交通部運輸研究所
INSTITUTE OF TRANSPORTATION, MOTC

2018 Annual Report 年報

交通部運輸研究所107年年報

2018 Annual Report of the Institute of Transportation, MOTC

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所長的話

安全、效率、品質及綠色為交通部當前四大施政主軸，而打造友善無縫(Friendliness)、具有產業機會(Opportunity)、安全可靠(Reliability)、悠遊易行(Mobility)、永續發展(Sustainability)，以及具有觀光魅力(Attraction)的FORMOSA 永續交通運輸環境，提供以民眾為中心的「人本交通」服務則是交通部的施政目標。本所長期扮演交通部智庫角色，肩負支援交通部政策擬訂、協助部屬機關及地方政府落實運輸政策、建立運輸系統技術標準與資訊平台，以及承擔運輸產官學研跨域溝通等工作。面對交通部四大施

Message from the Director General

Safety, efficiency, quality, and eco-green are the four main policies of the Ministry of Transportation and Communications (MOTC). Meanwhile, building Taiwan into a Formosa with friendliness, opportunities, reliability, mobility, sustainability, and attraction to provide a people-centered service with "Humanity-Oriented Transportation Development" is MOTC's goal of administration for a sustainable transportation environment. As the MOTC think tank over time, our duties include the formulation of transportation policies, assistance for subordinate agencies and local governments to implement transportation policies, establishment of technical standards and technical information platforms for the transportation system, and co-ordination of interdisciplinary transportation research among the government, academia, and research institutions. Face up to MOTC's four polices and administration goal as mentioned above, I encouraged my colleagues, based on the spirit of "Professional Navigation, Pursuit of Excel-

政主軸與施政目標，本人期勉全體同仁皆能秉持「專業領航、追求卓越」的精神，兼顧經濟發展、環境保育及社會公平等永續發展面向，建立創新與前瞻的思維，善用與整合最新的資通訊技術，以有效支援交通部提升整體運輸系統的安全與服務品質。

過去一年來，本所除持續協助交通部擔任APEC運輸工作小組、行政院永續會綠色運輸工作分組、交通部交通費率委員會、桃園航空城聯外運輸系統工作小組及自行車督導小組之綜合規劃分組與資訊分組幕僚，並籌辦「2018臺越交通合作論壇」外，亦在交通部四大施政主軸的指導下，陸續完成重大施政規劃並協助推動相關計畫，包括：

(1)**在安全方面：**產製「道路交通事故30天內死亡人數統計」等資料供交通部決策參考、協助臺鐵局推動安全管理系統(SMS)、協助路政司完成「代客駕車服務制度之研究」、協助公路總局辦理道路交通安全管理系統(ISO 39001)輔導課程。此外，同時發展適用國內道路交通環境的交通工程設計範例、推廣行為導向之創新駕駛教育訓練、辦理先進

lence" and sustainability of "Economic Development, Environment Protection and Social Equality", to develop innovative and visionary thinking, utilize and integrate Information Communication Technology (ICT), in order to assist the MOTC in improving the safety and service quality of the overall transportation system.

Last year, the Institute of Transportation (IOT) has assisted the MOTC continually in serving as the staffing role of the APEC Transportation Working Group Meeting, the Green Transportation Working Group of the National Sustainable Development Committee under Executive Yuan, the MOTC Transportation Fare Committee, the Connected Transportation System Working Group of the Taoyuan Aerotropolis, and the Integrated Planning Subgroup and Information Subgroup of the Bicycle Supervision Working Group. Also, the IOT has assisted the MOTC to organize the 2018 Taiwan-Vietnam Transport Cooperation Forum. Furthermore, the IOT has completed major administrative plans and assisted with the promotion of related projects based on MOTC's four main policies. These projects include:

(1) **Safety-related projects:** Production of the statistics of fatality numbers within 30 days of road traffic accidents for the reference of MOTC to make road safety policies, assistance for the Taiwan Railway Administration (TRA) to promote the Safety Management System (SMS), assistance for the Department of Railways and Highways, MOTC to complete a study on designated driving service regulations in Taiwan, and assistance for the Directorate General of Highways to offer guidance courses of the Road Traffic Safety Management System (ISO 39001). Furthermore, we developed the traffic engineering design examples suitable for the domestic road transport environment,

駕駛安全輔助系統ADAS結合車聯網先導計畫、建置都市交通事件資訊平台、建立臺東海岸公路浪襲預警系統提升封路決策支援、建立船舶動態資訊系統協助航行安全與海事調查、進行離岸風電航安與水下技術研發。

(2)在效率方面：構建海運決策輔助工具與空域模擬模式，提升我國港口及機場整體營運效率、推動預約式無障礙小客車運輸服務整合、辦理運輸物流「績效運籌模式研究」、進行汽燃費隨里程徵收之可行性研究、研發輕便型橋梁檢測機械手臂。

(3)在品質方面：完成「鐵路立體化觀察與評估分析」及「桃園機場與新南向國家客量連結分析」、協助推動「公路公共運輸多元推升計畫（106-109年）」及辦理「補助學界成立區域運輸發展研究中心計畫（106-107年度）」、推動高雄地區交通行動服務(Mobility as a Service, MaaS)、完成「106年度縣市政府橋梁維護管理評鑑作業」。

promoted behavior-oriented innovative driving education and training, conducted the Advanced Driving Assistance System-IoV integration pilot project, constructed the Urban Traffic Event Information Platform, established the Taitung Coastal Highway Wave Attack Early Warning System to support road closure decision-making, established the Automatic Identification System for ships to help enhance shipping safety and improve maritime accident investigation, and developed the navigation safety and underwater technology of the offshore wind farm.

(2) Efficiency-related projects: Development of shipping decision support tools and airspace simulation models to enhance the overall operational efficiency of ports and airports in Taiwan, promotion of the integration of booking service for accessible light buses, execution of the "Study of Performance-Based Logistics (PBL) Model" and "Feasibility Study of Collection of Vehicle Fuel Fee by Mileage", and development of the handy bridge inspection robot arm.

(3) Quality-related projects: Completion of the "Observation, Assessment, and Analysis of Railway Grade Separation" and "Passenger Volume Linkage Analysis between Taoyuan International Airport and New Southbound Policy-Target Countries", assistance for the implementation of the "Multiple Enhancement Project of Public Transportation of Highways (2017-2020)", execution of the "Financial Subsidy Project for Establishment of Regional Transportation Research and Development Center (2017-2018)", promotion of the "Mobility as a Service (MaaS)" in Kaohsiung City, and completion of the "2017 Evaluation of Bridge Maintenance and Management Performance of Local Governments".

(4)在綠色方面：協助交通部研訂「運輸部門溫室氣體排放管制行動方案(草案)」、完成我國永續發展目標(草案)2030年目標研訂及2020年目標確認、支援港務公司港區空污評估及減量工作、研提「2030市區公車全面電動化推動計畫」。

綜上所述，顯示本所不僅盡責擔任交通部的智庫，更已在我國交通基礎研究、前瞻技術研發、支援運輸政策規劃等重要任務上，達成具體的成果。

展望未來，配合交通部與本所組織調整，本所將持續扮演並強化交通部智庫角色，同時透過更前瞻的研究與規劃，提升重大政策研擬與支援決策實力；此外，亦將持續關注國際趨勢，強化海、空運輸規劃能力，以及運輸安全、公共運輸、智慧運輸、綠運輸、防災與調適等研究，以支援運輸施政與技術創新並促進產業發展，奠立我國運輸服務優質升級之堅實基礎。

交通部運輸研究所　所長

林繼國

(4) Eco-green-related projects: Assistance for MOTC to draw up the "Action Plan for GHG Emissions Control of the Transportation Sector (draft)", formulating the 2030 targets and verifying the 2020 targets for Taiwan's sustainable development goals (draft), support for the Taiwan International Ports Corporation, Ltd. to assess and reduce air pollution in port areas, and proposition of the "2030 Electric Urban Bus Promotion Plan".

In conclusion, apart from playing our role as the MOTC think tank well, the above information shows our concrete achievements in fundamental research, visionary technology development, and supporting transportation policy planning.

Looking out into the future, the IOT will continue and optimize our role as the MOTC think tank. In addition, through more visionary research and planning, we will improve our capacity in major policy planning and decision support. Furthermore, we will keep track of international trends, strengthen our planning capacity in sea and air transportation, and enhance researches on transportation safety, public transportation, intelligent transportation, green transportation, and disaster prevention and adaptation, in order to support transportation administration and technology innovation, promote industrial development in Taiwan, and so to lay the solid foundation for upgrading the quality of Taiwan's transportation service.

Institute of Transportation, MOTC
Director General

Lin, Chi-Kuo

02

組織與職掌

Organization and Functions

一、沿革

臺灣地區自政府播遷來此，經歷長年的勵精圖治，各項建設莫不欣欣向榮，經濟發展更是突飛猛進。在此期間，有關運輸部門的投資比重及其成長速度，雖亦因之與時俱增，但仍始終趕不上社會經濟快速發展及人民生活水準大幅提高的需要。因此運輸主管部門為解除擁擠、疏通瓶頸、提高容量，除當設法擴充及充分利用現有運輸設施外，更需妥善擬訂中長期運輸發展計畫，以適應未來的需求。

I. History

Since its relocation to Taiwan, the Central Government of the Republic of China has been actively engaged in infrastructure development. This effort has brought prosperity to Taiwan and transformed Taiwan into an economically dynamic force. However, although the investments in transportation have experienced substantial growth over the years, they lag consistently behind the overall growth of the economy and the rise in living standards. Consequently, transportation infrastructure is inadequate and traffic congestion is worsening. Therefore, government authorities have the responsibilities to develop strategies to better utilize existing transportation facilities and to prepare medium-range and long-range plans to satisfy future transportation demand.

由於運輸方面所需要的投資甚為龐大，且在整體經濟的考量下，可供應用的資金究屬有限，因此對於投資決策的研提及優先順序的釐定，便須由一個統一的運輸規劃機構來承擔；其次，由於運輸事業係屬公用事業，政府對其費率、加入、退出、能量等等，均有必要參與管理，而參與的方法是否適當、是否需要修正，亦須由一個統籌的運輸規劃機構進行研究； 再次，各種運輸事業彼此均具有競爭性，如何減少其相互間的競爭性而加強其輔助性，以完成最具效益的整體運輸系統，更須由一個運輸規劃機關來統籌完成。交通部基於上述 3 項考慮，乃於民國 59 年 8 月 1 日成立運輸計劃委員會專司其事。14 年中已完成諸多的運輸研究規劃工作，其犖犖大者計有：臺灣地區整體運輸規劃、高速公路交流道連絡道路系統整體規劃、臺北地區大眾運輸系統初步規劃、臺北市區鐵路改善計畫、臺北都會區大眾捷運系統計畫及高雄都會區大眾運輸系統長期發展計畫等等，皆已次第竣事。此外，該委員會並隨時配合政策需要，進行各項專案研究規劃，逐一付諸實施。

The development of transportation infrastructure requires huge capital outlays, while available manpower and monetary resources are always limited. Under the circumstances, there is a need to charge a single transportation planning agency with the responsibilities of setting priorities and programming for investment. Furthermore, transportation services are mainly regarded as public utilities and, as such, are subject to government regulations in connection with fare structure, capacity, formation and dissolution of firms, etc. To ensure that regulations are stipulated and implemented to the best interest of the nation, there is also a need for a single transportation planning agency to review existing and pending regulations for possible revisions. Finally, transportation services can complement each other but they can also be entangled in a counterproductive struggle to serve the same sector of market. In order to develop an efficient, integrated transportation system, it is imperative that a planning agency be dedicated to the development and coordination of transportation services. Because of these various concerns, the Ministry of Transportation and Communications established the Transportation Planning Board on August 1, 1970. Over a period of fourteen years since its inception, the Transportation Planning Board had completed a number of planning projects. Notable examples of such projects include: Taiwan Area Integrated Transportation Systems Planning Study; Plan for Integration of Freeway Interchanges and Connecting Highway Systems; Preliminary Plan of Taipei Area Public Transportation Systems; Taipei City Area Railway Improvement Plan; Plan of Taipei Metropolitan Area MRT System; and long-range Development Plan of Kaohsiung Metropolitan Area Public Transportation System. In addition, the Transportation Planning Board was also instrumental in conducting studies to assist the government in the formulation and implementation of policy decisions.

運輸計劃委員會係屬臨時編制單位，在行政運作上，在在受到經費及人力運用上的限制，委實無法因應日益遽增的運輸研究規劃業務。嗣乃奉令於民國 74 年元月 5 日，與原負責一般交通學術研究、交通幹部訓練、戰備器材管理運用及大陸交通資料蒐集研判等業務的交通研究所，合併改制為運輸研究所，成為政府常設機關，藉以健全編制，擴大規模，從而將經費與人力的運用納入常軌。民國 80 年元月 30 日，因業務大幅增加，奉准修改組織條例，增置副所長 1 人，並增設綜合技術組及加強中級研究規劃人力，以資因應。民國 88 年 7 月 1 日，因臺灣省政府功能業務與組織調整，原臺灣省政府交通處港灣技術研究所改隸本所，更名為港灣技術研究中心。民國 90 年 8 月 1 日，本所組織條例修正案，奉行政院核定施行，港灣技術研究中心與本所整併，並為本所之派出單位。

The Transportation Planning Board, however, was a provisional organization; it had very limited funding and manpower to tackle the increasingly complex transportation problems. Therefore, the Institute of Transportation was created on January 5, 1985 by merging the Transportation Planning Board with the former Institute of Traffic Research, which had the mandate to conduct traffic research and personnel training, manage battlefield equipment and supplies, and collect intelligence on Mainland China. Being a formal branch of the government, the Institute of Transportation is funded through a normal budgeting process. Because of the increased demand for its services, the organizational structure of the Institute was expanded, on January 30, 1991, by adding a Deputy Director-General, an Interdisciplinary Research Division, and intermediate-level planners. And since July 1, 1999, due to the adjustment of government functions, the Institute of Harbor and Maritime Technology has become affiliated to the Institute of Transportation and renamed as Center of Harbor and Maritime Technology. It was originally affiliated to the Department of Transportation of the Taiwan Provincial Government. As part of the entire government agency reorganization, the Institute of Transportation's organization adjustment has been approved by the Execute Yuan, and since August 1, 2001 the organization level of the Center of Harbor and Maritime Technology has again been adjusted. According to the new arrangement, the Center is incorporated with the Institute of Transportation and becomes an extemal agency of the Institute of Transportation.

二、組織及人力

本所設置運輸計畫、運輸工程、運輸經營管理、運輸安全、運輸資訊、綜合技術 6 個組與港灣技術研究中心等計 7 個業務單位，及秘書室、人事室、主計室等部門。依照本所組織條例，編制員額計 177 人，預算員額 157 人。另有約聘人員 4 人，技工及工友共 23 人。

II. Organization and Human Resources

The Institute of Transportation comprises seven divisions and a Secretariat, a Personnel Office, and an Accounting Office. The seven divisions include Planning, Engineering, Operations and Management, Safety, Information Systems, Interdisciplinary Research and the Harbor and Maritime Technology Center. According to the organization act of the Institute, the total authorized staff is 177 and the budgetary staff is 157. In addition, there are 4 contracted research employees and 23 technicians and office workers.

三、本所職掌

依據本所組織條例第二條規定，本所掌理下列事項：

1. 運輸政策之研究及建議事項。
2. 運輸系統規劃配合及運輸計畫之研擬、評估事項。
3. 運輸發展與政治、經濟、國防及社會關係之研究與配合事項。
4. 運輸工程之設計、研究及發展事項。
5. 運輸經營及管理效率之研究發展事項。
6. 運輸安全之研究及規劃事項。
7. 運輸研究成果之應用及指導事項。
8. 國內外運輸研究之聯繫及合作事項。
9. 運輸資料之蒐集、整理、編譯及提供事項。
10. 港灣技術之研究及建議事項。
11. 其他運輸研究事項。

III. Functions

According to Article 2 of the organization act of the Institute, the missions of the Institute are as follows:

1. Studying transportation policies and providing suggestions;
2. Coordinating planning, evaluation and project programming of transportation systems;
3. Studying the interrelationships among transportation development, political functions, socio-economic activities, and national defense;
4. Designing, researching and developing transportation engineering systems;
5. Studying the efficiency of transportation systems operation and management;
6. Studying and planning of transportation safety;
7. Applications of transportation research findings and guidance;
8. Liaison and cooperation of local and foreign transportation research;
9. Collection, compilation, translation and dissemination of transportation information;
10. Studying harbor and Maritime technologies and providing suggestions;
11. Other matters related to transportation research.

四、組織架構

本所組織架構如下：

IV. Organization Framework

Organization of the Institute is shown below:

所長 Director General

林繼國

Lin, Chi-Kuo

副所長 Deputy Director General

黃新薰

Huang, Hsin-Hsun

副所長 Deputy Director General

陳天賜

Chen, Tien-Tsyh

主任秘書 Chief Secretary

蘇振維

Su, Cheng-Wei

人事室 主任

林立曼 Lin, Li-Man

Director of Personnel Office

秘書室 主任

李淑惠 Lee, Shu-Hwui

Director of Secretariat

主計室 主任

連小瑩 Lien, Hsiao-Ying

Director of Accounting Office

公關室 主任

曹瑞和 Tsaur, Ray-Her

Director of Public Relation Office

港灣技術研究中心 主任

朱金元 Chu, Chin-Yuan

Director of Harbor and Marine Technology Center

運輸計畫組 組長

張舜淵

Chang, Shuen-Yuan

Director of Transportation Planning Division

運輸安全組 組長

張開國

Chang, Kai-Kuo

Director of Transportation Safety Division

運輸工程組 組長

許書耕

Hsu, Shu-Keng

Director of Transportation Engineering Division

運輸經營管理組 組長

陳其華

Chen, Chi-Hwa

Director of Transportation Operations & Management Division

運輸資訊組 組長

吳東凌

Wu, Tung-Ling

Director of Transportation Information Systems Division

綜合技術組 組長

曾佩如

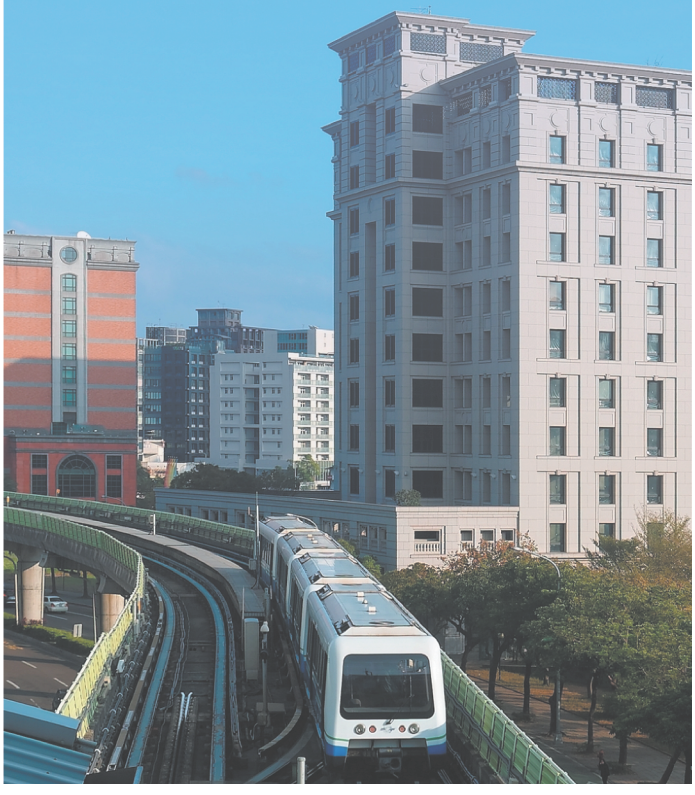
Tseng, Pei-Ju

Director of Interdisciplinary Research Division

03

年度研究主軸

Main Scheme of Annual Research



一、健全整體運輸規劃

辦理運輸規劃研究，精進計畫評估工具，以健全整體運輸發展為願景，運輸計畫組年度研究主軸如下：

1. 整體運輸規劃

(1) 擬訂鐵公路運輸發展願景與政策目標，探討發展課題，並研提因應策略，研擬「陸運政策白皮書」初稿。

(2) 辦理北臺區域整體運輸規劃，建構北臺區域運輸需求模式，預測未來運輸系統供需，研擬發展策略。

I. Improve the Overall Transportation Planning

Based on the vision of improving overall transport development to conduct transportation planning research and improve plan evaluation tools, the annual research guidelines of the Planning Division, IOT are:

1. Planning of overall transportation

(1) Set up a vision for highway and railway transportation development and policy objectives, explore development issues, propose response strategies and draft the "Land Transportation White Paper."

(2) Conduct the overall transportation plan of Northern Taiwan, set up Northern Taiwan Transportation Demand Model, project transportation system supply and demand for the future and develop the development strategy.

(3) 研議各層級運輸規劃資料規格化與整合機制，俾利跨單位、跨平台資源整合與流通共享，減少調查資源重複投入。

2. 評估工具開發

(1) 更新並提升「運輸部門決策支援系統」運作效能，協助各機關辦理政策分析及交通計畫評估。

(2) 檢討既有「傳統暨區域鐵路系統容量分析軟體」功能，重新改版並全面升級，提高軟體之友善性。

(3) 修訂高速公路基本路段車流分析方法，據以更新公路容量手冊與分析軟體功能。

(4) 辦理小貨車動態能耗與碳排放特性研究，完備所有客貨運車種之動態能耗 / 碳排資料庫，建立我國第 1 套車輛動態能耗 / 碳排推估模式。

3. 自行車路網規劃

(1) 針對「自行車環島 1 號線」沿線各區經典示範路網，進行旅次特性及滿意度調查。

(2) 檢視已建置完成之「自行車環島 1 號線」沿線各區經典示範路網，並提出改善建議。

(3) 持續擴充經典示範路網之路線圖資與現場影像建置，提升專屬網站 -「環騎圓夢」友善性。

(3) Propose transportation planning data standardization and integration mechanism at each level to enable cross-unit and cross-platform resource integration, exchange and sharing to reduce duplication of research investments.

2. Development of evaluation tools

(1) Update and enhance the operating effectiveness of the Taiwan Transportation Decision Support System and assist individual agencies in policy analysis and transport program assessment.

(2) Review functions of existing "Conventional Railway Capacity Software," revamp and upgrade it for better user friendliness.

(3) Develop traffic flow characteristics analysis method for freeway basic segment to revise the highway capacity manual and analysis software.

(4) Study the dynamic energy consumption and carbon emission characteristics of small trucks, complete the dynamic energy consumption/carbon emission database of passenger and freight vehicles, build up the first national dynamic energy consumption/carbon emission estimation model.

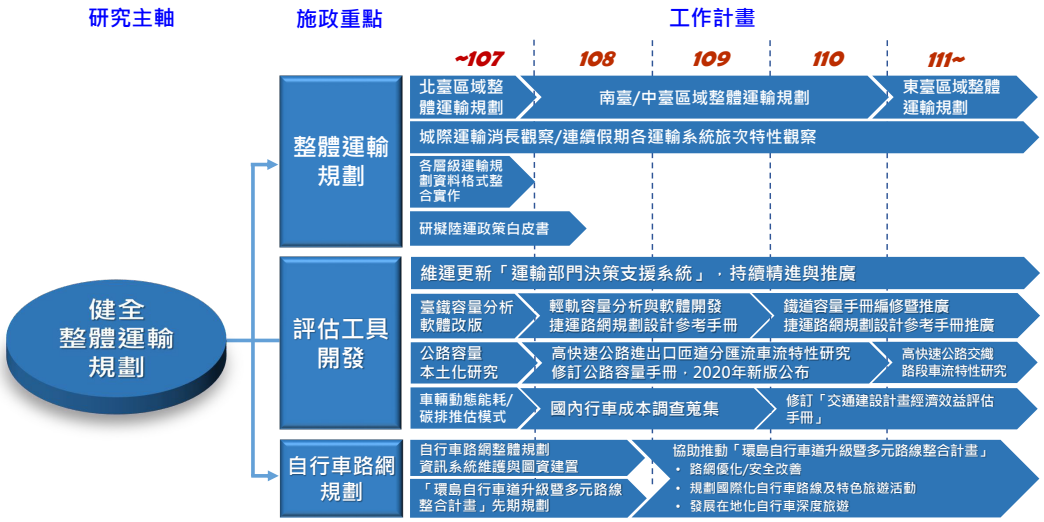
3. Planning of cycling route network

(1) Conduct trip characteristics and satisfaction level research over typical demo network of individual districts along the "Cycling Route No.1."

(2) Review established typical demo network of individual districts along the "Cycling Route No.1" and propose improvements/recommendations.

(3) Continue to enrich route information and on-the-scene image dataset of the typical demo network and improve the user-friendliness of the exclusive website "Taiwan Cycling Route."

研究主軸一 、健全整體運輸規劃



二、提升海空及軌道運輸發展

海空運為我國對外重要連結之運輸模式，建立海空運樞紐為我國發展海空運發展之願景；此外，軌道運輸亦需先進技術來提升營運效率。運輸工程組年度研究主軸如下：

1. 掌握國際海空運發展趨勢

(1) 持續進行國際海空運資料庫維護更新，透過數據量化分析，提供決策參考。成果方面在海運部份，提供航港局及港務公司在政策評估所需之精準全球貨櫃航線量化數據，例如：我國與新南向國家間航線營運資料、新南向國家間航線營運資料等；空運部分，提供民航局及桃園機場公司相關數據做為政策研析，例如：經桃園機場中轉北美市場旅次資料、由桃園機場經香港及仁川機場中轉歐洲各國旅次資料，以及桃園機場與新南向國家間航線營運資料。

II. Improve the Development of Sea, Air and Rail Transportation

Sea and air transport are critical linkages of Taiwan's external transportation model; building up sea and air transport hubs is the vision for sea and air transport development. Furthermore, rail transport also requires advanced technology to improve its operating efficiency. The annual research guidelines of the Engineering Division, IOT are:

1. Grasp the development trend of international sea and air transportation

(1) Continue to maintain and update the international sea and air transportation database and provide decision-making reference information through quantitative data analysis. Achievements in terms of sea transportation are as follows: provide precise quantitative data over the global container line required by the Maritime Port Bureau and Taiwan International Ports Corporation (TIPC) for policy evaluation, such as: operating data for shipping lines with and among the New Southbound Policy-target countries; achievements in terms of air transportation are as follows: provide relevant data for policy-making of the Civil Aeronautics Administration and the Taoyuan International Airport Corporation, such as: passenger transiting data at Taoyuan International Airport (TIA) to North America, passenger transiting

(2) 因應內外在環境激烈變化，定期辦理國際海空運期刊研讀與研討，並掌握國際先進技術及產業發展情勢，進行自行研究與資料蒐集，提供重要海空運議題之研析，支援交通部及部屬機關進行政策研擬，包括：新海運聯盟重組之航線變化與對我國港口之影響分析、環保規範對航運的影響、遠東地區海運貨櫃航線分析、國際航空最新減碳發展、國際標竿機場旅客服務智慧化發展趨勢、美國下一代飛航管理系統概況、新南向國家與我國及北美四大機場之航空客運起迄分析等議題。

2. 研擬海空運發展政策

(1) 因應國內外情勢變化，並蒐集產、官、學界意見，於 107 年度開始進行海、空運政策白皮書研擬工作。

(2) 傳統的海運面臨全球化競爭環境下皆面臨轉型的壓力，在航運以及港口作業方面，需透過物聯網相關技術以及智慧 E 化等管理方式提升效率。107 年度進行了智慧航港研究，其成果可作為我國航港未來推動智慧化與自動化的參考。

(3) 107 年度進行空域模擬模式構建之延續計畫，範疇以桃園機場為主，進行地面與空域班機模擬。本模擬軟體未來可協助評估各種情境下機場空側及空域之容量，可對政策擬定，如：增建跑道、空側使用、機坪設計等，提供實務應用之參考。

data between TIA and EU through Hong Kong and Incheon Airports, and airline operation data between TIA and the New Southbound Policy-target countries.

(2) Addressing fast changes in the internal and external environment, we organize regular seminars and discussion on international sea and air transport journals and grasp global advanced technology and industrial development trends to conduct self-study and data collection, in order to provide analysis of important sea and air transport issues and support MOTC and its divisions in policy-making including: changes in the route after the reorganization of the new maritime alliance and operational impact on Taiwan's ports, the impact of environmental protection regulations on shipping, analysis of container shipping routes in the Far East region, the latest development of carbon reduction in the international aviation market, and the intelligentization development trends of passenger services in leading international airports, overview of the next-generation air traffic management system in the United States, and analysis of air passenger traffic between Taiwan, the New Southbound Policy-target countries, and four major airports in North America.

2. Draw up the sea and air transport development policies

(1) Addressing changes in the domestic and international situation and collecting opinions from industry, government and academic entities to draft the sea and air transportation policy white paper in 2018.

(2) Traditional shipping industries are confronted with the pressure of transformation amid global competition. In terms of shipping and port operations, it is necessary to improve efficiency through IoT technologies, computerization, and other e-management skills. The smart port research conducted in 2018 may serve as the reference for the sea and airport authorities to adopt intelligentization and automation measures in the future.

(3) The extension project of airspace simulation model buildup in 2018 was aimed to simulate air flights on the ground and in the sky above TIA. This simulation software can assist in assessing the capacity of the airport's airside and airspace in various scenarios. That could be referred for policy-making such as building extra runways, usage of the airside, and apron design.

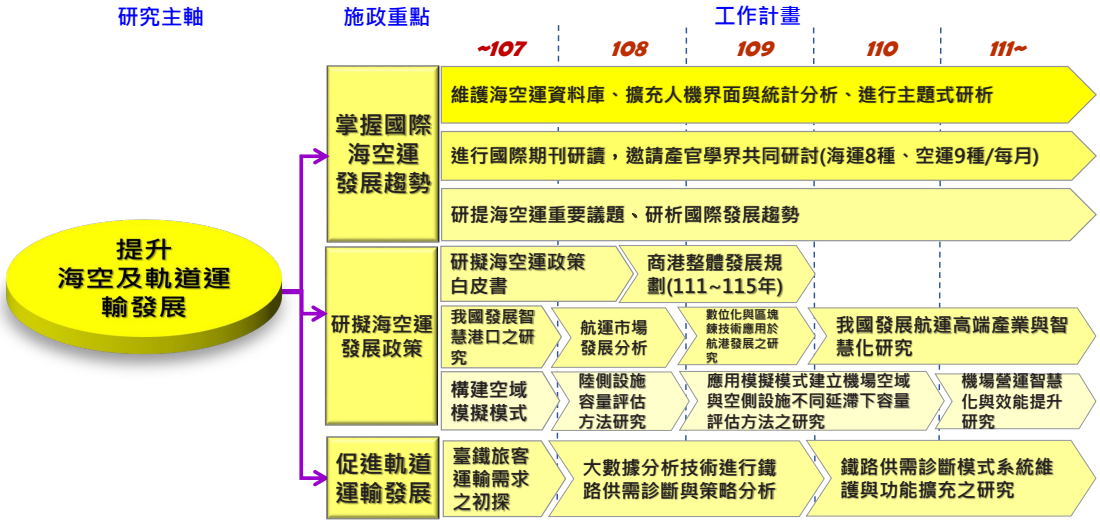
3. 促進軌道運輸發展

107 年度研究重點在藉由大數據分析技術，檢視臺鐵售票系統的歷史售票資訊，了解旅客運輸需求的分析方式，作為後續研發考量旅客運輸需求下的運能供給求解模式，據以診斷運輸供需現況，進行運能供給最佳化，達到提升軌道運輸效能之目標。

3. Promote the development of rail transportation

The 2018 kinds of researches focused on reviewing ticket sales history of the TRA ticketing system via Big Data analytical solution, learning about passenger transport behavior and furthermore to solve transport capacity model when taking passenger transport requirements into account, identifying transport supply-demand status, optimizing transport capacity and achieving the goal of improving rail transportation efficiency.

研究主軸二 、 提升海空及軌道運輸發展



三、強化運輸安全管理

強化運輸安全管理，以建構安全與人本的交通運輸環境為願景，運輸安全組年度研究主軸如下：

1. 先進管理制度

(1) 研擬運輸安全政策白皮書，重新診斷我國道路、鐵道、海運、空運等運輸安全面臨的課題，設定安全目標，擬訂政策主軸及策略方向，以提升運輸安全水準，強化安全管理機制。

III. Enhance the Transportation Safety Management

Based on the vision of enhancing transportation safety management and setting up a safe and humanity-oriented transportation environment, the annual research guidelines of the Safety Division, IOT are:

1. Advanced management system

(1) Draft the transportation safety policy white paper, re-diagnose the transport safety issues faced by our road, railway, maritime, and air transport systems, set safety goals, formulate policy guidelines and strategic directions to improve transport safety level and enhance safety management mechanisms.

(2) 參酌航空業與其他國家鐵道業界作法，規劃我國鐵道之安全管理系統 (Safety Management System, SMS) 應涵蓋之要項 (例如：安全責任與關鍵人員、安全風險管理、變革管理等) 及其作業指引，提供鐵道營運機構運用並推動 SMS。

(3) 受公路總局委託，培養桃竹苗、中區及雲嘉南等 3 個區域運輸發展研究中心，具備輔導建置道路交通安全管理系統 (ISO 39001) 之能力，並分別輔導臺西客運、臺中客運及和欣客運 3 家業者建置 ISO 39001。

2. 安全道路環境

(1) 利用先進技術 (例如無人機空拍結合人工智慧深度學習技術進行影像辨識)，辨識道路風險型態與集中情形之初探，此技術發展成熟後即可提前於事故發生前，先行分析改善其交通工程配置，以收防微杜漸的功效。

(2) 發展追撞與交叉撞事故型態的交通工程改善設計範例，以應用於路口追撞與交叉撞事故之改善，支援易肇事路段改善工作。

3. 創新教育宣導

(1) 應用各項智慧車載設備大規模蒐集國道客運駕駛實際行為資料，開發本土化駕駛行為安全指標及工具，強化我國運輸業者駕駛行為資料蒐集、分析及安全管理之能力，並歸納各項高風險駕駛行為態樣，作為未來教育訓練之基礎。

(2) 針對年輕族群特性，以手機平台設計機車安全教育遊戲，融入交通安全法規、路權等概念，以有趣、活潑的內容強化學習效果；辦理多場校園競賽，並與監理所站合作推廣，深入年輕族群，以創新教育模式提升安全認知。

(2) Set up items to be covered by our railway Safety Management System (SMS) by referring to the aviation industry and railway industry practices adopted by other nations (including: safety responsibility and involvement of key personnel, safety risk management, change management) and their operating guidelines for railway operators to apply and promote SMS.

(3) Entrusted by the Directorate-General of Highways to foster three regional centers for transportation research & development (Taoyuan-Hsinchu-Miaoli Area, Central Area, and Yunlin-Chiayi-Tainan Area), empower them with road traffic safety management system (ISO 39001) implementation capacity, and assist Taixi, Taichung and Ho-shin bus operators to build up the ISO 39001 system.

2. Safe road environment

(1) Using advanced technology (such as UAV aerial photography along with artificial intelligence and deep learning technology for image recognition) to explore ways of identifying road risk type and concentration situation. Maturing of the technology may help in preventing incidents from occurring by analyzing and improving traffic engineering configuration in advance.

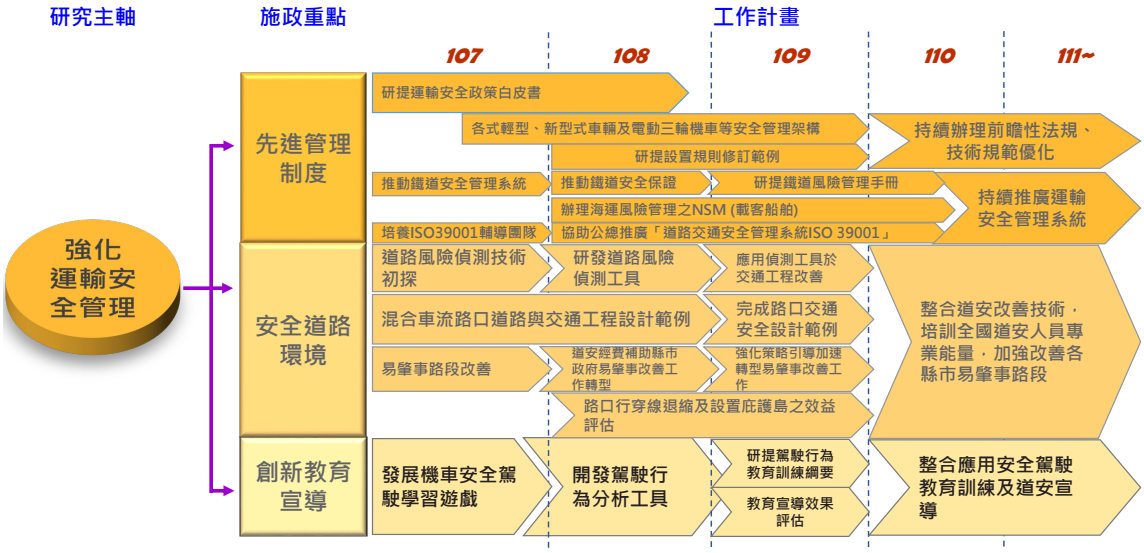
(2) Develop traffic engineering designs against rear-end and side collision incidents to reduce their occurring at intersections and cross-crash accidents and support improving stretches of high incident rate.

3. Innovative training and promotion program

(1) Collect, in large-scale, national highway bus driver act data with smart vehicle borne equipment to develop localized driving act safety indicators and tools; enhance transport industry driver act data collection, analysis and safety management; summarize various high-risk driving behavior patterns as the basis for future education and training.

(2) Addressing characteristics of younger generations to develop scooter safety driving training games for smartphones which combine transportation safety and regulation concepts, enhance learning effects with interesting and lively content; conduct multiple campus competitions and cooperate with local vehicle offices to promote and reach the younger generation targets in order to enhance safety awareness with innovative education models.

研究主軸三 、強化運輸安全管理



四、優化陸路運輸產業

促進陸路客貨運輸發展，改善經營環境及提升經營績效以優化陸路運輸產業為願景，運輸經營管理組年度研究主軸如下：

1. 政策面改善經營環境

(1) 蒐集國內外文獻、分析相關統計數據或調查結果，並拜會地方交通局局長徵詢看法，檢討公路公共運輸計畫發展成果及研擬後續推動策略，預為研擬下一期公路公共運輸計畫之準備。

(2) 賡續辦理區域運輸發展研究中心計畫，開設交通運輸專業人才培訓課程、輔導地方政府解決公共運輸問題、接受地方政府諮詢並協助地方向公路總局提案申請經費，強化學界與產業、政府部門的研發合作，促成在地公共運輸之永續發展。

(3) 研擬陸運政策白皮書有關鐵公路客貨運輸部分內容，分析發展現況與課題，並擘劃未來發展願景、策略與行動方案，以支援交通部推動陸路運輸產業發展。

IV. Optimize the Land Transport Industry

Based on the vision of optimizing the land transport industry to promote the development of passenger and freight transportation in land transport industry, improve the industry's operational environment and enhance the industry's operational performance, the annual research guidelines of the Operations and Management Division, IOT are:

1. Operational environment improvement policy

(1) Collect domestic and foreign literatures, analyze related statistics or survey results, and visit the Director-generals of the Transportation Bureau of local governments for advice in order to review the outcome of conducting the Public Transportation Promotion Program and propose the subsequent promotion strategies, which is for the preparation to draft the next Public Transportation Promotion Program.

(2) Continue carrying out the projects of regional transportation research & development centers to conduct transportation professionals training courses, counsel local governments to solve public transportation problems, and give advice for assisting local governments to apply for the fund from DGH, in order to enhance the cooperation among academic, industry, and government departments to achieve sustainable development of local public transportation.

(4) 檢討汽燃費徵收制度，進行國外里程收費案例分析及國內產業訪談，俾利 108 年度就技術、社會、政府、法令及財務等面向進行里程計費之可行性分析與探討，並針對利害關係人進行衝擊評估。

(5) 分析國外汽車貨運相關產業之整體法律體制，及貨運駕駛人與車輛之相關規定，俾利 108 年度研析我國汽車貨運業是否宜放寬特許制度，供交通部政策擬訂參考。

2. 技術面提升經營績效

(1) 探討國際上應用車載診斷系統 (OBD) 之現況與未來趨勢，並分析我國目前應用 OBD 所遭遇的問題與限制，以利車載診斷系統應用之推動。另訪談國內相關車機製造廠商，瞭解我國開發智慧節能車機可行性及能力，俾利智慧節能車機之開發。

(2) 規劃預約式無障礙小客車特約車隊制度並開發推動面可操作之系統工具，協助臺南市、嘉義市導入系統工具以驗證其可用性，除可提升營運與管理效率外，亦產生節能減碳成效。

(3) 開發「無縫銜接檢核系統」，協助交通主管機關及業者快速掌握軌道與公車轉乘班表縫隙，並實地檢核 17 個轉乘縫隙較大之臺鐵車站，提出具體改善方案。

(3) Draft the policies about passenger and freight transportation of railways and vehicles in White Paper on Land Transport by analyzing the current development status and issues of this field and proposing the future development vision, strategies and action plans, in order to support MOTC to promote the development of land transport industry.

(4) Review the Vehicle Fuel Use Charge (VFUC) system by analyzing foreign cases about the mileage-based charging system and asking the opinions of local industries, in order to study and discuss the feasibility of introducing the mileage-based charging system to Taiwan from the viewpoints of technical, social, governmental, legal and financial aspects in 2019, and assess impacts on stakeholders.

(5) Analyze other countries' overall legal system of vehicle freight industries and the relevant provisions about drivers and vehicles, in order to discuss whether to deregulate the franchise system of local vehicle freight industries in 2019, and to provide a reference for MOTC to make the related policy.

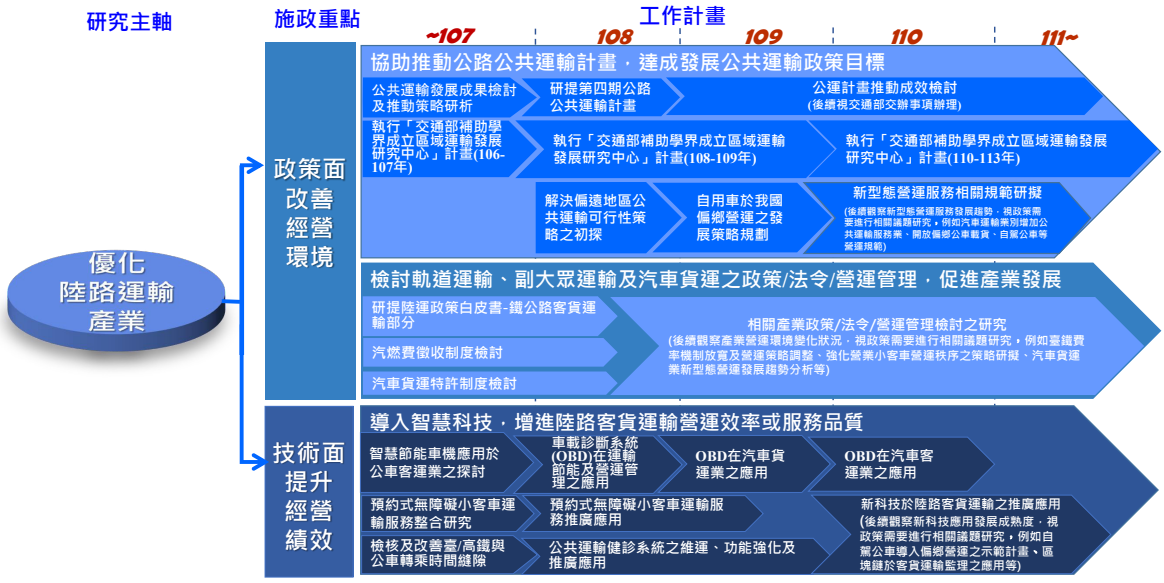
2. Operational efficiency improvement technology

(1) Review the international current status and future trends on OBD application and analyze the application problems and restricts encountered in Taiwan, in order to promote the application of on-board diagnostic system (OBD) in Taiwan. Besides, interview the domestic vehicle device manufacturers to understand the feasibility and capability of developing the devices in Taiwan, in order to develop smart energy-saving devices.

(2) Develop the reservation-based accessible vehicle fleet system and system components to facilitate the operation of the fleet. Then, introduce the customized assembled system components to Tainan City government and Chiayi City government to verify the availability. The results can not only improve the fleet operations and management efficiency but also show the energy-saving and carbon dioxide reduction benefits.

(3) Develop the evaluation system for seamless transfer to help transportation authorities and operators to quickly identify the transfer time gap between railway and bus schedules. In addition, carry out field inspections in 17 TRA stations with bigger transfer time gaps to propose specific improvement plans.

研究主軸四 、優化陸路運輸產業



五、整合智慧運輸服務

推動智慧運輸發展，以建立人本且永續的智慧交通生活環境為願景，運輸資訊組年度研究主軸如下：

1. 科技發展與創新應用

(1) 結合車路整合技術及車聯網技術，以基隆地區及中興新村為試驗場域，推動自動駕駛輔助及車聯網應用先導計畫。

(2) 應用資通訊技術滿足民眾行動服務需求，結合高雄市政府資源推動交通行動服務(MaaS)示範建置計畫。

(3) 研擬智慧運輸政策白皮書，擘劃未來發展願景、策略與行動方案，支援交通部推動智慧運輸系統發展建置計畫。

V. Integrate the Intelligent Transportation Services

Based on the vision of promoting intelligent transportation development and establishing a humanity-oriented and sustainable intelligent transportation environment, the annual research guidelines of the Information Systems Division, IOT are:

1. Technology development and innovative application

(1) Combining the road-vehicle integration technology and the vehicle networking technology to promote the pilot program for automatic driving assistance and vehicle networking applications in Keelung and Zhongxing New Village experimental fields.

(2) Meet mobile service requirements of the general public with communication technology, combining Kaohsiung City government resources to promote the "Mobility as a Service" (MaaS) demonstration construction project.

(3) Draft the intelligent transportation policy white paper, plan future development vision, strategy and action plan, and support MOTC to promote the intelligent transportation system development and implementation programs.

2. 資訊整合與跨域加值

(1) 因應交通旅運資訊多元化需求，結合高雄市政府推動交通事件整合服務示範計畫，並應用人工智慧（AI）技術，以交通管理需求進行道路路況影像辨識研究。本計畫不僅突破多項技術限制，提高影像辨識正確率與車輛辨識種類，更同時協助國內業者建立產業能量，具有擴展國際市場之潛能。

(2) 應用電信與電子票證資料，辦理公共運輸大數據分析研究，並分別以高雄市 (都會區) 與花蓮縣 (偏鄉地區) 為對象，深入分析公共運輸供需特性，提供縣市政府改善公共運輸之參考。

(3) 協助交通部研擬電動大客車推動計畫，推動自動輔助駕駛電動大客車，逐步落實 2030 年市區公車全面電動化目標。

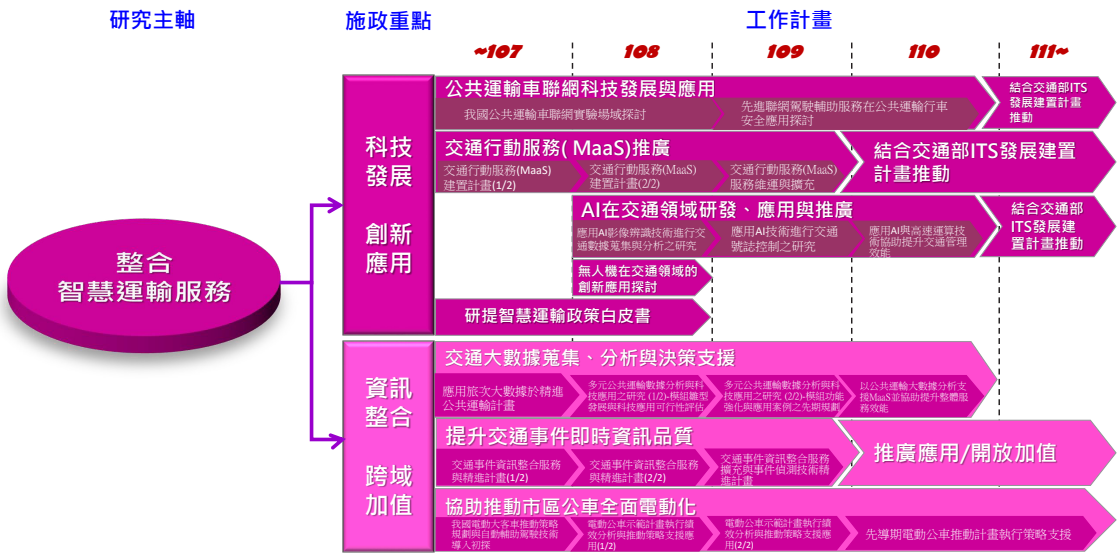
2. Information integration and value added cross-domain

(1) Addressing diversified needs of transportation and travel information, align with the Kaohsiung City Government's traffic incident integration service demonstration project, practice artificial intelligence (AI) technology and research road traffic image recognition for traffic management. The project not only breaks through multiple technical limitations to improve the image recognition and vehicle identification success rate but also assists domestic vendors to build up industry capacity to expand into the international market.

(2) Applying telecom and e-ticket data to conduct public transportation big data analysis and research, analyze supply and demand characteristics of public transportation in Kaohsiung City (urban) and Hualien County (remote), provide reference for local governments for public transportation improvements.

(3) Assist MOTC to develop electric bus promotion program and promote automatic/assisted driving electric bus, meeting the goal of total electrification of urban buses in 2030.

研究主軸五 、 整合智慧運輸服務



六、營造潔淨運輸環境

營造潔淨運輸環境，以建立潔淨的交通生活環境為願景，綜合技術組年度研究主軸如下：

1. 運輸部門減碳

(1) 協助交通部研訂「運輸部門溫室氣體排放管制行動方案」，於 107.10.3 報奉行政院核定。

(2) 提報第一期 (105-109) 運輸部門階段管制目標迄至 107 年底之執行狀況。

(3) 研提運輸部門溫室氣體減量中央與地方協力事項 (計 10 項)。

(4) 研擬綠運輸政策白皮書，納入交通部減碳減污之政策 / 計畫及相關推動工作。

2. 交通空污減量

(1) 完成首都圈「擴大公共運輸月票使用範圍 + 提高汽、機車停車收費占總停車位之比例」與「市區公車全面電動化 + 適度反映私人運具使用成本」之都會交通策略減污效益評估。

(2) 完成軌道運輸地下型車站降低懸浮微粒之研究，提出策略性思維建議，提供軌道運輸單位參考。

3. 運輸系統調適

(1) 完成運輸系統調適策略，包括四大構面 15 項策略，作為交通部與部屬機關研提行動方案之參據。

(2) 更新鐵公路風險資訊，作為交通部相關部屬機關研提調適行動計畫之參據。

VI. Build up a Clean Transportation Environment

Based on the vision of building up a clean transportation and living environment, the annual research guidelines of the Interdisciplinary Research Division, IOT are:

1. Carbon reduction of the transportation sector

(1) Assist MOTC to draft the "Action Plan for Greenhouse Gas Emission Control in the Transportation Sector", approved by the Executive Yuan on 2018/10/3.

(2) Submit the 2018 progress report of the regulated target of phase I (2016-2020) of transportation sector.

(3) Propose 10 tasks of cooperation between the central and local governments for reducing greenhouse gas of transportation sector.

(4) Draft the green transportation police white paper included MOTC's policies, programs and actions related to reduction of carbon and pollution emissions.

2. Reduction of traffic air pollution

(1) Complete the pollution reduction benefit assessment of the urban traffic policy, which includes the following two compositions of measures: "expanding the scope of use of the public transport monthly ticket" plus "increasing the percentage of paid parking spaces over total parking spaces", and "urban bus fleets fully electrified" plus "moderately reflect the external cost of using private vehicles."

(2) Complete the research of suspended particulate reduction of underground rail transport stations, and propose strategic recommendations for the rail transport authorities and operators.

3. Adaptation of transportation system

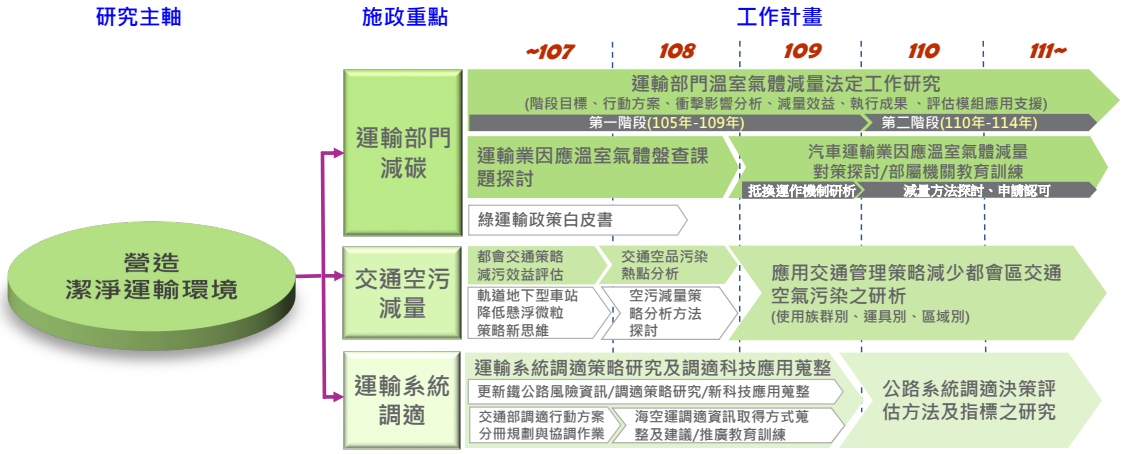
(1) Complete the adaptation strategy of transportation system, framed with 4 dimensions and 15 strategies, in order to provide MOTC and its external divisions the reference of making relevant action plans.

(2) Update the risk information of railway and highway, in order to provide MOTC and its external divisions the reference of making relevant adaptation action plans.

(3) 協助交通部完成調適行動方案 (107-111)6 分冊 (策略、氣象、公路、鐵道、空運及海運) 的規劃與協調作業。

(3) Assist MOTC to complete the planning and coordination of the 6 volumes (include: strategy, weather, highway, railway, air transport and shipping) of adaptation action plans (2018-2022).

研究主軸六 、 營造潔淨運輸環境



七、強化運輸技術研發

運用新興科技，強化運輸災防能力及管理效能，以提升海陸運輸安全並落實永續發展，港灣技術研究中心年度研究主軸如下：

1. 研發防災技術

(1) 陸運防災：在公路邊坡崩塌研究上，開發地表監測預警技術，發展土壤邊坡監測模組，至 107 年已完成 3 處試驗站安裝監測，並持續提升設施效能，且應公路總局四工處委託，搭配近景攝影技術，於台 7 甲線辦理 2 年期的試辦計畫，檢視應用於地質災害監測與預警之成果。另在地工織物應用於橋墩基礎保護之研究上，107 年與高速公路局合作，於國道三號大甲溪橋橋墩處進行實體佈設現地試驗，規劃接續將研提地工織物保護工法應用及其配置方式建議。

VII. Enhance Transportation Technology Research and Development

Adopt emerging technologies, enhance transportation disaster prevention capabilities and management effectiveness to improve safety of land and sea transportation and implement sustainable development, the annual research guidelines of the Harbor & Marine Technology Center, IOT are:

1. Research and development of disaster prevention technology

(1) Land transport disaster prevention: develop ground surface monitoring and early warning technology and develop soil slope monitoring module for road slope collapse study; installed 3 test stations with continuous performance improvements by the end of 2018; undergo 2-year test program on the provincial highway 7A with close-range photography technology as entrusted by DGH to verify results of geological disaster monitoring and early warning. Regarding research on applying geotextiles to the foundation protection of bridge piers, align with the Freeway Bureau, the Center conduct physical installation and field test to pier of the Dajiaxi Bridge at National Freeway 3 in 2018; the Center is planning to propose application and configuration of the geotextiles protection construction method.

(2) 港灣海象模擬：發展建置臺東、綠島及蘭嶼間海域風浪及水動力模組，提供細緻化海象模擬資訊，進行花蓮港觀測資訊之風浪及長浪特性分析以及颱風與季風波浪特性分析，並延伸應用於瘋狗浪之預警推估；另完成臺東海岸公路溢淹及沿岸地形變遷特性研究，及易致災區段鄰近之海岸地形變遷數值模擬分析，以利接續因應策略研擬。

(3) 港灣環境調查：辦理 107 年度基隆港、臺中港、高雄港、花蓮港、蘇澳港、臺北港、安平港、布袋港、澎湖 (馬公及龍門尖山港)、金門 (料羅、水頭、九宮港)、馬祖 (福澳、白沙、猛澳、青帆、中柱五碼頭區) 及綠島 (南寮港) 等 12 個地區附近海域之海氣象特性調查分析研究，建立我國港區長期性之海氣象特性資料庫，提供交通部

(2) Harbor oceanographic phenomena simulation: develop wind, wave and hydrodynamic modules in Taitung, Green Island and Lanyu to provide detailed oceanographic phenomena simulation information. Analyze wind, long wave, typhoon and monsoon wave characteristics based on Hualien Harbor observation data as well as extend into the early warning estimation of the rogue wave. Additionally, for setting up the response strategy in the future, the Center has completed the studies of over-flooding and coastal terrain change of Taitung coast highway and numerical simulation analysis of the coastal terrain change near the vulnerable area.

(3) Harbor environmental survey: conduct oceanographic phenomena characteristics survey, analysis and research (year 2018) against seas close to 12 areas including Keelung Port, Taichung Port, Kaohsiung Port, Hualien Port, Suao Port, Taipei Port, Anping Port, Budai Port, Penghu (Magong and Longmen Jianshan Port), Kinmen (Jiaoluo, Shuitou, Jiugong Port), Mazu (Fuao, Baisha, Mengao, Qingfan, Zhongzhu wharf area) and Lyudao (Nanliao Port) to build up the port area long-term oceanographic phenomena characteristics database for Department of Aviation and Navigation, MOTC,

航政司、航港局、港務公司及相關工程顧問公司等作為港區規劃、設計、施工、環境監控及營運管理之重要參據。

(4) 離岸風電區防災：配合離岸風電發展，於鄰近海域及港域進行 107 年度海氣象觀測及數值模擬，建立整合性觀測資料庫及資料的品質控管，同時探討鄰近主要母港之漂沙機制，進行模型試驗。另因應離岸風電主要母港臺中港未來大量工作船隻與運補船隊進出風場鄰近海域，年度中進行船舶交通流分析、航行安全監控系統及急難救助作業手冊研擬，提供交通部航港局、港務公司等作為離岸風電鄰近海域船舶航行安全之重要參據。

Maritime Port Bureau, Taiwan International Ports Corporation (TIPC) and relevant construction consultancy firms as the reference for planning, design, construction, environmental monitoring and operation management of the port area.

(4) Offshore wind farm disaster prevention: In conjunction with offshore wind power development, the Center has completed the observation and digital simulation of oceanographic phenomena in adjacent sea and port areas to establish integrated observation database and data quality control, and to explore the drifting sand mechanism of the adjacent main home port for model tests in 2018. Additionally, for addressing a large number of working vessels and transporting fleets accessing offshore wind farms' main home port, Taichung Port, the Center has conducted ship traffic flow analysis, navigation safety monitoring systems and emergency rescue operation manual drafting during the year to provide the Maritime Port Bureau and TIPC with reference for navigation safety of ships in the offshore area neighboring windfarms.

2. 建立智慧航運

(1) 船舶監控預警：蒐集我國海域範圍內船舶航行資訊，應用船舶自動識別系統、雷達、大數據分析等技術進行船舶航行特性分析，並建立船舶航行風險評估模組，提供交通部航港局作為船舶航行安全預警之參據。

2. Establishment of smart ship navigation

(1) Ship monitoring and early warning: collect ship navigation information within the territorial seas, conduct vessel navigation characteristics analysis based on vessel automatic identification system (AIS), radar, big data analysis and other technologies, and build up ship navigation risk assessment module for Maritime Port Bureau's vessel navigation safety early warning reference.

(2) 港灣環境資訊應用：完成 107 年度港灣環境資訊系統維護，改版整體網頁服務，結合港區海象、藍色公路、港區影像、港區地震、港區海嘯及港區腐蝕等 7 項資訊子系統，並綜整全國海象即時觀測資訊，與因應災防需求，發展通訊應用程式 line-bot 預警推播服務功能，提供整體性及即時性之港灣動態與靜態環境完整資訊。

(2) Harbor environmental information application: the Center has completed the 2018 maintenance of the Harbor Environment Information System, revised the overall web service, integrated 7 sub-systems which are: harbor area oceanographic phenomena, blue highway, port image, port earthquake, port tsunami and port erosion information, and summarized national oceanographic phenomena instant observation information in response to disaster prevention requirements, to develop communication application "line-bot" for early warning push notification service and provide complete and real-time information on the dynamic and static environment of the harbors.

3. 落實永續發展

(1) 公路橋梁維護管理系統：107 年度除持續精進系統，建置行動裝置 APP 外，另辦理橋梁評鑑，導入外部稽核與培訓檢測人員，並運用新興科技，強化及研發橋梁維管技術，協助提升橋梁安全。

(2) 港灣構造物設計基準編修：蒐集國內相關基準及研究成果與國外如英國 BS6349, 美國 CEM, 日本港灣設施基準同解說等設計規範，配合國內新規定及工程實務需求，107 年已依部頒規範格式，完成基準條文 1~6 篇之修訂及初審。

3. Implementation of sustainable development

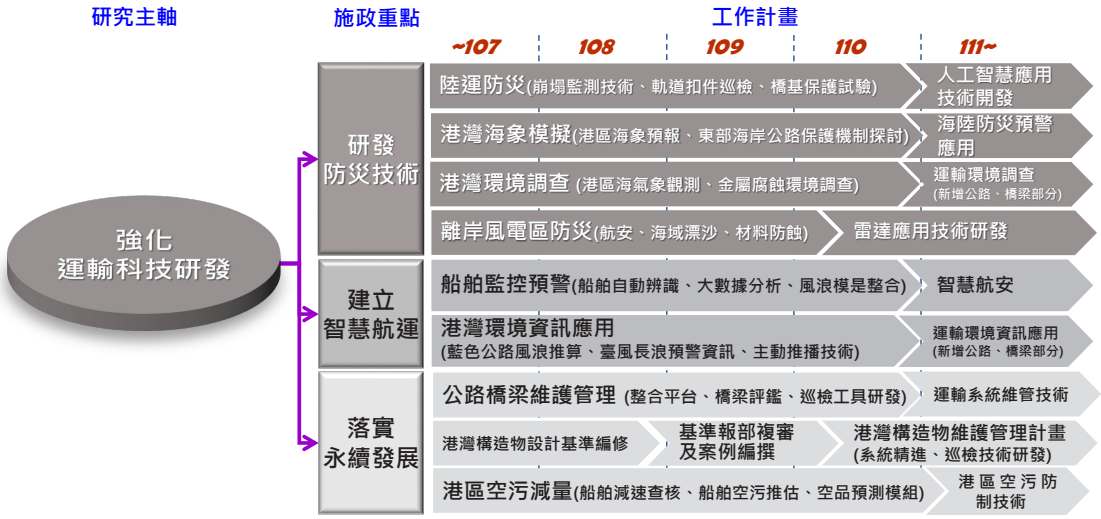
(1) Road bridge maintenance management system: In addition to continuously improving the system and implementing mobile APP in 2018, the Center has also conducted bridge evaluation, introduced external audit and trained inspection personnel. Furthermore, for improving bridge safety, the Center has adopted emerging technologies to strengthen and develop bridge maintenance and management technology.

(2) Revision of harbor structure design standards: the Center has collected relevant domestic benchmarks and research results, standards and design specifications of international harbor facilities (including British BS6349, US CEM, and Japanese harbor structure design guidelines) as well as aligned with new domestic regulations and practical engineering requirements to complete revision and preliminary review of the basic provisions volume 1-6 according to MOTC required specifications and format in 2018.

(3) 港區空污減量：結合交通部船舶自動識別系統、即時氣象資料、行政院環境保護署空氣品質測站資料，107 年進行各主要港區及臨海船舶對臺灣地區空氣品質之全年影響案例分析，並運用三維空氣品質網格模式 (CMAQ)，建置即時船舶排放量推算模組，以提供交通部航港局及港務公司等作為空污防制措施擬訂之參據。

(3) Air pollution reduction in port areas: Combined the Automatic Identification System (AIS), real-time meteorological data, and air quality data of EPA, Executive Yuan, the Center has analyzed annual impact of air quality over Taiwan area by main harbor areas and costal vessels in 2018. Furthermore, the Center has used the three-dimensional Community Multi- scale Air Quality Model (CMAQ) to build an immediate ship emissions estimation module to provide the Maritime Port Bureau and TIPC with a reference in proposing air pollution prevention measures.

研究主軸七 、 強化運輸技術研發



04

重點研究介紹

Introduction of Key Researches

本所配合交通部當前重點政策及國內交通問題，研擬及執行相關研究計畫，以協助完成國內交通政策之推動，並提供研究成果作為中央及地方政府交通單位施政之參考，這些當前交通政策重點包含：

(一) 道路安全改善應用；

(二) 公路客貨運輸創新研究與應用；

(三) 智慧運輸科技發展與創新應用；

(四) 運輸規劃評估工具；

(五) 公路防災新技術之開發應用；

(六) 資訊科技在港灣環境與航行安全之應用發展；

(七) 海空運決策支援應用工具之創新發展；

(八) 氣候變遷環境下運輸部門之因應作為。

以下即針對本所配合執行之重點研究項目擇要進行介紹。

In line with the current key policies of the Ministry of Transportation and Communications and the domestic transportation issues, the Institute develops and implements relevant research projects to assist in completing the advancement of domestic transportation policies, and provides the research outcomes as the reference for the administration of central and local government transportation units. These current transportation policies emphases include:

(1) Road Safety Improvements and Applications;

(2) Creative Research and Application on Highway Passenger and Cargo Transportation;

(3) Development and Innovation of Intelligent Transportation Technology;

(4) Transportation Planning and Assessment Tools;

(5) Development and Application of New Technologies for Road Disaster Prevention;

(6) Application and Development of Information Technology on Harbor Environment and Shipping Safety;

(7) Innovative Development of Decision-Making Support Tools for Marine and Air Transportation;

(8) Response of Transportation Sectors in Climate Change Environment.

The following is to introduce related key research projects implemented by the Institute.

一、道路安全改善應用

(一) 輔導運輸業者導入「道路交通安全管理系統 (ISO 39001)」

1. 計畫概述

聯合國宣布 2011-2020 年為道路安全行動十年，而實行道路交通安全管理標準 ISO 39001 為可採取的改善措施之一。本所於 104-105 年就該規範內容進行瞭解，並輔導 3 家運輸業者導入。106 年則持續輔導 2 家業者，彙整 3 年經驗，完成 ISO 39001 導入參考手冊，並針對國內運輸業之特性，研提國內運輸業之道路交通安全管理機制。

2. 研究成果

(1) 累計 104~106 年，共輔導首都客運、市府轉運站 (統一開發)、統聯客運、中台灣客運及桃園客運 5 家業者通過 ISO 39001 驗證。另中興巴士集團 6 家客運業者自行接受輔導建置，亦於 107 年 2 月通過驗證。

(2) 完成 ISO 39001 導入參考手冊，以提供運輸業者自行導入或接受輔導建置道路交通安全管理系統之參考。

(3) 研提我國道路交通安全管理機制，期透過運輸業安全管理系統分級方式 (基本管理→作業標準化→風險管理)，輔導國內運輸業者逐步建立道路交通安全管理系統。

I. Road Safety Improvements and Applications

(I) Guide the transportation companies to introduce "Road Traffic Safety (RTS) Management Systems (ISO 39001)"

1. Project Overview

The United Nations declared 2011-2020 as the Decade of Action for Road Safety and implemented the Road Traffic Safety (RTS) Management Standard ISO 39001 as one of the improvement measures that can be taken. The Institute studied the content of the specifications in 2015-2016 and guided three transportation companies to introduce the standard. In 2017, we guided two more companies, collected three years of experience, completed the ISO 39001 introduction reference manual, and studied the road traffic safety management mechanism of the domestic transportation industry based on the characteristics of the domestic transportation industry.

2. Research Outcomes

(1) Provided guidance to five companies, namely Capital Bus, Taipei City Hall Bus Station (Uni-President Development), UBus, Central Taiwan Bus and Taoyuan Bus to pass ISO 39001 certification between 2015 and 2017, and six bus operators of Chung Shing Bus Group accepted guidance to set up and successfully passed the certification in February 2108.

(2) Completed the ISO 39001 Introduction Reference Manual to provide reference for the transportation industry to introduce or accept guidance to establish the Road Traffic Safety Management System.

(3) Studied the road traffic safety management mechanisms of Taiwan, and gradually established the Road Traffic Safety Management System through the classification method of Transportation Industry Safety Management System (Basic Management → Operation Standardization → Risk Management) to guide domestic transportation companies in their road safety management.

3. 成果推廣與效益

(1) 本所於 104~106 年每年辦理推廣說明會，對象為運輸業主管機關、運輸業者、顧問公司等，分享本研究經驗及成果，提供後續建置道路交通安全管理系統之參考。

(2) 本所於 106 年 11 月 16 日至交通部業務會談簡報本案，依部長指示協助公路總局研提道路交通安全管理系統 (ISO 39001) 之推廣計畫，並於 107 年 1 月 15 日函送該局，提供該局據以辦理後續 5 年 (107~111 年) 推廣事宜。

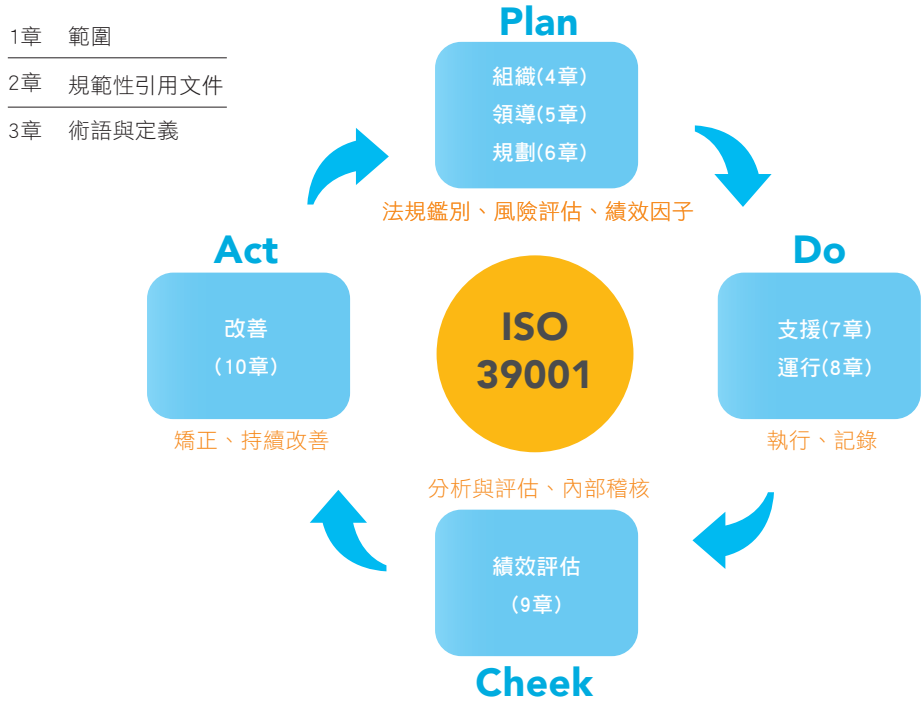
(3) 公路總局請本所持續協助於今 (107) 年辦理訓練計畫，培養 3 至 5 家輔導機構，以利後續推廣道路交通安全管理系統。

3. Promotion of Outcomes and Benefits

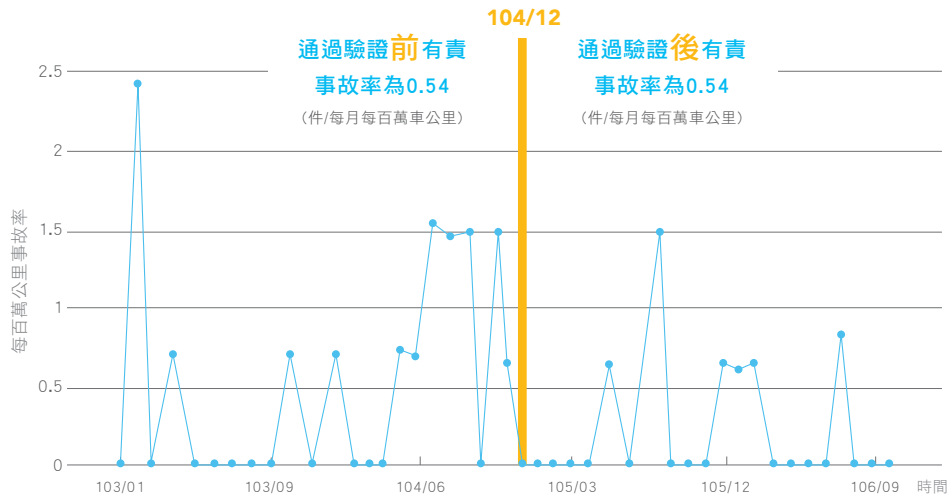
(1) The Institute organized information seminars every year from 2015-2017, targeting the competent authorities of the transportation industry, transportation companies and consultant companies to share our research experiences and outcomes, and provide references for the subsequent implementation of the Road Traffic Safety Management Systems.

(2) On November 16, 2017, the Institute went to the business meeting held by the Ministry of Transportation and Communications to brief this project, and assisted the Directorate General of Highways to study the promotion project of Road Traffic Safety Management System (ISO 39001) instructed by the Minister, and delivered the document by mail to the Directorate General on January 15, 2018, to provide them the basis of promotion events for the following five years (year 2018~2022).

(3) The Directorate General of Highways requested the Institute to continue assisting in the training plan for this year (2018), and to train three to five guiding institutions to facilitate the follow-up promotion of the Road Traffic Safety Management System.



道路交通安全管理系統 ISO 39001 之 PDCA 執行流程與架構
PDCA implementation Process and Architecture of the ISO 29001 Road Traffic Safety Management System



首都之星 (羅東站)103/1 ～ 106/9 之每月百萬車公里有責事故率統計

Monthly Million Bus/Kilometers Liable Accident Rate Statistics of Capital Star (Luodong Station) 1/2014~9/2017

（二）道路主要肇事型態之交通工程改善設計範例

(II) Traffic engineering improvement design examples of primary road accident patterns

1. 計畫概述

臺灣近十年之肇事件數約成長 90%，顯示交通安全問題已是刻不容緩的改善重點。本計畫針對路口常見的肇事型態，發展各肇事型態的交通工程改善設計範例，應用於路口各肇事型態的改善工作。

本計畫於 104 年起針對路口右轉側撞事故的防治，提出分流式指向線並進行試辦。105 年針對路口左轉側撞事故進行分析，並研擬改善方法。目前持續蒐集既有各型機車左轉方式資料，擴充改善方案。

未來將持續探討路口交叉撞、追撞、與巷口事故之交通工程改善方式，並彙整完成路口交通工程設計範例，辦理相關教育訓練。供交通部、公路總局及地方道路管理單位，進行易肇事路口改善分析，精準掌握路口肇事型態，發掘肇事原因，並提出有效改善方案，提升易肇事地點改善品質與效率。

1. Project Overview

The number of incidents in Taiwan in the past decade has grown by about 90%, indicating that traffic safety issues are an urgent emphasis for improvement. This project is aimed at the common accident patterns at intersections, and develops traffic engineering improvement design examples for various accident patterns, which are applied to the improvement works for those accident patterns at intersections.

This project proposed diversion marking and conducted trial for the prevention and control of the right turning side collision accident at intersections since 2015.Conducted analysis for the left turning side collision accident at intersections starting in 2016, and developed an improvement method. At present, the information of existing left-turn method for all types of motorcycles is being collected, to expand the improvement program.

In the future, the traffic engineering improvement program of cross collision, rear-end collision at intersections and accidents at alley entrances will be researched further, and intersection traffic engineering examples will be collected and organized to conduct educational training. Those research outcomes will be provided to the Ministry of Transportation and Communications, the Directorate General of Highways and local road management agencies to carry out improvement analysis of the intersections prone to accidents, accurately understand accident patterns at intersections, explore the causes of accidents, and propose effective improvement programs to enhance the quality and efficiency of improvement at locations prone to accidents.

2. 研究成果

(1) 藉由分流式指向線、車道化機車停等區與機車停等區小箭標等設施，降低路口右轉汽車與直行機車的衝突，並與臺中市、基隆市及新竹縣府合作試辦。以臺中市為例，改善後 1 年的肇事件數降低 54%，改善後第 2 年亦比改善前降低 42%。

(2) 提出機車直接左轉路口設置方式，針對特殊環境或交通條件的路口，使用不同左轉方式以消除機車左轉衝突，降低相關事故。

3. 成果推廣與效益

(1) 本所於 104~106 年每年辦理教育訓練，邀集中央機關、各縣市政府、各工程顧問公司等，以推廣研究成果，供各界參用。

(2) 107 年 6 月，本計畫與第 35 期易肇事路段改善計畫、道路交通車流及事故風險偵測與分析工具之發展應用計畫，辦理聯合推廣應用說明會。

2. Research Outcomes

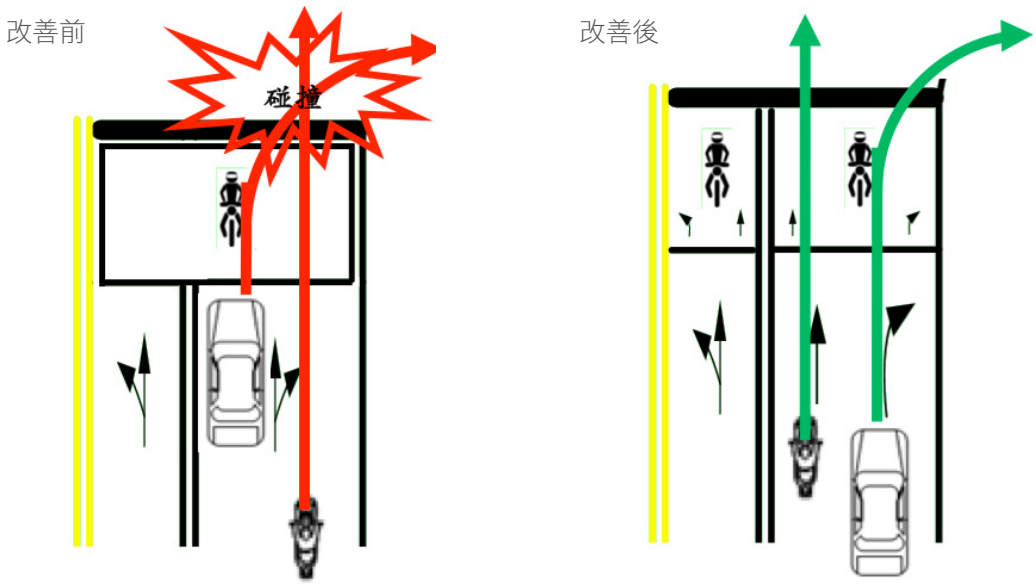
(1) Reduce the conflict between right-turning vehicles and straight-moving motorcycles by means of facilities such as diversion marking, traffic lane-based motorcycle waiting zones, and small arrow signs of motorcycle waiting zone, and cooperate with the governments of Taichung City, Keelung City and Hsinchu County to conduct trials. Taking Taichung City as an example, the number of accidents one year after the improvement was reduced by 54%, and the second year after improvement was also reduced by 42% compared with that of before the improvement.

(2) Propose the intersection setting method for the motorcycle direct left turn, use different left turn methods for special environments or traffic conditions to eliminate the left turn conflict of motorcycles and reduce accidents.

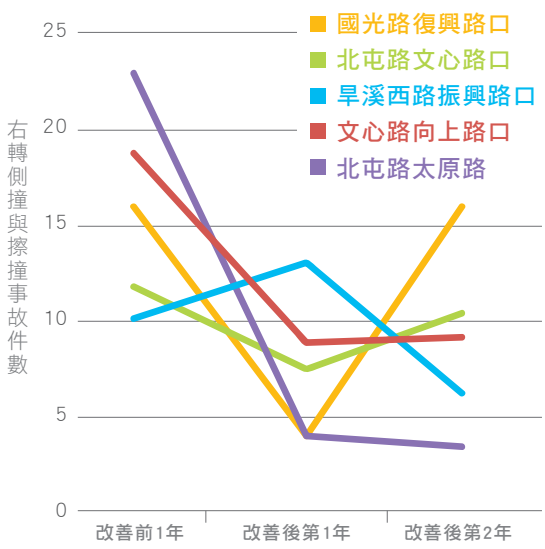
3. Promotion of Outcomes and Benefits

(1) The Institute organized educational training every year from 2015 to 2017, and invites the central competent authorities, all county and municipal governments, and engineering consulting companies to promote the research results for the use by all sectors.

(2) In June, 2018, the project held joint information seminars with the 35th Improvement Plan for the Road Sections Prone to Accidents, Developing Application Plan for Road Traffic Flow and Risk Detection and Analysis Tools.



改善右轉側撞設計範例
Example of Improving Right Turn Side Collision Design



台中市試辦路口改善前後比較圖

臺北市忠孝東路光復南路口繪設之分流式指向線
(摘錄自 2017 年 6 月 15 日中時電子報報導)

改善前後右轉側撞與擦撞事故比較及臺北市繪設實例

Comparisons of right turn side collisions and fender-bender accidents before and after improvement and examples of painted road markings in Taipei City

（三）機車交通事故住院傷患嚴重度之影響因子分析

1. 計畫概述

我國機車交通事故的受傷人數一年約在 30 萬人以上，造成龐大的社會成本。為瞭解較嚴重受傷的機車使用者的特性，本研究透過問卷方式取得 800 多位機車交通事故住院傷患的疾病、用藥、駕駛行為及習慣等資料，配合醫院端之傷害嚴重度數據進行統計分析，找出影響機車交通事故傷害嚴重度的危險因子。研究成果可提供民眾注意騎乘機車的危險因子，亦可提供政府、醫療、機車產業及學研單位研擬降低機車事故傷害嚴重度的對策參考。

2. 研究成果

(1) 比較機車各年齡族群住院嚴重度，包括：住院天數 15 天以上、使用呼吸器及外傷嚴重度高等 3 個項目，以 45-64 歲族群為對照組，年輕（18-24 歲）族群及老年（65 歲以上）族群的風險度要高出約 2 倍以上。

(2) 影響年輕及老年群組住院嚴重度的因子包括：事故前感到疲勞、會緊跟在大型車的後面或附近、紅燈轉綠燈前，會為了超越車輛而快速衝出去、行車速度較快等。其他年齡群出現的風險因子包括：周遭因光線或下雨，視線受影響而分心、右轉時差點與右後方過來的自行車發生擦撞、遇有機車兩段式左轉管制時，會直接左轉等。

(III) Analysis of factors affecting the severity of hospitalized injuries in motorcycle traffic accidents

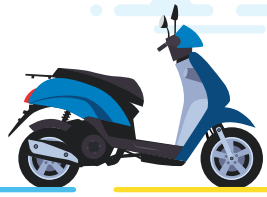
1. Project Overview

The number of people injured in motorcycle traffic accidents in Taiwan is about 300,000 a year, causing huge social costs. In order to understand the characteristics of the more seriously injured motorcyclists, this research obtained data on the illnesses, medications, driving behaviors and habits of more than 800 motorcycle traffic accident hospitalized patients through questionnaires, and conducted statistical analysis on the injury severity data in coordination with the hospitals to find out the risk factors that affect the severity of motorcycle traffic accidents. These research results can provide the public with the risk factors that require attention when riding a motorcycle, and can also serve as a reference for the government, medical, motorcycle industry and academic research institutes to develop countermeasures for reducing the severity of injuries in motorcycle accidents.

2. Research Outcomes

(1) Comparing the hospitalization severity of all age groups of motorcyclists, including three categories of: hospitalization days for more than 15 days, use of respirators and high severity of trauma, with 45-64 year olds as the control group, the risk level of young (18-24 years old) group and the elderly (over 65 years old) group is about two times higher.

(2) The factors affecting hospitalization severity of young and elderly groups include: fatigue before the accident, closely follow the large vehicle behind or around, before the red light turns green rush out in order the pass another vehicle, and high driving speed. The risk factors of other age groups include: line of sight is affected and distracted due to light or rain in the surroundings, near-collision a the bicycle coming from the right rear direction when making a right turn, and making a direct left turn on intersections with a two-stage left turn requirement for motorcycles, etc.



3. 成果推廣與效益

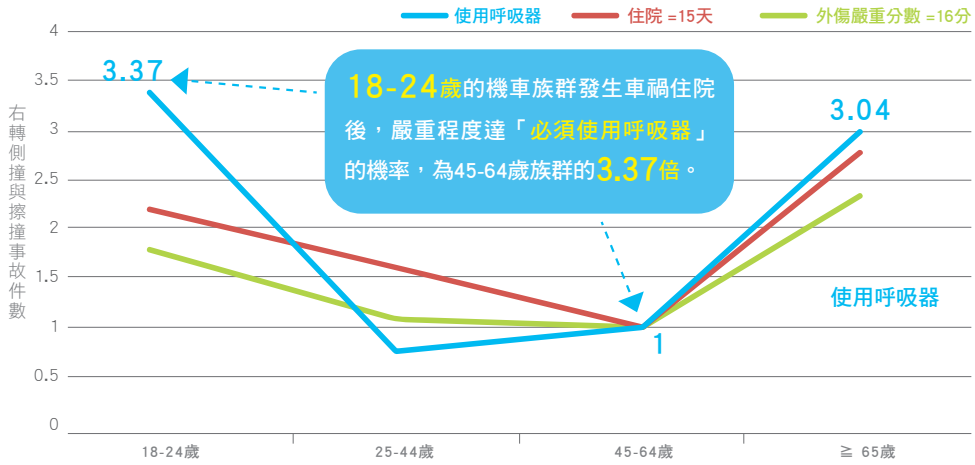
(1) 106 年 7 月 28 日發佈新聞稿，「機車族減少重傷的秘訣－降低車速，看清前路！」期盼引發民眾、利害關係人及團體對切身權益的關注，與政府部門就機車安全議題合作及投入資源。

(2) 107 年 5 月，於交通部道安委員會議進行報告，以提供交通部及相關機關研討未來防制機車事故之策略方向。

3. Promotion of Outcomes and Benefits

(1) A press release was issued on July 28, 2017, "The secret for motorcyclists to reduce serious injuries - reduce the speed and watch the road ahead!" to make public, stakeholders and groups more aware of their rights and interests in cooperating with government departments on motorcycle safety issues and investment of resources.

(2) In May 2018, this Institute presented its reports to the Road Traffic Safety Committee of the Ministry of Transportation and Communications to provide the ministry and relevant agencies with strategic directions for their discussions regarding the prevention of motorcycle accidents in the future.



機車各年齡族群住院嚴重度相對風險

Relative Risks of Hospitalization Severity for All Age Groups of Motorcyclists

各年齡層駕駛事故因子與傷害嚴重度相關性的單變量分析結果

Univariate analysis of the correlation between driving accident factors and injury severity in all age groups

年齡分層	傷害嚴重度	統計顯著的事故因子
18-24 歲	住院≧ 15 天	事故前感到疲勞 / 累
	使用呼吸器	會緊跟在大型車的後面或附近
25-44 歲	住院≧ 15 天	周遭因光線或下雨，視線受影響而分心右轉時、差點與右後方過來的自行車發生擦撞、紅燈轉綠燈前、會為了超越車輛而快速衝出去，會緊跟在大型車的後面或附近
	使用呼吸器	周遭因光線或下雨，視線受影響而分心
45-64 歲	住院≧ 15 天	事故前感到疲勞 / 累、事故前身體或心理感受異常、遇有機車兩段式左轉管制時，會直接左轉
	使用呼吸器	行車速度
	外傷嚴重分數≧ 16	太靠近前車，以致於緊急狀況時難以煞車
65 歲以上	住院≧ 15 天	紅燈轉綠燈前，會為了超越車輛而快速衝出去、行車速度
	外傷嚴重分數≧ 16	事故前身體或心理感受異常

（四）我國道路交通事故 30 天內死亡人數統計暨趨勢分析

1. 計畫概述

我國內政部警政署道路交通事故死傷人數之計算，係以事故發生後 24 小時內死亡為基準，超過 24 小時死亡之當事人皆被認定為受傷，然為與國際資料比較，本所自 96 年起即開始辦理「我國道路交通事故發生後 30 天內死亡人數統計」。於每年利用衛生福利部死因資料庫及內政部警政署事故資料庫，針對每一事故當事人死亡日期進行串檔，產製道路交通事故 30 天內死亡人數統計及相關報表，並定期於本所運輸安全網站資料系統 (TALAS) 公告，供各界參考使用。

此外，為使各級道路主管機關能夠掌握轄下道路交通安全水準，並掌握長期趨勢與事故特性，本所以 TALAS 網站公告之道路交通事故發生後 30 天內死亡人數統計相關報表為基礎，就各縣市「102-105 年道路交通事故死亡人數趨勢」進行分析，以期了解在不同車種、年齡層、酒精影響等條件下的道安水準與趨勢。

2. 研究成果

(1) **以長期趨勢觀察道安水準，鼓勵縣市政府善加應用資料：**本計畫以本所網站公告之各項報表為基礎，展示如何觀察道安水準長期趨勢及分析，以期協助各地方政府善用資料以改善道路交通安全。

(2) **以嚴重度與成長率為維度，呈現各縣市道安水準：**以近四年平均事故成長率及每單位人口 (車輛數) 死亡人數兩維度，分別探討各縣市高齡、年輕、機車、自行車 / 行人、汽車等不同屬性之事故狀況，希望透過各縣市與過去的自己比較，了解應加強改善的方向。

(IV) Statistics and trend analysis of fatality numbers within 30 days of road traffic accidents in Taiwan

1. Project Overview

The calculation of the number of fatalities and injuries in road traffic accidents by the National Police Agency, Ministry of the Interior is based on the death within 24 hours after an accident and the parties who died more than 24 hours after the accident were all identified as injured. However, compared with international data, this Institute started processing the "Statistics of Fatality Numbers within 30 Days of Road Traffic Accidents in Republic of China" since 2007. The cause of death database by the Ministry of Health and Welfare and the accident database of National Police Agency, Ministry of the Interior are used to link the each accident party's death date, and to produce the Statistics of Fatality Numbers within 30 Days of Road Traffic Accidents and related reports, which are published on the Institute's Transportation Safety Website Information System (TALAS) regularly for the reference of all sectors.

In addition, in order to enable the competent authorities of all levels in charge of roads to grasp the safety levels of road traffic under their jurisdiction, and to grasp long-term trends and accident characteristics, this Institute conducted analysis on the "Trend of Fatality Numbers within 30 Days of Road Traffic Accidents between 2013 and 2016" of all counties and cities, based on the Statistics of Fatality Numbers within 30 Days of Road Traffic Accidents and related reports published in the TALAS website, to understand the levels and trends of road safety under the conditions of different vehicle types, age groups, and influence of alcohol.

2. Research Outcomes

(1) **In observing long road safety standards with the long-term trend, the county and city governments are encouraged to make good use of the information:** This project demonstrates how to observe the long-term trend and analysis of road safety standard based on the reports published in the website of this Institute to assist all local governments to make good use of the information to improve the road traffic safety.

(2) **The levels of road safety of all counties and cities is presented along the dimensions of severity and growth rate:** The two dimensions of average accident growth rate in the past four years and the fatality numbers per

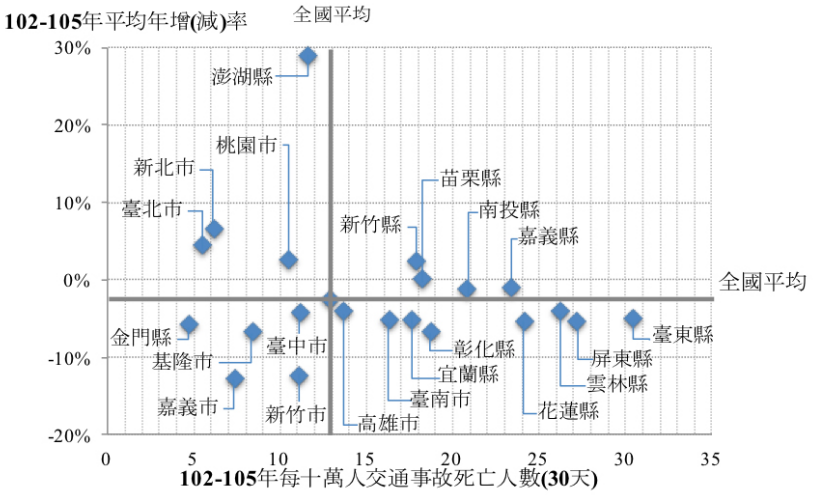
3. 成果推廣與效益

106 年 12 月 27 日於交通部道路交通安全督導委員會議研提報告，並函送各地方政府道安會報，讓地方首長能夠確實了解轄下道安水準，以對症下藥，提升道路交通安全。

population unit (number of vehicles) are used to explore the accident conditions of different attributes such as old persons, young persons, motorcycles, bicycles/pedestrians, automobiles respectively, and historical among all counties and cities are made to identify directions for the necessary improvements.

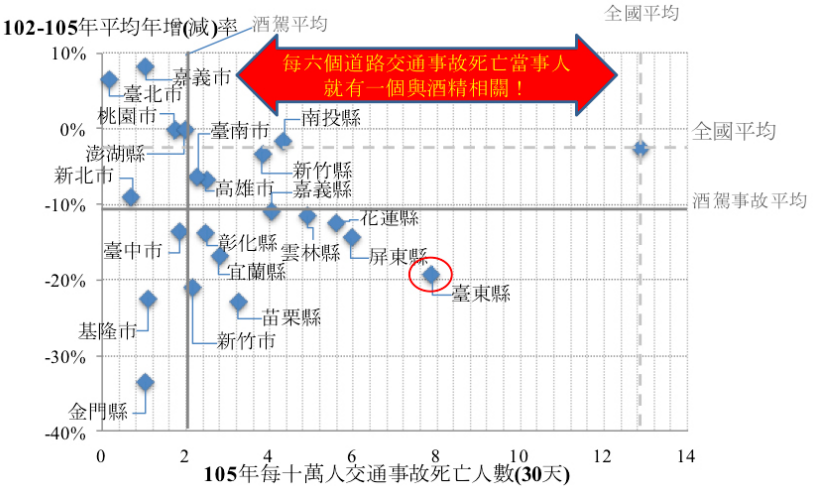
3. Promotion of Outcomes and Benefits

On December 27, 2017, this Institute submitted its report to the Road Traffic Safety Committee of the Ministry of Transportation and Communications, and delivered by mail to the local government's Road Safety Forum to enable local officials to truly understand road safety levels in their jurisdictions and to improve road traffic safety through measures that matter.



各縣市 102-105 年道路交通事故趨勢與嚴重程度

Trend and Severity of Road Traffic Accidents in all Counties and Cities From 2013 to 2016



各縣市 102-105 年道路交通事故趨勢與嚴重程度 (酒精相關事故)

Trend and Severity of Road Traffic Accidents in all Counties and Cities from 2013 to 2016 (Alcohol Related Accidents)

二、公路客貨運輸創新研究與應用

(一)應用健保資料構建通勤與就醫旅次起迄分布

1. 計畫概述

過去為掌握民眾旅次起迄分布，必須透過抽樣調查方式，藉由電話訪問或郵寄問卷方式記錄民眾近期外出之交通行為狀況，每份問卷約需花費數百元，且民眾拒訪率偏高，受限於調查需耗費大量時間與成本，除抽樣樣本數有限容易造成偏誤外，運輸需求調查也無法頻繁辦理，這些限制均會影響到調查結果應用之準確度。隨著資訊科技發展，政府各部門已累積諸多大數據資料庫，例如健保承保資料有多數民眾就業單位之資料，健保就醫資料則有民眾看診醫院及時間之資訊，爰本所嘗試應用去個資識別化之健保資料結合戶籍資料與稅籍資料構建通勤與就醫旅次之起迄分布資料，經以基隆市為案例進行實作，確認此方法可行。

2. 研究成果

(1) **構建基隆市民通勤旅次之起迄分布資料：**如以鄉鎮市區為交通分區，計產出約 24 萬筆通勤旅次起迄分布資料；如以村里為交通分區，因財政部資訊中心提供之非營利事業機構稅籍資料中有 23 萬筆缺乏機構登記地址所屬村里之資料，致僅能勾稽出約 15 萬餘筆通勤旅次之起迄分布資料。此資料產出時可區分性別、年齡群組進行統計。

II. Creative Research and Application on Highway Passenger and Cargo Transportation

(I) Applying national health insurance data to establish the origin-destination matrix of work and medical trips

1. Project Overview

In order to comprehend the origin and destination distribution of people's trips, we used to conduct a sample survey to collect the travel behavior information of the respondent's s recent trips by telephone interview or mail questionnaire. It costs hundreds of dollars to complete one questionnaire in the sample survey; besides, many people tend to be not involved in the survey. Considering it takes much time and money, we can't conduct the travel demand survey frequently; besides, the survey tends to be bias due to limited samples. All the restrictions mentioned above may affect the accuracy of the use of the travel demand survey results. With the development of information technology, the government authorities have gathered lots of big data databases, for example, the underwriting data of national health insurance contain the information of where the employer's workplaces are for most of insured and the medical care data of national health insurance contain the information of which hospital and date each insured visited when he went to the doctor. Therefore, Institute of Transportation, MOTC has tried to integrate the anonymized national health insurance data, the household registration data, and taxation registration data to establish the origin-destination matrix of work and medical trips. This method has been confirmed to be practical by a case study on Keelung City.

2. Research Outcomes

(1) **Establishing the origin-destination matrix of Keelung city citizens' work trips:** Based on the traffic zones of city districts, we can establish the origin-destination matrix of around 240,000 citizens' work trips. However, we can only establish the origin-destination matrix of around 150,000 citizen's work trips based on the traffic zones of villages since there are 230,000 organizations whose addresses don't contain the villages they are located in the non-profit organization taxation registration data provided by Fiscal Information Agency, Ministry of Finance. The origin-destination matrix mentioned above can be divided by the gender and age groups of citizens.

(2) **構建基隆市民至大型醫院就醫旅次之起迄分布資料**：計產出約 193 萬筆以村里為交通分區之就醫旅次起迄分布資料。此資料產出時可區分性別、年齡群組及就醫時間 (按月份或星期) 進行統計。

(3) 應用健保資料結合戶籍與稅籍資料構建通勤與就醫旅次之起迄分布資料雖可行，但無法得知運具選擇資訊，雖因而無法完全取代傳統運輸需求調查方法，但具互補效益，爰有其應用價值。

3. 成果推廣與效益

(1) 107 年 5 月辦理成果發表會進行知識分享，以利相關單位了解如何應用健保資料構建通勤與就醫旅次之起迄分布，應用於運輸需求模式校估，將有助於節省校估運輸需求模式所需之資料蒐集時間與成本。

(2) 107 年 7 月將印製完成之報告書函送相關單位參考，並發函財政部賦稅署及資訊中心說明非營利事業機構有 23 萬筆資料登記地址缺乏村里之影響，請其協助改善，俾利提升本研究方法之實用。

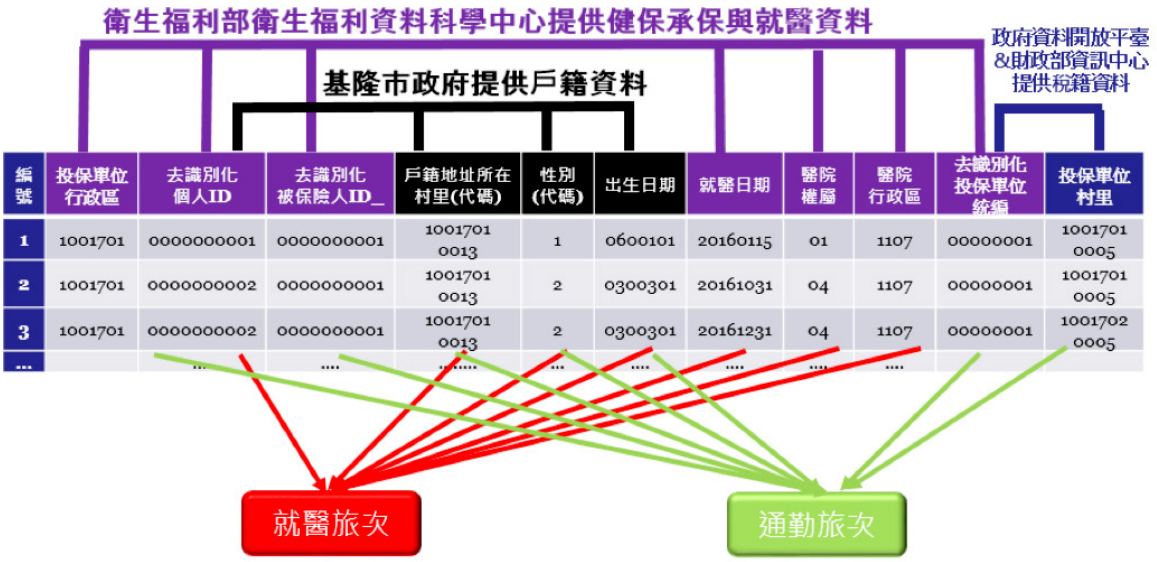
(2) **Establishing the origin-destination matrix of Keelung city citizens' medical trips:** Based on the traffic zones of villages, we can establish the origin-destination matrix of around 1,930,000 medical trips of Keelung city citizens to large hospitals during last year. The origin-destination matrix mentioned above can be divided by the gender, age groups, and medical date (according to month or day of week) of citizens.

(3) It is practical to integrating the national health insurance data, the household registration data, and taxation registration data to establish the origin-destination matrix of work and medical trips, but it is impossible to know the transportation mode of these trips, making it cannot completely replace the traditional travel demand survey. However, it has complementary benefits to the traditional travel demand survey, so it is still valuable.

3. Promotion of Outcomes and Benefits

(1) In May, 2018, Institute of Transportation, MOTC held a conference of research outcome presentation to share our experiences and findings about this project to transportation industry, hoping that it can help them understand how to apply the national health insurance data to establish the origin-destination matrix of work and medical trips. If we use it to calibrate and validate the current travel demand model, it will save our time and cost to collect the data we need.

(2) In July, 2018, Institute of Transportation, MOTC has sent the published report to transportation authorities for reference. IOT also sent Taxation Administration and Fiscal Information Agency of the Ministry of Finance an official document which mentioned the impact to this method resulting from the fact that there are 230,000 organizations whose addresses don't contain the villages they are located in the non-profit organization taxation registration data, and urge them to improve it in order to enhance the practicability of this method.



構建旅次起迄點示意圖 (資料來源與構建方法)
Schematic Diagram for Establishing the Origin-Destination Matrix of Trips (Data Sources and Application Method)

傳統運輸需求調查與應用健保資料構建通勤與就醫旅次起迄之比較

Comparison of Traditional Travel Demand Survey and Applying National Health Insurance Data to Establishing Origin-Destination Matrix of Work and Medical Trips

比較項目	傳統運輸需求調查	應用戶籍、健保承保與稅籍資料構建通勤旅次起迄	應用戶籍與健保就醫資料構建就醫旅次起迄
優點	・可反映旅次發生時間、旅次發生率、運具選擇。	・資料蒐集省時省成本，可加速資料更新以反映交通環境變化。 ・樣本數趨近母體。 ・可提高運輸需求模式就業人口分派之精確度。	・資料蒐集省時省成本，可加速資料更新以反映交通環境變化。 ・樣本數較多。 ・以往僅能掌握家其他旅次，此資料則能更細致掌握就醫旅次起迄與時間。
缺點	・調查耗時耗成本，需較長年期才能更新資料。 ・樣本數較少，資料需放大處理，爰可能存在較多偏誤。	・無法判斷旅次發生時間點、旅次發生率、運具選擇。 ・少部分民眾戶籍地不是實居地。 ・少部分民眾實際工作地址不在投保單位登記地址內。	・可判斷旅次發生日期，但無法判斷旅次發生時間點及運具選擇。 ・部分民眾就診並非從戶籍地出發。

（二）提昇貨運產業競爭力－導入績效運籌模式

1. 計畫概述

公路汽車貨運產業為關鍵物流服務業，承運國內內陸運輸 95% 以上之貨量，有必要隨著國際發展趨勢，發展多元創新及具彈性之營運模式。歐美國家大貨車租賃已行之有年，近年更採用績效運籌模式，將單純大貨車採購或租賃轉為以「大貨車運行績效」為交易主體之租賃契約。由於營運車輛為貨運業者之重要資產，如能採用績效運籌模式租賃所需車輛，使車輛於合理使用年限內，提升其使用效能並降低故障率且確保安全，將可使貨運業者的運具更具生產力及營運彈性，進而提升整體貨運產業競爭力。貨運產業於車輛部分導入績效運籌模式，除可協助業者降低成本、提升效率外，由於以績效為導向，車輛供應商將持續改善車輛保養維修作業與降低費用，可間接降低排碳量，有助於達成節能減碳促進國家永續發展之政策目標。

2. 研究成果

(1) 本研究以曳引車為例進行試算，顯示績效運籌模式能提高業者經營效率並降低成本，進而協助產業升級，並達到節能減碳之綜效。

(2) 在法制化作業上，須修法允許貨運業者使用租賃貨車進行營業行為。此外相關車輛牌照、整車進口關稅、舊車出口退稅及保險制度等亦須加以配合修訂，俾利績效運籌模式順利導入。

(II) Increase the competitiveness of the freight industry - Introduce Performance-based Logistics Model

1. Project Overview

As a key logistics service industry carrying more than 95% of the domestic inland transportation cargo volume, the highway freight trucking industry is essential to develop multi-innovative and flexible operations model in line with international trends. Large truck leases in Europe and the United States have been available for many years, and Performance-based Logistics has been adopted in recent years to convert simple truck purchases or leases into lease contracts with "large truck operation performance" as the subject of transaction. Since the operating vehicle is an important asset for the freight forwarder, if the vehicle can be leased under Performance-based Logistics, the vehicles can improve their performance, reduce failure rates and ensure safety within the reasonable duration of service that will enable the transportation vehicles of freight forwarder to achieve higher productivity and operational flexibility to enhance the competitiveness of the overall freight industry. For the freight industry to introduce Performance-based Logistics for its vehicles, in addition to help the freight forwarder reduce cost and improve efficiency. Since it is performance-oriented, the vehicle suppliers will continue to improve vehicle maintenance and repair and reduce costs which can indirectly reduce carbon emissions and contribute to the policy objectives of energy conservation and carbon emission reduction to advance sustainable development of the country.

2. Research Outcomes

(1) This research uses the tractor as the example for trial calculation that shows Performance-based Logistics can improve operating efficiency and reduce cost for the freight forwarder, thus assist industrial upgrading and achieve the comprehensive effect of energy conservation and carbon emission reduction.

(2) Regarding the legal aspect of this system, the law must allow freight forwarders to use leased trucks for their business activities. In addition, relevant vehicle licenses, vehicle import tariffs, old vehicle export tax rebates and insurance systems must also be revised in coordination in order to facilitate the successful introduction of Performance-based Logistics.

(3) 除上述法制須加以開放外，亦須貨運業者與供車方以互信為基礎，藉由雙方透通資訊平台共享車輛相關資訊，以利績效運籌合約之訂定與執行。

(3) In addition to the aforementioned legal system that must be made available, it is also necessary for freight forwarders and vehicle suppliers to share their vehicle related information through an information platform based on mutual trust, to facilitate the establishment and implementation of Performance-based Logistics contracts.

3. 成果推廣與效益

(1) 完成「國內汽車貨運產業及貨車供應鏈現況發展課題」稿件，並獲刊登於商業車誌 2018 年 2 月號。

(2) 106 年 7-9 月，深度訪談 18 家貨運、車輛供應業者，以了解我國貨運及車輛供應現況，並對於導入績效運籌模式進行意見交流；106 年 9 月邀集貨運業者及汽車製造業者，就國內外應用績效運籌模式發展現況、國際標竿案例及法制架構等議題進行交流。

(3) 106 年 12 月應邀參加 2017 瑞典日，與永德福臺灣分公司 (Scania) 就我國貨運產業導入績效運籌模式交換意見。

(4) 107 年 6-9 月，規劃辦理訪談貨運業者進行成果推廣，以提升業者對績效運籌模式之了解並凝聚共識。

3. Promotion of Outcomes and Benefits

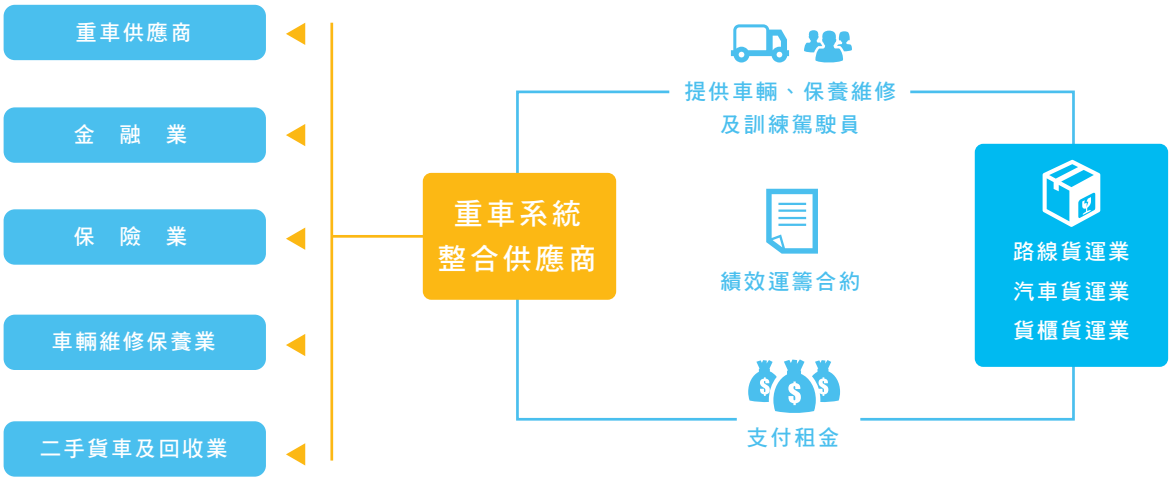
(1) Completed the manuscript of the "Development Subject for the Status of Domestic Trucking Freight Industry and Truck Supply Chain", and published it in the February 2018 issue of the CVNews.

(2) Between July and September of 2017, 18 freight forwarders and vehicle supply providers were interviewed in depth to understand the status of freight and vehicle supply in Taiwan, and exchange ideas on the introduction of Performance-based Logistics. In September 2017, this Institute invited freight forwarders and automobile manufacturers for exchanges on the issues of the development status of using Performance-based Logistics at home and abroad, international benchmark cases and legal frameworks.

(3) In December 2017, the Institute was invited to participate in the 2017 Sweden Day, and exchanged ideas with the Taiwan branch of Scania on the introduction of Performance-based Logistics to the freight industry of Taiwan.

(4) Between June and September of 2018, this Institute conducted planning to interview the freight forwarders to conduct the achievement promotion to enhance the understanding and build consensus of the Performance-based Logistics.

傳統的用車模式圖
Traditional Vehicle Usage Pattern Chart



以績效為基礎的用車模式圖
Performance-based Vehicle Usage Pattern Chart

(三)因應超高齡社會之小客車運輸服務推動策略

1. 計畫概述

依國家發展委員會估計，我國正逐步從「高齡化社會」進入「超高齡社會」，人口老化將使長期照顧、就醫、復健等需求增加，間接造成交通需求亦將增加。本案透過規劃無障礙小客車運輸服務發展環境與推動策略，以因應未來社會需求外，並整合資通訊技術以建構無障礙友善環境，滿足其日常交通需求，更可藉由電子化取代以往紙本稽核作業，以及提昇車輛使用效率，達到節能減碳之成效。

2. 研究成果

(1) 參考健保制度提出預約式無障礙小客車運輸服務發展架構，研擬特約車隊營運模式，納入無障礙計程車與民營福祉車，並規劃發展願景及短中長期預期目標，讓有限的政府資源能滿足更多有需要無障礙小客車運輸服務民眾。

(2) 配合新制度架構，開發預約式無障礙小客車運輸服務應用介面，以目前各縣市營運中的系統為基礎，介接新功能後，提供使用者更多元、更方便、更透明的乘車資訊與訂車管道，並就業者目前必要的行政作業，予以簡化及電子化，另優化車輛派遣邏輯，以提昇營運效率；此外，透過智慧化監管功能，亦可強化主管機關監管效率，節省稽核所需人力成本。

(III) Strategy of promoting the small passenger vehicle transportation services in response to hyper-aged society

1. Project Overview

According to estimates of the National Development Council, Taiwan is transitioning into a "hyper-aged society" from an "aging society". Population aging will increase the demand for long-term care, medical care and rehabilitation, and indirectly cause increasing demand for traffic. Through planning on development environment and promotion strategies of barrier-free passenger vehicle transportation services, in addition to respond to the needs of future society, also integratecommunication technology to construct a barrier-free friendly environment to meet daily traffic needs, this Project can also replace the previous paper audits with electronic operation as well as improve vehicle utilization efficiency to achieve the effects of energy conservation and carbon emission reduction.

2. Research Outcomes

(1) Propose a reservation-based barrier-free vehicle transportation service development framework in reference to the health insurance system, develop a special fleet operation model, incorporate barrier-free taxis and private welfare vehicles, and conduct planning on the development vision and short, medium and long term expected objectives, and allow the limited government resources to meet more in need for barrier-free vehicle transportation service.

(2) In line with the new system framework, develop an application interface for a reservation-based barrier-free vehicle transportation service. Based on the current operating system in all counties and cities of Taiwan, the interface with new functions will provide users with more diversified, convenient and transparent ride information and reservation channels, provide operators with simplified and electronic administrative operations, and optimize the vehicle dispatch logic to improve operational efficiency. In addition, through the intelligent supervision function, the efficiency of supervision and control for the competent authorities can be strengthened to save labor cost required for auditing.

3. 成果推廣與效益

(1) 已於 106 年 9 月至 107 年 1 月分別拜會桃園市副市長、臺南市副市長、高雄市交通局長、新北市交通局副局長、嘉義市社會處長等，簡報計畫研究成果，並商討 107 年度合作試辦事宜，加深首長對新制度願景之印象，以為未來施政參考。

(2) 已於 106 年 12 月中華民國運輸學會 106 年學術論文研討會進行發表，並投稿 2018 年長者及身心障礙者交通與運輸服務國際大會，擴大各界參考。

(3) 107 年 6 月於交通部性別平等專案小組第 6 屆第 6 次會議，專案報告研究成果與最新辦理情形，供交通部長官及性平委員參考。

(4) 本 (107) 年度將於臺南市、嘉義市進行試辦計畫，並於 12 月辦理推廣應用座談會，將邀集交通部、衛生福利部、各縣市政府等相關機關進行成果交流，期各縣市能導入新制度以因應未來社會需求。

3. Promotion of Outcomes and Benefits

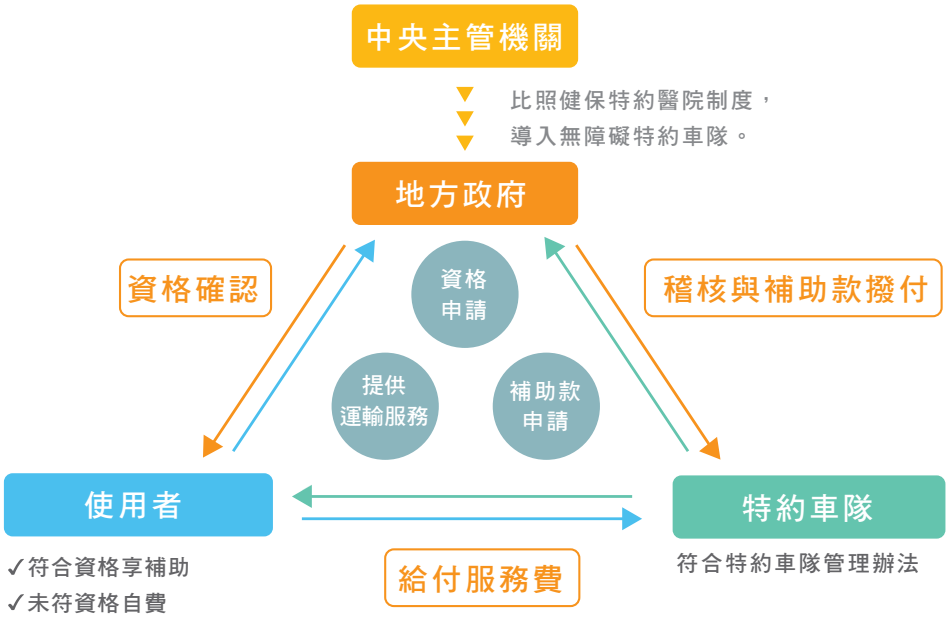
(1) From September 2017 to January 2018, this Institute visited the Deputy Mayor of Taoyuan City, the Deputy Mayor of Tainan City, the Director-General of the Transportation Bureau, Kaohsiung City, the Deputy Director-General of the Transportation Bureau, New Taipei City, and the Director-General of the Social Affairs Bureau, Chiayi City to brief the research outcomes of the Project, and discuss a joint cooperation pilot project for 2018, to deepen the impression of the Officials on the vision of new system, and as reference for future administrations.

(2) The Project has been published in the 2017 Academic Paper Seminar of the Chinese Institute of Transportation in December, 2017, and an article was submitted for publication to the International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED2018), expanding the references for all sectors.

(3) In June 2018, report the Project Research outcomes and Latest Processing Situation in the 6th Meeting of 6th Gender Equality Task Force of the Ministry of Transportation and Communications as reference of the Ministry Officials and Members of Gender Equality Committee.

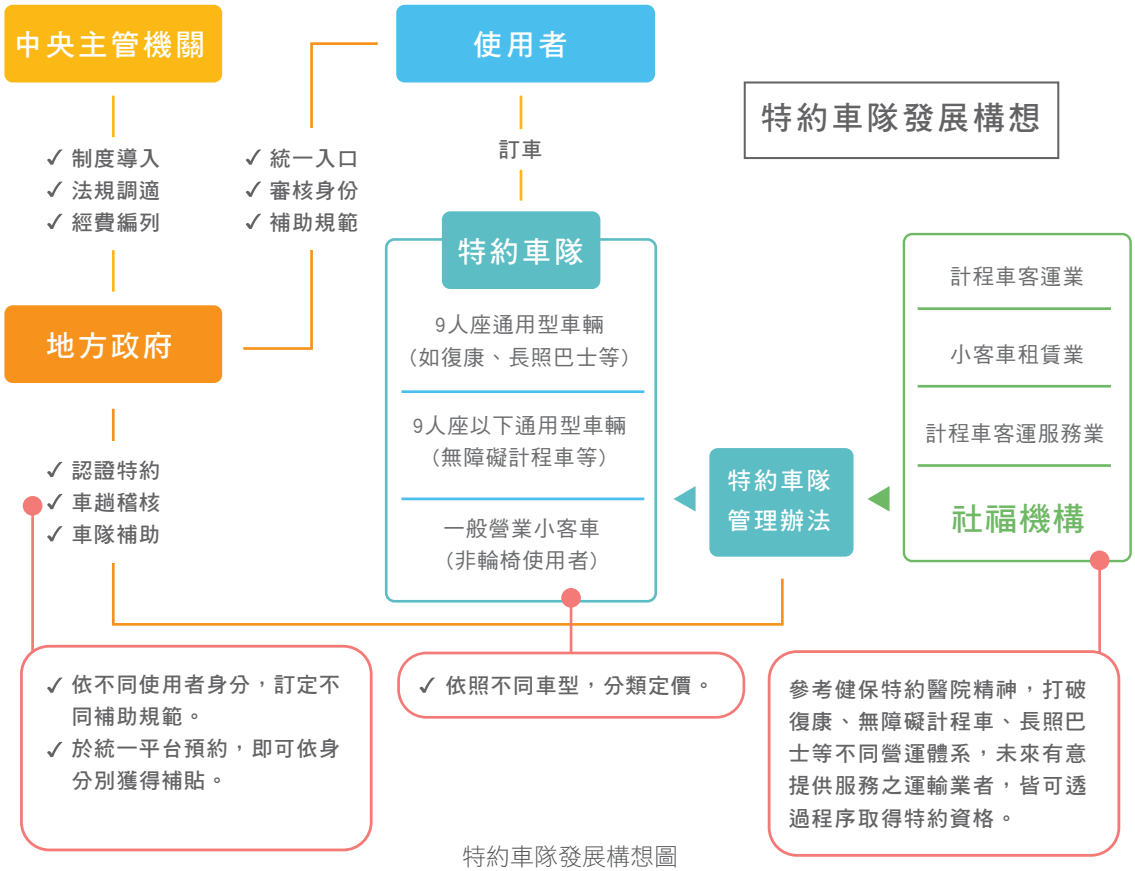
(4) In 2018, a pilot project will be held in Tainan City and Chiayi City and a promotion and application symposium will be held in December. The Ministry of Transportation and Communications, the Ministry of Health and Welfare, and all related agencies of all county and city governments are invited to exchange the achievements of this project, to enable all counties and cities to introduce the new system in order to respond to the needs of society in the future.

特約車隊運作機制



特約車隊運作機制圖
Special Fleet Operation Mechanism Chart

特約車隊發展構想



特約車隊發展構想圖
Special Fleet Development Concept Chart

（四）探討我國汽車燃料使用費之徵收制度

1. 計畫概述

國內汽車燃料使用費（以下簡稱汽燃費）徵收課題，各界一直有不同的看法，現行徵收方式係採隨車徵收方式辦理，然許多人認為汽燃費應採取「隨油徵收」以符公平原則，進而將此議題在公共政策參與網路平台上形成提案，進一步引起民意代表關注。本研究探討汽燃費徵收課題，以建立公平稅費課徵制度為前提，探討汽燃費徵收方案，規劃推動政策，以做為交通部施政之參據。

2. 研究成果

(1) 研究瞭解目前國際趨勢，各國已朝向禁售燃油車輛方向努力，而道路養護費用仍須持續支應，現況美國以燃油稅費做為道路養護費用財源亦面臨不足之困境，且相對於「隨里程徵收」方案，「隨燃料徵收」方案較無法反映使用者付費之精神，也不具有衍生新創產業的附加效益。

(2) 另「隨燃料徵收」在部會協調及行政成本上需由交通部主責考量以下各項因素：納入「用路不用油」車輛、排除「用油不用路」對象、建置徵收系統、維持既有免徵政策（客運業、計程車）以及油品流向管理、查緝及清分等部會共同合作分工。

(3) 費收基準在「使用者付費」與公平性原則下，參考車輛技術發展及國際道路養護費制趨勢，應採取「車輛總重」（對於道路破壞程度尤為顯著）及「車行里程」做為計算因子。研究並提出隨里程徵收階段性建議。

(IV) Exploring the vehicle fuel fee levy system in Taiwan

1. Project Overview

All sectors of the society have always had different point of views on the topic of the domestic Vehicle Fuel Fee levy. The current method is "Levied by Vehicle", however, many people think that the Vehicle Fuel Fee shall be "Levied by Fuel" to be in compliance with the principle of fairness, and this issue is formed as a proposal on the Public Policy Participation Network Platform, which further raised the attention of elected representatives. This research explores the topic of Vehicle Fuel Fee levy with the premises of establishing a fair tax and fee levy system, explores the Vehicle Fuel Fee levy plan, and conducts planning on promoting the policy as the reference for the Ministry of Transportation and Communications.

2. Research Outcomes

(1) The Research aimed to understand the current international trends, all countries have been striving towards the ban on the sales of fuel vehicles but the road maintenance costs are still need to be paid continuously so that the current situation in the United States is also facing the dilemma of shortage of fuel taxes as the financial source for road maintenance costs, and the "Levy by Mileage" program, "Levy by Fuel" program are relatively unable to reflect the spirit of The User Pays, and does not have the added benefits in derivative new industries.

(2) Additionally, in terms of the coordination between the Ministries and the administrative costs of "Levy by Fuel", the Ministry of Transportation and Communications needs to be responsible for considering the following factors: Include the vehicles of "Use Road Not Use Fuel", exclude the targets of "Use Fuel Not Use Road", establish the Levy System, maintain the existing exemption policy (passenger buses, taxis) as well as the cooperation and division of work between Ministries in the fuel flow direction management, investigation and clearing.

(3) Under the principle of "The User Pays " and fairness, in reference to vehicle technology development and international trends in road maintenance cost systems, fee levy benchmark shall adopt the "Vehicle Total Weight" (more significant to the road damage) and "Vehicle Travel Mileage" as the calculation factors. Research and propose the phased recommendations of "Levy by Mileage".

(4) 完成汽燃費徵收方案研擬，包含「隨車重徵收」、「隨燃料徵收」及「隨里程徵收」，進行配套措施研擬（如表）。

3. 成果推廣與效益

(1) 建置網路平台進行意見蒐集及觀念溝通。

(2) 辦理 5 場意見徵集溝通工作坊。

(3) 107 年賡續辦理「汽車燃料使用費隨里程徵收之可行性研究」。

(4) Completed the development of the Vehicle Fuel Fee Levy program, including "Levy by Vehicle Weight", "Levy by Fuel" and "Levy by Mileage", and conduct the development of supporting measures (as shown in the Table).

3. Promotion of Outcomes and Benefits

(1) Establish a network platform for opinion collection and concept communication.

(2) Organize five opinion collection and communication workshops.

(3) Continue the "Feasibility Study of Levying the Vehicle Fuel Fee by Mileage" in 2018.

汽燃費徵收方案及配套說明表

Explanation of Vehicle Fuel Fee Levy Programs and Supporting Measures

	現行規定	隨車重徵收方案	隨燃料徵收方案	隨里程徵收方案
費收基準	· 依車種汽缸數分級	· 車重	· 燃料用量 （電動車等非用油車輛另計）	· 車行里程、車重
徵收機制	· 隨車定期徵收	· 建立車重資料庫 · 依車重分級制定費率隨車徵收	· 委由油品銷售端代徵，並排除用油不用路收費對象（柴油用油占18%）： 1. 漁船與農機用油 2. 提桶加油 3. 旅館工廠等其他油品來自批發業	· 徵求民間技術服務選項包括： 1. 固定期間許可 2. 里程錶登錄 3.OBD 里程讀取器 4.OBD 里程讀取器附加 APP
免徵機制	· 客運及計程車免徵 · 離島以 70% 計徵	· 可沿用現行作業程序	· 運輸業者：另行退費或加油辨識。 · 離島：於離島加油站收費系統設定減徵。	· 運輸業者：沿用現行作業程序 · 離島：依登記車籍或車行區位減徵。

三、智慧運輸科技發展與創新應用

(一) 國道 5 號智慧路廊交通管理協控平台

1. 計畫概述

近年來，由於國道 5 號的便捷，吸引愈來愈多的旅客藉由該道路前往宜蘭地區觀光旅遊，不僅假日尖峰時段國道壅塞，且宜蘭地區交通問題亦愈發嚴重。因此本計畫於國道 5 號大臺北地區與宜蘭間進行雲端整合運輸路廊交通管理，透過即時交通資訊，以及大數據與視覺化決策分析，進行跨機關連續假期前路況預報與假期間 CMS 資訊發布協控運作，以輔助宜蘭地區交通管理與壅塞事件反應運作。

本計畫透過 105 年宜蘭童玩節、中秋節、雙十節，以及 107 年元旦與清明節連續假期進行運作，進行工作包括：

(1) 國 5 路況預報；

(2) 國 5 大客車通行路肩交管策略啟動建議；

(3) 宜蘭外圍地區透過 CMS 自動化發布國 5 旅行時間與交通管制等資訊；

(4) 宜蘭地區停車場、景點管制、路徑導引等 CMS 資訊發布。

2. 研究成果

(1) **完成跨機關交通管理協調運作案例與模式：**本計畫透過多次連續假期前的教育訓練與協調會議，以及假期間的即時運作，發展我國第 1 個跨機關 (高速公路局、公路總局，以及臺北市、新北市、基隆市、宜蘭縣等縣市政府) 之交通管理協調運作模式，可提供各機關於協控規劃時之參採依據。

(2) **完成跨機關交通管理協調運作軟體平台之開發與實測驗證：**透過結合大數據與

III. Development and Innovation of Intelligent Transportation Technology

(I) Intelligent corridor traffic management and its coordinated transportation management platform of National Freeway No. 5

1. Project Overview

In recent years, due to the great accessibility provided by National Freeway No. 5 to Yilan County, more and more travelers go to Yilan County for sightseeing, not only causing congestion of this national freeway during the peak hours of holidays, but also traffic problems in Yilan County in general have become more serious. Therefore, this Project is to conduct the cloud-based integrated corridor traffic management of National Freeway No. 5 between the Taipei Metropolitan area and Yilan County, through real-time traffic information, as well as big data and data visualization in decision support, to conduct cross-agency pre-holiday traffic condition forecasting and traffic information dissemination by coordinated CMS operations among several public agencies to support traffic management and congestion response operations in Yilan County during holidays.

The Project has been conducted during the 2016 Yilan Children's Folklore and Folkgame Festival, Mid-Autumn Festival, Double Tenth Day, and 2018 New Year's Day and Qingming Festival consecutive holidays. The work includes: (1) National Freeway No. 5 traffic condition forecasting; (2) Recommendations of National Freeway No. 5 on the timing of bus on shoulder traffic operation; (3) Information of travel time and traffic control on National Freeway No. 5 in Yilan County through automated CMS operation; (4) Real time information of parking space, scenic spot, and route guidance via CMS in Yilan area.

2. Research Outcomes

(1) **Completed the cross-agency traffic management coordination operation case and model:** Based on experience and lesson learned from several trials of long holidays, the first cloud-based integrated corridor management (ICM) platform for traffic operations among several agencies, Freeway Bureau, Directorate General of Highways, the county and city governments of Taipei City, New Taipei City, Keelung City and Yilan County, was developed. Before each trial, trainings were provided to operators and meetings were performed to ensure the smooth operation during long holiday. And the outcome of this Project can be a reference for

視覺化的資料分析，以及雲端化與虛擬化技術所開發區域協控平台，提供即時事前路況預報與及時反應路況之自動化跨機關 CMS 資訊發布，以輔助運輸路廊的交通管理運作，同時可經由客製化來滿足於不同協控需求區域的運作。

3. 成果推廣與效益

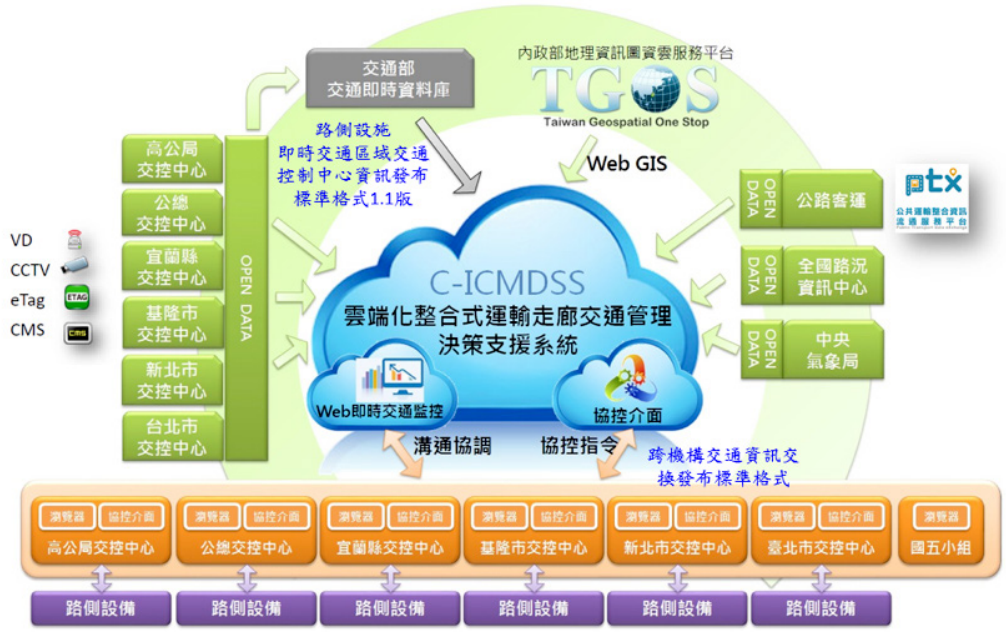
本計畫於執行過程辦理教育訓練、協調會議、成果說明會，藉以推廣跨機關協控觀念與運作模式，並藉由宜蘭地區連續假期之跨機關協調交通管理完案例，透過所研發的雲端整合運輸路廊交通管理平台來進行展示與運作。

other public agencies to adopt or deploy on similar corridor management issues.

(2) **Completed the cross-agency traffic management coordination operating software platform development and field testing:** Based on the integration of big data and visual data analysis, the regional coordination control platform was developed by cloud based and virtualization technologies, (i) to provide traffic forecasting, (ii) to automatically announce real time traffic condition via cross-agencies CMS, (iii) to automatically perform incident traffic response strategies, and (iv) to assist the traffic management for particular transportation corridor. This platform can be customized to meet the regional traffic operation needs in the future.

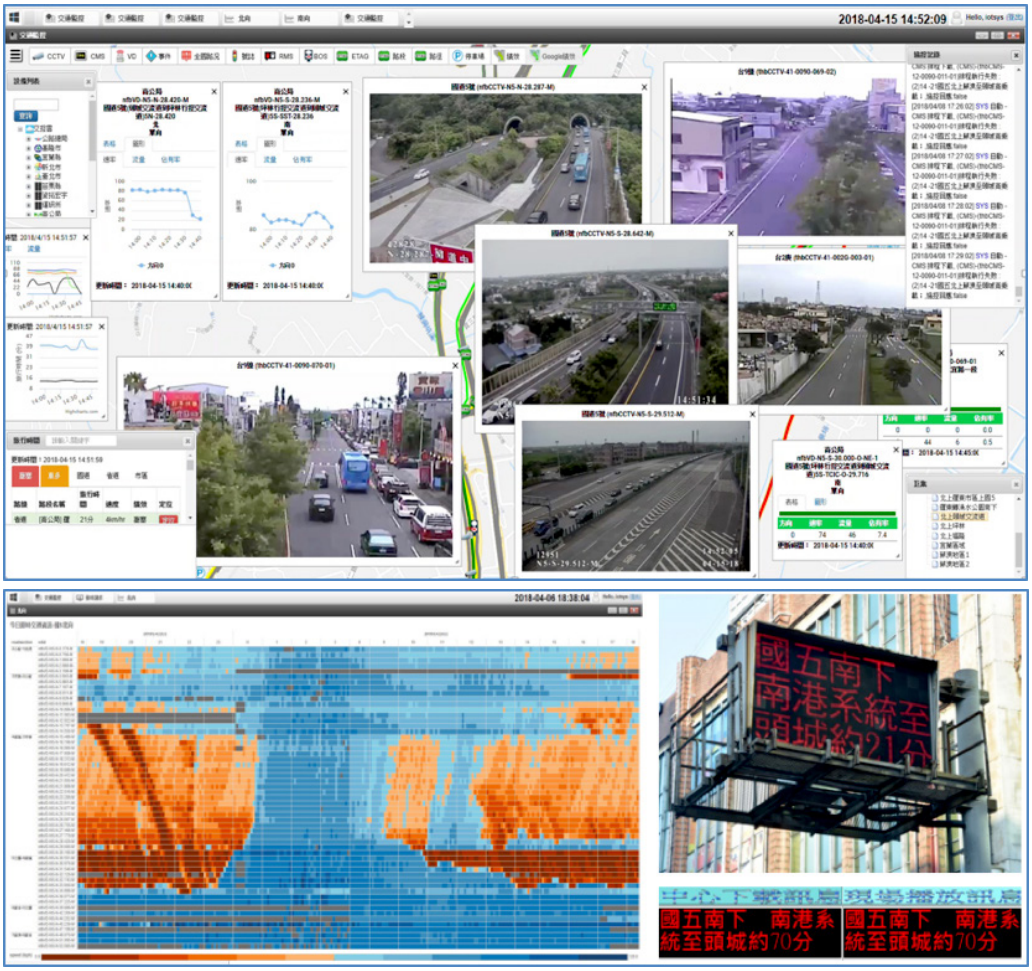
3. Promotion of Outcomes and Benefits

Trainings were provided, and coordination meetings among several public agencies were arranged before each field testing. To promote this cross-agencies traffic coordinated operation concept and models, the success of best practice of coordinated traffic management during long holidays in Yilan area with the cloud-based integrated transportation corridor traffic management platform was presented and demonstrated.



交通管理協控平台整體概念

Overall Concept of Traffic Management Coordination and Control Platform



交通管理協控運作及展示

Operation and Demonstration of Traffic Management Coordination and Control Platform

(二)我國車聯網實驗場域規劃

1. 計畫概述

本研究呼應國際智慧運輸在聯網自動駕駛車 (Connected Automated Vehicle, CAV) 發展趨勢，自 104 年至 106 年分別在基隆地區高快速公路與市區道路，以及中興新村構建我國第 1 個聯網自動輔助駕駛車整合研發與應用示範實驗場域。基隆場域著重於車聯網 (Connected Vehicle, CV) 在交通安全與管理，以及節能輔助駕駛等應用情境開發與實驗。中興新村場域則進一步結合先進駕駛輔助系統 (Advanced Driver Assistant Systems, ADAS)，進行我國首次透過 CAN 匯流排結合 ADAS 與 CV 的聯網自動輔助駕駛研發，來擴大行車風險偵測能力；中興新村場域同時以交通安全應用為課題，進行各項測試情境設計與實測，以評估聯網自動輔助駕駛車對於增加交通安全預警的可靠性，為我國後續在聯網自動輔助駕駛車研發與交通安全應用奠基。

(II) The demonstration of connected vehicle with ADAS for intersection safety in Taiwan

1. Project Overview

This research echoes the international development trend of Connected Automated Vehicle (CAV) in Intelligent Transportation System (ITS). The first connected advance drivers assistant system vehicle test beds in Taiwan was constructed in Keelung area and Jhongsing Village from 2015 to 2017. Keelung test bed consisted of highways, expressways and urban roads, and focused on the development and experimentation of Connected Vehicles (CV) in traffic safety and management, as well as in energy-saving assisted driving, while Jhongsing Village field was focused on intersection safety applications by further integrating CV with Advanced Driver Assistance Systems (ADAS) to expand driving risk detection capabilities through via CAN bus. Several safety related test cases were developed to evaluate the performance and reliability of contribution from integrated CV and ADAS. Outcome of this research has laid the foundation for further research and development of Connected Automated Vehicles and its traffic safety applications in Taiwan.

2. 研究成果

(1) **完成高快速公路與市區道路之車聯網在交通安全與管理，以及節能輔助駕駛等實驗場域構建及應用情境實驗：**本計畫透過架設於路側與車輛的 DSRC 通訊設備進行危險路段、減速 / 施工區、彎道、異常天候、道路標誌指示等交通安全即時警示；同時結合號誌控制器之路側 DSRC 設備所廣播之即時號誌時相秒數，發展路口行人安全與避免行車闖紅燈等應用，以及提供節能輔助駕駛建議等。而在交通管理上，則結合高速公路即時車流資料與 DSRC 車聯網資料，發展高速公路考量交通安全車流均勻行駛速率之建議研發與實驗。

(2) **完成中興新村聯網自動輔助駕駛車實驗場域構建與交通安全應用情境實驗：**完成結合 ADAS 與 CV 聯網自動輔助駕駛車輛車載端與路側端之實驗場域，以及實驗監控與資料分析平台等建置，同時進行聯網自動輔助駕駛車輛在交通安全應用情境之規劃與設計，以及實測與資料蒐集分析、功能測試、碰撞時間點推估、可靠度計算等。

3. 成果推廣與效益

本計畫於執行過程辦理多場運輸需求面與產業面之論壇，藉以蒐集車聯網與自動輔助駕駛車之多元面向實驗場域需求，同時經由成果說明會說明計畫階段性執行成果。本計畫研發成果有助於我國相關部會與各縣市政府以及產業界，在發展聯網自動輔助駕駛車與實驗環境，以及評估其對我國交通運輸衝擊評估之碁盤構建與發展參據。

2. Research Outcomes

(1) **Completed the construction of test bed for connected vehicles applications on traffic safety and management on highways, expressways and urban roads, and the energy-saving assisted driving experiments:** By installing DSRC road side units (RSU), several applications were developed to provide safety related alters on high hazard intersections and roads, work zones, curve road, abnormal weather situation, and in-vehicle signage. These DSRC RSUs were also integrated with traffic signal controllers to broadcast real time traffic signal phase and timing (SPaT) for applications on traffic red light violation, pedestrian crossing, and energy-saving driving assistant. For traffic management, by integrating real time traffic data from freeway administration and data collected from connected vehicles, suggested traveling speed was calculated and sent to drivers via DSRC to achieve the capability on smoothing freeway traffic flow.

(2) **Completed the Jhongsing Village connected automated assisted vehicle test bed construction and traffic safety related experiments:** This Project completed test bed construction and traffic safety related experiments by integrating the ADAS and CV with DRSC RSUs. A data center to monitor these experiments and collect data for analysis was established. At the same time, the safety related applications and testing scenarios were planned and designed, while performing field testing and data collection analysis, functional testing, estimation of potential collision time and point, and reliability calculation.

3. Promotion of Outcomes and Benefits

Several forums from the perspectives of transportation requirements and industry had been organized to collect multi-aspects of requirement of test bed for connected vehicles and automated assisted vehicles during research. Phased outcome of this research has also been demonstrated. The research and development outcomes of this project will be served as the building block and reference for the Ministries, county and city governments, and industries in developing the connected automated assisted vehicles. And these two experimental environments can be used to evaluate impacts of connected automated assisted vehicles while introducing into Taiwan.

基隆場域車聯網應用情境與展示
Application Scenarios and Demonstrations of Connected Vehicles in Keelung

中興新村場域聯網自動輔助駕駛應用情境與展示
Application Scenarios and Demonstrations of Connected Automated Driving Assisted in Jhongsing Village

（三）都市交通事件資訊整合服務

1. 計畫概述

本計畫遵循行政院國家時空資訊雲落實智慧國土政策綱領，配合交通部推動 105-109 年度「時空資訊雲落實智慧國土計畫」，自 105 年度起辦理多元交通事件資訊發展整合服務系列計畫，以交通事件資訊為計畫標的，制訂相關資訊標準化作業、規劃合適之通報機制與工具，並選擇高雄市 (交通局) 合作辦理即時交通事件資訊通報解除與發布實作，期能強化即時道路資訊之蒐集與多元整合。

2. 研究成果

(1) 本計畫於 105-106 年度完成高雄市各類 (包括工務、警政、消防、交通等) 交通事件資訊之通報、發布與解除機制之建立，經與各權責單位持續訪談與協調，共計收納 19 個交通事件資料源，彙整高雄市約計 80% 道路事件資訊。

(2) 完成都市交通事件標準草案修訂，並開發建置都市交通事件資訊整合與發布平台，已充分建立高雄市各事件單位橫向聯繫管道 (例如工務局道路刨鋪事件可供交通局公車改道措施提早安排、相關單位活動或事故可供消防局規劃救援車輛提早避開管制道路等)，並可提供機關首長即時掌握全市交通動態。

(III) Urban traffic event information integration service

1. Project Overview

This Project followed the Guidelines for National Space-Time Information Cloud Implementation in Intelligent Homeland Policy of the Executive Yuan to promote the 2016-2020 "Space-Time Information Cloud Implementation in Intelligent Homeland Project" in cooperation with the Ministry of Transportation and Communications, and managed multivariate traffic event information development and integration service series plan since 2016, to develop relevant information standardization operations and conduct planning on appropriate reporting mechanisms and tools for traffic event information as the plan objectives, and selected Kaohsiung City (Transportation Bureau) for cooperation with managing real-time traffic event information reporting, clearing and announcing practices, to strengthen the collection and multivariate integration in real time.

2. Research Outcomes

(1) The project completed the establishment of all types of traffic event information reporting, announcement and clearing mechanism for Kaohsiung City (including Public Works, Police, Fire, Transportation, etc.) in 2016-2017, through continuous visits and coordination with all responsible authorities, received a total of 19 sources of traffic event, which helped collect and organize about 80% of road event information of Kaohsiung City.

(2) Completed the revision of a draft Urban Traffic Event Standard, and developed and constructed the Urban Traffic Event Information Integration and Announcement Platform, which established horizontal communication channels for all Event Authorities in Kaohsiung City (for example, road paving events of Public Works Bureau can be used for advance arrangement for bus detours by the Transportation Bureau, activities or accidents of relevant units can be provided to the Fire Bureau to deploy rescue vehicles with avoidance of controlled roads), and enables agency officials to grasp traffic movement in the city in real time.

3. 成果推廣與效益

(1) 本計畫於 106 年 5 月辦理都市事件資訊創新應用工作坊，對象為高雄市政府相關業務局處、加值應用單位與前端開發者社群，透過溝通與共同分析，輔助事件資料流產製、整合與應用面向之設計參考。

(2) 本計畫於 106 年 8 月提報交通部第 16 次業務會談報告，另亦規劃於 107 年 5 月至「2018 年日本福岡第 16 屆 ITS 亞太論壇」發表相關研究規劃成果，以宣導計畫成果，提供各界參採。

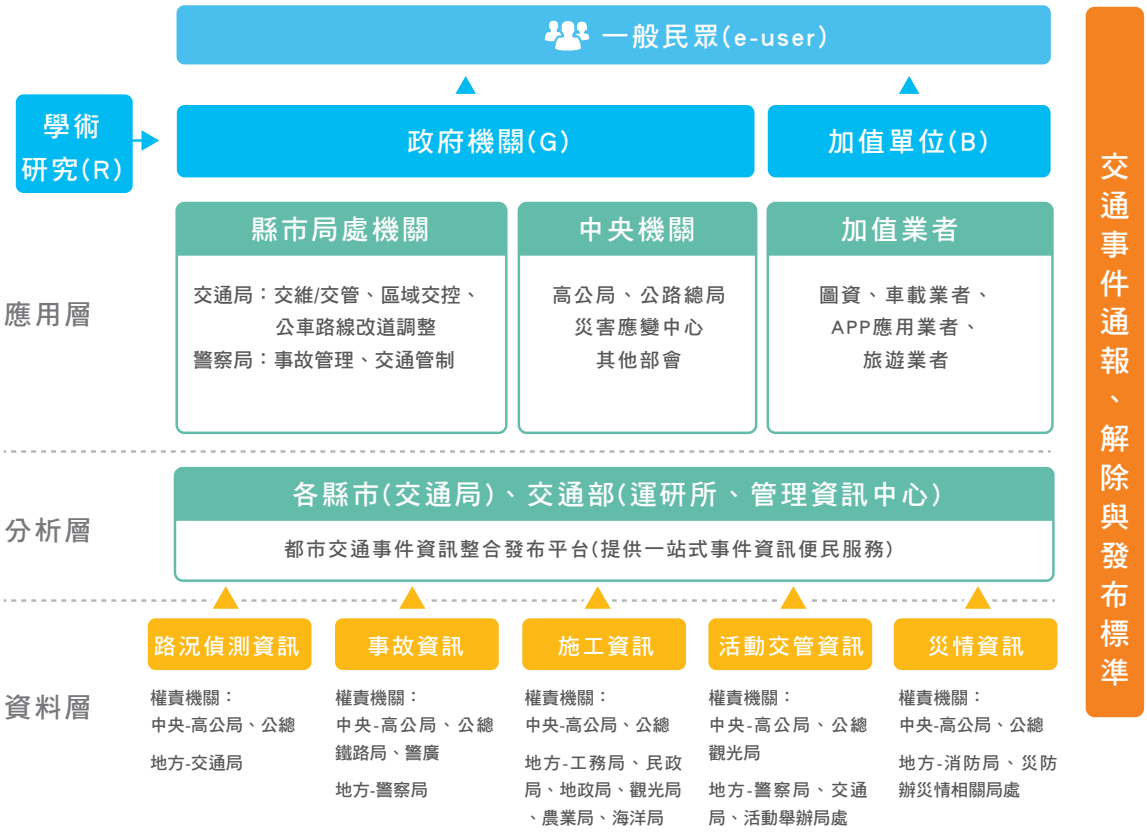
(3) 未來將持續完成高雄市交通事件資訊通報機制驗證與落實作業，並研擬補助機制逐年擴大各縣市交通事件資料源，以完善即時路況資訊之重要一環，提升智慧交通資訊服務與加值應用。

3. Promotion of Outcomes and Benefits

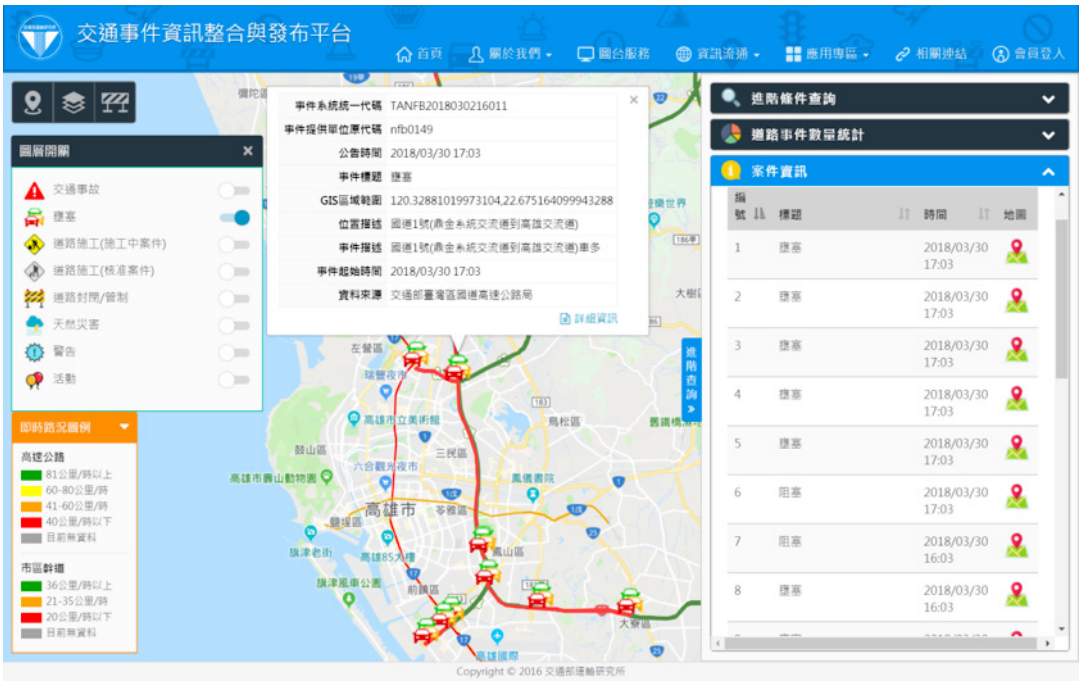
(1) This project organized an Urban Event Information Innovation Application Workshop in May 2017 to assist relevant business bureaus of Kaohsiung City Government, value-added application units and front-end developer communities, through communication and joint analysis, to provide design references for the production, integration and application of incident data flows.

(2) This Project submitted reports to the 16th Business Conversations of the Ministry of Transportation and Communications in August 2017, and planned to go to "2018 16th ITS AP Forum in FUKUOKA, Japan" in May 2018 to publish the relevant research and planning achievements to promote the project achievements for the reference of all sectors.

(3) In the future, this project will continue to complete the Kaohsiung City traffic accident information reporting mechanism verification and implementation operations, and develop the subsidy mechanism to expand the data sources of traffic accidents in all counties and cities every year, to perfect important links of real time road condition information, and enhance the intelligent traffic information services and value-added applications.



交通事件資訊匯流概念圖
Concept Chart of Traffic Event Information Convergence



都市交通事件資訊整合與發布平台
Urban Traffic Accident Information Integration and Announcement Platform

（四）客運時空資訊大數據應用分析

1. 計畫概述

分析交通數據之本質，在於提供運輸政策與運輸管理之決策參考依據，而掌握旅客之起迄分佈與路線乘載狀況，能提供現況管理效能之改善參考，爰本研究首要目的旨在分析與產製全國首版客運路線乘載狀況時空圖，俾利公共運輸相關單位透過時空圖檢視路線服務效率，協眾人之力掌握全國客運路線之服務績效。另本研究初步嘗試整合交通與電信信令數據，以數據去個資化與分區統計化之理念，判斷分析公共運輸供需缺口，俾利相關單位發展高吸引力公共運輸服務之參據。

2. 研究成果

(1) 本研究取得 106 年全臺共約 3 千條之客運路線 (上下車刷卡) 之交易資料與公車動態資訊系統資料，完成首版客運路線乘載狀況時空分析圖 (以 106 年全國資料較為完整之 4 月份進行開發)，公共運輸相關單位可參考上開時空圖，研提公車營運之改善建議。

(2) 本研究另初步嘗試將電信網格資料與公共運具時空軌跡比對，產出高雄與花蓮兩地以電信資料為基礎之旅次起迄矩陣，並配合相關的公共運輸資料（如路線、班次等），嘗試分析公共運輸可能存在的缺口，找出可能發生供不應求以及供過於求的時段與空間區段。

(IV) Application and analysis of the passenger transport space-time information big data application analysis

1. Project Overview

Analyze the nature of traffic data to provide a reference basis for the decision-making of transportation policy and transportation management, to grasp the distribution of origins and destinations of passengers and route loading conditions, which can provide references for improvement of current condition management efficiency. Therefore, the primary purpose of this study is to analyze and produce a first version of a national passenger transport route loading condition space-time diagram, in order to facilitate public transportation related units to assess route service efficiency through the space-time diagram, and engage the public to grasp service performance of the national passenger transport route. In addition, this study initially attempts to integrate traffic and telecommunications signaling data, using anonymized personal information and zoning statistics to determine and analyze gaspbetween supply and demand in public transportation, in order to provide relevant units with a reference basis to develop highly attractive public transportation services.

2. Research Outcomes

(1) This study obtained transaction data (of card swipes of passengers boarding and alighting) of about 3000 passenger transport routes and the bus movement information system data of 2017 for all of Taiwan, and completed the first version of passenger transport route loading condition space-time analysis diagram (developed with more complete April 2017 national data), the public transportation relevant units can refer to this diagram to study and propose improvement of bus operations.

(2) This study also initially attempted to compare space-time trajectory between the telecommunication grid data and the public transportation vehicles, and generated a trip origin and destination matrix based on the telecommunication data between two places in Kaohsiung and Hualien in combination with relevant public transportation data (such as routes, run schedules, etc.), attempted to analyze possible gaps in public transportation, and identified the time and space segments where supply cannot meet demand and supply exceeds demand.

3. 成果推廣與效益

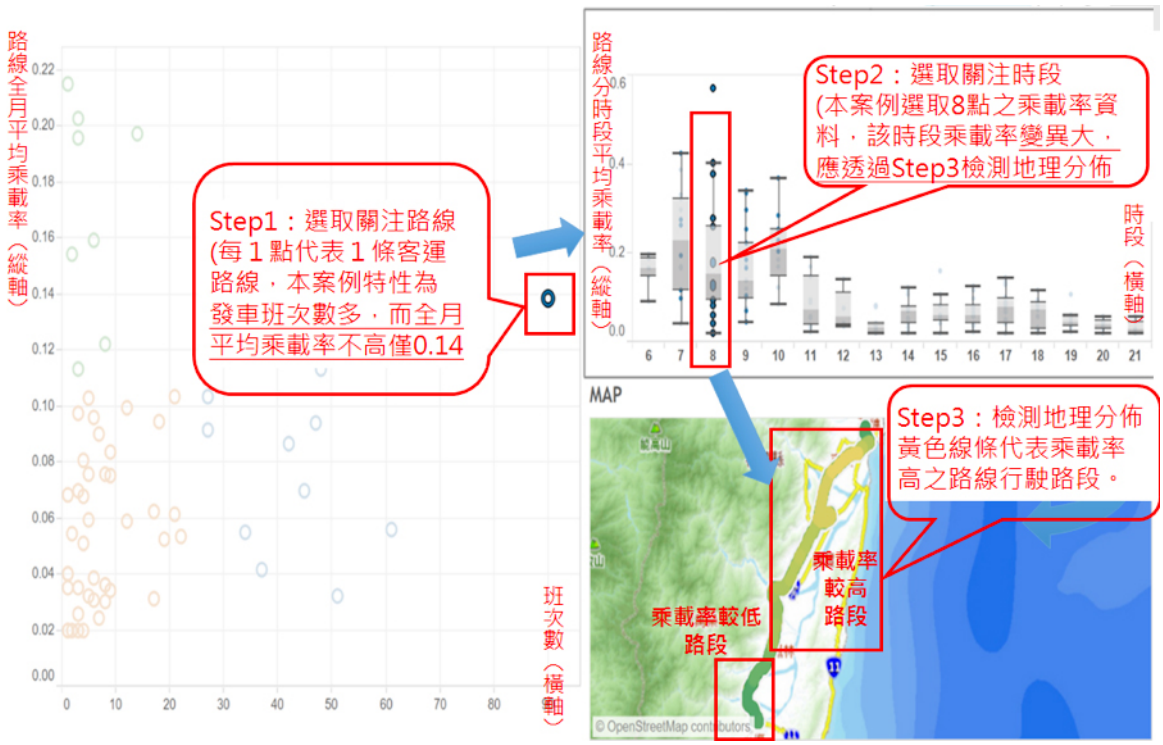
(1) 本計畫於 106 年 12 月辦理旅運時空資料分析與公共運輸服務應用發展計畫成果發表會，對象包括各區域運輸中心、地方政府與顧問公司，可協助各單位瞭解如何應用本計畫成果導入票證與電信數據，以精進公共運輸管理作業。此外，亦於 106 年運輸年會「大數據在交通運輸應用」 場次中發表與宣導相關成果。

(2) 本計畫已於今 (107) 年 5 月初與運輸管理組合作研商「客運乘載人數分析圖」之成果與未來推廣方向，俾利公路總局、區域運輸發展研究中心與地方政府未來定期透過客運乘載人數分析圖，研提公車營運精進策略。

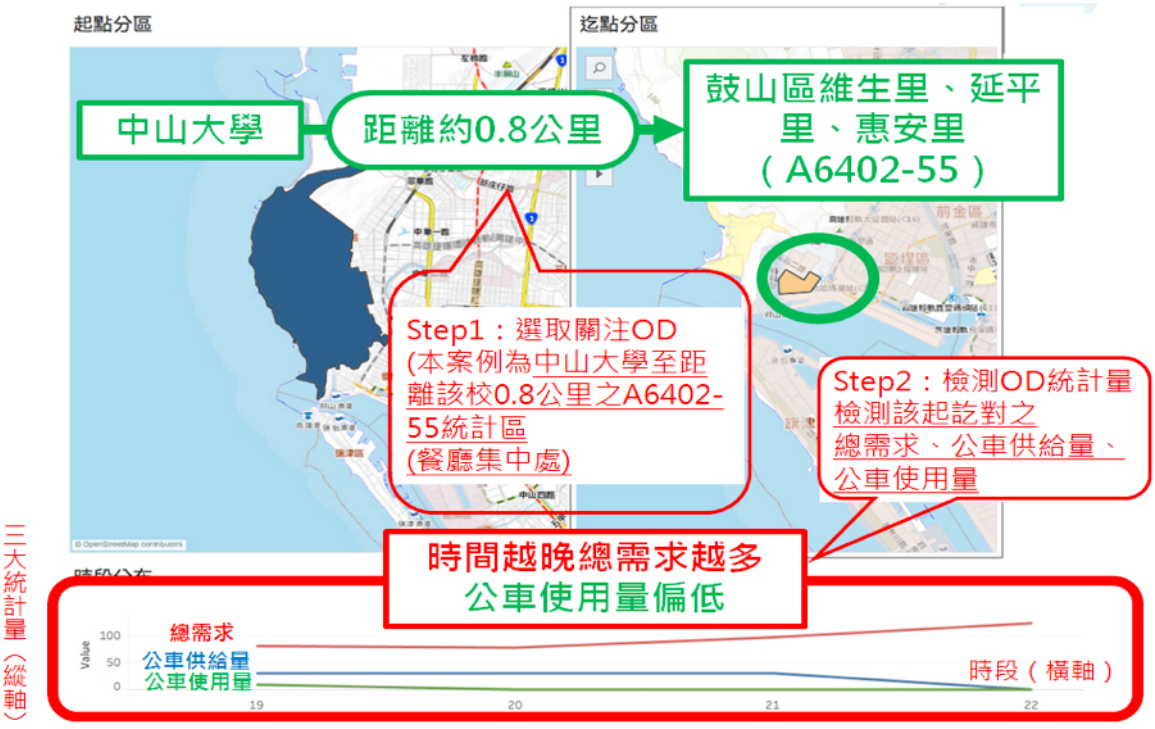
3. Promotion of Outcomes and Benefits

(1) In December 2017, This project organized an outcome presentation of the trip space-time data analysis and public transportation service application development project, for a audience of regional transportation centers, local governments and consulting companies, to assist them to understand how to apply the project outcomes to ticket and telecommunications data to improve public transportation management operations. In addition, the project outcomes were published and promoted in the sessions of "Bid Data in Transportation Applications" of the 2017 Institute of Transportation Conference.

(2) This project has been cooperating with the Transportation Management Division to research the achievements of "Analysis Diagram of Numbers of Passengers on Board Passenger Transport" and the future direction of promotion in early May of 2018, in order to facilitate regular research and proposals for bus operation improvement strategies for the Directorate General of Highways, Regional Transportation Development Research Center and local governments through the Analysis Diagram of Numbers of Passengers on Board Passenger Transport in the future.



客運乘載率之三階段分析說明圖
Illustration of Three-Step Analysis of Passenger Transport Loading Rate



電信數據為基礎之旅次起迄 (OD) 分析概念圖
Concept Diagram of Trip Origin and Destination (OD) Analysis Based on Telecommunication Data

（五）研發成果智能財權推廣應用與交通科技知識分享服務

1. 計畫概述

(1) **科技研究計畫創新研發成果盤點、專利可行性分析及技術推廣：**配合交通部及本所 106 年度推動中計畫，協助完成專利檢索分析、提供專利申請建議與技術授權協助，並針對國際創新交通技術發展課題，完成專利地圖分析。

(2) **知識管理系統資料庫維護更新與功能提昇：**完成本所知識管理系統知識文件資料庫維護更新作業，以及本所「交通科技知識分享服務網」服務內容維護更新。

(3) **智財權疑慮諮詢服務及教育訓練：**提供執行計畫之智財權法律疑慮諮詢服務，並辦理智財權及知識管理相關議題教育訓練。

2. 研究成果

(1) **完成研究成果可專利性分析：**共完成 6 項研究計畫之研究成果可專利性分析，並確認 2 項計畫成果具創新技術，已進行專利申請。

(2) **完成專利地圖分析：**完成「AI 智慧交控」、「MaaS 交通行動服務」及「ADAS 先進駕駛輔助系統」等技術課題之專利地圖分析。

(3) **完成知識管理與知識分享資料庫維護更新：**完成本所「知識管理系統」及「交通科技知識分享服務網」資料庫內容維護更新。

(V) Reserch on the promotion and application of intellectual property rights of research and development outcomes, and sharing transportation technology knowledge

1. Project Overview

(1) **Inventory, patent feasibility analysis and technology promotion of innovative research and development outcomes of scientific and technological research projects:** In line with projects promoted by the Ministry of Transportation and Communications and this Institute in 2017, we assisted with the completion of a patent search analysis, provided recommednations for patent applications, rendered and technology licensing assistance, and completed a patent map analysis on the international innovative transportation technology development.

(2) **Knowledge management system database maintenance update and functional enhancement:** Complete maintenance and an update of this Institute's knowledge management system and knowledge documents database as well as the service content of this Institute's "Transportation Technology Knowledge Sharing Service Network".

(3) **Intellectual property rights concerns consultation services and educational training:** Provide intellectual property rights legal counseling services for executing projects, and organize education and training on issues related to intellectual property rights and knowledge management.

2. Research Outcomes

(1) **Completed research outcomes patentability analysis:** Completed research outcomes patentability analysis for six research projects, and confirmed two project outcomes that have innovative technologies for which we have filed patent applications.

(2) **Completed patent map analysis:** Completed patent map analysis of technical topic of "AI Intelligent Traffic Control", "Mobility as a Service (MaaS) " and "ADAS Advanced Driver Assistance System".

(3) **Completed maintenance and update of the Knowledge Management and Knowledge Sharing Database:** Completed the maintenance and update of the contents of in "Knowledge Management System" and "Transportation Technology Knowledge Sharing Service Network" of this Institute.

3. 成果推廣與效益

(1) 107 年 5 月辦理「公共運輸行動服務方案 (MaaS, Mobility as a Service) 暨智慧交通專利技術解析」成果推廣說明會，說明 MaaS 服務技術及 AI 智慧交控技術之國際專利技術發展現況與趨勢，作為未來我國研析建置相關交通服務與建設之參考。

(2) 本計畫研究成果將發表於中華民國運輸學會 107 年學術論文研討會，透過學術活動之討論交流，發掘更深層之潛在交通技術課題，作為我國未來精進相關研究與研議發展策略之參據。

3. Promotion of Outcomes and Benefits

(1) Organized a research outcomes presentation on "Mobility as a Service (MaaS) for Public Transportation and Intelligent Transportation Patent Technology Analysis" in May 2018, to explain international trends in patent technology development related to MaaS service technology and AI Intelligent traffic control technology, as a reference for future research, analysis and construction of relevant transportation services in Taiwan.

(2) The research outcomes of this project will be published in the 2018 Academic Paper Seminar of the Chinese Institute of Transportation, through discussion and exchange of academic activities, to explore deeper potential transportation technology topics as references for future research and proposal development strategies for improvements in this field in Taiwan.

國際 AI 智慧交控專利技術發展現況與趨勢研析
Research and Analysis on the Development Status of International AI Intelligent Traffic Control Patent Technology

四、運輸規劃評估工具

(一) 鐵路立體化前後觀察分析

1. 計畫概述

民國 91 年大臺北地區鐵路全面地下化後，除消除平交道，站區發展以及沿線縫合效益亦相當明顯；尤其是臺北車站的後站地價提高與前站相當，同時納入高鐵營運路線，成為多元運具轉運樞紐，更帶動地方經濟發展，因此各地方政府紛紛效法，競相爭取鐵路立體化計畫。

鐵路設施為全國性公共財，其建設經費龐大，基於政府財政狀況，以及整體運輸資源有效運用與分配之考量，對於各都市地區鐵路立體化建設之推動，應有一客觀且具體的評估審核標準。時至今日，各地方政府陸續提出多項鐵路立體化計畫，為了解鐵路立體化對交通改善及都市發展之影響，現階段應針對既有案例深入觀察與分析。

2. 研究成果

(1) 以萬板專案為案例分析對象，研究發現臺鐵板橋站周邊的發展受到市地重劃及行政機關遷移的政策搭配，其對土地使用與土地價值的影響都較萬華站周邊有效且顯著，並非單受鐵路立體化影響。

(2) 研究顯示，鐵路立體化工程消除平交道後，確實減少臺鐵事故，惟車站路線的營運維修成本卻大幅增加，以萬華站為例，水電、清潔、站務與設備更新等營運成本增加 3.9 倍，而維修成本則增加 8.1 倍。

(3) 鐵路立體化後，臺鐵車站內容許配置的股道數均大幅減少，僅能勉強滿足客運需求，其他原先具備的貨運、軍運或機廠儲

IV. Transportation Planning and Assessment Tools

(I) Observation and analysis before and after railway grade separation

1. Project Overview

After the railway underground project of the Metropolitan Taipei area in 2002, in addition to eliminate level crossings, the development of the station area and the weaving effects along the railway were also quite obvious. The increase of land price behind Taipei Station was about the same as in front of it. With theHigh Speed Rail route connecting the station at the same time, Taipei Station has become a multimodal transportation transit hub which also drove the development of local economy forward, therefore, all local governments followed suit and competed for Railway Grade Separation projects.

Railway facilities are national public goods with huge construction funds. Based on the government's financial situation and considerations of effective use and distribution of overall transportation resources, there should be objective and concrete review and evaluation standards for moving the Railway Grade Separation construction forward for all urban areas. To this day, all local governments have successively proposed a number of Railway Grade Separation plans. In order to understand the impact of Railway Grade Separation on traffic improvement and urban development, the existing cases must be performed with in-depth observation and analysis.

2. Research Outcomes

(1) Taking the Wanhua-Banqiao Project as the object of its case study, the research found that the development around the Taiwan Railways Banqiao Station coincided with the city's readjustment and the moving of aAdministrative agencies and its impact on land use and land value was more significant than that of Wanhua Station, which was not solely affected by the Railway Grade Separation.

(2) The study shows that after the Railway Grade Separation project that eliminated the level crossing, it did reduce Taiwan Railway accidents. However, the operation and maintenance costs of the station route have increased significantly. Take Wanhua Station as an example, operating costs of water and electricity, cleaning, station maintenance and equipment upgrade have increased by 3.9 times, while maintenance costs increased by 8.1 times.

車等功能被迫移至他處，大幅降低列車調度的彈性。

(4) 本研究蒐集日本國土交通省「都市鐵路道路及鐵路連續橫交路段立體化要綱」所列之立體化先決條件，並分析既有「鐵路立體化建設及周邊土地開發計畫申請與審查作業要點」所面臨之問題，提出具體之短中長期修正建議內容。

3. 成果推廣與效益

(1) 106 年 1 月 11 日於鐵工局辦理「都市軌道運輸 - 鐵路立體化與捷運化審議精進方向」專家學者座談會中，分享本研究蒐集日本國土交通省「都市鐵路道路及鐵路連續橫交路段立體化要綱」所列之立體化先決條件，供作鐵路立體化要點修訂之參考。

(2) 106 年 9 月 28 日由本所召開「鐵路立體化建設對交通及都市發展之影響分析」學者專家座談會，透過國內鐵路專家的建言，提供中央政府審議參考。

(3) 106 年 12 月於運輸學會 106 年學術論文研討會發表「鐵路立體化建設對交通及都市發展之影響分析」。

(4) 日本國土交通省及日本交通計劃協會於 106 年 11 月 23 日前來拜會本所時，將研究成果與日方進行分享。

(3) After the Railway Grade Separation, the number of station tracks allowed to be configured in the Taiwan Railways station was greatly reduced, and only barely met passenger transport demand, while other original functions of cargo freight, military or machine storage were forced to be moved somewhere else, greatly reducing the flexibility of train dispatching.

(4) This research collected the prerequisites of Grade Separation listed in the "Grade Separation Outlines for Urban Railway Roads and Railway Continuous Crossings" of the Ministry of Land, Infrastructure, Transport and Tourism of Japan, analyzed the problems facing the existing "Directions Governing Application and Review of Railway Grade Separation Construction and Surrounding Land Development Plan", and proposes specific recommendations for short, medium and long-term revisions.

3. Promotion of Outcomes and Benefits

(1) In the symposium of experts and scholars on the "Urban Rail Transit - Railway Grade Separation and MRT Review Progression Direction" at the Railway Reconstruction Bureau on January 11, 2017, the Institute shared the prerequisites of Railway Grade Separation listed in the "Grade Separation Outlines for Urban Railway Roads and Railway Continuous Crossings", from the Ministry of Land, Infrastructure, Transport and Tourism of Japan, collected by this study, and provided these as references for the revision of the Directions for Railway Grade Separation.

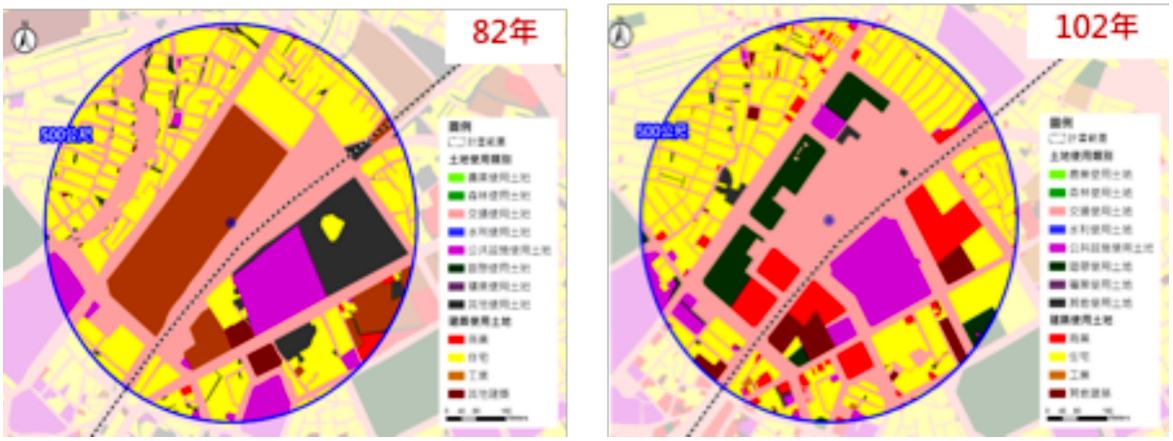
(2) The Institute convened a symposium of experts and scholars for the "Impact Analysis of Railway Grade Separation Construction on Transportation and Urban Development" on September 28, 2017, which provided references for the review by the central government through the recommendations by the domestic railway experts.

(3) The Institute published the "Impact Analysis of Railway Grade Separation Construction on Transportation and Urban Development" in the 2017 Academic Paper Seminar of the Chinese Institute of Transportation in December 2017.

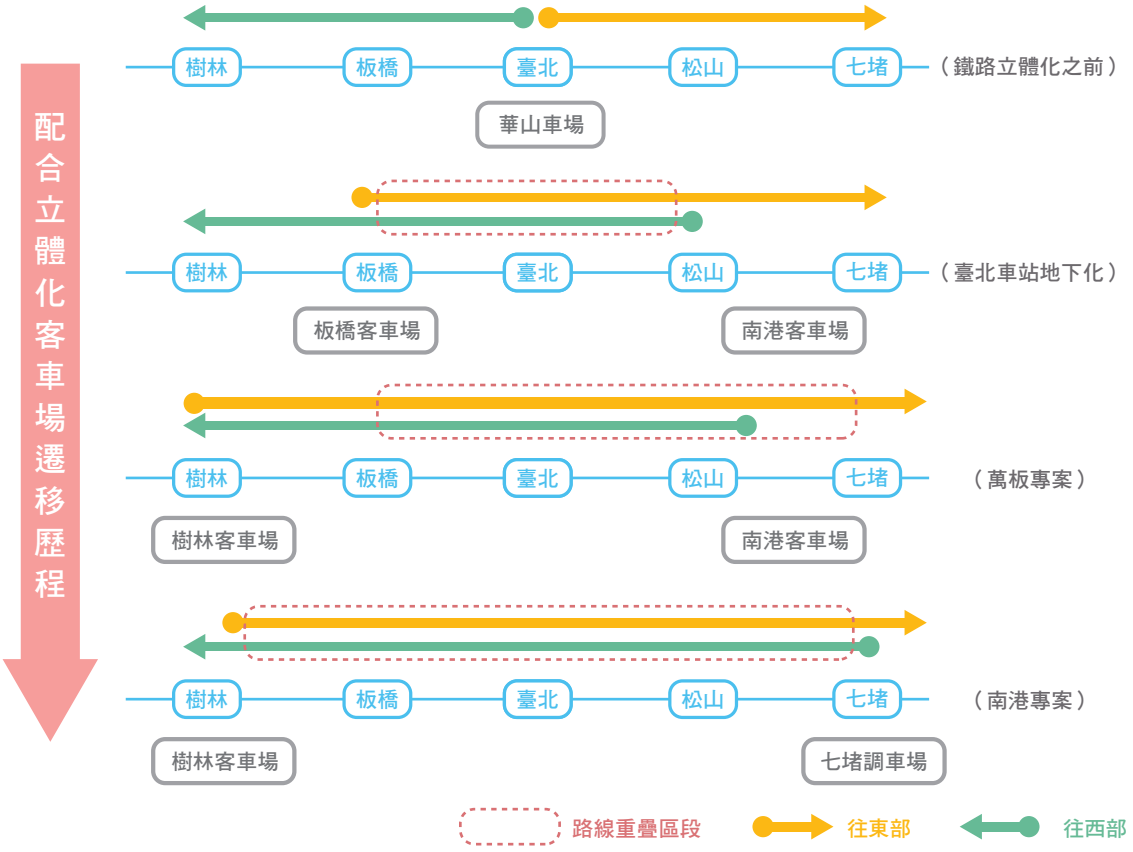
(4) When the Ministry of Land, Infrastructure, Transport and Tourism of Japan and the Japan Transportation Planning Association came to visit the Institute on November 23, 2017, the research outcomes were shared with the Japanese visitors.

(5) 研究期間已邀請路政司、臺鐵局、鐵工局等相關單位參與各項工作會議，研究成果將內化至相關計畫的審查作業。

(5) During the research period, the relevant units of the Department of Railways and Highways, Taiwan Railway Administration and the Railway Reconstruction Bureau have been invited to participate in all work meetings, and the research outcomes will be internalized to the review operations of related projects.



板橋車站周邊 500 公尺土地利用變化圖 (土地使用多樣化，商業面積增加)
500-meter Land Use Variation Map of 500-meter Surrounding Banqiao Station
(Diversified Land use, Increased Commercial Area)



鐵路車站立體化，站內股道配置改變，客車場向外遷移
Railway Station Grade Separation, Change of Station Tracks Configuration, and the Passenger Train Moving Outward.

(二) 軌道容量分析方法與軟體應用

1. 計畫概述

「軌道容量」係指「在特定運轉條件下，單位時間通過某特定路線區間的最大列車數或旅客數」，以臺鐵路線容量為例，其影響因素包括路線條件 (如：站間軌道數目、站間距離、路線幾何條件、銜接路線的多寡、道岔的號數、橫渡線的配置、站內軌道與月台布置)、交通條件 (如：列車性能、車種組成、方向分布、停站時間與停站型態) 及控制條件 (如：列車操控方式、閉塞制度、閉塞區間長度、號誌配置)，藉由容量分析可以估算軌道系統在某種運轉條件下的運輸能力，亦可藉此來評估不同設施配置及運轉條件對於軌道容量的影響，進而提出適合的運轉策略。

本所自 92 年起著手進行軌道容量系列研究，已建構完成傳統暨區域鐵路系統 (即臺鐵系統) 及都會捷運系統之容量模式，並開發容量分析軟體，於 102 年編訂「2013 年臺灣鐵道容量手冊」，供作產官學研分析及決策之參據。

2. 研究成果

(1) **建構臺鐵系統及都會捷運系統之容量模式，並開發容量分析軟體：**本研究開發的「臺鐵系統容量模式及軟體」可周延評估分析單一區段及複線連續區段之容量 (含瓶頸)、敏感度、可靠度及單線連續區段之容量等相關議題；而「都會捷運系統容量模式軟體」可分析最繁忙區間、折返站、轉乘站瓶頸點、整體路網容量，及側線平面交叉對主線容量之影響。上述研究成果皆已編訂容量手冊，擴大推廣供各界應用。

(II) Track capacity analysis method and software application

1. Project Overview

"Railway" refers to "the maximum number of trains or passengers passing through a specific route interval per unit time under specific operating conditions". Taking the capacity of the Taiwan Railways route as an example, the impact factors include the route conditions (such as: number of tracks between stations, distance between stations, route geometry conditions, number of connecting routes, number of railroad switches, configuration of the crossing lines, tracks and platform layout in the station), traffic conditions (such as: train functions, train type composition, direction distribution, station stopping times and stopping types) and control conditions (such as: train operation and control mode, blocking system, blocking interval length, signaling configuration) Capacity analysis can be used to estimate the transportation capacity of a track system under certain operating conditions, and can also be used to evaluate the impact of different facility configurations and operating conditions on the track capacity, to propose appropriate operational strategies.

The Institute has maintained a series of research on track capacity since 2003 and has constructed capacity models for the traditional and regional railway system (i.e., the Taiwan Railways System) and the Metro Rapid Transit System, and developed capacity analysis software. In 2013, this Institute compiled the "2013 Railway Capacity Manual in Taiwan", used as a reference for analysis and decision making by government, industry, academia, and research institutes.

2. Research Outcomes

(1) **Constructed the capacity models for the Taiwan Railways System and the Metro Rapid Transit System and developed the capacity analysis software:** The "Taiwan Railways System Capacity Model and Software" developed in this research can be used to evaluate and analyze in every instance of the capacity of a single segment and a continuous segment of a double-track (including bottlenecks), sensitivity, reliability, and capacity of single-line continuous segments and other related topics. The the "Metro Rapid Transit System Capacity Model Software" can analyze the busiest intervals, turn back stations,

(2) **本研究容量分析技術於軌道規劃、設計及興建階段之實務應用：**本研究建構之容量模式及軟體已透過實務案例驗證可行。容量分析技術不僅可應用於規劃階段之軌道系統運轉策略評估，亦可針對設計及營運階段評估軌道系統之服務績效。

3. 成果推廣與效益

(1) 本案在研究期間已辦理多場次的教育訓練。

(2) 本所刻正辦理傳統鐵路容量分析軟體改版作業，俟 107 年完成後，將邀請臺鐵局、鐵道局、地方政府及辦理鐵路相關計畫的技術顧問機構舉辦一系列推廣課程，期強化各界對於軌道容量分析的能力。

(3) 後續將建議各機關在辦理軌道計畫評估與規劃作業時，於招標文件要求技術顧問機構落實軌道容量分析作業，並於審查階段，就容量分析成果進行詳實審查，俾確保各項軌道建設計畫不致衍生路線容量瓶頸問題。

transfer station bottleneck points, overall road network capacity, and the impacts of the side line level crossings on the main line capacity. The aforementioned research outcomes have been compiled into a capacity manual, expanded and promoted use by all sectors.

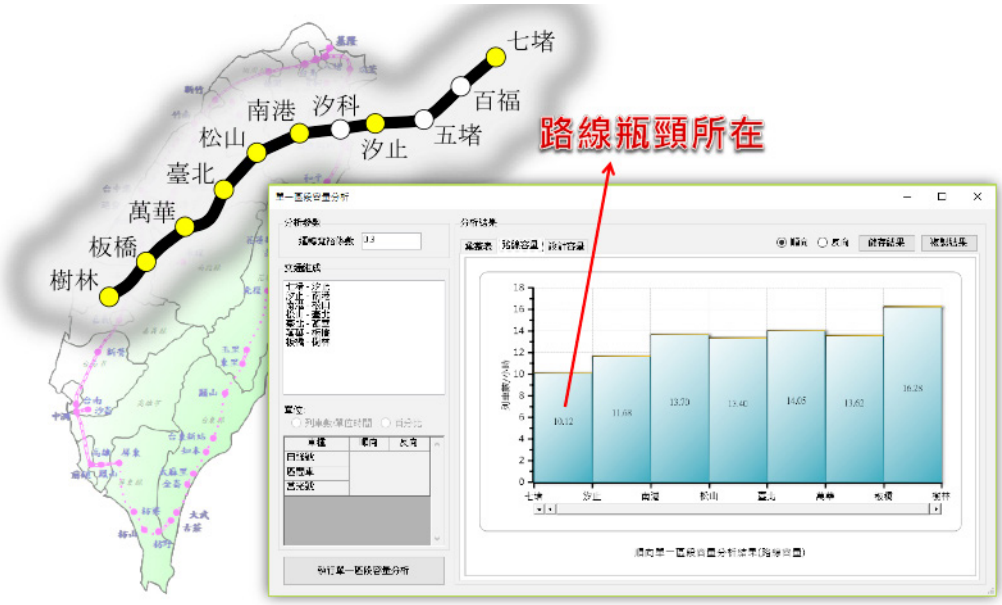
(2) **The practical applications of the capacity analysis technology of this research in track planning, design and construction phases:** The capacity model and software constructed in this research have been verified as feasible through practical cases. The capacity analysis technology can be applied not only to evaluate the track system operation strategy during the planning phase, but also to evaluate the service performance of track system during the design and operation phases.

3. Promotion of Outcomes and Benefits

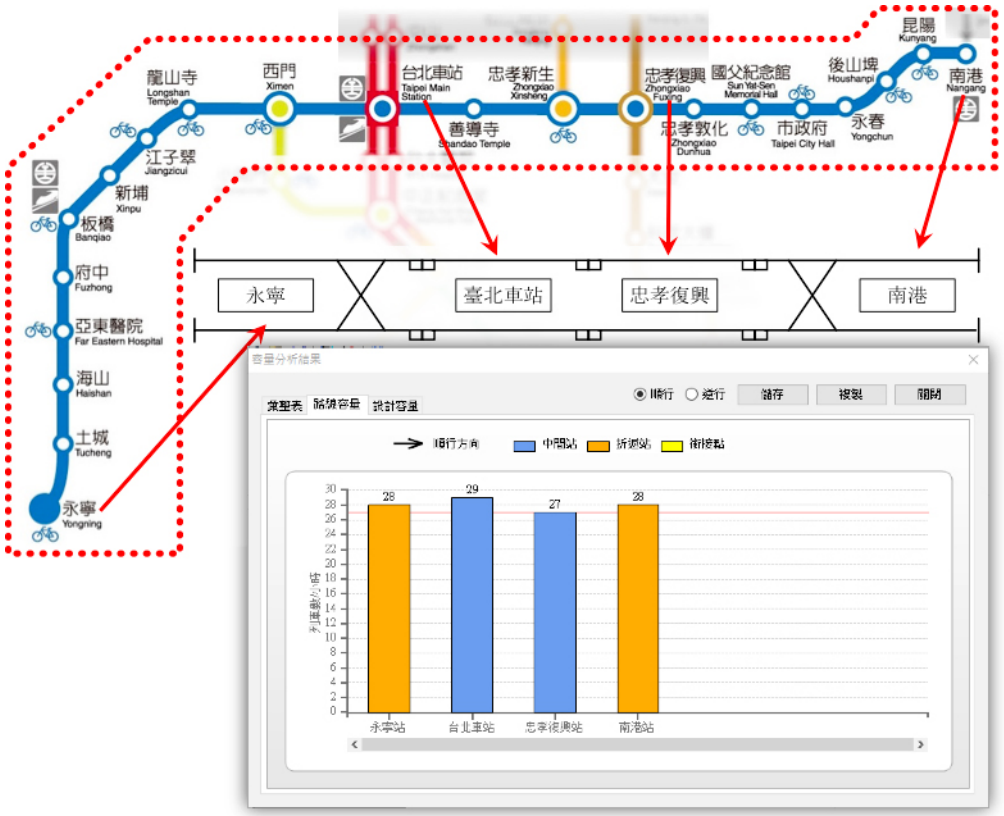
(1) The project has organized multiple educational trainings during the research period.

(2) The Institute is in the process of revising the traditional railways capacity analysis software. After completion in 2018, the Taiwan Railways Administration, Railway Bureau, local governments and the technical consultant organizations managing railway-related projects will be invited to hold a series of promotion courses to strengthen the capability of track capacity analysis for all sectors.

(3) The Institute will recommend that the agencies request the technical consultant organizations to implement the track capacity analysis operation in their tendering documents when conducting track plan evaluation and planning operations, and conduct detailed reviews on the capacity analysis results during the review phase to prevent any track construction plans from causing route capacity bottleneck issues.



傳統暨區域鐵路容量分析 (以臺鐵七堵 - 樹林為例)
Traditional and Regional Railways Capacity Analysis (Taking Taiwan Railways Qidu - Shulin as the Example)



都會捷運系統容量分析（以北捷永寧 - 南港為例）
Metro Rapid Transit System Capacity Analysis (Taking Taipei MRT Yongning - Nangang as the Example)

(三) 車輛動態能耗與碳排放特性系列研究

1. 計畫概述

車輛能耗 / 碳排放特性隨車種、道路類型及交通狀況而異，惟傳統上大多以「每公升燃油跑幾公里」，再結合總行駛里程來計算耗油量，實無法反映行駛里程不變但「速率」提升所帶來的節能效果，為避免估算結果失真，本所自 96 年起展開一系列車輛行駛中之能耗與碳排放特性研究 (包括大小客車、機車、大小貨車)，希望建構一套能耗 / 碳排放模式，並與運輸規劃模式整合應用。

本系列研究透過實車道路實驗，以「行駛時間」為分析基礎，建立各車種動態能耗 / 碳排放特性資料庫與推估模式，不僅符合世界研究趨勢，亦能反映各車種於實際交通情境之動態能耗 / 碳排放，並可細緻地估算交通計畫或改善措施之節能減碳效果，作為交通主管機關審議與決策參據。

2. 研究成果

(1) 建立國內第一套車輛動態能耗 / 碳排放特性參數資料庫與推估模式：

a. 成功應用新式車載量測設備，蒐集車輛於實際道路行駛狀態下之逐秒速率、能耗 / 碳排放資料，建置各車種動態能耗 / 碳排資料庫。

b. 建立國內第一套能耗 / 碳排放推估模式，可實際反應道路類型、速率與能耗 / 碳排放之關係。

(III) Research series on the dynamic energy consumption and carbon emission characteristics of vehicles

1. Project Overview

Vehicle energy consumption/carbon emission characteristics vary with vehicle type, road type and traffic conditions. However, traditionally, fuel consumption is calculated based on "kilometers per liter of fuel" then combined with total driving mileage, but it actually cannot reflect the energy-saving effects brought by the increase of "speed" with the total driving mileage unchanged. In order to prevent such distortion of calculation results, this Institute has maintained a series of studies on energy consumption and carbon emission characteristics of vehicles (including large and small passenger cars, motorcycles, and large and small trucks) since 2007to construct a set of energy consumption / carbon emission models, and integrate them for use with transportation planning models.

This series of studies establishes a database and estimation models for dynamic energy consumption / carbon emission characteristics for all vehicle types through actual road tests and based on "driving time" as the basis for analysis, which not only conforms to global trend in this type of research, but also reflects the dynamic energy consumption / carbon emission of all vehicle types in actual traffic scenarios. These models can estimate the energy conservation and carbon emission reduction effects of transportation plans or improvement measures in detail, which can be used as reference for review and decision making by the competent authorities in charge of transportation.

2. Research Outcomes

(1) Established the first set of domestic database for dynamic energy consumption / carbon emission characteristic parameters of the vehicles and the estimation model:

a. Applied the new on-board measuring equipment successfully to collect the second-by-second speed, energy consumption / carbon emission data of vehicles under actual road driving conditions, and constructed a dynamic energy consumption / carbon emission database of all vehicle types.

b. Established the first set of domestic energy consumption / carbon emission estimation models which can reflect the actual relationships between road types, speed and energy consumption / carbon emissions.

(2) 調整修訂「交通建設計畫經濟效益評估手冊」節能減碳效益參數：

a. 本系列研究成果提供各車種不同道路類型各速率之能耗 / 碳排放推估值對照表，已納入本所「運輸部門能源消耗與溫室氣體排放整合資訊平台」供公眾查詢使用。

b. 依據研究成果修訂「交通建設計畫經濟效益評估手冊」節能減碳效益參數，作為估算運輸建設方案節能減碳效益之基礎。

(2) Adjusted and revised the energy conservation and carbon emission reduction benefit parameters of the "Economic Benefits Evaluation Manual for Transportation Infrastructure Project":

a. The outcomes of this series of studies provided a comparison table of energy consumption / carbon emission estimates of all speeds for different road types of all vehicle types. These outcomes have been incorporated in the "Transportation Sector Energy Consumption and Greenhouse Gas Emissions Integrated Information Platform" open to the public.

b. The energy conservation and carbon emission reduction benefit parameters of the "Economic Benefits Evaluation Manual for Transportation Infrastructure Project" were revised in accordance with the research outcomes, as the basis for estimating the energy conservation carbon emission reduction benefits of transportation infrastructure projects.

3. 成果推廣與效益

(1) 歷年研究成果已協助交通部及縣市交通主管機關就「ETC 與人工收費比較」、「竹北交流道改善」、「國 1 五股至楊梅段拓寬」、「機車實施怠速熄火之分析」、「國 5 與國 1 國道客運能耗觀察分析」、「桃園大興西路交控改善」等案，進行節能減碳效益分析與評估。

(2) 105 年 10 月於世貿中心舉辦之第二期能源國家型科技計畫 (NEP- Ⅱ) 成果展中簡報本研究成果並與各界交流；本系列研究成果已於 106 年上傳「政府資料開放平臺」供各界下載應用。

(3) 105 年 11 月辦理「交通建設計畫經濟效益評估手冊與應用軟體」教育訓練，邀請交通規劃與計畫評估人員參與，說明本研究成果於經濟效益評估之應用。

(4) 107 年預計辦理系列研究成果發表暨後續推廣座談會，邀集環保署、交通部及六都交通主管機關就本研究建置之車輛能耗 / 碳排放資料庫與推估模式之深化推廣運用進行交流。

(5) 本系列研究成果可強化運輸部門基線資料庫，並與整體運輸規劃模式整合，建立運輸活動與能耗 / 碳排放之關聯，已可將環境永續議題納入評估體系。

3. Promotion of Outcomes and Benefits

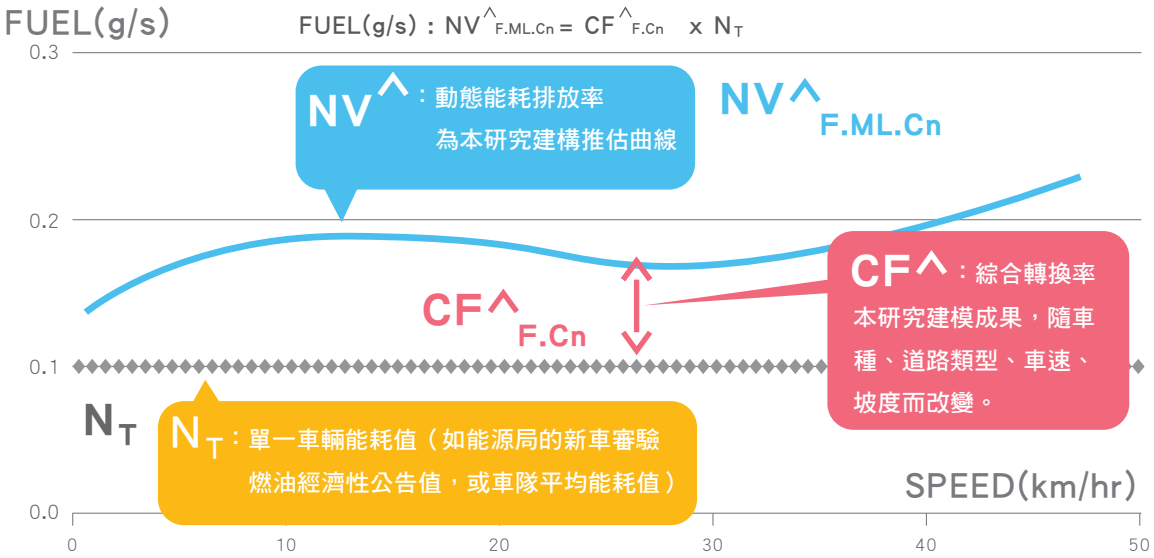
(1) The research outcomes of the past years have assisted the Ministry of Transportation and Communications and the transportation competent authorities of counties and cities to conduct energy conservation carbon emission reduction benefits analysis and evaluation on the following projects of "Comparison of ETC and Manual Toll Collection", "Improvement of Zhubei Interchange", "Widening the Section of National Freeway No. 1 from Wugu to Yangmei ", "Analysis of the Implementation for Motorcycles to Turn off Engine while Idling", "Observation and Analysis of National Freeway No. 5 and No. 1 Passenger Transport Energy Consumption", "Traffic Control Improvement of Daxing West Road, Taoyuan".

(2) In the National Energy Program-Phase II (NEP-II) Outcome Presentation held at the Taipei World Trade Center in October, 2016, this Institute presented its research outcomes and communicated with all sectors. Theoutcomes from this series of studies have been uploaded to "DATA.GOV.TW" for everyone to download and use.

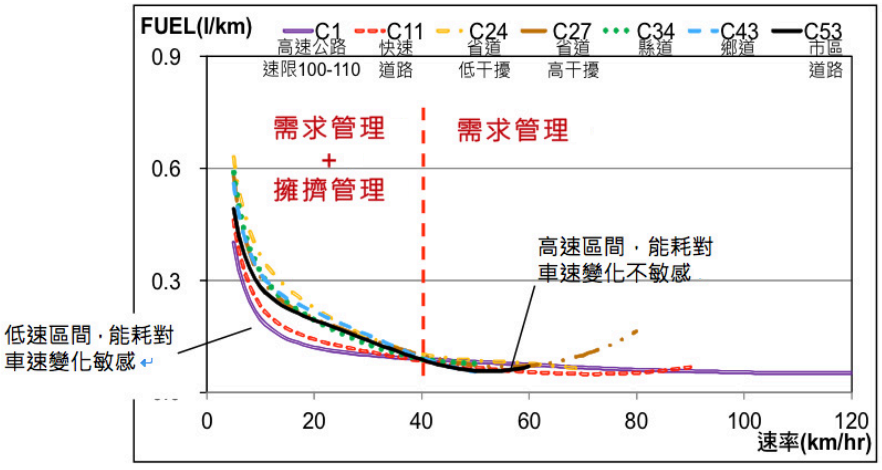
(3) The Institute organized educational training for the "Economic Benefits Evaluation Manual for Transportation Infrastructure Project and Application Software" in November, 2016, invited transportation planning and project evaluation personnel to participate, and explained the outcomes of this study in the application of economic benefits evaluation.

(4) The Institute will organize an outcomes presentation of the series of studies and follow-up promotion symposium, and invite the Environmental Protection Administration, Ministry of Transportation and Communications and competent authorities in charge of transportation of six municipalities to conduct communications on deepening the promotion and application of the vehicle energy consumption / carbon emission database and estimation model constructed by this study.

(5) The outcomes of this series of studies can strengthen the baseline database of the transportation departments and integrate with overall transportation planning models, to establish a relationship between transportation activities and energy consumption / carbon emissions, and the environmental sustainability issues can be incorporated into the evaluation system.

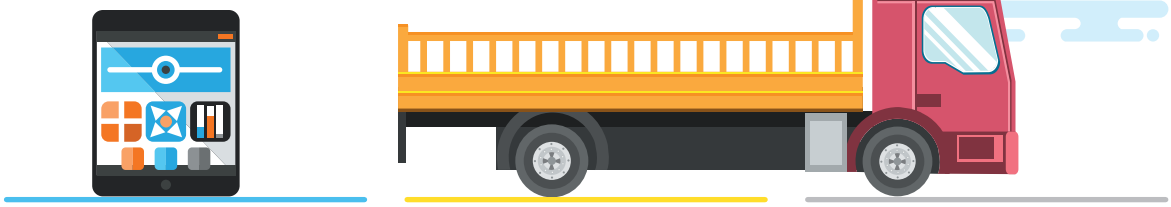


模式構建概念示意圖
Schematic Diagram of Model Construction Concepts



不同道路類型及車速下之能耗曲線與意涵 (小客車為例)
Energy Consumption Curves and Implementations of Different Road Types and Driving Speeds (Taking Small Passenger Cars as an Example)

車載量測設備
On-board Measuring Equipment



(四)新版交通建設計畫經濟效益評估手冊

1. 計畫概述

在政府有限的財政資源下，經濟效益評估已為政府當前進行交通建設計畫決策的重要工具。本所自 96 年起辦理「交通建設計畫經濟效益評估作業」系列研究，同時編訂「交通建設計畫經濟效益評估手冊」並發展應用工具軟體，而為使評估結果更具說服力，各項評估參數有必要定期檢視其與國家社會經濟發展之關聯並進行修訂，另為提高交通建設計畫評估及審議作業效率，應用工具軟體亦有必要配合各項參數修正，同步進行更新。

2. 研究成果

(1) 完成交通建設計畫經濟效益評估重要參數之檢討及修正，更新版評估作業手冊並開發工具軟體：可供交通部所屬機關、縣市政府以及顧問公司等單位使用，以精進評估方法以及改良評估工具。

(2) 建立國內交通建設經濟效益評估作業程序標準化以及參數一致性：有助於強化交通建設計畫編擬及審議決策之效能，避免計畫因缺乏客觀之經濟效益評估作業依據，而導致評估結果不一致之困擾。

(3) 舉辦教育訓練，有助於提升交通建設計畫評估品質與審議效率：本所已舉辦數次教育訓練，對象包括交通部所屬機關、地方政府及民間主要顧問公司，藉由訓練提升我國交通規劃與計畫評估相關業務人員經濟效益評估之觀念，增進專案評估能力與素質。

(VI) New version of economic benefits evaluation manual for transportation infrastructure projects

1. Project Overview

In the context of limited financial resources of the government, economic benefit evaluation has become an important tool for the government's decision-making in transportation infrastructure projects. This Institute has managed a series of studies on the "Economic Benefits Evaluation Operation for Transportation Infrastructure Projects" since 2007, and compiled the "Economic Benefits Evaluation Manual for Transportation Infrastructure Project" at the same time and developed application tools software. Tomake the evaluation results more convincing, it is necessary to inspect and revise all evaluated parameters periodically on their relationships with national socio-economic developments. In order to improve the efficiency of the transportation infrastructure project evaluation and review operations, it is also necessary to use and update the application tools software for the revision and update of all parameters.

2. Research Outcomes

(1) Completed the review and revision of important parameters of Economic Benefits Evaluation for Transportation Infrastructure Project, created an updated version of the Evaluation Operation Manual and developed the tools software for use by agencies of the Ministry of Transportation and Communications, county and city governments, and consultant companies, to improve their evaluation methods and tools.

(2) Standardized the procedures for evaluations of domestic transportation infrastructure economic benefitsas well as the consistency of parameters: to facilitate strengthening the effectiveness of transportation infrastructure project preparation and review decision-making, to avoid projects lacking a basis of objective economic benefit evaluation operation, which previously resulted in the dilemma of inconsistent evaluation results.

(3) Organized education and training to facilitate improving the evaluation quality and review efficiency for the transportation infrastructure projects: the Institute has organized several education and training sessions for agencies of the Ministry of Transportation and Communications, local governments and major private consultant companies, to give personnel related to transportation planning and project evaluations in Taiwan with enhanced concepts and competencies for economic benefit evaluations.

3. 成果推廣與效益

(1) 已於 104 年 9 月及 105 年 11 月針對階段研究成果辦理教育訓練，可逐步提升國內交通規劃與計畫評估相關業務人員對經濟效益評估之認知與觀念，並藉由意見回饋，檢討修正經濟效益評估作業手冊及作業規範，以兼顧理論與實務運作之需要。

(2) 透過所開發之工具軟體，可提供更實用與友善之操作介面，增加交通從業人員使用意願，並提升交通建設計畫評估與審議作業效率。

(3) 相關研究成果已逐步內化至交通建設計畫審議作業，長期將持續提供教育訓練，以提升國內交通規劃與計畫評估相關業務人員對經濟效益評估之認知與觀念。

(4) 為強化本手冊之權威性，後續將針對關鍵參數與重要課題進行基礎研究，並推廣予國發會、交通部與部屬機關、縣市政府，以及顧問公司等參考應用。

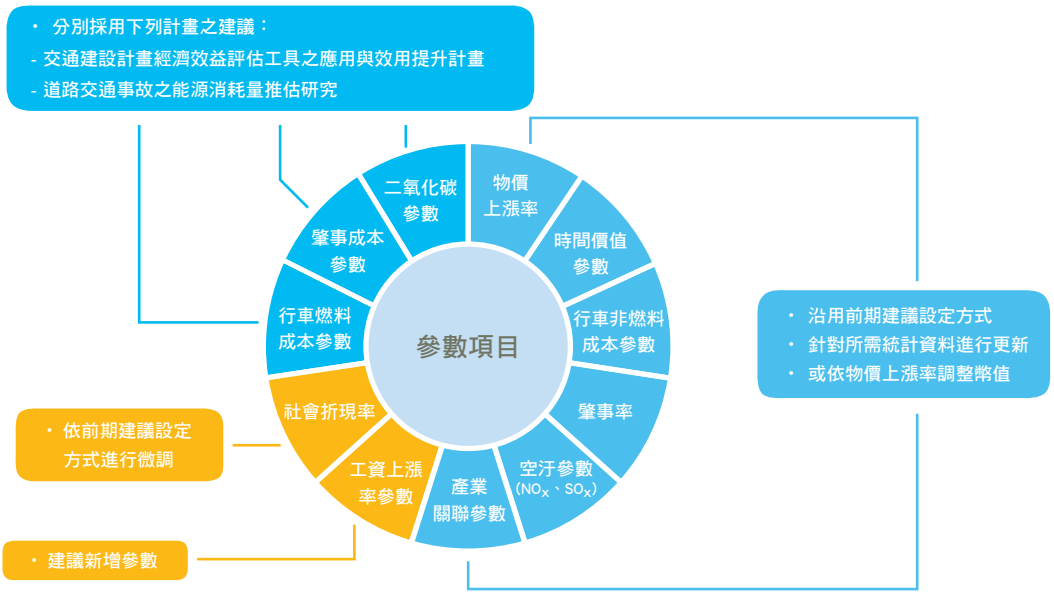
3. Promotion of Outcomes and Benefits

(1) Organized education and training sessions on the outcomes of studies in September of 2015 and November of 2016, which can gradually enhance the awareness and concept of economic benefit evaluation among professionals related to domestic transportation planning and project evaluations. We also reviewed and revised the Economic Benefit Evaluation Operation Manual and Operation Specifications taking into consideration feedback on both theoretical and practical operations.

(2) Through the developed software tools, more practical and friendly operation interface can be provided, to increase the willingness of transportation professionals, and enhance the efficiency of transportation infrastructure project evaluation and review operations.

(3) The relevant research outcomes have been gradually internalized to the review operation of transportation infrastructure project and the education and training sessions are provided continuously for the long term, to enhance the awareness and concept of the business personnel related to domestic transportation planning and project evaluation.

(4) In order to strengthen the authority of this manual, basic research will continue to be performed on key parameters and important topics in the future, and promoted to the National Development Council, the Ministry of Transportation and Communications and their subordinate agencies, county and city governments, and consultant companies to be used as a reference in their work.



交通建設計畫經效評估重要參數修正方式之建議
Recommendations on Correction Methods of Important Parameters for Economic Benefits Evaluation for Transportation Infrastructure Project

新版手冊新增部分

1. 手冊使用指南
   - 手冊簡介
   - 手冊適用範圍與對象
   - 本次更新內容快覽
2. 計畫功能9大分類
   - 速率提升/擁塞改善
   - 服務品質提升
   - 容量/運能提升
   - 可靠度提升
   - 安全提升
   - 防/救災能力提升
   - 營運效率提升
   - 都市空間利用改善
   - 環境友善度提升
3. 營運年期參考值
   - 公路建設
   - 軌道建設
   - 航空建設
   - 港埠建設
4. 重要提醒常見錯誤
5. 工資上漲率參數
6. 參數資訊總覽表

新版手冊調整與更新部分

1. 行車成本節省效益
   以二分之一法則為計算基礎
2. 參數更新
   依目前可取得之最新統計資料更新
3. 國際海空運輸
   成本效益分析 + 總體經濟效果
4. 產業經濟外溢效果
   採外加方式處理
5. 能耗與碳排估算
   採用「車輛動態能耗碳排模式」
6. 肇事成本
   加計交通事故衍生之外部成本(公路)
7. 油價預測
   以EIA預測結果為推估基礎
8. 參數設定資料
   原則採用近5年平均值

新版交通建設計畫經效評估手冊主要增修內容
Main content revisions of the new version of the Economic Benefits Evaluation Manual for Transportation Infrastructure Project

五、公路防災新技術之開發應用

(一) 臺東海岸公路浪襲預警系統

1. 計畫概述

臺 9 線為臺東至西部主要道路，其新建臨海部分路段近年受到颱風波浪侵襲而造成通行人員傷害或封閉。為提升浪襲防災應變時間，研發推算海岸公路波浪溯上技術，提供颱風期間浪襲路段通行安全所需之防災預警資訊。

在整合本所發展之臺灣海象即時觀測作業系統、臺灣近岸海象模擬作業系統、臺東海岸公路波浪溯上系統，建置「臺東海岸公路浪襲預警系統」，以簡易網頁方式，提供臺 9 線浪襲易致災路段 (多良段、南興段) 於颱風期間預警資訊，做為浪襲封路之決策輔助參考。

2. 研究成果

整合臺東鄰近觀測、模擬資料及波浪溯上系統，建置「臺東海岸公路浪襲預警系統」，以簡易網頁方式提供多良、南興段之 24 小時浪襲預警資訊，做為浪襲封路之輔助決策參考，可改善僅仰賴即時觀測之封路作業，讓人員有充分時間做應變及調度。

3. 成果推廣與效益

(1) 成果推廣供交通部公路總局第三區養護工程處防災應變參考，降低颱風期間現場人員監測之安全風險，並有充分時間做應變及調度，107 年 1 月已於第三區養護工程處辦理相關推廣教育訓練。

(2) 本系統後續可持續配合颱風期間使用狀況進行滾動式檢討，以精進預警系統準確性，研究成果亦可提供後續研究臺東海岸公路 (臺 9 線) 沿岸地形變遷之特性之基礎。

V. Development and Application of New Highway Disaster Prevention Technology

(I) Taitung coastal highway wave attack early warning system

1. Project Overview

Taiwan Highway No. 9 is the primary highway from Taitung to the west. Some of the newly constructed seafront road sections have been damaged or closed by the typhoon wave attacks in recent years. In order to improve the disaster prevention and response time of wave attacks, this Institute researches and develops the coastal highway wave run-up estimation technology, to provide the disaster prevention warning information needed for the passage safety of road sections attacked by waves during typhoons.

To integrate the Taiwan Marine Real Time Observation Operation System developed by the Institute, Taiwan Coastal Marine Simulation Operation System, and Taitung Coastal Highway Wave Run-up System, we have constructed the "Taitung Coastal Highway Wave Attack Early Warning System" with a simple webpage to provide early warning information for the road sections of Highway No. 9 (Duoliang section, Nanxing section) prone to wave attack disaster during typhoon, as the reference to assist decision making of road closure during wave attacks.

2. Research Outcomes

To iIntegrate Taitung's proximity observation, simulation data and wave run-up system, we have constructed the "Taitung Coastal Highway Wave Attack Early Warning System" with a simple webpage to provide 24-hour wave attack early warning information for the Duoliang and Nanxing Sections as the reference to assist decision making of road closure during wave attacks, which can improve the road closure operations that rely solely on real time observations, allowing personnel to have sufficient time for emergency response and dispatch.

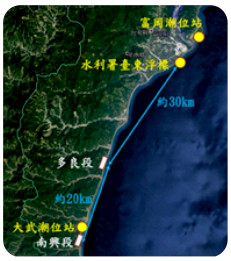
3. Promotion of Outcomes and Benefits

(1) The outcomes were promoted as a disaster prevention emergency response reference for the Third Maintenance Office, Directorate General of Highways, Ministry of Transportation and Communications to reduce the safety risks of on-site personnel monitoring during typhoons, and to have sufficient time for emergency response and dispatch. The Third Maintenance Office has organized promotional education and training in January 2018.

(3) 本計畫已於 107 年 5 月 10 日部務會報進行報告，成果推廣供相關公路主管機關如：國道高速公路局、公路總局、臺鐵局…等，於海岸公鐵路檢、監測管理使用。

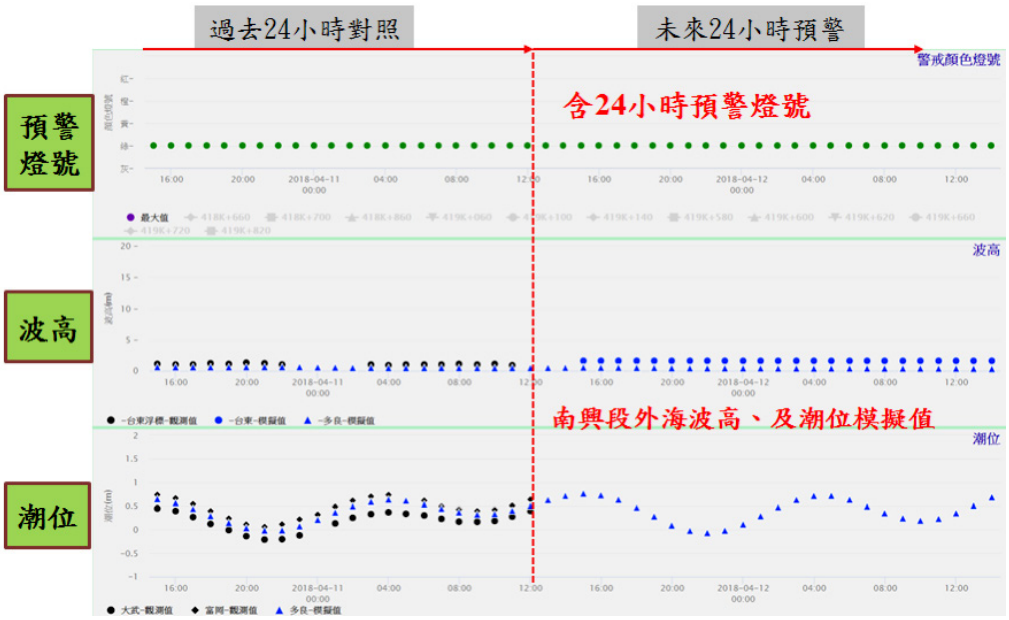
(2) The system will continue to conduct rolling reviews uring typhoons in the future to improve the accuracy of the early warning system. The research outcomes can also serve as a basis for future studies on the characteristics of the coastal terrain changes along the Taitung Coastal Highway (Taiwan Highway No. 9).

(3) The project has been presented in the Ministry Affairs Report on May 10, 2018, and the outcomes were promoted to the competent authorities in charge of highways: Freeway Bureau, Directorate General of Highways, and Taiwan Railways Administration,etc., to use in coastal highway and railway inspection and monitoring management.



改善僅仰賴即時觀測之封路作業，增加海象預報資訊，讓人員有充分時間可做應變及調度。

「臺東海岸公路浪襲預警系統」架構圖
Architecture Diagram of "Taitung Coastal Highway Wave Attack Early Warning System"



「臺東海岸公路浪襲預警系統」畫面圖
Screen Shot of "Taitung Coastal Highway Wave Attack Early Warning System"

（二）公路邊坡崩塌無線感測網路監測模組

1. 計畫概述

本研發之目的係針對公路土壤邊坡可能遭遇之淺層崩塌破壞進行解析法分析並研發搭配之無線感測土層反應模組，發展不同於現有以雨量監測為指標之經驗法預警模式，以提高預警之準確與時效性。而模組設計是引用各種消費性電子產品之微機電感測元件，來監測獲取地表傾角、地表位移及土中分層含水量等即時數據，並結合無線通訊技術，撰寫控制韌體，架構成分布式感測網路，為一易安裝、低成本、拋棄式之監測模組，目前研發成果可供做公路淺層土壤邊坡崩塌監測之應用。

2. 研究成果

(1) 完成無限邊坡因入滲引致淺層滑動之水力力學耦合邊坡穩定理論分析、建立無線監測模組整合測試與資料系統架構。

(2) 設計省電控制模式，撰寫省電控制及資料收集傳輸韌體，不僅現地不需架設伺服器，也緩解長期以來現地設施電源不足之困擾。

(3) 設置 2 處公路土壤邊坡淺層崩塌監測無線感測網路模組試驗場址 (西湖及甲仙場址)，進行現地長期監測、資料判釋及模式修繕應用。

(II) Wireless sensing network monitoring module for highway side landslides

1. Project Overview

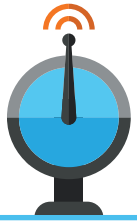
The purpose of this research and development is to conduct analysis on shallow landslides that damage slopes along highways through an analytical method, and also researches and develops a matching wireless sensing soil layer response module, to develop an early warning model different from the existing empirical method using rainfall monitoring as an indicator to enhance the accuracy and timelyness of early warnings. The module design uses the micro-electromechanical sensing components of various consumer electronic products to monitor the real-time data of surface dip angles, surface displacement and stratified water content in the soil, and combines these with wireless communication technology to write control firmware, to construct the distributed sensing network, which is an easy-to-install, low-cost, disposable monitoring module. The current research and development outcomes can be used for monitoring shallow landslides on slopes along highways.

2. Research Outcomes

(1) Completed the theoretical analysis of hydrodynamic coupling slope stability caused by infiltration of infinite slopes resulting in shallow slides, and established wireless monitoring module integration test and data system architecture.

(2) Designed a power-saving control mode, programmed power-saving control and data collection transmission firmware, for which not only the local site does not need to set up a server, but which also alleviates the longstanding dilemma of insufficient power for the facilities on local sites.

(3) Set up two highway soil side slope shallow collapse wireless sensing network module test sites (Xihu and Jiaxian site) to conduct long term monitoring of local sites, data interpretation and model adjustmens and applications.



3. 成果推廣與效益

(1) 目前所用訊號傳輸模組須具備一定通透性，且雨天傳輸距離相對減少，未來將選用適宜之傳輸網路或整合高功率無線傳輸元件，有助於設備佈設與系統推廣應用。

(2) 目前研發成果適用於淺層土壤邊坡崩塌監測之用，未來期望能在邊坡深層破壞理論上更深入研究，發展適用深層破壞之簡易型監測軟硬體模組。

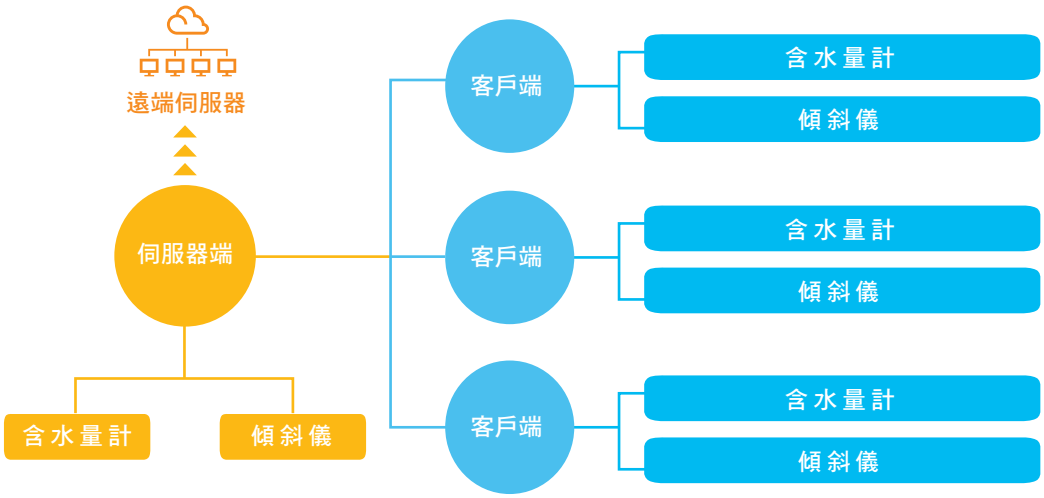
(3) 106 年 11 月，本所規劃辦理「2017 年道路橋梁災害防治技術研討會」，邀集高公局、公路總局、臺鐵局、高鐵局及地方政府進行成果交流，以推廣成果應用並研討未來精進方向。

3. Promotion of Outcomes and Benefits

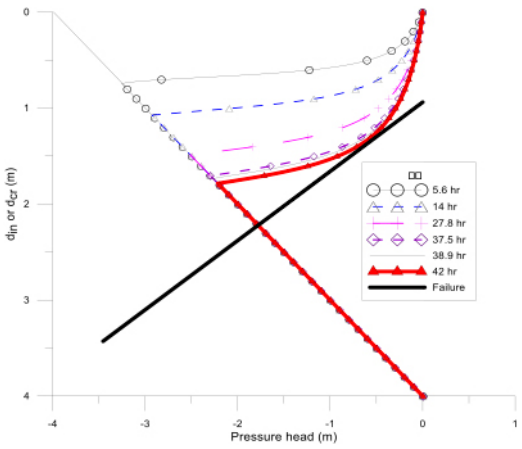
(1) The current signal transmission module used must have a certain power, but on rainy days the transmission distance is reduced. In the future, a suitable transmission network or integrated high-power wireless transmission components will be used to deploy the equipment and expand the system.

(2) The current research and development outcomes are applicable to the monitoring of shallow soil side slope collapses. In the future, we hope to conduct further research into side slope deep layer damage theory and develop simple monitoring software and hardware modules for applicable for deep layer damage.

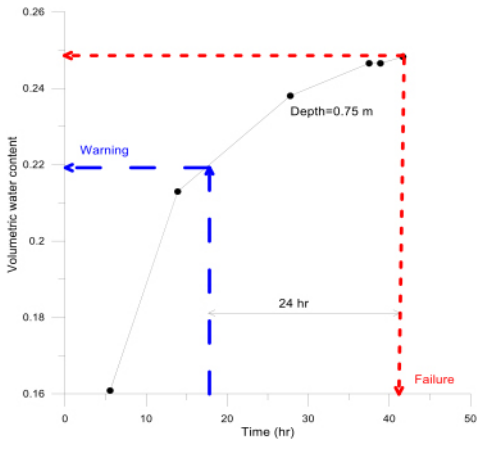
(3) In November 2017, the Institute planned and managed the "2017 Road and Bridge Disaster Prevention Technology Seminar", and invited the Freeway Bureau, Directorate General of Highways, Taiwan Railways Administration, Bureau of High Speed Rail and local governments to discuss the research outcomes, to promote the application of outcomes and to discuss directions for future improvement.



系統架構示意圖
System Architecture Schematic Diagram



a. 室內試驗壓力水頭與破壞包絡線圖



b. 依時預警概念圖

理論破壞模式及依時預警概念圖
Theoretical Failure Mode and Time-dependent Warning Concept Chart

（三）公路邊坡近景攝影測量自動化雲端服務系統

1. 計畫概述

近景攝影測量係基於影像處理的三維重建技術，可提供高精度量測及表面三維重建的成果，本計畫目的為建立公路邊坡近景攝影測量標準建置程序並整合自動解算及資料管理模組，提供全自動邊坡表面三維重建及多期三維資料差異分析，用來記錄道路整體邊坡變遷，做為崩塌潛勢判斷之依循，提供公路主管機關決策參考使用。

2. 研究成果

(1) 建立近景攝影測量技術應用於道路邊坡檢監測之標準建置程序，包含不同邊坡適用性、影像監測設備規劃及佈設之程序，自動辨識標之材質、大小…等佈設方式，控制點及監測點佈設原則，將作業程序標準及簡便化，提供需求單位設置之依循，並依此獲取可靠之資料。

(2) 運用物聯網（IoT）架構結合監測模組（數位相機＋小型單板電腦）及解算伺服器，提供現場自動連續攝影監測及資料回傳伺服器解算；系統運行架構以程式語言 Python 進行開發，建置全自動影像資料獲取、三維地形資料重建、多期地形資料差異比對及資料庫查詢系統。

(III) A cloud service system for automatic monitoring road side slope use of close range photogrammetry

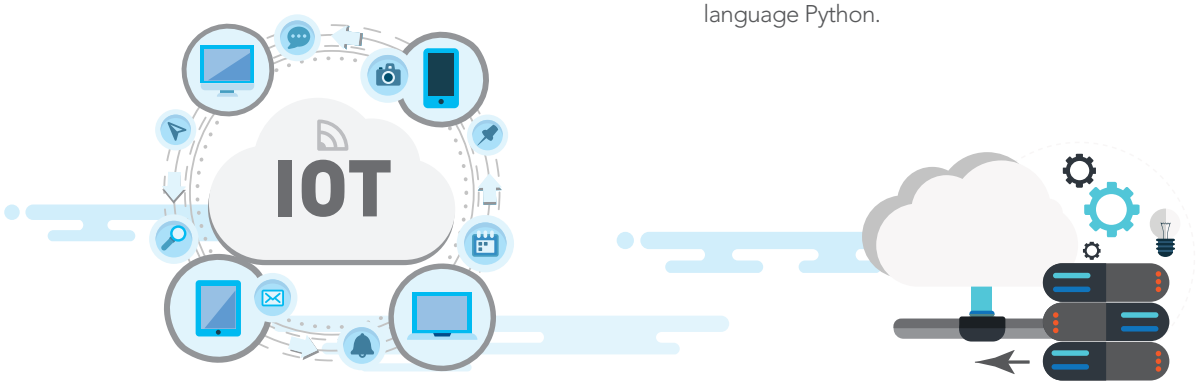
1. Project Overview

Close-range photogrammetry is based on technologies that reconstruct images into 3D (three-dimensional) renderings, which can turn the results of high-precision measurements and into 3D reconstruction of surfaces. The purpose of this project is to establish a road side slope close-range photogrammetric standard operating procedure operating and integrate automatic operation and data management modules, to provide automatic 3D reconstruction and multi-period 3D data differential analysis for slope surfaces, to record the overall side slope changes, as the basis for judging collapse potential and a reference for decision-making by government.

2. Research Outcomes

(1) Established close-range photogrammetry technology used in the standard operating procedure of road side slope monitoring, including the applicability of different side slopes, the planning and deployment procedures for image capture equipment, materials, size of the special signs for automated identification and other deployment methods, control point and monitoring point deployment principles, to standardize and simplify operating procedures, and provide a basis for user to follow, and obtain reliable information accordingly.

(2) Used Internet of Things (IoT) architecture combined with monitoring module (digital camera + small pad computer) and solver server to provide on-site automated continuous monitoring and data return server computing; The modules in this system have automated image capture, 3D data reconstruction, multi-period 3D data differential analysis and database query, which developed with programming language Python.



3. 成果推廣與效益

(1) 成果推廣供相關公路主管機關如：國道高速公路局、公路總局、臺鐵局…等於邊坡檢、監測管理使用，減少現場人工勘查及提升管理效能，並已辦理相關推廣研討會議。

(2) 本計畫建立近景攝影測量技術應用於道路邊坡檢監測使用之標準建置程序、自動化三維重建及提供多時序差異分析比對，用於記錄道路邊坡變遷及分析崩塌潛勢使用，以較低之建置成本，來達到邊坡全自動表面三維重建及資料比對與管理之成效，減少現場人工勘查及提升管理效能。

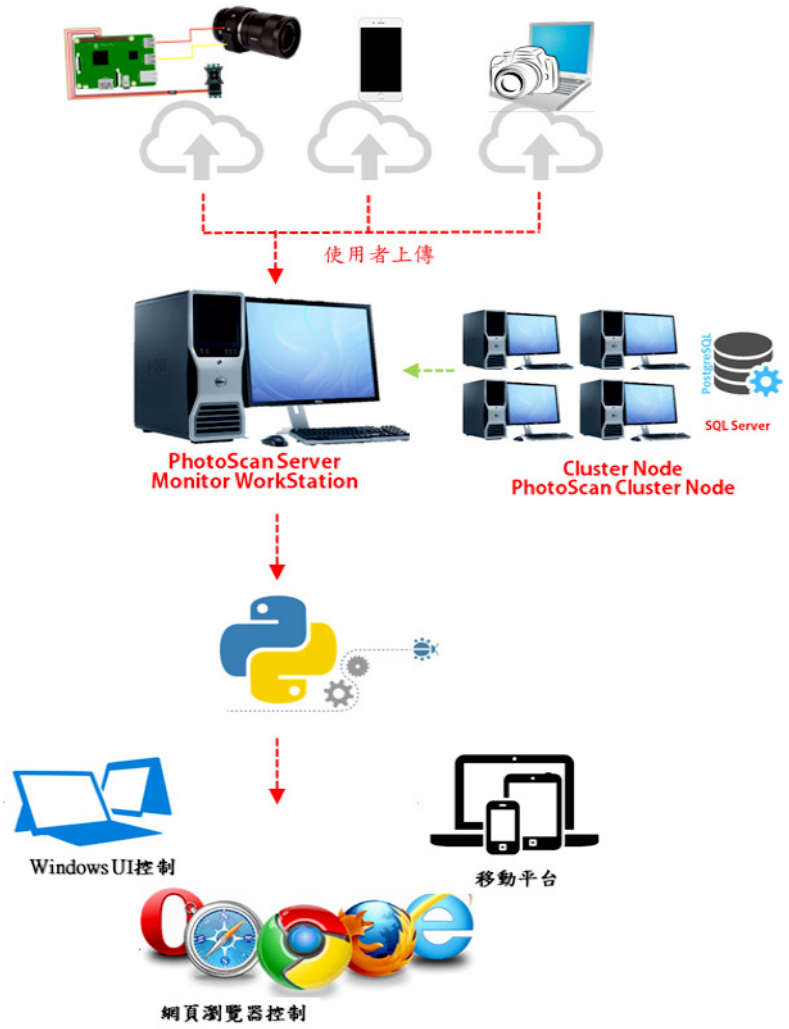
(3) 本計畫開發之自動化三維重建計算之核心，亦可提供使用者於進行邊坡巡檢作業時，僅需藉由手持或無人飛行載具 (UAV) 掛載相機方式對於目標邊坡進行拍攝後，將影像上傳至本系統進行自動三維化之服務，以量化方式記錄邊坡表面資料來輔助目視檢測之不足。

3. Promotion of Outcomes and Benefits

(1) The outcomes are promoted to competent authorities in charge of highways such as: Freeway Bureau, Directorate General of Highways, and Taiwan Railways Administration, etc., on the use of side slope inspection and monitoring management, to reduce on-site manual survey and improved management efficiency, and we have organized promoting.

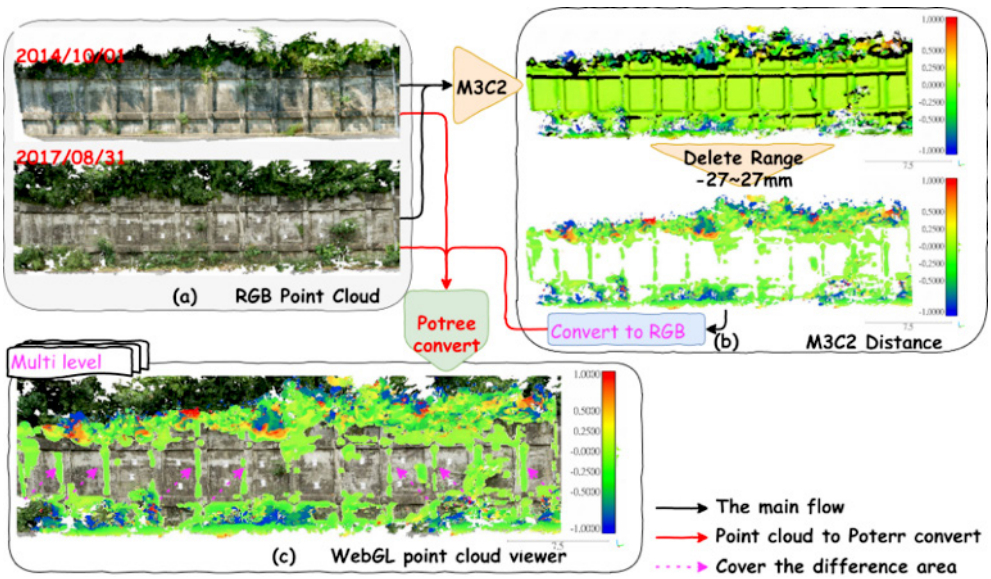
(2) This project established close-range photogrammetry technology used in to the standard operating procedures for road side slope monitoring, automated 3D reconstruction and provided multi-period 3D data differential analysis, used to record road slope changes and analyze the collapse potential with lower cost, to achieve the effect of 3D reconstruction of the slope automatically as well as data differential analysis and management, and reduced the on-site manual survey and improved management efficiency.

(3) The core of the automated 3D reconstruction calculation developed by this project is that it only requires a handheld or unmanned aerial vehicle (UAV) mounted with a camera to photograph the targeted side slopes during side slope inspections operation, then upload the images to this system to perform automated 3D rendering, and record the surface data of side slopes with quantitative methods to complement the insufficiency of visual inspections.



近景攝影測量技術之自動化雲端系統架構

Automated Cloud System Architecture of Close-Range Photogrammetry Measurement Technology



點雲差異比對及點雲展示

Point Cloud Difference Comparison and Point Cloud Display

六、資訊科技在港灣環境與航行安全之應用發展

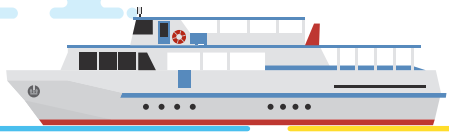
(一) 船舶航行對沿岸及港域之空污影響評估

1. 計畫概述

近年來空污議題受到各界高度關切，船舶排放而來的空氣污染亦不容忽視，船舶排放量不等同於對環境的直接影響比重，因為污染物從排放源排放到大氣後，會受到大氣條件影響 (氣流、風向、風速、溫度、濕度、輻射、沈降等) 及與其他污染物產生化學反應 (氣相、液相、固相、光化學反應等)，形成對周遭生活環境之污染物濃度，而造成不同之危害程度。本研究有兩大重點：(1) 使用美國環保署公告之 AERMOD 空氣擴散模式，結合氣象局與本所船舶自動辨識系統 AIS 等資料，建置高雄港及臺中港區之即時空氣品質推估系統，瞭解原生性空氣污染物 (如：NOx 及 SOx) 之增量空間分布。(2) 利用本所 AIS 資料及勞氏資料庫推估港域 20 海浬區域之船舶排放量，並採 CMAQ 空氣品質網格模式，結合環保署的物排放清冊 (TEDS 9.0) 建置臺灣地區排放量及氣象局的大氣 (WRF) 資料，推估臺灣各主要港區及周邊海域船舶排放對臺灣空氣品質影響之案例分析。

2. 研究成果

(1) 建置高雄港區及臺中港區之即時空氣品質推估系統，瞭解其一次原生性空氣污染物 (如：NOx 及 SOx) 之增量空間分布，藉此可提供即時高污染原之排放量，俾利及時排除減低空污。



VI. Application and Development of Information Technology on Harbor Environment and Shipping Safety

(I) Assessment of the impact of vessel navigation on air pollution along the coast and in harbor areas

1. Project Overview

In recent years, air pollution has received much attention from all sectors, and air pollution from vessels cannot be ignored. The vessel emissions cannot be directly equated to direct impact on the environment since these emitted pollutants will be affected by atmospheric conditions (airflow, wind direction, wind speed, temperature, humidity, radiation, sedimentation, etc.) and will engage in chemical reactions (gas phase, liquid phase, solid phase, photochemical reaction, etc.) with other pollutants, to form pollutant concentrations in the surrounding living environment that cause different degrees of harm. This research has two major focuses: (1) Use the AERMOD air diffusion model of the US Environmental Protection Agency, combined with the automatic identification system AIS of the Taiwan Central Weather Bureau and this Institute and other data to construct a real-time air quality estimation system for the Port of Kaohsiung Area and Port of Taichung Area to understand the incremental spatial distribution of primary air pollutants (such as NOx and SOx). (2) The case study of using the AIS data and the Lloyd's database to estimate vessel emissions in a 20 nautical mile radius around these harbor areas, and adopt the CMAQ air quality grid mode, combined with the Air Pollution Emission Register (TEDS 9.0) of the Environmental Protection Administration to construct the Taiwan Area Emissions and Weather Research Forecasting (WRF) data of the Central Weather Bureau, to estimate the impact of ship emissions from Taiwan's major harbor areas and surrounding sea areas on Taiwan's air quality.

2. Research Outcomes

(1) Constructed a real time air quality estimation system for the Port of Kaohsiung Area and Port of Taichung Area to understand the incremental spatial distribution of its one time primary air pollutants (such as NOx and SOx), thus providing real time emissions of high pollution sources, in order to facilitate timely elimination and reduction of air pollution.(2) Complete the ISO 39001 import reference manual to provide reference for the transport industry to introduce or accept coaching to establish a road traffic safety management system.

(2) CMAQ 模式已於 106 年完成基本運算模式，107 年建立即時船舶排放量推算模組，108 年建立即時氣象模組，逐步精進船舶排放對空氣品質影響推估系統，做為後續進行空品預報作業之基礎。

(3) 研究成果可供交通部、航港局與港務公司或環保署等於研擬港區及沿岸空污對策參考，提升港口國際競爭力，確保環境永續發展。

3. 成果推廣與效益

(1) 已辦理多場成果教育訓練，對象包含航港局、港務公司、環保署等、顧問公司等，有助於交流與推廣，後續將持續辦理教育訓練。

(2) 已至交通部業務會談及港務公司主管會議進行成果簡報，可有效宣導計畫研究成果與效益，俾利後續之推展與應用。

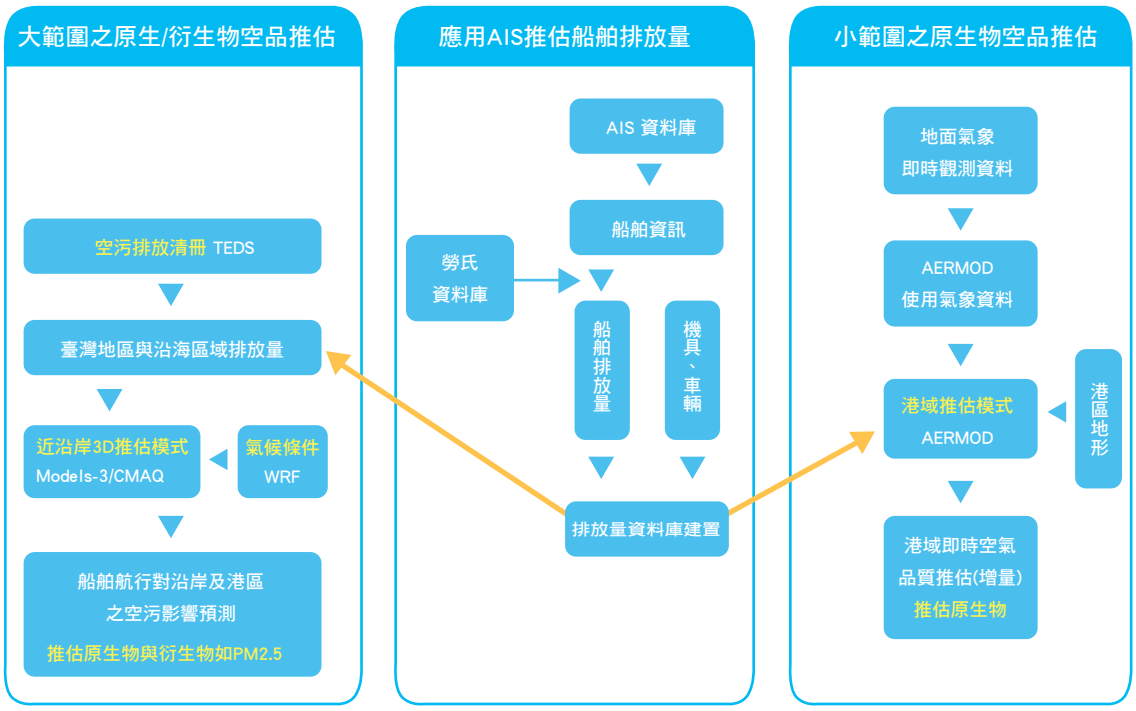
(2) The basic operation mode was completed for the CMAQ model in 2017. The real time vessel emission estimation module was established in 2018. The real time meteorological module will be established in 2019. The impact estimation system of vessel emissions on air quality will be improved gradually, to be used as the basis of conducting air quality forecasting in the future.

(3) The research outcomes can serve as a reference for the Ministry of Transportation and Communications, Maritime and Port Bureau, Taiwan International Ports Corporation or Environmental Protection Administration to develop air pollution countermeasures in the port area and along the coast, to enhance the international competitiveness of the ports and ensure the sustainable development of environment.

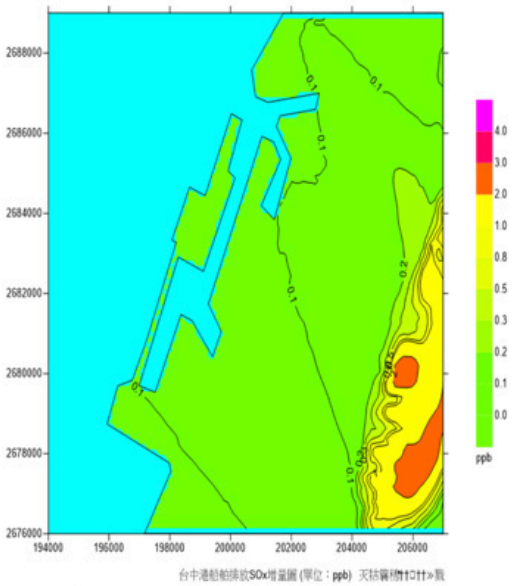
3. Promotion of Outcomes and Benefits

(1) A number of outcomes and education and training sessions have been organized for the Maritime and Port Bureau, Taiwan International Ports Corporation, Environmental Protection Administration and consultant companies, which were helpful for communication and promotion, and will continue to organize educational trainings in the future.

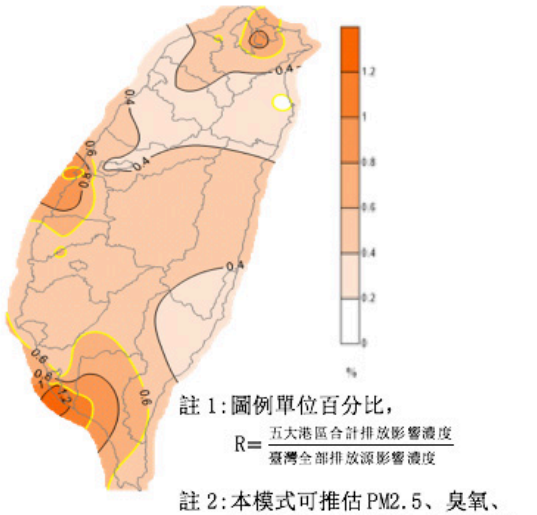
(2) The Institute has attended the business conference of the Ministry of Transportation and Communications and management meeting of the Taiwan International Ports Corporation to present the research outcomes and benefits of the project, in order to facilitate the subsequent promotion and application.



研究架構圖
Research Architecture Chart



AERMOD 推估臺中港 NOx 增量



CMAQ 推估五大港口 SO_4^{2-}
(硫酸鹽)排放貢獻比例

AERMOD 與 CMAQ 模式推估結果範例圖
Sample Map of AERMOD and CMAQ Model Estimation Results

(二) 臺灣海域智慧化航安系統發展與應用

1. 計畫概述

依據航港局海難事故統計資料顯示，每年在臺灣海域之商船及漁船發生海難事故次數約有 200 多件。鑑此，本計畫乃研究船舶自動識別系統 (Automatic Identification System,AIS) 與數位選擇呼叫 (Digital Selective Calling,DSC) 結合之可能性，強化海運安全基礎資料之蒐集與資訊系統建立之機制，以提升海運系統之安全，減少生命財產損失。

配合臺灣港務股份有限公司積極推動「臺灣港群綠色港口推動方案」，而其中「船舶減速查核系統」主要目的在致力於監控進出港船舶的減速情況，期望有效降低港區二氧化碳的排放量，達到港埠環境保護的目標；透過 AIS 的通訊技術，來追蹤船舶進出港口時的減速情形，並計算出具體的船舶減速數據，藉由具體的船舶減速數據來規劃與建立臺灣各國際港的船舶減速查核機制。為延伸 AIS 資訊覆蓋範圍，透過臺馬之星於航行過程中持續監控 AIS 訊號轉發回基站的情況，進而優化 AIS 系統資訊覆蓋範圍可能性，落實海上交通安全保障之目的。

2. 研究成果

(1) **海難救助 DSC 與 AIS 整合系統：**整合 AIS 與 DSC 之船舶資訊介面系統，並透過遠端監控即時查詢 DSC 與 AIS 顯示資訊，簡化船舶救援流程及減少海岸電臺須持續監聽船舶遇險頻道的人力成本，以利時刻掌握海難訊息。

(2) **臺灣港埠船舶減速查核機制系統：**依據洛杉磯港船舶減速查核機制所定義之方式，透過本所建置船舶減速查核應用程式，以

(II) Development and application of an intelligent navigation safety system for the Taiwan sea area

1. Project Overview

Statistical data of maritime disaster accidents of the Maritime and Port Bureau show that there have been more than 200 maritime disaster accidents of merchant ships and fishing vessels in Taiwan sea area. In view of this, the project is to research the possibility of combining the Automatic Identification System (AIS) and the Digital Selective Calling (DSC) to strengthen the collection of maritime safety basis data and establish an information system, to enhance the safety of the marine transportation system and reduce the loss of life and property.

Cooperated with the Taiwan International Ports Corporation to actively promote the "Taiwan Ports Group Green Harbor Promotion Program", whose main purpose of "Ship Deceleration Examine and Audit System" is to monitor the deceleration of vessels entering and leaving the ports, to reduce carbon dioxide emissions in the port area to protect the environment around the port. Use AIS communication technology to track the deceleration of vessels entering and leaving the ports, and calculate specific ship deceleration data, to plan and establish vessel deceleration examine and audit mechanism in Taiwan's international ports by specific vessel deceleration data. In order to extend the coverage of AIS information, the AIS signal is continuously monitored and forwarded back to the base station through TAIMA STAR during the navigation process, to further optimize the potential covrage area of the AIS information system to safeguard maritime traffic safety.

2. Research Outcomes

(1) **Maritime Disaster Rescue DSC and AIS Integrated System:** Integrate the vessel information interface systems of AIS and DSC, and through remote monitoring real time query DSC and AID displayed information, to simplify the ship rescue process and reduce the manpower cost for the coastal station to continuously monitor the vessel distress channel, in order to grasp maritime disaster messages at all times.

(2) **Taiwan Port Vessel Deceleration Monitoring Mechanism System:** Based on to the methods defined by the Los Angeles Port Ship Deceleration Monitoring Mechanism to obtain integrated average speeds through the vessel

各區段設定的海浬數做加權平均，獲得整合平均速度。當船舶於進出港時，航行速度若調降到 12 節以下的情況時，減速每降低 20% 將減少 40% 的燃料消耗。

(3) 行動中繼傳輸技術應用於 AIS 系統之研發：運用微控制器擷取 AIS 資訊在完成資料處理後，利用中繼傳輸設備進行 AIS 資料的自動轉發以達至延伸 AIS 系統資訊覆蓋範圍約 30 海浬，改善了 AIS 系統資訊收發距離受限因而導致 AIS 系統資訊不完全的狀況，進而優化 AIS 系統資訊覆蓋範圍。

3. 成果推廣與效益

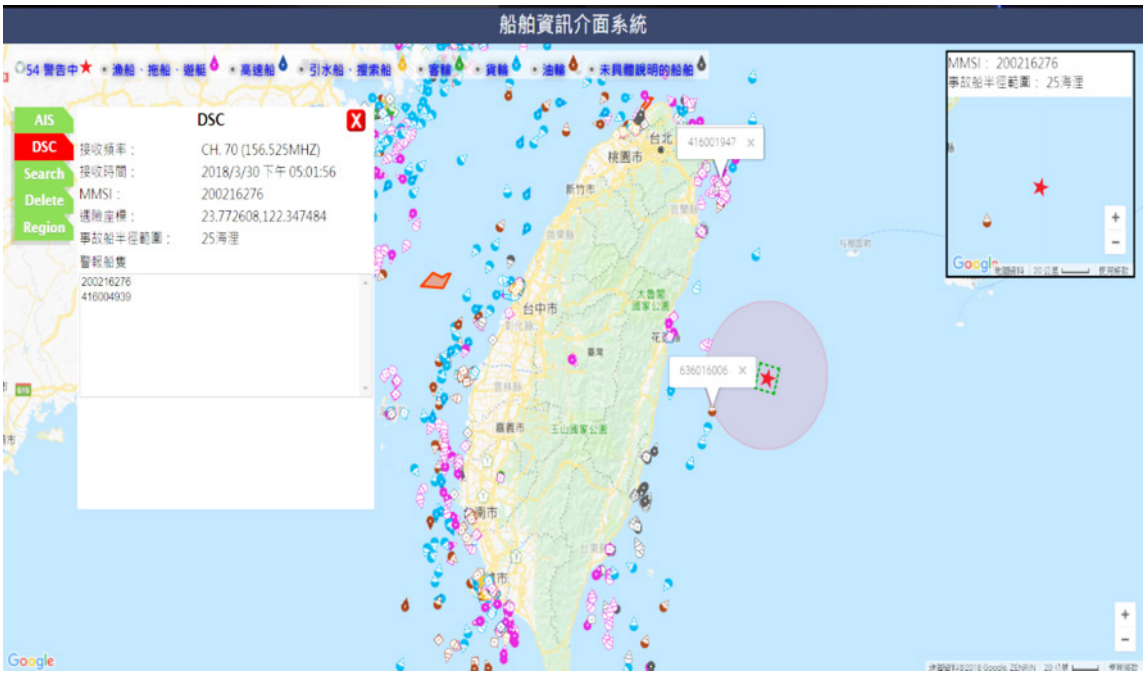
針對 105 年臺灣港埠 7 大港口船舶減速查核機制結果，於 106 年 9 月 5 日交通部召開「為臺灣港區及沿海空氣品質改善盡一份力！船舶一起來減速！」記者會，及 106 年 9 月 29 日於基隆海岸電台向交通部航政司、國家通訊傳播委員會、海巡署與航港局辦理專案報告「海難救助 DSC 與 AIS 整合系統」推廣使用說明會。未來（108 年）將因應離岸風電新興建設的設置，而導致海上船舶航行安全風險提高的問題，提出一解決方策，以海難救助 DSC、AIS 系統為基礎整合海洋陣列雷達，發展成為離岸風場船舶航行安全監測系統，透過系統平臺完善的船舶資訊，有效降低船舶因離岸風電發展建設造成航行事故發生的可能性。

deceleration monitoring application built by this Institute, calculate weighted averages based on the number of nautical miles set for each section. When a vessel enters or leaves the port, every 20% deceleration of a vessel's speed below 12 knots will reducefuel consumption by 40%.

(3) **The mobile relay transmission technology is used in the research and development of AIS system:** Use the microcontroller to capture AIS information after data processing, use the relay transmission device to forward the AIS data automatically to extend the AIS system information coverage area to about 30 nautical miles, improve the AIS system information transmission and reception distance limit that resulted in incomplete AIS system information, and further optimized the AIS system information coverage area.

3. Promotion of Outcomes and Benefits

Regarding the results of the vessel deceleration monitoring mechanism for the seven major ports of Taiwan in 2016, the Ministry of Transportation and Communications held a press conference of "Making a contribution to the improvement of Taiwan's port area and coastal air quality! Let all vessels slow down together!" on September 5, 2017, and presented the project report "Maritime Disaster Rescue DSC and AIS Integrated System" Promotion and Application Seminar to the Department of Aviation and Navigation of the Ministry of Transportation and Communications, National Communications Commission, Coast Guard Administration and Maritime and Port Bureau at the Keelung Coastal Station on September 29, 2017. In the future (2019), this Institute will submit a solution program in response to newly constructed offshore wind power farms that cause problems of increasing risks tovessel navigation safety, integrate the marine array radars based on the maritime disaster rescue DSC and AIS systems, to develop an improved offshore wind farm vessel navigation safety monitoring system to effectively reduce the possibility of navigation accidents caused by offshore wind power development and construction.



海難救助 DSC 與 AIS 系統整合圖
Sea Disaster Rescue DSC and AIS Systems Integration Map

(三) 港灣環境資訊系統及預警運用

1. 計畫概述

本所港灣環境資訊網包括有海象觀測資訊、海象模擬資訊、藍色公路資訊、港區影像資訊、港區地震資訊、海嘯模擬資訊及大氣腐蝕資訊等 7 項查詢功能，提供整體性、即時性海象資訊供政府單位及一般民眾參考。基於海象資料之立即性應用並轉化為可靠之資訊需求越趨強烈，整合各單位的觀測資料、資料品管、資料即時展示及資料檢核、統計分析工作有其落實之必要性。

2. 研究成果

(1) 整合建構共 33 條海上藍色公路船舶動態與海氣象資訊系統，強化本島與離島間船舶航行安全，藍色公路是整合臺灣海象即時觀測系統、臺灣近岸海象模擬作業系統及船舶動態支援系統所建成，系統可提供船隻所在位置、船名、航速、航向資訊，也可查詢得知船隻所在位置風速、風向、波高與波向。

(2) 自 2011 年起本所持續與中央氣象局、經濟部水利署、臺灣海洋科技研究中心等單位合作介接海象資料，「港灣環境資訊網」逐步成為全國性海象觀測資料整合平台，提供海象資訊查詢服務。

(3) 全臺依地理環境及相關性，首創彙整劃分為 12 海域，針對風力、波浪、潮位、海流等資料進行長期統計分析並出版統計年報、資料年報及風力專刊，作為後續海岸相關工程設計規劃參考資料。

(III) Harbor environment information system and early warning application

1. Poject Overview

This Harbor Environment Information Network of the Institute includes seven query functions of marine observation information, marine simulation information, blue highway information, port image information, port earthquake information, tsunami simulation information and atmospheric corrosion information, to provide integral and real time marine information as a reference for government agencies and the general public. Based on the immediate application of marine information and with stronger requirement of converting into reliable information, the network integrates observation information, information quality control, information real time display and information check and verification, statistical analysis has its necessity of implementation.

2. Research Outcomes

(1) Consolidated and constructed 33 marine blue highway ships movement and marine meteorological information system, to strengthen the ship navigation safety between the island and offshore islands. The blue highway is constructed with integrated Taiwan marine real time observation system, Taiwan coastal marine simulation operation system and ships movement dynamics support system. The system can provide the vessel position, vessel name, speed and direction information, as well as wind speed, wind direction, wave height and wave direction where the vessel is located.

(2) Since 2011, the Institute has cooperated with Central Weather Bureau, Water Resources Agency, Ministry of Economic Affairs, Taiwan Ocean Research Institute to interface with marine information. The "Harbor Environment Information Website" has gradually become the national marine observation data integrated platform to provide inquiry service of marine information.

(3) For the first time, Taiwan was organized and divided into 12 maritime areas based on geographical environment and relativity, to conduct long-term statistical analysis on the data of wind, waves, tide levels and currents, and publishes a statistical annual report, annual data reports and a wind special issue, as reference materials for subsequent coastal related engineering design and planning.

(4) 展示全國 12 海域之風速、波高及流速，即時且最大觀測資訊，除平時查詢外，可應用颱風期間海象轉變時，得知全國海域受颱風影響實際變化，提供港務公司及航港局等單位參考。

3. 成果推廣與效益

(1) 106 年 5 月，完成整合馬祖海氣象及陸海空交通資訊網頁「馬祖卡蹓去」網頁開發，並於機場及港區舉辦網頁推廣活動。

(2) 106 年 9 月，召開「全國海象資料庫研商會議」，邀集國立成功大學近海水文中心、國立成功大學成大水工試驗所、國立中山大學、臺灣海洋科技研究中心等研究單位與會討論，對於成立「全國海象資料庫」深獲各單位認同與支持。

(3) 106 年 11 月，以研究成果參加第 39 屆「海洋工程研討會暨科技部計畫成果發表會」論文海報競賽獲獎。

(4) 107 年 4 月，再行邀集公部門及研究單位，研討「全國海象資料庫」未來執行方向。

(4) Demonstrated the wind speed, wave height and flow velocity, real time and most observation information for the 12 maritime areas of Taiwan. In addition to ordinary enquiries, it can be used to find out the actual changes in 12 maritime areas of Taiwan affected by typhoons when the sea state changesto provide references for the Taiwan International Ports Corporation and the Maritime and Port Bureau.

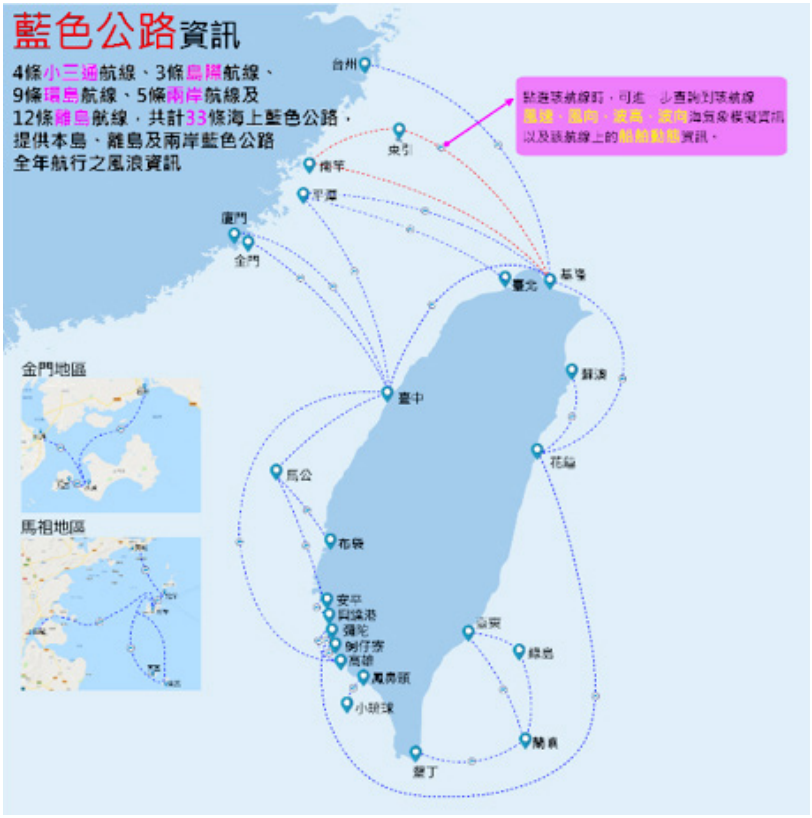
3. Promotion of Outcomes and Benefits

(1) Completed the integration of the Matsu marine meteorological data and the land, sea and air traffic information website "Matsu Go Touring Fun" webpage development in May 2017 and held promotional activities at the airport and port area.

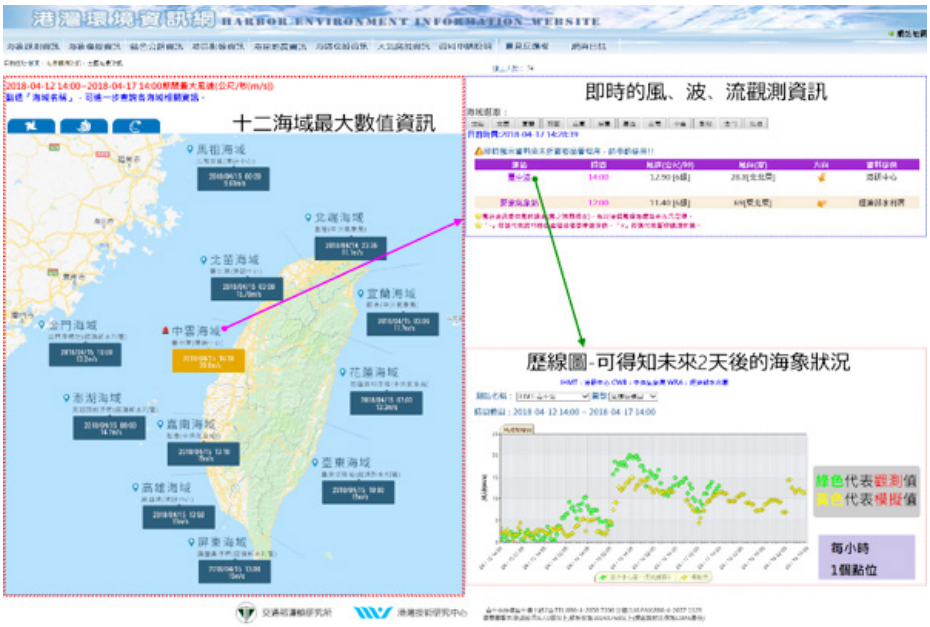
(2) Convened the "National Marine Database Walrus Database Research and Discussion Conference" in September 2017, attended by research units of the Coastal Ocean Monitoring Center of National Cheng Kung University, Hydraulics Laboratory of National Cheng Kung University, National Sun Yat-sen University and Taiwan Ocean Research Institute, who gave positive feedback on the "National Marine Database"

(3) The Institute won the award for Paper Poster Contest of the 39th"Ocean Engineering Seminar and the Ministry of Science and Technology Project Outcomes Achievements Presentation" with the Research Outcomes in November 2017.

(4) Invited the public sector and research units again in April 2018 to discuss the future implementation direction of the "National Marine Database".



海上藍色公路海氣象資訊系統
Marine Meteorological Information System of Marine Blue Highway



全國 12 海域海象資訊網頁
Marine Information Webpage of 12 Sea Areas in Taiwan

（四）港灣構造物維護管理制度與資訊系統之推動與應用

1. 計畫概述

國內主要商港港灣構造物使用時間多已超過 40 年，以基隆港為例，港務公司轄管之 44 座碼頭中，其使用時間就有 28 座超過 40 年，部分甚已達 70 年。因此，如何強化與有效維護構造物使用效能，實為刻不容緩之課題。在實務應用上，除須建立維護管理制度，也應搭配開發資訊系統，以有效運用維修經費，確保設施營運安全及延長使用壽命，方能達到港埠永續經營之目的。

本所近年針對國內主要商港與其附屬港之碼頭與防波堤等港灣構造物，進行現況調查與檢測評估，藉由建立平時、定期及特殊狀況之巡檢制度，儘早發現構造物劣損狀況與採用適當維修對策，降低更大損壞發生。同時開發維護管理資訊系統，持續優化擴充模組功能與資料庫內容，改善系統操作與實用性，研究成果將提供航政與港務管理單位辦理相關政策規劃或實務執行參考應用。

2. 研究成果

(1) 以全面性之調查與檢測方式，瞭解花蓮、基隆、蘇澳與臺北港及金門港務處金門港、連江縣港務處馬祖港等港區碼頭與防波堤等港灣設施現況，並檢討目前維護管理方式，進行修正與精進，協助港務公司解決人力不足，未能完善設施維護之窘境。

(IV) Promotion and application of harbor structure maintenance management system and information system

1. Project Overview

The main domestic commercial harbor structures have been in use for more than 40 years. Take the Port of Keelung as an example, among the 44 wharfs under the jurisdiction of the Taiwan International Ports Corporation, 28 of them have been used for more than 40 years, and some even as ong as 70 years. Therefore, strengthen and maintaining the efficiency of these structures is an urgent task that cannot bear delay. In practical terms, this requires establishing a maintenance management system paired with an information system to effectively use the repair and maintenance funds to ensure the safe operation of facilities and prolong their service life to achieve sustainable operation for the harbors.

In recent years, the Institute has conducted studies, testing and assessments on the current conditions of harbor structures such as wharfs and breakwaters in major domestic commercial ports and their affiliated ports, through establishing inspection systems for ordinary, regular and special situations to discover structural damage and adopt appropriate repair and maintenance countermeasures as early as possible to preventgreater damage. Develop a maintenance management information system at the same time to optimize the expansion module functions and the contents of database at the same time, to improve the operation and practicability of the system. The research outcomes will serve as a reference for policy planning and practical implementation by navigation and port management units.

2. Research Outcomes

(1) The Institute used comprehensive investigation and testing methods to understand the current conditions of harbor facilities such as wharfs and breakwaters in the ports of Hualien, Keelung, Suao and Taipei as well as the Kinmen Port of the Harbor Bureau, Kinmen, Matzu Port, Harbor Bureau of Lienchiang County, and reviewed the current maintenance management methods, conducted corrections and improvements, to assist the port corporations in solving their dilemma of insufficient manpower shortages that cannot improve the maintenance of facilities.

(2) 精進及擴充舊有港灣構造物維護管理系統，改善操作功能及使用便利性，並新增系統公告、留言與圖文等 3 個模組，加強訊息傳達互動以及意見回饋，完整呈現圖文資料，亦以響應式網頁重新設計系統使用功能，協助港務單位能在最少人力之下，以資訊化、系統化作業方式提升碼頭養護及控管能力。

3. 成果推廣與效益

(1) 計畫成果提供交通部航港局、臺灣港務公司、金門縣港務處、連江縣港務處等港務單位或工程顧問公司，辦理港灣構造物維護管理政策規劃或實務執行之重要參考。

(2) 106 年 12 月，辦理「花蓮港港灣構造物維護管理系統」教育訓練與成果推廣講習，對象為航港局與臺灣港務公司花蓮港務分公司等，有效提供其辦理港灣構造物維護管理業務之實際應用。

(3) 臺灣港務公司依據監察院對老舊碼頭風險監管及維護管理之質詢，已委請本所辦理 107-110 年「各國際及國內商港港灣構造物維護管理計畫」，並組成專案推動小組，積極推動建立維護管理機制。

(4) 連江縣政府為未來維護港灣設施決策之需要，已委請本所辦理 106-109 年「港灣結構物維護管理系統維運」，積極建立維護管理制度與精進資訊系統之實用功能。

(2) Improved and expanded the old harbor structure maintenance management system, improved operational functions and convenience of use, and added three modules of system announcements, messages and graphics, to enhance interactive communication and feedback, present comprehensive graphic information , and redesign the system use function with Responsive Web Design, to assist the Ports Authorities to enhance their wharf maintenance and control capabilities with information and system based methods under the constraint of limited manpower.

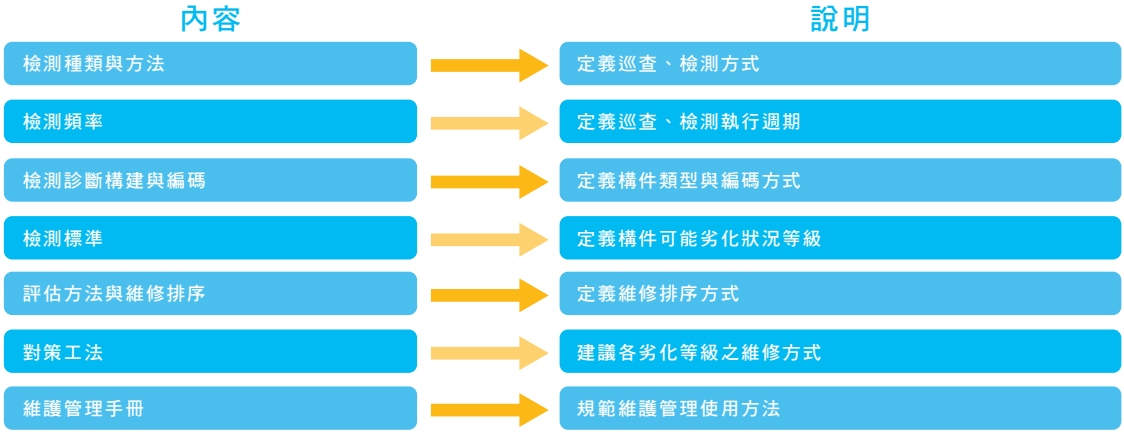
3. Promotion of Outcomes and Benefits

(1) Provide the project outcomes to the Maritime and Port Bureau of the Ministry of Transportation and Communications, the Port Units of Taiwan International Ports Corporation, Harbor Bureau of Kinmen County, Harbor Bureau of Lienchiang County or the Engineering Consultant Companies as the important reference to manage harbor structure maintenance management policy or practical implementation.

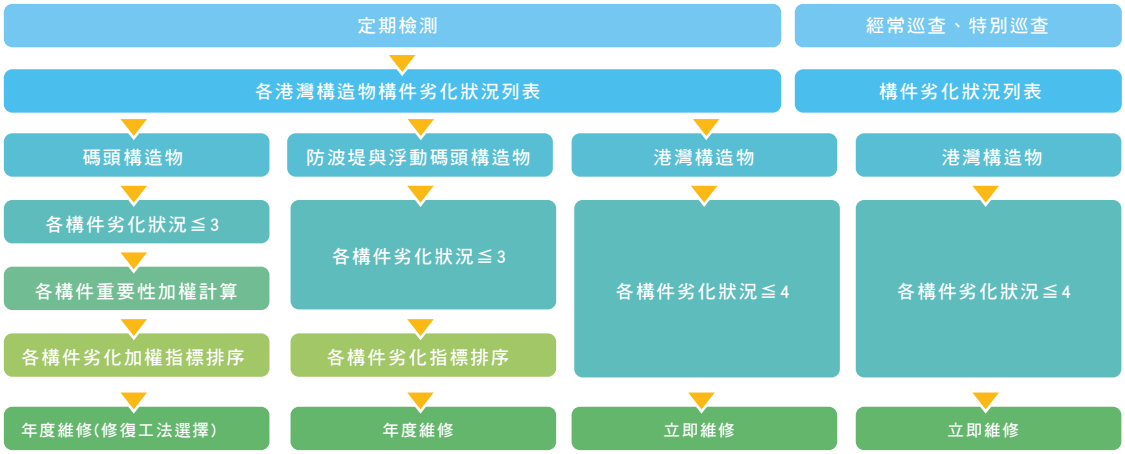
(2) Organized the "Port of Hualien Harbor Structure Maintenance Management System" educational training and outcomes promotion workshop in December 2017for the Maritime and Port Bureau and Port of Hualien of Taiwan International Ports Corporation, to provide them with the practical applications for managing harbor structure maintenance management business.

(3) Based on an interpellation in the Control Yuan on risk supervision management and maintenance management of the old wharfs, the Institute has been appointed to manage the "International and Domestic Commercial Ports Harbor Structure Maintenance Management Plan" for 2018-2021, and has formed a Project Team to establish the maintenance management mechanism.

(4) The Lienchiang County Government has appointed the Institute to manage the "Operation and Maintenance of the Harbor Structure Maintenance Management System" for 2017 - 2020 for the requirements of future maintenance of harbor facility decision-making, to establish the maintenance management system and improve the practical functions of its information system.

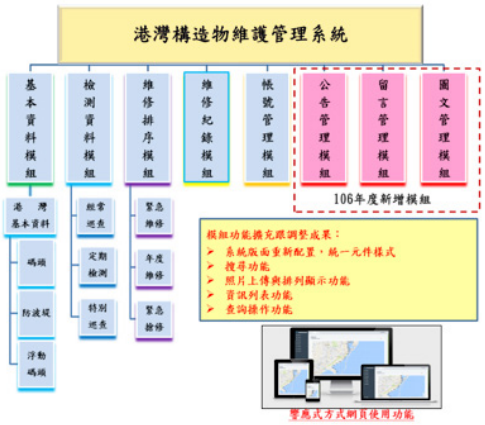


a. 維護管理制度內容



b. 評估方法

港灣構造物維護管理制度內容與評估方法
Harbor Structure Maintenance Management System Content and Assessment Method



a. 系統架構

b. 系統主要內容

港灣構造物維護管理系統架構與主要內容
Harbor Structure Maintenance Management System Architecture and Main Contents

七、海空運決策支援應用工具之創新發展

(一)國際貨櫃航運網路模型之構建與應用

1. 計畫概述

海運是全球競爭市場，以往在研判全球海運變化對我國港埠影響時，多藉由專家訪談或資料分析等方式進行趨勢發展的研判。本計畫完成國際航運網路模型構建，透過模型的分析，將海運未來可能發展情境，以量化的方式呈現其影響。本計畫以前期所開發之航網模型為基礎，提升模型所涵蓋之海運網路完整度，由原亞太區域為主，提升至涵蓋全球之航線網路，並納入航線與船舶配置的考量及其規模經濟效果。航網模型係以節點與節線表現國際港口與航線，以及貨櫃在港口內於不同航線間之轉運行為，可據以進行情境分析，協助研判海運發展趨勢。

VII. Innovative Development of Decision-Making Support Tools for Marine and Air Transportation

(I) Construction and application of the international container shipping network model

1. Project Overview

Marine transportation is a global competitive market. In the past, when determining the impact of global marine transportation changes on Taiwan's ports, trends were mostly determined through expert interviews or data analysis. This project constructed an international shipping network model to present future potential development scenarios of marine transportation with the method of quantification through analysis by the model. This project is based on a previously developed navigation network model., to enhance the completeness of the marine transportation network covered by the model. Expanded from the original coverage area of the Asia-Pacific it now covers the global route network, and includes considerations of route and vessel positions as well as economies of scale. The navigation network model is to present the international ports and routes with nodes and nodal line, as well as the transshipment activities of the containers in the port between different routes, can be used for scenario analysis and assist in determination of marine transportation trends.

2. 研究成果

藉由本計畫建構之國際航運網路模型進行各項情境分析成果，使以往偏質化研判之海運趨勢預測，得以有數量化之佐證，本計畫研究成果擇要摘述如下：

(1) 港埠費率優惠：模型求解結果顯示若高雄港之轉運成本降為 0，則彎靠高雄港之線航線數將增加約 30%。然航商尚有許多無形成本，例如我國所受之政治限制，對航商而言即為重要之間接成本。而這些無形成本，均無法反映於港埠費率中。

(2) 東協各國成長：模型求解結果顯示若東協各國運量成長 20%，高雄港之航線數將增加約 12%，但東向美東航線將不再彎靠高雄港，同時將在西向美東航線之服務範圍內被邊緣化；若東協各國運量成長 50%，則高雄港之航線數將減為與基本情境相同，但東向美東航線仍不彎靠高雄港。同時西向美東航線將出現延伸化之現象；若東協各國運量成長 100%，則高雄港之航線數將成長約 41%，但若東協各國同時擴充其港口，則高雄港之航線數將大幅衰退 (由 +41% 降為 +20%)。目前我國港口設施仍優於東南亞港口，包括處理大型船舶之能力，但未來若東協各國提升其港口設施及運轉能力，對我國帶來衝擊可能更大，建議港務公司等單位應預為籌謀。

2. Research Outcomes

Conducted various scenario analysis outcomes through the international marine transportation network model so that marine transportation trend forecasts in the previous biased-qualitative determination can be quantified. The outcomes of this project are summarized as follows:

(1) Port Tariff Discount: The model solution results show that if the transshipment cost of Port of Kaohsiung is reduced to 0, the number of routes for Kaohsiung Port of call will increase by about 30%. However, there are still many intangible costs, such as the political restrictions imposed on Taiwan, which is an important indirect cost for ocean carriers that cannot be reflected in the port tariffs.

(2) Growth of ASEAN countries: The model solution results show that if the transportation volume of ASEAN countries grows by 20%, the number of routes for Port of Kaohsiung will increase by about 12%, but the eastbound US East Coast route will no longer call at Kaohsiung Port, and will marginalize the service area of the westbound US East Coast route at the same time. If the transportation volume of ASEAN countries grows by 50%, then the number of routes for Port of Kaohsiung will be reduced to the same as the basic scenario, but the eastbound US East Coast route will not call at Port of Kaohsiung. At the same time, the westbound US East Coast route will be extended; if the transportation volume of ASEAN countries grows by 100%, then the number of routes for Port of Kaohsiung will grow by about 41%, but if the ASEAN countries expand their ports at the same time, the number of routes for the Port of Kaohsiung will decline sharply (from +41% down to +20%). At present, Taiwan's port facilities are still better than those of the Southeast Asian ports, including capabilities for handling large ships, however, if the ASEAN countries improve their port facilities and operational capabilities in the future, the impact to Taiwan may be greater. It is recommended that the Taiwan International Ports Corporation and other units plan and prepare in advance.

3. 成果推廣與效益

本計畫由巨觀角度建立國際航運網路模型，提供一全球化視野之貨櫃航運變化分析工具，其研究成果推廣與效益說明如下：

(1) 106 年 12 月，將成果以「容許資訊不完整之國際貨櫃航運網路模型」投稿運輸計劃季刊，提供各界參考。

(2) 107 年 4 月，摘整本計畫重要內容納入「2017 年海空運重要議題」，陳報交通部。

(3) 107 年 5 月，將本計畫研究報告函送交通部航港局與臺灣港務公司等單位參據。

(4) 另本計畫相關成果亦表現於本所辦理之海運相關計畫審查與意見研提，包括：

a. 106 年 12 月、107 年 1 月針對臺灣港務公司提報修正「近期全球海運聯盟重組與國際海運發展情勢分析報告」研提意見案；

b. 107 年 3 月針對臺灣港務公司所擬「如何維持高雄港千萬 TEU 大港地位對策」報告，經該公司函請本所協助針對高雄港貨櫃成長趨緩之可能因素 (包含進出、轉口貨源) 及相關因應方式，提供相關資訊案。

3. Promotion of Outcomes and Benefits

This project established the International Marine Transportation Network Model from a macroscopic point of view, and provided the analysis tools for container marine transportation changes from a global perspective. The promotion of the research outcomes and benefits are as follows:

(1) An outcomes paper titled "International Container Marine Transportation Network Model with Allowance of Incomplete Information" was submitted to the Quarterly Journal of Transportation Planning in December 2017 to provide reference for all sectors.

(2) Summarized the important content of this project to be included in the "2017 Important Issues on Marine and Air Transportation" and reported to the Ministry of Transportation and Communications in April 2018.

(3) The research reports of this project were delivered to the Maritime and Port Bureau of the Ministry of Transportation and Communications and the Taiwan International Ports Corporation for their references in May 2018.

(4) The outcomes of this project were also presented in marine transportation related project reviews and opinion proposals organized by the Institute, including:

a. In December 2017 and January 2018, the Institute submitted a revised "Analysis Report for the Recent Global Shipping Alliance Reorganization and International Shipping Development Situation" to the Taiwan International Ports Corporation for comments.

b. In March 2018, the Institute provided information on the " Countermeasures to Maintain the Multi- Million TEU Large Port Status for the Port of Kaohsiung" planned by Taiwan International Ports Corporation, and the Corporation requested the Institute to provide further data on possible factors behind the slowing growth of container volume (import/export and transshipment) for the Port of Kaohsiung and potential responses.

東協十國運量成長 100% 高雄港遠東區域航線圖
Route Map of Kaohsiung Port Far East Area with
Transportation Volume Growth of 100% for the ASEAN 10 Countries

(二) 國際海運資料庫之建置與應用

1. 計畫概述

當前全球經濟版圖變化快速，海上貨物運輸情勢亦隨之劇烈起伏，我國位居東亞中心，四面環海，雖曾享受多年的海上運輸榮景，但近年來之變化對我國相當不利，2017 年全球貨櫃港排名，高雄港從原本第 14 再下降至第 16，值得政府高度關注並妥善因應。

高品質政策之形成與評估，需要高品質的科學化分析；而高品質的數據，則為高品質政策所不可或缺之元素。鑑於貨櫃運輸為我國海上運輸重心，且海上貨櫃運輸具有全球性，因此本所建置「國際海運資料庫」，長期蒐集全球海洋貨櫃運輸之主航線及區域航線資料，建置並精進相關資料的統計分析及繪圖功能，同時在年末依據當年度各季資料變化，進行議題分析。

(II) Construction and application of international marine transportation database

1. Project Overview

The current global economic landscape changes rapidly, and the situation of maritime cargo transportation also fluctuates violently. Taiwan is located in the center of East Asia and surrounded by sea. Although we have enjoyed many years of maritime transportation, the changes in recent years have been quite unfavorable to Taiwan. In the ranking of 2017 Global Container Ports, the Port of Kaohsiung slide from the 14th to the 16th, which warrants high attention and proper response for the Government.

The formation and evaluation of high-quality policies requires high-quality scientific analysis, and high-quality data is an indispensable element of high-quality policies. In view of the fact that container transportation is the focus of maritime transportation for Taiwan, and maritime container transportation is global in nture, we built the "International Maritime Transportation Database" to collect the main and regional navigation routes information of global ocean container transportation for the long term, build and improve the statistics of related information and visualize its functions, and conduct issue analysis based on the seasonal data changes of current year at the end of year.

2. 研究成果

(1) 已蒐集 2011 Q2 至 2018 Q4 間國際貨櫃運輸網路資料，可作為船舶大型化、聯盟重組、巴拿馬運河拓寬等對航商航線部署行為影響之分析工具。

(2) 2016 年之前以遠東為中心，每季約蒐集 600 條航線；2017 年起擴大蒐集全球所有貨櫃定期航線，每季約蒐集 1,500 至 1,550 條航線，以運能計，所蒐集航線約達全球所有運能之 93%，資料已相當完整，使相關分析可以更為全面而準確。

(3) 完成弓形圖產製、互動地圖顯示及資料庫條件篩選等軟體，並整合為可相互協調支援之軟體系統，使數量龐大的資訊得以具體而視覺化地呈現。

(4) 針對港口連結度分析、新聯盟航線佈署分析以及區域航線型態進行議題式分析，研析成果可供航政司、航港局及港務公司等單位作為策略研擬評估之參考。

2. Research Outcomes

(1) The international container transportation network data between 2011 Q2 and 2018 Q4 has been collected, which can be used as the analysis tool for the impact of ship upsizing, shipping alliance reorganization, and Panama Canal widening on the route deployment activities by ocean carriers.

(2) Focused on the Far East prior to 2016, about 600 routes were collected every quarter. Since 2017,the collection has eanded to cover all global regular container routes , with about 1,500 to 1,550 routes collected every quarter. These collected routes cover about 93% of all global transportation capacity and the data are quite complete enabing more comprehensive and accurate analysis.

(3) Completed the software of Segmentation Chart production, interactive map display and database condition screening, and integrated these into asoftware system that can coordinate and support each other, so that a large amount of data can be presented in a concrete and visual manner.

(4) Conducted issue-oriented analysis on port connectivity, new alliance route deploymentsand regional route types. The outcomes of this research and analysis can serve as reference for strategy development by the units of the Department of Navigation and Aviation, Maritime and Port Bureau and Taiwan International Ports Corporation.

3. 成果推廣與效益

本所海運資料庫已累積多年貨櫃航線資料，未來除持續蒐集最新資料，也將將精進資料庫之使用者介面與統計分析功能俾充分發揮資料庫之效益，其研究成果推廣與效益說明如下：

(1) 106 年 5 月，函送 2011 年第 2 季至 2016 年第 2 季航線統計資料，供部航政司、統計處、交通部航港局、臺灣港務股份有限公司參用。

(2) 106 年 12 月，舉辦座談會，邀集交通部、航港局、港務公司與學界先進與會交流，就資料庫系統功能提升及應用等提供發想及建議。

(3) 107 年 1 月、2 月，應航港局需要，提供我國與新南向國家間及新南向國家間 106 年航線營運資料。

(4) 107 年 4 月，於交通部第 31 次業務會談報告「國際海、空運資料庫建置維護與資料分析」。

(5) 107 年 12 月，規劃辦理座談會，邀集交通部、航港局、港務公司與學界等進行成果交流，以提升資料庫系統運用並研討未來精進方向。

(6) 由於資料來源受保密條款限制，後續仍將賡續在合乎保護約定的範圍內，以產製統合圖表方式提供交通部、航港局及港公司進行政策研擬參據。

3. Promotion of Outcomes and Benefits

The marine transportation database of the Institute has accumulated many years of container route data. In addition to continuing to collect the latest information, the user interface of database and the analysis functions will be improved in order to bring the benefits of database into full function. The promotion of the research outcomes and benefits are as follows:

(1) The route statistics data from the second quarter of 2011 to the second quarter of 2016 were delivered by mail in May 2017 as reference for the Department of Navigation and Aviation, Department of Statistics, Maritime and Port Bureau of the Ministry of Transportation and Communications, and Taiwan International Ports Corporation.

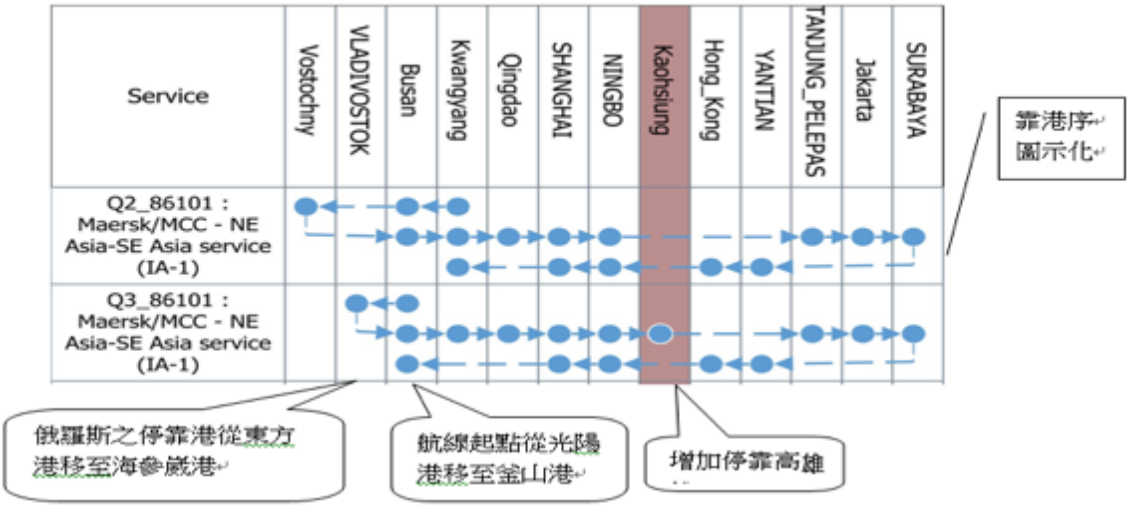
(2) Asymposium was held in December 2017 attended by the Ministry of Transportation and Communications, Maritime and Port Bureau, Taiwan International Ports Corporation and academic leaders. Ideas were exchangedand recommendations given on the enhancement and application of the database system functions.

(3) The 2017 route operation information between Taiwan and the New Southbound Countries as well as between the New Southbound Countries was provided in January and February of 2018, in response to the needs of the Maritime and Port Bureau.

(4) In April 2018, the "Construction, Maintenance and Data Analysis of the International Marine and Air Transportation Database" report was presented in the 31st internal conference of the Ministry of Transportation and Communications.

(5) A symposium was held in December 2018 attended by the Ministry of Transportation and Communications, Maritime and Port Bureau, Taiwan International Ports Corporation and the academic community. The outcomes were discussed to enhance the use of database system and explore future directions of improvement.

(6) Since data souces are subject to confidentiality provisions, the database will continue to be provided as a reference to conduct policy development for the Ministry of Transportation and Communications, Maritime and Port Bureau, Taiwan International Ports Corporation in form of graphic charts and diagrams within the scope of data protection agreement.



航線 86101 2017 年 Q2 及 Q3 之運行路線比較（弓形圖）
Operating Routes Comparison of Navigation Route 86101 Q2 and Q3, 2017 (Segmentation Chart)

(三) 桃園機場空域微觀模擬模式之構建

1. 計畫概述

空域容量為掌握我國機場容量提升之重要要素之一，為此須有一專門工具進行分析，國外現有套裝軟體如 SIMMOD、TAAM 等，動輒需數十萬至近千萬元 (新臺幣) 費用才能購得，其費用甚高且系統功能未必完全符合我國空域管理需求，另外核心技術全然掌握於廠商當中，當需要新增功能時，則可能須額外付費。基於此，為探討及分析我國空域容量，需建置符合我國空域特性之模擬模式，以模擬空域航機運作情形，同時提升我國自主分析民航空域容量之研究能量。

2. 研究成果

(1) **完成終端管制區域模擬：**系統藉由平面 (經緯度位置) 及高程資訊，組合出航機在 3 度空間中之運行狀況。

(2) **完成桃園機場空側及停機坪模擬：**系統可以微觀顯示出航機於桃園國際機場之場面運行狀況，包括航機離場、到場，以及拖機狀態，另外也可顯示停機坪占用情況。

(3) **模擬驗證結果：**機場常以單位時間內可起降之航空器數作為容量之重要指標，因此本研究蒐集模擬過程中，每小時起降之航空器數量，並與 106 年 6 月 30 日當天桃園國際機場全天各小時實際到離場之航空器數量統計相比。實際全日當中，到場最高的 1 小時為 29 架次，離場最高的 1 小時為 30 架次，離到場合計時，最高的 1 小時為 43 架次。而系統模擬結果顯示到場最高的 1 小時為 24 架次，離場最高的

(III) Construction of micro simulation model of Taoyuan Airport airspace

1. Project Overview

Airspace capacity is one of the important factors to grasp airport capacity increase of Taiwan, and there must be a special tool to conduct analysis for this purpose. The current foreign software packages such as SIMMOD, TAAM, etc., easily need to spend hundreds of thousands to nearly 10 million (NTD) to purchase, and the expense is very high but the system function may not fully meet the airspace management requirements for Taiwan. In addition, the core technology is totally controlled by the manufacturer, and additional expenses may be required to pay when new functions are needed. Based on this, in order to explore and analyze the airspace capacity of Taiwan, it is necessary to build a simulation model that conforms to our airspace characteristics, to simulate the operation of airspace aircraft, and to improve the research energy of independent analysis of civil aviation capacity for our country.

2. Research Outcomes

(1) **Completed the terminal control area simulation:** The system composed the operation status of the aircraft in the three-dimensional space by plane (latitude and longitude position) and elevation information.

(2) **Completed of the airside and apron simulation of Taoyuan Airport:** The system can microscopically display the operation status of the aircrafts on the Taoyuan International Airport surface, including the departure and arrival of aircraft, and the status of aircraft tow, as well as the display of occupancy status of aprons.

(3) **Simulation verification results:** Airports often uses the number of aircraft that can take off and land per unit time as an important indicator of capacity. Therefore, this research collected the numbers of aircraft that take off and land every hour during a simulation, and compared those with the number of aircraft actually landing at and departing from Taoyuan International Airport every hour of the day of June 30, 2017 . During the actual entire day, the maximum number of arrivals in 1 hour was 29 flights, and the maximum number of departure in 1 hour was 30 flights, and the maximum number was 43 flights in 1

1 小時為 27 架次，離到場合計時，最高的 1 小時為 46 架次；模擬結果顯示與實際情況相似。

3. 成果推廣與效益

本研究已完成空域模擬基本理論分析，初步掌握民航空域容量分析之重要組成單元與關鍵參數，並建立模擬模式雛型，其研究成果推廣與效益說明如下：

(1) 106 年 12 月，成果投稿於運輸計劃季刊，提供各界參考。

(2) 107 年 5 月，於「海空運決策支援應用工具之創新發展」研討會發表，使各界可以瞭解本所在空域模擬方面研究之具體成果。

(3) 107 年 11 月，召開座談會，邀請相關專家共同討論，以釐清模式模擬成效。

hour when combining both departures and arrivals. The system simulation results showed that the maximum number of arrivals was 24 flights in 1 hour, the maximum number of department was 27 flights in 1 hour, and the maximum number was 46 flights in 1 hour when combining both departures and arrivals. The simulation results displayed were close to the actual situation.

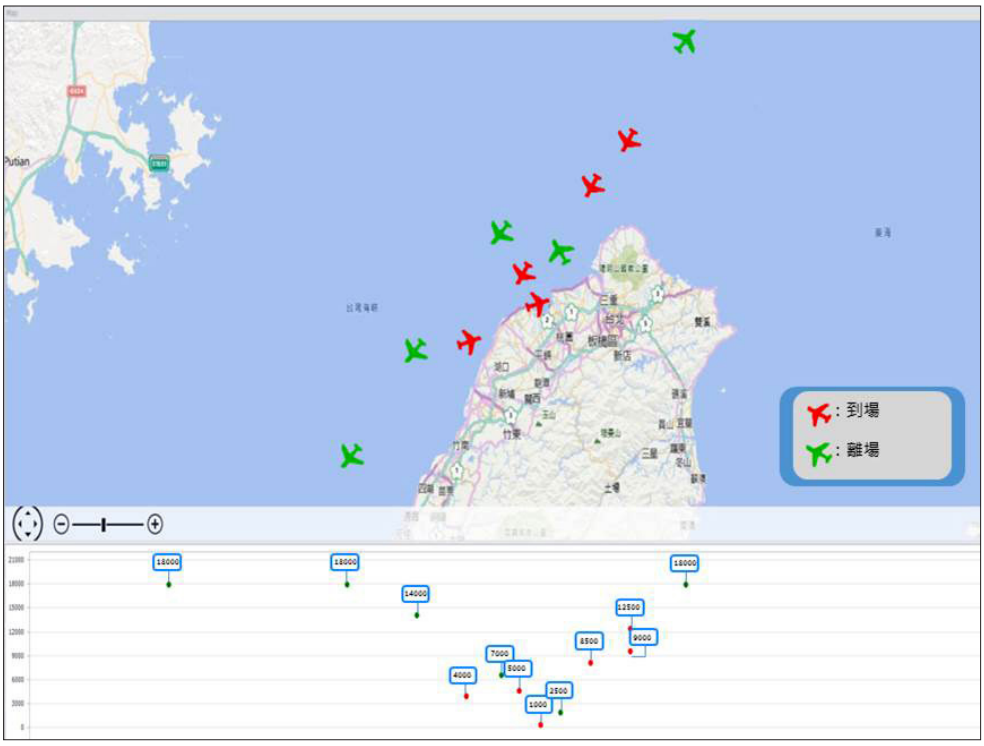
3. Promotion of Outcomes and Benefits

This Research has completed the basic theoretical analysis of airspace simulation, initially grasped the important components and key parameters of the civil aviation airspace capacity analysis, and established a prototype simulation model. The promotion of research outcomes and benefits are as follows:

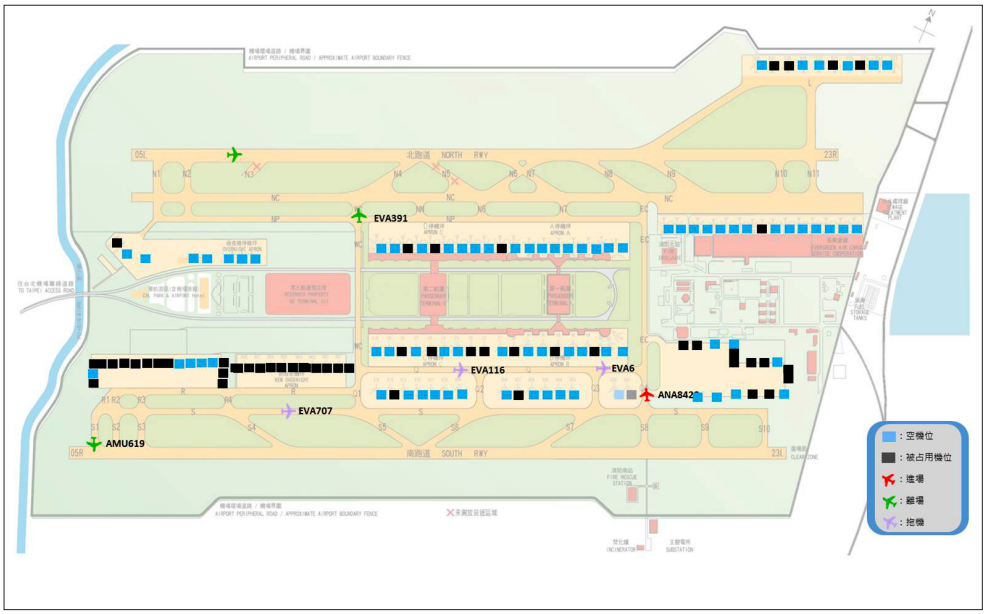
(1) A paper of outcomes was submitted to the Transportation Planning Journal in December 2017, as a reference for all sectors.

(2) A paper title "Innovative Development of Decision-making Support Tools for Air and Sea Transportation" was presented at a Symposium in May 2018, for all sectors to understand the specific outcomes of research in airspace simulation by the Institute.

(3) A symposium was held with experts to discuss and clarify the model's simulation effectiveness in November 2018.



空域模擬顯示視窗
Airspace Simulation Display Window



空側及停機坪顯示視窗
Airside and Apron Display Window

(四) 國際空運資料庫之建置與應用

1. 計畫概述

為掌握國際空運發展趨勢，本研究擴充與更新本所國際空運資料庫，包含購置國際空運上供給與需求面之資料，並運用資料探勘技術，活化資料庫應用範疇，協助本所進行空運相關研究，近年重要研究議題包括「桃園國際機場航空客運起迄分布分析與比較」、「以大數據分析法初探我國與新南向國家航空客運市場供需情形」、「新南向國家與我國及北美四大機場之航空客運起迄分析」等。

2. 研究成果

(1) 106 年持續更新資料並強化功能，包括維護資料庫、更新資料庫內容、改善使用者介面並擴充分析功能、資料之統計分析。

(2) 資料庫目前掌握包括我國、新南向國家、兩岸直航及全球重要航點在內，合計 185 座機場的基本設施、營運和運量資料。

(3) 106 年購置 IATA MarketIS 桃園、仁川、香港、東京成田、新加坡樟宜、上海浦東、杜拜、洛杉磯、舊金山、紐約甘乃迪及溫哥華等 11 座機場之旅客起、迄及中轉資料，並進行議題式分析。

(IV) Construction and application of an international air transportation database

1. Project Overview

In order to grasp the trends in international air transportation, this research expands and updates the international air transportation database of the Institute, including the acquisition of information on the supply and demand side of international air transportation, and uses the data exploration technology to activate the scope of data application, to assist this Institute in conducting air transportation related research. Important research topics in recent years include "Analysis and Comparison of the Origin and Destination Distribution of Air Passenger Transportation in Taoyuan International Airport", "Initial Exploration of the Supply and Demand Situation of Air Passenger Transportation Market of Our Country and New Southbound Countries with Big Data Analysis", "Air Passenger Transportation Origin and Destination Analysis between the New Southbound Countries, Taiwan,and Four Major Airports in North America.

2. Research Outcomes

(1) We continuously updated the data and strengthened the functions in 2017, including maintaining the database, updating the contents of the database, improving the user interface, and expanding the analysis functions and statistical analysis of the data.

(2) The current database includes the data on the basic facilities, operations and traffic volume of 185 airports, including Taiwan, the new southbound countries, direct cross-strait flights and important global destinations.

(3) We purchased the IATA MarketIS passenger origin, destination and transit information of 11 airports including Taoyuan, Incheon, Hong Kong, Tokyo Narita, Singapore Changi, Shanghai Pudong, Dubai, Los Angeles, San Francisco, New York Kennedy and Vancouver in 2017, and conducted issue-based analysis.

3. 成果推廣與效益

本資料庫建置以來，已能有效掌握桃園機場與主要競爭機場市場情形，並運用資料庫研析重要課題，其研究成果推廣與效益說明如下：

(1) 105 及 106 年應民航局要求，協助提供國外主要機場設施與營運資料，及經由香港及仁川機場中轉歐洲各國旅次資料。

(2) 106 年 11 月 28 日邀請交通部、民航局、桃園機場公司座談，就提升資料庫系統運用、未來分析與精進方向研提建議。

(3) 107 年 4 月 3 日於交通部業務會議報告資料庫建置維護與資料分析。

(4) 107 年上半年將邀請交通部航政司、民航局、航空公司座談，分享資料庫中有關新南向國家相關分析結果，供相關政策參考。

3. Promotion of Outcomes and Benefits

Since the establishment of this database, it has been able to effectively grasp the market situation between the Taoyuan Airport and the main competitive airports, and use the database to analyze important issues. The research outcomes promotion and benefits are as follows:

(1) We assisted providing the major overseas airport facilities and operational information, and the travel information in transit to European countries through Hong Kong and Incheon Airports, in response to the request of the Civil Aeronautics Administration in 2016 and 2017.

(2) We invited the Ministry of Transportation and Communications, Civil Aeronautics Administration, and the Taoyuan International Airport Corporation for discussion on November 28, 2017 to propose recommendations on enhancing the usability of the database system, future analysis and directions for improvement.

(3) We reported the database establishment, maintenance and data analysis at an internal conference of the Ministry of Transportation and Communications on April 3, 2018.

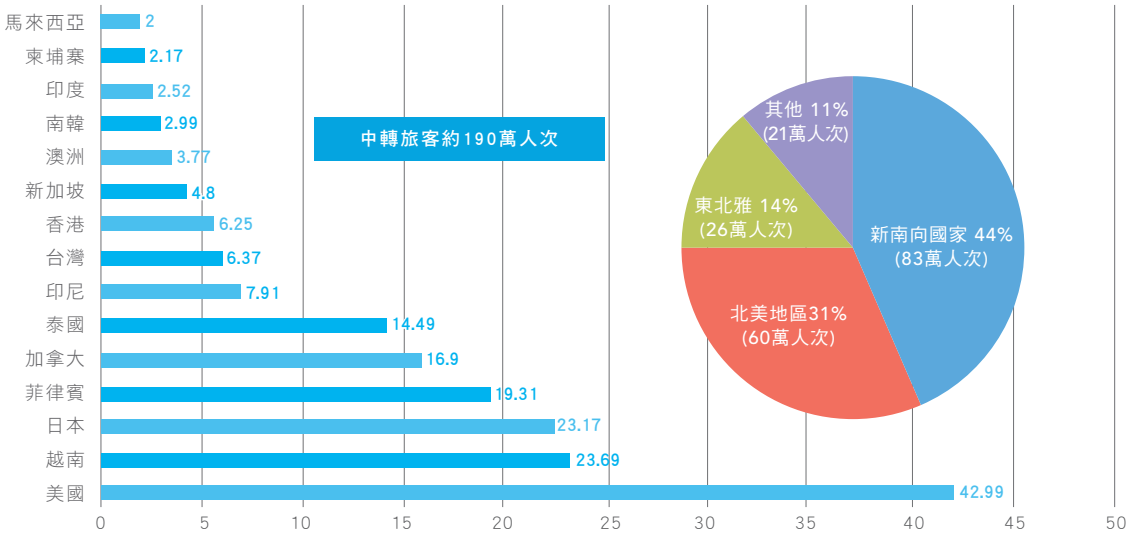
(4) The Institute will invite the Department of Navigation and Aviation, Civil Aeronautics Administration of the Ministry of Transportation and Communications and the airlines for discussion in the first half of 2018, to share the analysis results related to the new southbound countries in the database, as a reference for policy.

亞洲鄰近機場之比較
Comparison of Nearby Airports in Asia

機場	總計（萬人次）			出入境（萬人次）			中轉（萬人次）		
	2015	2016	成長率	2015	2016	成長率	2015	2016	成長率
仁川	4,357	5,126	17.7%	3,921	4,687	19.5%	436	439	0.7%
桃園	3,572	3,958	10.8%	3,413	3,768	10.4%	159	190	19.5%
上海浦東	5,820	6,283	8.0%	5,579	5,971	7.0%	241	312	29.4%
新加坡	4,968	5,265	6.0%	4,285	4,537	5.9%	683	728	6.6%
成田	3,244	3,386	4.4%	2,921	3,045	4.3%	323	341	5.5%
香港	5,708	5,925	3.8%	4,823	5,001	3.7%	886	924	4.3%

新南向國家往返北美四大機場之中轉分析
Transit Analysis of the New Southbound Countries to and from the Four Major Airports in North America

中轉機場	北美四大機場合計（千人次）			美國舊金山、洛杉磯、紐約（千人次）			加拿大溫哥華（千人次）		
	2015	2016	成長	2015	2016	成長	2015	2016	成長
桃園	398.7	541.1	35.7%	291.3	395.6	35.8%	107.4	145.5	35.40%
香港	533.6	720.6	35.1%	351.1	394.4	12.4%	178.5	322.2	80.50%
仁川	575.9	711.6	23.6%	526.7	637.5	21.0%	45.1	70.1	55.40%
杜拜	946.8	1,081.90	14.3%	889.2	1,009.90	13.6%	57.5	72.1	25.30%
成田	472.3	504.4	6.8%	400.6	438.3	9.4%	67.7	62	-8.40%
新加坡	83.4	78.3	-6.2%	78.1	72.4	-7.3%	1.3	1.8	38.90%



利用桃園機場中轉之主要國家 / 區域
Major Countries/Regions Use Taoyuan Airport for Transit

八、氣候變遷環境下運輸部門之因應作為

（一）氣候變遷鐵公路之風險評估方法及調適策略

1. 計畫概述

氣候變遷對於各國基礎設施造成的衝擊愈加明顯且嚴重，聯合國政府間氣候變遷專門委員會 (IPCC) 於第四次氣候評估報告，提出氣候變遷衝擊風險意涵，說明氣候變遷風險應考量危害及脆弱程度。

「國家氣候變遷調適政策綱領」揭櫫我國國家層級之調適政策目標，溫室氣體減量管理法亦明文規定，中央目的事業主管機關應進行調適策略之研議。交通系統為重要之基礎設施，其中又以路網密集之鐵公路系統提供主要之輸運服務。爰本所以鐵公路系統為研究範疇，評估在氣候變遷下各路段發生淹水及坡災，導致無法通行及影響社經程度之風險，作為鐵公路管理機關研提細部具體調適行動計畫之參據。

VIII. Response of Transportation Sectors in Climate Change Environment

(I) Risk assessment and adaption action plan of climate change on railway and highway system

1. Project Overview

The impact of climate change on the infrastructure of various countries is increasingly obvious and serious. The United Nations Intergovernmental Panel on Climate Change (IPCC) has presented the risk implications of climate change impact in the 4th climate assessment report, explaining the hazards and vulnerabilities to be considered in the climate change risks.

The "Adaptation Strategy to Climate Change in Taiwan" unveils the national level adaptation strategy objectives of Taiwan. The Greenhouse Gas Reduction and Management Act also stipulates that the central competent authorities in charge of the key business sectors must conduct research on adaptation strategies. The transportation system is an important infrastructure with the road network of intensive railways and highways system that provide the main transportation services, therefore, this Institute takes the railways and highway system as the scope of its research to evaluate the flooding and slope disasters in various road sections under climate changes that resulted in the risks of inability to pass and degree of impact to society and economy, as a reference for the railways and highways management agencies to propose detailed specific adaptation action plans.

2. 研究成果

(1) **加值應用相關機關既有資料，建立鐵公路氣候變遷風險評估方法：**以二維矩陣 (風險＝危害度 x 脆弱) 分析鐵公路各路段淹水及坡災風險等級；危害度採用淹水模擬圖資 (水利署) 及坡地崩塌機率模式 (中興工程社)；脆弱度以各路段之交通量、路段服務範圍之鄉鎮產值、預警監測能力及設施安全性作為評估指標。

(2) **建置鐵公路氣候變遷調適資訊平台：**以 SuperGis 軟體建立國道、省道、快速公路、高鐵及臺鐵等系統之氣候變遷風險資訊平台。提供管理機關線上查詢，所轄設施在氣候變遷不同重現期雨量下各路段之危害度、脆弱度以及風險等級。

(3) **完成鐵公路氣候變遷調適行動方案建議：**透過鐵公路氣候變遷風險評估、設施管理機關問卷調查及訪談，掌握災點發生成因、改善成效，盤點鐵公路調適缺口。以評估工具面、風險管理面、設施韌性面、災後復建面、跨域整合面等五大面向，歸納 31 項行動方案建議。

2. Research Outcomes

(1) **We established an assessment method for climate change risks of railways and highways using the existing data of agencies with added value:** Analyze the flooding and slope disaster levels of each road section of railways and highways with a two-dimensional matrix (risk = level of harm x vulnerability); the level of harm uses flooding simulation map data (Water Resources Agency) and a landslide probability model (Sinotech Engineering Consultants, Inc.); vulnerability is based on the traffic volume of each road section, the township production output value of the road section service area, early warning monitoring capability and facility safety as the assessment indicators.

(2) **We constructed the Railways and Highways Climate Change Adaptation Information Platform:** We established a Climate Change Risk Information Platform for national highways, provincial highways, expressways, high-speed rails and Taiwan railways with SuperGis software. We provided an online inquiry interfacefor management agencies to query the degree of harm, vulnerability and risk level of the various road sections of the facilities under their jurisdiction in different recurrence periods of climate change.

(3) **We completed the recommendations for Railways and Highways Climate Change Adaptation Action Plan:** Through the railways and highways climate change risk assessment, a facility management agency questionnaire survey and interviews to grasp the causes of disaster points, we improved the effectiveness and inventoried the railways and highways adaption gap. With the five major aspects of assessment tools, risk management, facility toughness, post-disaster reconstruction, cross-field integration we summarized 31 recommendations for the Action Plan.

3. 成果推廣與效益

(1) 於第七屆亞洲區域科學研討會發表「A GIS-based Tool for Adaptation Analysis for Taiwan’s Highway and Railways」，向學研各界推廣本計畫研究方法及 GIS 平台工具。

(2) 近 3 年定期邀集部屬機關 (公路總局、臺鐵局、高公局、高鐵局、鐵工局、高鐵公司) 辦理鐵公路氣候變遷調適資訊平台教育訓練，推廣氣候變遷調適概念及平台功能，使公路總局、臺鐵局等機關運用於實際設施管理養護業務。

(3) 本計畫主要成果係在鐵公路設施管理機關人力及資源有限下，提供其快速掌握全臺路網初始風險資訊，並推廣提供公路總局、臺鐵局等機關，進一步檢視確認高風險成因及推動具體改善計畫，以有效提升鐵公路系統調適能力。

3. Promotion of Outcomes and Benefits

(1) We presented the "A GIS-based Tool for Adaptation Analysis for Taiwan's Highway and Railways" at the 7th Asian Regional Science Symposium to promote the research methodology and GIS platform tools to all academic and research sectors.

(2) The Institute has regularly invited the agencies (Directorate General of Highways, Taiwan Railways Administration, Freeway Bureau, Bureau of High Speed Rail, Railway Reconstruction Bureau, and Taiwan High Speed Rail Corporation) over the past three years, to organize education and training on the Railways and Highways Climate Change Adaptation Information Platform, and promote the climate change adaptation concept and platform functions to enable the Directorate General of Highways, Taiwan Railways Administration and other agencies to apply the platform in their actual facilities management and maintenance operations.

(3) The main outcomes of this project are to provide a rapid grasp of initial risk information of the entire Taiwan road network for the Railways and Highways Facility Management Agencies under the constraints of their limited manpower and resources, promote and provide the Directorate General of Highways, Taiwan Railways Administration and other agencies to further examine and confirm the high risk causes and promote the specific improvement plans, to effectively improve the adaptation capability of railways and highways systems.

風險(5等級)＝危害度X脆弱度

整合部外單位及交通部跨局處資料，加值產製風險資訊。

危害度指標：

1.淹水潛勢(淹水潛勢圖)

2.坡災潛勢(崩塌機率模式)

搭配設施型式(路網數值圖)

脆弱度指標：

1.潛在影響程度
- 交通量(運輸部門決策支援系統)
- 產值(運輸部門決策支援系統)

2.運輸設施調適能力
- 預警應變作為(設施管理單位)
- 替代道路數(GIS地圖分析)
- 設施安全性(設施管理單位)

風險矩陣		危害度				
		低	中低	中	中高	高
脆弱度	低	低	低	中低	中	中
	中低	低	中低	中	中	中高
	中	中低	中低	中	中高	中高
	中高	中低	中	中	中高	高
	高	中	中	中高	高	高

鐵公路氣候變遷風險評估指標及矩陣圖
Railways and Highways Climate Change Risk Assessment Indicators and Matrix Diagram

鐵公路氣候變遷調適資訊平台畫面圖
Screenshot of Railways and Highways Climate Change Adaptation Information Platform

（二）運輸部門第一期溫室氣體排放管制目標之減量作為

1. 計畫概述

為推動國家溫室氣體減量政策，環保署依據溫管法規定，擬訂國家因應氣候變遷行動綱領及溫室氣體減量推動方案。交通部依溫管法暨施行細則規定，擬定運輸部門溫室氣體排放管制行動方案，作為我國運輸部門推動溫室氣體減量之依循，並作為直轄市、縣（市）依溫管法訂定溫室氣體管制執行方案之依據。

運輸部門為我國溫室氣體排放第三大部門，以公路運輸排放為最大宗，占比達95.87%；公路運輸排放又以小客車 51% 最高、其次是大貨車 18%。運輸部門於溫室氣體減量推動工作，主要面臨的挑戰包含「公共運輸成長率亟待提升」、「傳統化石燃料的依賴性高」以及「老舊車輛占比逐年增加，運輸系統能源效率待提升」，亟需在這些面向著力以達成減量目標。

(II) Reduction activities of the first phase greenhouse gas emission control objectives for the transportation sector

1. Project Overview

In order to promote the national greenhouse gas reduction policy, the Environmental Protection Administration has developed a national action guideline for climate change and a greenhouse gas reduction promotion program in accordance with the provisions specified in the Greenhouse Gas Reduction and Management Act. The Ministry of Transportation and Communications has developed the Transportation Sector Greenhouse Gas Emission Control Action Plan in accordance with the provisions specified in the Greenhouse Gas Reduction and Management Act and Enforcement Rules, as the basis for Taiwan's transportation departments to follow in promoting greenhouse gas reduction, and as the basis for special municipalities, counties, and cities to establish greenhouse gas control and implementation program in accordance with the Greenhouse Gas Reduction and Management Act.

The transportation sector is the third largest sector of greenhouse gas emissions in Taiwan, with highway transportation emissions its largest proportion, accountingfor 95.87%. Passenger cars are the highest in highway transportation emissions with 51%, followed by large trucks with18%. For promoting greenhouse gas reduction in the transportation sector, the main challenges include "the growth rate of public transportation needs to be improved", "high dependence on traditional fossil fuels" and "the proportion of old vehicles is increasing year by year, and the energy efficiency of transportation systems is to be improved". There are urgent needs to strive on those aspects in order to achieve the objectives of reduction.

2. 研究成果

(1) 配合環保署研訂溫室氣體排放第一期階段管制目標，**協助推估運輸部門能源消費量、各減碳策略節能量**。

(2) 研提運輸部門減量情境、減量貢獻估算，以及**第一階段管制目標運輸部門衝擊影響評估報告**。

(3) 完成**運輸部門溫室氣體排放管制行動方案 (草案)** 之研擬，包含 (a) 發展公共運輸系統，加強運輸需求管理、(b) 建構綠色運輸網絡，推廣低碳運具使用，建置綠色運具導向之交通環境，以及 (c) 提升運輸系統及運具能源使用效率等三大策略，研提 19 項減碳措施。

2. Research Outcomes

(1) We cooperated with the Environmental Protection Administration to research and develop the first-phase control targets for greenhouse gas emissions, and **assisted in estimating the energy consumption of transportation sector, the energy conservation of each carbon reduction strategy.**

(2) We proposed reduction scenarios, estimations of reduction contributions and **the Transportation Sector Impact Assessment Report for the First Phase Control Objective for the transportation sector.**

(3) We completed the development **of transportation sector greenhouse gas emission control action plan (draft)**, including (a) Develop public transportation systems, strengthen transportation requirement management, (b) Construct green transportation networks, promote the use of low-carbon transportation vehicles, and construct the transportation environment oriented in green vehicle, and (c) Improve three major strategies of transportation system and transportation vehicle energy efficiency, and propose 19 carbon reduction measures.

3. 成果推廣與效益

(1) 106 年 10 月 5 日完成「運輸部門溫室氣體排放管制行動方案（草案）」，提送環保署於 11 月 23 日辦理公聽會對外說明，**預計 107 年 6 月底前報行政院核定**。

(2) 核定後之運輸部門之排放管制行動方案可作為後續地方政府訂修溫室氣體管制執行方案之依據。

(3) 透過交通部、環保署、經濟部等部會執行相關措施，預計至 2020 年汽油使用減少約 85 萬公秉、柴油減少約 13 萬公秉、電力增加 4.1 億度，共減少 198 萬公噸溫室氣體排放量。

(4) 以運輸部門排放管制行動方案為基礎，進而支援交通部配合經濟部撰擬能源轉型白皮書，進一步擬訂運輸部門節能計畫 (草案)。

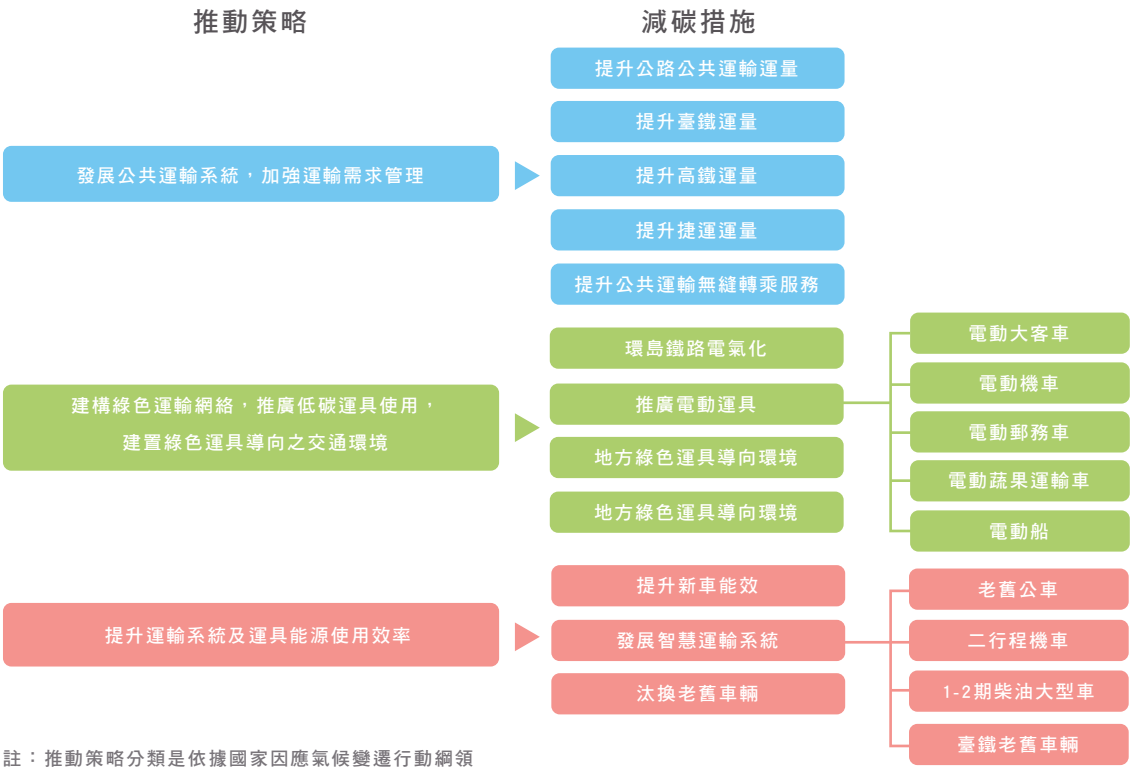
3. Promotion of Outcomes and Benefits

(1) We completed the "Transportation Sector Greenhouse Gas Emission Control Action Plan (Draft)" on October 5, 2017, and submitted it to the Environmental Protection Administration to organize a public hearing for public **explanation on November 23, expecting to submit it to the Executive Yuan before the end of June 2018.**

(2) The approved Transportation Sector Greenhouse Gas Emission Control Action Plan can be used as the basis for the local governments to develop and revise their greenhouse gas control implementation programs.

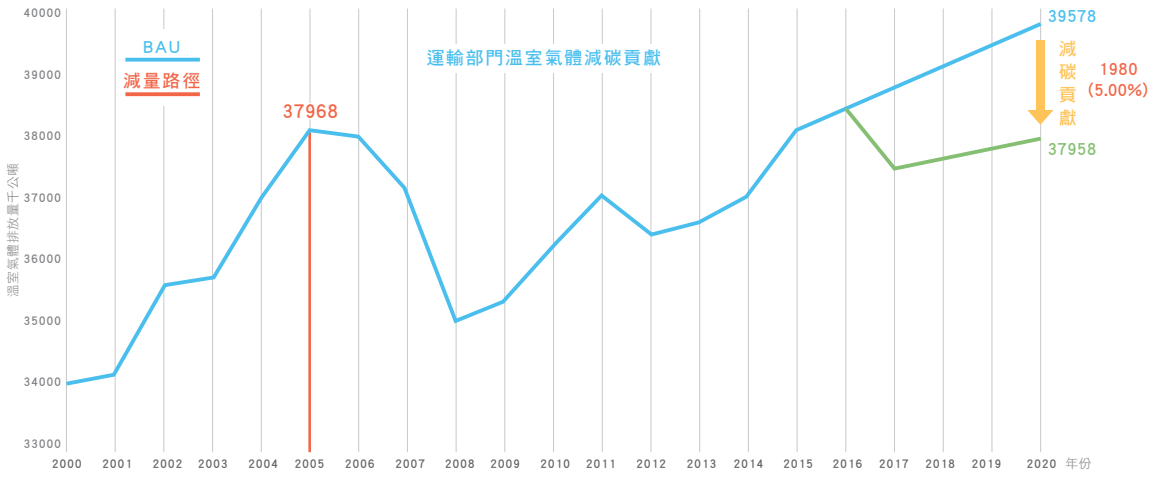
(3) Through the implementation of measures by the Ministry of Transportation and Communications, Environmental Protection Administration and Ministry of Economic Affairs, it is estimated that the use of gasoline will be reduced by approximately 850,000 kiloliters, diesel will be reduced by approximately 130,000 kiloliters, and power use will increase by 410 million kWh, making for a total reduction of 1.98 million metric tons of greenhouse gas emissions by 2020.

(4) Based on the Transportation Sector Emission Control Action Plan, we further supported the Ministry of Transportation and Communications in coordinating with the Ministry of Economic Affairs to draft a white paper on energy transition, and develop the Transportation Sector Energy Conservation Plan (Draft).



註：推動策略分類是依據國家因應氣候變遷行動綱領

運輸部門減碳策略架構圖
Structural Chart of the Transportation Sector Carbon Reduction Strategy



註：依據能源局規劃電力排放係數(2020年0.491公斤CO2/度)，預期2020年可再減量67千公噸

運輸部門減碳貢獻示意圖
Schematic Diagram of Carbon Reduction Contribution of the Transportation Sector

(三) 交通環境空污暴露風險與成因分析

1. 計畫概述

近期民眾日益關注空氣污染問題，都會交通污染成因主要來自車輛排放，交通單位管理思維多在追求營運安全與運輸效率，較輕忽交通源排放空污集中問題對民眾健康影響。環保署推估全國 PM2.5 濃度來源，境內移動污染源約占 30%~37%，為協助交通部掌握交通空污狀況，以及研擬空污防制策略，本計畫透過蒐集國內外交通源細懸浮微粒（PM2.5）暴露實測之研究，以瞭解交通環境空污暴露風險與成因，並研提降低交通污染管理策略建議。

(III) Risk and causes of air pollution exposure in traffic environment

1. Project Overview

Recently, the public is increasingly concerned with the air pollution. The main cause of metropolitan traffic pollution is from vehicle emissions. The management thinking of transportation units is mostly in pursuit of operational safety and transportation efficiency, and pays less attention to the problem of concentrated air pollution emitted by traffic sources that affect public health. The Environmental Protection Administration has estimated the source of PM2.5 concentration in the country, with domestic mobile pollution source accounted for 30%~37%. In order to assist the Ministry of Transportation and Communications to control traffic pollution, as well as develop an air pollution prevention strategy, this project collects research of domestic and foreign traffic sources Particulate Matter (PM2.5) exposure field surveys to understand the risks and causes of air pollution exposure in traffic environments, and proposes recommendations for management strategies for reducing traffic pollution.

2. 研究成果

(1) 完成交通污染文獻彙析

a. **交通環境細懸浮微粒 ($PM^{2.5}$) 暴露之研究：**

(a) 臺北都會區對通勤族之實測 (Liu et al., 2015；Dai-Hua Tsai et al., 2008；龍世俊，2005) 發現不同通勤交通方式，騎機車者 $PM_{2.5}$ 暴露濃度遠高於搭乘公車與捷運公共運輸運具者。

(b) 義大利羅馬公車站候車族群 PM 暴露 (Maurizio et al., 2017) 實測發現公車進出站瞬間會排放出非常大量的超細懸浮微粒 ($PM_{0.1}$)。

b. **交通減污防制策略趨勢：**國際已著重私人管制策略包括車牌管制、進城費與車輛污染分級。國內最近也將透過修法劃設空氣品質維護區與提高老舊車輛之環保標準限制高污染車輛使用。

(2) 建議運輸部門空污防制策略方針

a. **降低整體交通污染排放量策略建議：**包括「研議柴油公車補助落日期限」、「研議加嚴車輛持有條件可行方案，減緩車輛成長速度」、「研議隨車齡 / 車種加收年附加空污費」，以及「增訂大貨車能效標準」等。

b. **降低交通微環境暴露措施建議：**「車輛分級標示，並禁止高污染車輛進入空品區」、「研議改變大客車排氣管位置 (朝上)」、「推動機車停等紅燈時怠速熄火」、「種植吸附 PM2.5 效率較高行道樹」。

2. Research Outcomes

(1) We completed a traffic pollution literature analysis

a. **Research on the exposure of Particulate Matter ($PM^{2.5}$) in traffic environment:**

(a) The field survey of Taipei Metropolitan Area on commuters (Liu et al., 2015; Dai-Hua Tsai et al., 2008; Shih-Chun Candice Lung, 2005) found that in different commuter modes of transportation, the exposure of PM2.5 for motorcyclists is much higher than the commuters riding public transportation vehicles of bus and MRT.

(b) PM exposure of the bus waiting groups at bus stops in Rome, Italy (Maurizio et al., 2017), the field survey found that a very large amount of ultrafine particle fraction ($PM_{0.1}$) was emitted instantaneously from the bus arrivingn at and leaving from the bus stops.

b. **Traffic Pollution Reduction and Control Strategy Trends:** The international focus has been on private control strategies including license plate control, city access fees and vehicle pollution grading. Recently, we will also limit the use of high pollution vehicles by delineating air quality maintenance zones and raising the environmental standards of old and used vehicles through amending the law.

(2) We recommended air pollution prevention strategies and guidelines to the transportation sector

a. **Recommendations for reducing overall traffic pollution emissions strategies:** including "Proposal on a phase-out deadline for diesel bus subsidies", "Proposal onf the feasibility program for tightening the vehicle possession conditions, slowing down the growth rate of vehicles", "Proposal on levying additional annual air pollution by age and type of vehicles", as well as "Augment Energy Efficiency Standards for Large Trucks".

b. **Recommendations for reducing the traffic micro-environment exposure measures:** "Vehicle classification labeling and prohibiting high pollution vehicles from entering air quality zones", "Proposal to change the position of bus exhaust pipes (upward)", "Promote motorcycles to Turn off their Engines while Idling while waiting at Red Light", "Plant street trees with higher adsorption of PM2.5".

3. 成果推廣與效益

(1) 106 年 7 月就階段性文獻回顧重點，於交通部業務會談向部長及有關機關首長簡報，使了解交通環境汙染源 PM2.5 暴露情形及規劃減污策略之重要性。

(2) 106 年 11 月研擬「降低交通污染源管理措施之建議」五大策略 14 項措施及 37 項建議推動工作，向部長及本部機關首長簡報，多數建議獲得部長認同，並指示相關業務司及部屬機關化為實際行動。

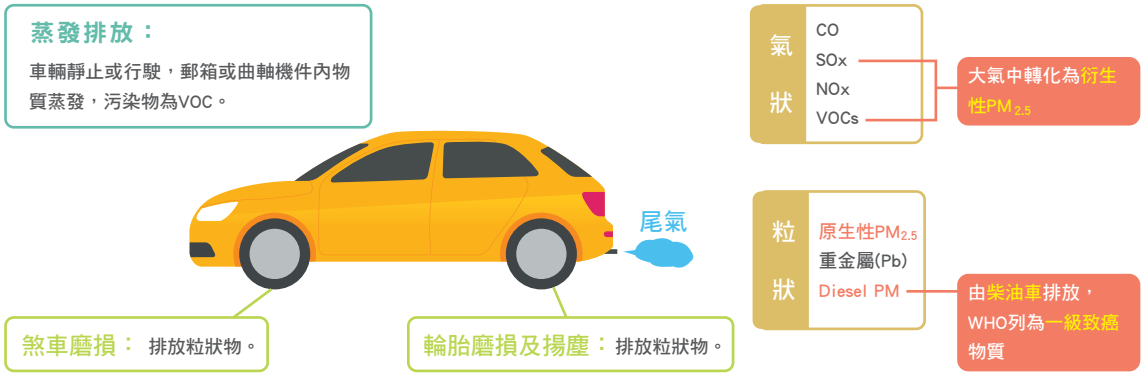
(3) 107 年 4 月撰擬「臺北地區通勤族群暴露 PM2.5 濃度之比較」科普短文，希透過交通部美好生活連結者社群，向機車騎士宣導高度暴露 PM2.5 對健康之傷害，以改變機車騎士運具選擇行為。

3. Promotion of Outcomes and Benefits

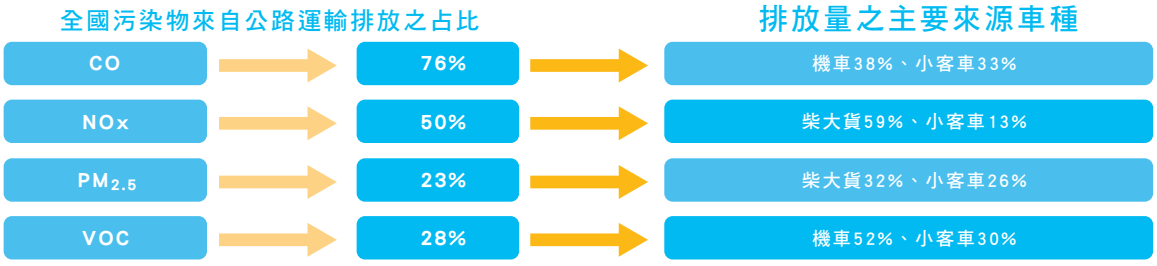
(1) We briefed the Minister and heads of agencies in an internal conference of the Ministry of Transportation and Communications in July 2017, on the focus of phased literature review, for them to understand the importance of PM2.5 exposure from traffic environment pollution sources and conduct planning on pollution reduction strategies.

(2) We developed 5 major strategies, 14 measures and 37 recommendations of promotional works in the "Recommendations for Reducing Traffic Pollution Source Management Measures" in November 2017, and briefed the Minister and heads of agencies under the ministry. Most of the recommendations were approved by the Minister and the departments and subordinated agencies were instructed to turn the recommendations into practical actions.

(3) We composed the "Comparison of Commuters Exposed to PM2.5 Concentration in Taipei Area" popular science short essay in April 2018, to promote the knowledge that high PM2.5 exposure is harmful to the health of motorcyclists through the Good Life Connector Social Networking Community (Facebook) of the Ministry of Transportation and Communications, to change the behavior of vehicle selection for the motorcyclists.



交通污染源排放污染物來源
Source of Pollutants Emitted from the Traffic Pollution Source



環保署 TEDS9.0 推估空氣污染物來自公路運輸之占比
Percentage of Air Pollutants from Road Transportation Estimated by Environmental Protection Administration TEDS 9.0

臺北都會區，比較不同通勤模式之$PM_{2.5}$暴露濃度

◆各通勤族群之暴露濃度比較(2005年1月~4月)：

機車（67.5 μg/m³）>>公車（38.5 μg/m³）>捷運（35.0 μg/m³）

指標等級	1	2	3	4	5	6	7	8	9	10
分類	低	低	低	中	中	中	高	高	高	非常高
$PM_{2.5}$ 濃度 (μg/m³)	0-11	12-23	24-35	36-41	42-47	48-53	54-58	59-64	65-70	≥71

臺北都會區通勤者暴露實測說明
Taipei Metropolitan Area Commuter Exposure Field Survey Description

(四) 都會運輸節能減碳評估模組之應用

1. 計畫概述

為支援交通部推動節能減碳業務，評估交通管理策略減碳成效，本計畫於運輸部門政策決策支援系統，導入臺北都會運輸需求模式，並開發都會運輸節能減碳策略評估模組。另藉由探討「臺北都會區公車與捷運雙向轉乘優惠」與「提高臺北市中心停車成本」都會交通措施之減碳效益，展示都會運輸節能減碳策略評估模組之評估功能，以及比較不同交通管理策略對於都會運輸系統之能耗及碳排放變化趨勢影響，作為交通部門研擬減量措施之參考。

(IV) Application of metropolitan transportation energy conservation carbon reduction evaluation module

1. Project Overview

In order to support the Ministry of Transportation and Communications to promote energy conservation carbon reduction businesses and evaluate the effectiveness of transportation management strategies in reducing carbon emissions, this project introduced the Taipei Metropolitan Transportation Requirements Model into the transportation sector policy decision making support system, and developed the Metropolitan Transportation Energy Conservation Carbon Reduction Strategy Evaluation Module. It also presented the evaluation functions of Metropolitan Transportation Energy Conservation Carbon Reduction Strategy Evaluation Module through exploring the carbon reduction benefits of "Taipei Metropolitan Area Bus and Mass Rapid Transport Two-way Transfer Discount" and "Improving the Parking Cost in the Downtown of Taipei City", and compared the impact of different traffic management strategies on changes inenergy consumption and carbon emission trends of the metropolitan transportation system, as a reference for transportation departments to develop their carbon reduction measures.

2. 研究成果

(1) **以臺北都會區為優先探討地區，開發都會運輸策略節能減碳模組：**透過臺北都會區運輸需求預測模式 (TRTS-4S) 運輸活動量推估結果，進行都會尺度節能減碳運輸策略探討。

(2) **應用都會運輸節能減碳策略評估模組，進行案例分析：**探討臺北都會區 (含新北市) 「公車與捷運雙向轉乘優惠」與「提高臺北市中心停車成本」措施對於運輸活動、能耗與碳排之影響。

a. 在假定分析交通工具使用能源別不變條件之下，取消轉乘優惠 (8 元優惠) 將增加約 4 千公秉油當量、年總碳排約增加 11 千公噸，能耗與碳排比例皆增加 0.15%。

b. 臺北市中心停車全面收費將減少年總能耗約 155 千公秉油當量，年總碳排約減少 407 千公噸，能耗與碳排比例皆減少 5.67%。

2. Research Outcomes

(1) **We developed the Metropolitan Transportation Strategic Energy Conservation Carbon Reduction Module with the Taipei Metropolitan Area as the priority exploration area:** Conduct a metropolitan-scale energy conservation carbon reduction transportation strategy exploration through the transportation activities estimate results of the Taipei Metropolitan Transportation Requirements Forecasting Model (TRTS-4S).

(2) **We applied the Metropolitan Transportation Strategic Energy Conservation Carbon Reduction Module to conduct case analysis:** Explore the impacts of "Taipei Metropolitan Area Bus and Mass Rapid Transport Two-way Transfer Discount" and "Improving the Parking Cost in the Downtown of Taipei City" measures on the transportation activities, energy consumption and carbon reduction on Taipei Metropolitan Area (including New Taipei City).

a. Under the assumption that the energy used by the transportation vehicle is not changed, the cancellation of transfer discount (8 NTD Discount) will increase about 4 thousand kiloliters of oil equivalent. The annual total carbon emissions will increase by about 11 thousand metric tons, both energy consumption and carbon emissions ratio are increased by 0.15%.

b. Collecting parking charges for all downtown areas of Taipei City will reduce annual total energy consumption by approximately 155 thousand kiloliters of oil equivalent, and reduce annual total carbon emissions by approximately 407 thousand metric tons; both energy consumption and carbon emissions ratio will decrease by 5.67%.

3. **成果推廣與效益**

(1) **透過模組持續應用評估臺北都會區相關交通措施：**應用評估於臺北都會區相關交通措施之節能減碳效益，可適時提供雙北市交通主管機關擬定更優質之交通管理策略。

(2) **擴充都會運輸策略節能減碳模組之空污效益評估功能：**結合環保署空氣污染排放清冊係數，增加交通管理措施空氣汙染改善效益之評估功能，可適時提供雙北市交通主管機關擬定兼顧節能減碳及減污之交通管理策略。

3. Promotion of Outcomes and Benefits

(1) **We evaluated the traffic measures of the Taipei Metropolitan Area through the continuous application of the module:** We used it in evaluating the energy conservation carbon-reduction benefits of the traffic measures in the Taipei Metropolitan Area, and provide it to the Transportation Competent Authorities of Taipei and New Taipei Cities to develop traffic management strategies with better quality.

(2) **We expanded the air pollution effect evaluation functions of the Metropolitan Transportation Strategic Energy Conservation Carbon Reduction Module:** We combined it with the air pollution emission inventory coefficient of the Environmental Protection Administration to increase the evaluation functions of the air pollution improvement effect of traffic management measures, and provide it to the Transportation Competent Authorities of Taipei and New Taipei Cities to develop traffic management strategies tht take both energy conservation carbon reduction and pollution reduction into consideration.

取消轉乘優惠 (8 元優惠)

增加年總能耗約 4 千公秉油當量、增加年總碳排約 11 千公噸。

臺北市區 (不含文山區、士林區與北投區) 停車全面收費

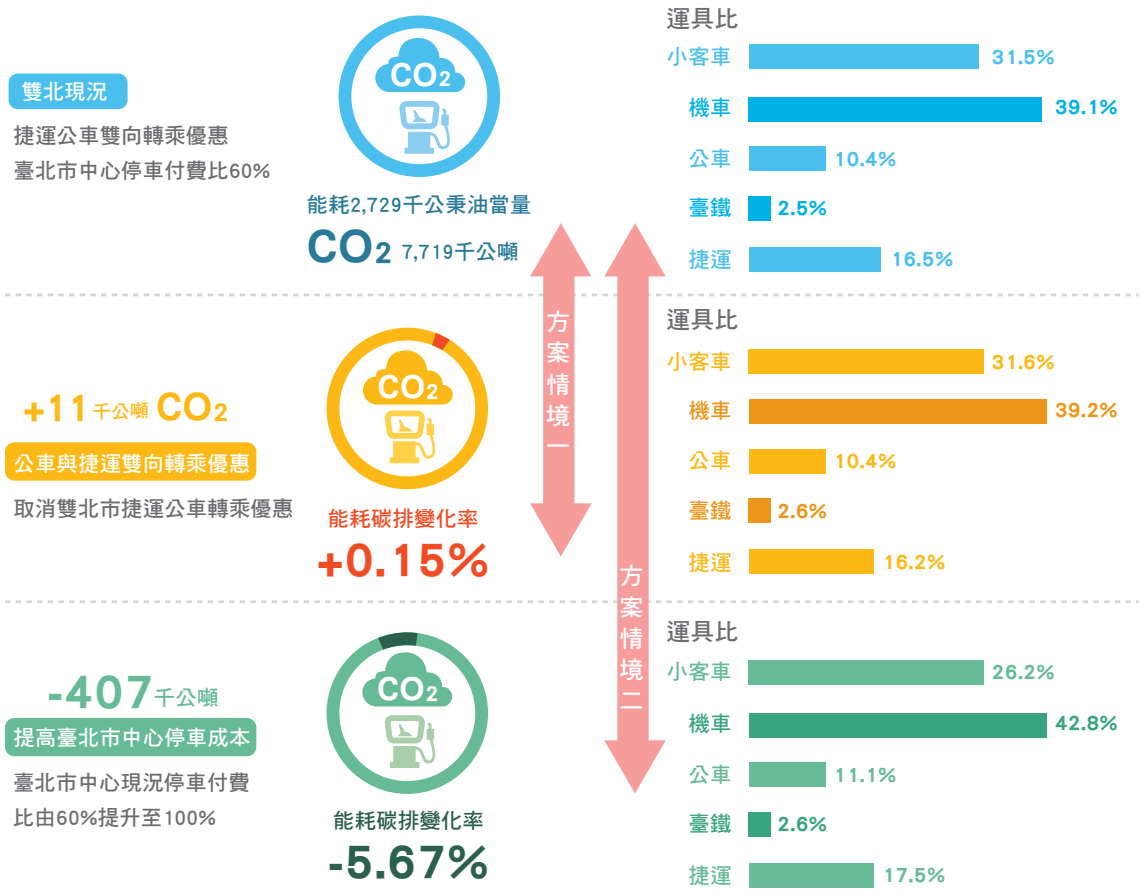
減少年總能耗約 155 千公秉油當量，減少年總碳排約 407 千公噸。

Cancellation of Transfer Discount ($8 Discount)

This increased annual total energy consumption by about 4 thousand kiloliters of oil equivalent, and increased annual total carbon emissions by about 11 thousand metric tons.

Collecting Parking Charges for All Downtown Area of Taipei City (excluding Wenshan District, Shilin District and Beitou District)

This reduced annual total energy consumption by approximately 155 thousand kiloliters of oil equivalent, and reduced annual total carbon emissions by approximately 407 thousand metric tons.



應用案例分析結果示意圖
Application Case Analysis Results Schematic Diagram

05

研討會與教育訓練

Seminar and Training Workshop

以下簡述本所 107 年度辦理完成之各項研討會、專題講座與教育訓練課程。

The following briefly describes all seminars, lectures and training workshops of the Institute in 2018.

日期 Date	主 題	Topic
1/2	107 年 1 月空運期刊研討會	Seminar: January 2018 Air Transport Journal
1/9	107 年 1 月海運期刊研討會	Seminar: January 2018 Maritime Journal
1/11	「臺東海岸公路浪襲預警系統」推廣教育訓練	Promotion & Training: Wave Attack Warning System for Taitung Coastal Road
1/15	「MIKE 21 二維海洋波流模擬軟體實務訓練」-水動力模組	Practical Training: MIKE 21 for Two-Dimensional Coastal and Sea Software-Hydrodynamic Module
1/16	降低移動污染源管理措施之適法性探討研究會	Seminar: Legality of Reducing the Management Measures of Mobile Pollution Sources
1/16	「MIKE 21 二維海洋波流模擬軟體實務訓練」-波浪模組	Practical Training: MIKE 21 for Two-Dimensional Coastal and Sea Software-Spectral Waves Module
1/17	「空氣品質維護區限制高污染車輛進入管理作為」專家座談會議	Experts Meeting: Management of Restricted Entry of Air Quality Maintenance Area for High Emission Vehicles
1/24	「我國港口區域航線南向趨勢」專題講座	Lecture: The Southward Trend of Regional Routes of Taiwan Ports
1/31	「出席 COP23 國際會議心得分享」研究會	Experience Sharing Seminar: Attend the COP23 International Conference
2/5	「自動駕駛發展趨勢分析」研討會	Seminar: Future Trend Analysis of Automated Driving
2/5	智慧財產管理與運用系列講座 (四)—成果歸屬的實務經驗：以科技部為例	Lecture: Intellectual Property Management and Application(IV)- Practical Experience of the Government Scientific and Technological Research and Development Results Ownership: Case of the Ministry of Science and Technology
2/5	智慧財產管理與運用系列講座 (五)—交通部科學技術研究發展成果歸屬及運用辦法實施重點說明	Lecture: Intellectual Property Management and Application(V)- Key Points of Implementing the MOTC Scientific and Technological Research and Development Results Ownership and Utilization Regulation
2/6	溫室氣體減量及管理法第 1 次研究會	Seminar: Greenhouses Gas Reduction and Management Act (1st session)
2/8	政府網站創新應用說明會	Seminar: Innovative Applications of the Government Website
2/13	「各國運輸白書章節架構」研究會	Seminar: National Transport Policy White Paper Chapter Architecture

日期 Date	教育訓練課程	Education and Training Courses
2/22	「MIKE 21 二維海洋波流模擬軟體實務訓練」-地形變遷模組	Practical Training: MIKE 21 for Two-Dimensional Coastal and Sea Software-Sand Transport Module
2/23	「MIKE 21 二維海洋波流模擬軟體實務訓練」-海岸線地貌演變模組	Practical Training: MIKE 21 for Two-Dimensional Coastal and Sea Software-Shoreline Morphology Module
2/26	「交通污染源排放量推估與應用」研究會	Seminar: Estimation and Its Application of Emissions of Traffic Air Pollution Sources
2/26 ~ 2/27	「MIKE 21 二維海洋波流模擬軟體實務訓練」-Boussinesq 方程波浪模組	Practical Training: MIKE 21 for Two-Dimensional Coastal and Sea Software-Boussinesq Module
3/7	107 年 3 月空運期刊研討會	Seminar: March 2018 Air Transport Journal
3/13	107 年 3 月海運期刊研討會	Seminar: March 2018 Maritime Journal
3/27	「運輸部門決策支援系統維運技術服務 (107 年)」教育訓練 (第 1 場次)	Training Workshop: 2018 Technical Services of the Taiwan Transportation Decision Support System (1st session)
3/28	「電動大客車電池系統發展趨勢」研討會	Seminar: Development Trend of the Battery System for Electric Buses
3/28	溫室氣體減量及管理法第 2 次研究會	Seminar: Greenhouses Gas Reduction and Management Act (2nd session)
4/3	107 年 4 月空運期刊研討會	Seminar: April 2018 Air Transport Journal
4/10	107 年 4 月海運期刊研討會	Seminar: April 2018 Maritime Journal
4/18	「國際航空貨運發展趨勢」專題講座	Lecture: Development Trends of Global Air Freight
4/23	「機場空側容量與航管作業關係」專題講座	Lecture: The Relationship between Airport Airside Capacity and Air Traffic Management Operations
4/25	「預約式無障礙運輸服務之整合研究」駕駛 APP 教育訓練。	Training Workshop: Driver APP Tutorial and Trainning of Smart Accessible Mobility System (SAMS)
4/26	第 1 次運輸規劃軟體實務演練	1st Training Workshop of Northern Taiwan Transportation Demand Model
4/27	公路容量及小車當量之估計方法技術講習	Workshop: Estimation Methods for Highway Capacity and Passenger Car Equivalent
5/1	107 年 5 月空運期刊研討會	Seminar: May 2018 Air Transport Journal

日期 Date	教育訓練課程	Education and Training Courses
5/1	「貨櫃航運聯盟對臺灣港群的影響」專題講座	Lecture: The Influence of Container Shipping Alliance on Taiwan Ports
5/4	「公共運輸行動服務方案 (MaaS, Mobility as a Service) 暨智慧交通專利技術解析」成果推廣說明會	Research Result Promotion Seminar: Patent Analysis of the Mobility as a Service (MaaS) and Intelligent Traffic Technology
5/8	107 年 5 月海運期刊研討會	Seminar: May 2018 Maritime Journal
5/14	三維地理資訊發展策略研析研討會	Seminar: Development Strategy Analysis of the 3D Geographic Information
5/15	「機場主計畫規劃與空側容量關聯實務分享」專題講座	Lecture: Association Practice Sharing on Airport Master Plan and Airside Capacity
5/24	第 2 次運輸規劃軟體實務演練	2nd Training Workshop of Northern Taiwan Transportation Demand Model
5/25、6/15、6/22	公共運輸縫隙掃描決策支援系統教育訓練 (北部、中部及南部共 3 場)	Training Workshop: Decision-making Support Systems on Scanning the Service Gap of Public Transportation (3 sessions, in northern, central and southern Taiwan)
6/5 ~ 10/9	道路交通安全管理系統 ISO39001 輔導課程 (共 29 場次)	Training Workshop: Road Traffic Safety Management System (ISO 39001) (29 sessions)
6/6	107 年 6 月空運期刊研討會	Seminar: June 2018 Air Transport Journal
6/7、10/30	鐵路運輸安全管理系統 (SMS) 制度化策略之研擬專家研討會 (共兩場次)	Expert Forum: Research on the Institutionalization Strategy of Railway Transportation Safety Management System (2 sessions)
6/12	107 年 6 月海運期刊研討會	Seminar: June 2018 Maritime Journal
6/13	「日本成田機場公司化後之經營策略與經驗」專題講座	Lecture: The Business Strategy and Experience on Corporatization of Japan Narita Airport
6/19	「軌道運輸場站室內空氣品質管理之探討」專題演講	Lecture: Indoor Air Quality Management of Rail Transport Stations
6/26	「道路交通車流及事故風險偵測與分析工具之發展應用」成果發表會	Research Result Promotion Seminar: Application of Road Traffic Flow Analysis and Accident Detection Tools
7/3	107 年 7 月空運期刊研討會	Seminar: July 2018 Air Transport Journal
7/4	TIME 模型 (The Integrated MARKAL-EFOM System) 之運輸參數討論會	Seminar: Transport Parameters of TIME Model (The Integrated MARKAL-EFOM System)
7/10	107 年 7 月海運期刊研討會	Seminar: July 2018 Maritime Journal

日期 Date	教育訓練課程	Education and Training Courses
7/19	第 3 次運輸規劃軟體實務演練	3rd Training Workshop of Northern Taiwan Transportation Demand Model
7/23 ~ 7/24	107 年度橋梁檢測人員培訓課程 (初訓北 1 場)	2018 Fundamental Training for Bridge Inspectors (Taipei 1st session)
7/24	「Mastering Bitcoin」研究會	Workshop: Mastering Bitcoin
7/25	2018 臺越交通合作論壇	2018 Taiwan-Vietnam Transport Cooperation Forum
7/25	運輸部門積極減量作為交流會議	Workshop: Proactive Initiatives of Carbon Mitigation of Transport Sector
7/31	五所大專院校學生使用公共運輸意見研討工作坊	Workshop: Opinions of Using Public Transportation from Students of 5 Colleges
7/31	高雄地區學生使用公共運輸意見蒐集工作坊	Workshop: Gathering Students' Public Transportation Using Experiences in Kaohsiung
7/31 ~ 8/1	107 年度橋梁檢測人員培訓課程 (初訓南 1 場)	2018 Fundamental Training for Bridge Inspectors (Tainan 1st session)
8/3	ITS 系列論壇 - 人工智慧在交通運輸之運用	ITS Serial Forums: Application of Artificial Intelligence (AI) in Transportation
8/7	107 年 8 月空運期刊研討會	Seminar: August 2018 Air Transport Journal
8/8 ~ 8/9	107 年度橋梁檢測人員培訓課程 (初訓中 1 場)	2018 Fundamental Training for Bridge Inspectors (Taichung 1st session)
8/14	107 年 8 月海運期刊研討會	Seminar: Auguest 2018 Maritime Journal
8/16	107 年度橋梁檢測人員培訓課程 (回訓臺北場)	2018 Advanced Training for Bridge Inspectors (Taipei session)
8/21 ~ 8/22	107 年度橋梁檢測人員培訓課程 (初訓中 2 場)	2018 Fundamental Training for Bridge Inspectors (Taichung 2nd session)
8/23	107 年度橋梁檢測人員培訓課程 (回訓臺中場)	2018 Advanced Training for Bridge Inspectors (Taichung session)

日期 Date	教育訓練課程	Education and Training Courses
8/28 ~ 8/29	107 年度橋梁檢測人員培訓課程 (初訓南 2 場)	2018 Fundamental Training for Bridge Inspectors (Tainan 2nd session)
9/4	「自行車標誌、標線系統說明暨討論會議」- 北部場	Seminar: Bicycle Sign and Marking System (Taipei session)
9/4 ~ 9/5	107 年度橋梁檢測人員培訓課程 (初訓北 2 場)	2018 Fundamental Training for Bridge Inspectors (Taipei 2nd session)
9/5	107 年 9 月空運期刊研討會	Seminar: September 2018 Air Transport Journal
9/11	107 年 9 月海運期刊研討會	Seminar: September 2018 Maritime Journal
9/11 ~ 10/9	「混合車流路口道路與交通工程設計範例」教育訓練講習會 (共 3 場次)	Training Workshop: Typical Examples for Road and Traffic Engineering Design in Mixed-Traffic Situation (3 sessions)
9/13	運輸政策白皮書 - 智慧運輸篇發展課題座談會	Symposium: Transportation Policy White Paper-The ITS Development Issues
9/17	「自行車標誌、標線系統說明暨討論會議」- 南部場	Seminar: Bicycle Sign and Marking System (Kaohsiung session)
9/21	107 年度橋梁檢測人員培訓課程 (回訓臺南場)	2018 Advanced Training for Bridge Inspectors (Tainan session)
9/27 ~ 10/15	「2018 年傳統區域鐵路系統容量分析概論暨分析軟體應用」教育訓練 (5 場次)	Training Workshop: 2018 Taiwan Conventional and Regional Railway Capacity Analysis Software (CRCS) (5 sessions)
9/28	智慧財產管理與運用系列講座 (六)—商標爭議實務見解趨勢案例介紹	Lecture: Intellectual Property Management and Application(VI)- Practice Opinions and Case Study of the Trademark Dispute
10/2 ~ 10/3	107 年度橋梁檢測人員培訓課程 (初訓北 3 場)	2018 Fundamental Training for Bridge Inspectors (Taipei 3rd session)
10/3	AI 與安控整合應用之發展論壇	Forum: Integrated Application of Artificial Intelligence (AI) and Safety Control
10/5	「107 年臺灣公路容量分析軟體教育訓練」- 臺中場	Training Workshop: 2018 Taiwan Highway Capacity Analysis Software (THCS) (Taichung session)
10/5	107 年 10 月空運期刊研討會	Seminar: October 2018 Air Transport Journal
10/9	「107 年臺灣公路容量分析軟體教育訓練」- 臺北場	Training Workshop: 2018 Taiwan Highway Capacity Analysis Software (THCS) (Taipei session)

日期 Date	教育訓練課程	Education and Training Courses
10/9	107 年 10 月海運期刊研討會	Seminar: October 2018 Maritime Journal
10/12	運輸部門氣候變遷調適研議計畫專家學者座談會	Experts Meeting: Climate Change Adaptation Research Project of the Transport Sector
10/16	「運輸業排放清冊以及調查內容」專家學者座談會	Experts Meeting: Data Sources and Investigation Items of Transport Industry Greenhouse Gas Emissions Inventory
10/16	「船舶急難救助即時資訊整合系統」教育訓練	Training Workshop: Immediate Information Integration System for Ship Emergency Assistance
10/17	智慧財產管理與運用系列講座 (七)—政府機關辦理業務所涉著作權問題解析	Lecture: Intellectual Property Management and Application(VII)- Problem Analysis of Copyright Issues Involved in Government Business
10/17	「都會運輸評估模組開發成果與應用案例分析」專家座談會	Experts Meeting: Development of Metropolitan Transport Greenhouse Gas Mitigation Evaluation Module and its application cases
10/19	107 年內政空間統計大數據研討會	2018 Conference on Big Data of Interior Geographic Space Statistics
10/22	交通行動服務 (MaaS) 國內外經驗分享	Seminar: Domestic and Foreign Experience Sharing of the Mobility as a Service (MaaS)
10/23	交通部 ITS 中長期發展方向初探工作坊	Workshop: Preliminary Study of ITS Medium and Long Term Development Tendency of the MOTC
10/23	「應用旅次特性大數據精進公共運輸服務計畫」座談會	Symposium: Application of Trip Big Data for Improving Public Transportation
10/25	「運輸部門節能減碳策略評估整合資訊平台」教育訓練	Training Workshop: Integrated Information Platform of Transport Sector's Energy Saving & Carbon Reduction Strategic Assessment
10/26	「機車兩段式左轉停等紅燈怠速熄火改善空污集中之研析」專家座談會	Experts Meeting: Analysis of Reducing the Air Pollution around the Intersections by Stopping the Engine of Motorcycles Waiting The Signals While Conducting Two-Stage Left-Turn
11/1	「運輸部門決策支援系統維運技術服務 (107 年)」教育訓練 (第 2 場次)	Training Workshop: 2018 Technical Services of the Taiwan Transportation Decision Support System (2nd session)
11/1	「鐵路運輸安全管理系統 (SMS) 制度化策略之研擬」教育訓練	Training Workshop: Research on the Institutionalization Strategy of Railway Transportation Safety Management System
11/5	「駕駛模擬儀軟硬體系統、交通事故發生地點及資料分析系統 TALAS 及駕駛行為偵測系統」教育訓練	Training Workshop: IOT Driving Simulator, TALAS and Driving Behavior Detection System

日期 Date	教育訓練課程	Education and Training Courses
11/6	軌道運輸車站室內空氣品質管理工作坊	Workshop: Indoor Air Quality Management of Rail Transport Stations
11/7	107 年 11 月空運期刊研討會	Seminar: November 2018 Air Transport Journal
11/9	臺灣橋樑防蝕工法與腐蝕資訊系統應用研習會	Seminar: Applying Anticorrosive Method and Corrosive Information System to Bridges in Taiwan"
11/13	107 年 11 月海運期刊研討會	Seminar: November 2018 Maritime Journal
11/13	「馬祖港維護管理系統擴充與精進」教育訓練	Training Workshop: Improved and Amplified Maintenance Management System for Port Structures of Matsu Port
11/13	「港區及沿岸空氣品質受船舶航行之影響分析與即時推估系統建立」教育訓練	Training Workshop: Air Quality Impact Analysis of Ship Emissions from Harbors and Coastal Area of Taiwan and Establishment of the Air Quality Real-Time Forecasting System
11/22	第 4 次運輸規劃軟體實務演練	4th Training Workshop of Northern Taiwan Transportation Demand Model
11/28	「各層級運輸規劃模式資料格式之整合實作說明會」- 北部場	Workshop: Integrating Different Levels of Transportation Planning Model Data (Taipei session)
11/29	「各層級運輸規劃模式資料格式之整合實作說明會」- 南部場	Workshop: Integrating Different Levels of Transportation Planning Model Data (Kaohsiung session)
12/5	「107 年臺灣公路容量分析軟體教育訓練」- 公路總局場	Training Workshop: 2018 Taiwan Highway Capacity Analysis Software (THCS) (for Directorate General of Highways, MOTC)
12/10	「臺灣港埠船舶減速查核系統操作」教育訓練	Training Workshop: Operation of Vessel Speed Reduction Surveillance System
12/19	2018 長者、身障、偏鄉族群運輸創新服務論壇	2018 Forum of Innovative Mobility and Transport for Elderly, Disabled Persons and Remote Area
12/20	「ArcGIS 地理資訊系統」教育訓練	Training Workshop: ArcGIS Geographic Information System
12/21	高雄地區運具使用意見蒐集工作坊	Workshop: Gathering the Transportation Using Experiences in Kaohsiung
12/24	「旅運時空資料分析與公共運輸服務應用發展計畫」成果發表會	Research Result Promotion Seminar: Plan of the Travel Data Analysis and Public Transit Service Development

06

大事紀要

Major Events

107 年度大事紀要
2018 Calendar of Events

日期 Date	重要記事 Event
01 17	本所進行道路交通安全管理系統 (ISO 39001) 多年期研究，透過輔導客貨運業者試辦及驗證，並建置導入參考手冊，所得之績效證實該系統對交通安全維護具高度價值，為擴大實施效益，並依部長指示完成「道路交通安全管理系統 (ISO 39001) 推廣計畫」，於 107 年 1 月提供公路總局做為推動客運業建立安全管理系統之參據，以提昇運輸業者行車安全，減少道路交通事故。 The Institute of Transportation (IOT) has been conducting a multi-year study on ISO 39001 - Road Traffic Safety System, and offering guidance to passenger/cargo transportation companies on the adoption and validation of related trial projects by preparing guidance manuals. All performance results obtained from trials have affirmed the system's value to traffic safety. To implement the system on a larger scale, the IOT proposed its "ISO 39001 - Road Traffic Safety System Promotion Plan" per the instructions of the Minister, and presented the plan to the Directorate General of Highways in January 2018 to serve as a reference for the implementation of a safety management system for passenger transportation companies and thereby improve traffic safety while reducing road accidents.
03 16	本所於交通部例行記者會以「沿著 Blue Line．踩踏不迷路」為題，說明自行車道藍色標線（Blue Line）對於自行車道路線指引具有良好的指示效果，並正式宣布於澎湖縣縣道 203 進行為期 6 個月的試辦計畫，當試辦成效良好，後續將進行相關法制化作業，正式納入法規，並推廣至各縣市，以提昇自行車友善的轉乘環境。 During a regular press conference organized by the Ministry of Transportation and Communication (MOTC), the IOT made a presentation titled "Along the Blue Line" to demonstrate the effectiveness of Blue Lines painted along cycling trails to guide cyclists. An announcement was made to commence a 6-month trial-run for this project along the Penghu County Roadway 203, and if the results are favorable, the use of Blue Lines for cycling trails will be legislated and implemented at other counties and cities to create a cyclist-friendly environment.

日期 Date	重要記事 Event

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配合《國土計畫法》的施行，本所奉交通部指示研提「全國國土計畫－運輸部門空間發展策略」，自 105 年起迄今共計出席數十場部會研商與說明會，及相關審議會，並依審查意見修訂策略內容。「全國國土計畫」報院核定期間，本所配合交通部出席 107 年 4 月 12、19 及 26 日等 3 次行政院國土計畫審議會。該計畫已於 4 月 30 日公告實施，其中的「運輸部門空間發展策略」將作為我國交通運輸在國土空間上發展之指導原則。

To accommodate the implementation of the "Spatial Planning Act," IOT was instructed by MOTC to devise a "Nationwide Spatial Plan - Transportation Department Spatial Planning Strategy." The IOT has participated in several dozen meetings, seminars and discussions since 2016 and made adjustments to the proposed strategy based on the opinions obtained from the above. When the "Nationwide Spatial Plan" was presented to the Executive Yuan for approval, the IOT represented the MOTC and participated in 3 Spatial Planning Review Committee meetings held on April 12, April 19 and April 26, 2018. The Nationwide Spatial Plan was implemented on April 30, and the "Transportation Department Spatial Planning Strategy" will serve as a guiding principle for the future use of space for transportation-related purposes within the nation.

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「APEC 第 45 次運輸工作小組會議 (TPT-WG45)」會議於本 (2018) 年 4 月 22~24 日在韓國首爾 (Seoul) 召開，本所統籌我國出席代表團工作，成員包括政府部門及民間相關單位代表共計 19 員。

我國代表團各單位出席代表分別於相關專家小組申辦計畫 (計 1 件)、報告於 TPT-WG 錄案計畫辦理情形 (計 1 件)、報告我國各運輸領域發展情形 (計 4 件)、吸收他國觀念，俾作為推動相關事務參考，代表團已依原訂計畫圓滿達成任務返國。

"The 45th APEC Transportation Working Group (TPT-WG45)" meeting was convened in Seoul, Korea between April 22 and 24, 2018, during which the IOT was assigned the responsibility to coordinate a team of 19 comprising members of government agencies and private institutions to represent the nation at the meeting.

The team of representatives received valuable insights from its involvements in the special project discussion (1 case), TPT-WG task progress report (1 case), and national transportation development report (4 cases) during the meeting, which will provide useful references for the tasks ahead. The team of representatives returned home after having fully accomplished its mission as planned.

日期 Date	重要記事 Event
05 21 - 24	本所舉辦年度研究成果發表週，內容涵蓋海陸空運輸與資通訊、社福、環保、節能、防災、氣候變遷等課題。進行 4 天 8 場次合計 31 項成果發表、40 位專家學者與談，共 1,121 人次參加。藉由研究成果發表活動，擴大本所研究成果推廣應用對象，並透過各界在相關領域研究與實務推動上之經驗分享，共同激盪未來研究課題，以及交通運輸政策方向之建言。 IOT held its annual conference series to publish research progress on a number of topics including air/surface transportation, ICT, social welfare, environmental protection, energy conservation, disaster prevention and climate change. Eight conference sessions were held over a period of 4 days, during which a total of 31 reports were published, 40 industry experts/scholars were invited to the discussions and 1,121 visits were received. By releasing the research results, IOT aimed to share knowledge with all who may find the studies useful, while at the same time inviting people from different fields of expertise to share their experiences on implementation, discuss relevant topics, and make recommendations on future transportation policies.
25	本所於交通部例行記者會以「客運業好幫手 - 健康駕駛管理系統」為題，說明本所輔導成立之北區區域運輸發展研究中心與豪泰客運公司合作導入健康管理機制，係規定駕駛員每日發車前使用心臟頻譜血壓計進行量測，藉由量測資料分析發現，除能掌握每位駕駛員心血管健康狀態，並針對異常或危險狀態採取適當的管理處置措施，日後若能順利在其他客運業者或遊覽車業者推動，將更有助於提升公共運輸的安全性與服務品質，讓民眾安心使用公共運輸運具。並獲公視、中廣、台灣新生報等媒體報導。 During a regular press conference held by MOTC, the IOT made a presentation on the "Driver Health Management System" to introduce the new health management system developed by the North Center for Transportation Research and Development (NCTRD) and HowTai Transportation with the help of IOT. The system requires drivers to have cardiograph and blood pressure measured before dispatch each day. By analyzing the measured data, the transportation company is able to monitor the cardiovascular health of every driver and take appropriate measures to address conditions that are abnormal or even dangerous. The implementation of this system at other transportation or tourist bus companies will help improve the safety, service quality and people's confidence towards public transportation. The system was also covered by media including PTC, BCC and TSSD News.
06 6	吳所長玉珍榮退，所長職務由交通部主任秘書林繼國調任。 Director Yu-Chen Wu retired and was succeeded by Chief Secretary Chi-Kuo Lin of the MOTC.

日期 Date	重要記事 Event
06/26	本所舉辦「道路交通車流及事故風險偵測與分析工具之發展應用」成果發表會，藉由無人機設備拍攝交岔路口車輛流動影像，分析行經之車流量、車種、車速及軌跡資料，透過車輛軌跡找出易發生車輛間衝突之位置分佈，並建立車流衝突診斷工具平台，能在肇事發生前即診斷出交通衝突問題，供交通管理單位與道路設計者作為交通安全改善之參考。 IOT held a presentation on the "Development and Application of Road Traffic and Accident Risk Detection and Analysis Tools." This analytical approach involved capturing videos of traffic flow at intersections using drones and analyzing data such as the volume, model, speed and trail of moving vehicles to identify areas that are prone to collisions. A traffic conflict diagnosis platform has also been developed to diagnose potential traffic conflicts before accidents occur, which should provide useful reference for traffic administrators and road designers in improving traffic safety.
07/25	依據「臺越交通合作瞭解備忘錄(MOU)」之合作共識，本所協助交通部舉辦「2018臺越交通合作論壇」，在本次合作論壇會議中，針對「公私部門合作 (PPP) 參與投資交通公共建設」議題，進行法規面、工程面、合作案例與合作機會之經驗分享與交流討論，並邀請兩國相關公、私部門來賓與會座談。本次合作論壇之辦理，除令我國廠商及銀行投資團體了解目前越南各項交通建設之投資機會與方向，進而發掘及開拓越南交通基礎建設投資商機外，亦分享我國 PPP 交通投資成功經驗，提供越方作為後續發展相關交通系統建設及運輸服務之參考。 As part of the "Taiwan-Vietnam Memorandum of Understanding (MOU) for Transport Cooperation," IOT assisted MOTC in organizing the "2018 Taiwan-Vietnam Transport Cooperation Forum," during which it hosted a discussion on "Public Private Partnership (PPP) in Traffic Infrastructure Investment" where guests from public and private departments of both countries were invited to exchange experiences and opinions on legal aspects, construction practices, case studies and collaborative opportunities concerning this issue. The forum not only provides local companies and investment banks with a better understanding by which to capitalize on traffic infrastructure investment opportunities and trends in Vietnam, but also enables Taiwan to share its successful PPP experience in traffic investments with Vietnam, and thereby assist them in the development of traffic infrastructures and transport services in the future.

日期 Date	重要記事 Event

08/24

本所於交通部例行記者會以「浪襲預警有撇步！臺東海岸公路浪襲預警系統」為題，說明本所建置完成「臺東海岸公路浪襲預警系統」，與中山大學合作開發波浪溯上資料庫，整合鄰近之觀測資料本所之海象預報資料、及浪襲預警資訊，透過網頁形式展示台 9 線易浪襲路段 (多良，南興段)24 小時預報之四個等級警戒燈號，可提供公路總局第三區養護工程處及其第一線人員可隨時經電腦或手持裝置 24 小時之預報浪襲資訊，做為浪襲封路之決策輔助參考。

During a regular press conference organized by MOTC, the IOT made a presentation on the " Taiwan East Coast Highway Sea Wave Hazard Alert System" that it has developed in a joint effort with the National Sun Yat-sen University. The system incorporates a wave run-up database and combines IOT's marine weather forecast and wave hazard alerts from nearby areas into predicting hazards 24 hours in advance for sections of the Taiwan Provincial Highway No. 9 that are susceptible to high sea waves (particularly the Duoliang and Nanxing Sections). The predictions are presented using a 4-level alert indicator on the webpage. Wave hazard predictions will be made accessible by the DGH's Third Maintenance Office and frontline workers at any time using computers or handheld devices and should prove useful in making road block decisions.

09/28

本所於高雄市舉辦交通行動服務 (MaaS) 啟用記者會。與會貴賓包括本部祁次長與高雄市史副市長、高雄市各機關與民意代表、當地企業及大學高階主管共同見證我國第一個也是亞洲第一個交通行動服務啟用儀式。

IOT held a press conference in Kaohsiung City to announce the activation of Mobility as a Service (MaaS). The press conference saw the presence of IOT Deputy Director Hao, Deputy Mayor Shih of Kaohsiung City, government officials and representatives of Kaohsiung City, local businesses and college administrators, who bore witness to the activation of the nation's and Asia's first MaaS.

日期 Date	重要記事 Event
09 27 28	本所開發完成傳統區域鐵路系統的軌道容量分析模式與電腦軟體，為期各界對軌道容量分析有進一步了解，並具備使用軟體分析能力，於 107 年 9 月底至 10 月中旬辦理「2018 年傳統區域鐵路系統容量分析概論暨分析軟體應用」教育訓練，推廣對象包括鐵道局、臺鐵局、大專院校、各縣市政府及顧問公司等，分別於北中南區舉辦 5 場次，參與人數達 121 人。 IOT completed the development of the model and software for rail capacity analysis of the regional railway system. In an attempt to help the public, develop a better understanding of rail capacity analysis and the ability to use this software, the IOT organized a series of training courses on "2018 Regional Railway System Capacity Analysis and Software Application" from the end of September to mid-October 2018 to a broad range of audience including the Railway Bureau, Taiwan Railways Administration, colleges, county/city governments and consulting companies. A total of 5 sessions were held in northern, central and southern Taiwan to an audience size of 121.
10 01 11 15	
03	本所協助交通部會同環保署、經濟部共同研訂之「運輸部門溫室氣體排放管制行動方案」，業經行政院於 107 年 10 月 3 日核定。方案中提出「發展公共運輸系統，加強運輸需求管理」、「建構綠色運輸網絡，推廣低碳運具使用，建置綠色運具導向之交通環境」及「提升運輸系統及運具能源使用效率」三大策略 11 項措施，預期至 109 年運輸部門溫室氣體排放量可較未採取任何減量作為時減少 198 萬公噸 CO_2e。 The "Transportation Department Greenhouse Gas Emission Control Action Plan" jointly developed between IOT, Environmental Protection Administration and the Ministry of Economic Affairs was approved by the Executive Yuan on October 3, 2018. The action plan proposed 3 strategies and 11 solutions including: "development of public transportation system and enhanced management of transportation requirement," "construction of green transport network, promotion of low-carbon vehicles and creation of green vehicle-based traffic environment" and "improving the energy efficiency of transportation systems and vehicles." These strategies and solutions are expected to reduce greenhouse gas emission by 1.98 tonnes CO_2e for the transportation department by 2020, compared to the absence of these solutions.

日期 Date	重要記事 Event

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05 | 09

本所持續發展公路容量分析模式、修訂公路容量手冊，並擴增分析軟體 THCS (Taiwan Highway Capacity Software) 功能，為使各界瞭解公路容量手冊未來修訂方式及軟體操作方法，增進實務面之應用，業於 107 年 10 月 5 日及 9 日在臺中、臺南辦理 2 場次「107 年臺灣公路容量分析軟體教育訓練」，推廣對象包括公路總局、高公局、大專院校、各縣市政府及顧問公司等，參與人數達 47 人。

IOT continues to make improvements to its highway capacity analysis models and update the highway capacity manual and constantly expands the features of its Taiwan Highway Capacity Software (THCS). In an attempt to promote the public's understanding of how the highway capacity manual will be amended in the future and how the software is operated in practice, IOT held two sessions of "2018 Taiwan Highway Capacity Analysis Training" in Taichung and Tainan on October 5 and 9, 2018, respectively, to a total audience of 47 from the DGH, Freeway Bureau, colleges, county/city governments and consulting companies.

14 | 17

「APEC 第 46 次運輸工作小組會議 (TPT-WG46)」於本 (2018) 年 10 月 14~17 日在秘魯利馬 (Lima) 召開，期間舉行開／閉幕會議、4 個專家小組會議、2 個次級專家小組會議及 1 個周邊會議，共計 9 個會議 (10 月 14 日召開主事成員與專家小組主席之會前會)。

本所統籌我國出席代表團工作，成員包括政府部門及民間相關單位代表共計 17 員。

我國代表團各單位出席代表分別於相關專家小組報告於 TPT-WG 錄案計畫辦理情形 (計 2 件)、報告我國各運輸領域發展情形 (計 6 件)、吸收他國觀念，俾作為推動相關事務參考，代表團已依原訂計畫圓滿達成任務返國。

"The 46th APEC Transportation Working Group (TPT-WG46)" meeting was convened in Lima, Peru between October 14 and 17, 2018. A total of 9 meetings including the opening meeting, the closing meeting, 4 expert group meetings, 2 sub-group meetings and 1 side meeting were held during the event (a pre-arranged meeting of lead members and director of the expert group was convened on October 14).

IOT was assigned the responsibility to coordinate a team of 17, comprising members of government agencies and private institutions to represent the nation at the meeting.

The team of representatives received valuable insight from its involvements in special project discussions, TPT-WG task progress report (2 cases), and national transportation development report (6 cases) during the meeting, which will provide useful reference to the tasks ahead. The team of representatives returned home having fully accomplished its mission as planned.

日期 Date	重要記事 Event

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13 本所與公路總局、國立交通大學共同舉辦「ISO39001 道路交通安全管理系統推廣說明會」，就培養桃竹苗、中區、雲嘉南三個區域運輸發展研究中心成為 ISO 39001 輔導機構，以及其各自輔導臺西客運、臺中客運及和欣客運 3 家公路客運業者導入 ISO 39001 之過程，向各界分享相關經驗及成果，以提供政府機關及運輸業者之參考，參加人數達 80 人。

IOT, DGH and the National Chiao Tung University jointly organized a series of "Promotion Seminar for ISO 39001 - Road Traffic Safety System" to share its experiences and performances in counseling the three Centers for Transportation Research and Development located in Taoyuan/Hsinchu/Miaoli, central Taiwan and Yunlin/Chiayi/Tainan, and their counseling for transportation companies including Taisi Bus, Taichung Bus and Ho-Hsin Bus in the adoption of ISO 39001. The seminar received a total audience of 80, and the information conveyed will prove useful to government agencies and transportation companies in future decision making.

14 本所長年協助交通部辦理無障礙運輸研究、推廣與政策制定工作，獲得美國運輸研究委員會（TRB）「長者及身心障礙者交通與運輸服務國際大會 (TRANSED)」系列會議常設秘書處，即 Svayam 共融環境全球中心 (Svayam – Global Centre for Inclusive Environments)「2018 SVAYAM 無障礙獎」最佳無障礙公共交通獎，並於「2018 第 15 屆長者及身心障礙者交通與運輸服務國際大會」晚宴暨 svayam 無障礙獎頒獎典禮中頒發本獎項。

IOT has long been assisting MOTC in the study, promotion and policy-making of accessible transportation. It received Most Accessible Public Transport award in the "2018 SVAYAM Accessibility Awards" organized by Svayam - Global Centre for Inclusive Environments, and was presented the award during the Transportation Research Board's (TRB) "International Conference on Mobility Transport for the Elderly and Disabled Persons (TRANSED)" and Svayam award ceremony.

日期 Date	重要記事 Event

11

15

因臺鐵普悠瑪於 107 年 10 月 21 日發生重大事故，行政院第 3623 次院會奉院長指示成立「運輸安全委員會」，獨立調查陸、海、空重大事故，建置更完全、完善之運輸環境。

奉行政院指示由人事行政總處及交通部配合協助飛安會推動，完成「國家運輸安全調查委員會組織法草案」及「運輸事故調查法草案」，其中交通部指示由本所擔任彙辦窗口。

行政院院會於 11 月 15 日通過前揭 2 法案，並送立法院審議。

Following the major accident of Puyuma Express on October 21, 2018, the IOT assembled a "Transportation Safety Committee" under the instruction issued by the Premier of Executive Yuan during the 3623rd session. The purpose of this committee is to conduct independent investigations on major accidents involving surface, marine and air transportation to enable further improvements to the transport environment.

Under the instruction of the Executive Yuan, the Directorate-General of Personnel Administration and MOTC assisted Aviation Safety Council in the completion of "National Transportation Safety Investigation Committee Foundation Act (Draft)" and "Transportation Accident Investigation Act (Draft)," and IOT had represented the MOTC on this matter.

During the session dated November 15, the Executive Yuan passed the 2 drafts above and presented them for review at the Legislative Yuan.

26

本所依交通部指示，於 107 年 11 月 26 日召開「108 年春節連續假期疏運計畫研商會議」，邀集路政司、航政司、道安會及民航局、航港局、鐵道局、台高公司、臺鐵局、觀光局、公路總局、高公局及桃園機場公司，針對各單位所提108年公路、軌道、航空、海運、觀光春節疏運計畫，以整體疏運觀點，進行討論，並請各單位依會議討論結果修正疏運計畫內容後於 107 年 12 月 4 日函報交通部。

Under the instruction of MOTC, the IOT convened the "2019 CNY Holiday Traffic Relief Planning Conference" on November 26, 2018, during which it invited the Department of Railways and Highways, Department of Aviation and Navigation, Road Safety Council, Civil Aeronautics Administration, Maritime Port Bureau, Railway Bureau, Taiwan High Speed Rail Corporation, Taiwan Railways Administration, Tourism Bureau, DGH, Freeway Bureau and Taoyuan International Airport to discuss diversion of traffic for the 2019 Chinese New Year from different perspectives including highway, railway, airway, seaway and tourism. Participants were asked to revise their traffic relief plans based on discussions of the meeting and submit to the MOTC on December 4, 2018.

日期 Date	重要記事 Event

11

29 本所於 106 年導入 ISO 27001 資訊安全管理系統 (ISMS)，今 (107) 年持續維持，由艾法諾國際股份有限公司 (AFNOR Asia) 主導稽核員於 11 月 29 日進行外部稽核，稽核結果通過。

IOT first adopted ISO 27001 - Information Security Management System (ISMS) in 2017. To maintain certification this year (2018), the IOT engaged AFNOR Asia to conduct an external audit on November 29 and passed the audit.

30 本所協助交通部與行政院公共數位創新空間團隊合作辦理【開放政府第 41 次議題協作會議】議題：「汽機車燃料稅改隨油徵收」，透過與提案附議人、相關利益團體及政府單位等共同討論汽車燃料使用費徵收議題，以促進政府單位與民間對於本議題之瞭解。

IOT assisted MOTC and Public Digital Innovation Space, Executive Yuan, to organize a discussion on the issue of "Imposing fuel tax with fuel" during the [41st Open Government Issue Discussion Meeting]. By engaging proposers, interest groups and government agencies in the discussion of fuel taxing, IOT hopes to direct attention from the public and private sectors and enhance their understanding of this issue.

Members of the Transportation and Procurement Committee, Control Yuan, visited IOT as part of their inspection on the work activities, facilities and budget execution of MOTC. Control Yuan members were briefed personally by Minister Wu, while Mr. Chi-Kuo Lin (head of IOT) and Mr. Yung-Huei Chou (head of Tourism Bureau) provided an overview of IOT, a progress update of the tourism service center, and outcomes of existing research projects.

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06 本所「交通部補助學界成立區域運輸發展研究中心」計畫 (104-107 年)，於中華民國運輸學會年會獲頒 107 年度「傑出交通運輸計畫」獎項。本計畫係自 104 年 10 月起於全臺成立六大區域運輸發展研究中心 (以下簡稱區域中心)，藉由區域中心推動地方運輸部門人才培訓，強化學界與產業、政府部門的研發合作促成在地公共運輸之永續發展。

IOT's "MOTC Center for Transportation Research and Development Subsidy Program" (2015-2018) was awarded "2018 Outstanding Transportation Program" during the annual meeting of Chinese Institute of Transportation. The program began in October 2015 with the establishment of six Centers for Transportation Research and Development (CTRDs) throughout Taiwan. The purposes of the CTRDs are to promote talent training among local transportation departments, enhance R&D collaboration between the academe, the industry and government agencies, and contribute to the sustainable development of local public transportation.

日期 Date	重要記事 Event
12/25	本所進行兩年期「預約式無障礙小客車運輸服務之整合研究」，於 12 月 19 日在本所 B1 國際會議廳辦理「2018 長者、身障、偏鄉族群運輸創新服務論壇」，由所長開場致詞，邀請國內專家學者、民間業者、無障礙相關團體及政府部門等參與，共同探討如何透過運輸服務的提升，讓無障礙環境更加友善及智慧化。 As part of the 2-year "Integrated Study of Reservation-based Accessible Small Passenger Vehicle Transportation Service," IOT held the "2018 Forum on Innovative Transportation Service for Elders, Persons with Disability and Residents in Remote Areas" at its International Conference Room (B1) on December 19, during which local experts, scholars and representatives from private businesses, accessibility organizations and government agencies were invited to explore ways to improve transportation services and create a more accessible, friendly and smarter transport environment.

07

附錄：年度研究計畫

Appendix: Annual Research Projects

以下分別從運輸系統研究規劃、海空運輸研究發展、運輸安全研究發展、運輸經營管理研究發展、運輸科技與資訊整合應用研究發展、淨潔運輸環境研究發展以及災防技術研究發展等 7 大項重要業務，概略說明本所 107 年度研究計畫。

The research projects for 2018 of the Institute are introduced in the following 7 major business fields: transportation system research and planning, marine and air transportation research and development, transportation safety research and development, transportation operation & management research and development, transportation technology and information integrated application research and development, clean transportation environment research and development, and disaster prevention technology research and development.

一、運輸系統研究規劃

相關執行計畫如下：

- 反映實際交通情境之車輛動態能耗與碳排放特性研究 - 以小貨車為例 (2/2)
- 北臺區域陸路運輸服務均衡發展策略研究
- 公路交通系統模擬模式調校與新版容量手冊研訂 (3/3)
- 106-108 年臺灣公路容量分析軟體 (THCS) 優化與推廣 (107 年度)
- 自行車友善環境路網整體規劃與評估 (3/3)
- 自行車路網示範系統之圖資建置與行銷 (3/3)
- 運輸部門決策支援系統維運技術服務 (107 年)
- 各層級運輸規劃模式資料格式之整合實作
- 傳統暨區域鐵路系統容量分析軟體之升級改版與推廣作業 (2/2)
- 106 年西部城際陸路公共運輸消長觀察
- 跨入我國第三次空間革命時代
- 108 年版運輸政策白皮書 - 鐵公路運輸
- 花東地區臺鐵系統服務效能提升檢討分析
- 淡北運輸走廊道路供需檢討

I. Transportation System Research and Planning

Related projects are as follows:

- Study on the Characteristics of Real-life Energy Consumption and Carbon Emissions of Small Trucks (2/2)
- Study on Comprehensive Land Transportation Planning of Northern Taiwan
- Development and Calibration of the Highway Traffic Systems Simulation Model, and Revision of the Taiwan Highway Capacity Manual (3/3)
- Optimization and Promotion of Taiwan Highway Capacity Analysis Software (2018)
- Integrated Technical Planning and Evaluation of Friendly Bike Lane Network (3/3)
- Developing of Image Data for the Demonstration System and Marketing of Cycle Route (3/3)
- Technical Services of the Taiwan Transportation Decision Support System (2018)
- Study on the Integration of All Levels of Transportation Planning Model Data
- Version Upgrade and Promotion of Conventional Railway Capacity Software (2/2)
- The Market Share Changes of Intercity Public Transportation after HSR in Operation (2017)
- Crossing into the Third Spatial Revolution Era in Taiwan
- 2019 Surface Transport Policy White Paper of Taiwan
- Study on Evaluation of the Hualien-Taitung Line Railway Service Efficiency Improvement
- Review of the Road Supply and Demand of the Tamsui-Taipei Transport Corridor

- 蘇花改通車對蘇花公路影響與交通改善策略之研究
- 東部整體礦砂石運輸改善策略 - 產業需求分析

- The Impact on Existing Suhua Highway after the Opening of the Improved Sections and the Traffic Improving Strategies
- Improvement Strategies of Ore and Gravel Transportation in Eastern Region - Analysis of Industry Demand

二、海空運輸研究發展

相關執行計畫如下：

- 鐵路旅客運輸需求之初探
- 空域模擬模式功能擴充之研究
- 物聯網技術應用於智慧港口及碼頭作業之研究
- IMO 防制船舶污染機制發展之研究
- 探討巴拿馬運河拓寬後之越太平洋貨櫃航線變化
- 藍色公路專船營運之成本效益分析
- 我國船員政策研析
- 國際機場空側設施容量評估方法初探
- IT 在航空產業之最新發展趨勢研究
- 航機離到場及地面操作國際發展趨勢初探
- 空運政策白皮書
- 海運策白皮書

II. Marine and Air Transportation Research and Development

Related projects are as follows:

- Study on Estimating the Passenger Demand of the Taiwan Railway
- Study on the Enhancement of the Aviation Simulation Model
- Application of Internet of Things Technology at Smart Ports and Terminal Operation
- Study on the Development of IMO's Ship Biofouling Control Scheme
- Changes to the Trans-Pacific Service after the Expansion of the Panama Canal
- Cost-Benefit Analysis of Blueway Container Special Ship Operation
- Analysis of Taiwan's Seafarer Policy
- Preliminary Study on the Assessment Methods of Airside Facilities Capacity of International Airports
- IT Development Trend in the Aviation Industry
- Preliminary Analysis for Development of Aircraft Departure/Arrival and Ground Operations
- Air Transport Policy White Paper
- Maritime Policy White Paper

三、運輸安全研究發展

相關執行計畫如下：

- 鐵路運輸安全管理系統 (SMS) 制度化策略之研擬
- 「大型車輛裝設車輛安全設備推動計畫」成效追蹤評估計畫
- 駕駛行為分析工具開發及行為特性探討

III. Transportation Safety Research and Development

Related projects are as follows:

- Study on the Development of Railway Safety Management System Strategies
- Effectiveness Evaluation of the "Promotion Program for Installation of Vehicle Safety Equipment on Large Vehicles"
- Tool Development and Application for Driver Behavior Analysis

- 自行車及類似運具安全管理之研究
- 混合車流路口道路與交通工程設計範例 (2/4)
- 第 36 期臺灣地區易肇事路段改善計畫
- 我國遊覽車客運業安全管理暨安全專責人員制度研議
- 運輸安全政策白皮書之檢討修訂
- 我國運輸安全調查委員會設置可行性探討
- 機車使用者社經背景及使用行為分析

- Study of Safety Management of Bicycles and Similar Modes of Transport
- Design Model on Road Traffic Engineering at Intersection under Mixed Traffic (2/4)
- The 36th Project for Improving Accident-Prone Locations in the Taiwan Area
- Research on Developing the Safety Manager System for Tourism Bus Carrier
- Revision of White Paper on Transportation Safety
- Discussion on the Feasibility of Transportation Safety Investigation Committee
- Analysis on Socioeconomic Background and Usage Behavior of Motorcycle Users

四、運輸經營管理研究發展

相關執行計畫如下：

- 我國臺、高鐵車站與公車轉乘接駁時間縫隙檢核及改善機制之研究
- 預約式無障礙小客車運輸服務之整合研究 (2/2)
- 汽車燃料使用費隨里程徵收之可行性研究
- 我國汽車貨運業特許制度檢討之研究
- 「107 年運輸政策白皮書 - 公路公共運輸」之研擬
- 我國貨運產業電動小貨車應用績效運籌模式之探討
- 開發智慧節能車機應用於公共汽車客運業之初探
- 車載診斷系統 (ODB) 在運輸科技管理上之應用初探
- 需求反應式公共運輸服務 (DRTS) 執行成果之檢討
- 日本鐵路觀光推動經驗與策略之探討
- APEC 供應鏈連結運輸相關議題初探

IV. Transportation Operation & Management Research and Development

Related projects are as follows:

- Study on the Evaluation and Improvement of the Transfer Time Gaps between the Intercity Railway and Bus System in Taiwan
- Integrated Study on Prearranged Handicap Accessible Car Services (2/2)
- The Feasibility Study on the Distance-Based Collection System of Vehicle Road Charge
- Study on the Legal Concession System of the Motor Freight Industry in Taiwan.
- Drafting the 2018 Transport Policy White Paper on Bus Industry
- Study on the Performance-based Logistics Model for Electric Small Truck in Freight Industry in Taiwan.
- Preliminary Study on the Application of Smart Energy Saving Ob-Board Unit in the Bus Industry
- Preliminary Study on the Application of On-Board Diagnostic (OBD) on Transportation Technology Management
- Review of the Implementation of Demand Responsive Transit Service (DRTS)
- Study on the Tourism Experience and Strategies of Railway System in Japan
- Preliminary Study on the Transportation Related Issues of APEC "Supply Chain Connectivity Action Plan"

五、運輸科技與資訊整合運用研究發展

相關執行計畫如下：

- 應用旅次特性大數據精進公共運輸服務計畫
- 我國電動大客車推動策略規劃與自動輔助駕駛技術導入初探
- 科技應用計畫專案管理及監督審驗
- 交通行動服務（MaaS）示範建置計畫
- 交通事件資訊整合服務與精進計畫 (1/2)
- 科技計畫研發成果管理推廣與知識分享
- 107 年度 APEC 運輸領域重點議題發展趨勢分析
- 制定「運輸政策白皮書 - 智慧型運輸系統」
- 我國聯網自動駕駛實驗場域需求探討
- 電動大客車推動策略初探
- 應用電信與票證數據於研析人流分佈與運輸管理策略
- 人工智慧於交通領域運用之案例探討

V. Transportation Technology and Information Integrated Application Research and Development

Related projects are as follows:

- Trip Big Data Analysis of Improving Public Transport Service Project
- Promotional Strategy Planning of the Electric Bus and Preliminary Research of the Advanced Driver Assistance Systems for Taiwan
- Management and Supervising of Technology Application Plans
- Demonstration Project of the Mobility as a Service (Maas)
- Integration Service and Improvement Plan for Urban Traffic Event (1/2)
- Management, Promotion and Knowledge Sharing of the Scientific and Technological Research and Development Results
- Significant Issues and Trend Analysis on Transportation Sphere in APEC for 2018
- White Paper on Transportation Policy Intelligent Transportation System
- Demand Study of the Experimental Field of the Connected Automated Vehicles in Taiwan
- Preliminary Research on the Promotional Strategy for Electric Bus
- Study of Trip Distribution and Transportation Management Using Cellphone and Card Data
- Case Study on Application of AI Technology in Transportation

六、淨潔運輸環境研究發展

相關執行計畫如下：

- 都會運輸節能減碳策略評估模組開發及應用 (2/2)
- 運輸部門氣候變遷調適策略研議計畫
- 運輸部門溫室氣體減量及能源使用管理委託服務專案

VI. Clean Transportation Environment Research and Development

Related projects are as follows:

- Development and Application of the Evaluation Model for Urban Transport Energy Saving and Carbon Reduction Strategies (2/2)
- Climate Change Adaptation Strategies for the Transportation Sector
- Commissioned Service Project for Greenhouse Gas Reduction and Energy Consumption Management of Transportation Sector

- 陸路運輸業能源消耗及溫室氣體排放推估及評估指標研析 (2/2)
- 公路能源消耗及溫室氣體排放量檢核之研析
- 柴油大客車排污對健康影響之研析
- 機車兩段式左轉停等紅燈怠速熄火改善空污集中之研析
- 臺鐵及高鐵對車站室內空氣品質自主管理情形之探討
- 交通污染源 PM2.5 推估研究之回顧與彙析

- Research on Assessment Indicator and Estimation of Energy Consumption and Greenhouse Gas Emission for Land Transportation Industry (2/2)
- Research on Energy Consumption and Greenhouse Gas Emission of Road Transportation
- Literature Review on the Effects of Diesel Bus Pollutant Emission on Health
- Research on Scooter Idling and Two-Stage Left Turns Policy to Improve Concentrated Air Pollution
- Research on the Self-Management of Indoor Air Quality in Taiwan Railway and Taiwan High Speed Rail stations
- Retrospective Analysis of PM2.5 Estimation Research on Traffic Pollution Sources

七、災防技術研究發展

相關執行計畫如下：

- 離岸風電水下技術研發
- 離岸風電建置與航安技術發展計畫
- 港灣構造物設計基準相關條文修訂
- 公路土壤邊坡滑動無線感測網路監測系統研發
- 離岸風機基樁與金屬構件腐蝕防治之研究
- 離岸風機基礎穩定性檢監測技術研發
- 風力作用下船舶受力及繫纜力之預警評估
- 港區及沿岸空氣品質受船舶航行之影響分析與即時推估系統建立
- AIS 系統訊號干擾研究與訊號全解碼資料庫建置
- 離岸風電區之船舶監控及急難救助

VII. Disaster Prevention Technology Research and Development

Related projects are as follows:

- Research and Development of Underwater Technology on Offshore Wind Turbines
- Development of Offshore Wind and Navigation Safety Technology Plan
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交通部運輸研究所
INSTITUTE OF TRANSPORTATION, MOTC

地址：10548 臺北市松山區敦化北路240號
電話：(02) 2349-6789
網址：www.iot.gov.tw

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