

Intelligent Transport Systems (ITS) in Hong Kong: Recent Development and Future Applications

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Agenda

- *Background*
- *Four Recent ITS Applications in Hong Kong*
- *Potential ITS Applications*
- *Q & A*

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Better Use of New Technologies

Intelligent Transport Systems

- ◆ Passenger information
- ◆ Driver information
- ◆ Traffic Management and Information Centre
- ◆ Common payment systems e.g. the Octopus card



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What are Intelligent Transport Systems (ITS)?



Deployment of advanced information and telecommunication technologies to enhance the safety, efficiency, reliability, user and environmental friendliness of the transport system

Source: The Final Report of the ITS Strategy Review (2001)

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Four Recent ITS Applications in Hong Kong

1. Traffic Speed Map

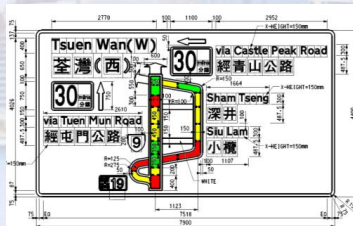


2. Driving Route Search Service (DRSS)



3. Journey Time Indication System (JTIS)

4. Speed Map Panels (SMP)



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1. Traffic Speed Map

Project Information

Client: [Transport Department of HKSAR](#)

Project Manager: Electrical & Mechanical Services
Department of HKSAR

Contractor: Autotoll Limited

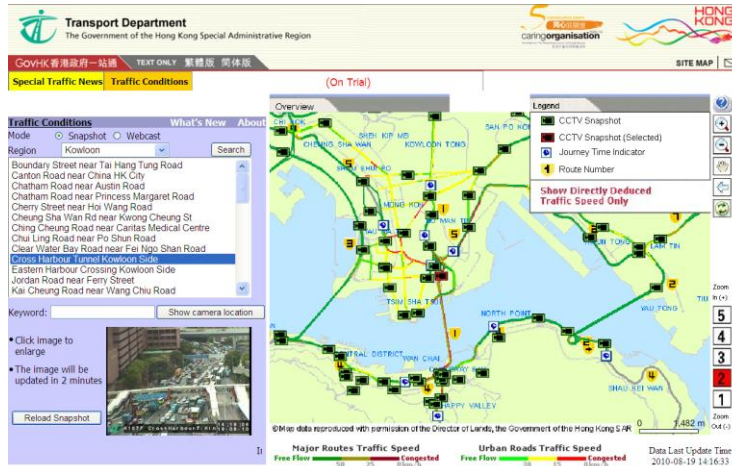
Sub-contractor: [Hong Kong Polytechnic University](#)

Launch of Service: [January 2007](#)

Update: [May 2010](#)

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1. Traffic Speed Map

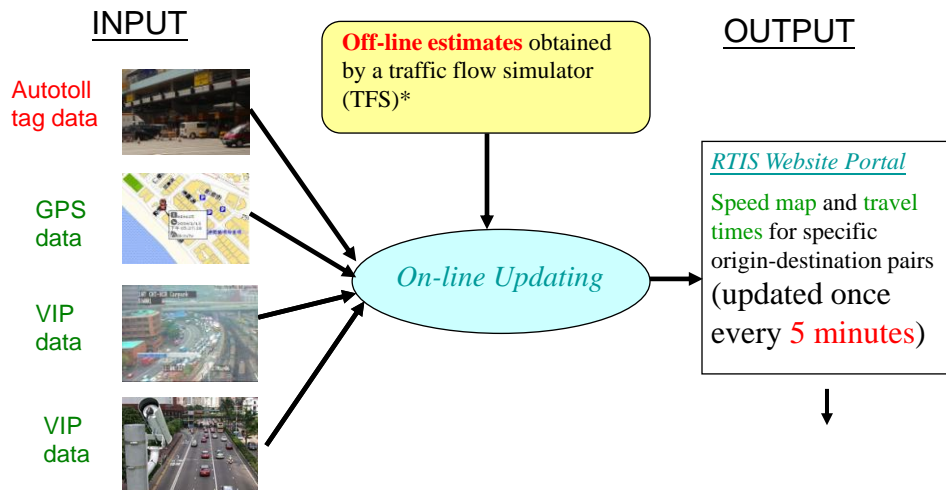


http://tis.td.gov.hk/rtis/ttis/index/main_partial.jsp

- Launched in Hong Kong Transport Department's website in January 2007
- Recently updated in May 2010 with use of the latest road network in Hong Kong

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Real-time Traffic Information System (RTIS) Framework



* Lam W.H.K., Chan K.S. and Shi J.W.Z. (2002) A Traffic Flow Simulator for Short-term Travel Time Forecasting. *Journal of Advanced Transportation*, 36(3), 265-291.

Presentation Summary of Traffic Speed Map

- Accuracy level of traffic speed colour
- Validation methods
 - Test car survey on road segments **without** CCTV cameras
 - Observation survey based on CCTV images
- Validation results
 - Test car survey
 - Observation survey

Title: [Using automatic vehicle identification data for travel time estimation in Hong Kong](#)

Author(s): Tam Mei Lam; Lam William H. K.

Source: TRANSPORTMETRICA Volume: 4 Issue: 3 Pages: 179-194 Published: 2008

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Accuracy Level of Traffic Speed Map

Under normal condition, **90% probability** of observed average speed falling within the specified speed range throughout the whole day.

For example, 08:40-08:45:

On a road segment of a **major route**:

Observed average speed = 28 km/h

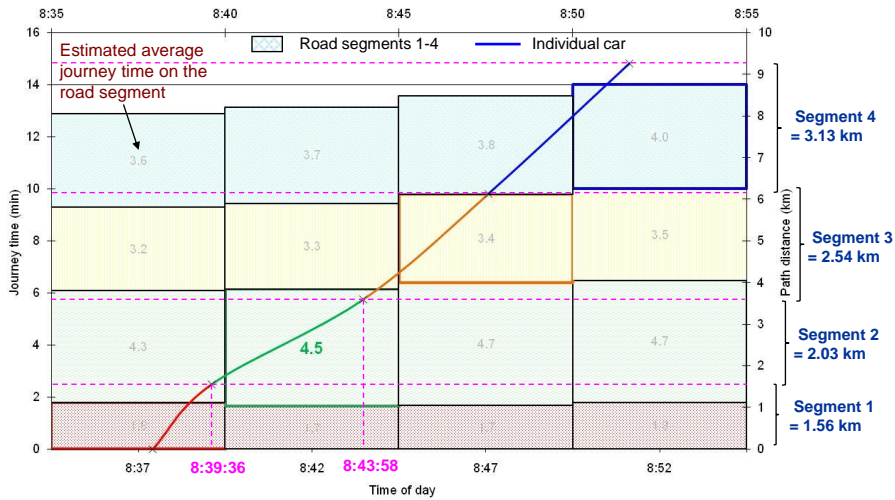
Estimated speed colour = Yellow ✓

Estimated speed colour = Red ✗



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Test Car Surveys



For example, on the 2nd road segment of a major route:
 Estimated average speed at 8:40-8:45 = 2.03 km / 4.5 min = 27 km/h (Yellow)
 Observed speed by test car = 2.03 km / (8:43:58-8:39:36)
 = 2.03 km / 4.37 min = 28 km/h

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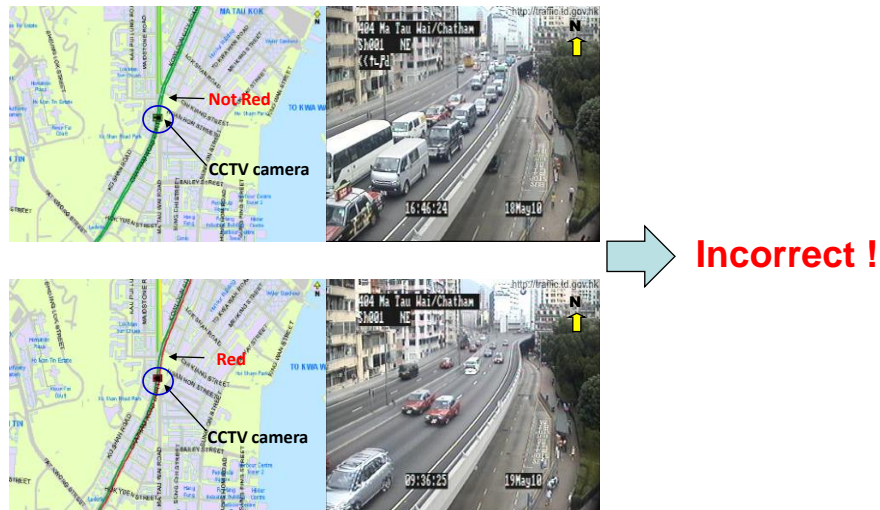
Validation Results of Test Car Surveys

- Survey day: one typical **weekday** (Tue, Wed or Thu) in May 2010 for each path
- Survey period: **one peak** and **one non-peak** periods (each period was 2 hours)
- Survey route: **5** selected routes in urban area of Hong Kong

Route	Number of observed average speeds on the segments along the path	Number of accurate speed color estimates	Accuracy	Achievement of targeted accuracy level
A	48	45	93.8%	✓
B	95	89	93.7%	✓
C	80	77	96.3%	✓
D	112	109	97.3%	✓
E	160	149	93.1%	✓

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Observation Surveys on CCTV Images



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Results of Observation Surveys

- Survey day: 14 May (Fri) - 24 May (Mon) 2010, excluding public holiday of 21 May 2010 (a total of **10 days**)
- Survey period: 08:00-20:00 (**12 hours**)
- Frequency of checking : **10-minute** interval
- Location: **30** selected locations with CCTV cameras
- Results:
 - **all** locations with accuracy of $\geq 90\%$
 - 29 locations (96.7%) with accuracy of $\geq 95\%$
 - 27 locations (90.0%) with accuracy of $\geq 97\%$
 - **17** locations (56.7%) with accuracy of $\geq 99\%$

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2. Driving Route Search Service (DRSS)

The screenshot shows the website for the Driving Route Search Service (DRSS) by the Transport Department. The header includes the department's name in Chinese and English, and the service name in Chinese and English. The main interface is divided into several sections:

- Route Search:** Features input fields for 'From' and 'To', both with 'Keywords Districts' dropdown menus. Below these are three radio button options: 'Shortest Travel Time' (selected), 'Lowest Toll (Private Car Only)', and 'Shortest Distance'. There are 'Reset' and 'Search' buttons.
- Tips:** A scrollable list of eight instructions for using the service, such as 'For textual input of "Origin" and "Destination", please key-in the street name with house number...'
- Category Search:** A section for searching by category.
- Tourism Board Attractions:** A section for searching by attractions.
- Map:** A map of Hong Kong showing major districts: YUEN LONG, TAI PO, NEW TERRORIES, TUEN MUN, SHA TIN, SAI KUNG, KOWLOON, TSEUNG KWAN O, LANTAU ISLAND, and HONG KONG ISLAND. The map includes a north arrow, a scale bar (0-5 km), and a 'Map Tool Bar' with icons for search, zoom, and other map functions.
- Footer:** A 'Hyperlinks' section with buttons for 'Special Traffic News', 'Traffic Speed Map', 'Traffic CAM Online', and 'Special Traffic and Transport Arrangements'. Below these are links for 'Disclaimer', 'Contact Us', 'Help', 'Tips and General Notes', and a URL: <http://drss.td.gov.hk/drss>.

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Presentation Summary of Driving Route Search Service (DRSS)

- Project information
- Criteria of route search
 - Shortest travel time
 - Lowest toll
 - Shortest distance
- Features of DRSS
 - Incorporation of real-time traffic speed data
 - Road network information
 - Special traffic news

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2. DRSS Project Information

Client: **Transport Department of HKSAR**

Project Manager: Electrical & Mechanical Services
Department of HKSAR

Contractor: Autotoll Limited

Commencement: **April 2008**

Launch of Service: **April 2010**

Sub-contractor: **Hong Kong Polytechnic University**

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Route Search

運輸署
Transport Department

駕駛路線搜尋服務 (試驗版)
Driving Route Search Service (Pilot Version)

Text Size 繁體

Route Search

From: HONG KONG POLYTECH Keywords: Districts

To: The University of Hong Kong Keywords: Districts

Shortest Travel Time

Lowest Toll (Private Car Only)

Shortest Distance

Reset Search

Result:

	Distance(km)	Time(min)	Toll(\$)	Other Option :
(WHC)	7.9	11	50	(CHT) 9 15 20 (EHC) 21.8 32 25

1. Start Point keep going to YUK CHOI ROAD 75m

2. YUK CHOI ROAD keep/turn left to HONG TAI PATH 150m

3. HONG TAI PATH keep/turn left to HONG CHONG ROAD 206m

4. HONG CHONG ROAD choose Exit 6C 327m

5. Exit 6C keep/turn left to CHATHAM ROAD SOUTH 117m

6. CHATHAM ROAD SOUTH choose Exit 105m

Back View Route

Category Search

Tourism Board Attractions

Hyperlinks

Special Traffic News Traffic Speed Map Traffic CAM Online Special Traffic and Transport Arrangements

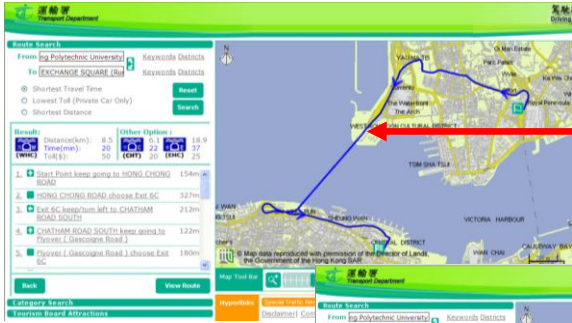
Disclaimer Contact Us Help Tips and General Notes

<http://drss.td.gov.hk/drss/>

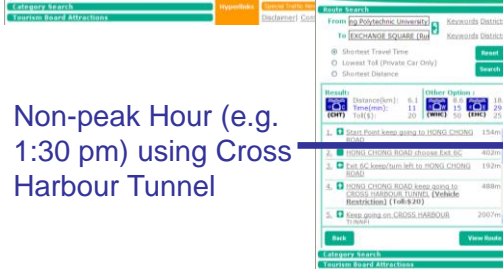
Launched in Hong Kong Transport Department's website in April 2010

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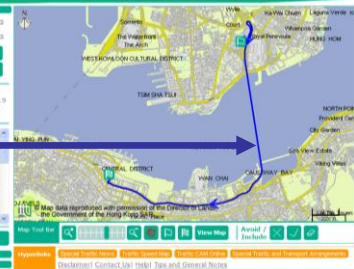
Incorporation of Real-time Traffic Speed Data



Peak Hour (e.g. 9:00 am) using Western Harbour Crossing

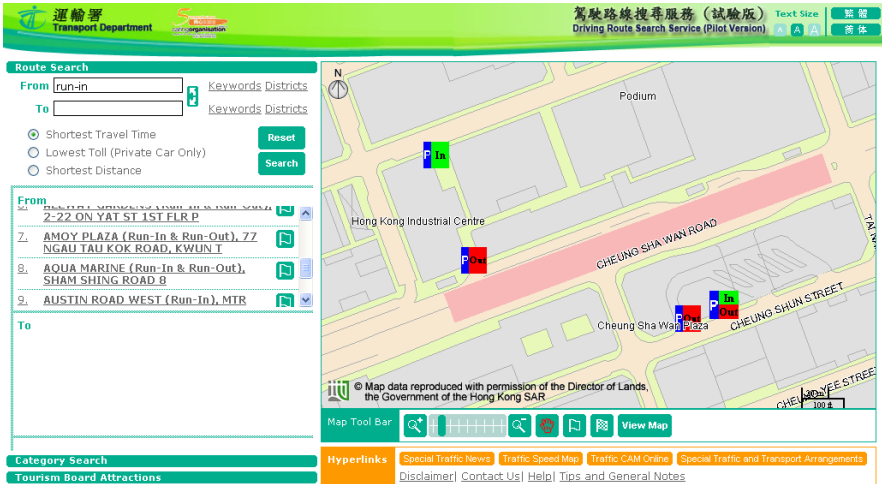


Non-peak Hour (e.g. 1:30 pm) using Cross Harbour Tunnel



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Road Network Information (Parking)



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Road Network Information (No-Stopping Restriction)

運輸署
Transport Department

駕駛路線搜尋服務 (試驗版)
Driving Route Search Service (Pilot Version)

Text Size 繁體 簡體

Route Search

From Keywords Districts

To Keywords Districts

Shortest Travel Time
 Lowest Toll (Private Car Only)
 Shortest Distance

Reset Search

From

To

Map data reproduced with permission of the Director of Lands, the Government of the Hong Kong SAR

Map Tool Bar

Hyperlinks

Special Traffic News | Traffic Speed Map | Traffic CAM Online | Special Traffic and Transport Arrangements

Disclaimer | Contact Us | Help | Tips and General Notes

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Special Traffic News

運輸署
Transport Department

駕駛路線搜尋服務 (試驗版)
Driving Route Search Service (Pilot Version)

Text Size 繁體 簡體

Route Search

From Waterloo Road Keywords Districts

To Jordan Road Keywords Districts

Shortest Travel Time
 Lowest Toll (Private Car Only)
 Shortest Distance

Reset Search

Result: Distance(km): 4.1 Time(min): 10 Toll(\$): 0

1. Start Point keep going to WATERLOO ROAD 1516m
2. WATERLOO ROAD choose Exit BA 25m
3. Exit BA keep/turn right to WATERLOO ROAD 187m
4. WATERLOO ROAD keep/turn right to ARGYLE STREET 60m
5. ARGYLE STREET keep/turn left to WATERLOO ROAD 1293m
6. WATERLOO ROAD keep/turn left to YUNNAN LANE 60m
7. YUNNAN LANE keep/turn right to SHFK 39m

Back View Route

Category Search

Tourism Board Attractions

Hyperlinks

Special Traffic News | Traffic Speed Map | Traffic CAM Online | Special Traffic and Transport Arrangements

Disclaimer | Contact Us | Help | Tips and General Notes

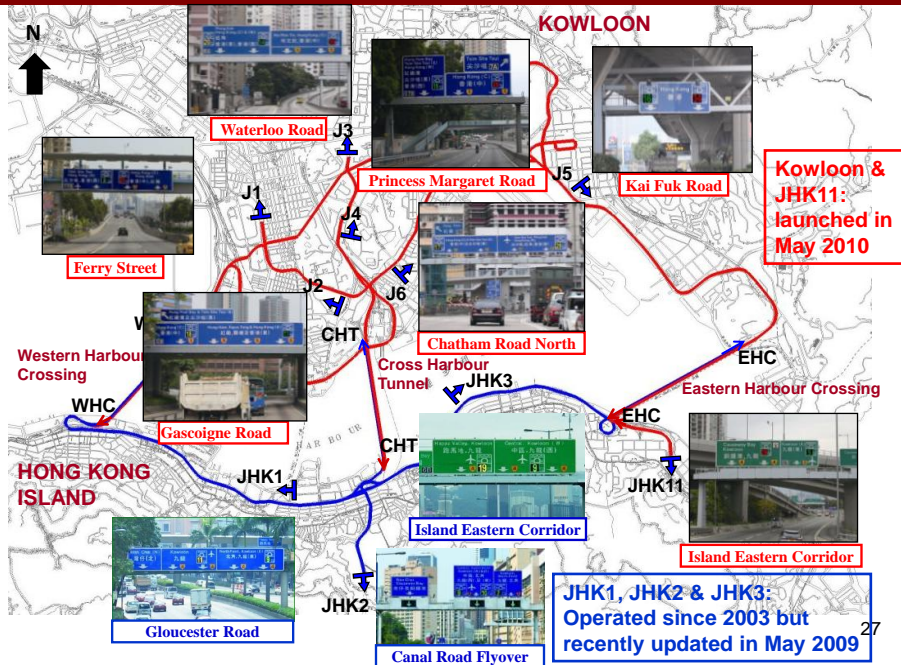
Special Traffic News - Windows Internet Explorer

Special Traffic News

1. Due to watermain burst, all lanes of Waterloo Road Yau Ma Tei bound near House No. 118 are closed to all traffic. Vehicles on Prince Edward Road West are prohibited to turn left onto Waterloo Road Yau Ma Tei bound. At the same time, the U-turn loop leading from Waterloo Road northbound to southbound is closed. Bus routes 113 and 208 have been diverted. Motorists are advised to use alternative route(s) such as Argyle Street.

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3. Journey Time Indication System (JTIS)



Presentation Summary of Journey Time Indication System (JTIS)

- Project information
- Two different types of traffic detectors
 1. Automatic vehicle identification (AVI) detector using RFID for electron toll collection
 2. Spot speed detector (e.g. Autoscope)
- Accuracy requirement of journey time estimates
 - Within $\pm 20\%$ errors with a compliance of 95% throughout the survey periods within two survey days (a weekday and a weekend) for each selected path.
- Validation results on 13 selected paths



3. JTIS Project Information

Client: **Transport Department of HKSAR**

Project Manager: Electrical & Mechanical Services
Department of HKSAR

Contractor: Autotoll Limited

Contract Period:

Implementation: **October 2008**

Launch of Service: **May 2009 (Hong Kong Island: JHK1-3),
May 2010 (Kowloon and JHK11)**

Defects Liability Period: **12 months**

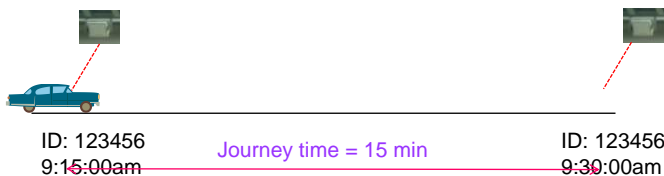
Operation & Maintenance (O&M): **8 years**

Sub-contractor: **Hong Kong Polytechnic University**

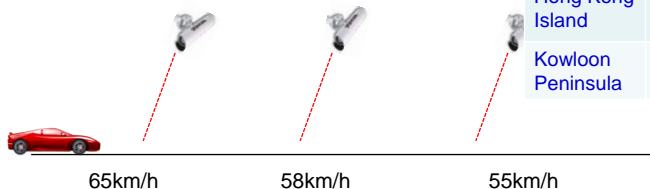
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Two Types of Traffic Detectors

- Automatic vehicle identification (AVI) detector



- Spot speed detector

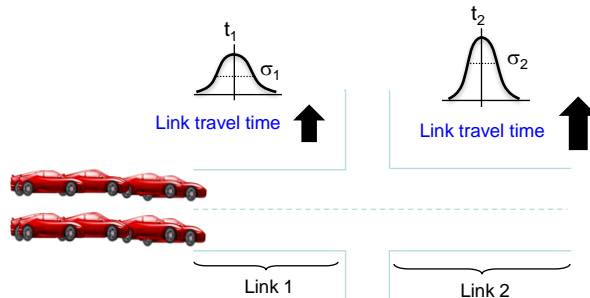


	No. of AVI detectors	No. of spot speed detectors
Hong Kong Island	9	16
Kowloon Peninsula	13	19

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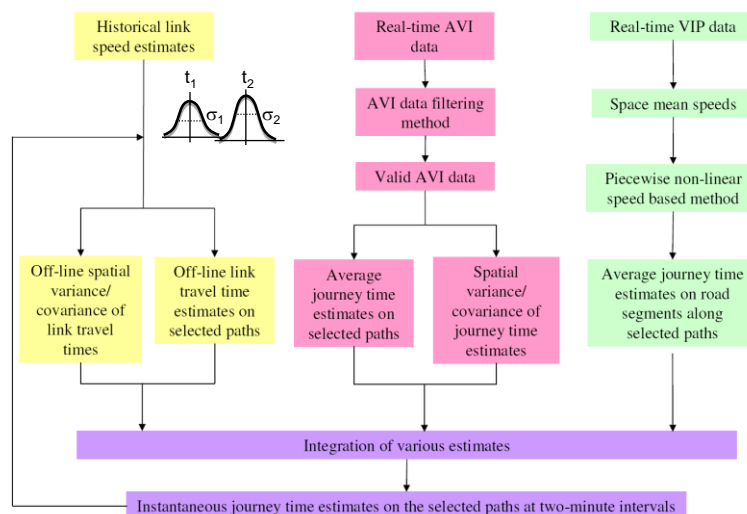
Offline Travel Time Estimates

- ❖ Average link travel time estimates (t_1, t_2)
- ❖ Spatial variance (σ_1^2, σ_2^2) and covariance ($\sigma_1\sigma_2$) relationships of link travel times



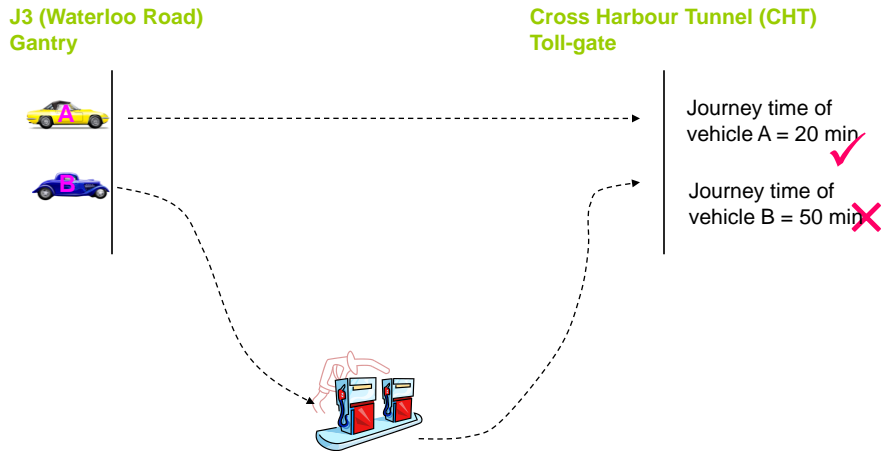
Title: [Real-Time Estimation of Arterial Travel Times with Spatial Travel Time Covariance Relationships](#)
 Author(s): Chan K. S.; Lam William H. K.; Tam Mei Lam
 Source: TRANSPORTATION RESEARCH RECORD Issue: 2121 Pages: 102-109 Published: 2009 ³¹

Algorithm for Journey Time Estimation



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AVI Data Filtering



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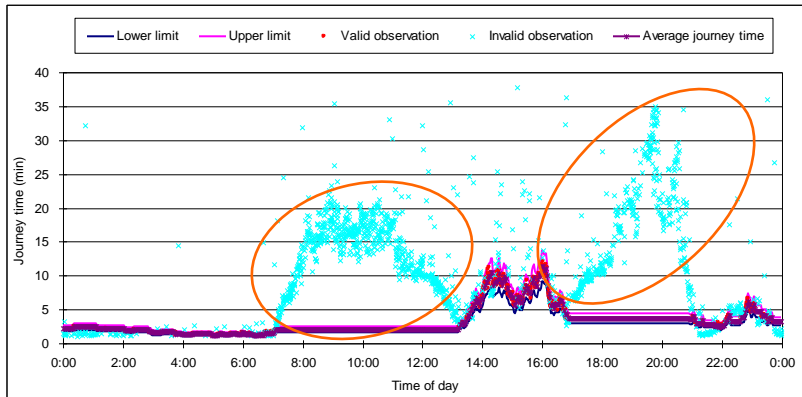
AVI Data Filtering Methods

	JTIS	TransGuide	TranStar	Transmit
Interval	2 minutes	2 minutes	30 seconds	15 minutes
Thresholds of valid time window	Stochastic (dependent on various factors at the previous time intervals)	Fixed ($\pm 20\%$ of mean journey time at the previous time interval t-1)	Fixed ($\pm 20\%$ of mean journey time at interval t-1)	Fixed ($\pm X\%$ of mean journey time at interval t-1, X is defined by users)
Applications in	Hong Kong	San Antonio, USA	Houston, USA	New York/ New Jersey, USA

Tam M.L. and Lam W.H.K. (2008) Using Automatic Vehicle Identification Data for Travel Time Estimation in Hong Kong. Transportmetrica, Vol. 4, No. 3, 179-194.

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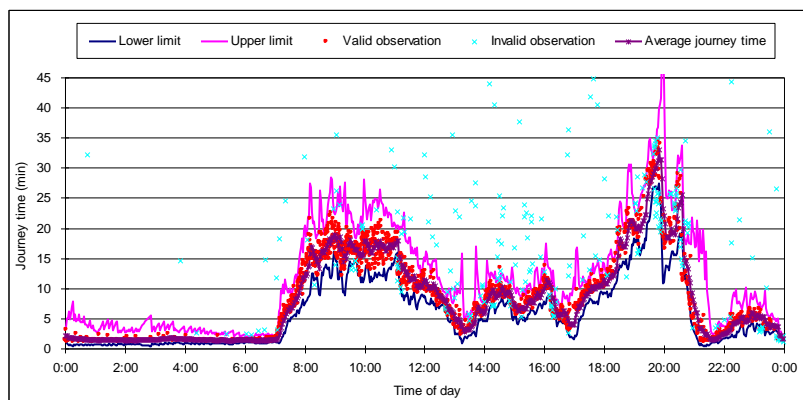
AVI Data Filtering Method for Generating Valid Time Windows using **Fixed** Threshold (e.g. $\pm 20\%$ of mean journey times at previous time interval t-1)



J4 (Princess Margaret Road) – Cross Harbour Tunnel (Toll gate) on 5 Feb 2010 (Friday)

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JTIS Data Filtering Method for Generating Stochastic Valid Time Windows



J4 (Princess Margaret Road) – Cross Harbour Tunnel (Toll gate) on 5 Feb 2010 (Friday)

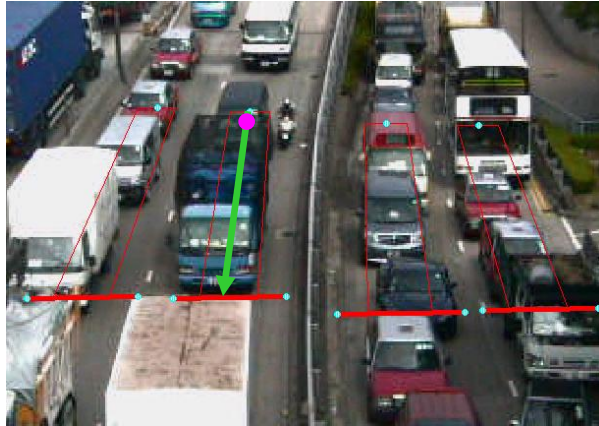
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Speed Data Collected by Autoscopes

Time mean speed



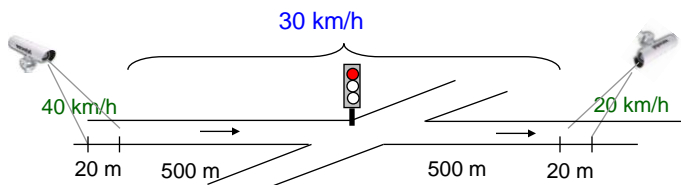
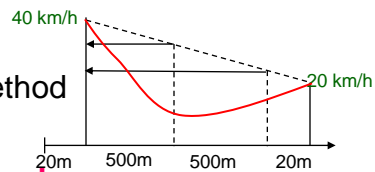
Space mean speed



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Speed-based Method for Estimating Journey Time

- Average speed method
- Piecewise linear speed based method
- **Piecewise non-linear speed based method** (with consideration of covariance relationship of link travel times/speeds)



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Integration of Different Journey Time Estimates

- Instantaneous journey time estimates
= $A * \text{journey time estimated by valid Autotoll tag data}$
+ $B * \text{journey time estimated by Autoscope data}$
+ $C * \text{offline journey time estimates}$
- Weights of A and B are dependent on sample sizes of valid Autotoll tag and Autoscope data, respectively
- Offline estimates are the lowest priority ($C=1-A-B$)

Title: [Application of automatic vehicle identification technology for real-time journey time estimation](#)

Author(s): Tam Mei Lam; Lam William H. K.

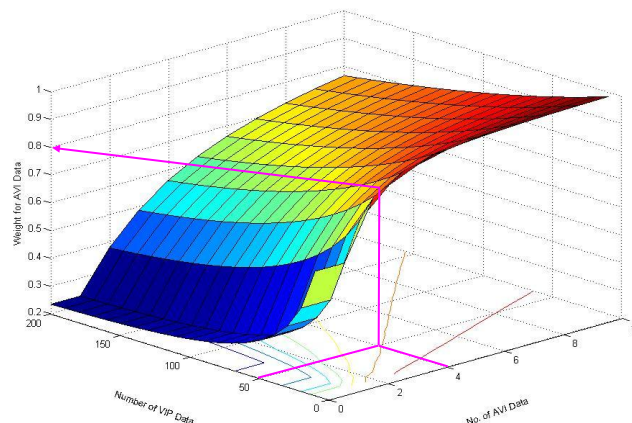
Source: INFORMATION FUSION Volume: 12 Issue: 1 Pages: 11-19

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Published: JAN 2011

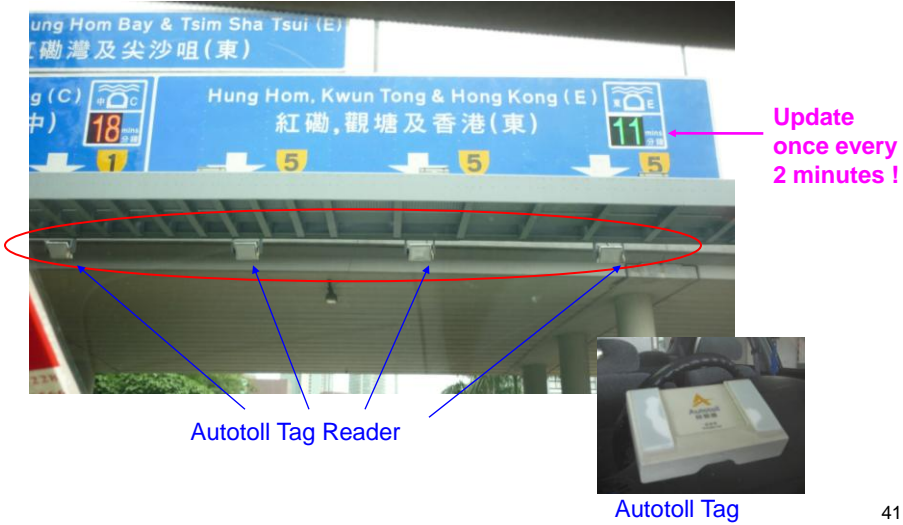
Integration of Different Traffic Data

- Mainly dependent on sample sizes of AVI tag data



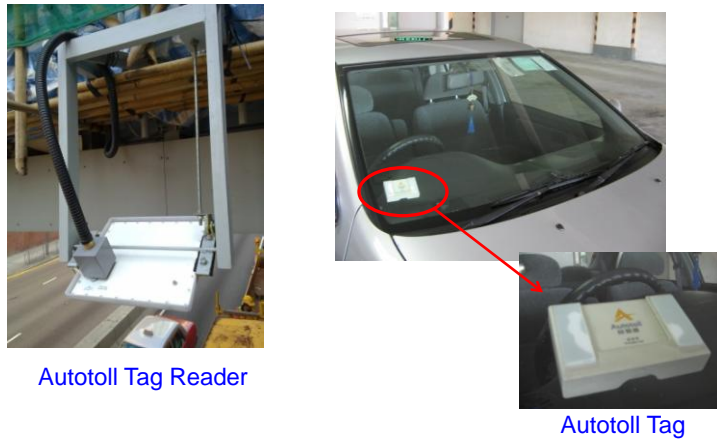
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Automatic Vehicle Identification (AVI) Detector – Autotoll Tag Reader



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Automatic Vehicle Identification (AVI) Detector – Autotoll Tag Reader (RFID technology)



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Autotoll Tag Data

Journey time indicator

rt_from_time	rt_to_time	rt_od_pair	rt_travel_time	rt_vehicle_class
2011-05-08 18:46:09.000	2011-05-08 19:01:53.000	H2-CH	944.0	1
2011-05-08 18:40:16.000	2011-05-08 19:06:55.000	H2-CH	1599.0	30
2011-05-08 18:53:30.000	2011-05-08 19:08:57.000	H2-CH	927.0	11
2011-05-08 18:53:46.000	2011-05-08 19:09:00.000	H2-CH	914.0	1
2011-05-08 18:54:16.000	2011-05-08 19:10:28.000	H2-CH	972.0	1
2011-05-08 18:54:28.000	2011-05-08 19:10:12.000	H2-CH	944.0	1
2011-05-08 18:59:41.000	2011-05-08 19:11:32.000	H2-CH	711.0	30
2011-05-08 19:04:07.000	2011-05-08 19:17:39.000	H2-CH	812.0	1
2011-05-08 19:04:25.000	2011-05-08 19:18:09.000	H2-CH	823.0	1
2011-05-08 19:04:31.000	2011-05-08 19:18:25.000	H2-CH	834.0	1
2011-05-08 19:06:34.000	2011-05-08 19:19:34.000	H2-CH	780.0	30
2011-05-08 15:02:19.000	2011-05-08 19:18:53.000	H2-CH	15394.0	1
2011-05-08 19:06:42.000	2011-05-08 19:20:13.000	H2-CH	811.0	1
2011-05-08 19:10:58.000	2011-05-08 19:23:54.000	H2-CH	776.0	11
2011-05-07 21:36:12.000	2011-05-08 19:22:48.000	H2-CH	78356.0	1
2011-05-08 19:14:30.000	2011-05-08 19:25:35.000	H2-CH	665.0	30
2011-05-08 19:15:36.000	2011-05-08 19:28:31.000	H2-CH	775.0	1
2011-05-08 19:20:30.000	2011-05-08 19:30:19.000	H2-CH	589.0	30
2011-05-08 19:22:39.000	2011-05-08 19:33:25.000	H2-CH	646.0	11
2011-05-08 19:25:27.000	2011-05-08 19:35:19.000	H2-CH	592.0	1



19:04:31

Tunnel Toll-gate



19:18:25

Journey time from journey time indicator to tunnel toll-gate

$$= 19:18:25 - 19:04:31 = 13 \text{ min } 54 \text{ sec} = 834 \text{ sec}$$

Tag in circulation is about **250,000** tags out of 613,000 licensed vehicles in Hong Kong in March 2011 (**87,000** penetration of tags of 174,000 commercial vehicles is about **50%**).

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Real-time Data collected by Autotoll Tag Reader



Autotoll Tag

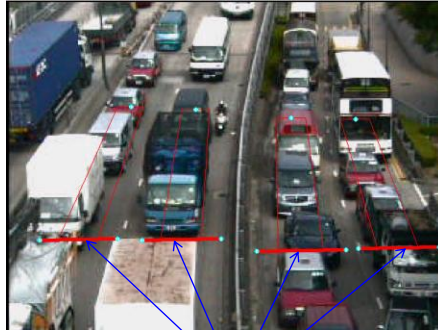


11 tolled links in HK

Tag in circulation is about **250,000** tags out of 613,000 licensed vehicles in Hong Kong in March 2011 (**87,000** penetration of tags of 174,000 commercial vehicles is about **50%**).

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Spot Speed Detector – Video Image Processing (VIP) Technology



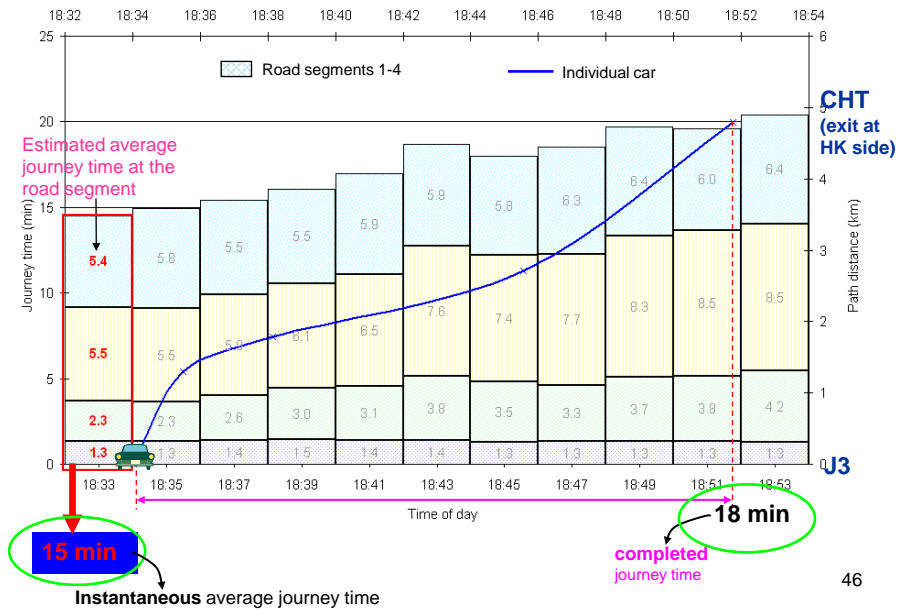
Video detector: **Autoscope**

Data Collected: Traffic counts, time mean speed and space mean speed, etc.

Detection zones of **Autoscope**

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JTIS Instantaneous Average Journey Time Estimates



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Performance Criterion for Journey Time Validation

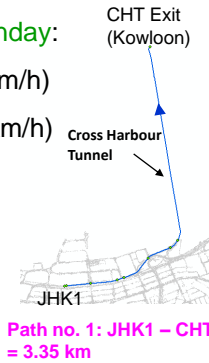
- Within +/- 20% errors with a compliance of 95% throughout the survey periods within two survey days (a weekday and a weekend) for each selected path.

For example, JHK1-CHT at 09:00:00-09:01:59 on **Sunday**:

Observed instantaneous journey time = 4 min (50 km/h)

Estimated instantaneous journey time = 5 min (40 km/h)

Estimation error = $(5-4)/4 \times 100\% = 25\% > 20\%$



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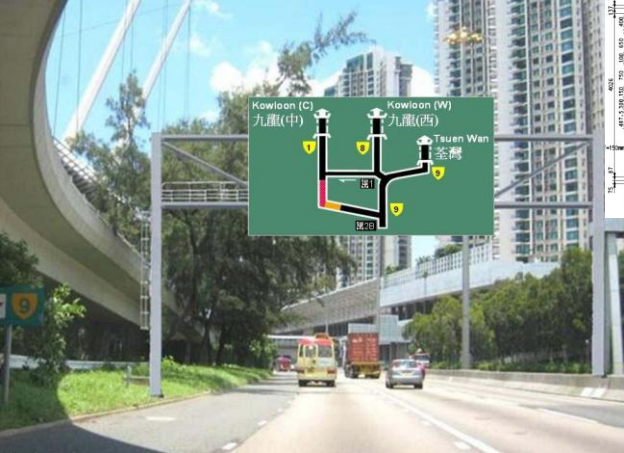
Validation Results

JTIS (Hong Kong Island)				JTIS (Kowloon Peninsula)			
Path No.	Selected path	No. of samples	Accuracy*	Path No.	Selected path	No. of samples	Accuracy*
1	JHK1-CHT	94	97.9%	1	J1-CHT	159	98.1%
2	JHK1-EHC	91	98.9%	2	J1-WHC	117	98.3%
3	JHK2-CHT	120	95.0%	3	J2-CHT	78	96.2%
4	JHK2-EHC	102	97.1%	4	J2-EHC	203	99.0%
5	JHK2-WHC	110	95.5%	5	J3-CHT	110	96.4%
6	JHK3-CHT	103	95.1%	6	J3-EHC	137	100.0%
7	JHK3-WHC	114	98.3%	7	J3-WHC	80	98.8%
8	JHK11-CHT	90	97.8%	8	J4-CHT	86	95.3%
9	JHK11-EHC	119	99.2%	9	J4-WHC	132	98.5%
				10	J5-CHT	187	97.3%
				11	J5-EHC	184	98.4%
				12	J6-CHT	93	95.7%
				13	J6-WHC	114	96.5%

The requirement of the targeted accuracy level is achieved.

*Percentage of samples within ± 20% errors throughout the survey periods in the validation. 48
 JHK1-JHK3, JHK11 and J1-J6 are the journey time indicators in Hong Kong Island and Kowloon Peninsula, respectively. Abbreviation: CHT – Cross Harbor Tunnel; EHC – Eastern Harbor Crossing; WHC – Western Harbor Crossing.

4. Speed Map Panels (SMP) in the New Territories



SMP informs the motorists of the traffic conditions of the roads ahead by using different colors to represent different congestion levels, together with journey time information.

Presentation Summary of Speed Map Panels

- Project information
- Location and layout of SMP
- **Two different types of traffic detectors**
 1. Spot speed detector (e.g. Autoscope)
 2. Automatic vehicle identification (AVI) detector using **Automatic license plate recognition technology**



REG_NUMBER: GH5286
 CONFIDENCE: 94
 VESNAME: Fixed VES
 VES_LOC: Gloucester Rd
 NORTHING: 2466490
 EASTING: 208700

SMP Project Information

Client: **Transport Department of HKSAR**

Project Manager: Mott MacDonald (HK) Limited

Contractor: Autotoll Limited

Contract Period:

Implementation: **January 2010**

Expected Launch of Service: **June 2012**

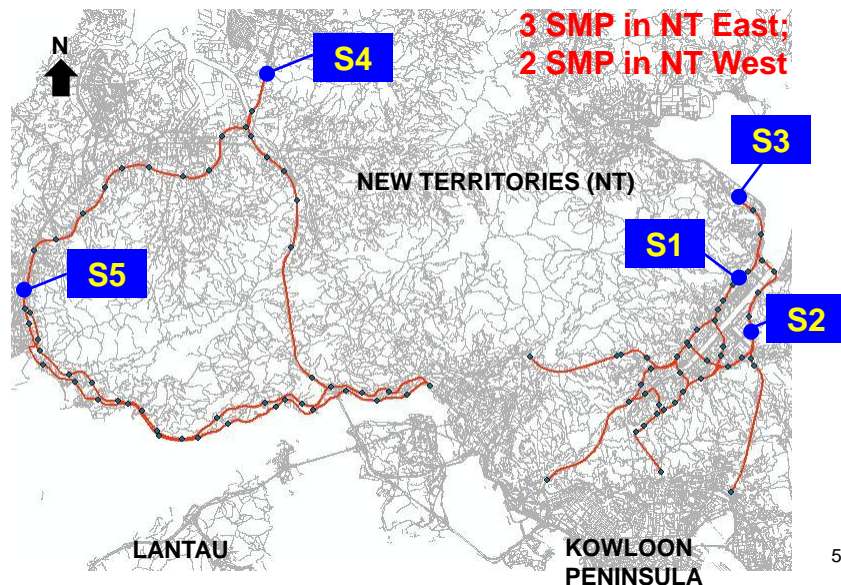
Defects Liability Period: **12 months**

Operation & Maintenance (O&M): **8 years**

Sub-contractor: **Hong Kong Polytechnic University**

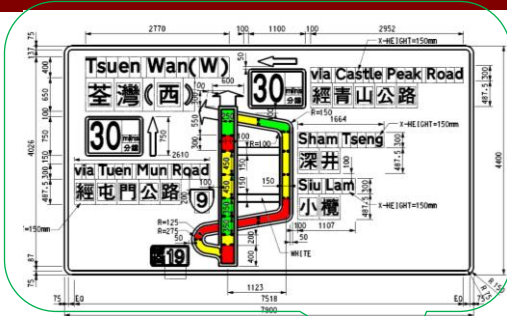
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Location of Five Speed Map Panels (SMP)



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Speed Map Panel (S5) in NT West



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Two Types of Traffic Detectors



Traffic detectors

- 39 link speed detectors
- 96 spot speed detectors



Link speed detector:
Automatic license plate recognition technology

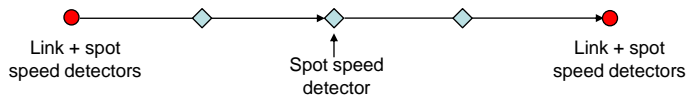


Spot speed detector:
Video image processing technology

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Two Types of Traffic Detectors

- Link speed and spot speed detectors are installed at the starting and the end points of the path segments.
 - Longest path segment = 9.4 km
 - Shortest path segment = 1.1 km
- Average spacing of spot speed detectors is **not greater than 1.2 km**.



	No. of vehicles (as at March 2011)
All licensed vehicles in Hong Kong	613,000 (100%)
Corporate vehicles (owned by limited companies)	174,000 (28%)
Corporate vehicles with Autotoll tags	87,000 (14%)

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Validation Approach for Journey Time and Traffic Speed Range Measurements

■ Floating car surveys

Day of Week:	1 weekday and 1 weekend (Sat or Sun)		
Survey Period:	08:00-11:00;	12:00-15:00;	17:00-20:00
No. of Selected Paths: 13	9 (NTE) + 4 (NTW) = 11 for journey time and traffic speed range validation		
	2 (NTE) for traffic speed range validation only		
Test Cars:	5-10 test cars for each selected path were estimated based on the path distance and the cycle time of test cars on each path		

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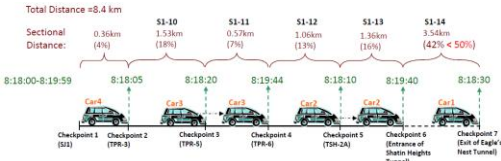
Distance of the 13 Selected Paths in SMP

Path No.	Selected Path	Path Distance (km),	Path No.	Selected Path	Path Distance (km)
1	SJ1-SMT	7.7	10	SJ4-TKTL	12.0
2	SJ1-TSCA	8.4	11	SJ4-TKTM	26.9
3	SJ1-LRT	7.5	12	SJ5-TWTM	16.9
4	SJ2-TSCA	9.7	13	SJ5-TWCP	17.3
5	SJ2-LRT	7.1			
6	SJ2-TCT	5.4			
7	SJ3-TSCA	11.9			
8	SJ3-LRT	11.0			
9	SJ3-TCT	10.2			

Distance of the longest selected path in JTISK (J3-EH) = 12.3km

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Journey time surveys



- No. of test cars were estimated based on the path distance and the cycle time of the test car
- Allocate at least **one test car** on each road segment of the selected path simultaneously
- Similar to take a snapshot at each road segment of the selected path at the same time
- Test cars are travelled at **similar speed of surrounding traffic (y = 0)**
 - $y = \text{No. of vehicles overtaking test car} - \text{No. of vehicles passed by test car}$
 - $y \propto q \cdot (v - v_w) / v$ where $v = \text{speed of test car}$, $v_w = \text{speed of traffic stream}$, $q = \text{flow}$
 - If $y=0$, then $v=v_w$
- The targeted accuracy level of the journey time estimates is within **+/- 20% errors** with a compliance of **95%** throughout the survey periods **within two survey days** (a weekday and a weekend) for each selected path.

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Colour codes for Traffic Speed Ranges

- **Major routes:**
Red: 0-25km/h; Amber: 25-50km/h; Green: > 50km/h
- **Urban roads:**
Red: 0-15km/h; Amber: 15-30km/h; Green: > 30km/h

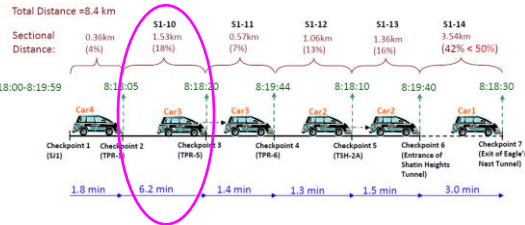
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Performance Criterion for Traffic Speed Range

- The targeted accuracy level of the **computed speed range** for SMP should be fallen within **+/- 20%** with a compliance of **95%**.
- Thus, the computed speed ranges for two types of routes become:
 - Major Routes**
Red: 0-30km/h; Amber: 20-60km/h, Green: >40km/h
 - Urban Roads**
Red: 0-18km/h; Amber: 12-36km/h, Green: >24km/h

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Example (Road Segments of a Major Route)



S1-10:
 $1.53 / 6.2 * 60$
 $= 15 \text{ km/h}$

Observed Speed Range: 50 25 0 km/h

Computed Speed Range with allowance of +/-20% errors: 60 40 30 20 0 km/h

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Technologies for Incident Management



Feasibility Study on Deploying Advanced Technologies in Incident Management

- Executive Summary
February 2010

http://www.td.gov.hk/filemanager/en/publication/executive%20summary_english.pdf

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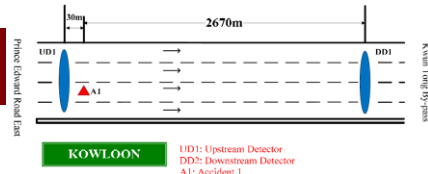
Traffic Accident on Major Road



13:40PM on Nov 19 2008.

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Incident Detection



Time Interval (t)	Predicted Travel Speed (Y_T) (km/h)	Observed Travel Speed (X_t) (km/h)	Relative Difference of Travel Speed ($(Y_T - X_t) / Y_T$)	Threshold of Relative Difference of Travel Speed
10:10-10:11	54.0	60.0	-0.1	0.4
10:12-10:13 (Estimated incident occurrence time)	54.0	50.0	0.1	0.4
10:14-10:15	54.0	8.0	0.9	0.4
10:16-10:17	54.0	4.6	0.9	0.4
10:18-10:19	54.0	17.0	0.7	0.4
:	:	:	:	:
10:36-10:37	54.0	10.0	0.8	0.4
10:37-10:38	54.0	57.3	-0.1	0.4

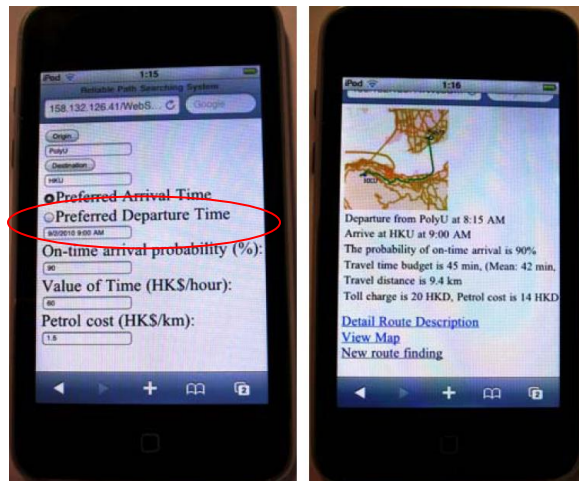
Notes: (1) Alarm is given when the relative difference of travel speed at two successive time intervals exceeds the threshold value.

(2) Y_T is referred to the predicted travel speed at the time interval of incident occurred.

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Route Guidance

- Reliable routing service with on-time arrival probability

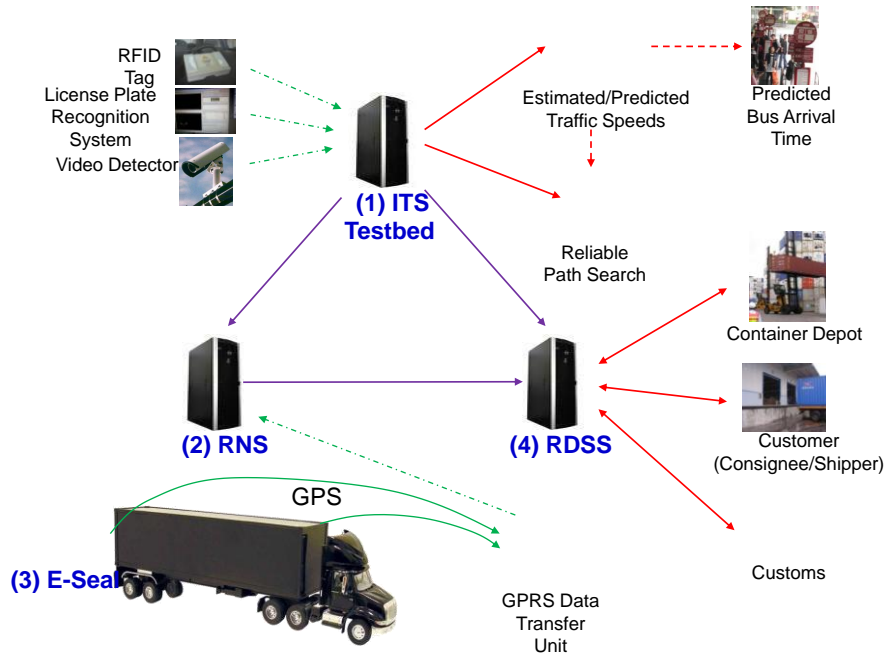


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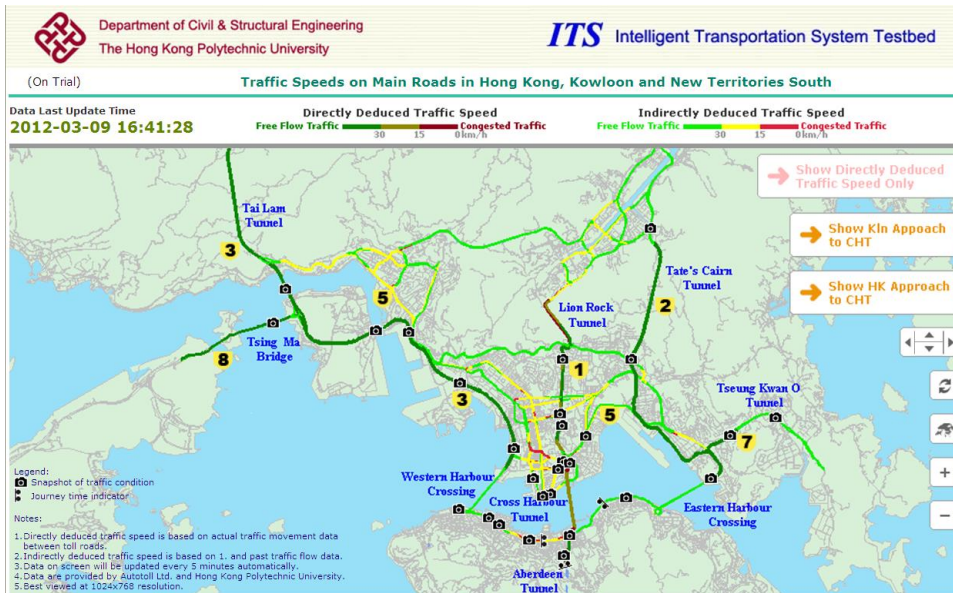
Reliable Route Searching System

Title: [Reliable shortest path finding in stochastic networks with spatial correlated link travel times](#)
 Author(s): Chen Bi Yu; Lam William H. K.; Sumalee Agachai; et al.
 Source: INTERNATIONAL JOURNAL OF GEOGRAPHICAL INFORMATION SCIENCE Volume: 26 Issue: 2 Pages: 365-386 Published: 2012

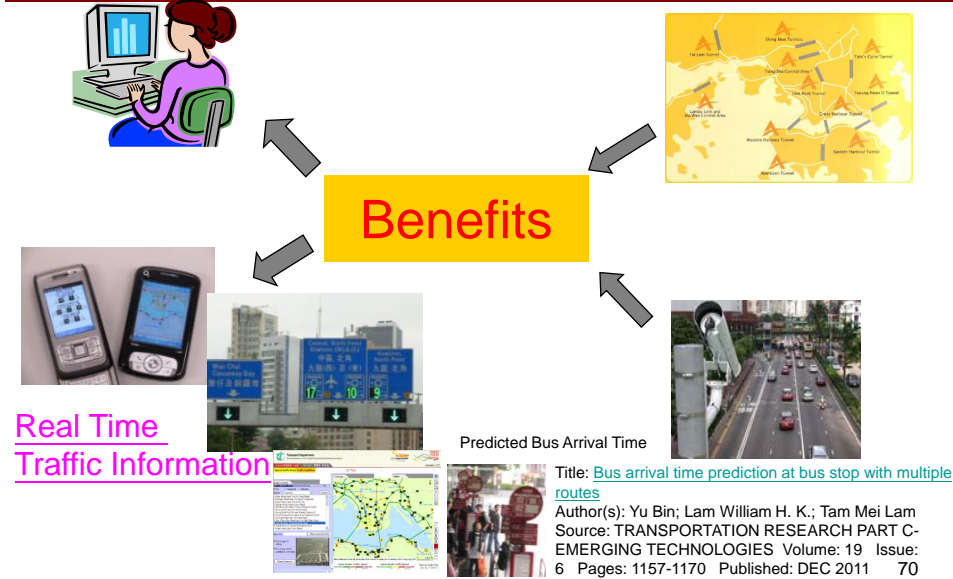
Overall System for Niche Areas ITS Project



Intelligent Transportation System Testbed



Benefits to the Community



Website of ITS in Hong Kong

- http://www.td.gov.hk/en/transport_in_hong_kong/its/its_achievements/index.html
 - Journey Time Indication System
 - Traffic Speed Map
 - Area Traffic Control Systems
 - Traffic Control and Surveillance System
 - Closed Circuit Television Images on the Internet
 - Automatic Toll Collection System
 - Octopus
 - Electronic Parking Meters
 - Red Light Cameras and Speed Enforcement Cameras
 - Traffic Control Centre



* An integrated real-time traffic database for ITS in Hong Kong. 71

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<http://www.cse.polyu.edu.hk/~cehklam/>

-The End-



The 17th HKSTS International Conference
15-17 December, 2012, Hong Kong
<http://www.hksts.org>

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Questions/Comments?



The 5th International Symposium on Transportation Network Reliability
(INSTR) 18-19 December, 2012, Hong Kong

<http://www.instr2012.org>

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