

**17 November 2009**

**Legislative Council Panel on Transport  
Subcommittee on Matters Relating to Railways**

**Airport Railway Capacity**

**Introduction**

1. Suggestions have been made that the proposed terminus of the Express Rail Link should be located at Kam Sheung Road, rather than at West Kowloon and that an extension of the Airport Express from Tsing Yi be constructed and operated as a bifurcated service, serving both HK Airport and the alternative location for the Express Rail Link terminus. This report assesses whether the Airport Express can accommodate such a bifurcated service.

**Airport Railway Signalling Design**

2. The Airport Railway comprises two interleaved train services, the Airport Express and the Tung Chung Line. These services share common tracks at two critical sections; the harbour crossing between Hong Kong and Kowloon stations, and the section from Tsing Yi station across the Tsing Ma and Kap Shui Mun bridges. These two sections of the alignment constrain the maximum capacity of the Airport Express and the Tung Chung Line.

3. The signalling system controls the movement of trains and is designed as a safety critical system to ensure safe separation between trains at all times. The original objective for the design of the signalling system for the Airport Railway, taking the above track configuration into account, was for a maximum signalled capacity of one Airport Express train every 4.5 minutes and one Tung Chung Line train every 2.25 minutes, equivalent to 39 trains per hour at the critical section between

Hong Kong and Kowloon stations, using the following service pattern (Pattern A):

Tung Chung Line – to Tung Chung  
Airport Express – to Airport  
Tung Chung Line – to Tsing Yi  
repeat

The full service was envisaged between Hong Kong and Tsing Yi and the constraint imposed by the Tsing Ma bridge (only 1 train on each track at any time) accommodated by running alternate Tung Chung Line trains from Hong Kong to Tsing Yi only.

4. During the 11 years of operation since opening of the Airport Railway the service pattern has been changed to increase the train service to Tung Chung. A revised service pattern is now being operated which allows 2 out of 4 trains in the cycle to serve Tung Chung (Pattern B), instead of the original 1 out of 3, i.e.:

Tung Chung Line - to Tung Chung  
Airport Express – to Airport  
Tung Chung Line – to Tung Chung  
Tung Chung Line – to Tsing Yi  
repeat

The total train throughput of Pattern B is less than Pattern A due to the slower average speed of the Tung Chung Line trains caused by the additional stops and the revised interleaving arrangements at the sections of shared tracks. The maximum signalled capacity of this pattern, at the constraint between Hong Kong and Kowloon stations, is 36 trains per hour.

### **Operational Capacities**

5. All railways operate at less than their maximum signalled capacities on a sustained basis due to the inevitable interruptions arising from unpredicted passenger behaviour and

minor technical issues associated with the complex equipment. The Airport Railway comprises a mixed fleet of Airport Express and Tung Chung Line trains running on shared tracks at some locations and this introduces further complexity, taking into account such factors as the Airport Express In-Town-Check-In baggage loading operation at Hong Kong and Kowloon stations and the heavy boarding and alighting demand at Hong Kong station for the Tung Chung Line.

6. Since commencement of operations in 1998 a number of new stations have been added to the Airport Railway which were not envisaged in the original design. These are the Asia World Expo station on the Airport Express, the station at Sunny Bay serving the Disneyland Resort Line and the busy Tung Chung Line and West Rail interchange at Nam Cheong station, all of which create additional problems when the Airport Express and Tung Chung Line services need to interleave at the shared sections of track.

7. Maximum practical operational capacities are generally set in the range of 75% to 90% of the signalled capacity depending on the nature of the railway. The recommended figure by the UIC (International Union of Railways - the worldwide association of railway operators) for a mixed railway such as the Airport Railway is 75%. MTR Corporation Ltd also considers that the appropriate operating margin for the Airport Railway should be of this order, and this gives maximum practical operational capacities of 33 trains per hour for Pattern A and 32 trains per hour for Pattern B.

### **Current Airport Railway Service**

8. The current service operated on the Airport Railway using Pattern B is as follows:

Tung Chung Line – 5 trains per hour to Tung Chung  
Airport Express – 5 trains per hour to Airport  
Tung Chung Line – 5 trains per hour to Tung Chung

Tung Chung Line - 5 trains per hour to Tsing Yi  
repeat

9. The maximum practical operational capacity of this pattern, taking into account the operating margin explained above, i.e. 32 trains per hour for Pattern B, is:

Tung Chung Line – 8 trains per hour to Tung Chung  
Airport Express – 8 trains per hour to Airport  
Tung Chung Line – 8 trains per hour to Tung Chung  
Tung Chung Line - 8 trains per hour to Tsing Yi  
repeat

### **Future Growth**

10. In 2008 the passenger throughput of the HK Airport was 48.6 million passengers. This is expected to increase to around 70 million passengers by 2020, with further growth in the longer term. An increase in the Airport Express service from 5 trains per hour at present, to the maximum practical operational capacity of 8 trains per hour in the longer term, together with an expansion of the Airport Express trains from 7 passenger cars to 9 passenger cars will be necessary to accommodate this growth. The proposed Airport Rail Link between the HK Airport, Qianhai and Shenzhen Airport (now called the Western Express Line) may also increase the demand on the Airport Express although no decisions have yet been made on this proposed link.

11. Similarly, growth in demand for the Tung Chung Line is also expected. Apart from population growth at Tung Chung, further increases in demand will come from strategic development initiatives. With the completion of the HK-Macao-Zhuhai Bridge, additional vehicle traffic will be created, which in the longer term may require additional road infrastructure within Hong Kong. As much as can be practically achieved, onward passenger trips into Hong Kong should be by rail and therefore a connection from the Tung Chung Line to the HK Boundary Crossing Facilities of the Bridge needs to be

considered and capacity on the Tung Chung Line reserved for this purpose. If in the longer term the North Island Line proceeds, it will also have an impact on the Tung Chung Line demand due to the improved connectivity brought about by the extension of the Tung Chung Line beyond Hong Kong station towards the east. When this growth does materialise, it will be necessary to increase Tung Chung Line services from the current 15 trains per hour to 23 trains per hour, i.e. 15 trains per hour from Hong Kong station to Tung Chung and 8 trains per hour to Tsing Yi station. The remaining spare capacity on the Tung Chung Line is 1 train per hour, which would not be sufficient to create additional train paths for a reasonable Airport Express service to the proposed alternative location for the Express Rail Link terminus at Kam Sheung Road.

### **Other Issues**

12. At Hong Kong Station the Airport Express has been operating on a temporary basis using a single combined arrival and departure platform. This limits the capacity of the Airport Railway to a maximum of 6 Airport Express trains per hour and up to 20 Tung Chung Line trains per hour. In addition the length of the Airport Express trains cannot be increased above the current 7 passenger cars and 1 baggage car. There is provision for a second Airport Express platform at Hong Kong Station. The use of this platform however requires the reclamation to the east of Hong Kong station to be completed as well as the extended Airport Express and Tung Chung Line turnback tunnels within this reclamation. Once this reclamation and additional tunnels are completed, the Airport Railway capacity can be expanded up to the maximum practical operational capacity stated in paragraph 9 above, and also the length of the Airport Express trains can be increased to the maximum of 9 passenger cars and 1 baggage car.

13. Other measures to improve the capacity of the Airport Railway have previously been considered. The major constraint for the Airport Railway is the two-track cross harbour section between Hong Kong and Kowloon stations. It is considered to be

not feasible to expand this to four-track. To do so would require partial demolition of the IFC development, some of the piers on the Central waterfront and some of the Kowloon station development. Land in the area of the future WKCD would be occupied for an extended period. The Western Harbour Road tunnel may also be affected. The risk of the construction works affecting the service on the existing Airport Railway would also be high. This expansion is considered to be impractical.

14. Further suggestions have been made that the bifurcated service could be provided by splitting Airport Express trains at Tsing Yi with one part of the train bifurcating to Kam Sheung Road and the other part continuing to HK Airport. This practice has been adopted overseas for lightly loaded lines in rural areas but is not practical for intensive services in an urban environment. Modern trains such as the Airport Express trains are permanently coupled together and can not be separated. Even if new trains were purchased with additional cabs, control systems, etc, the time needed to separate or join trains and wait for the necessary time slots would be in the order of 3-5 minutes and would block traffic on the Airport Express Line for this period. The maximum length of trains able to proceed to the Airport would be reduced in proportion to the split of the trains at Tsing Yi, with a corresponding reduction in Airport Express capacity to the HK Airport. This idea would also create problems with passenger understanding and railway safety.

## **Conclusion**

15. The explanation given above shows that the Airport Railway does not have adequate capacity to accommodate an extension from Tsing Yi to the proposed alternative location for the Express Rail Link at Kan Sheung Road, and still meet the need for future growth at the HK Airport and on Lantau.

**MTR Corporation Limited**  
**November 2009**