出國報告（出國類別：國際會議）

2018 年第 25 屆智慧型運輸系統世界大會

服務機關：交通部高速公路局
姓名職稱：卓明君組長
派赴國家：丹麥
出國期間：107 年 9 月 14 日至 9 月 23 日
報告日期：107 年 12 月 19 日

公務出國報告摘要

頁數：43

報告名稱：2018年第25屆智慧型運輸系統世界大會
主辦機關：交通部高速公路局
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出國人員：交通管理組卓明君組長
出國類別：國際會議
出國地點：丹麥
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分類號/目：H0/綜合類（交通運輸）
關鍵詞：智慧型運輸系統(ITS)、交控系統、交通行動服務(MaaS，Mobility as a Service)
內容摘要：

第25屆智慧型運輸系統世界大會訂2018年9月17日至21日於丹麥哥本哈根Bella Center召開，大會內容包括全體會議、行政會議、特別主題會議、技術會議、科學會議、商業會議、另類會議等。

本次大會主題為：「提升生活品質(Quality of Life)」，展示了哥本哈根利用ITS解決方案，如動態都市空間(Dynamic Urban Space)、自行車使用的資訊可變標誌系統(Variable Message Signs for Cyclists)、交通號誌系統最佳化(Traffic Signal Optimization)、交通管理(Traffic Management)、智慧路燈系統(Intelligent Street Lighting)、環保駕駛(Eco-Driving)，和交通行動服務(MaaS，Mobility as a Service)，帶給市民良好的生活品質。哥本哈根認為ITS是幫助改善交通，促進行車秩序和加強公共交通的重要手段，同時也提供了更智慧、更環保、更健康的解決方案。因此，哥本哈根希望透過ITS解決方案，預計於2025年成為第一個碳平衡的城市。

從哥本哈根經驗得知，ITS的應用在於解決民眾生活所遭遇的交通問題，透過一些巧思與智慧化交通管理手段，也可以獲得明顯的改善。

國內ITS發展與應用已與國外同步甚而超前，除相關交控系統及智慧型運輸軟硬體系統不斷更新提升外，也應思考各道路系統之服務功能需求，透過各式運具及各道路路況資訊整合服務，而不再追求單一運具或道路之最佳化運作模式，才能針對民眾複合式路徑及多旅次目的，提供最適合的整體解決方案。

目　　錄

壹、目的

為推廣智慧型運輸系統（Intelligent Transportation Systems，ITS）的應用及介紹相關領域之技術，由亞太、歐洲、美洲等地區智慧型交通組織發起的智慧型運輸系統世界大會，訂每年輪流選定主辦城市舉辦一屆，從 1994 年於法國巴黎舉辦第一屆世界大會開始，至本（25）屆由丹麥哥本哈根舉行。

本次大會主題為：「提升生活品質(Quality of Life)」，展示了哥本哈根利用 ITS 解決方案，如動態都市空間(Dynamic Urban Space)、自行車使用的資訊可變標誌系統(Variable Message Signs for Cyclists)、交通號誌系統最佳化(Traffic Signal Optimization)、交通管理(Traffic Management)、智慧路燈系統(Intelligent Street Lighting)、環保駕駛(Eco-Driving)，和交通行動服務(MaaS，Mobility as a Service)，帶給市民良好的生活品質。哥本哈根認為 ITS 可改善交通，促進行車秩序和加強公共交通的重要手段，同時也提供了更智慧、更環保、更健康的解決方案。因此，哥本哈根希望透過 ITS 解決方案，預計於 2025 年成為第一個碳平衡的城市。

本局高速公路交控系統之發展，從 1984 年於國 1 基隆至楊梅路段及國 2 機場支線建置了 80 公里長的第 1 代交控系統，路側設備包括車輛偵測器(VD)、閉路電視攝影機(CCTV)及資訊可變標誌(CMS)等進行交通量收集與資訊發布；1996 年於國道基隆至新竹路段建置了 250 公里長的第 2 代交控系統，除 VD、CCTV、CMS 持續建置外，亦引進匝道儀控系統(RMS)及國 3 北部路段隧道群的車道管制號誌系統(LCS)，以及後期建置於隧道內的影像式事件偵測系統(IID)；2010 年則由本局負責建置 12 條東西向快速公路及高速公路整體路網共 1,410 公里長的第 3 代交控系統，增加了速限可變標誌(CSLS)及 1968 客服專線、旅行時間看板(TTS)，至 2014 年計程電子收費(ETC)之巨量資料產出與分析應用，與 2017 年底建置試辦國 5 藍牙(BT)交通資訊推播系統等；自 2018 年開始由本局委託廠商統一建置 1 套中央電腦系統，結合大數據分析及自建雲端化系統平台，開始構建第 4 代交控系統，同時於同年底推出改版 1968App 與網頁，導入使用者經驗及介面(UX/UI)重新設計，並結合電子地圖操作介面，更提供個人化的適地性(LBS)路況資訊推播服務。

為了解目前國外在智慧運輸領域之發展及技術，爰本局於本年度編列相關預算參與本屆 ITS 世界大會，由筆者奉派參加與會。

圖 1-1 筆者於 Bella Center ITS 展覽會場-台灣館前與王政次等人合影

圖 1-2 筆者於 Bella Center ITS 會場入口

貳、行程紀要

本（25）屆智慧型運輸系統世界大會訂 107 年 9 月 17 日至 107 年 9 月 21 日共 5 天在丹麥哥本哈根市召開，含往返搭飛機時程，本次出國行程自 107 年 9 月 14 日深夜 23 時 40 分起至 107 年 9 月 23 日 21 時 15 分止，共計 10 天，詳細行程如下。

日期	星期	行程	內容	備註
9 月 15 日 9 月 14 日	五 六	台北－哥本哈根	去程	法國巴黎轉機
9 月 16 日	日	哥本哈根	台灣 ITS 活動	
9 月 17 日	一	哥本哈根 Bella Center 會議中心	1. 報到及開幕 2. ITS 展覽會場	
9 月 18 日	二	哥本哈根 Bella Center 會議中心	1. 研討會 2. ITS 展覽會場 3. 技術參訪：Scalling C-ITS solution in City of Copenhagen-a ITS experience in City of Copenhagen	
9 月 19 日	三	哥本哈根 Bella Center 會議中心	1. 研討會 2. ITS 展覽會場 3. 技術參訪：The Oresund bridge-the smart link between Demark and Sweden	
9 月 20 日	四	哥本哈根 Bella Center 會議中心	1. 研討會 2. ITS 展覽會場 3. 技術參訪：Traffic Management Strategy in Copenhagen:City Traffic Management Platform and Dynamic Signal Control in City of Copenhagen	
9 月 21 日	五	哥本哈根 Bella Center 會議中心	1. 研討會 2. ITS 展覽會場	
9 月 22 日 9 月 23 日	六 日	哥本哈根－台北	返程	英國倫敦轉機

此外，交通部王國材政務次長榮獲本年度「Hall of Fame on ITS World Congress-ITS 世界大會名人堂終身成就獎」，並於本屆世界大會開幕式接受頒獎表揚。

圖 2-1 交通部王國材政務次長榮獲本屆世界大會名人堂終身成就獎

圖 2-2 主辦單位於開幕典禮聘請專家手繪本屆 ITS 的主題

參、活動內容

哥本哈根是世界上最適宜居住的城市之一。這座城市融合了當地的生活品質和全球視野。它以其創新的氣候挑戰和環境方法而享譽國際，並享有世界上最適合騎自行車的城市美譽。哥本哈根在面對環境、交通安全和壅塞的城市發展挑戰方面，取得了顯著成果。哥本哈根目標在 2025 年成為第一個碳平衡的首都，若屆時實現該項目標，將使它成為歐洲綠色技術和創新領域的領導者。哥本哈根已經發展 ITS 和綠色交通，並積極參與了許多創新項目。這包括使用 ITS 提高駕駛通過路口號誌綠燈的機率，使公共交通更具吸引力及便利性，減少空氣污染排放，並提高騎自行車者的通行時間。

本次大會主題為：「提升生活品質(Quality of Life)」，為各界展示哥本哈根最新的 ITS 解決方案和交通行動服務，透過 ITS 來改善市民居住的生活品質。哥本哈根市堅信採用 ITS，可以讓哥本哈根於 2025 年成為第一個碳平衡的城市。哥本哈根認為 ITS 可改善交通，促進行車秩序和加強公共交通的重要手段，同時也提供了更智慧、更環保、更健康的解決方案。

本屆大會透過會議研討、展覽展示、技術考察、大會交流活動，及實地示範方式，將智慧型運輸系統相關研究成果呈現給與會人員瞭解並親自體驗。

一、研討會

在大會期間舉辦各種會議共 200 餘場次，議題內容環繞各國在智慧型運輸系統推動發展之成果及所面臨之挑戰，會議依性質區分為全體會議、行政會議、特別主題會議、技術會議、科學會議、商業會議等項。(各會議討論議程表如附錄一)

（一）全體會議（Plenary Sessions）

共舉辦 3 場，讓與會者瞭解本屆 ITS 年會的重點，即如何利用綠能智能及交通行動服務 MaaS，來提升民眾的生活品質，並提出 ITS 面對最新挑戰與機會，以及 ITS 的政策及策略。

（二）行政會議（Executive Sessions）

共舉辦 12 場，由政府交通官員、主要組織和高級商務代表、學者等與會分享其在最新 ITS 的經驗成就及解決方法，包括健康宜居的城市、交通行動服務 MaaS、資料開放、如何提升安全性等。

（三）特別主題會議（Special Interest Sessions）

舉辦 90 場，由專業開發者及 ITS 專家，提供目前所關注的自動駕駛車輛、交通行動服務 MaaS、5G 時代的來臨、行動支付、V2I、V2X、人工智慧和機器學習、跨域整合支付等。

（四）技術會議（Technical Sessions）

舉辦近 79 場，由 ITS 方面之專家及學者發表論文，針對 ITS 各方面的最新發展和應用進行發表和展示，以了解最新的智慧型運輸系統技術。

（五）科學會議（Scientific Sessions）

舉辦 11 場，由 ITS 方面之專家及學者發表 ITS 相關專業性論文。

（六）商業會議（Commercial Paper Sessions）

舉辦 4 場，起源於第 11 屆名古屋世界年會，並被之後的世界年會傳承下來。發言人透過海報和現場展示，為參與代表展示其最新的成果和經驗，提供發言人與現場聽眾面對面直接進行充分交流和討論的平台。

二、技術參訪

本屆 ITS 大會之技術參訪分為兩個部分，一為哥本哈根的交控體驗行程(Copenhagen 1:1 tours)，體驗智慧城市哥本哈根，了解該市為改善市民生活品質所做的努力。「哥本哈根 1：1」」即是與哥本哈根市的專業人士進行一對一會談的唯一機會，他們實施解決方案並體驗結果。體驗哥本哈根成為世界上最適宜居住的城市之一。總共規劃安排 7 項體驗行程：哥本哈根交通管理策略-動態號誌控制管理平台、哥本哈根的自行車 ITS 解決方案、哥本哈根解決方案實驗室、哥本哈根市的 C-ITS 解決方案-在哥本哈根市的 ITS 體驗、乘船遊覽-宜居港口的可持續解決方案、哥本哈根的智能街道照明、自行車規劃即是城市規劃(Traffic Management Strategy in Copenhagen: City Traffic Management Platform and Dynamic Signal Control in City of Copenhagen、ITS solutions for bicyclist in Copenhagen、Copenhagen Solutions Lab & BLOXHU、Scalling C-ITS solutions in City of Copenhagen－a ITS experience in City of Copenhagen、Boat tour－Sustainable solutions in the liveable harbor、Intelligent Street Lighting in Copenhagen、 (Bicycle planning is city planning)等；另一為技術考察(Technical Visits)，包括哥本哈根的自動化地鐵、新地鐵城

市環、訪問 DTU：Transport 2.0 符合 Energy 2.0、交通塔東-交通管理中心、移動的未來-Ideon 科學園區、奧爾堡大學-商業，創新和技術 ITS 研究之間的明智聯繫、厄勒海峽大橋-丹麥和瑞典間的智慧聯繫、DOLL Living Lab、瑞典馬爾默的智能和綠色交通解決方案、哥本哈根機場-乘客服務智慧解決方案(Copenhagen's Autonomous Metro、New Metro City Ring、Visit to DTU: Transport 2.0 meets Energy 2.0、Traffic Tower East – Traffic management center、The future of mobility – Ideon science park、Aalborg University – the smart link between business，innovation and technical ITS research、The Oresund bridge – the smart link between Denmark and Sweden、DOLL Living Lab、Smart and green traffic solutions in Malmö，Sweden、Copenhagen Airport – Intelligent solutions for passenger services)等 10 項考察行程。(如附錄二)

筆者報名參加了 2 項體驗行程及 1 項技術考察行程，以下就參訪行程概述如下：

（一）哥本哈根市的 C-ITS 解決方案-在哥本哈根市的 ITS 體驗（Scalling C-ITS solutions in City of Copenhagen – a ITS experience in City of Copenhagen）

大會資料顯示，自 2014 年以來，哥本哈根市與其技術合作夥伴 Dynniq 和 Technolution 一起在哥本哈根環城路一半約近 50 個號誌路口進行合作服務。以 ITS-G5 服務和行動通訊（例如 3G / 4G）服務基礎下，透過交通號號控制和通信技術，提供駕駛者或騎自行車者動態速度建議。基於這些建議，駕駛人或騎自行車者可以調整其速度，以避免在號誌路口停車並提高駕駛/乘坐效率和舒適度。哥本哈根市是 C-ITS 實施的先驅之一，並將採用最新的解決方案繼續在 C-ITS 中發揮主導作用。

在本次參訪行程中，大會安排停留在位於哥本哈根市東側交控中心旁的號誌路口現勘，了解哥本哈根利用安裝於路口號誌桿上方的信號發射器，提供車輛內車載機相關即時路況資訊，與國內目前相關單位作法相同，而本局在國 5 試辦藍牙交通資訊推播系統，亦是採路側安裝信號發射器，將路況資訊發送至安裝 App 的手持行動裝置。另筆者原本以為會讓參訪者進去交控中心參觀，可惜大會是安排在另一個技術參訪行程。

圖 3-1 哥本哈根市的 C-ITS 解決方案體驗參訪路線(大會提供資料)

圖 3-2 哥本哈根市的 C-ITS 解決方案體驗參訪路口(引用大會官網)

（二）厄勒海峽大橋-丹麥和瑞典之間的智慧聯繫(The Oresund bridge－the smart link between Denmark and Sweden)

根據大會提供資料，本行程係由遊覽車全程於提供瑞典和丹麥之間唯一連接的厄勒海峽大橋行駛，並到達位於瑞典側的收費站。在收費站內將介紹電子收費系統，包括車輛偵測，以及通過收費站控制速度的智慧安全管控方式。

另一個重點是交通控制中心，介紹瑞典和丹麥警方一個跨境連接的閉路電視系統，以及兩個國家的救援部隊和其他系統的警報系統。

厄勒海峽大橋的主跨是世界上其中一段最長的斜拉橋主跨，有 490 公尺。而橋塔高 204 公尺，大橋則全長 7,845 公尺，大概是瑞典和丹麥大陸距離的一半，重 8,200 萬公斤。而其餘的距離則位處在 Peberholm(Pepper islet)這個人工島上，有 4,055 公尺長。這個名稱源自對岸的薩爾特島。Peberholm 島位處丹麥，島上有一段隧道，長 4,050 公尺，當中 3,510 公尺在海底下，而兩端則各有 270 公尺的引道。在島上，兩條鐵路線位於行車路的下方。大橋橋面和水平面間有一段高 57 公尺的空間供船隻航行，不過絕大多數的船隻往來都使用杜洛格敦海峽（Drogden），即是隧道所在的地方。(資料來源:維基百科)

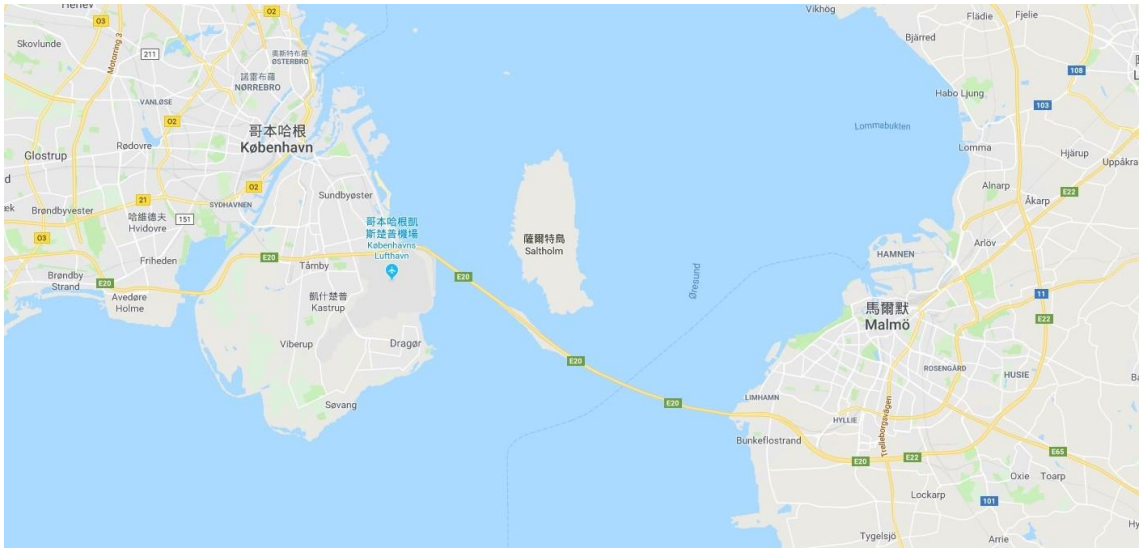
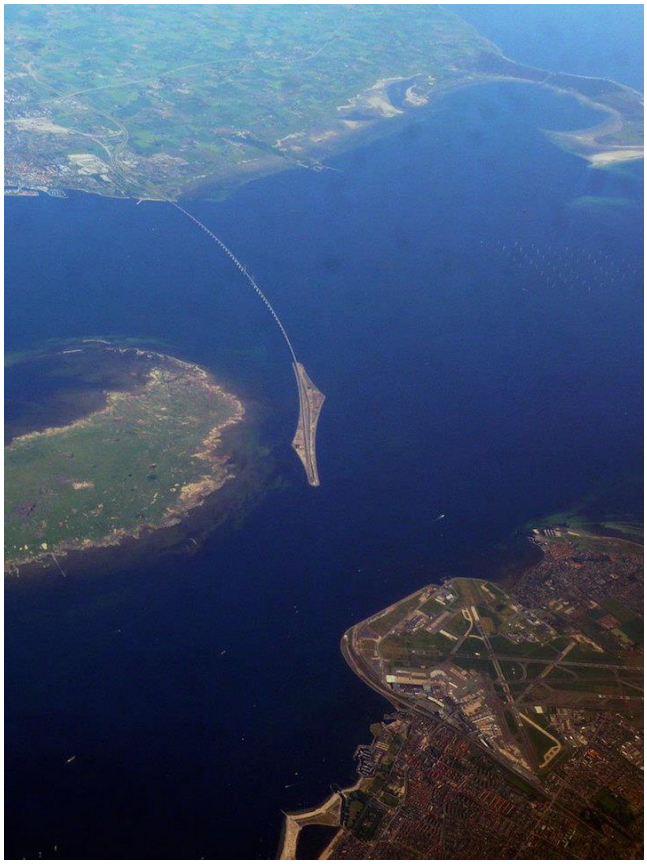


圖 3-1 哥本哈根地圖(資料來源:Google 地圖)



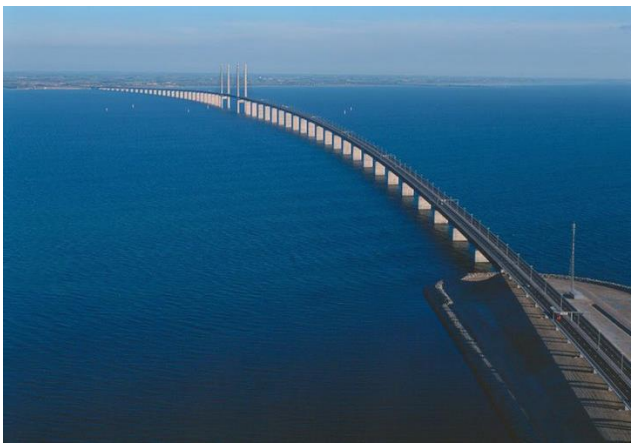




圖 3-2 厄勒海峽大橋(資料來源:MY MODERN MET)

本次參訪地點係位於瑞典端的收費站旁的交通控制中心，從丹麥出境後，過橋進入瑞典需要辦入境簽證，故在大會即將開幕之前，筆者即收到主辦單位電子郵件提醒是否屬申根簽證國家，避免搭車進入瑞典時因簽證問題無法進入，慶幸本國屬申根簽證國家範圍，故無需再另辦簽證，惟當日參訪團 1 車進入瑞典境內時(其實也只是在橋的東端收費站旁)，卻未檢查參訪人員的護照，大概是整車採團進團出方式，故猜測是大會特地為這次活動與瑞典方面情商通融。

下車後，領隊先將整團分 3 組成員帶開分別由專人介紹交通控制中心、收費系統及動態減速系統等：

1. 交通控制中心：負責厄勒海峽大橋(含隧道段)之事件偵測及路況監控、故障排除通報，該閉路電視系統亦將同時提供給瑞典和丹麥警方，以及兩個國家的救援部隊和其他系統的警報系統。影像監控工作臺由 1 位人員負責監看及接收通報任務，採 24 小時輪班運作。初步觀察該監控工作站及圖誌顯示牆內容較簡易，所以並無本局北區交控中心於白天電話此起彼落的通報聲，三面採玻璃隔間採光好，也可從側邊直視外面的收費站情形，整體工作環境舒適。另發現旁邊還有 1 席工作臺，人員直接面向玻璃窗外之收費站，並無大面的影像圖誌顯示看板監看路況，從其桌上的麥克風設備，可能與進收費站的車輛管理廣播有關。

圖 3-3 厄勒海峽大橋交控中心監看席

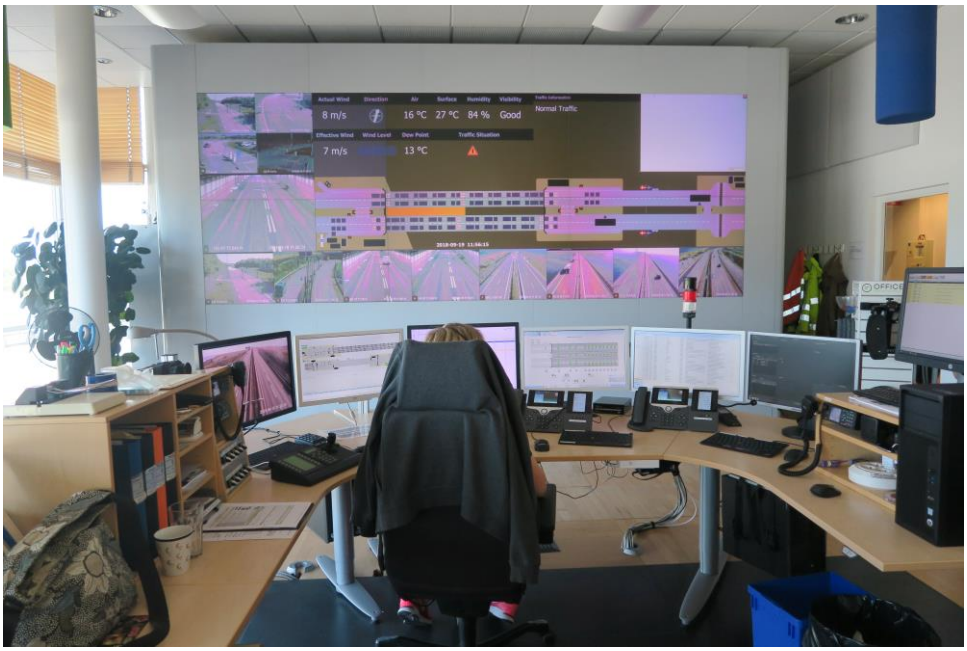


圖 3-4 厄勒海峽大橋交控中心監看席

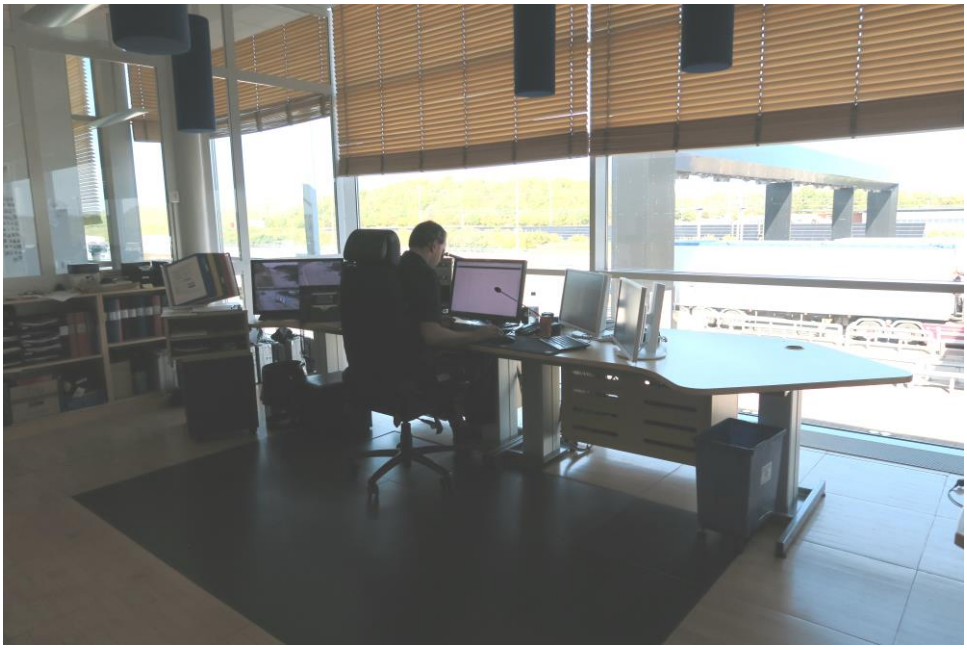


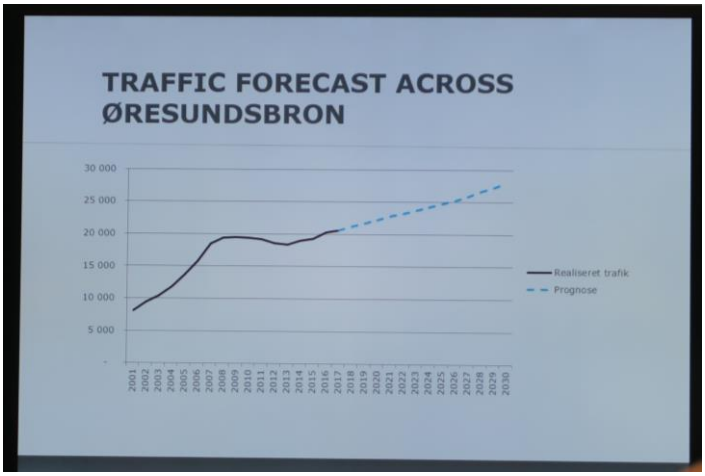
圖 3-5 厄勒海峽大橋交控中心另一工作席

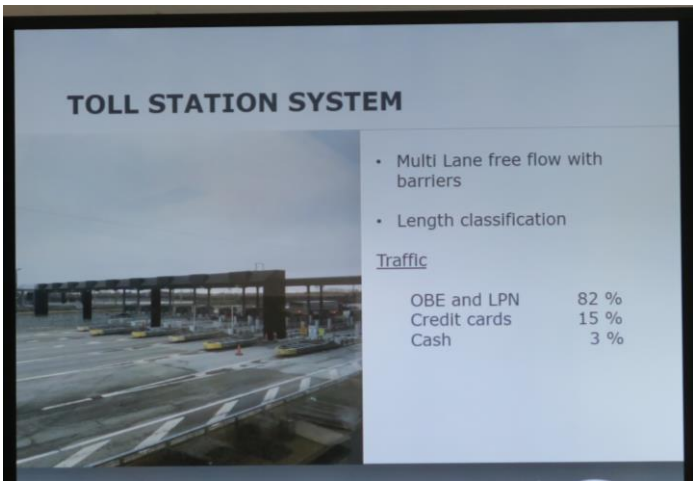
2. 收費系統：採人工收費、信用卡收費及電子收費等多種收費方式。其中的電子收費是採多車道柵欄式，當車輛內的 OBU 在進收費車道前被偵測設備偵知並於系統核對資料正確後，電子收費車道的柵欄即打開讓其通過。另亦提供持信用卡或找零收費車道。由於是由單向 2 車道

展開至少 7 個收費車道，故參觀期間接近中午並未見到有等停車繳費大排長龍的現象。

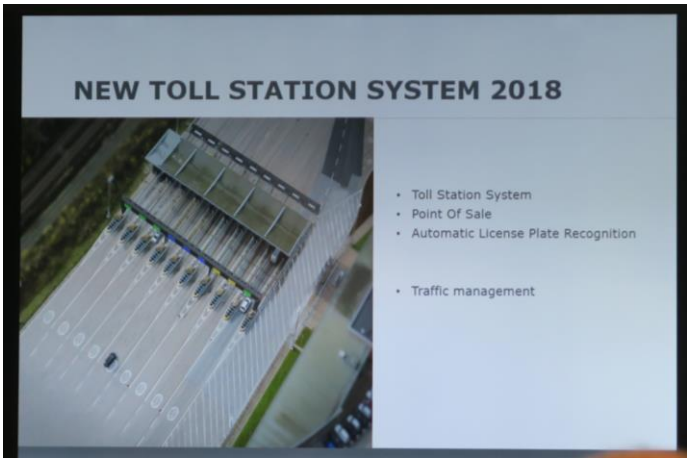
從現場準備簡報中得知：(簡報內容詳附圖)

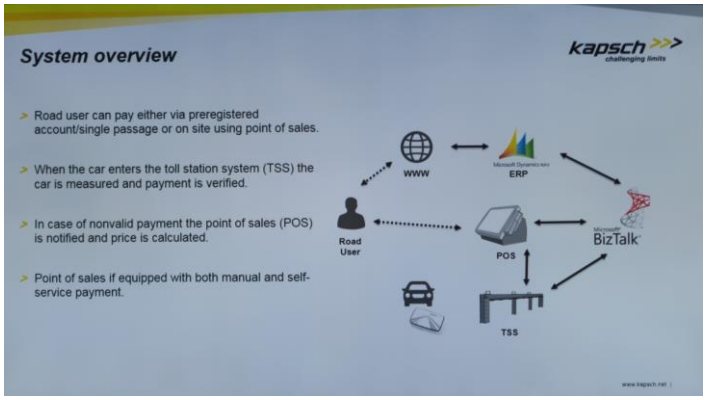
- 小客車佔通過收費站 90%
- 交通量持續成長
- 同時採人工收費及非人工收費
- 柵欄式多車道自由流收費
- 使用電子收費佔 82%、信用卡付費佔 15%、人工收費佔 3%
- 2018 年增加車牌辨識收費方式

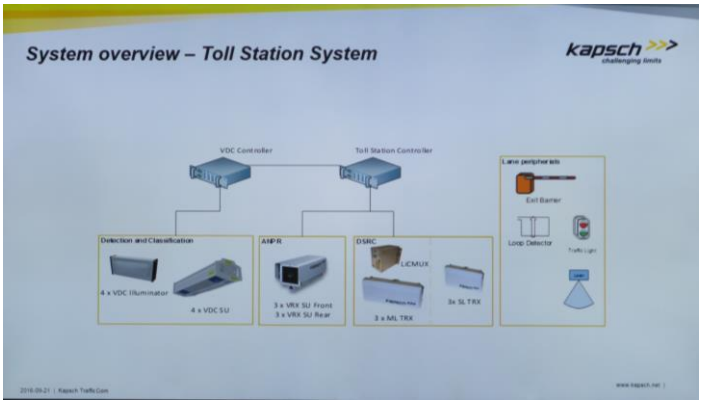


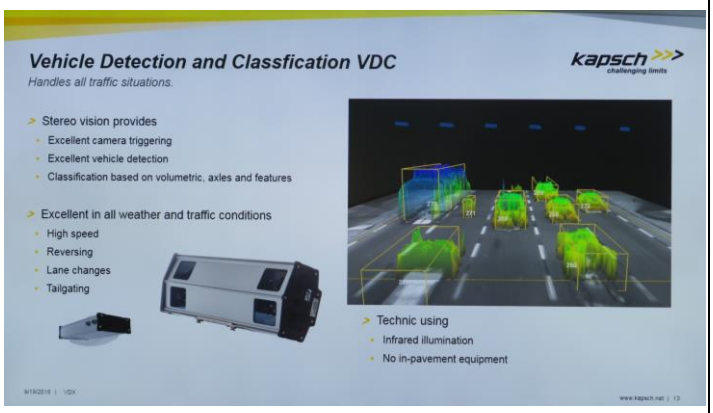


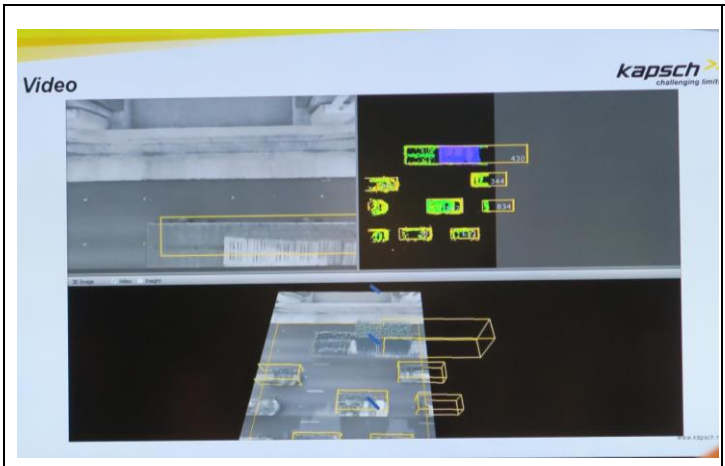

MEANS OF PAYMENT
MLB 803
G Pay
Pay


NEW TOLL STATION SYSTEM 2018
Toll Station System
Point Of Sale
Automatic License Plate Recognition
Traffic management


System overview
kapsch
Road user can pay either via preregistered account/single passage or on site using point of sales.
When the car enters the toll station system (TSS) the car is measured and payment is verified.
In case of nonvalid payment the point of sales (POS) is notified and price is calculated.
Point of sales if equipped with both manual and self-service payment.
WWW
ERP
Road User
POS
BizTalk
TSS

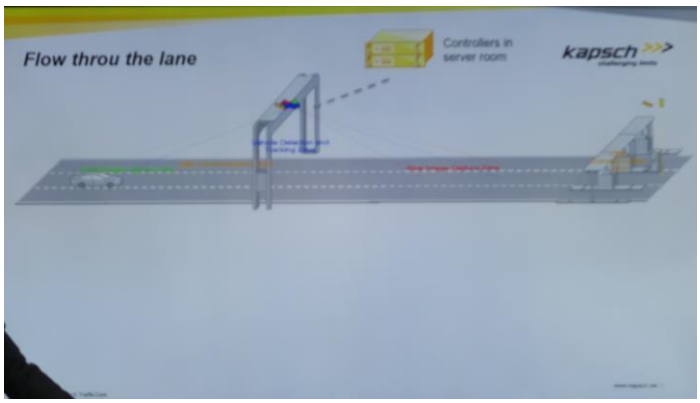

System overview – Toll Station System
kapsch
VDC Controller
Toll Station Controller
Detection and Classification
4 x VDC Illuminator
4 x VDC SU
ANPR
3 x VRX SU Front
3 x VRX SU Rear
DSRC
LICMUX
3 x ML TRX
3x SL TRX
Lane peripherals
Exit Barrier
Loop Detector

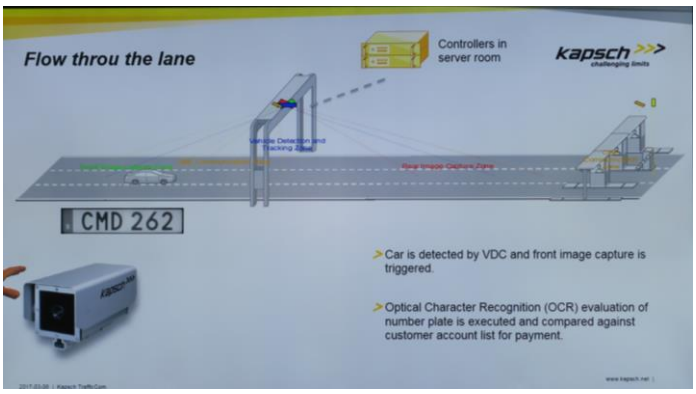

Vehicle Detection and Classfication VDC
Handles all traffic situations.
kapsch
Stereo vision provides
Excellent camera triggering
Excellent vehicle detection
Classification based on volumetric, axles and features
Excellent in all weather and traffic conditions
High speed
Reversing
Lane changes
Tailgating
Technic using
Infrared illumination
No in-pavement equipment

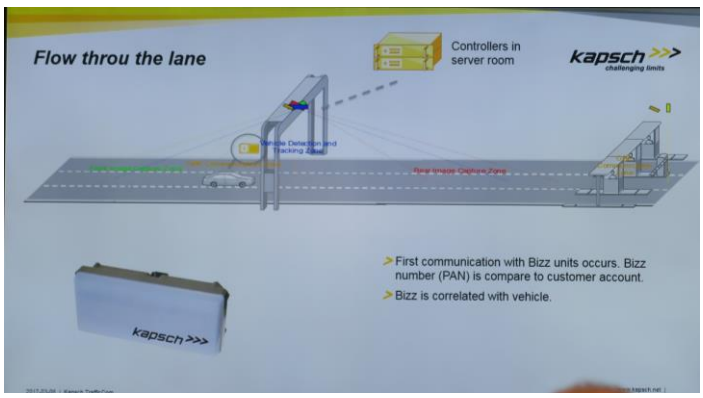

Video
kapsch


Vehicle Registration
ANPR
Matching front an rear images from the VDC
Infrared flash to handle all weather
ANPR engine to match plate to registered customers
ZAK 985
MMG·488
CMD 262
SGX 527
kapsch


DSRC -Bizz
Enter your subtitle here.
kapsch
Standardized interoperabilty
CEN TC278 DSRC System
EasyGo and EETS compatible
High confidence
Path tracking and correlation
User friendly
Second chance antenna


Flow throu the lane
Controllers in server room
kapsch


Flow throu the lane
Controllers in server room
kapsch
CMD 262
Car is detected by VDC and front image capture is triggered.
Optical Character Recognition (OCR) evaluation of number plate is executed and compared against customer account list for payment.


Flow throu the lane
Controllers in server room
kapsch
First communication with Bizz units occurs. Bizz number (PAN) is compare to customer account.
Bizz is correlated with vehicle.

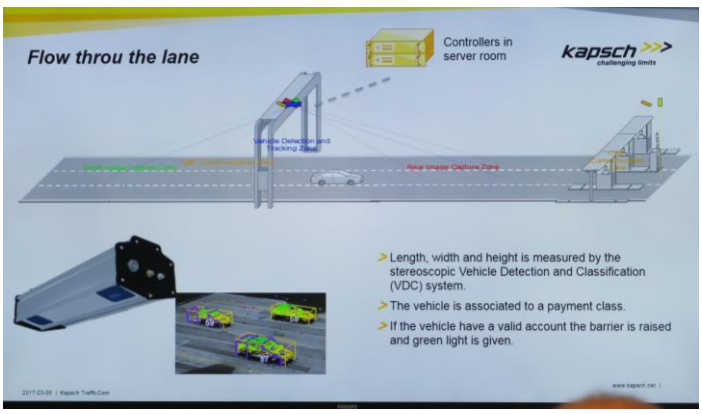
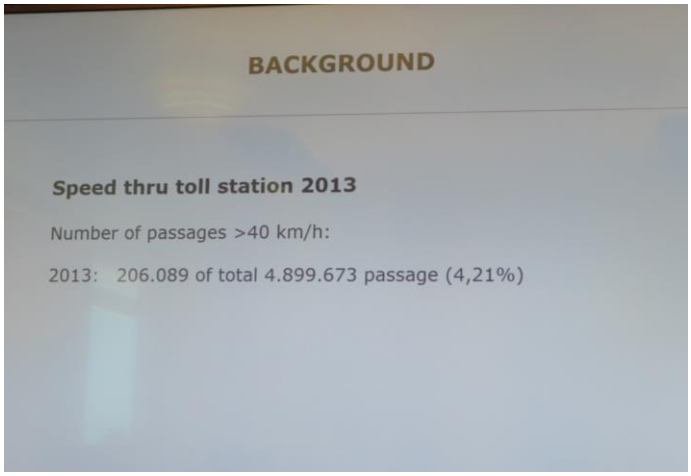
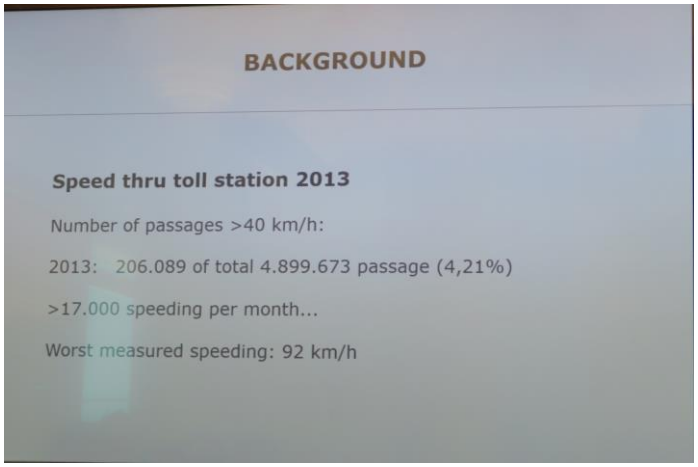

Flow throu the lane
Controllers in server room
kapsch
Length, width and height is measured by the stereoscopic Vehicle Detection and Classification (VDC) system.
The vehicle is associated to a payment class.
If the vehicle have a valid account the barrier is raised and green light is given.

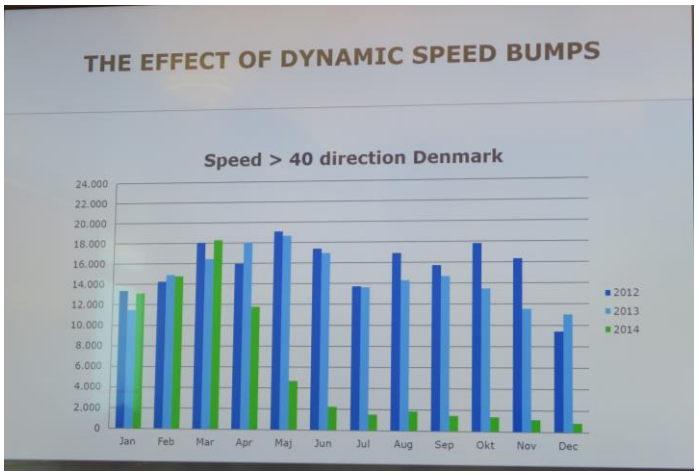
圖 3-6 厄勒海峽大橋收費系統簡報

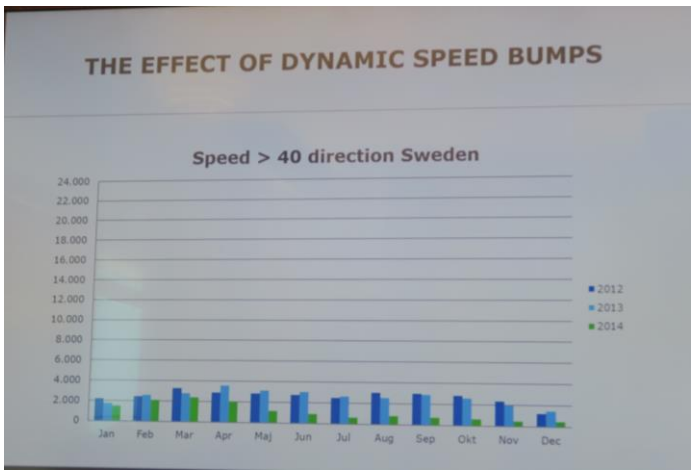
3. 動態減速系統：經統計 2013 年厄勒海峽大橋收費站過站的時速，大於 40km/h 的車輛佔 4.21%(206,089 輛)，平均每月超過 17,000 輛，最高時速達 92km/h。往丹麥方向車速大於 40km/h 的車輛普遍較往瑞典多，初步瞭解應與往丹麥方向為離開瑞典境內，而往瑞典方向則是要進入瑞典有關。當 2014 年 5 月啟用動態減速系統後，時速大於 40km/h 車

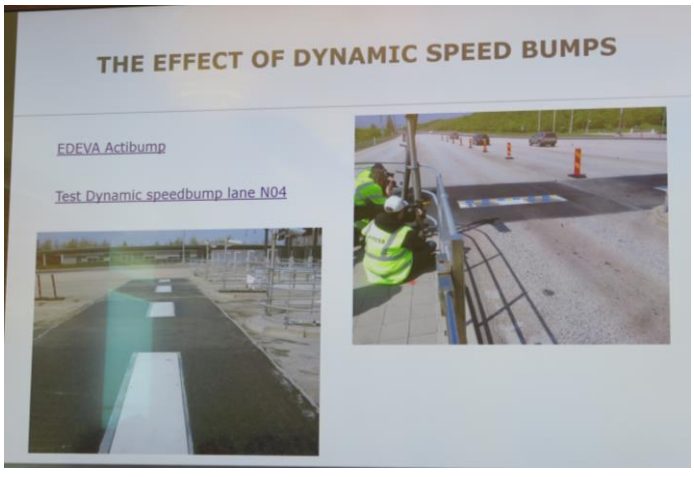
輛明顯減少許多，尤其是往丹麥方向降低最多。該系統係在路面埋設車速偵測器，當車輛壓佔偵測出時速大於 40km/h 時，下游不遠處之減速系統的鋼板則會一側往下降低，造成車輛經過時產生跳動不適而減速，經由該系統之啟動，讓通過收費站之車輛速度集中於 40km/h，增加行車安全及改善行車環境。











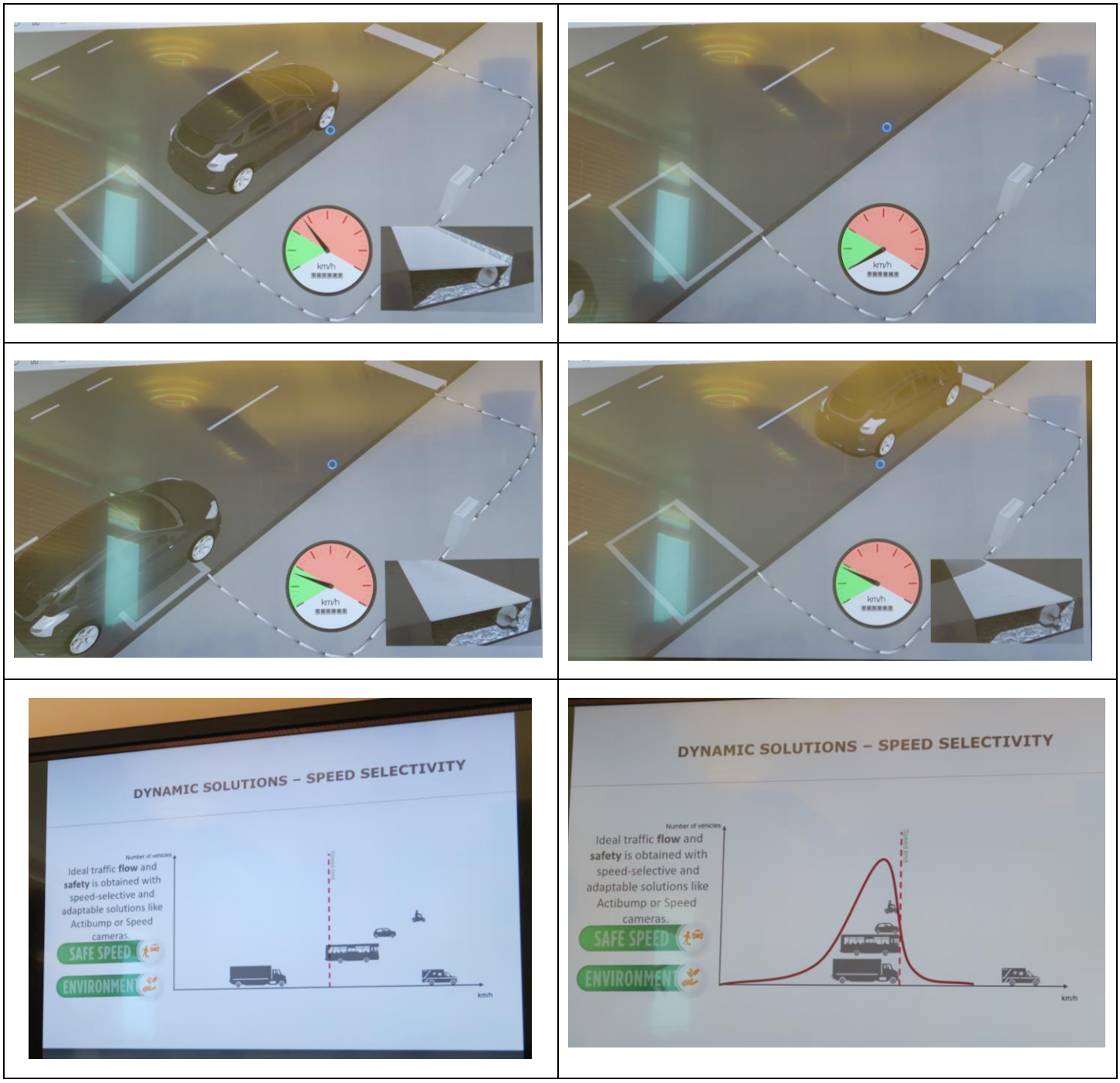


圖 3-7 厄勒海峽大橋動態減速系統簡報

圖 3-8 厄勒海峽大橋動態減速系統未啟動現場情形

圖 3-9 厄勒海峽大橋動態減速系統啟動現場情形

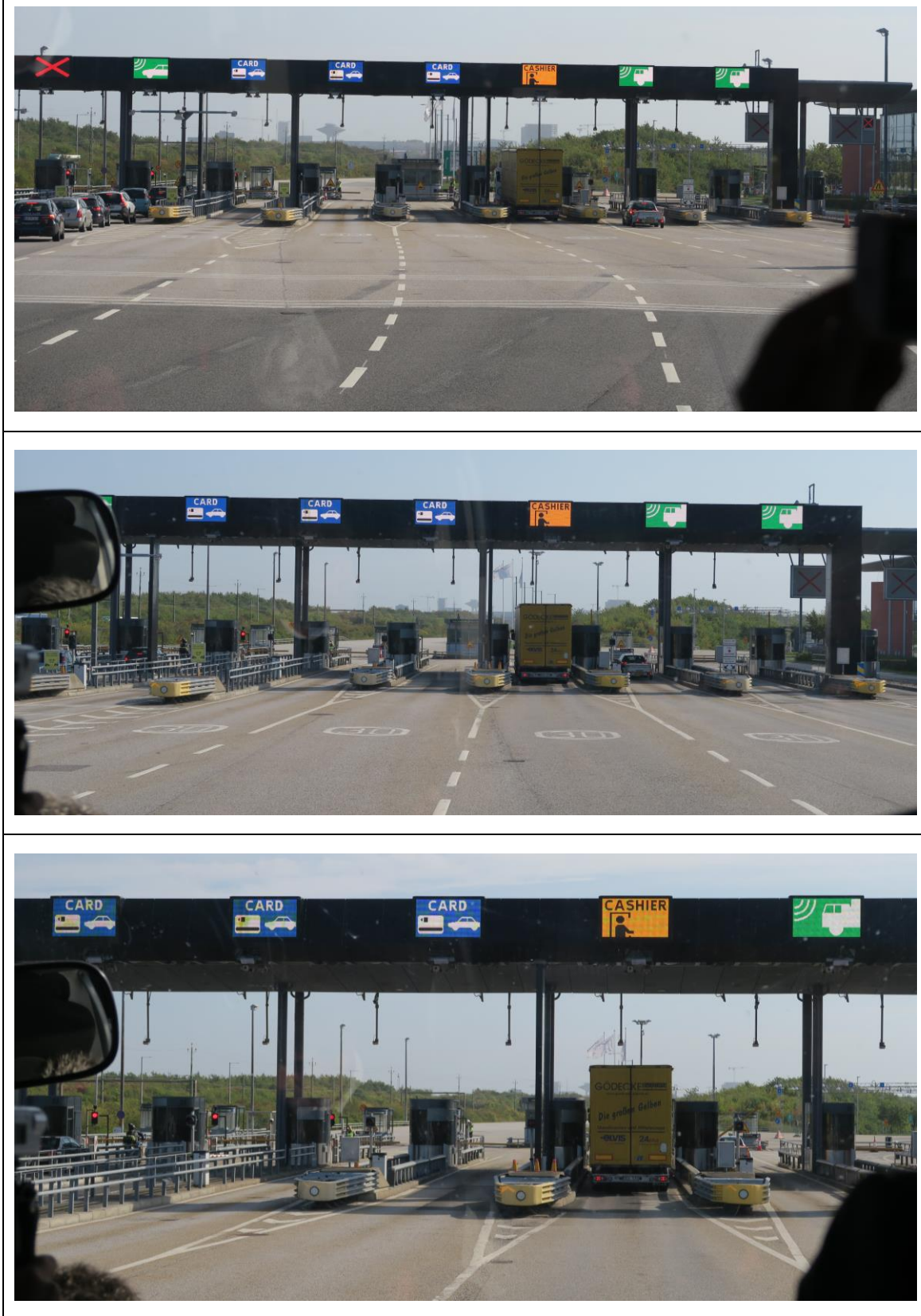


圖 3-10 厄勒海峽大橋收費站進站前車道配置情形

圖 3-11 厄勒海峽大橋收費站過站情形

（三）哥本哈根交通管理策略-動態號誌控制管理平台(Traffic Management Strategy in Copenhagen: City Traffic Management Platform and Dynamic Signal Control in City of Copenhagen)

哥本哈根市過去三年一直專注於優化道路網絡上的主要路廊-重點為提供自行車、行人、公共巴士和駕駛者更好的機動性。通過優化主要路廊的交通號誌，可以防止或縮短號誌路口的等待時間。服務目標使騎自行車者和公共交通工具在城市中的汽車上具有競爭優勢。交通管理策略實施結果，則反映於交通行旅時間、停靠次數和旅行時間可靠性。

參訪行程將現勘中央路口，並介紹哥本哈根市交通號誌控制的不同方法，包括：

1.哥本哈根市的交通管理策略
2.如何監控提升騎自行車者於哥本哈根道路網絡的效能
3.號誌優化的方法
4.使用 FCD（浮動車數據）數據作為中央走廊號誌優化的觸發器
5.使用號誌狀態建立自行車和行人模擬器來監控服務目標
6.調整號誌的不同方法：城市交通管理平台的優化和動態號誌控制和地區性號誌控制。

在本次參訪中，筆者所搭乘的遊覽車，可以透過車載機(OBU)與每個路口安裝的信號柱所發送的號誌時制進行運算，提供駕駛可以通過前方路口的行車速率；另如車輛停在路口，該車載機亦會顯示紅燈倒數秒數，真實呈現 V2I 的車聯網智慧交控，然而整套系統運作最優化涉及各路口動態即時交通量變化等因素，故筆者好奇詢問如何即時大量運算眾多路口車流量取得最佳化，結果答案很簡單，即除了 1 處流量較大路口號誌採動態調整時制外，其餘路口號誌均採固定時制，然後利用車載機上提供可通過號誌路口的行車速率，讓車輛接近路口時，盡可能在第一個號誌運作周期配合車載機顯示可通過的行車速率通過，所以整個動態號誌系統不在於處理每個號誌路口最佳運作時制，而是透過提供每輛車可通過固定時制號誌路口的行車速率來達到最佳化結果，實務上也確實發揮該交通管理策略成效。

圖 3-12 哥本哈根交通管理策略-動態號誌控制管理平台參訪路線(大會提供資料)

圖 3-13 哥本哈根交通管理策略-動態號誌控制管理平台參訪路線

車載機

圖 3-14 哥本哈根交通管理策略-動態號誌控制管理平台之車載機顯示情形

三、展覽概述

本屆展覽涉及交通運輸、建設、通訊技術、汽車、能源等相關行業，以及智慧型運輸系統技術綜合應用領域。參展單位包括 39 家行動網路營運商、89 家公共機構、132 家研究單位、181 家服務提供商、162 家供應商、197 家交通運輸業、53 家使用單位、44 家汽車製造商。

本國民間業界亦在 ITS 展覽會場參展發表國內廠商辦理 ITS 各項成果，如銓鼎科技在本局國道 5 號開發之即時交通路況資訊藍牙推播系統、工研院智慧路側預警系統及自動駕駛中型巴士、中華電信公司與交通部合作開發結合大數據分析、智慧交通與行動支付的 UMAJI 遊買集 App、遠通電收公司於本局建置電子收費系統等，利用各國 ITS 相關人員參與大會的機會，將台灣發展 ITS 廠商之經驗與技術實績帶出國外。

圖 3-15 由國內相關業界所共同布展的台灣館

圖 3-16 遠通電收公司之電子收費系統介紹

圖 3-17 銓鼎科技公司開發之藍牙資訊推播系統

展覽會場中，除了剛開始發生中國 ITS 代表團抗議台灣館的布展及對本國 ITS 代表團出席名稱有意見之小插曲外，其餘幾家廠商所開發的路側偵測設備產品，均結合影像辨識技術及大數據分析軟體，來提升設備偵測率及辨識功能；另有德國廠商開發影像辨識的電子收費軟硬體系統模組，可作為國內參考，分述如下：

（一）Citilog：SmartCam-td，標榜智慧交通攝影機，結合業者建構的雲端資料庫，利用大數據分析攝影機所錄攝車流畫面進行交通資訊的收集，包括車流量、車種分類、平均車速、佔有率及服務水準等，此外，透過軟體跟硬體的配合及影像分析的技術，可以進行車輛逆向、誤闖及行駛路肩等事件偵測。

（二）HOUSTON：Radar SpeedLane Pro 雙雷達車輛偵測器，原先開發產品係為單雷達偵測器，近幾年開始陸續有雙雷達產品推出，準確率較單雷達高，惟成本亦較高，本次大會詢問業者表示，目前雙雷達產品價格已與單雷達相近，而該公司之偵測器內另增加一組高解析度攝影機，可以透過影像自動辨識分析，自動與雙雷達偵測出來結果進行調校，無需傳統式採人工錄影讀取影像後進行比對校估。

（三）VITRONIC：TOLLCHECKER，由硬體跟軟體模組組成的平台，採用影像車牌辨識系統來進行收費。每一模組均提供主要功能，從路側到後端辦公室之車輛偵測、車輛辨識、收費及系統維運等。這些模組皆由客製化且高效率辨識車輛及行駛軌跡，並具有容易拆裝的時效性。後端則採圖形化顯示介面，可依據使用者需求提供每部車輛行駛紀錄、車牌等資訊。

圖 3-18 Citilog SmartCam-td 高解析度數位攝影機畫面(廠商提供資料)

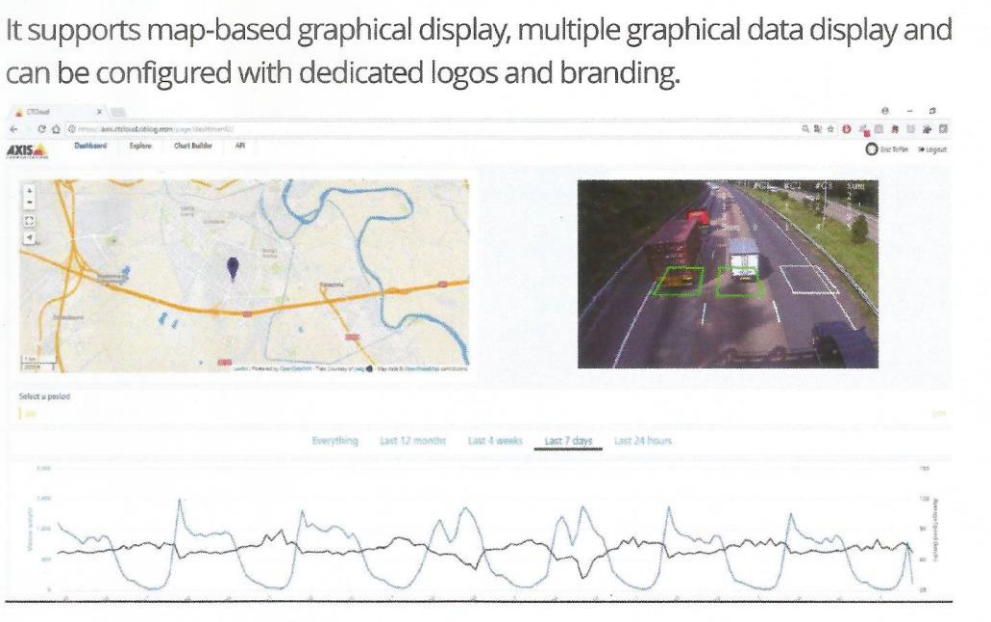


圖 3-19 Citilog SmartCam-td 圖層顯示及影像偵測畫面(廠商提供資料)

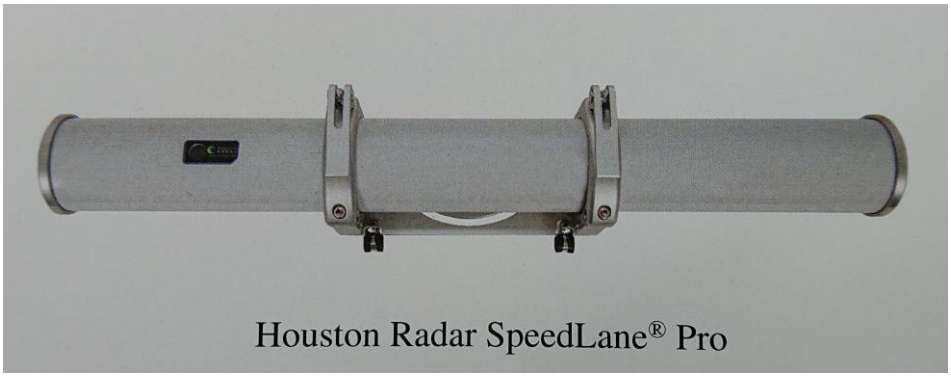


圖 3-20　HOUSTON-RadarSpeedLane Pro 之雙雷達車輛偵測器(廠商提供資料)

圖 3-21　HOUSTON-RadarSpeedLane Pro 之內建影像畫面(廠商提供資料)

圖 3-22 VITRONIC-TOLLCHECKER 之門架設置情形(廠商提供資料)

圖 3-23 VITRONIC-TOLLCHECKER 之後端影像處理畫面(廠商提供資料)

圖 3-24 VITRONIC-TOLLCHECKER 之後端影像處理畫面(廠商提供資料)

肆、心得與建議

一、心得

筆者曾於 10 年前參加於美國紐約舉辦的第 15 屆 ITS 世界大會，當時大會所展示的 V2I 或 V2V 技術應用，初步了解是大會事先將展示路線中的號誌、資訊可變標誌、停車位剩餘資訊等，先安排好路側設備發射器與導覽車上的 OBU 進行資訊交換的展示，而非全面性的實際推廣應用。相隔了 10 年，在丹麥哥本哈根，這些透過路對車、車對路等車聯網的應用，已經構建在市區的路口號誌系統、交通管理系統等與生活息息相關的課題，並展現出 ITS 運用的效益與發展。

近年來在資通訊技術發展成熟及大數據分析運用普及下，影像辨識技術的進步，將人工智慧逐漸地在我們生活中一一實現，如本屆 ITS 大會所提供的兩款自動駕駛接駁車輛，以及今年國內智慧城市展覽中所示範供體驗搭乘的自動駕駛車輛，都已將民眾生活帶向另一種智慧運輸的行車環境。

此外，行動支付的普及與整合各運具的交通行動服務(MaaS)，也在近年來於世界各地蔓延。交通已不是單一運具的選擇與服務，整合民間或個人的私人運具，與官方提供的公共運輸，再結合在地觀光及商業活動來提供使用者更多元與即時性的選擇，如交通部與中華電信公司合作在國 5 路廊所開發的「「UMAJI 遊・買・集」App，即結合了「大數據分析」、「智慧交通」與「行動支付」等功能的旅行服務 App，透過手機行動裝置將片段的大眾交通運具加以整合，提供方便無縫的查詢、購票及搭乘服務。

二、建議

適逢本局交控系統軟、硬體設備陸續更新提升改善階段，中央電腦系統也從四個交控中心各自建置獨立運作，統一由局開發一套中央電腦系統交由各交控中心運作，並導入雲端架構平台，結合電子收費資料大數據分析功能等，讓即時大量的高快速公路整體路網路況資訊，能迅速分析並即時提供用路人，並透過中央電腦系統適時執行相關交管策略，即是希望能改善國道交通之壅塞問題。

從哥本哈根經驗得知，ITS 的應用在於解決民眾生活所遭遇的交通問題，

透過一些巧思與智慧化交通管理手段，也可以改善車輛於號誌路口通過效率，或是利用路側資訊可變標誌提供自行車騎乘者即時路況改道資訊之導引，或是交控中心工作環境的明亮簡約設計，或是原理簡單卻效果顯著的動態減速系統。其中在動態號誌最佳化系統中，透過車載機，以圖形化方式提供可安全通過路口的行駛速率，同時遇紅燈時亦提供紅燈倒數秒數資訊等。本局明年度於 1968App 提供適地性(LBS)路況資訊推播服務後，後續可研議於啟動匝道儀控之交流道入口前，提供類似紅燈倒數或建議可通過行車速率之圖形化資訊。至於動態減速系統的簡單運作原理，可應用於需均速或易超速之路段，惟國道主線行駛速率較高而不宜採用，避免後方車輛追撞情形發生。另智慧路燈系統，本局刻正於 1 處交流道及服務區試辦，未來將視試辦結果研議擴大試辦範圍。

國內 ITS 發展與應用已與國外同步甚而超前，除相關交控及智慧運輸軟硬體系統不斷更新提升外，也應思考各道路系統之服務功能需求，透過各式運具及各道路路況資訊整合服務，而不再追求單一運具或道路之最佳化運作模式，才能針對民眾複合式路徑及多旅次目的，提供最適合的整體解決方案。

附錄一：大會討論議程表(大會官網資料)

Programme at a glance

	Bella Center		Hall B				
	Auditorium Bordeaux	Auditorium Vienna	Tokyo	Montreal	London	Madrid	Turin
Monday 17 September							
11.00 – 12.30			SIS01 Comparing permits authorising trials of automated vehicles. Which works best?	TS01 Legal and governance issues	SIS02 Communication technologies for connected vehicles and automated driving		TS02 City air quality
Lunch (12.30 – 13.30)							
13.30 – 15.00			SIS09 Legal framework for AV accident	TS05 The future evolution of ITS	SIS10 Assessing next generation technologies for emerging future transportation environments	SIS03 Bringing new products and services to market	TS06 Electromobility
16.00 – 17.30	Copenhagen Hall Opening Ceremony						
Tuesday 18 September							
09.00 – 10.30			SIS16 Automated buses: the future of (last-mile) public transport?	TS10 Better parking terminal operations	SIS17 Evolution from current automotive connectivity and ITS deployments to 5G and 5G C-V2X	TS11 Communication Technologies 1	SIS18 ITS For Life
Coffee Break							
11.00 – 12.30	PL1 Achieving higher quality of life in our cities						
Lunch (12.30 – 13.30)							
13.30 – 15.00	ES01 Healthy and liveable cities	ES02 Putting citizens first in mobility design	SIS23 Deployment of Autonomous Shuttles on Public Roads – Experiences from Different Countries	TS15 Safety	SIS24 Smart Villages: ITS in Rural Areas	TS16 Standards and architecture	SIS25 Promote the Electromobility integration in urban environment
Coffee Break							
15.30 – 17.00	ES03 Essentials for developing a smart city	ES04 Managing the ebbs and flows of travel	TS20 Public transit systems	TS21 User acceptance	SIS28 Cooperative-ITS Standards Gaps	TS22 Communication technologies 2	SIS29 Copenhagen CO2-Neutral by 2025
Coffee Break							
17.15 – 18.45			SIS34 Autonomous Vehicles in Public Transport	SIS35 Strategy of Practical Implement of V-I Cooperative Systems for Traffic Accident Avoidance	SIS36 ICT serving automated road transport	SIS37 From Problem to Prototype: A Coordinated, Use-Case Based Approach	SIS38 Challenge of a common methodology to assess ITS impact on reducing emissions
Wednesday 19 September							
09.00 – 10.30			SIS42 Automated shuttles – lessons from trials and the path to deployment	TS27 Vulnerable Road Users	SIS43 Technical Challenges to Integrating Low Speed Automated Vehicles into the Transportation Network	TS28 Roadmaps to deployment	SIS44 Smart metrics for smart cities – traffic signals' contribution to liveability
10.45 – 11.30							
Coffee Break							
11.00 – 12.30	PL2 Ensuring integrated mobility services						
Lunch (12.30 – 13.30)							
13.30 – 15.00	ES05 MaaS: Seamless and effortless mobility	ES06 Institutional and legal challenges of CCAM	SIS48 Effective Measures of Success: The United States Connected Vehicle Pilots	TS32 V2X Solutions & Concepts	SIS49 Fast deployment of V2X using cellular networks and neutral servers	TS33 Sensing, detection, classification	TS34 Testing new approaches 1
Coffee Break							
15.30 – 17.00	ES07 The role of Open Data in the digital infrastructure – AM	ES08 Efficiency in freight transport – EU	SIS53 Impact Assessment of Automated Vehicles on Traffic flow and Environment	TS38 Traffic management and connected infrastructure 1	SIS54 Establishing a Large-Scale Security Credential Management System for V2X Communication	SIS55 Fusion of road infrastructure and vehicle sensor data for automated driving	TS39 Signal optimising and traffic management

Topics: Mobility services | Environment | Automation | Freight | Satellite | Transport networks | Cross-border

25th ITS World Congress

Copenhagen, Denmark, 17 – 21 September 2018

Programme at a glance

	Bella Center		Hall B				
	Auditorium Bordeaux	Auditorium Vienna	Tokyo	Montreal	London	Madrid	Turin
Thursday 20 September							
09.00 – 10.30	**ES09** Delivering effective CCAM	Workshop: ITS Security and Safety Issues for Automated Vehicles & MaaS 8.30 – 11.00	**SIS59** Road authorities and operators and connected, cooperative transport	**TS43** Traffic management and connected infrastructure 2	**SIS60** Cybersecurity for Public-Facing ITS Systems	**TS44** Testing and Simulations	**SIS67** Enabling electromobility services interoperability and enhanced performance of electric vehicles
Coffee Break							
11.00 – 12.30	**ES10** The real impacts of CCAM	Part 1: TM 2.0 and Public Authorities as Service Providers in Traffic Management	**SIS65** Data in autonomous driving: different strategies to data compatibility	**TS49** Mixed traffic and transitions	**SIS66** Open Auto Drive Forum: A new Cooperation Approach for Automated Driving Ecosystem	**TS50** Security	**TS45** Vehicle detection and network efficiency
Lunch (12.30 – 13.30)							
13.30 – 15.00	**ES11** Enhancing the cybersecurity & resilience of transport infrastructure	Part 2: TM 2.0 and hybrid infrastructure as enablers for MaaS in the context of automated transport		**TS55** Impact evaluation	**SIS72** Taking automated driving to the next level: solving challenging environmental conditions	**TS56** Traffic Control and Data	**SIS73** Connected Vehicle Certification – Today, Tomorrow and Beyond
Coffee Break							
15.30 – 17.00	**ES12** Upping the game in safety		**SIS76** Investigating the emerging employment opportunities created by future transport technology	**TS62** Modelling and simulation	**SIS77** Automated vehicle data sharing enabled by Feature Extraction and Anonymisation	**TS63** Alertness in automated vehicles	**SIS78** Deploying Connected ITS in small cities
Coffee Break							
17.15 – 18.45			**SIS84** Highway chauffeur and high density truck platooning in real environment	**TS66** Traffic management and connected infrastructure 3	**SIS85** Integrating Technology, Data, People and Training for Successful Traffic Incident Management	**TS67** Data and ITS	**TS68** CAV Testbeds 1
Friday 21 September							
09.00 – 10.30			**SIS90** Deploying C-ITS services and Learning from evaluations	**TS72** Traffic management and connected infrastructure 4	**TS73** Testing new approaches 2	**TS74** Automated decision making	**TS75** CAV Testbeds 2
Coffee Break							
11.00 – 13.00	**Auditorium Hamburg** PL3 What's next for automated mobility? + Conclusions + Closing Ceremony						
Lunch (13.00 – 14.00)							

Topics: Mobility services | Environment | Automation | Freight | Satellite | Transport networks | Cross-border

www.itsworldcongress.com

25th ITS World Congress

Copenhagen, Denmark, 17 – 21 September 2018

Session types: PL: Plenary Session ES: Executive Session SIS: Special Interest Session TS: Technical Session SP: Scientific Session CP: Commercial Paper Session NS: Nordic Stream

25TH ITS WORLD CONGRESS
COPENHAGEN
17 – 21 SEPTEMBER 2018
Quality of life

附錄二：技術參訪項目(大會官網資料)

Demonstrations

SWARCO: Micro-Mobility – making the travel experience safer, quicker, more convenient and environmentally sound

The Micro-Mobility industry is developing at a fast pace. Towns and cities increasingly invest in the expansion of their cycle path networks. Services such as bike-sharing, car-sharing, public transport etc. are becoming more and more attractive. However, such sustainable, intermodal transportation also raises new safety concerns.
SWARCO demonstrates jointly with its partners several highly innovative safety use cases, among others collision warning between pedestrian and cyclists, the Bike Lane Assist and AI-based video analytics for real-time traveler insights. We improve quality of life by making the travel experience safer, quicker, more convenient and environmentally sound.

Avanti R&D in cooperation with Murata Manufacturing Co. Ltd – Traffic Monitoring System for Bicycles

The Avanti R&D, Inc. demonstration, in cooperation with Murata Manufacturing Co., Ltd., will showcase a bicycle monitoring system. The system, originally designed for vehicles, is an edge computing architecture which utilizes computer vision to provide non-identifying, aggregated information on count, speed, class, and type, and transmit it to the cloud via a self-healing wireless mesh network. By employing such an architecture, the amount of data output by the system is drastically reduced compared with traditional hard-wired camera-based systems. This minimizes the amount of infrastructure needed, thereby reducing the installation and maintenance costs.
The Avanti team will be exploring extension of its edge computing architecture for the anonymous re-identification of cyclists between adjacent nodes without sending data to the cloud. By outputting this information, calculation of travel times along specific paths could be combined, giving a picture of overall flow.

Copenhagen 1:1

Experience the smart city of Copenhagen and learn about what the city has done to improve the quality of life for its citizens. Copenhagen 1:1 offers a unique opportunity for a one-on-one meeting with the professionals from the City of Copenhagen who have implemented solutions and experienced the results. Join experts on guided tours and experience what has made Copenhagen one of the most livable cities in the world.

ITS solutions for cyclists in Copenhagen

Tuesday 18 September: 12:00–14:30 and 15:00–17:30

Visit to bicycle ITS solutions in Copenhagen. Join us on electric bicycles tour to see how Variable Message Signs (VMS) for bicycles provides dynamic information to cyclist based on real-time sensor data, how sensor data is used to prioritize cyclists in intersections and how bicycle barometers placed in key locations are used communicate to cyclists. See how LED lane lights and apps can make it easier to follow waves for cyclists. Try our "I Bike CPH" app first hand and experience the ITS services it offers to cyclists, and hear how this open source app can collect anonymous bicycle data like travel times and thereby support our traffic management for cyclists.

Intelligent Street Lighting in Copenhagen

Thursday 20 September: 18:00–20:00

Hear about Copenhagen City's smart city network (the mesh network) installed in street lighting. Learn about the solutions, where cyclist and pedestrians are detected and the street lighting is adapted to actual traffic conditions. Get a chance to experience the functionality of the street lighting, the intelligent intersections and intelligent pedestrian crossings.

Photo Credit: Troels Heien

Scaling C-ITS solutions in City of Copenhagen – a ITS experience in City of Copenhagen

Tuesday 18 September: 13:00–14:30

Since 2014, the City of Copenhagen with its Technology partners Dynniq and Technolution have implemented cooperative services in almost 50 intersections in Copenhagen. The tour will present a state-of-the-art and real-world system and application for improving efficiency – a solution applicable for other cities. As part of the ITS experience you will hear more on the learnings on how to implement and scale up C-ITS solutions and impacts, and how the implemented C-ITS solutions are being upgraded to Day 1 / Day 1'5 C-ITS services in the C-MobILE project.

Photo Credit: Troels Heien

Bicycle planning is city planning

Thursday 20 September: 10:00–12:00 and 12:30–14:30

Copenhagen is known as the best bicycle city in the world. 41 % of all commutes to work or schools happen by bike and 97% state that they are happy with the quality of the bicycle infrastructure. This is not a coincident. The city and its many stakeholders have been working hard for decades to improve the network of bike lanes and the overall quality of the cycle experience. Safety and speed has been improved in many areas and for the first time Copenhagen has more cyclists than cars driving through the city centre. On this 2-hour cycle tour we will get the Copenhagen Cycle experience and learn how innovative bicycle solutions has made Copenhagen one of the world's most liveable cities.

Boat tour – Sustainable solutions in the liveable harbour

Wednesday 19 September: 15:30–18:00
Thursday 20 September: 15:30–18:00

The harbour of Copenhagen is rapidly changing. Gone are the industry and big ships of the past and in come the harbour baths, kayaks and life. On this tour we will focus on the urban transformation of the harbour and how the city aims for creating sustainable and liveable neighbourhoods along the docks of Copenhagen. We will visit the new developments of Southern and Northern part of the harbour and see some examples of how Copenhagen plans to become carbon neutral in 2025.

Copenhagen Street Lab and BLOXHUB

Tuesday 18 September 14:30–17:30
Thursday 20 September 14:30–17:00

Copenhagen has dedicated an area in the heart of the city to test what role innovative technologies can play in initiatives to benefit the citizens. Copenhagen Street Lab showcases the newest solutions within smart city and IoT, including smart parking, mobility monitoring and smart waste management. The 1:1 urban laboratory provides proof of concept for decision-makers and companies and helps determine which qualified solutions to scale. The tour will offer a first-hand experience of how living labs can help create smarter, greener and more liveable cities, and will include a visit to BLOXHUB, Copenhagen's new hub for sustainable urban development.

Copenhagen 1:1

Traffic Management Strategy in Copenhagen

Tuesday 18 September: 11:00–12:30
The City of Copenhagen has the last three years had focus on optimizing major corridors on the road network – with focus on getting better mobility for the bicycles, pedestrians, public buses and motorists. By optimizing the traffic signals along the major corridors, the waiting time at controlled intersections is prevented or shortened. Thereby getting the maximum out of the road network. As such, cyclists, public transport bus passengers, pedestrians and motorist can be provided with service goals. Service goals that give cyclists and public transport a competitive edge over the motorcar in the city. Join us on this guided tour to learn more about traffic optimization in Copenhagen.
Photo Credit: Troels Heien

Technical visits

Traffic Tower East – Traffic management centre

Tuesday 18 September: 9:30–13:00
Tuesday 18 September: 13:00–16:00
Wednesday 19 September: 9:30–13:00
The Traffic Tower East contains control centres for the railway in Eastern Denmark, the commuter train in the metropolitan area and all national roads in Denmark. The Traffic Tower East is a brand new building with an exciting architecture built specifically for the purpose of traffic management. The visit consists of a brief introduction to the background, architecture and ideas behind the Traffic Tower East and visits to the traffic management centre of the Danish Road Directorate and the traffic management centre of Banedanmark.

The future of mobility – Ideon science park

Wednesday 19 September: 9:00–14:30
In the Swedish city of Lund, less than one hour from Copenhagen, Ideon Science park has been the birthplace of global technology giants such as Bluetooth and Ericsson Mobile. Today it is a central platform for developing the mobility solutions of tomorrow. The tour participants will be introduced to some of its cutting edge ITS start-ups and Electric Vehicle solutions. They will also learn about sustainable mobility as a service, and how to develop user centric platforms open for combined mobility.

Copenhagen Airport – Intelligent solutions for passenger services

Wednesday 19th Sept.: 9:30 - 11:30.
Go to Copenhagen Airport and take a deep dive in intelligent solutions for Wayfinding, Check-in and Taxi Management. Director of Passenger Service, Thomas Hoff Andersson, will join you on this landside tour, where you can learn about the newest digital trends and solutions in Copenhagen Airport.

Technical visits

Visit to DTU: Transport 2.0 meets Energy 2.0

Wednesday 19 September: 13:30–16:30
A visit to EV Lab offers you the chance to experience the Grid-integrated Electric Vehicle (GIV). GIV represents a new generation of EVs purposely designed to support the power system. New technology called Vehicle-To-Grid (V2G) allows the EVs to send energy from the battery back to the grid to help keep the power system in balance. EV lab specializes in EV power system integration, which includes smart grids, interoperability, and power measurement studies. The lab also specializes in technologies and components important to the operation and performance of EVs. The EV Lab is located at the Technical University of Denmark (DTU).

Aalborg University – the smart link between business, innovation and technical ITS research

Wednesday 19 September: 13:00–17:30
Aalborg University, AAU, invites to a technical visit at our campus in Copenhagen. AAU prides itself with problem-based learning through cooperation with more SMEs and large international companies than other universities in the region. AAU is ranking 8th in the world and 1st in Europe amongst the best universities for engineering, and focuses on an agile cooperation between students as well as high-level international renowned professors with the business sector. The technical visit will demonstrate how the professors and students work to combine both the theoretical learning and cooperation with the business around AAU to prepare the students in the best way for their first job after they finished theirs Masters.

The Oresund bridge – the smart link between Denmark and Sweden

Wednesday 19 September: 11:00–14:00
Friday 21 September: 9:00–12:00
Guided bus transfer over the Oresund bridge with general information of the only fixed link between Sweden and Denmark. During the transfer, there will be a presentation of the purpose of building the link – to facilitate integration between two countries. On arrival in the Toll station on the Swedish side of the link different ITS systems will be shown in 3–6 stations. In the Toll station, we will focus on Electronic Toll Collection including vehicle detection. We will also show a smart and safe way to control speed through the toll station.

DOLL Living Lab

Thursday 20 September: 9:00–13:00
DOLL Living Lab is Europe's largest test-field, showroom and innovation hub for smart city and intelligent lighting in a full-scale real-life urban environment, addressing the needs of the emerging smart and connected cities. The tour offers insights into some of the world's leading smart city solutions and latest technologies implemented in Greater Copenhagen. This includes motion detection for cars, bikes and pedestrians; driverless buses; light management systems; EV-stations, and much more. Since its opening in 2014, DOLL has created an innovative playground and transparency in the new complex markets with more than 40 different international and Danish companies currently testing and showcasing their newest smart solutions.
Photo Credit: Rasmus Degnbol

Technical visits

Smart and green traffic solutions in Malmö, Sweden

Thursday 20 September: 13:00–17:30

To create a world class public transport system in Malmö, the city will have several Bus Rapid Transport (BRT) lines. The first line started in 2014 and has proven to be a great success. By the end of 2018 electrical buses will be introduced in Malmö, and from 2021 the first electrical BRT-lines are planned to start running. Excellent bus traffic also needs excellent traffic information with new commuter signs and improved functionality in mobile apps. In a Mobility as a Service (MaaS) perspective, the city is improving bike facilities and green vehicle parking/charging. Welcome to Malmö to experience our smart solutions!

The new Metro Cityring

Tuesday 18 September: 10:00–12:00

The construction of the new metro line, The Cityring, is the largest construction project in the capital since Christian IV founded Christianshavn in the 17th century. The Cityring will have 17 underground stations and will cover major parts of the city centre as well as other districts of Copenhagen. In 2025, 9 out of Denmark´s 10 largest stations will have metro connection. Cityring takes shape both below and above the ground. The elevator towers pop up, escalators are lowered in the stations, the rail system grows day by day and the new trains are being tested in the tunnels as we approach the opening in the summer of 2019.

Copenhagen's autonomous metro

Friday 21 September: 10:00–12:00

The metro in Copenhagen is driverless and is controlled by a fully automated operating system. The system increases safety in the metro and minimizes the risk of human error. The Copenhagen Metro has helped to set new standards in public transport and has contributed to creating good transport options, urban development and growth. But how does a driverless train work? And who's behind the backbone to get the whole system around the clock, 7 days a week and 365 days a year? Now you have a unique chance to see the heart of the metro system – at the Metro Control and Maintenance Center.

附錄三：ITS Copenhagen(大會提供資料)

Who?

Shops, cafés and restaurant keepers

Traffic managers in the City of Copenhagen

Cyclists and pedestrians

Local residents

What?

Using empty parking spaces during the day for street life activities. Dynamic allocation of cycle and pedestrians paths depending of the moment of the day. In 2017 we tested this functionality during a pilot.

Why?

Flexible and dynamic usage of the city space

Vibrant street life

Who?

Cyclists, i.e. cyclists commuting between home and work or school

Traffic managers in the City of Copenhagen

What?

Stimulate cycling by showing that travel times on bicycle is shorter than by car. Improve perceived safety by asking bicyclists to care for one another in case of high density of cyclists. Directing cycle traffic to avoid congestion, by showing congestion levels and alternative routes.

Why?

Increase traffic safety for cyclists

CO_2 Stimulate cycling to get less emissions of noxious gasses in the city

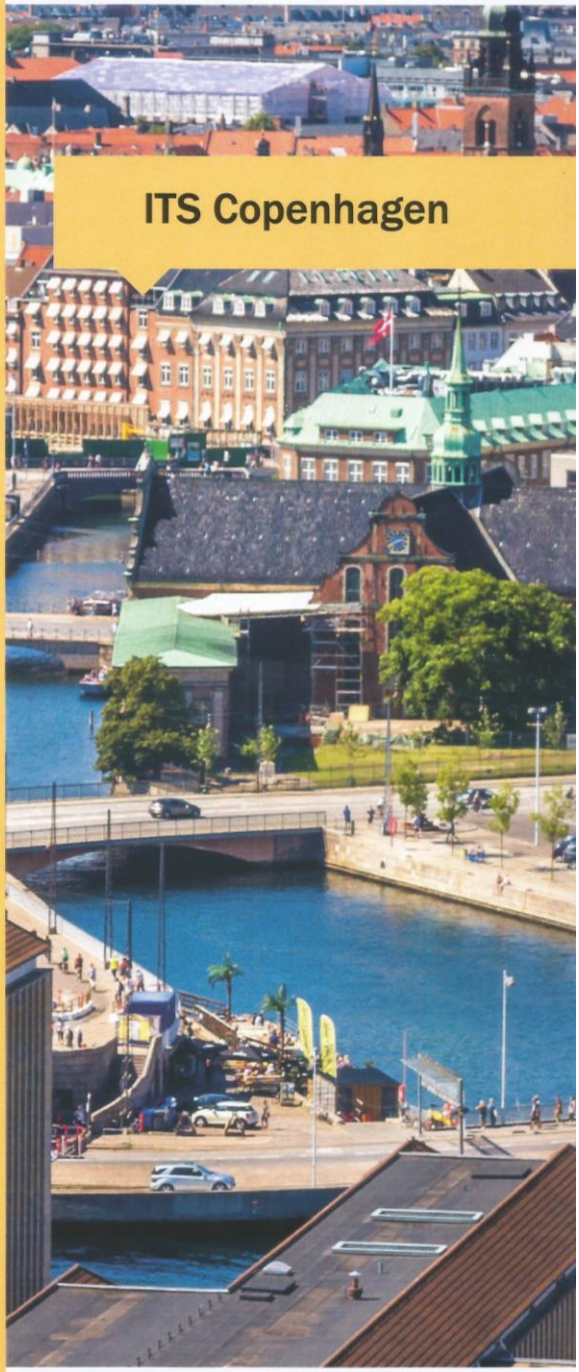
Better use of the cycling paths through green waves

Better spread of cyclists over the available cycling paths

Technolution

COWI

the right development



ITS Copenhagen

CITY OF COPENHAGEN

Traffic Management

Who?

- Citizens, tourists and business community
- Traffic managers in the City of Copenhagen
- The Danish Road Directorate
- Traffic managers in adjacent municipalities in Greater Copenhagen

What?

Meet defined service goals for traffic in Copenhagen. Real time traffic management of flow according to service goals and political priorities. Handle structural traffic issues (such as rush hour and events) as well as unstructured traffic issues (such as accidents and extreme weather). Provide information to all road users.

Why?

- More effective traffic management connecting relevant systems
- Assess the service levels and (de)activates scenarios to enhance the quality of traffic flows
- Better overview of the current traffic, traffic flow and traffic bottle necks
- Fast and effective respond time to local incidents

Traffic Signal Optimization

Who?

- Citizens, tourists and business community
- Traffic managers in the City of Copenhagen
- Public bus transport and other traffic providers in the city of Copenhagen
- Municipalities round Copenhagen

What?

Optimize and coordinate signal controllers to enhance traffic along corridors. Enhance the quality of travelling of cyclists and public bus transportation, while maintaining the quality for motor cars.

Why?

- Less emission of noxious gasses in Copenhagen
- Better and optimized use of existing road network
- Meet defined service goals for traffic in Copenhagen
- Better quality of travelling for "green" transportation choices

Intelligent Street Lighting

Who?

- Cyclists commuting between home and work or school
- Traffic managers in the City of Copenhagen
- Pedestrians crossing intersections

What?

During the night the level of illumination levels of street lights will be reduced by 50% in order to save power consumption. Approaching cyclists are detected and the illumination levels are brought back to 100% temporarily while the cyclists pass the intersection.

Why?

- Improve the safety for cyclist and pedestrian crossing intersections during the dark hours in Copenhagen
- Improve the perception of safety for the vulnerable road users (i.e. cyclist and pedestrians)

Eco-Driving

Who?

- Truck drivers and the truck companies they work for, cyclists and motorists in general
- Traffic managers in the City of Copenhagen

What?

Reduce the number of stops for the road users by providing dynamic speed advice at controlled intersections by using time-to-green and time-to-red facilities on the designated corridors to reduce their CO2 emission, and more convenient travel experience.

Why?

- Truck companies reduce fuel costs
- Less emissions of noxious gasses in the city
- A smoother travel experience for the drivers
- (Bus) companies and private motorists reduce fuel costs