

## **Tunnelling to Save The Environment – Case Study on Penchala Link**

*This paper was originally presented at the IEM Seminar on 1<sup>st</sup> and 2<sup>nd</sup> October 2003 entitled Transportation and the Environment*

### **Introduction**

The Western Kuala Lumpur Dispersal Scheme (WKLTDs, 26 km) will provide an orbital route between MRR I and MRR II through a comprehensive package upgrading the road network in the rapidly growing areas west of the city centre (an estimate of 80,000 residential units are forecast over the next 10 years). The scheme is shown in Figure 1. The aim of the project is to improve accessibility to new developments in the future, as well as addressing existing problems of congestion and environmental impact in the area. The scheme is focused on the need to cater for both radial and orbital movements and is intended to complement existing and proposed roads.

The WKLTDs has three main components namely :

- creation of a new orbital route located between the Middle Ring Road I and the Middle Ring Road II; ( Kerinchi Link – completed in June 2001)
- construction of a new radial link connecting new townships in the north west of KL through to the city centre: (Penchala Link – under construction) and
- improvement of the existing radial link of Jalan Damansara / Jalan Semantan ( Damansara Link – completed in June 2001)

Penchala Link is the final phase of WKLTDs and connects Lebuhraya Damansara – Puchong (LDP) at Kg. Sg. Penchala, to Kerinchi Link via an interchange at Mont Kiara. This is also the shortest link at 5.5 km although it is strategically important to the overall scheme. Situated below a heavily forested area, approximately at the mid-point, is the 720m long twin-bored Penchala Tunnel.

The purpose of this paper is to highlight the environmental benefits a tunnel option for this link provides when compared to an equivalent cutting type option. It must be stressed that a considerable number of options, and variants on these, were considered during the evaluation and early planning stages. However, for the purposes of simplicity, comparisons here will be restricted to the actual tunnel solution, which is presently nearing completion, with one particular conventional 'cutting solution' which is reasonably representative of all the various cutting options.

### **Environmental benefits of WKLTDs as a whole**

Before looking at the environmental benefits associated with the 'tunnelling solution' as opposed to the 'cutting solution' for Penchala Link it is worthwhile to describe the benefits that the WKLTDs Scheme as a whole, and package 'C' in particular, contribute to the Kuala Lumpur environs:-

Referring to Figure 1, it can be seen that the ring roads are not concentric with central Kuala Lumpur at the centre, rather they are centred to the West of KL, hence the dispersal distances are significantly greater on the Western side. This demonstrates the motivation behind constructing WKLTDs, relieving congestion between the Outer and Middle Ring Road Systems, to the West of the city. The strategic importance of the final link, Package 'C' can also be seen.

Relieving congestion = reduction in journey times, less jams so less pollution and less stress!

WKLTD Package 'C', the 5.5km Penchala Link results in a reduction in the journey from West KL (Sri Damansara) to central KL by 10km – 20 minutes. A tangible benefit in terms of reduced fuel consumption and emissions.

It is worthwhile to note that such schemes often have the affect of moving the point of congestion closer to the centre (in the mornings) so it is important that such schemes are fully supported by upgrading associated and surrounding infrastructure to derive their full benefit.

### **Selection of Alignment for Penchala Link - Tunnel versus Cutting Solutions**

Various alignment options were studied for the link between LDP and Kerinchi link. In simplistic terms the selection process whittled these options down to two:-

#### **Tunnel Solution**

[Figure 2 depicts the tunnel solution actually constructed]

This selected alignment with a total length of 5.5km consists of 3 interchanges, i.e. Penchala Interchange, TTDI Interchange and Mont Kiara Interchange.

The alignment was carefully selected and fine-tuned to minimise disturbance to existing residential properties and the existing environment.

The proposed 720m tunnel is located beneath Bukit Kiara hill between TTDI and Mont Kiara Interchanges. The entrances to, and exits from, the tunnel were carefully studied to minimise cutting. This tunnel will be the first twin cell, three lanes tunnel in Malaysia.

A 16 span bridge is also being constructed at TTDI Interchange. This large structure was selected ahead of conventional and less expensive options because it enabled the volume of filling to be minimised, there is less inconvenience to existing houses and the aesthetics of the Interchange are enhanced.

#### **Cutting Solution**

An alternative to the tunnelling solution, entailing a considerable length of highway in a deep cutting through a densely forested area is depicted in Figure 3]. This typifies the 'cutting solution' options and is quite similar to the cutting/pass only a kilometer further to the North on the NKVE.

This alternative alignment runs along the existing road of Jalan Kg. Penchala and cuts through the hilly area on the northern side of Bukit Kiara hill and finally connects to Mont Kiara Interchange. As this alignment follows the existing Jalan Sungai Penchala, a large number of properties would be affected (estimated 350 houses) compared to only in the order of 30 houses affected by adopting the "Tunnel option".

Service roads are also required along both sides of this alignment to allow access to all the adjacent property lots. This would give rise to increased land acquisition and would create further social problems during the implementation stage.

This option was evaluated with the view of upgrading the existing Jalan Kg Penchala and connecting it to Mont Kiara Interchange.

The total length for this alternative alignment is approximately 6.1km

#### **Reasons for Selection :**

During the selection process many issues were considered, the 'tunnel solution' was preferable for the following reasons:-

a. **Reduction in length of alignment.**

The selected alignment for the tunnel solution results in an overall reduction in length of the link of 0.6 km compared to the cutting option.

Reduction in the overall required length to connect the two locations equates to a reduction in journey time and pollution from vehicle emissions.

b. **Tunnelling to save the environment**

The tunnel option provides an effective way to connect two locations separated by a hill. The obvious alternative of cutting through the hill will give rise to the following adverse environmental impacts:-

1. Natural jungle with mature tree will be destroyed
2. Fauna & Flora will be disturbed
3. Migratory routes will be cut
4. Erosion problems will arise during construction
5. Siltation of rivers due to erosion from cutting slopes
6. Loss of recreation area (jungle track) a popular jogging route.
7. Increase of runoff due to change of surface runoff coefficient.
8. Groundwater regime will be altered
9. Siltation and increase of runoff will increase the potential for flash floods
10. Increased disturbance during construction from vehicle movements, open blasting etc.
11. Contribute to warmer world climate

Considerable benefits to the environment by opting for the tunnelling solution:-

The loss of primary jungle required for the 'cutting' would have been 20 times that required for the tunnel so the impact in terms of the loss of natural resources and habitats would have been immense.

Half a million tonnes of rock have been excavated, by controlled blasting, to form the tunnels and its approaches. The cutting solution would have required the removal of 5.6 times this, 2.8 million tonnes of granite rock. The increases in the consumption of explosives and environmental pollution (noise, dust etc.) during construction are significant let alone the loss of a valuable natural resource. Additionally, all the rock obtained from the tunnel was recycled and used in the construction of the road pavements and the concrete tunnel lining. The 'cut and fill equation' resulted in no net loss or gain of fill, so disposal of unsuitable, or unwanted materials, was kept to minimum. An excellent example of balancing development with the environment. The rock excavated for the cutting solution would have been more weathered and far less suitable, the unsuitable and surplus material would have to be disposed of creating an adverse environmental impact in itself.

Operationally, increased gradients to the cutting approaches would lead to increased exhaust, noise and light (a new but real concept to consider environmentally) emissions and higher fuel consumption together with associated environmental costs from alighting the cutting in terms of increase brake wear and fuel consumption.

The alignment of existing watercourses has been maintained.

The reduced construction time for the tunnelling solution is a benefit environmentally equating to less dust, less noise and less siltation.

**c. Land Acquisition**

The tunnel solution is beneficial to the Promoter in terms of reduced land acquisition although the construction costs and risks are much greater with the tunnel solution. Usable land is very limited in the urban area. In order to minimise as much as possible the land acquisition area for the highway, a tunnel is the best option compared to an open cut slope.

Reduction in land acquisition will mean a reduction in social problems. The social issue / problem is inevitable during the acquisition process. Many properties would have to be acquired and owners relocated and compensated.

**Conclusions**

Gamuda/SPRINT took the decision to construct Penchala Tunnel, rather than Penchala Pass, for a variety of reasons, not least of which were the various commercial considerations. However, based purely upon environmental factors, the tunneling solution would have been selected ahead of all other alternatives, this was a factor which was not lost during the selection process.

The tunnelling solution is neat, discrete and far less obtrusive than the equivalent cutting solution.