

淡江大學運輸管理學系運輸科學碩士班

碩士論文

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運用探針車與偵測器資料融合估計車輛  
旅行時間之研究

A Study of Vehicle Travel Time Estimation – Applying Data  
Fusion Techniques via Probe Vehicles and Vehicle Detectors

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論文提要內容：

在全球化資訊系統推動下，國內交通運輸相關單位開始注重引進資訊、通訊等科技，結合交通運輸之專業知識，隨著世界智慧型運輸系統(Intelligent Transportation System)發展之潮流將先進的科技整合到運輸領域中。而車輛旅行時間估計(Vehicle Travel Time Estimation)為近年來新興之課題，其可提供交通管理者、交通運輸營運者與用路人進行最佳控制、規劃、調度、排程、決策等策略，以提升掌握更準確性之交通現況。

傳統車輛旅行時間估計可分為兩類：一為係以每隔一段距離，在固定點設置偵測器以偵測車輛，此方法可蒐集車流量、時間平均速度(Time Mean Speeds)、車間距離(Headway)、車輛種類、車道佔有率(Lane Occupancy)等資料，以進行車輛旅行時間之估計；另為則以利用在交通車流(Traffic Flow)中行駛之裝有GPS 配備之車輛來收集資料，此種裝有GPS 配備之車輛也就是探針車輛(Probe Vehicle)，其可蒐集車輛定位訊號、位置、時間、速度等資料，以計算估計車輛旅行時間。國內目前高速公路之固定式偵測器佈設位置，僅於都會區周圍佈設較為密集，並無全面性佈設；且偵測器故障情形亦多，若單一以固定式偵測器估計車輛旅行時間，其估計誤差除模式本身誤差之外，亦因佈設距離過長及偵測器故障情形，導致整體估計車輛旅行時間誤差甚大。在固定式偵測器佈設位置不密集之路段上及固定式偵測器故障情況下，即可透過探針車蒐集之資料進行交通資料融合(Data Fusion)，可將上述兩種問題產生之誤差降低。

本研究透過兩種不同型態之交通資料偵測器蒐集交通基本資料，透過時空特性轉換成相同時間間隔(Time Interval)及路段之旅行時間資料，進行資料融合，補足各時間間隔及路段旅行時間資料，藉以提昇整體估計車輛旅行時間之準確度。此外由於本研究課題之相關資料蒐集在現實狀況中受到諸多限制，除當前過內高速公路並無充足及完整之偵測器資料可供研究利用外，在探針車輛資料取得方面亦困難且數量不足，因此係以模擬分析為基礎獲得相關交通基本資料，並透過各估計演算式，以進行車輛旅行時間資料融合模式。研究成果顯示均方根誤差值於偵測器為8.59；探針車為7.97；資料融合為7.69。成功地顯示資料融合估計車輛旅行時間具有有效性與代表性。

關鍵詞：車輛旅行時間估計、資料融合、PARAMICS 模擬器、偵測器、探針車

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***A Study of Vehicle Travel Time Estimation – Applying Data Fusion Techniques via Probe Vehicles and Vehicle Detectors***

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*Abstract:*

With the impetus of internationalization information systems, the authority concerned of communication and transportation in Taiwan has started to emphasize on bringing on the latest technologies of information system and signal communication, combining professional knowledge of transportation, and integrating advanced technologies into the field of transportation with the world trend on the development of Intelligent Transportation System. Vehicle travel time estimation is a recently-flourished issue. It provides transportation authorities, operators and drivers with best strategies on controlling, planning, dispatching, arranging, and deciding, which promotes accuracy to the control of traffic situation.

The traditional vehicle travel time Estimation can be classified into two types. One is installing fixed detectors within the same distance. This way can collect data of vehicle flow, time mean speeds, headway, car type, and lane occupancy etc. The other is to collect information by using cars equipped with GPS on the traffic flow. Car equipped with GPS, also called probe vehicle, can collect information about car signal, location, time, and speed etc. So far, the highway in Taiwan uses fixed detectors and the set-up of detectors is, instead of every area, merely dense in the city area. Besides, there are many detectors breakdown situations. It is inaccurate if we just use a single way to estimate vehicle travel time. In addition, it is more inaccurate

if the distance of detector set up is too long or if there are machinery breakdown situations. Using the information collected by probe vehicles can proceed data fusion, which can lower the inaccuracy caused by distance and breakdown.

This study proposes and examines a more fresh issue on vehicle travel time Estimation by using two different vehicle detector of collecting basic traffic data. It becomes the same time interval and section- travel time through space-time transformation. It proceeds data fusion so as to make up a deficiency and to increase the accuracy of overall vehicle travel time estimation. Due to many restrictions in data collection, there was no sufficient or complete detector data to refer to. In addition, data collection on probe vehicle was also difficult and the number was insufficient. So, this study utilized data fusion mode to estimate vehicle travel time on the basis of basic traffic data, simulation analysis and various mathematical calculation modes. The results of the study show that root mean square error of detectors is 8.59, probe vehicles is 7.97, and data fusion is 7.69. The study successfully shows the efficiency and representation of data fusion on vehicle travel time estimation.