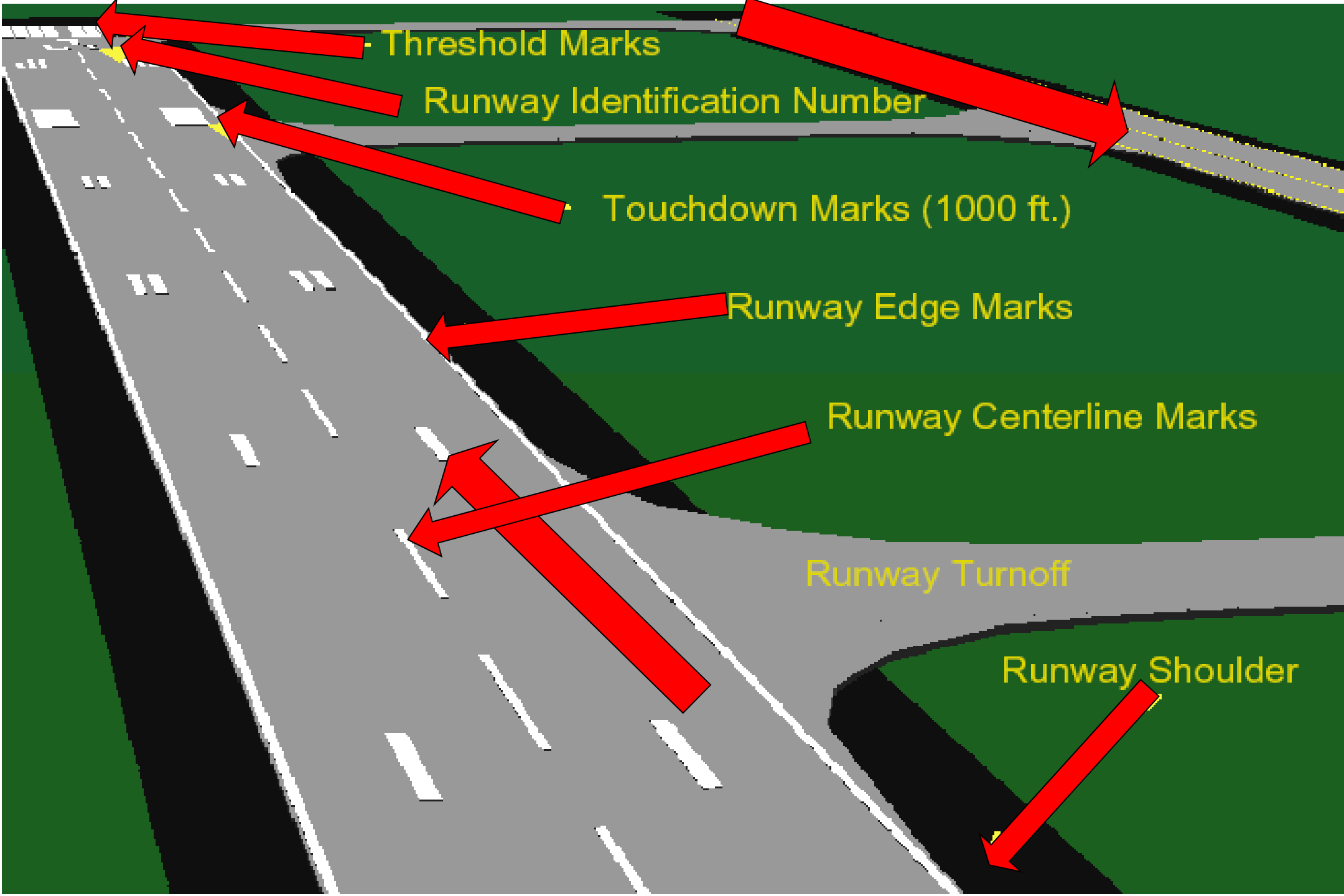
Drainage system

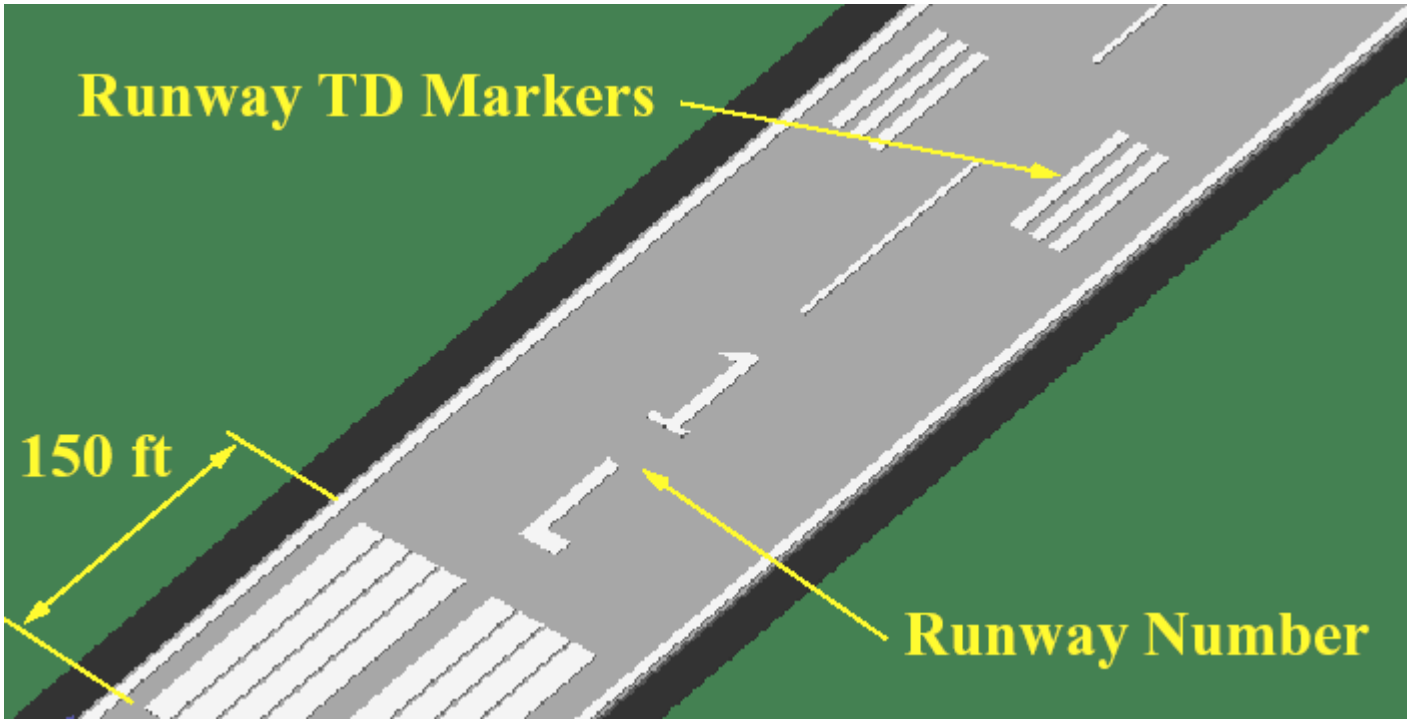
The important system to make ensure that the runway is in dry condition and that is no water gathers on it

4000m long runway x 60m wide with 2 parallel taxiways each 45.2m wide

Runway Marking

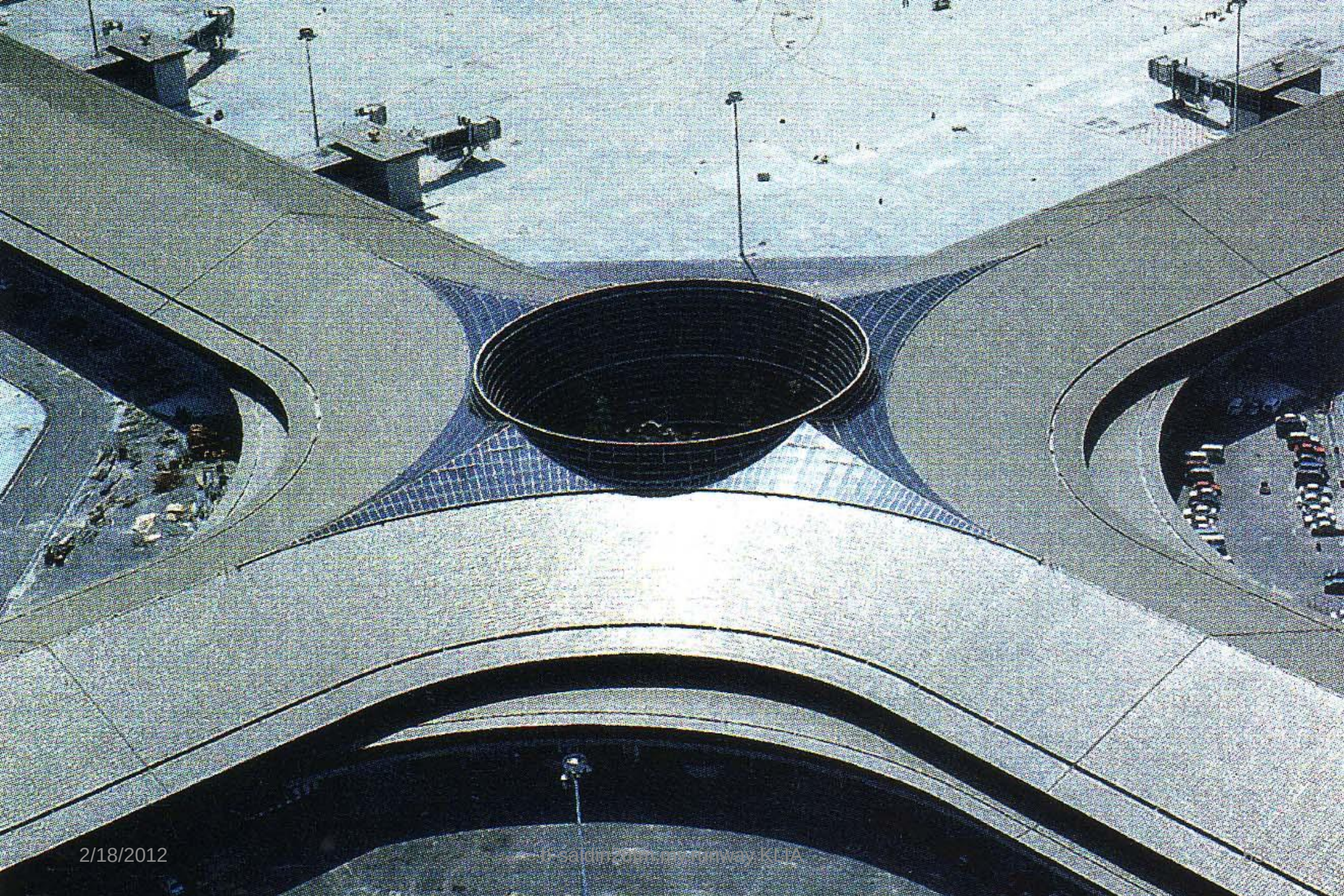



Threshold Marks
Runway Identification Number
Touchdown Marks (1000 ft.)
Runway Edge Marks
Runway Centerline Marks
Runway Turnoff
Runway Shoulder

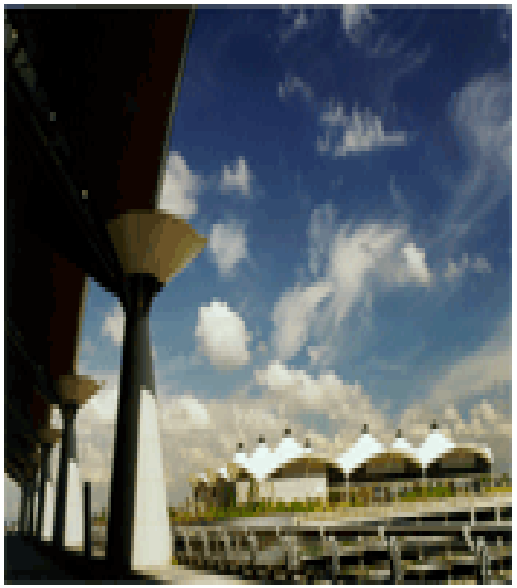

Runway TD Markers
150 ft
Runway Number


'Taxiway'.
13 6 '02

’Taxiway'.




Keluar
Exit



SATELITE 'A' BUILDING

- Three main levels with a total floor area of 144,000 square metres and serve as the international arrival and departure terminal of the KLIA.

- At the height of cubic metre per day and 1000 tonnes of structural steel erected per month. The project was completed within the stipulated period of 30.5 months, in time.

CONTROL TOWER

CONTROL TOWER

Gondola curtain wall cladding, sandwich panels, glazed panels, glazing & louvres are found used in the construction of the control tower

THE BUILDING OF CONTACT PIER

BEFORE

AFTER

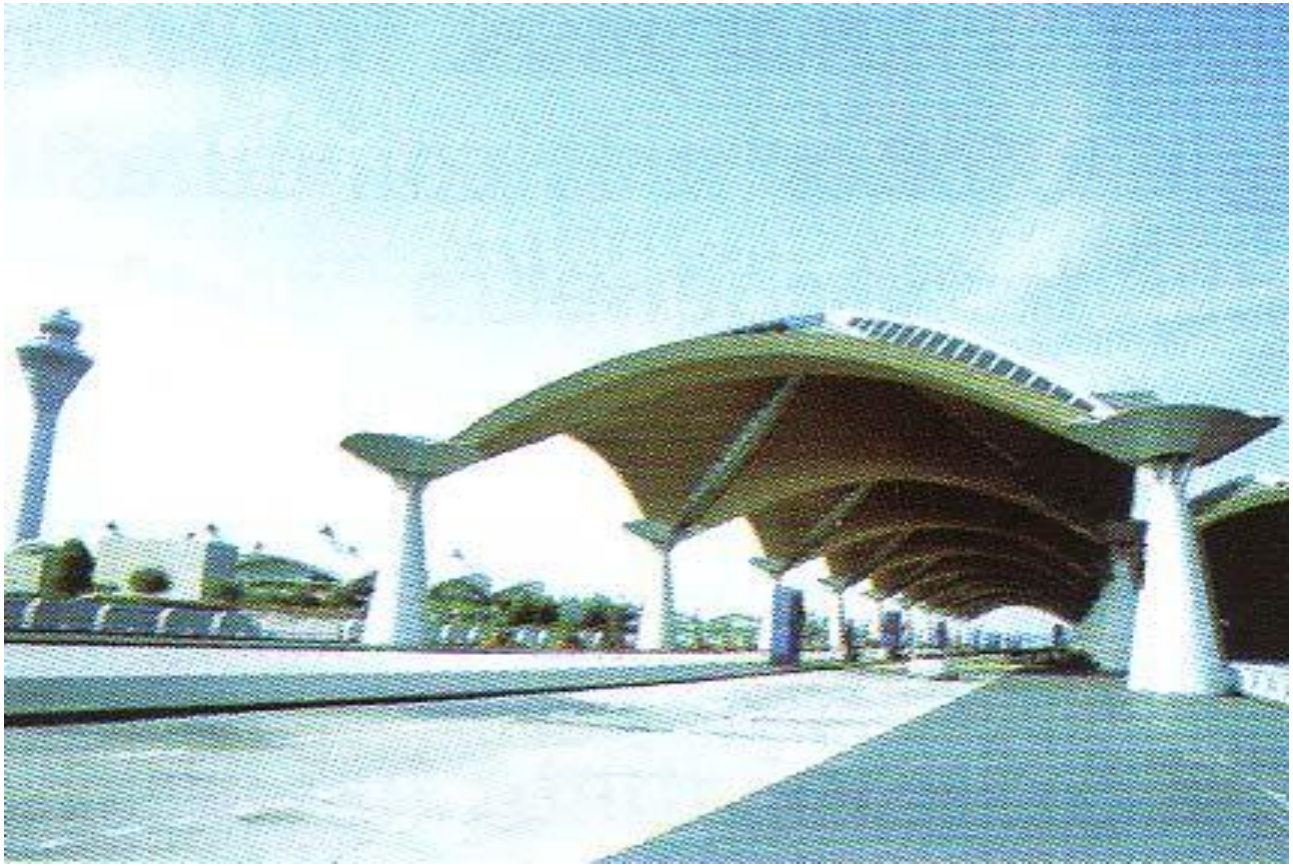
- Two-armed contact pier is attached to the Main Terminal Building

AEROTRAIN

- A track transit system
- Shuttle passengers between the Satelite Building and the Main Terminal Building in under 2 minutes
- Starting on an elevated track from the Contact Pier, the Aerotrain will travel under the taxiways into the Satelite Building within 2 minutes

KOMPLEKS BUNGA RAYA

- Stainless steel standing seam acoustic roof cladding system

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TAX FREE

APRON CONTROL TOWER

- Design and Build VCR (cladding, glazing, ceiling, floor, escape system, synthetic roofing)

THANK YOU