INFORMATION NOTE No. 16
IMPACT OF TECHNOLOGY ADVANCEMENT ON TRANSPORT SYSTEM

INTRODUCTION

1. The purpose of this Paper is to examine the impact of technology advancement that could be brought about by the applications of Information Technology (IT), Intelligent Transport Systems (ITS) and Transport Information System (TIS) on the travel demand of Hong Kong and their assumptions in the reference scenario transport demand assessment.

BACKGROUND

2. In considering technology advancement, IT, ITS and TIS are represented under three different tiers as far as transport system is concerned. As illustrated in Figure 1, ITS falls under the umbrella of the broad term IT while TIS is one of the many sub-systems of ITS.

3. Information Technology (IT) refers to the deployment of advanced information and telecommunication technologies in different public and private sectors. Public sector includes government agencies. Private sector includes telecommunication, transportation, banking, finance, insurance, hotel, engineering and other businesses using electronic business and electronic commerce. In addition, personal computer usage of Internet and Web site can also be related to IT.

4. Intelligent Transport Systems (ITS) refer to the deployment of advanced information and telecommunication technologies to enhance the safety, efficiency, reliability and user and environmental friendliness of the transport system.

5. Transport Information System (TIS) refers to a central data warehouse keeping comprehensive traffic and transport related information. This information could be disseminated to the General Public, Transport Operators and Government Agencies under various channels such as the internet.

6. This paper will look into the impacts, in relation to the three hierarchical applications of IT, ITS and TIS on transport system.
IMPACT OF INFORMATION TECHNOLOGY (IT) – TELECOMMUTING

7. The advancement of information technology will mainly affect the demand for trip making. The applicability of IT to the strategic development of Hong Kong includes telecommuting, e-commerce, e-shopping and internet public access points. These activities might reduce the needs to travel and change the travel pattern, which could also affect the overall travel demand, either positively or negatively.

8. Telecommuting can be defined as working at home while communicating with the workplace through telecommunication devices. Learning from international experience, government involvement is essential to popularise telecommuting. Moreover, joint effort of more than one government department is needed to implement a successful telecommuting programme.

9. The need for e-commerce and e-shopping is largely driven by the private sector. Private sector involvements include telecommunication, transportation, banking, finance, insurance, hotel, engineering and other businesses using electronic business and electronic commerce. In addition, personal computer usage of Internet and Web site can also be related to IT.

10. IT could also enable the strengthening of economic and social linkages with China through the use of telecommuting. In the long term, there would probably be more and more Hong Kong residents living in the Mainland while working for Hong Kong. On the other hand, Residents in the Mainland might also work for Hong Kong firms while residing in the Mainland.
IMPACT OF INTELLIGENT TRANSPORT SYSTEMS (ITS)

11. On the transport supply side, the development of ITS would optimise usage of transport systems and networks by various means like traffic monitoring and regulating, information provision and safety enhancement.

12. ITS is widely used in Europe, U.S.A., Japan and Singapore. There are various ITS applications currently in use in these countries. In the U.K., the key ITS applications that have been identified include urban traffic control systems, bus priority signal, speed and red-light violation enforcement cameras, CCTV systems, parking management, tactile devices to separate cyclist and motorist and variable message signs. In U.S.A., six categories of ITS user services have been identified and grouped. These include travel and traffic management, commercial vehicle operations, public transport management, electronic payment, emergency management and advanced vehicle safety systems. In Japan, nine key areas of ITS applications are identified. They consist of navigation system, electronic toll collection systems, safe driving, traffic management, road management, public transport support, commercial vehicle operations, pedestrian support and support for emergency vehicle operations. In Singapore, ITS applications are under “i-transport”∗, which include a wide range of measures such as traffic.smart, transit.smart, travel.smart and manage.smart covering all aspects of land transport travel.

13. Although ITS has been in use in Hong Kong for over the last twenty years, the applications of which are limited to Area Traffic Control (ATC), Traffic Control & Surveillance (TCS), Autotoll, Octopus Card, Electronic Parking Meter, Red Light and Speed Enforcement Cameras, etc. As compared with other countries like the UK, Japan and USA, Hong Kong seems lagging behind on more advanced applications such as route guidance, fleet management as well as advanced traveller and tourist information. Many of these possible ITS applications are still in search of Public-Private-Partnerships. There are certain dilemmas hindering the advancement with regards to the financial arrangement, how to monitor or to facilitate, justifications, cost and benefits, etc.

* “i-transport” is part of Singapore's long-term plan to continue delivering more efficient and effective land transport networks that are integrated, cost-effective and sustainable to meet transportation needs through the deployment of Intelligent Transport Systems (ITS).
14. As mentioned above, TIS can be regarded as a sub-system under ITS. The key function is mainly to provide central data warehouse to support efficient and effective collection, processing and dissemination of transport and traffic data.

15. There are not many TIS being used in Hong Kong. Currently, the most common sources of getting travel information are from broadcastings from various media and from the internet. Motorists can obtain real-time on-the-road information from Variable Message Signs, Tunnel Congestion Signs, CCTV images on the Internet as well as the latest Journey Time Indication System implemented in June 2003.

16. In 2000, Transport Department initiated the ITS Strategy Review to formulate an ITS strategy and deployment plan in Hong Kong. The review recommended two main initiatives namely “A Smart Way to Travel” and “A Smart Way for Safety and Efficiency” as follow up actions from 2001 to 2010.

17. Under “A Smart way to Travel”, a Transport Information System (TIS) serving as a centralised data warehouse will be set up in TD by end 2004. Adopting spatial information and web-based technologies, the TIS supports real-time updating and retrieval of transport and traffic information. On one hand, the general public will have access through the Internet to information on routing, public transport services and general traffic conditions. On the other hands, traffic information will be made available to Government agencies such as Highways Department, Fire Services Department and Hong Kong Police Force for the planning and management of their transport-related operations. Transport operators such as bus companies, railway companies, tunnel operators and commercial vehicle fleet operators will also be able to gain access to TIS and hence adjust their operation readily to cope with changes in the traffic conditions. Other private sector initiatives such as valued added services, Passenger Information System, Parking Management Systems and Pedestrian/Cyclist Guidance Systems will also be benefited from the TIS.

IT CONSIDERATIONS IN THE FUTURE

Popularity of Telecommuting?

18. The study on home office activities had been carried out extensively in the HK 2030 Study and the findings were reported in Working Paper 14: Studies on Home Office Activities in Hong Kong. A total of 8 interview surveys were conducted among the fields of internet, computer hardware and programming, surveying, architecture, academic and business centre.
The major findings are provided in Annex 1. In general, the ideas of having home-base business are quite well received by the interviewees. However, there are various issues to be overcome. These includes, the incompatibility with the current practice; institutional constraints; and failure to relate the quality of life and tele-working.

19. Based on the above study, the job types that can be enabled by IT provision and switched to telecommuting have been worked out. It is noted that 25% of the total employment is just about as far as IT penetration can get as some job types will have all employees switching to telecommuting and that further penetration is simply not possible. If the employment figure in 2030 is about 4 million, it is anticipated that the working population whom can possibly adopt telecommuting (maximum telecommuting workforce) would not exceed 1 million. The 1 million ceiling is only an aspiration for maximum penetration of telecommuting into the workforce. In reality, the number of people that can go for telecommuting would be much less due to current practice, institutional constraints and at least a minimum proportion of staff is expected to be retained to manage the daily operation of the office.

20. A series of tests have been conducted to simulate the telecommuting situation under different proportions of total workforce switching to telecommuting (from 2.5% to 25%). The result is summarized in Annex 2. Assuming half of the “maximum telecommuting workforce” (i.e. 500,000) is able to switch to telecommuting, it is expected that the average speed in the AM peak could be improved by around 5% and the number of trips in the AM peak would also be reduced by 5%. A 5% reduction of average speed would tally to about 1km/hr and such improvement would be substantial to urban traffic environment.

21. Some schools of thoughts\textsuperscript{5,7} suggest that the overall reduction of trips might not be as much as expected because these people working at home offices might generate more shopping and delivery trips which would compensate the reduction of commuting trips. However, these shopping trips are usually to be taken place during the off peak hours. Therefore, it might be true to say that, the effect of telecommuting would “flatten” the daily travel pattern and would provide some local relieve to the traffic congestion during peak hours.

22. However, if only a quarter of the “maximum telecommuting workforce” would shift to telecommuting (i.e. one of four people in the office will work at home), the amount of speed improvement will only be about 1.5% with a corresponding 2% trip reduction in the AM peak. In this case, the amount of improvement would be relatively nominal.

23. In general, the ideas of having home-base business are quite well received by the interviewees. However, there are various issues to overcome. These include, the incompatibility with the working culture of Hong Kong; and the resistance to change. At present there are only 3% of the total workforce work in home offices in Hong Kong because
the nature of job does not allow or people think that it is less efficient and the quality of work is low to work at home. It is hard to achieve the theoretical ceiling of 25% without major promotion of the concept.

24. The problem now lies to whether a half or a quarter of the maximum telecommuting workforce can be vacated? No one can predict how the behavioral mindset of the workforce will be like in 30 years. Base on the current trend and the way of thinking of the Hong Kong people, we do not anticipate there will be much people going for the concept of telecommuting in the near future. However, should there be any change in any of the above constraints (especially in shifting of current practice and people's mindset), changing in travel demand and travel pattern may be encountered to an extent depending on the degree of penetration.

**Development of ITS**

25. Taking into account of the local conditions and transport characteristics of Hong Kong, The Consultancy Study on the Provision, Management and Operation of Traffic Control and Surveillance Facilities for the Strategic Road Network (SRN Study) had adopted a more conservative estimate in order not to overestimate the global benefit of the application of ITS system to the strategic road network of Hong Kong. Depending on the type of ITS, it is therefore expected that the application of each stand-alone ITS system might reduce the overall recurrent delay by 2% and/or reduce traffic accidents by 10%. The overall benefits of ITS in terms of various hybrid applications would be much higher but it would be difficult to setup a specific scenario for testing under the course of the HK2030 study.

26. As different countries focus on different areas of ITS, there is no universal framework on the classification of ITS applications. However, ITS Strategy Review has managed to compile a comprehensive list of 11 potential ITS applications.

27. The ITS Strategy Review of Transport Department also initiated “A Smart Way for Safety and Efficiency”. The priority is to have comprehensive traffic control and surveillance coverage over the territory and develop territorial-wide coordination among control centres for traffic and incident management. In this connection, four projects are to put into place:

   a) extend the coverage of ATC systems;
   b) install the TCS facilities on major expressways;
   c) establish a Traffic Control Centre (TCC); and
   d) implement a Journey Time Indication System (JTIS)
28. The above four projects become the short-term strategy of ITS application in Hong Kong. In considering the medium to long-term strategies, we will need to make reference to what other countries are doing while we have not been looking into? In an ongoing study undertaking by the Department of infrastructure and Planning, Royal Institute of Technology, Stockholm in Sweden\(^6\), over 100 experts have expressed views on the prospects of applying ITS to urban transport system. It has been suggested that there are five basic features or building blocks on the future ITS application to transport system. They are:

\begin{itemize}
  \item[a)] State-of-the art traffic control centers;
  \item[b)] Route guidance systems;
  \item[c)] Congestion Pricing;
  \item[d)] Smart Card; and
  \item[e)] Pocket Terminals (personal digital assistant, graphical mobile phone handset, etc.).
\end{itemize}

29. Under item a), Hong Kong is now working on a TCC to improve the efficiency of traffic control. Under b), there have been diverse views on whether the route guidance system will suit the small geographical size of Hong Kong. People might opine that route guidance system will not work in Hong Kong unless it is a “Dynamic” one that could provide real-time information such as: road works, diversions, congestion level, etc. In terms of smart card, Hong Kong has already allocated lots of resources on the development of smart card system such as the Octopus card, e-Park card as the new electronic identity card and is considered way ahead of many other countries.

30. However, Hong Kong seems to lag behind on the development of Congestion Pricing system (London has just launched their road pricing system in February 2003) and the development of pocket terminal. The development of pocket terminal is market-led and tie in with the development of palm/ handheld personal digital assistant (PDA) as well as the 3Gs technology.

31. Out of the five building blocks, only c) Congestion Pricing would lead to substantial impact on traffic demand. However, the needs and justifications for road pricing in the future would have to be further explored under separate studies. As motorists are assumed to be fully aware of the traffic situation during the assignment process, the effect of route guidance system has already been taken into account in the reference assessment. The impacts of the other building blocks have not been assumed in the reference transport assessment.
Development of TIS

32. As mentioned above, the ITS Strategy Review has formulated another short-term initiative on “A Smart Way to Travel”. Under this, a TIS is being developed to provide information on routes and fares; the need to interchange; and pre-trip planning function.

33. For medium to long-term planning on TIS, it seems that more transport information should be provided, in particular, to tourists. As compared with other countries, there are hardly enough tourist information centres in Hong Kong. The public transport system in Hong Kong was originally designed to facilitate the travel of local residents. Since the relaxation of the tourism policy of the Mainland, there are increasing demands of Mainland travellers, especially on self-travel.

34. Although the public transport system in Hong Kong is probably one of the world best, there is simply inadequate information service to both tourists or local trip makers as on where are the “nice places to go” and “how to get to there”. Future development on tourist information system and public transport system will definitely have positive effect to the tourist industry of Hong Kong. Upon completion of the Transport Information System by the end of 2004, tourists can also access through the Internet to information on routing, public transport services and general traffic conditions as described in paragraph 17.

35. The rapid development of GPS technology could offer opportunity to freight operators as well as cross boundary public transport operators to consider establishing a fleet management system. The launching of such system would enable more journeys to be made and reduce operating cost due to much better planning and schedule.

36. The impact of TIS cannot be easily quantified and modelled as the effects are more qualitative than quantitative. In considering general transport indicators such as journey time, most transport models have already assumed every trip makers are well informed of the real-time traffic situation before they make their route choice, time to start journey and on what mode. Therefore, the provision of transport information is more or less taken as the status quo. However, there should be intangible benefits resulting from the application of TIS such as enables better quality of life; boosts the image of a World City; and promotes tourism.
CONCLUSIONS

37. In the reference scenario transport assessment, we do not envisage there will be significant telecommuting activities in Hong Kong in 2020 and 2030 that would affect the total travel demand.

Planning Department
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REFERENCES


7. Patricia L. Mokhtarian, Assistant Professor of Civil and Environmental Engineering at the University of California, Davis, USA, “The Information Highway: just because we’re on it doesn’t mean we know where we’re going”. World Transport Policy and Practise, MCB University Press, 1996
Figure 1: IT Activities in Transport System

1st tier

Information Technology (IT)
- E-shopping
- Tele-office
- Intelligent Transport System

2nd tier

Intelligent Transport System (ITS)
- Urban Traffic Control (e.g. Area Traffic Control)
- Strategic Road Network Management (e.g. CCTV)
- Public Transport Management (e.g. Fleet Management)
- Road Safety (e.g. red light camera)
- Intelligent Vehicle (e.g. Route Guidance System)
- Transport Information System

3rd tier

Transport Information System (TIS)
- GIS
- Intranet/Internet
- WAP/GPRS/3G
- Variable message sign
- Media broadcasting
Annex 1

Findings of the Case Study on Home Office Activities in Hong Kong

(a) Many of the interviewees were optimistic about the prospect of teleworking as they thought that workers would increasingly prefer flexible working environment.

(b) Some interviewees only considered home business as the stepping stone to the conventional business operation because of its low start-up cost.

(c) The mode of home businesses is particularly suitable for professionals, artists, translators, designers and IT workers.

(d) Regarding policy support to teleworking, the interviewees were mainly concerned with IT infrastructure and financing.

(e) The interviewed home business workers preferred living in the core urban areas or places close to transport nodes for meetings, seminars or other businesses. In addition, it was easier for interviewees to obtain supporting services, such as computer repairing, in the core urban areas.

(f) It would be very useful if home business workers could have their own reading/working rooms in their apartments. Living space thus could be a concern.

(g) Teleworking provided an alternative option for female workers who needed to take care of their children and families.

(h) For individual home businesses, the chance of success appeared to be better if the teleworker was experienced in his profession.

(i) In view of the low overhead and flexible working style, home business could allow retired persons to extend their careers.

(j) Some interviewees indicated that clients generally might not have confidence in home businesses. Business centres might be useful in providing home businesses with more conventional correspondence addresses and places for meetings.
Annex 2

Effects of Telecommuting on Transport Attributes

Effect of Telecommuting on Transport Attributes

- % change in transport attributes
- % workforce switch to telecommuting

Graph showing the effect of telecommuting on transport attributes.