ITS of SMART
(Storm Management And Road Tunnel)

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Overview

• The dual-purpose SMART tunnel is able to solve 2 main problems in Kuala Lumpur

  a) Resolves the flood problem in the city and other flood prone areas, and

  b) Eases traffic congestion on the main southern gateway to the city at Sg. Besi airfield
Overview

- 3 km in the central portion of 9.7 km tunnel is for dual purposes
- About 6 km motorway tunnel

- Unidirectional traffic flow - reduce accident risk
- 2 traffic lanes and 1 emergency lane – expedite emergency response
- Vehicle restriction - light vehicle only, < 2.0m height
3 Modes of Operation
DUAL-PURPOSE USAGE OF SMART

MODE I: NO STORMS

MODE II: MOST STORMS - 7 TO 10 TIMES

MODE III: MAJOR STORMS - ANNUAL EVENTS (OCT '01)
Stormwater Components
Flood Detection System:
Catchment Monitoring & Warning System

- Rainfall Gauging Stations
- Water Level Gauging Stations
- River Flow Monitoring
- Warning Stations
- Remote Terminal Unit
- Radio Telemetry
- Repeater Stations
- Radar System (future)
Flood Detection System:
Weather Stations layout
Flood Gates: North Junction Box / South Junction Box
Road Gates: North Junction Box / South Junction Box

- Prevention of vehicles entry during storm events
- Prevention of flood discharge entering to the ingress/egress connection
Motorway Components
Typical Tunnel Section

- Heat Detection
- Tunnel Lighting
- Hydrant and etc.
- Leaky Feeder Cable for Radio and Cellular
- CCTV
- Lane Traffic Signal
- Gas Analyzer
Tunnel Ventilation (Upper Deck)
Tunnel Ventilation (Lower Deck)
Tunnel Lighting

- To provide continuity in visual performance for motorists entering and travelling through road tunnel.

- IP 68 enclosure and subjected to 2.5 Bar water pressure and bracket design shall withstand 5.5 m/s flow.

<table>
<thead>
<tr>
<th>Traffic Direction</th>
<th>Th Zone</th>
<th>Tr1 Zone</th>
<th>Tr2 Zone</th>
<th>Tr3 Zone</th>
<th>Interior Zone</th>
<th>Exit Zone</th>
</tr>
</thead>
</table>

Th - Threshold Zone
Tr1 - Transition Zone 1
Tr2 - Transition Zone 2
Tr3 - Transition Zone 3
Tunnel Heat Detection System

- The system will respond to the rate of temperature rise, about 10 seconds.

- Programmable fire zones

- Triggering CCTV system and Fire Alarm System during the case of tunnel fire.
Tunnel Fire Protection: Emergency Points And Equipment

- Hose Reel, Fire Extinguishers, Breakglass and Emergency Telephone are located at each cross passages, ventilation shafts and escape shafts.

- Hydrants & Fire Extinguisher are installed along the tunnel

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**Hydrant & Fire Extinguisher**

**Hose Reel, Fire Extinguisher, Break Glass & Emergency Telephone**
Tunnel Radio Communication and Cellular System

• Re-broadcast FM radios, cellular (telco), fire department, police and ambulance signal signal into the tunnel.

• Audio break-in facility to broadcast emergency messages from the control center into the tunnel through FM frequencies.

• IP 68 antenna installed to enable the use of mobile phones.

• Public Address and emergency phone are provided in the cross passages and escape shafts.
CCTV

- **Tunnel Surveillance**
  - PTZ CCTV at selected locations
  - Fixed CCTV along the tunnel
  - Linked to Fire Detection System
  - Linked to Control Center via Fiber Optic Cable

- **Automatic Incident Detection**
  - Measurement of traffic flow speed, occupancy count
  - Detection of speed drop, stop vehicles, inverse direction and smoke
Tunnel Monitoring & Control System (TMCS)

Traffic Management & Control System (TMCS)

- Electrical Distribution System Monitoring
- Tunnel Lighting Control and Monitoring
- Ventilation System Control and Monitoring
- Fire Protection System Monitoring
- Emergency Telephone System Monitoring
- Emergency Response Plan
- Automatic Incident Detection
- Alarm logging

Fully Integrated Traffic Management and Control System

- Fire Alarm
- Tunnel Lights
- Vent. Sys.
- CCTV
- Emer. Tel.
- Lane Sign
- Pump
- Gates
- FDS (JPS)

Operations Interface
- Emergency Services
- Public Information Internet (future)

Toll Collection
Event 1

Tunnel Closure from Mode 2 to Mode 3

- FDS: Regulate Diversion Weir
- Toll Booth Operator / Patrolman
  - VMS
  - Radio
  - AID
  - CCTV
  - SCADA
  - Patrolman
- TMCS
- Traffic Diversion
- Water flow into Tunnel
- Open Flood Gate
- Close Road Gate
- Broadcasting
- Estimate Quantity of Vehicle
- Monitor Evacuation
- Off Road Drainage Pump / Ventilation
- Check XP Water Tight Door
Event 2

Traffic Accident

- LHD
- CCTV / AID
- VMS → Alert Motorist
- Radio → Broadcasting
- Patrolman → Traffic Diversion
- AQME → Ventilation
- PA at XP → Communication
Event 3

Fire Accident

- AQME
  - LHD
  - CCTV

- Radio
- SCADA
- Toll Booth
- Patrolman

- VMS → Alert Motorist
- VMS → Broadcasting
- VMS → Ventilation / Lighting
- VMS → Close
- VMS → Traffic Diversion
EVENT 3: Fire Accident
Cross Passage and Emergency Escape

- Cross passages linking both tunnel road decks with stairs spaced approximately 250m intervals.
- Shaft Buildings at approximately 1km apart with stairs and lifts connecting the two road decks to the surface.
EVENT 3: Fire Accident
Ventilation System
EVENT 3: Fire Accident
Cross Passage and Emergency Escape
THANK YOU
Terima Kasih

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