

Kuala Lumpur is the capital city of Malaysia and has a city population of 1.5 million and a metropolitan population of 4, 450,000 people<sup>1</sup>. The city is located inland, at the confluence of Klang and Gombak River on the Malay Peninsula in Southeast Asia. It also enjoys an equatorial climate which is warm and sunny, along with plentiful rainfall, especially during the southwest monsoon from September to April. During the monsoon heavy and persistent tropical downpours create a situation for dangerous flash floods.

Kuala Lumpur has a population density of 19,135 people per square mile. This is similar to other cities in Asia such as Hong Kong (16,073/sq mi) and Singapore (16,604/sq mi). However, even with this relatively high population density, the transit usage in the city is fairly low. Only 16% of residents use the mass transit network in the city<sup>2</sup> (Compared to Hong Kong's 87%<sup>3</sup> and over 60% of Singapore's population<sup>4</sup>); which consist of light rail, monorail, heavy rail commuter rail and bus. This is low compared to other cities in the region and world with same or higher population densities, meaning that a lot of people here are driving cars. This brings about serious congestion.

**Figure 1**



<sup>1</sup> <http://www.citypopulation.de/World.html>

<sup>2</sup> [http://en.wikipedia.org/wiki/Kuala\\_Lumpur](http://en.wikipedia.org/wiki/Kuala_Lumpur)

<sup>3</sup> <http://answers.google.com/answers/threadview?id=784708>

<sup>4</sup> [http://en.wikipedia.org/wiki/Mass\\_Rapid\\_Transit\\_%28Singapore%29](http://en.wikipedia.org/wiki/Mass_Rapid_Transit_%28Singapore%29)

To combat flash floods and traffic congestion in the city center the Malaysian government developed the SMART Tunnel. The SMART Tunnel (Stormwater Management and Road Tunnel), is a storm drainage and limited access highway combination tunnel and is a major national project. It is the longest stormwater tunnel in South East Asia, second longest in Asia (3.968 km/2.46 mi) and is the world's first dual use tunnel. SMART is primarily a stormwater mitigation project to curb flooding in the city center. The project has a secondary purpose which is to act as an alternative traffic bypass system between the southern suburbs and the city center. The tunnel cost 2.1 billion Ringgits. The lower section of the tunnel is used for storm water runoff during typical monsoonal downpours and two highway decks sit above the lower section<sup>5</sup>. Construction of the tunnel began in 2003. The two automobile decks of SMART were officially opened on, May 14, 2007, after many delays. Meanwhile, the stormwater sections on the SMART system began operations at the end of June 2007.

### **Tunnel Modes**<sup>6</sup>

- First mode (No storms)
  - The first mode, under normal conditions where there is no storm or low rainfall, no flood water will be brought into the tunnel.

**Figure 2**



<sup>5</sup> See Figure 1

<sup>6</sup> [http://www.smarttunnel.com.my/project\\_smart.htm](http://www.smarttunnel.com.my/project_smart.htm)

- Second mode (Most storms)
  - When the second mode is activated, flood water is diverted into the bypass tunnel in the lower level of the auto tunnel and it is important to note, that in modes 1 and 2, the auto decks are still open to traffic.

Figure 2



- Third mode (Major storms)
  - At the third mode of operation auto decks are closed to traffic. The tunnel is monitored extensively. There will be sufficient time to allow the last vehicle to exit the tunnel before the automated flood gates are opened to allow water to pass through. The auto decks will be reopened to traffic within 48 hours after the closure after cleaning and inspection.



## **Pros of SMART**

With the opening of the tunnel travel times from the southern gateway to the city center have been reduced dramatically. What used to be trip that would take 10 – 15 minutes now takes a mere 4 minutes. This not only reduces the travel time but for the time being will help relieve congestion which helps reduce air pollution.

Also, much of the area where the tunnel was built was prone to flooding due to it being at the confluence of the Klang and Gombak rivers. The flood waters that used to go directly into these rivers will now be held in a holding pond. From the holding pond the water will be diverted to the SMART Tunnel and then on to one of the city's reservoirs. This will prevent spillover and flash flooding reducing flood events in Kuala Lumpur by 90%<sup>7</sup>. The tunnel will be able to move 9 million cubic meters of water.

## **Cons of SMART**

Some critics say that the 2.1 billion RM price<sup>8</sup> of the tunnel was far too expensive for its benefits. The biggest problem seems to be one with the desiltation. Desiltation is the process of removing mud and other debris from an area that has flooded. For instance, during a major rain event, the SMART Tunnel will be filled with the flood waters along with mud and debris picked up from the run off. After the rain has passed and the water has been channeled to the reservoir mud and debris that weren't carried away will be left in the tunnel. The process to clean the mess up takes a considerable amount of time and many believe that the desalination process was not tested and planned thoroughly<sup>9</sup>. Currently the government is estimating 48 hours reopening time after the last car passes through before a closure.

Also with the increased road capacity will traffic in turn worsen? Induced congestion is when capacity is added to a freeway and essentially invites more people to drive. When more people begin to drive the freeway will once again

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<sup>7</sup> <http://www.skyscrapercity.com/showthread.php?t=312375&page=4>

<sup>8</sup> Tunnel 'will ensure' KL is flood free, David Yeow and Azira Shaharuddin

<sup>9</sup> <http://mindacergas.wordpress.com/2007/06/28/not-so-smart-tunnel/>

become overloaded and congested. This also discourages people from using the already underutilized yet comprehensive mass transit system.

Also, as chemicals that the stormwater pick up from not only the streets above but the oil and dirt from the tunnel itself bring about other environmental concerns, such as water contamination at the reservoir? There doesn't appear to be any plans for wetlands or other natural water treatment in the reservoir.

In all, the SMART project is an incredibly innovative project in which limited resources such as land and money are used to combat to major issues such as flooding and congestion. Designs such as this are expensive but allow governments to kill two birds with one stone. However, by cutting down on travel times for motorists will this encourage more people to drive and not use the underutilized but comprehensive transit system? Finally, will the 48 hour desiltation time be enough? All of these questions must be answered to see if the benefits from this project outweigh the cost.