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

IOT

中華民國112年年報
Annual Report 2023

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壹 所長的話

交通部主管全國交通行政及交通事業，涵蓋運輸、觀光、氣象、郵政等領域，肩負推動國家重大交通建設、提供優質便利民行服務的重任，為積極有效發揮施政效能，交通部努力推動重點工作包括完成臺鐵公司化、爭取國際觀光客來臺、降低交通事故、完善全國公共運輸路網、進行高快速公路路網斷點連接、提供偏鄉基本民行、加速機場與港口建設、提升智慧運輸效益，同時全面維護交通安全，以提供安全便利、優質舒適的交通生活環境。

本所長期扮演交通部智庫角色，肩負「前瞻智庫、落實應用、能量構建」三大任務，並以「運輸安全」、「運輸效率及交通平權」、「國際海空競爭力」及「永續運輸發展」等為當前四大施政主軸，並且因應國內外情勢與國家整體發展需求，持續針對交通運輸系統進行前瞻性與整體性之研究發展、規劃、審議及建議等業務。本所全體同仁皆秉持「專業領航、追求卓越」之精神與團隊共識，採取「以終為始」的目標及成果導向，以求落實每項研究成果皆能支援交通部施政之目標。此外，亦持續協助交通部擔任APEC運輸工作小組、行政院永續會永續運輸工作分組、行政院2050淨零排放路徑評估專案工作組、交通部氣候變遷運輸部門減緩與調適推動小組、交通部交通費率審議會、桃園航空城聯外運輸系統工作小組，以及交通科技產業會報無人機科技產業小組等幕僚工作。

回顧過去一年，本所在「運輸安全」、「運輸效率及交通平權」、「國際海空競爭力」及「永續運輸發展」等四大施政主軸，陸續完成重大施政規劃並協助推動相關計畫，包括：

01 Message from the Director General

The Ministry of Transportation and Communications (MOTC) is responsible for overseeing national transportation administration and enterprises, including transportation, tourism, meteorology, and postal services. It undertakes the significant task of promoting major national transportation projects and providing high-quality and convenient services to the public. To effectively enhance policy implementation,the MOTC strives to advance key initiatives. These initiatives include the corporatization of Taiwan railways, attracting international tourists to Taiwan, reducing traffic accidents, improving the national public transportation network, connecting freeway and expressway network gaps, providing basic mobility services in rural areas, accelerating airport and port construction, enhancing the benefits of intelligent transportation, and ensuring transportation safety to provide a safe, convenient, high-quality, and comfortable transportation environment.

The institute has long played the role of a think tank for the MOTC, shouldering the three major tasks of "Forward-looking Think Tank, Practical Application, and Capacity Building" and focusing on the four main policy axes of "Transportation Safety," "Transportation Efficiency and Mobility Equality," "International Maritime and Aviation Competitiveness" and "Sustainable Transportation Development." In response to domestic and international situations and national development needs, we continue to conduct forward-looking and comprehensive research and development, planning, review and recommendations on the transportation system. All colleagues at the institute uphold the spirit and team consensus of "Professional Navigation, Pursuit of Excellence," adopting "begin with the end in mind" goal and outcome orientation to ensure that each research result supports the MOTC's policy objectives. In addition, we continue to assist the MOTC in serving as APEC transportation working group, the Executive Yuan sustainability committee's sustainable transportation task force, the Executive Yuan's 2050 net-zero emissions pathway assessment project working group, the MOTC climate change transportation sector mitigation and adaptation promotion task force, the MOTC transportation fare review committee, Taoyuan Aerotropolis Interconnected Transportation System Working Group, and transportation technology industry council's unmanned vehicle technology industry group, among other advisory roles.

Looking back on the past year, we have successively completed major policy planning and assisted in promoting related projects under the four main policy axes of "Transportation Safety," "Transportation Efficiency and Mobility Equality" "International Maritime and Aviation Competitiveness" and "Sustainable Transportation Development" including:

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一、**在運輸安全方面：**完成「道路交通安全基本法」草案、「國家道路交通安全綱要計畫（113-116）」草案、「事故碰撞型態導向之路口設計範例推廣示範」、「以無人機探勘人車流動資訊之應用情境規劃與先導測試-斜交及多岔路口」、「新興科技導入學校交通安全教育之研發示範－教學輔助工具規劃與開發」、「應用人工智慧分析技術探勘高風險路段-行車異常事件及高風險駕駛行為分析」、「大型車輛裝設主動預警系統之試運行使用成效評估」、「我國人工智慧車聯網之號誌控制實作－匝道儀控與平面道路號誌協控實作」、「第 41期臺灣地區易肇事路段改善計畫」、「『區域運輸發展研究中心服務升級2.0計畫』（112-113年）－道安改善計畫」、「研析國家鐵道安全計畫之安全績效與目標管理-安全指標規劃與資料分析」、「應用影像智慧化技術判釋海岸公路及防波堤越波研究-夜間越波判釋」、「港區影像智慧辨識技術之研究-空間基礎資料建構及影像檢監測應用技術發展」，以及「港灣構造物維護管理資訊系統精進與擴充」。

二、**在運輸效率及交通平權方面：**完成東臺區域運輸需求模式建構及供需預測分析、並持續推動本土化公路容量研究，辦理「高速公路交織路段容量及服務水準分析之研究－典型路段」、「鐵路供需診斷數位分身軟體平台之建置-鐵路數位分身軟體平台雛型架構之規劃」、「區域運輸發展研究中心服務升級2.0計畫」（112-113年）、「推動通用計程車特約制度-成效檢討及服務優化」、「構建5G智慧交通數位神經中樞－功能擴充與精進」、「無人機搭配AI影像辨識應用於橋梁檢測之研究-無人機自動化檢測架構探討」、「無人機偏鄉物流運送服務驗證計畫」，並辦理「橋檢新工具－無人機結合AI技術成果觀摩會」、「第三屆領航盃－無人機創意應用競賽」及交通部無人機科技產業小組「無人機暢遊實境－交通部無人機研發與應用成果發表會」；此外，完成「交通行動服務（Mobility as a Service,MaaS）跨域合作與應用優化之研究-應用探討與推動規劃」，協助高雄市政府交通局與日本小田急電鐵株式會社簽署合作備忘錄並共同召開「臺日交通行動服務（MaaS）跨境合作啟動記者會」。

(1) **In terms of transportation safety:** completed the draft of "Road Traffic Safety Basic Act," the draft of "National Road Traffic Safety Guideline and Action Plan (2024-2027)," "Promotion and Demonstration of Intersection Design Examples Based on Collision Patterns," "Application Scenarios and Pilot Run of Vehicle and Pedestrians Traffic Flow Information Using UAV Aerial Videography – Diagonal Intersections and Multi-Fork Intersections," "Incorporating Emerging Technology into School Traffic Safety Education R&D Demonstration–Plan and Development of teaching assistant software," "Applying Artificial Intelligent Method for Exploring Risk-prone Road Section – Aberrant Events and Risky Driving Behavior Analysis," "Evaluation of the Trial Operation of Large Vehicles Installed with Active Warning Assist System," "Implementation of AI Signal Control for Internet of Vehicles in Taiwan – Ramp Metering and Signal Coordination for At-grade Roads," "The 41st Project for Improving Accident-Prone Road Sections in Taiwan Area," "Service Upgrade Plan 2.0 for Regional Transportation Development Research Centers (2023– 2024) – Road Safety Improvement Plan," "A Study on Application of Safety Performance Management by Objectives in Railway State Safety Program–Development of Safety Indicators and Data Analysis," "Application of Intelligent Image Interpretation Techniques to Study Wave Overtopping of Coastal Highways and Breakwaters–Night-time Wave Overtopping Interpretation," "Research on Intelligent Image Recognition Technology in Port Areas – Development of Spatial Basic Data and Image Inspection and Monitoring Application Technologies" and "Refinement and Expansion of Port Infrastructure Maintenance Management Information System."

(2) **In terms of transportation efficiency and equality:** constructed "Eastern Taiwan Regional Transportation Demand Model" and completed the supply-demand forecast analysis of transportation system, continued to promote localized highway capacity research, conducted "Analysis of traffic capacity and level of service of freeway weaving segments-typical segments," "Construction of Digital Twin Software Platform for Railway Supply and Demand Diagnosis – Planning of the Prototype Framework for Railway Digital Twin Software Platform," "Service Upgrade Plan 2.0 for Regional Transportation Development Research Centers (2023–2024)," "Implement the Contract System of Accessible Taxis – The Effectiveness and Service Optimization," "Construction of 5G Intelligent Transportation Digital Nerve Center – Function Expansion and Enhancement," "Study on Application of Drones Combined with AI Image Recognition in Bridge Inspection – Exploration of the Framework for Drone Automated Inspection," "Drone Rural Logistics Service Verification Plan," and conducted "New Bridge Inspection Tools – Drone Combined with AI Technology Results Demonstration," "Third Pilot Cup – Drone Creative Application Competition" and the MOTC unmanned vehicle technology industry group's "Drone Immersion Reality – MOTC Unmanned Vehicle Research and Application Results Presentation"; in addition, completed "Research on Optimization of Cross-domain Cooperation and Application of Mobility as a Service (MaaS) – Application Exploration and Promotion Planning," assisted the Kaohsiung City Government Transportation Bureau and Japan's Odakyu Electric Railway Co., Ltd. in signing a cooperation memorandum and jointly held "Taiwan–Japan Mobility as a Service (MaaS) Cross-border Cooperation Launch Press Conference."

三、**在國際海空競爭力方面：**持續更新國際海空運資料庫，掌握國際海空運市場發展及趨勢變化，研提海空運重要議題，提供施政決策參考應用，並且完成我國與鄰近國家及港口之航線彎靠、高雄港之非聯盟航線分析，桃園-洛杉磯航線中轉連結度及東南亞中轉往返北美旅次等分析、完成「我國航港資訊整合與數位化發展架構之研究-航港產業數位化調查與發展藍圖研擬」、「應用大數據技術建構國際機場潛在市場評析方法之研究」及「國際機場運作模擬分析軟體系統規劃與建置－系統規劃設計與軟體單元確立」。

四、**在永續運輸發展方面：**持續整合串聯自行車路線並優化「全國自行車單一總入口網」、辦理「自行車通勤路線示範計畫」成果發表記者會、配合我國2050年淨零排放政策目標，辦理「電動車公共充電樁設施設置需求評估計畫」、結合工研院等產官學研能量，於北士科站導入便捷完整之電動大客車智慧充電管理系統、協助交通部推動運輸部門2050淨零轉型及氣候變遷因應法法定工作、配合「臺灣2050淨零排放路徑及策略總說明」將低碳交通區納入淨零轉型措施，辦理「低碳交通區推動機制之研究」、研提111年度「維生基礎設施領域成果報告」及「國家氣候變遷調適行動計畫(112-115年)」維生基礎設施領域調適行動方案。

展望未來，配合交通部與本所組織與功能調整，本所將持續扮演及強化交通部智庫角色，透過精進交通基礎研究、前瞻科技創新應用研發及運輸政策規劃等核心任務，以提升重大政策研擬與決策支援實力；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，以支援運輸施政與科技創新應用並促進產業發展，奠立我國運輸服務優質升級之堅實基礎。

(3) **In terms of international maritime and aviation competitiveness:** continuously updated the international maritime and aviation transportation database, monitored the development and trend changes of the international maritime and aviation transportation market, proposed important maritime and aviation transportation issues and provided references for policy decision-making applications, and completed the analysis of our country's routes connecting with neighboring countries and ports, non-alliance routes of Kaohsiung Port, the connectivity of Taoyuan-Los Angeles route and Southeast Asia transit trips to and from North America, completed "Research on the Integration and Digital Development Framework of Our Country's Maritime and Port Information – Investigation of the Digitalization of Maritime and Port Industry and Development Blueprint," "Research on Constructing Potential Market Evaluation Methods for International Airports Using Big Data Techniques" and "Planning & Construction of International Airport Operation Simulation Analysis Software System – System Planning & Design and Software Module Establishment."

(4) **In terms of sustainable transportation development:** continuously integrated and linked bicycle routes and optimized "Taiwanbike Website," held a press conference to announce the results of "Bicycle Commuting Route Demonstration Project," cooperated with the country's 2050 net-zero emission policy goals to conduct "Public Charging Station Demand Assessment Plan for Electric Vehicles," integrated the capabilities of Industrial Technology Research Institute and other industry–academia research units to introduce a convenient and comprehensive intelligent charging management system for electric buses at North Shida station, assisted the MOTC in promoting 2050 net-zero transformation of the transportation sector and the statutory work of Climate Change Response Act, cooperated with "Taiwan 2050 Net-zero Emission Pathway and Strategy General Description" to incorporate low-carbon transportation zones into net-zero transformation measures, conducted "Research on the Promotion Mechanism of Lowcarbon Transportation Zones," proposed "2022 Basic Infrastructure Field Results Report" and Basic Infrastructure Field Adaptation Action Plan of "National Climate Change Adaptation Action Plan (2023–2026)."

In prospect, in line with the organizational and functional adjustments of the MOTC and the Institute of Transportation, MOTC, the Institute will continue to act as and enhance its function as a think tank for the MOTC. The Institute will improve the core missions such as transportation basic research, forward-looking technological innovation application research and development, and transportation policy planning to enhance material policy research and planning and decision-making support capabilities. In addition, the Institute will continue to observe international trends, enhance sea and air transportation planning capabilities, and study transportation safety, public transportation, smart transportation, green transportation, disaster prevention and adaptation, etc., in order to support transportation administration and technological innovation applications, and to promote industrial development for laying a solid foundation to upgrade the transportation services of Taiwan.

交通部運輸研究所　所長

林建河

Director General
Institute of Transportation, MOTC

Chi-Ho Lin

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組織與職掌

Organization and Functions

一 沿革

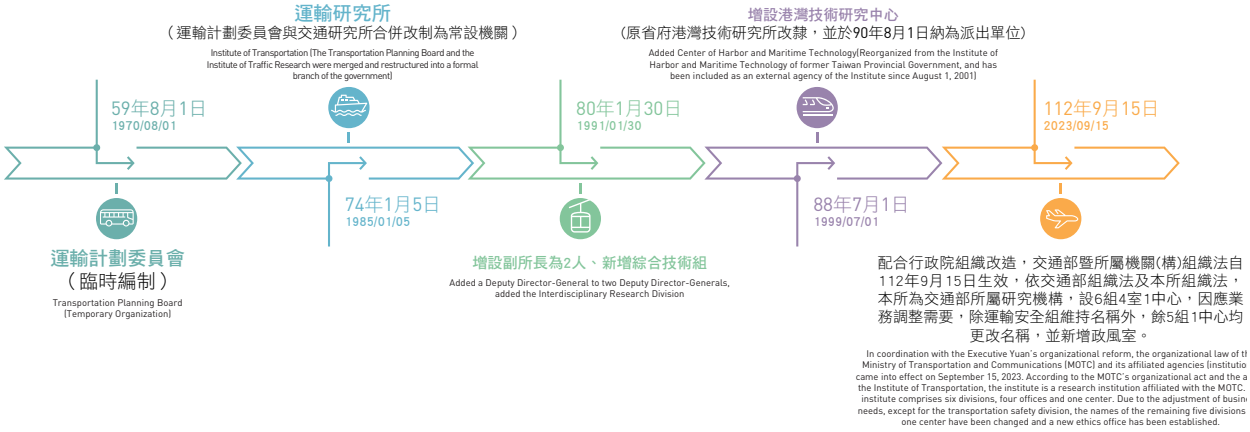
臺灣地區自政府播遷來此，經歷長年的勵精圖治，各項建設莫不欣欣向榮，經濟發展更是突飛猛進。在此期間，有關運輸部門的投資比重及其成長速度，雖亦因之與時俱增，但仍始終趕不上社會經濟快速發展及人民生活水準大幅提高的需要。因此運輸主管部門為解除擁擠、疏通瓶頸、提高容量，除當設法擴充及充分利用現有運輸設施外，更需妥善擬訂中長期運輸發展計畫，以肆應未來的需求。

由於運輸建設所需要的投資甚為龐大，且在整體經濟發展的考量下，可供運用的資金有限，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構來統籌完成。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。成立以來已完成諸多的運輸研究規劃工作，舉其犖犖大者計有：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。

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.

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 MOTC established the Transportation Planning Board on August 1, 1970. Since its inception, the Transportation Planning Board had completed a number of planning projects. Notable examples of such projects include: Planning for Integrated Transportation Systems in the Taiwan Area; Planning for Integration of Freeway Interchanges and Connecting Highway Systems; Preliminary Planing of Public Transportation Systems in the Taipei Area; Planing of Railway Improvement in the Taipei City Area; Planing of MRT System in the Taipei Metropolitan Area; 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.



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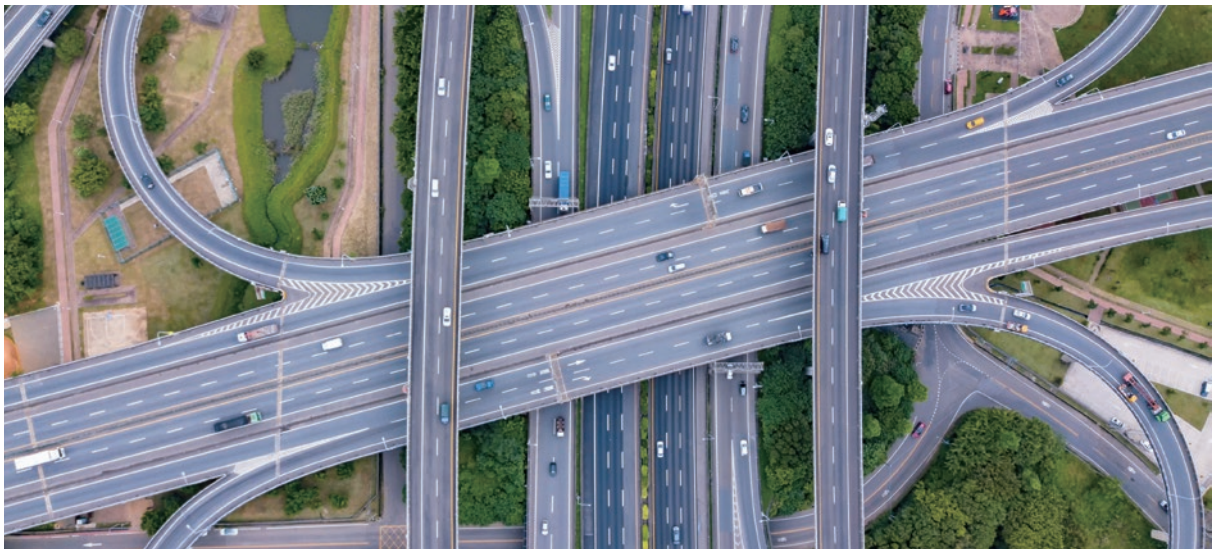
運輸計劃委員會係屬臨時編制單位，在行政運作上，在在受到經費及人力運用上的限制，委實無法因應日益遽增的運輸研究規劃業務。嗣乃奉令於民國74年元月5日，與原負責一般交通學術研究、交通幹部訓練、戰備器材管理運用及大陸交通資料蒐集研判等業務的交通研究所，合併改制為運輸研究所，成為政府常設機關，藉以健全編制，擴大規模，從而將經費與人力的運用納入常軌。民國 80 年元月 30 日，因業務大幅增加，奉准修改組織條例，增置副所長1人，並增設綜合技術組及加強中級研究規劃人力，以資因應。民國88年7月1日，因臺灣省政府功能業務與組織調整，原臺灣省政府交通處港灣技術研究所改隸本所，更名為港灣技術研究中心。民國90年8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。配合行政院組織改造，交通部暨所屬機關（構）組織法自112年9月15日生效，依交通部組織法及本所組織法，本所為交通部所屬研究機構。本所設6組4室1中心，因應業務調整需要，除運輸安全組維持名稱外，餘5組1中心均更改名稱，並新增政風室。

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 transportation information 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 functional adjustments of Taiwan Provincial Government, 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 external agency of the Institute of Transportation. In coordination with the Executive Yuan's organizational reform, the organizational law of the Ministry of Transportation and Communications (MOTC) and its affiliated agencies (institutions) came into effect on September 15, 2023. According to the MOTC's organizational act and the act of the Institute of Transportation, the institute is a research institution affiliated with the MOTC. The institute comprises six divisions, four offices and one center. Due to the adjustment of business needs, except for the transportation safety division, the names of the remaining five divisions and one center have been changed and a new ethics office has been established.



二 組織及人力

本所設有運輸計畫及陸運、運輸工程及海空運、運輸經營及管理、運輸安全、運輸科技及資訊、運輸能源及環境6個組與運輸技術研究中心等計7個業務單位，及秘書室、人事室、主計室、政風室等行政單位。本所112年底預算員額148人（含職員130人、聘用人員3人，技工、工友及駕駛15人）。

II Organization and Human Resources

The institute has seven business units: transportation planning and land transport division, transportation engineering and maritime and air transport division, transportation operations and management division, transportation safety division, transportation technology and information division, transportation energy and environment division, and transportation technology research center. Additionally, there are administrative units which include the secretariat, personnel office, accounting office, and ethics office.

At the end of 2023, the institute's budgeted staff was 148 people (including 130 staff members, 3 contracted personnel, and 15 technicians, workers and drivers).

貳

三 本所職掌

依據本所組織法第二條規定，本所掌理下列事項：

1. 運輸政策之研究及建議。
2. 運輸系統規劃之研究及發展。
3. 運輸工程之研究及發展。
4. 運輸經營與管理之研究及發展。
5. 運輸安全之研究及發展。
6. 運輸能源與環境之研究及發展。
7. 運輸科技與資訊之研究及發展。
8. 運輸技術之研究及發展。
9. 國內外運輸研究之聯繫及合作。
10. 其他有關運輸研究事項。

III Functions

The IoT is responsible for the following tasks:

1 Transportation policy research and recommendations.

2 Transportation system planning research and development.

3 Transportation engineering research and development.

4 Transportation operations and management research and development.

5 Transportation safety research and development.

6 Transportation, energy, and environmental research and development.

7 Transportation technology and information technology research and development.

8 Transportation technique research and development.

9 Contact and collaboration with domestic and international transportation institutions.

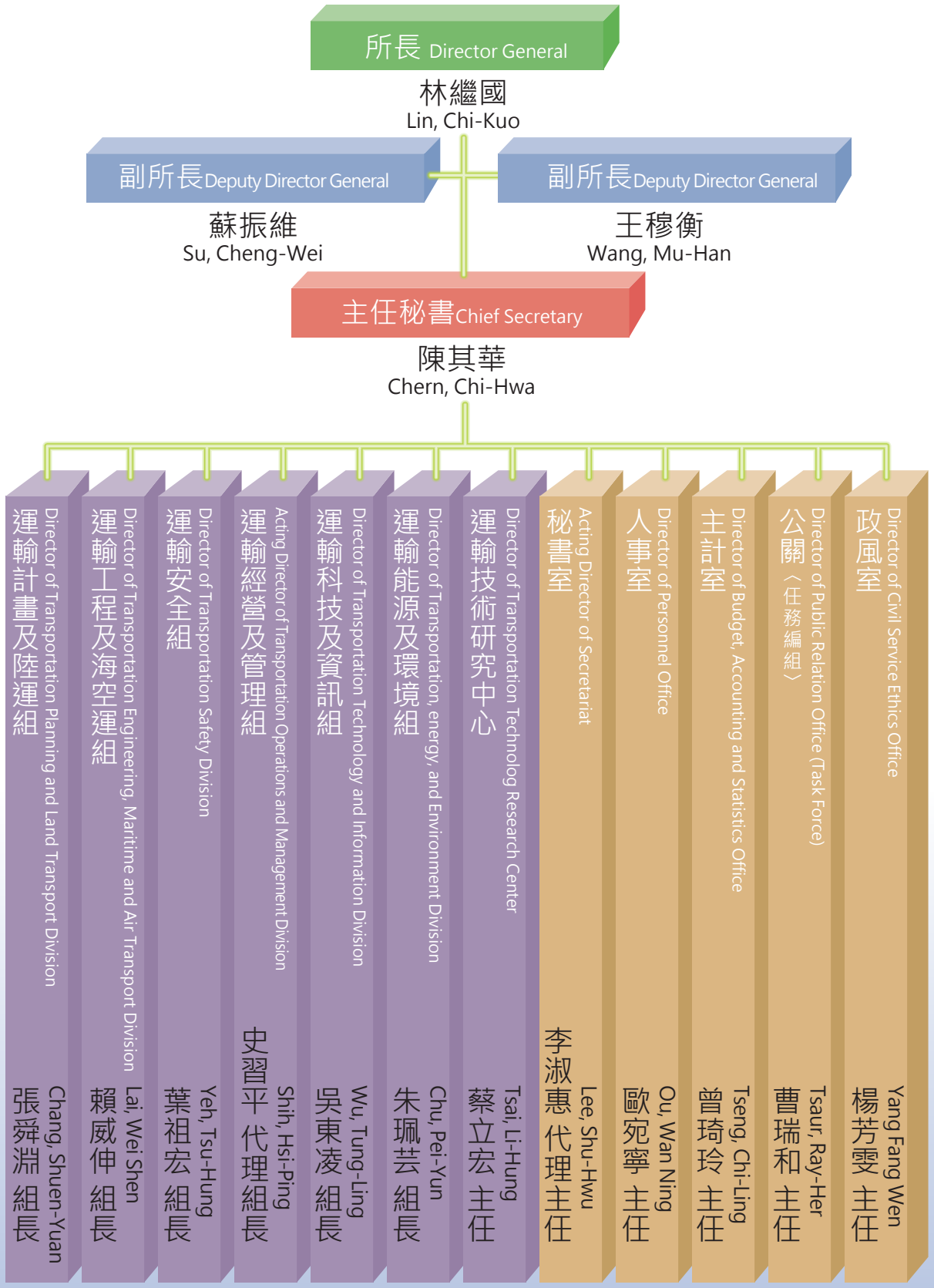
10 Other transportation research-related matters.

四 組織架構

本所組織架構如下圖（本圖將請廠商重新美編設計）：

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 **蘇振維 Su, Cheng-Wei**

副所長Deputy Director General **王穆衡 Wang, Mu-Han**

主任秘書Chief Secretary **陳其華 Chern, Chi-Hwa**

人事室 主任 Director of Personnel Office

歐宛寧 Ou, Wan-Ning

秘書室 代理主任 Acting Director of Secretariat

李淑惠 Lee, Shu-Hwui

政風室 主任 Director of Civil Service Ethics Offic

楊芳雯 Yang, Fang-Wen

主計室 主任

Director of Budget, Accounting and Statistics Office

曾琦玲 Tseng, Chi-Ling

公關室 主任 Director of Public Relation Office

曹瑞和 Tsaur, Ray-Her

運輸技術研究中心 主任

Director of Transportation Technology Research Center

蔡立宏 Tsai, Li-Hung

運輸計畫及陸運組 組長

Director of Transportation Planning and Land Transport Division

張舜淵 Chang, Shuen-Yuan

運輸安全組 組長

Director of Transportation Safety Division

葉祖宏 Yeh, Tsu-Hung

運輸工程及海空運組 組長

Director of Transportation Engineering, Maritime and Air Transport Division

賴威伸 Lai, Wei Shen

運輸經營及管理組 代理組長

Acting Director of Transportation Operations and Management Division

史習平 Shih, Hsi-Ping

運輸科技及資訊組 組長

Director of Transportation Technology and Information Division

吳東凌 Wu, Tung-Ling

運輸能源及環境組 組長

Director of Transportation Energy and Environment Division

朱珮芸 Chu, Pei-Yun

參 03

年度研究主軸與重點

Annual Research Theme and Focus

依據本所配合交通部運輸發展政策以及國內交通需求，持續滾動規劃之研究發展路徑藍圖，112年之七項研究主軸與重點如下：

一 強化運輸規劃與審議支援

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，研究重點如下：

1. 因應環境變遷滾動辦理整體運輸規劃

（1）持續辦理區域及全國整體運輸規劃，105年開始辦理區域整體運輸規劃，目前已完成北臺、南臺及中臺區域整體運輸規劃，於112年辦理東臺區域（宜花東）整體運輸規劃系列研究之第2年期計畫，完成東臺區域運輸需求模式構建、未來年運輸需求預測與供需分析，做為後續113年進行東臺區域陸路運輸系統發展策略研析之基礎。

（2）持續維護與更新運輸規劃支援系統，完成以內政部TGOS服務取代GIS Server，建置新版圖台底層框架與圖台介面設計；強化數據庫資料查詢統計功能，新增生活圈運輸需求模式成果查詢功能，112年持續提供圖形資料庫予交通部公路局、內政部國土管理署建立永續生活圈運輸評估模型、國土規劃（含都會區域計畫）之機制探討使用。

（3）辦理大漢溪兩岸整體交通路網規劃構想計畫，依行政院吳政委澤成於112年2月10日指示，本案以充分使用大漢溪兩岸空間方式進行快速道路構想規劃，完成大漢溪兩岸整體交通路網規劃構想計畫，提供公路局接續辦理可行性評估等相關作業參考。

2. 持續精進審議評估／決策支援工具

（1）延續過去本所進行之公路容量分析系列研究，於112年起針對高速公路交織路段進行研究，本年度完成典型路段初步分析模式，做為113年起進行非典型、銜接高速公路交織路段研究及未來臺灣公路容量手冊增修編訂之基礎。

The research and development roadmap blueprint planned on a rolling basis is continued according to the transportation development policy of the MOTC and Communications and is reflective of the domestic demand for transportation. There were seven main schemes and key points of 2023 and they are described as follows:

I Enhance the Transportation Planning and Reviewing Support

Organize transportation planning and research and better project evaluation tools to normalize overall transportation developments. Highlights of the research are as follows:

1. Overall Transportation Planning on a Rolling Basis Reflective of Environmental Changes

(1) Continue to conduct regional and national overall transportation planning, starting from 2016, regional overall transportation planning has been carried out. The overall transportation plans for Northern Taiwan, Southern Taiwan and Central Taiwan have been completed. In 2023, the second year of overall transportation planning series for Eastern Taiwan (Yilan, Hualien, Taitung) was conducted, completing the construction of a transportation demand model for Eastern Taiwan, future transportation demand forecasts and supply–demand analysis. They serve as the basis for subsequent analysis of land transportation system development strategies for Eastern Taiwan in 2024.

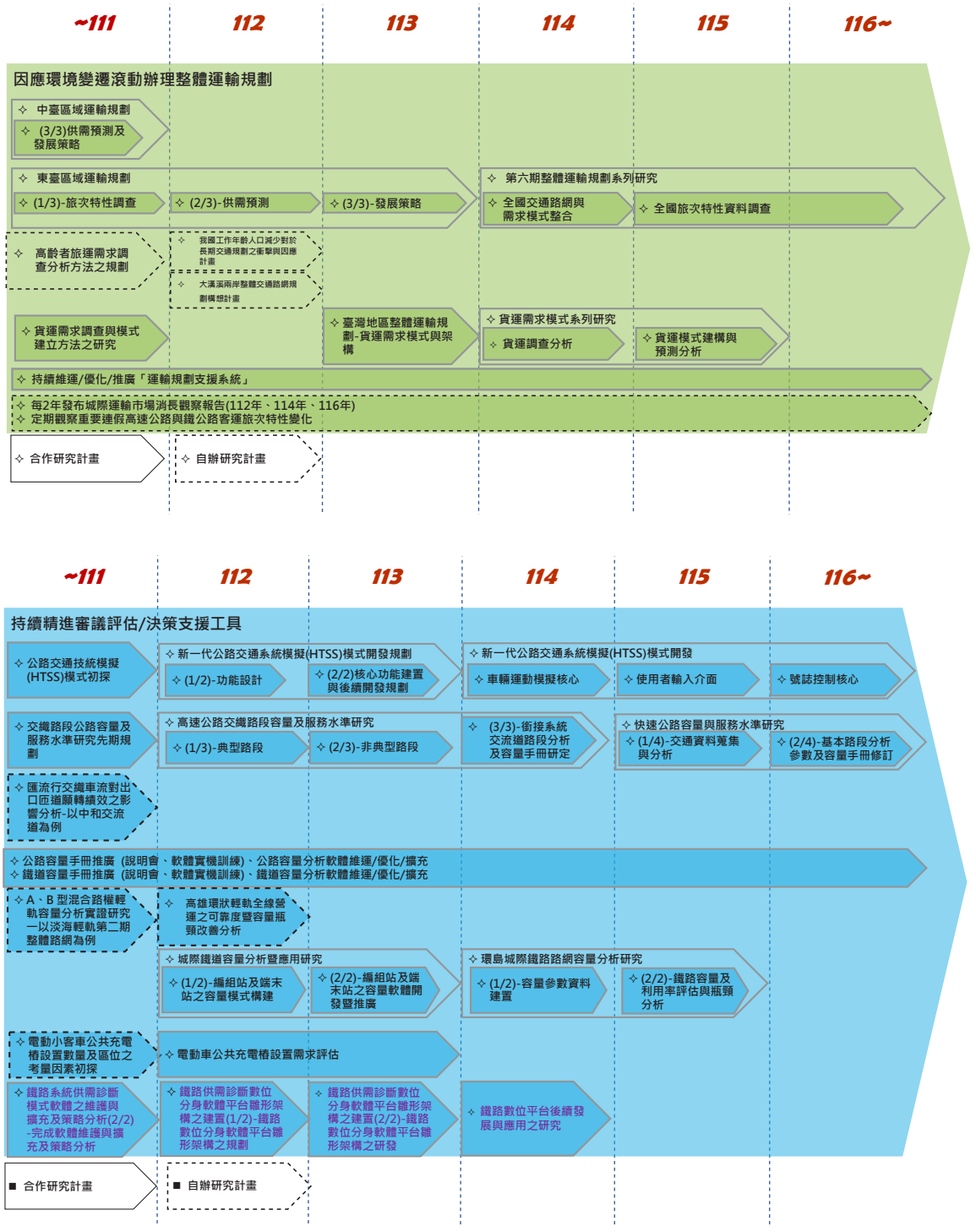
(2) Continue to maintain and update the transportation planning support system, replace GIS server with the Ministry of the Interior's TGOS service, build a new map platform framework and interface design; enhance the database's data query and statistical functions, and add the living circle transportation demand model results query function. In 2023, the graphical database continues to be provided to the Highway Bureau and the National Land Management Agency of the Ministry of the Interior for the establishment of sustainable living circle transportation evaluation models and the exploration of mechanisms for national land planning (including metropolitan area planning).

(3) Conceptual plan for the overall traffic network on both sides of the Dahan River was completed as per the directive of Commissioner Wu on February 10, 2023. This project involves the concept planning of express roads utilizing the space on both sides of the Dahan River, providing a reference for the Highway Bureau to carry out feasibility studies and other related operations.

2. Continuous Advancement of Review and Evaluation/Decision-making Support Tools

(1) Continuing past highway capacity analysis research, a study on freeway weaving sections began in 2023. The preliminary analysis model for typical sections was completed this year, which serves as the basis for subsequent studies on atypical and connecting freeway system interchanges weaving sections resesearch, and future amendments to Taiwan highway capacity manual from 2024 onwards.

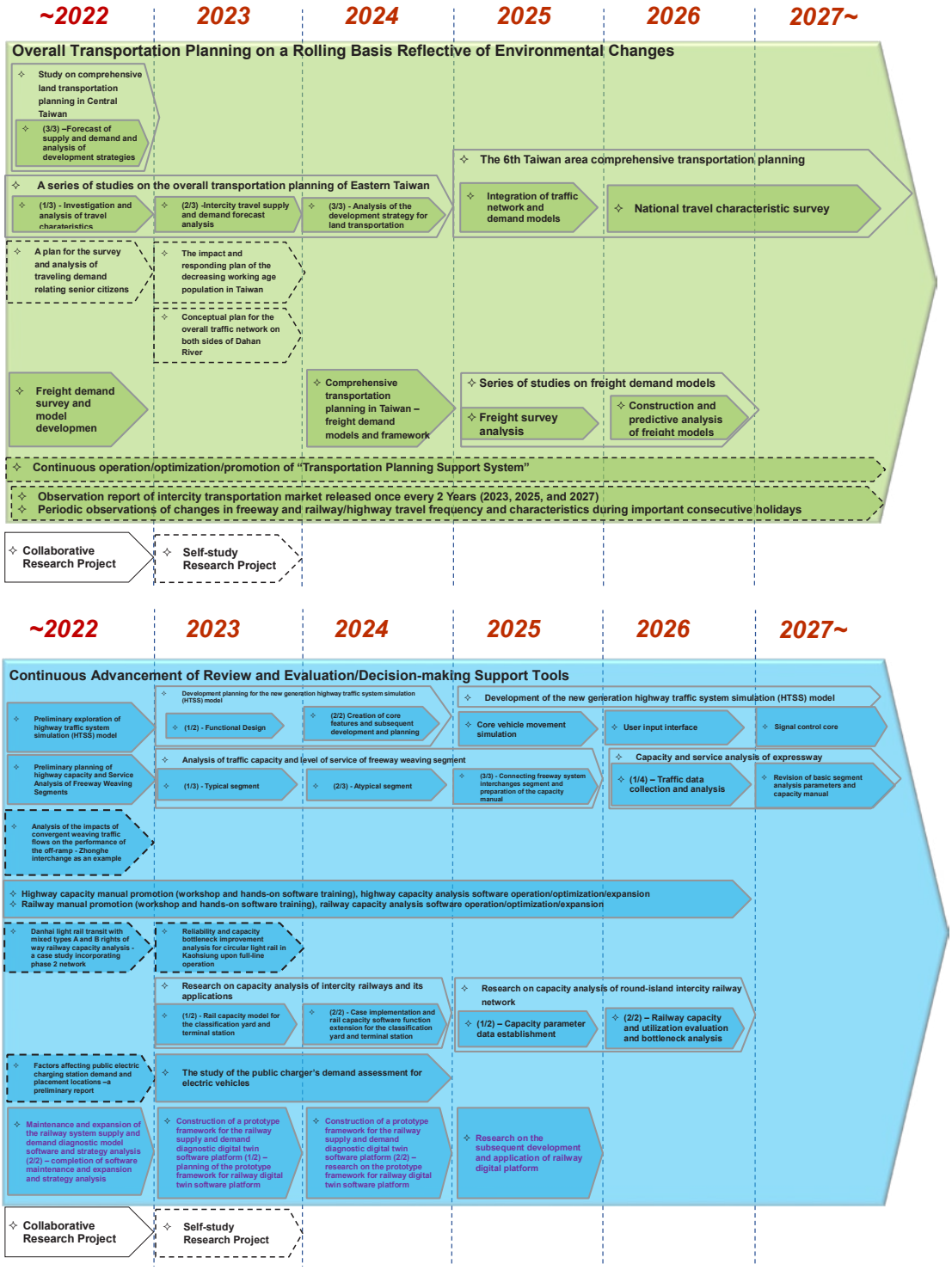
主軸 1：強化運輸規劃與審議支援



（2）延續過去本所進行之鐵路供需分析系列研究，於112年起針對鐵路數位分身進行研究，透過蒐整國際先進國家鐵路數位分身標竿案例文獻資料，完成軟體平台雛型架構之規劃，並進行相關案例分析，做為後續113年進行數位分身平台研發及做為列車模擬與評估建設計畫方案之輔助工具之基礎。

(2) Continuing past railway supply and demand analysis research, a study on railway digital twins began in 2023. By collecting international benchmark cases of advanced railway digital twins, the prototype planning of software platform architecture was completed and related case analyses were conducted, laying the foundation for subsequent development of digital twin platform in 2024 as an auxiliary tool for train simulation and evaluation of construction project plans.

1: Enhance the Transportation Planning and Reviewing Support



（3）延續過去本所進行之鐵道容量分析系列研究，於112年針對城際鐵道之編組站及端末站進行容量分析研究，完成構建可分析編組站與端末站之容量分析模式，並進行相關案例分析，做為後續113年進行傳統暨區域鐵路容量分析軟體功能擴充與臺灣鐵道容量手冊增修編訂之基礎。

(3) Continuing past railway capacity analysis research, a study on capacity analysis of classification yard and terminal station of intercity railways was conducted in 2023. The construction of capacity analysis models for classification yard and terminal station was completed and related case analyses were conducted. These will serve as the basis for the expansion of traditional and regional railway capacity analysis software functions and amendments to the Taiwan rai lway capacity manual in 2024.

二 提升海空運競爭優勢

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海空運發展之願景，研究重點如下：

1. 掌握國際海空運發展趨勢進行前瞻性策略研提

（1）海空運輸在全球經濟發展扮演重要角色，全球溫室氣體排放中航空及海運運輸均各自占約2%，且國際民航組織及國際海事組織均以2050年淨零排放為國際長期理想目標，爰就海空領域分別辦理減碳發展趨勢探討，蒐集國際組織有關國際間減碳相關決議、規範及建議，以掌握國際減碳之方向及趨勢，並檢視瞭解我國有關部門之相關作為。

（2）發展海空運決策輔助系統，以海運而言，航港產業有其特殊性，靠港過程中涉及眾多利害關係人及複雜作業流程，除了建立適當的系統進行準確且一致性的訊息傳遞外，其中關鍵課題不僅為技術問題，更須先達成訊息交換之共識，參與誘因及系統信任程度等；空運部分亦有如機場空側運作瓶頸、支援規劃與精進機場空側調度與配置等問題，爰就海空運領域分別辦理港口協調整合決策系統及機場運作模擬分析系統等研究，透過研究瞭解我國現行作業流程及實務做法，提出前述領域相關決策系統之建議。

（3）後疫情期間及疫後全球貨運發展趨勢丕變，全球供應鏈因疫情衝擊，從長鏈轉變成短鏈，從全球化走向區域化，以致國際航空貨運發展策略需配合調整因應，爰辦理「亞太樞紐國際機場疫後永續發展推動趨勢探討」，蒐整疫後國際航空貨運趨勢變化、我國國際機場貨運發展現況與未來規劃、國籍航空公司對國際貨運發展布局及我國國際航空貨運重要課題進行分析，俾做為交通部、民航局、桃園機場公司及國籍航空業者擬定政策與發展策略之參據。

II Improve the Competitive Advantage of Sea and Air Transportation

Sea and air transportation is an important model for our country to be linked internationally. Becoming a sea and air transportation pivot is a vision for the development of sea and air transportation in our country. Highlights of the research are as follows:

1. Keeping Track of Development Trends for International Sea and Air Transportation and Propose Forward-looking Strategies

(1) Maritime and air transportation play an important role in global economic development, with both aviation and maritime transport each accounting for about 2% of global greenhouse gas emissions. Both the international civil aviation organization and the international maritime organization aim for net-zero emissions by 2050 as a long-term international goal. Therefore, studies on carbon reduction trends in the maritime and air sectors were conducted, collecting international resolutions, regulations and recommendations related to international carbon reduction to understand global carbon reduction directions and trends, and to review and understand the relevant actions of domestic departments.

(2) Continue to develop the decision support systems for maritime and air transport. In maritime transport, the shipping and port industry has its particularities, involving many stakeholders and complex operational processes during the port call process. In addition to establishing appropriate systems for accurate and consistent information transmission, the key issues are not only technical but also require consensus on information exchange, incentives for participation and the level of system trust. In air transport, issues such as airport airside operation bottlenecks, support planning, and airside dispatch and configuration optimization exist. Research on port coordination and integration decision support systems and airport operation simulation analysis systems was conducted to understand the current domestic operational processes and practical methods, and provide recommendations for the aforementioned decision systems in these areas.

(3) The post-pandemic period has seen significant changes in global cargo development trends. Impacted by the pandemic, the global supply chain has shifted from long chains to short chains, and from globalization to regionalization, requiring adjustments to international air cargo development strategies. Therefore, "Study on the Sustainable Development Promotion Trends of Post-pandemic Asia-Pacific Hub International Airports" was conducted to analyze post-pandemic international air cargo trend changes, the current status and future planning of our international airport cargo development, the international cargo development layout of our national airlines, and key issues in our international air cargo. This analysis provides a reference for the MOTC, Civil Aeronautics Administration, Taoyuan International Airport Corporation and national airlines in formulating policies and development strategies.

（4）海運數位化為航港產業長期關注的議題，然與其他產業相較之下，航港產業的數位化發展較為緩慢，有必要對相關策略進行深入研究，爰辦理「我國航港資訊整合與數位化發展架構之研究」，112年進行航港產業數位化調查與發展藍圖研擬，藉以擘劃我國航港產業數位化發展方向，透過規劃數位化發展推動藍圖，擬訂相關推動策略。

2. 精進海空運資料庫功能進行主題式研析

（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，提供決策應用。海運成果部分，提供航港局及港務公司政策評估所需之全球貨櫃航線數據，例如：全球疫情前後主航線部署變化分析、國籍航商之區域航線部署分析等；在空運成果部分，提供交通部航政司、民航局、桃園機場公司在政策評估疫情影響所需分析資料，例如：2019至2021年桃園機場貨運市場分析、疫情期間亞洲主要航空公司貨機機隊應用分析、東南亞國家往返歐美移動路徑之旅次變化。

（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（構）進行政策研擬，包括：疫情前後全球主航線部署之變化分析、國籍航商之區域航線部署、桃園機場於美國-越泰菲中轉市場之競爭力、臺港航空貨運概況分析、國際航空客貨運量復甦狀況初探、民用航空運輸業者因應疫情相關作為、永續航空燃料應用趨勢之初探。

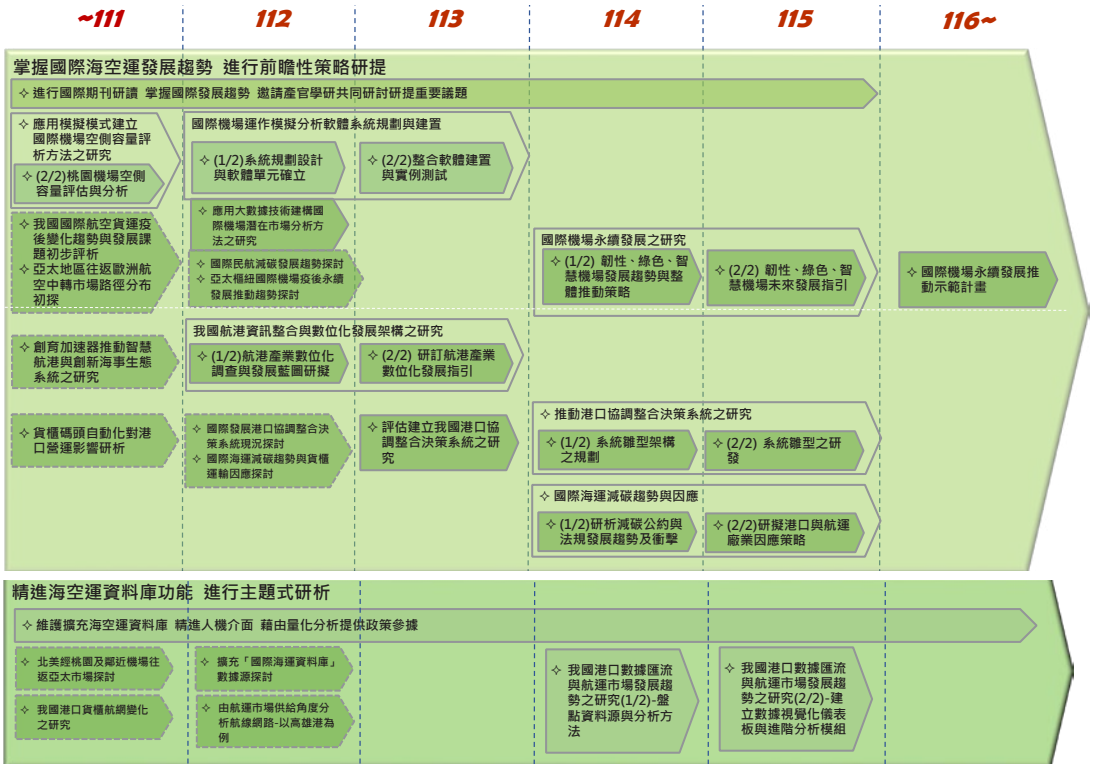
(4) Maritime digitization has been a long-term concern for the shipping and port industry, but compared to other industries, the shipping and port industry's digital development has been relatively slow. This necessitates in-depth research on relevant strategies. Therefore, "Study on the Integration and Digital Development Framework of Taiwan's Shipping and Port Information" was conducted, which includes conducting a survey on the digitization of the shipping and port industry, developing a blueprint for digital development in 2023, planning the direction of Taiwan's shipping and port industry's digital development, and formulating related promotion strategies.

2. Advancement of Sea and Air Transportation Database Features for Topic-based Analysis

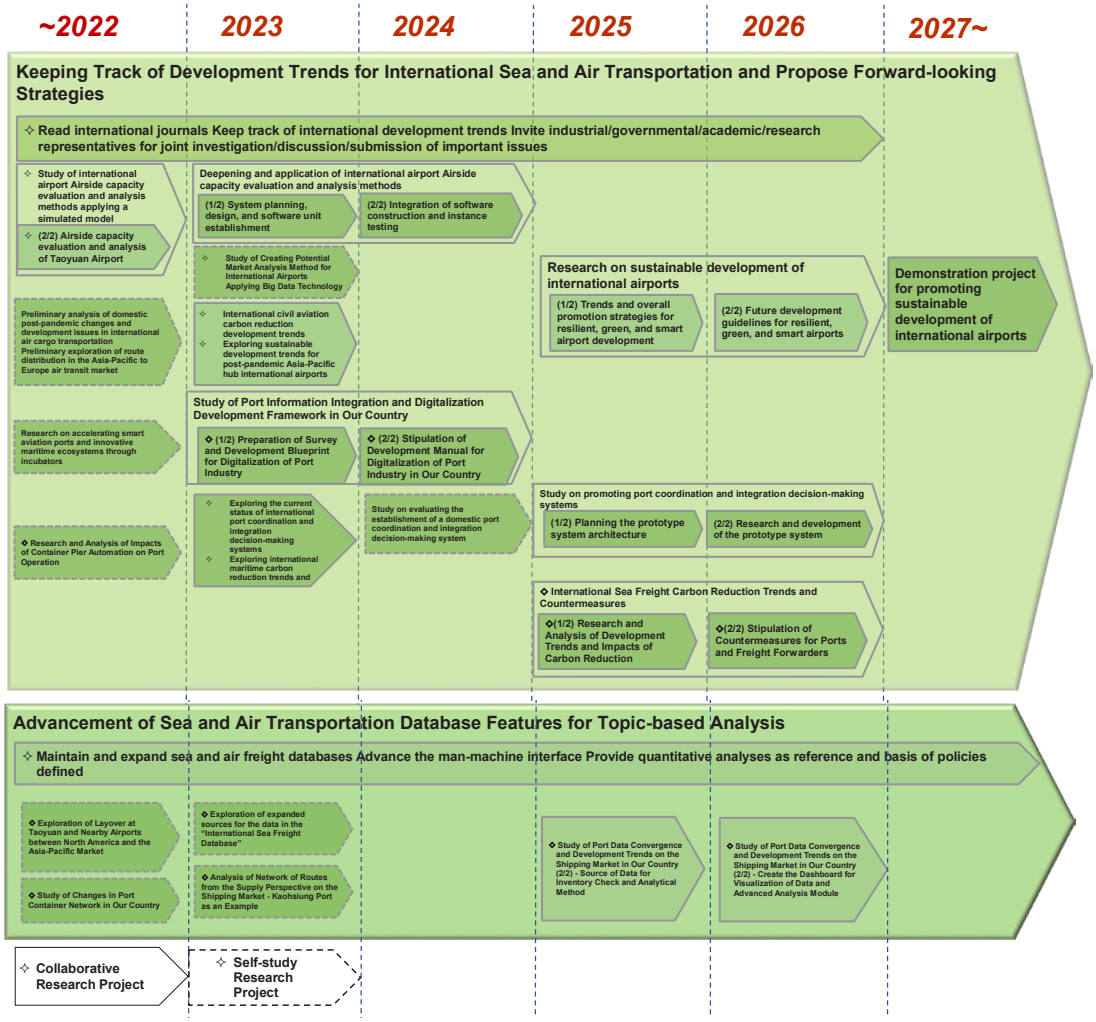
(1) Continue to maintain and update the international maritime and air transport database, and provide decision-making applications through quantitative data analysis. In maritime transport achievements, global container shipping data needed for policy evaluation by the maritime and port bureau and port authorities was provided, such as the analysis of changes in major shipping routes before and after the global pandemic and the deployment analysis of regional routes by national shipping companies. In air transport achievements, analysis data needed for policy evaluation by the department of navigation and Aviation Administration of the MOTC, Civil Aeronautics Administration, and Taoyuan International Airport Corporation during the pandemic was provided, such as the analysis of Taoyuan airport's cargo market from 2019 to 2021, the application analysis of cargo fleets of major Asian airlines during the pandemic and the trip changes of Southeast Asian countries to and from Europe and America.

(2) Due to intense changes in internal and external environments, international maritime and air transport journal studies and seminars are regularly conducted to grasp international advanced technology and industry development trends. These studies include conducting research and data collection to provide analysis of important maritime and air transport issues, and supporting the MOTC and its subordinate agencies in policy formulation. These studies also include analysis of changes in global main shipping route deployment before and after the pandemic, the deployment of regional routes by national shipping companies, the competitiveness of Taoyuan airport in US-Vietnam-Thailand-Philippines transit market, an overview of Taiwan-Hong Kong air cargo, initial exploration of international air passenger and cargo recovery, responses of civil aviation operators to the pandemic, and initial exploration of sustainable aviation fuel application trends.

主軸 2：提升海空運競爭優勢



2: Improve the Competitive Advantage of Sea and Air Transportation



三 優化公共運輸服務及產業轉型

促進陸路運輸發展，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，研究重點如下：

1. 優化公路公共運輸經營環境

（1）賡續協助交通部公路局推動「公路公共運輸服務升級計畫(110-113年)」，包括參與提案審查會議以及就公路局陳報交通部核定之補助作業要點規範及辦理計畫內容研提專業意見。

（2）奉交通部指示研擬新一期公運計畫向行政院爭取經費，透過研究探討Covid-19疫情對公共運輸載客量之影響與因應對策，以及進行智慧公共運輸服務發展策略規劃，召開12場次工作會議及6場次座談會以徵詢各界意見並進行交流，完成「公路公共運輸永續及交通平權計畫（114-117年）」（草案）陳報交通部轉行政院審議，做為推動下一期公運計畫之依據。

（3）賡續辦理區域運輸發展研究中心服務升級2.0計畫，其中透過開設交通運輸專業人才培訓課程、提供地方政府諮詢並輔導解決公共運輸問題，以彌補地方政府推動公路公共運輸所欠缺之人力及能力，協助地方政府發展公共運輸。

（4）賡續檢討修訂汽車客運業路線別成本計算制度，112年完成成本分析應用軟體之開發，協助汽車客運業者釐清各條營運虧損補貼路線實際成本項目，提供業者提升經營管理績效及主管機關數位治理之需求。

III Optimize Public Transportation Services and Industrial Transformation

Promote land transportation, improve the operating environment, and boost operational performance in order to optimize the land transportation industry. Highlights of the research are as follows:

1. Optimize the Operating Environment for Highway Public Transportation

(1) Continue to assist the Highway Bureau of the MOTC in promoting "Highway Public Transportation Service Upgrade Plan (2021–2024)," including participating in proposal review meetings and providing professional opinions on the subsidy operation guidelines and content plan reported by the Highway Bureau to the MOTC and Communications for approval.

(2) Following the MOTC's instructions, a new public transportation plan was drafted to secure funding from the Executive Yuan. This included studying the impact of the Covid-19 pandemic on public transportation ridership and developing response strategies, as well as planning the development strategy for intelligent public transportation services. Twelve work meetings and six forums were held to solicit opinions and facilitate exchanges, resulting in "Highway Public Transportation Sustainability and Mobility Equality Plan (2025–2028)" (draft) submitted to the MOTC for review by the Executive Yuan, serving as the basis for promoting the next phase of public transportation plan.

(3) Continuing with the service upgrade plan 2.0 for a regional transportation development research centers, this included training courses for transportation professionals, providing consultation and assistance to local governments to solve public transportation issues, thus addressing the manpower and capability shortages in promoting highway public transportation, and assisting local governments in developing public transportation.

(4) Continue the review and revision of route-based costing systems for bus services industry; in 2023, the development of cost analysis application software was completed, helping the bus services operators clarify the actual cost items for each subsidized operational loss route, providing operators with a way to enhance operational management performance and meet the needs of digital governance for competent authorities.

2. 推動智慧運輸及包容性服務

（1）因應交通行動服務屬創新服務型態，涉及面向廣大，且隨著越來越多城市推動MaaS服務及其發展演進，亦衍生許多值得進一步探討及擴充應用之議題；112年就MaaS使用者數據資料應用面向、跨域合作、服務永續提供等議題進行探討，同時推動交通行動服務（MaaS）國際交流合作，協助高雄市政府交通局與日本小田急電鐵株式會社推動跨國實質合作，並辦理APEC「提昇移動力整合新紀元」第二場次國際論壇。

（2）精進通用計程車特約制度及系統軟體以落實「人本交通」政策，112年持續與6個直轄市政府合作提供預約式通用計程車服務，強化地方政府推動通用計程車策略與作法，累計完成574,008趟次服務，平台會員數達32,428人。

3. 協助汽車運輸業綠色及數位轉型

（1）蒐集分析電動大客車營運數據監控管理平台資料，用以掌握各項重要關鍵指標（如用電效率、SOC使用量、低電量比率等指標特性）；並藉由個案分析結果與客運業者進行交流，蒐集指標參數之相關影響因子，提供客運業者參考與應用，以及做為交通部滾動檢討電動大客車推動政策與後續計畫應用推動之基礎；另於中興集團北士科停車場建置電動大客車智慧充電管理系統，完成發展客運業者之電動大客車充電班表及契約容量最佳充電策略。

2. Promote Intelligent Transportation and Inclusive Services

(1) Given that mobility as a service (MaaS) is an innovative service model involving a wide range of aspects, and with more cities promoting and evolving MaaS services, many issues worth further exploration and expanded application have emerged. In 2023, discussions were held on issues such as the application of MaaS user data, cross-domain cooperation and sustainable service provision. International exchanges and cooperation on MaaS were promoted, assisting the Transportation Bureau of Kaohsiung City Government in promoting transnational practical cooperation with Japan's Odakyu Electric Railway Co., Ltd., and holding the second APEC "Enhancing Mobility Integration for a New Era" international forum.

(2) Refine the contract system and software of accessible taxis to implement the "People-centered Transportation" policy. In 2023, continuous cooperation with six metropolitan city governments provided reservation-based special taxi services and strengthened local governments' strategies and practices for promoting accessible taxis, resulting in 574,008 trips and 32,428 platform members.

3. Assistance in the Green and Digital Transformation of the Motor Transportation Industry

(1) Collect and analyze operational data from electric buses through a monitoring management platform to grasp key indicators (such as power efficiency, state of charge usage and low power ratio characteristics). Exchange case study results with passenger transport operators, collect related influencing factors of indicator parameters, provide operators with references and applications, and serve as the basis for the MOTC to continuously review electric bus promotion policies and subsequent application promotion plans. Additionally, establish an intelligent charging management system for electric buses at Beitou and Shilin Technology's parking lot of Zhongxing Group to develop optimal charging schedules and contract capacity strategies of electric buses for passenger transport operators.

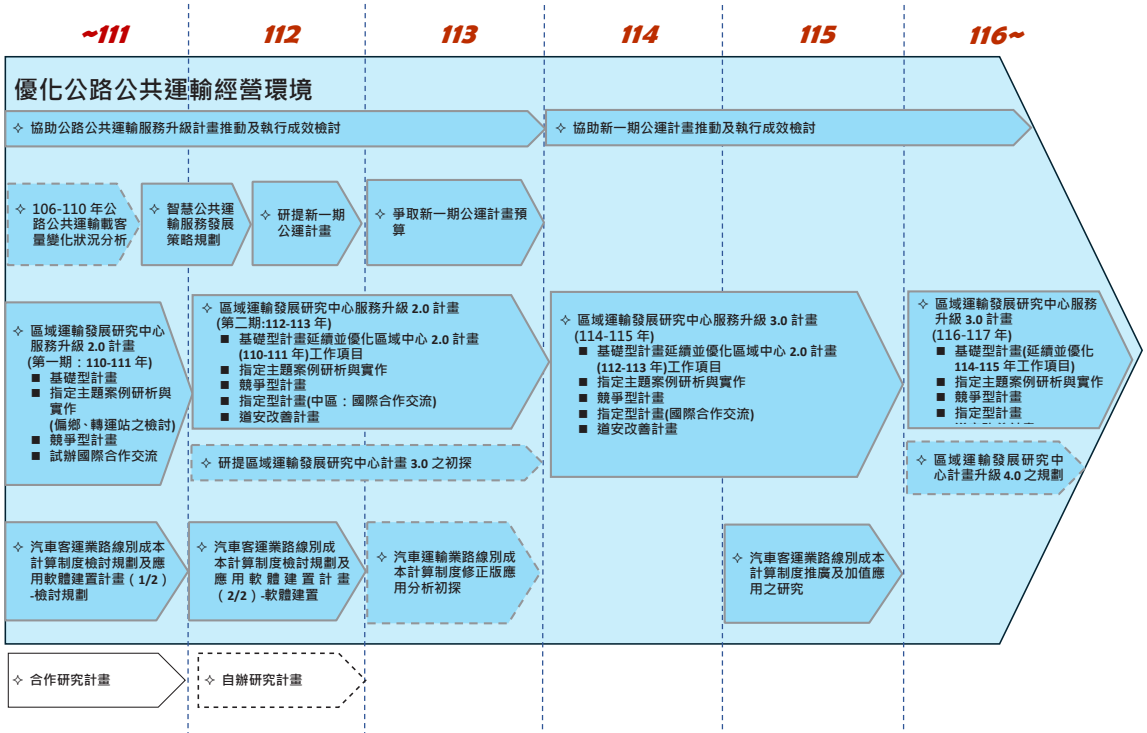
（2）辦理「小客車租賃服務整合旅遊生態系平台」軟體著作權授權公告，以輔導小客車租賃業者進行數位轉型。藉由導入新科技與智慧化服務來增加同業／異業結盟之機會，提供消費者行動化租車服務強化民眾更好的服務體驗，以提升整體產業的競爭力。截至112年底，計有中華民國小客車租賃商業同業公會全國聯合會及臺中市小客車租賃商業同業公會等2家公會提出申請並完成授權。

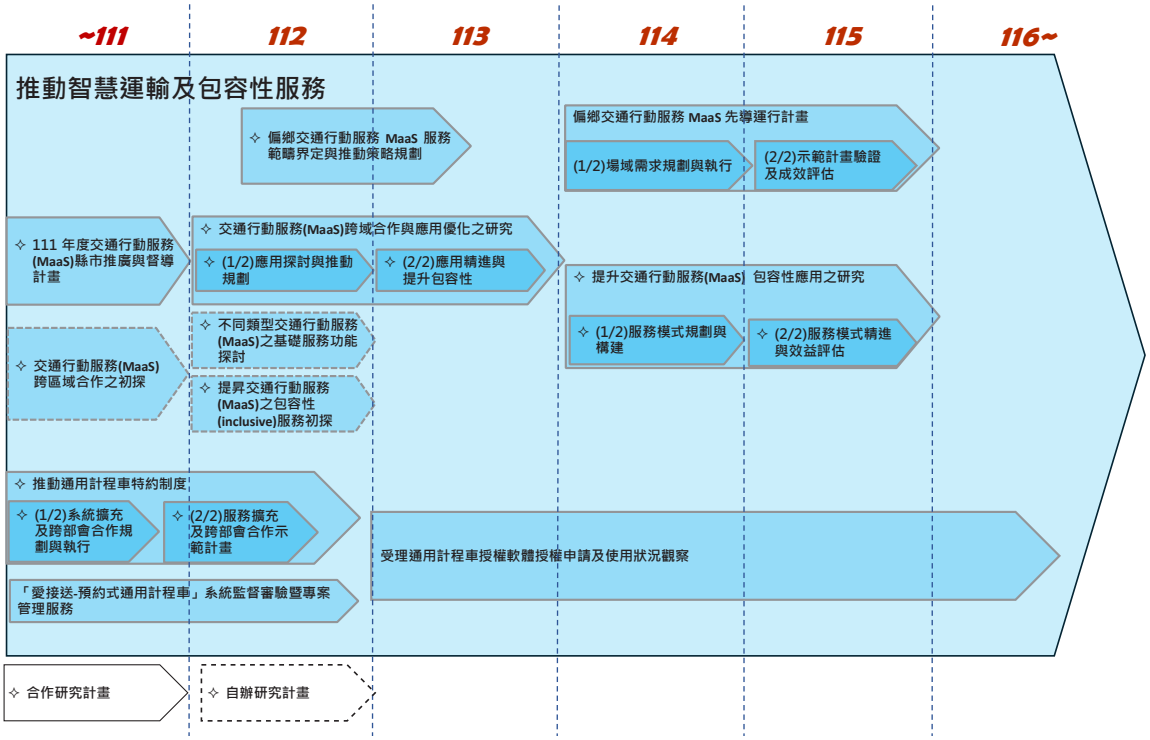
（3）為協助汽車客運業導入先進技術推動產業數位治理，112年完成整合區塊鏈技術與OBD車載設備的「駕駛數位履歷管理系統」研發，透過4輛公車、4位駕駛，行駛5條路線，累計行駛5,033趟次，2,900小時，產生174萬筆實車測試資料，驗證透過行車數據輔助導正不良駕駛行為以提升行車安全之技術架構概念具可行性。

(2) Conduct the "Integrated Car Rental Service for Tourism Ecosystem Platform" software copyright licensing announcement to guide car rental operators in digital transformation. Introduce new technologies and intelligent services, increase opportunities for alliances within and outside the industry, provide mobile car rental services to enhance consumer service experience, and improve the overall competitiveness of the industry. By the end of 2023, applications for and completion of licensing were submitted by the national union of car rental commercial associations and Taichung car rental commercial association.

(3) To assist the bus services industry in introducing advanced technologies to promote digital governance, in 2023, the development of "Driver Digital Resume Management System" integrated blockchain technology and OBD onboard devices was completed, involving 4 buses, 4 drivers and 5 route travels, accumulating 5,033 trips and 2,900 hours, and generating 1.74 million real-world test data points to verify the feasibility of the technical architecture concept for improving driving safety through data-assisted correction of poor driving behaviors.

主軸 3：優化公共運輸服務及產業轉型

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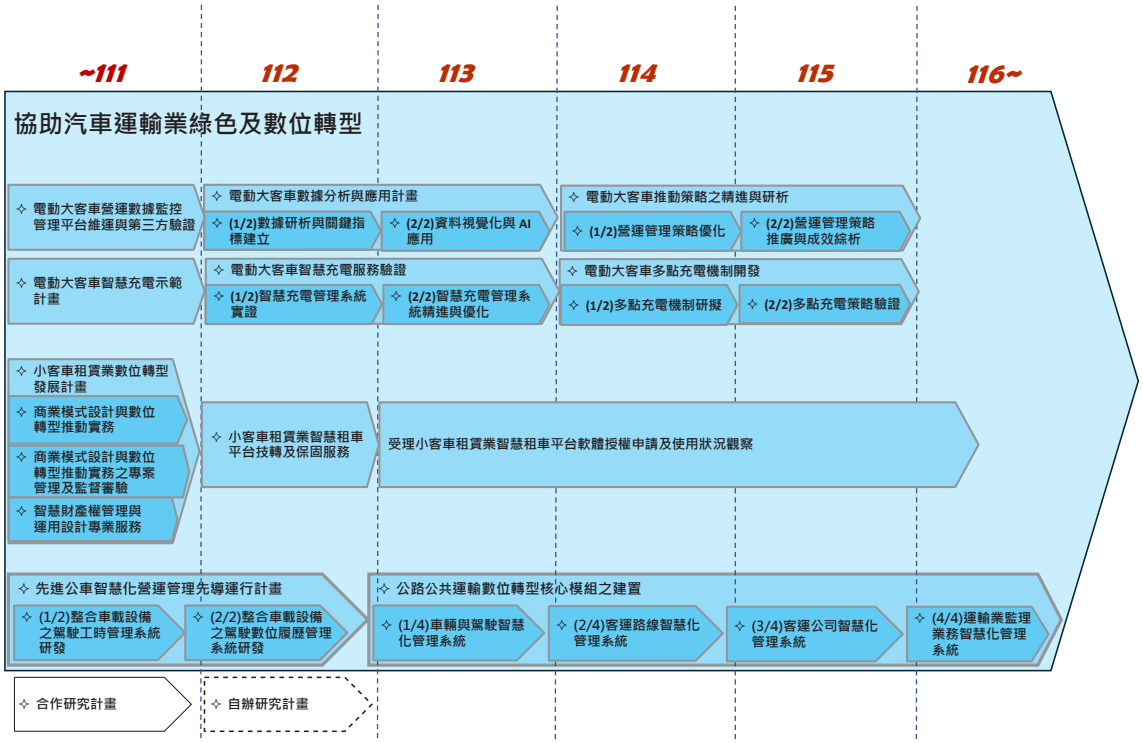
推動智慧運輸及包容性服務
偏鄉交通行動服務 MaaS 服務範疇界定與推動策略規劃
偏鄉交通行動服務 MaaS 先導運行計畫
(1/2)場域需求規劃與執行
(2/2)示範計畫驗證及成效評估
111 年度交通行動服務(MaaS)縣市推廣與督導計畫
交通行動服務(MaaS)跨域合作與應用優化之研究
(1/2)應用探討與推動規劃
(2/2)應用精進與提升包容性
提升交通行動服務(MaaS) 包容性應用之研究
(1/2)服務模式規劃與構建
(2/2)服務模式精進與效益評估
交通行動服務(MaaS)跨區域合作之初探
不同類型交通行動服務(MaaS)之基礎服務功能探討
提昇交通行動服務(MaaS)之包容性(inclusive)服務初探
推動通用計程車特約制度
(1/2)系統擴充及跨部會合作規劃與執行
(2/2)服務擴充及跨部會合作示範計畫
受理通用計程車授權軟體授權申請及使用狀況觀察
「愛接送-預約式通用計程車」系統監督審驗暨專案管理服務
合作研究計畫
自辦研究計畫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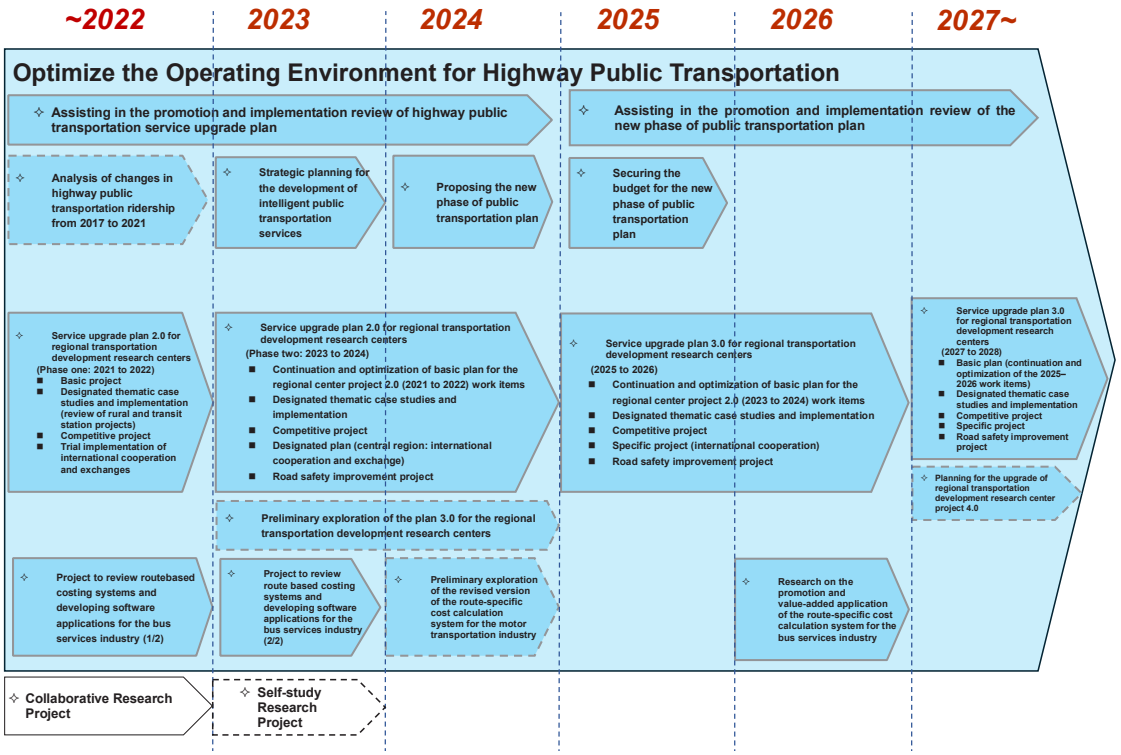
協助汽車運輸業綠色及數位轉型
電動大客車營運數據監控管理平台維運與第三方驗證
電動大客車數據分析與應用計畫
(1/2)數據研析與關鍵指標建立
(2/2)資料視覺化與 AI 應用
電動大客車推動策略之精進與研析
(1/2)營運管理策略優化
(2/2)營運管理策略推廣與成效綜析
電動大客車智慧充電示範計畫
電動大客車智慧充電服務驗證
(1/2)智慧充電管理系統實證
(2/2)智慧充電管理系統精進與優化
電動大客車多點充電機制開發
(1/2)多點充電機制研擬
(2/2)多點充電策略驗證
小客車租賃業數位轉型發展計畫
商業模式設計與數位轉型推動實務
商業模式設計與數位轉型推動實務之專案管理及監督審驗
智慧財產權管理與運用設計專業服務
小客車租賃業智慧租車平台技轉及保固服務
受理小客車租賃業智慧租車平台軟體授權申請及使用狀況觀察
先進公車智慧化營運管理先導運行計畫
(1/2)整合車載設備之駕駛工時管理系統研發
(2/2)整合車載設備之駕駛數位履歷管理系統研發
公路公共運輸數位轉型核心模組之建置
(1/4)車輛與駕駛智慧化管理系統
(2/4)客運路線智慧化管理系統
(3/4)客運公司智慧化管理系統
(4/4)運輸業監理業務智慧化管理系統
合作研究計畫
自辦研究計畫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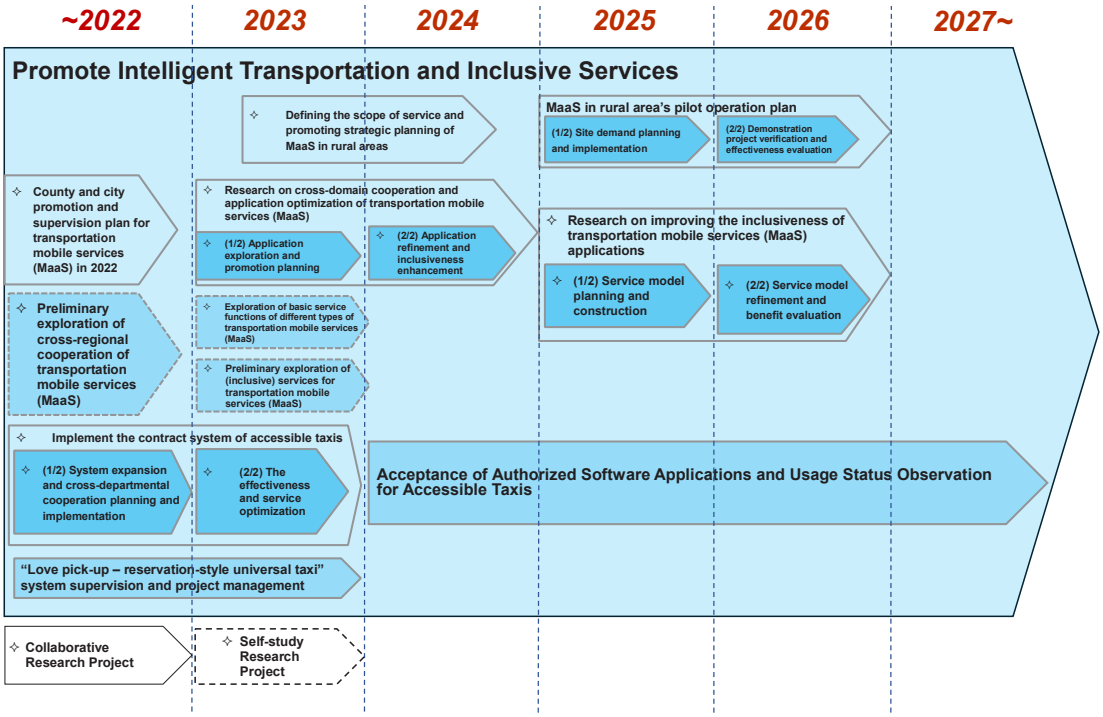
Optimize the Operating Environment for Highway Public Transportation
Assisting in the promotion and implementation review of highway public transportation service upgrade plan
Assisting in the promotion and implementation review of the new phase of public transportation plan
Analysis of changes in highway public transportation ridership from 2017 to 2021
Strategic planning for the development of intelligent public transportation services
Proposing the new phase of public transportation plan
Securing the budget for the new phase of public transportation plan
Service upgrade plan 2.0 for regional transportation development research centers (Phase one: 2021 to 2022)
Basic project
Designated thematic case studies and implementation (review of rural and transit station projects)
Competitive project
Trial implementation of international cooperation and exchanges
Service upgrade plan 2.0 for regional transportation development research centers (Phase two: 2023 to 2024)
Continuation and optimization of basic plan for the regional center project 2.0 (2021 to 2022) work items
Designated thematic case studies and implementation
Competitive project
Designated plan (central region: international cooperation and exchange)
Road safety improvement project
Service upgrade plan 3.0 for regional transportation development research centers (2025 to 2026)
Continuation and optimization of basic plan for the regional center project 2.0 (2023 to 2024) work items
Designated thematic case studies and implementation
Competitive project
Specific project (international cooperation)
Road safety improvement project
Service upgrade plan 3.0 for regional transportation development research centers (2027 to 2028)
Basic plan (continuation and optimization of the 2025–2026 work items)
Designated thematic case studies and implementation
Competitive project
Specific project
Road safety improvement project
Planning for the upgrade of regional transportation development research center project 4.0
Preliminary exploration of the plan 3.0 for the regional transportation development research centers
Project to review routebased costing systems and developing software applications for the bus services industry (1/2)
Project to review route based costing systems and developing software applications for the bus services industry (2/2)
Preliminary exploration of the revised version of the route-specific cost calculation system for the motor transportation industry
Research on the promotion and value-added application of the route-specific cost calculation system for the bus services industry
Collaborative Research Project
Self-study Research Project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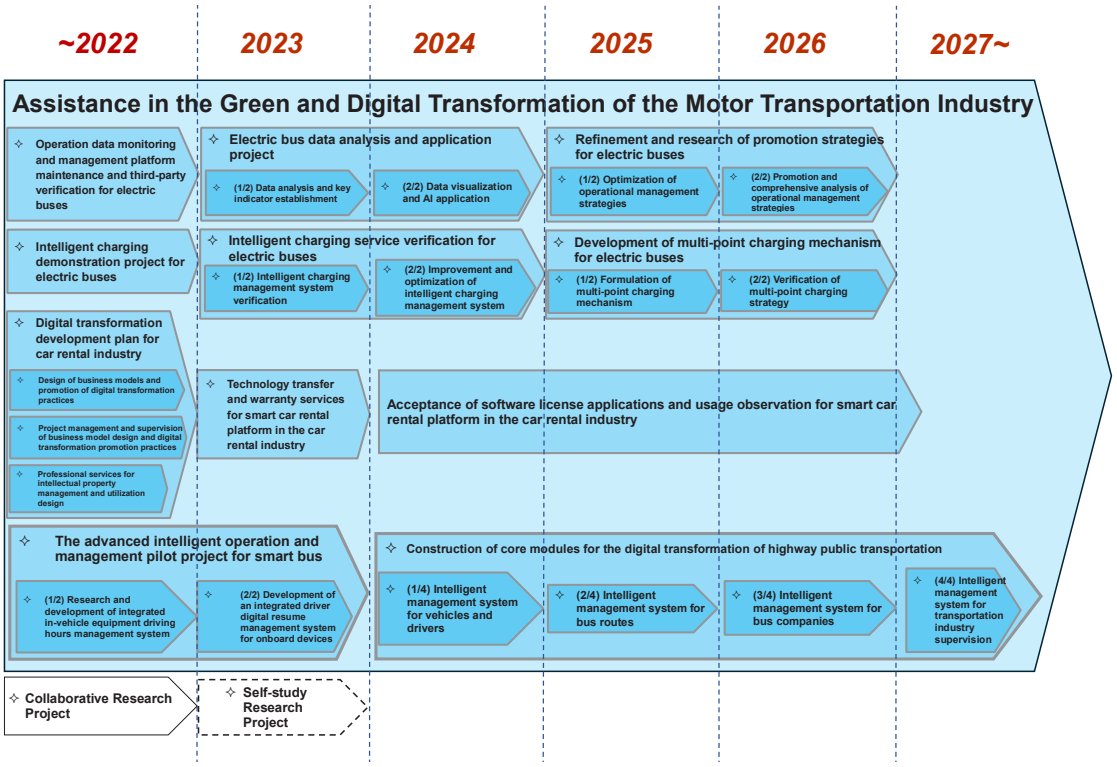
Promote Intelligent Transportation and Inclusive Services
Defining the scope of service and promoting strategic planning of MaaS in rural areas
MaaS in rural area's pilot operation plan
(1/2) Site demand planning and implementation
(2/2) Demonstration project verification and effectiveness evaluation
County and city promotion and supervision plan for transportation mobile services (MaaS) in 2022
Research on cross-domain cooperation and application optimization of transportation mobile services (MaaS)
(1/2) Application exploration and promotion planning
(2/2) Application refinement and inclusiveness enhancement
Research on improving the inclusiveness of transportation mobile services (MaaS) applications
(1/2) Service model planning and construction
(2/2) Service model refinement and benefit evaluation
Preliminary exploration of cross-regional cooperation of transportation mobile services (MaaS)
Exploration of basic service functions of different types of transportation mobile services (MaaS)
Preliminary exploration of (inclusive) services for transportation mobile services (MaaS)
Implement the contract system of accessible taxis
(1/2) System expansion and cross-departmental cooperation planning and implementation
(2/2) The effectiveness and service optimization
Acceptance of Authorized Software Applications and Usage Status Observation for Accessible Taxis
"Love pick-up – reservation-style universal taxi" system supervision and project management
Collaborative Research Project
Self-study Research Project



四 營造潔淨且具韌性的運輸環境

因應氣候變遷持續推動綠運輸永續發展，以建立潔淨的交通生活環境為願景，研究重點如下：

1. 運輸部門淨零排放工作推動與效益評估

（1）彙提「第二期運輸部門溫室氣體排放管制行動方案」，並於111年9月16日奉行政院核定；編寫110年運輸部門溫室氣體排放管制行動方案執行成果報告，並於112年2月3日奉行政院核定；協助審視共22個地方政府提報之第二期溫室氣體管制執行方案，並就涉及運輸部門部分提供意見。

（2）因應國際淨零排放趨勢，配合環境部研議第3期（115-119年）溫室氣體階段管制目標，透過評估模型推估運輸部門第3期溫室氣體排放基線、能源需求及減碳目標，將做為行政院後續協商六大部門第3期減碳目標之基礎。另編撰111年運輸部門溫室氣體減量行動方案執行成果報告，並研提改善建議。

IV Build up a Clean and Resilient Transportation Environment

Sustainable green transportation continued to be promoted in response to climate change with the creation of a living environment featuring clean transportation as the vision. Highlights of the research are as follows:

1. Promotion of Net-Zero Emission and Efficacy Assessment of Transportation Department

(1) The "Second Phase Transportation Sector Greenhouse Gas Emission Control Action Plan" was compiled and approved by the Executive Yuan on September 16, 2022; the 2021 transportation sector greenhouse gas emission control action plan implementation results report was compiled and approved by the Executive Yuan on February 3, 2023; assist in reviewing the second phase of greenhouse gas control implementation plans submitted by 22 local governments and provide opinions on parts involving the transportation sector.

(2) In response to international net-zero emission trends and in cooperation with the Ministry of Environment, the third phase (2026–2030) of greenhouse gas phased control targets was studied, estimating the third phase baseline emissions, energy demand and carbon reduction targets for the transportation sector, and serving as the basis for the Executive Yuan's subsequent consultations on the third phase carbon reduction targets for six major departments. The 2022 transportation sector greenhouse gas reduction action plan implementation results report was also compiled, with improvement suggestions proposed.

（3）就行政院112年4月21日核定之淨零轉型關鍵戰略行動計畫，配合交通部關鍵戰略7「運具電動化及無碳化」與環境部關鍵戰略10「淨零綠生活」之管考作業，提報半年度執行情形報告與年度執行成果報告。

（4）因應行政院111年3月30日發布「臺灣2050淨零排放路徑及策略總說明」，並於112年4月21日核定淨零轉型關鍵戰略行動計畫，將低碳交通區納入運具電動化及無碳化及淨零綠生活之行動措施，本所於112年辦理「低碳交通區推動機制之研究」案，蒐整及研析國內外低碳交通區類似案例，研提我國地方政府推動低碳交通區法制規劃、相關配套及分期推動建議，提供地方政府規劃之參據。

2. 整合串聯自行車路線並優化資訊系統

（1）持續整合串聯自行車路線，辦理環島及多元路網優化改善及微調新增串聯路線，並檢視已完工路線，研提待改善建議予權責單位辦理改善，以提升自行車騎乘環境友善性。

（2）強化自行車相關軟體服務，持續優化「全國自行車單一 總入口網」，完成自行車自動路線規劃功能及與觀光署「自行車旅遊網」整併規劃，截至112年5月底止瀏覽人數已超過74萬人次，本網站亦已於112年5月27日正式移轉由觀光署維運。

（3）推廣環騎圓夢App並協助觀光署辦理「2023世界自行車日-全臺環騎」活動，順利呈現環臺軌跡資料，辦理5場環騎圓夢App教育訓練，並於112年6月3日透過環騎圓夢App，「以自行車道做畫布，騎自行車當畫筆」，完成藝術創作「臺灣騎跡」之壯舉。

（4）112年5月5日辦理「自行車通勤路線示範計畫」成果發表記者會及2個月線上集章活動，另完成「交通部自行車路網標誌、標線說明影片」拍攝，交由相關單位協助宣傳。

(3) In response to the Executive Yuan's April 21, 2023 approval of the net-zero transformation key strategic action plan, cooperate with the MOTC's seven key strategies "Vehicle Electrification and Decarbonization" and the Ministry of Environment's ten key strategies "Net-zero Green Living" for management and control operations, and submit semi-annual implementation reports and annual performance reports.

(4) In response to the Executive Yuan's announcement of "Taiwan 2050 Net-zero Emission Pathway and Strategy Overview" on March 30, 2022 and approval of the net-zero transformation key strategic action plan on April 21, 2023, which incorporates low-carbon transportation zones into the actions for vehicle electrification and decarbonization and net-zero green living, the "Study on the Promotion Mechanism of Low-carbon Transportation Zones" project was conducted in 2023. This project involved collecting and analyzing similar domestic and international low-carbon transportation zone cases, proposing legal planning, relevant supporting measures, and phased promotion recommendations for local governments in promoting low-carbon transportation zones to provide references for local government planning.

2. Integration and Connection of Cycling Routes and Optimization of the Information System

(1) Continue to integrate and connect bicycle routes, optimize and adjust new connected routes for round-the-island and diversified networks, review completed routes, and propose improvement suggestions to the responsible units for implementation to enhance the friendliness of bicycle riding environment.

(2) Strengthen bicycle-related software services, continuously optimize "Taiwanbike Website,"and complete the automatic route planning function for bicycles, and integrate with the Tourism Bureau's "Bicycle Tourism Network." As of the end of May 2023, the website had over 740,000 visits, and the website was officially transferred to the Tourism Administration for maintenance on May 27, 2023.

(3) Promote Taiwan Cycling Route App and assist the Tourism Administration in organizing the "2023 World Bicycle Day – Cycling Around Taiwan" event, successfully presenting round- the- island trajectory data, conducting 5 Taiwan Cycling Route App training sessions, and through Taiwan Cycling Route App "Using Bicycle Paths as the Canvas and Bicycles as the Brush" on June 3, 2023, the artistic creation of "Taiwan Cycling Trails" was completed.

(4) On May 5, 2023, a press conference was held to present the results of "Bicycle Commuting Route Demonstration Project" along with a two-month online stamp collection event. The "MOTC's Bicycle Network Signs and Markings Explanation Video" was completed and handed over to relevant units for promotional assistance.

3. 精進改善交通空污管理策略

（1）蒐集及整理過往路口交通空污相關之研究成果，初步掌握影響路口交通空污之關鍵因素，瞭解路口交通空污改善之研究及發展趨勢，提供相關主管機關做為減污工作推動之參考應用。

（2）研提交通環境特性及空污資料蒐集及調查計畫，並依據計畫內容辦理現地調查，監測路口之細懸浮微粒及一氧化碳濃度，可做為第2年期辦理分析與評估之依據。

4. 建立鐵公路系統強化調適能力指引

（1）依公路系統規劃階段調適指引架構及作法，蒐集國內外公路系統強化調適能力相關案例。

（2）與公路設施管理機關進行溝通交流（訪談或會議等形式），針對重要課題與國內外實務案例分析成果進行意見交流，以及討論強化調適指引應用。

（3）為確保公路系統在氣候變遷環境下的氣候韌性，使公路系統在面臨極端天氣事件可維持營運服務，完成公路系統規劃階段強化調適能力指引，並函送公路權管機關（公路局、高公局）參考應用，高速公路局已將調適指引導入「國2甲由台15線延伸至台61新建工程」辦理風險評估，本所並參酌公路局「西濱曾文溪橋段新建工程計畫」，完成「公路系統規劃階段氣候變遷調適指引」修正，除提升指引之可操作性之外，後續亦將提供給國內公路主管機關（構）之參考應用。

3. Improve the Traffic Air Pollution Management Strategies

(1) Research results on traffic pollution at intersections were collected and summarized, identifying key factors influencing intersection traffic pollution, understanding research and development trends in improving intersection traffic pollution, and providing relevant authorities with references for pollution reduction efforts.

(2) Transportation environment characteristics and air pollution data collection and investigation plan were proposed, with field surveys conducted according to the plan to monitor particulate matter and carbon monoxide concentrations at intersections, which will serve as the basis for the second year of analysis and evaluation.

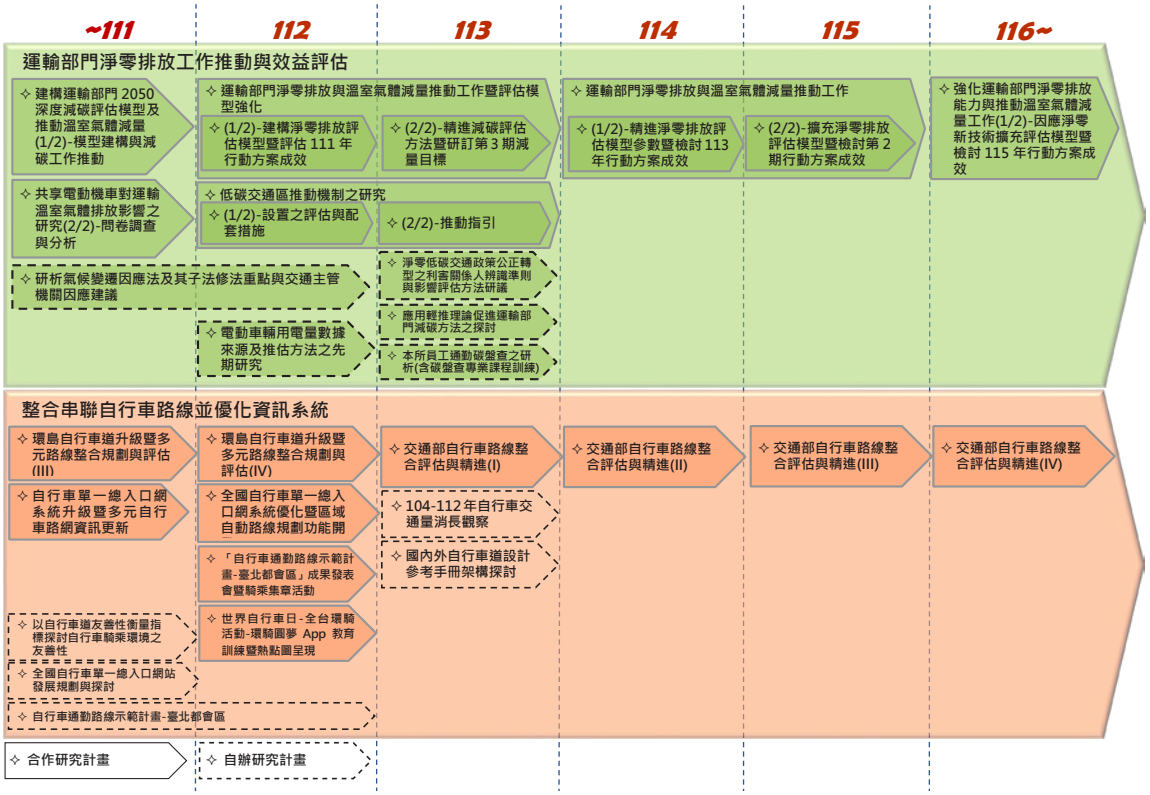
4. Establishment of Guidelines for Climate Change Adaptive Capabilities of Railway/Highway Systems

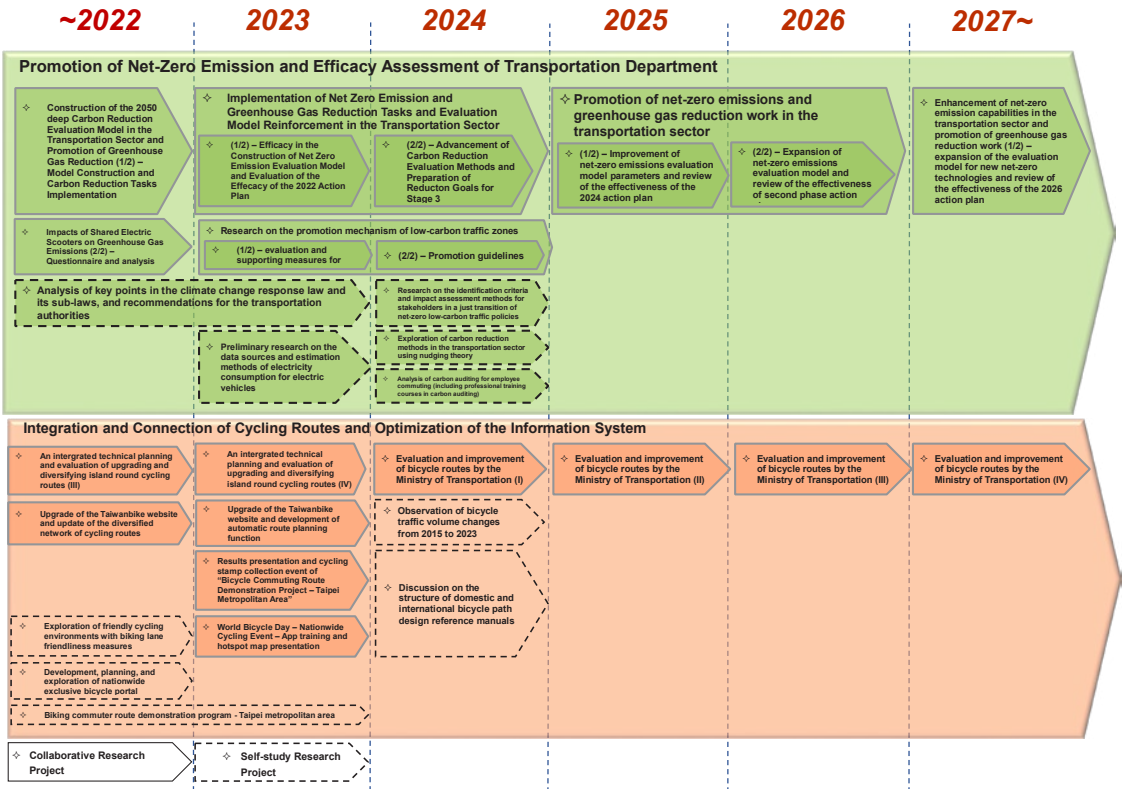
(1) In line with the highway system planning phase adaptation guidelines framework and practices, domestic and international cases related to enhancing highway system adaptative capabilities were collected.

(2) Communication and exchanges were held with highway facility management agencies (through interviews or meetings) to exchange opinions on important topics and the results of practical case analyses from home and abroad, and to discuss the application of enhanced adaptation guidelines.

(3) To ensure the climate resilience of the highway system under climate change and enable the highway system to maintain operational service during extreme weather events, the highway system planning phase enhanced adaptative capabilities guidelines were completed and sent to highway authority agencies (Highway Bureau, Freeway Bureau) for reference. The Freeway Bureau has introduced the adaptation guidelines into "Extension of National Highway No. 2 to Provincial Highway 15 and Construction of a New Route to Provincial Highway 61" for risk assessment. Based on "Hsipintsengwenhsi Bridge Section Construction Plan" of the Highway Bureau, the "Highway System Planning Phase of Climate Change Adaptation Guidelines" were revised to enhance operability and will be provided to domestic highway authorities for reference and application.

主軸4：營造潔淨且具韌性的運輸環境

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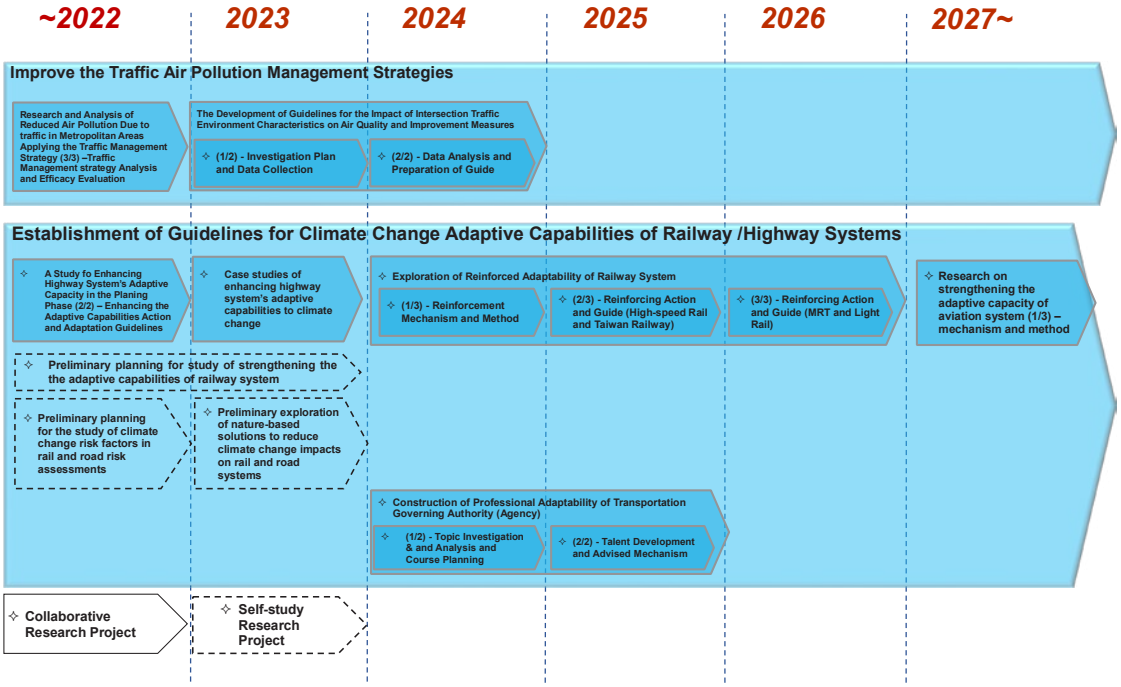
Promotion of Net-Zero Emission and Efficacy Assessment of Transportation Department
Construction of the 2050 deep Carbon Reduction Evaluation Model in the Transportation Sector and Promotion of Greenhouse Gas Reduction (1/2) – Model Construction and Carbon Reduction Tasks Implementation
Implementation of Net Zero Emission and Greenhouse Gas Reduction Tasks and Evaluation Model Reinforcement in the Transportation Sector
(1/2) – Efficacy in the Construction of Net Zero Emission Evaluation Model and Evaluation of the Effecacy of the 2022 Action Plan
(2/2) – Advancement of Carbon Reduction Evaluation Methods and Preparation of Reducton Goals for Stage 3
Promotion of net-zero emissions and greenhouse gas reduction work in the transportation sector
(1/2) – Improvement of net-zero emissions evaluation model parameters and review of the effectiveness of the 2024 action plan
(2/2) – Expansion of net-zero emissions evaluation model and review of the effectiveness of second phase action
Enhancement of net-zero emission capabilities in the transportation sector and promotion of greenhouse gas reduction work (1/2) – expansion of the evaluation model for new net-zero technologies and review of the effectiveness of the 2026 action plan
Impacts of Shared Electric Scooters on Greenhouse Gas Emissions (2/2) – Questionnaire and analysis
Research on the promotion mechanism of low-carbon traffic zones
(1/2) – evaluation and supporting measures for
(2/2) – Promotion guidelines
Analysis of key points in the climate change response law and its sub-laws, and recommendations for the transportation authorities
Research on the identification criteria and impact assessment methods for stakeholders in a just transition of net-zero low-carbon traffic policies
Preliminary research on the data sources and estimation methods of electricity consumption for electric vehicles
Exploration of carbon reduction methods in the transportation sector using nudging theory
Analysis of carbon auditing for employee commuting (including professional training courses in carbon auditing)
Integration and Connection of Cycling Routes and Optimization of the Information System
An intergrated technical planning and evaluation of upgrading and diversifying island round cycling routes (III)
An intergrated technical planning and evaluation of upgrading and diversifying island round cycling routes (IV)
Evaluation and improvement of bicycle routes by the Ministry of Transportation (I)
Evaluation and improvement of bicycle routes by the Ministry of Transportation (II)
Evaluation and improvement of bicycle routes by the Ministry of Transportation (III)
Evaluation and improvement of bicycle routes by the Ministry of Transportation (IV)
Upgrade of the Taiwanbike website and update of the diversified network of cycling routes
Upgrade of the Taiwanbike website and development of automatic route planning function
Observation of bicycle traffic volume changes from 2015 to 2023
Results presentation and cycling stamp collection event of "Bicycle Commuting Route Demonstration Project – Taipei Metropolitan Area"
Discussion on the structure of domestic and international bicycle path design reference manuals
Exploration of friendly cycling environments with biking lane friendliness measures
World Bicycle Day – Nationwide Cycling Event – App training and hotspot map presentation
Development, planning, and exploration of nationwide exclusive bicycle portal
Biking commuter route demonstration program - Taipei metropolitan area
Collaborative Research Project
Self-study Research Project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Improve the Traffic Air Pollution Management Strategies
Research and Analysis of Reduced Air Pollution Due to traffic in Metropolitan Areas Applying the Traffic Management Strategy (3/3) –Traffic Management strategy Analysis and Efficacy Evaluation
The Development of Guidelines for the Impact of Intersection Traffic Environment Characteristics on Air Quality and Improvement Measures
(1/2) - Investigation Plan and Data Collection
(2/2) - Data Analysis and Preparation of Guide
Establishment of Guidelines for Climate Change Adaptive Capabilities of Railway /Highway Systems
A Study fo Enhancing Highway System's Adaptive Capacity in the Planing Phase (2/2) – Enhancing the Adaptive Capabilities Action and Adaptation Guidelines
Case studies of enhancing highway system's adaptive capabilities to climate change
Exploration of Reinforced Adaptability of Railway System
(1/3) - Reinforcement Mechanism and Method
(2/3) - Reinforcing Action and Guide (High-speed Rail and Taiwan Railway)
(3/3) - Reinforcing Action and Guide (MRT and Light Rail)
Research on strengthening the adaptive capacity of aviation system (1/3) – mechanism and method
Preliminary planning for study of strengthening the the adaptive capabilities of railway system
Preliminary planning for the study of climate change risk factors in rail and road risk assessments
Preliminary exploration of nature-based solutions to reduce climate change impacts on rail and road systems
Construction of Professional Adaptability of Transportation Governing Authority (Agency)
(1/2) - Topic Investigation & and Analysis and Course Planning
(2/2) - Talent Development and Advised Mechanism
Collaborative Research Project
Self-study Research Project

五 深化運輸安全管理

改善運輸安全，強化主動預防式之安全機制，以建構安全與人本的交通運輸環境為願景，重點如下：

1. 完備鐵路運輸安全管理系統（SMS）、海事安全及其他安全政策法制研議

（1）為支援交通部、鐵道局及航港局精進國家鐵道安全計畫所需之工具與策略及所需海運安全管理策略，另依據國家道路交通安全綱要計畫（113至116年），本所辦理鐵道SMS、海事安全及推動道安改善專業能力建構相關研究，並支援交通部擬定運輸安全政策之重要交辦事項。

（2）鑑於我國道安情勢嚴峻，外界期盼政府借鏡日本推動交通安全對策法經驗推動基本法之立法，本所112年依交通部交辦協助研提「道路交通安全基本法」草案，歷經2場座談會，並經112.12.01立院三讀、112.12.15總統公告及113.01.01行政院公告施行。

（3）根據道路交通安全基本法九大政策面向，本所協助交通部統籌彙整中央各部會提報資料，完成基本法立法後首版「國家道路交通安全綱要計畫（113-116）」，在九大政策面向下研提29項策略、32項行動計畫，經行政院於113.2.7正式核定。

（4）為協助鐵道局推動鐵道監理之績效目標管理，規劃112-113年進行2年期計畫。112年完成先進國家鐵道監理機關與營運機構安全資料類型與績效指標內涵回顧、研析國家鐵道安全績效指標內容與目標值，以及鐵道營運機構安全領先指標，以識別鐵道營運機構高風險項目，並有助監理業務之推動。

V Deepen Transportation Safety Management

Improve transportation safety and strengthen the spontaneous preventive safety mechanism, with a safe and humanistic transportation environment as the vision. Highlights of the research are as follows:

1. Completion of Railway Transportation Safety Management System (SMS) and Policies Discussion of Maritime and Other Transportation Mode Safety

(1) To support the MOTC, Railway Bureau, and Maritime and Port Bureau in refining the national railway safety plan and required maritime safety management strategies, and according to the national road traffic safety Guideline and Action plan (2024-2027), research related to railway SMS, maritime safety and the promotion of road safety improvement professional capacity building were conducted to support the MOTC in formulating key tasks for transportation safety policy.

(2) Given the severe road safety situation in Taiwan and the public's expectation for the government to learn from Japan's experience in promoting traffic safety measures and basic law legislation, the draft "Road Traffic Safety Basic Act" was proposed with the assistance of the MOTC in 2023. After two forums, it passed its third reading in the Legislative Yuan on December 1, 2023, and was announced by the President on December 15, 2023 and implemented by the Executive Yuan on January 1, 2024.

(3) Based on the nine policy aspects of the Road Traffic Safety Basic Act, the MOTC coordinated and compiled data from various central ministries, completing the first edition of "National Road Traffic Safety Guideline and Action Plan (2024–2027)" after the basic law legislation. Under the nine policy aspects, 29 strategies and 32 action plans were proposed and officially approved by the Executive Yuan on February 7, 2024.

(4) To assist the Railway Bureau in promoting performance target management for railway supervision, a two-year initiative for 2023-2024 was planned. In 2023, a review of the types and contents of safety data and performance indicators for railway supervisory agencies and operating institutions in advanced countries was completed. The review analyzed the content and target values of national railway safety performance indicators and identified high-risk items for railway operating institutions to support the promotion of supervisory business.

（5）112年起推動道安改善專業能力建構系列研究，從建立道安知識平台、研提道安人員專業培訓制度、研提道安專業輔導／諮詢團隊機制及建立事故多重肇因分析方法及架構等4面向著手，從基礎面提升我國第一線道安從業人員的專業知能，以及精進事故分析、事故肇因研析及改善策略研提等道安改善工具，做為長期推動道安改善專業能力建構之基礎。

（6）為將政府資源結合學研能量，進行區域人才培訓，自112年起辦理區域運輸發展研究中心服務升級2.0計畫（112-113年）-道安改善計畫，透過區域中心協助進行縣市道安問題深入研析及輔導縣市改道安專業能力建構，區域中心亦須配合交通部路政及道安司指示成立「道安提升行動小組」，協助縣市研提「道路交通事故防制策略作為」。

2. 評估車輛安全輔助系統功能

（1）透過蒐集、分析裝載主動預警輔助系統之試運行大型車輛駕駛行為資料及感受，了解相關主動預警輔助系統於我國交通環境中實際應用時對駕駛及其行為的相關影響，以為後續政策研擬應用。

（2）112年進行大型車輛裝設主動預警輔助系統之試運行使用成效評估，建立成效評估架構、提出四大評估指標，設計使用成效評估方法（確立抽樣方法、受測者定義、實驗設計、實驗程序、資料分析及統計方法），並配合設備研發、裝設期程啟動相關調查及資料蒐集程序。

3. 改造交通安全知能與行為

（1）做為108課綱交通安全教育的教學資源，發展具擬真情境、互動性、遊戲性的交通安全教育教學軟體，提供國小、國中、高中實施交通安全課程時運用，以協助學校交通安全教育的落實推動。

(5) Since 2023, a series of studies on professional capacity building for road safety improvement has been promoted, starting from four aspects: establishing a road safety knowledge platform, proposing a professional training system for road safety personnel, proposing a mechanism for professional guidance/consultation teams, and establishing a multi-causal analysis method and framework for accidents. This aims to improve the professional knowledge and skills of first-line road safety personnel, refine accident analysis and propose accident causation analysis and improvement strategies, serving as the basis for long-term promotion of professional capacity building for road safety improvement.

(6) To combine government resources with academic and research capabilities for regional talent training, the regional transportation development research center service upgrade plan 2.0 (2023-2024) - road safety improvement plan has been implemented since 2023. Through regional centers, in-depth analysis of county and city road safety issues and guidance for building professional capacity in road safety are provided. Regional centers also comply with the MOTC's department of railways,highways,and road safety instructions to establish "Road Safety Enhancement Action Group" and assist counties and cities in proposing "Road Traffic Accident Prevention Strategies and Measures."

2. Evaluation of Vehicle Safety Assistance System Functions

(1) By collecting and analyzing driving behavior data and feedback from trial runs of large vehicles equipped with active warning assistance systems, the actual impact of related active warning assistance systems on drivers and their behavior in Taiwan's traffic environment can be understood, providing a basis for subsequent policy research and application.

(2) In 2023, an effectiveness evaluation was conducted for the trial operation of active warning assistance systems installed on large vehicles. An evaluation framework was established, four key evaluation indicators were proposed, and a method for evaluating effectiveness was designed (including sampling methods, definition of test subjects, experimental design, experimental procedures, data analysis and statistical methods). Relevant surveys and data collection procedures were initiated in line with equipment development and installation schedules.

3. Reformation of Roadway Safety and Road User Behavior

(1) To serve as a teaching resource for 2019 curriculum traffic safety education, an interactive, game-like traffic safety education software with realistic scenarios was developed, providing elementary, junior high and high schools with tools to implement traffic safety courses, thus assisting in promoting traffic safety education in schools.

（2）112年依據交通部各學習階段交通安全基本能力架構，選擇學校教學所應用之電腦、平板、手機等數位裝置，進行教學輔助軟體規劃與開發，以行人步行演練、自行車騎乘演練、高中的機車騎乘情境等模組，規劃基本學習情境與危險情境感知，並製作教學指引及操作手冊協助師生運用交通安全多元教材，落實交通安全教育。

4. 轉型與推廣交通安全工程設計技術

（1）持續透過推廣應用，檢討更新交通安全工程設計技術工具，優化相關技術的成熟度與可應用程度，同時可增加相關工具應用的深度與廣度，有效協助道路主管機關改善道路安全。

（2）為配合各項道安改善工作推展，本所研擬重要道安改善原則及指引，已由交通部函送道路管理機關應用，以提升國內道路交通安全。目前已陸續完成「人行空間改善原則」、「改善機車交通環境之原則及作法」、「有聲號誌設置指南」、「行人專用時相與行人早開時相設置原則」、「校園周邊人行空間改善參考指引」等。

(2) In 2023, based on the MOTC's basic traffic safety competencies framework for different learning stages, digital devices such as computers, tablets and smartphones used in school teaching were selected to plan and develop educational support software. Modules included pedestrian walking exercises, bicycle riding exercises, and high school motorcycle riding scenarios; planning basic learning contexts and hazard perception scenarios; and creating teaching guides and operation manuals to help teachers and students use diverse traffic safety teaching materials and implement traffic safety education.

4. Engineering Design and Technologies for Transformation and Promotion of Traffic Safety

(1) Through continuous promotion and application, traffic safety engineering design technical tools are reviewed and updated to optimize the maturity and applicability of related technologies, while also increasing the depth and breadth of tool application, effectively assisting road authorities in improving road safety.

(2) To support various road safety improvement initiatives, important road safety improvement principles and guidelines were developed and sent by the MOTC to road management agencies for application, thus enhancing domestic road traffic safety. Principles and guidelines such as "Principles for Improving Pedestrian Spaces," "Principles and Methods for Improving Motorcycle Traffic Environments," "Guidelines for Setting Up Audible Signals," "Principles for Setting Up Pedestrian-only Phases and Early Pedestrian Phases," and "Reference Guidelines for Improving Pedestrian Spaces around Schools" have been completed.

（3）推廣「事故型態導向之路口交通工程設計範例參考手冊」，110-112年與全國22縣市政府合作進行易肇事路段改善的推廣應用，並辦理18場教育訓練，指導相關從業人員熟悉肇事診斷學作業流程、事故碰撞構圖分析方法與設計範例參考手冊的應用方式，進而提升交通工程環境之安全水準。

（4）112年透過高屏澎區域中心，持續改良111年建立之「易肇事路口安全改善檢查表」，在高雄、屏東、澎湖進行試檢查，改善檢查表內容，並同步推廣應用，以協助道路主管機關檢視路口安全危害，並加以改善。

（2）112年分析自行車環島、多元及串聯路線之自行車事故，除開發事故分析平台，並研提改善機制，提供交通部及管理機關分析瞭解自行車事故狀況及特性，據以改善自行車騎乘安全環境。

（6）臺灣地區易肇事路段改善計畫係交通部每年提升道路安全之重要工作，責由本所自民國69年開始辦理第1期計畫，至111年已完成40期。該計畫蒐集道路交通事故資料，並分析易肇事路段之肇事次數、死傷人數等資料，俟完成易肇事路段現地會勘工作，並將改善方案彙整成報告書報部核定後，送各道路主管機關據以執行。112年仍持續辦理第41期臺灣地區易肇事路段改善計畫。

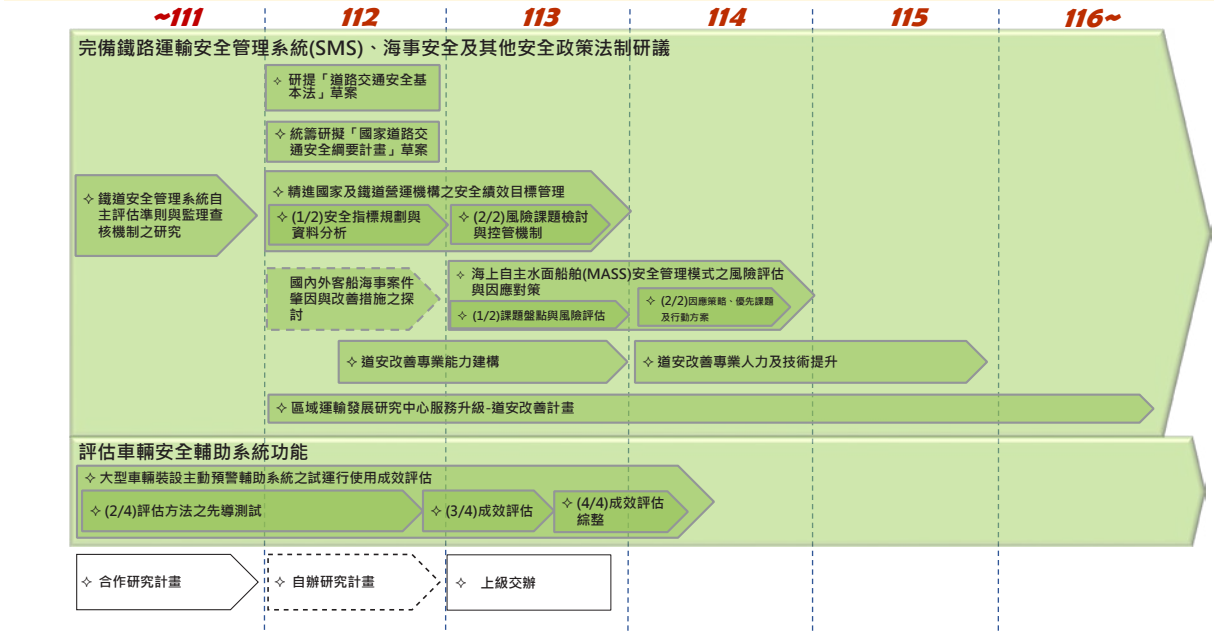
(3) The "Accident Type-oriented Intersection Traffic Engineering Design Reference Manual" was promoted, and from 2021 to 2023, collaboration with governments of 22 counties and cities nationwide was conducted to promote and apply improvements in accident-prone road sections. Eighteen training sessions were held to guide relevant personnel in understanding the process of accident diagnostics, collision diagram analysis methods and the application of design reference manual, thereby enhancing the safety level of traffic engineering environment.

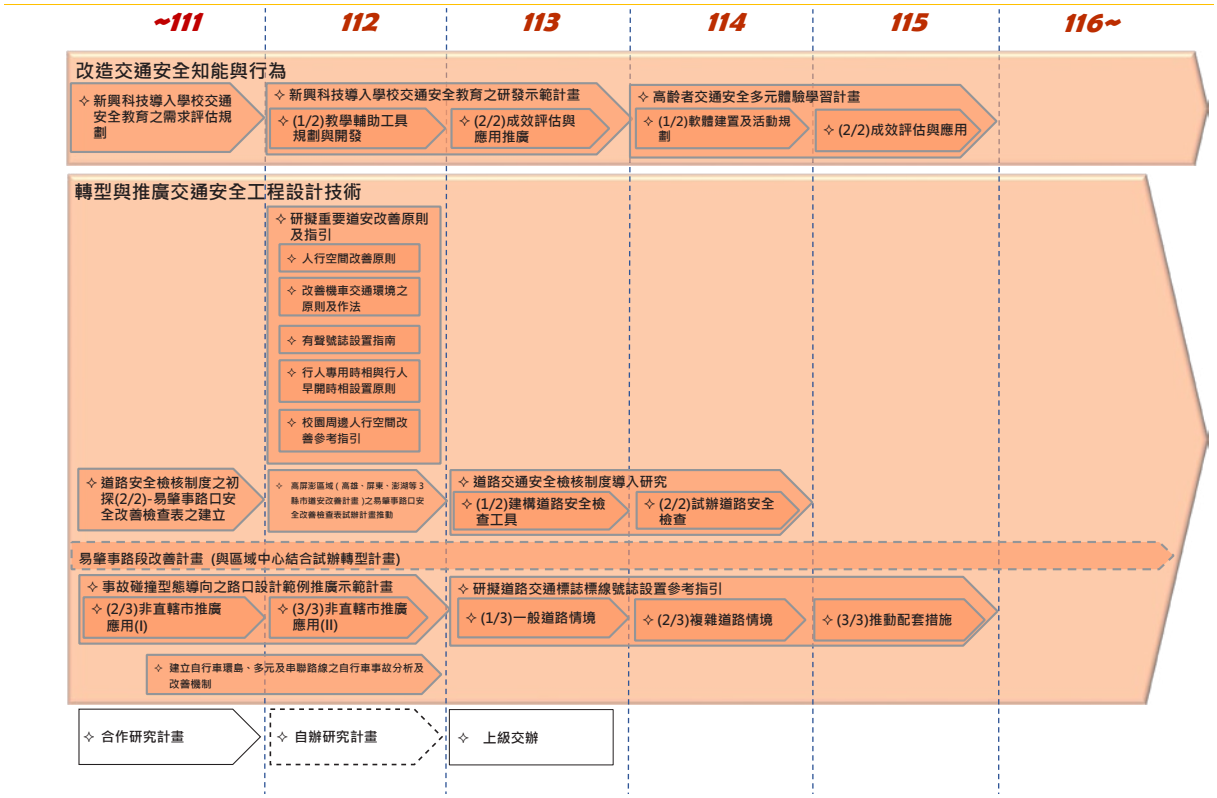
(4) In 2023, "Accident-prone Intersection Safety Improvement Checklist" established in 2022 was continuously improved through Kaopingpeng regional center, with trial inspections conducted in Kaohsiung, Pingtung and Penghu to improve the checklist content and promote its application, thus assisting road authorities in identifying and improving intersection safety hazards.

(5) In 2023, bicycle accidents on round-island, diverse and interconnected routes were analyzed. An accident analysis platform was developed and improvement mechanisms were proposed to provide the MOTC and management agencies with insights into the status and characteristics of bicycle accidents, thereby improving the bicycle riding safety environment.

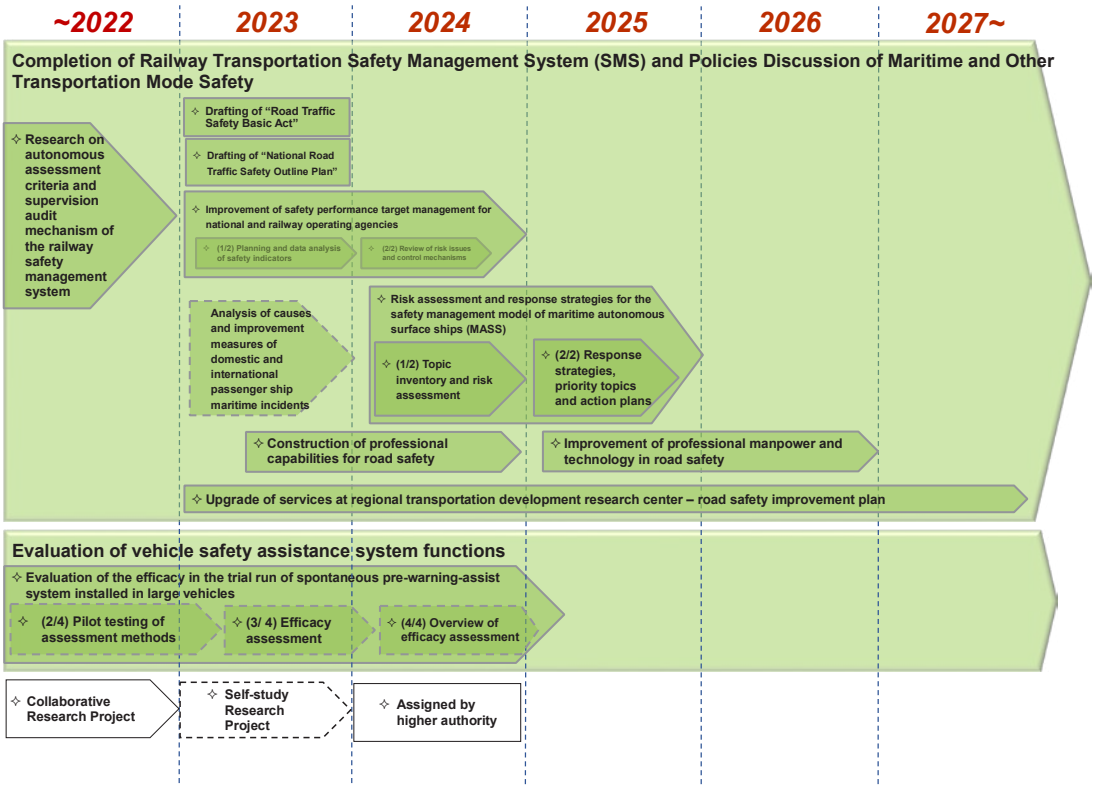
(6) The project for improving accident-prone road sections in Taiwan area is an important annual task for the MOTC to enhance road safety. The institute has been responsible for this plan since 1980 and had completed 40 phases by 2022. The plan collects road traffic accident data, analyzes the frequency of accidents and the number of casualties in accident-prone sections, and after completing on-site inspections, compiles improvement plans into reports for approval by the Ministry, which are then executed by the respective road authorities. In 2023, the 41st Project for Improving Accident-Prone Road Sections in Taiwan area continued to be implemented.

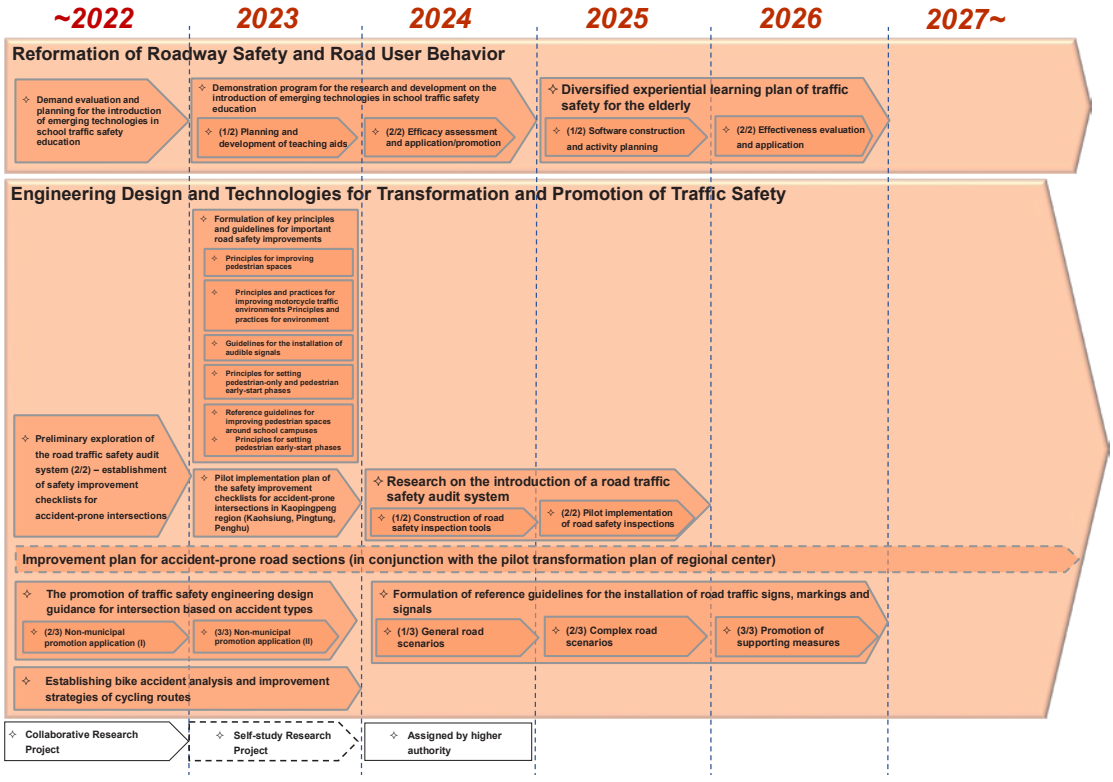
主軸5：深化運輸安全管理





5: Deepen Transportation Safety Management





六 推動交通科技創新應用及產業發展

運用科技創新技術，促進交通運輸產業發展，以建立人本且永續的智慧交通生活環境為願景，研究重點如下：

1. 推動交通科技創新應用

（1）運用5G結合AIoT等創新科技，延續110-111年提出之整體規劃構想與階段性推動成果，辦理112-113年智慧交通數位神經中樞系統之功能擴充與精進作業，持續擴充示範城市實證場域範圍與所需偵測設備、提升緊急救援車輛智慧優先號控功能、發展人工智慧交通管理／公共運輸之相關模式庫與知識庫，並將所研發之相關關鍵技術整合於112年完成第一階段智慧交通數位神經中樞系統，透過數位雙生模型以視覺化呈現各項交通監控與預測成果，所發展之交通管理相關模式庫已可預測車流即將壅塞，並於30分鐘前提出示警，以利交通管理單位即時採行應變作為。

（2）發展應用人工智慧（AI）多目標強化學習（Reinforcement Learning, RL）在都市交通號誌控制應用與實作，以及納入高速公路交流道區域之人工智慧號誌協控課題及其模擬模式構建，以期逐步構建我國在人工智慧號誌控制的實力。

（3）以國道客運為對象，整合110-111年車內、外行車異常事件影像辨識技術開發成果，進一步以業者落地應用為目的，進一步提出高風險駕駛行為分析工具，以及建立高風險駕駛行為管理雛型系統，做為後續年度應用及提出完整管理模式與分析平台之基礎。

（4）結合無人機空拍與AI人工智慧影像辨識等先進技術，建立人車流動的動態軌跡圖，分析路口交通衝突情形，有系統地導入於交通研究、分析與應用上，有助於提升交通安全治理品質。

VI Promote the Innovative Application of Transportation Technology and Industrial Development

Utilize innovative technologies to boost the transportation industry's developments, creating a humanistic and sustainable smart traffic living environment as the vision. Highlights of the research are as follows:

1. Promote the Innovative Application of Transportation Technology

(1) Utilizing innovative technologies such as 5G combined with AIoT, the comprehensive planning concepts and phased promotion results proposed in 2021-2022 were extended to conduct functional expansion and enhancement of intelligent transportation digital nerve center system in 2023–2024. This includes continuously expanding the scope of demonstration city verification fields and the necessary detection equipment, enhancing the intelligent priority control functions for emergency rescue vehicles, developing related model libraries and knowledge bases for artificial intelligence traffic management/public transportation, and integrating the developed key technologies into the first phase of intelligent transportation digital nerve center system completed in 2023. Through a digital twin model, various traffic monitoring and prediction results are visually presented. The developed traffic management model library can predict impending traffic congestion and provide warnings 30 minutes in advance, enabling traffic management units to take timely responsive measures.

(2) The application of artificial intelligence (AI) multi-objective reinforcement learning (RL) was developed for urban traffic signal control and implementation, including the incorporation of AI signal coordination control topics and simulation models in freeway interchange areas, aiming to gradually build the nation's strength in AI-based traffic signal control.

(3) For national highway passenger transportation, the image recognition technology development results for internal and external abnormal driving events from 2021 to 2022 were integrated, further proposing high-risk driving behavior analysis tools and establishing a prototype system for managing high-risk driving behaviors, serving as a foundation for future applications and proposing a comprehensive management model and analysis platform.

(4) Advanced technologies such as drone aerial photography and AI image recognition were combined to establish dynamic trajectory maps of people and vehicle flows, analyzing traffic conflicts at intersections. This systematic approach is introduced into traffic research, analysis and application, helping to improve the quality of traffic safety governance.

（5）持續就遙控無人機空拍技術、影像AI自動辨識及交通衝突分析軟體進行優化，改善相關程序處理效率及分析方法，並研提交通衝突分析軟體推廣應用模式。完成「機會左轉進階分析」及「人車衝突」先導測試計畫，以測試及驗證相關分析技術，且應用於易肇事路口分析及改善。

2. 推動無人機科技產業發展

（1）在推動無人機偏鄉物流運送部分，前已辦理二期整合示範計畫，完成概念驗證（POC）階段成果。112年聚焦「偏鄉緊急運補」及「離島物流配送」2類情境，與中華郵政及國內優秀業者合作，以本計畫做為無人機技術驗證平台，並推動實際營運服務驗證。

（2）在推動無人機橋梁檢測部分，已開發國內混凝土橋梁AI影像辨識模式，並設計橋梁檢測無人機雛型，進行實地橋梁檢測驗證；112年更結合無人機自動化飛行，利用AI影像辨識橋梁構件劣化狀況，以增進橋梁檢測品質與效率。

（3）在無人機產業創新與推廣部分，辦理領航盃無人機創意應用競賽，鼓勵大專院校及公務機關（構）投入無人機研發應用、並協同臺灣無人機大聯盟推動產業國際交流。

(5) The optimization of remote drone aerial photography technology, AI automatic image recognition and traffic conflict analysis software continued to improve related process efficiency and analysis methods, proposing a promotion application model for traffic conflict analysis software. The "Advanced Analysis of Left Turn Opportunity" and "Human-vehicle Conflict" pilot test projects were completed to test and verify relevant analysis technologies, applying them to the analysis and improvement of accident-prone intersections.

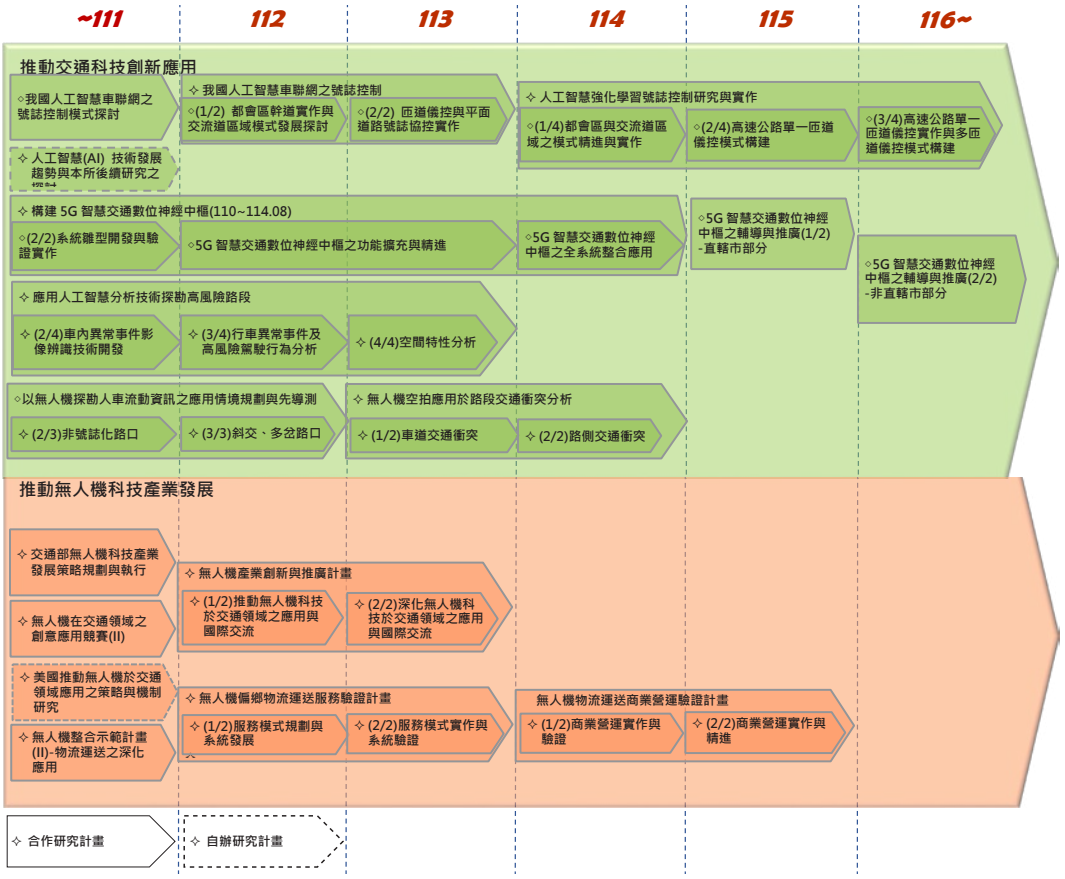
2. Promotion of the Development of the Drone Technology Industry

(1) In promoting rural drone logistics delivery, two phases of integrated demonstration projects were completed, achieving concept verification (POC) phase results. In 2023, the focus was on two scenarios: "Emergency Resupply in Rural Areas" and "Logistics Distribution on Outlying Islands" in cooperation with Chunghwa Post and outstanding domestic companies, using this project as a platform for drone technology verification and promoting actual operational service verification.

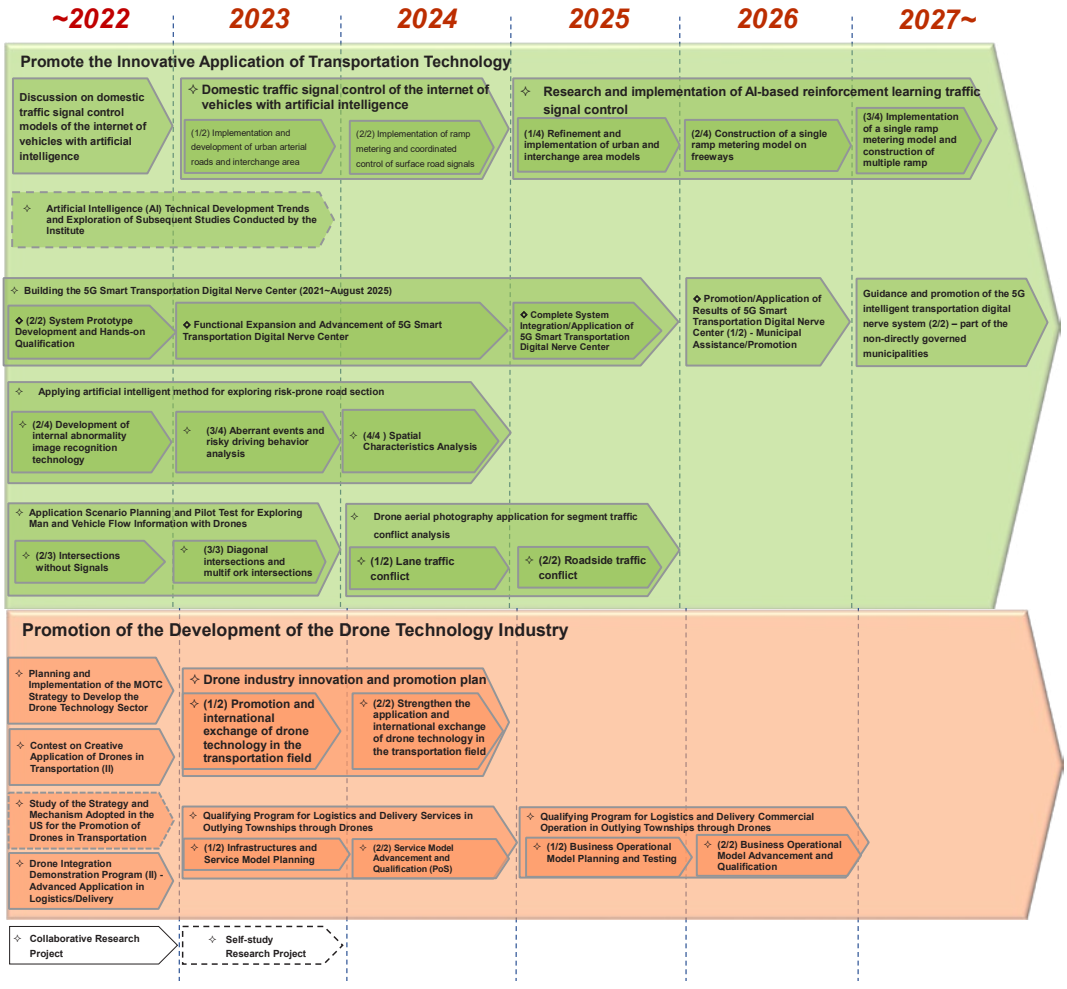
(2) In promoting drone bridge inspection, the AI image recognition model for domestic concrete bridges was developed, and a prototype drone for bridge inspection was designed and verified through field inspections. In 2023, automated drone flights were combined with AI image recognition to assess bridge component deterioration, and enhance the quality and efficiency of bridge inspections.

(3) In the innovation and promotion of drone industry, "Competition for Creative Applications of UAS in the field of Transportation" was held to encourage colleges, universities and public agencies to engage in drone research and application. UAS-Taiwan drone alliance was coordinated to promote international industry exchanges.

主軸6：推動交通科技創新應用及產業發展



6. Promote the Innovative Application of Transportation Technology and Industrial Development



七 精進交通設施維護管理與災防技術

結合新興科技，強化運輸系統之抗災能力及管理效能，以提升海陸運輸安全並串聯運輸技術之跨域整合、溝通及協調，研究重點如下：

1. 研發及精進鐵公路及商港災防技術

（1）公路災防部分，研發地工織布橋基保護工法，提供高速公路局大甲工務段執行國3大甲溪橋基保護應用並協助觀測成效，以及建置鼎型塊+織布保護工法三維水理分析模型，做為評估保護成效參據。研發成果獲得交通部「112年創新提案制度」「甲等獎」及高速公路局「112年度知識競賽」「知識品質獎」第2名之獎項。

（2）商港災防部分，辦理船舶特高頻資料交換（VHF Data Exchange System, VDES）測試站建置，包含於彰化芳苑燈塔（王功燈塔）設置一處固定測試訊號站及另一移動裝置，探討訊號解讀及資訊應用，未來將能藉由連接陸地、海洋、空中和太空衛星等相關訊號，有助於促進我國海域航行安全並提升搜救效能，協助航港局推動智慧航安相關計畫。

（3）針對花蓮縣豐濱鄉台11線人定勝天路段研發波浪溯升／浪襲之日間、夜間影像自動化判釋方法，可由影像判釋水線位置變化及波浪溯升高程，並以波浪數值模式模擬波浪溯升，發展越波機器學習模型，做為精進海岸公路浪襲預警系統之依據，提供公路局東區養護工程分局於颱風浪襲封路決策應用參採，強化通行安全管理

VI Improve the Transportation Facilities Maintenance Management and Disaster Prevention Technology

Emerging technologies were combined to reinforce the capabilities of the transportation system to withstand disasters and the managerial efficacy and to accordingly enhance sea and land transport safety and facilitate cross-disciplinary integration, communication, and coordination of transportation technologies. Highlights of the research are as follows:

1. R&D and Advancement of Railway/Highway and Commercial Port Disaster Prevention Technology

(1) In the area of highway disaster prevention, a geotextile bridge foundation protection method was developed and provided to the Miaoli work section of National Freeway Bureau for the application of Dajia River Bridge Foundation Protection on National Freeway No. 3, and assisted in observing the effectiveness. A three-dimensional hydraulic analysis model of the tripod blocks + geotextile protection method was established as a reference for evaluating protection effectiveness. The research results won "2023 Innovation Proposal System" first-class award from the MOTC and the second place in "2023 Knowledge Competition" knowledge quality award from the National Freeway Bureau.

(2) Regarding commercial port disaster prevention, we have established a very high frequency data exchange system (VDES) test station including a fixed test signal station at Changhua Fangyuan Lighthouse (Wanggong Lighthouse) and a mobile device to explore signal interpretation and information applications. In the future, connecting relevant signals from land, sea, air and space satellites will promote maritime navigation safety and enhance search and rescue efficiency, and assist the maritime and port bureau in promoting smart navigation safety projects.

(3) We have developed automated image interpretation methods for wave run-up during both daytime and nighttime for the Ren Ding Sheng Tian section of Provincial Highway No.11 in Fengbin Township, Hualien County. This allows for image interpretation of shoreline position changes and wave run-up heights, and uses numerical wave models to simulate wave run-up. Additionally, we have developed a wave overtopping machine learning model to refine the coastal highway wave impact warning system. This provides Easter Region Branch Office of Highway Bureau of the MOTC with application reference for typhoon wave impact road closure decisions, thus enhancing traffic safety management.

2. 精進橋梁檢測與管理

橋梁檢測部分，完成研發具組裝操作簡便、容易攜攜、成本經濟及可用於感潮河段狹小施作空間等優點之「橋梁梁底狹小空間檢測工具」，並優化相關檢測構件，經測試驗證6座橋梁，能穩定伸展並移動至橋梁下方拍攝梁底影像，提供檢測相關橋梁應用，後續將持續精進其功能，並推廣移轉研發成果，提供橋梁維護管理單位未來實務應用，以提升橋檢作業之品質、效率及人員作業安全。

南方澳大橋斷落事件後，在制度面，為健全全國橋梁之安全維護管理體制，奉交通部指示研擬完成「橋梁維護管理作業要點（草案）」，於109年7月21日由行政院頒布生效，以「健全制度、落實執行」為主軸，透過要點促使各部會、縣市政府、公立學校及公營事業機構於既有法系架構下導入3層次管理機制，據以建立合宜制度並持續強化橋梁維管作業，「車行橋梁管理資訊系統」除調整帳號控管方式及新增統計儀表板外，並於各單位登入系統首頁增加未檢測及未維修橋梁數提醒、每月1日自動將前述提醒資訊以電子郵件通知各單位設定帳號、改善檢測人員頭像與檢測構件照片拍攝問題、以及提升主系統覆核功能，針對檢測時間疑似過短及檢測人員頭像疑似有誤標註示警等精進功能。為持續精進「全國橋梁統計資訊網」開放資料，本所於112年5月31日邀集各橋管機關（包括各部會、交通部公路局、高公局、各縣市政府等）召開「全國橋梁統計資訊網增加資料開放項目研商會議」，經與會單位討論後，新增開放橋梁「轄下機關（養護單位）」、「道路等級」、「路線」、「橋梁里程」、「橋面板材質」等5項資訊供外界查詢，爰統計資訊網開放資料由原9項（橋梁名稱、使用狀態、中央主管機關、管理機關、所在縣市、所在區鄉、竣工年月、橋梁總長、結構型式）增至14項，可供民眾查詢及瞭解橋梁資料。

2. Advancement of Bridge Testing and Management

In terms of bridge inspection, we have completed the development of "Bridge Girder Bottom Narrow Space Inspection Tool," which is easy to assemble and operate, portable, cost-effective and suitable for use in the narrow spaces of tidal rivers. The tool and related inspection components have been tested on six bridges, demonstrating their ability to extend and move stably under the bridge to capture girder bottom images, and provide relevant applications for bridge inspection. Further enhancements will continue and the research results will be promoted and transferred to provide practical applications for bridge maintenance management units, thereby improving the quality, efficiency and safety of bridge inspection operations.

After the collapse of Su'ao south bridge incident, to improve the safety maintenance and management system of all national bridges, the MOTC directed the drafting of "Bridge Maintenance Management Operation Guidelines (Draft)," which was promulgated by the Executive Yuan and came into effect on July 21, 2020. Centered on "establishing a sound system and ensuring implementation," the guidelines aim to prompt all ministries, county and city governments, public schools and public enterprises to introduce a three-tier management mechanism within the existing legal framework, thereby establishing appropriate systems and continuously strengthening bridge maintenance operations. The "Vehicular Bridge Management Information System" has been enhanced to adjust account control methods and add statistical dashboards, with reminders for the number of uninspected and unrepaired bridges have been added to the system's homepage for each unit. On the first day of each month, this reminder information is automatically sent by email to the accounts set by each unit. Improvements include resolving issues with photo capture of inspectors and inspected components, enhancing the main system's review function and adding advanced features to flag suspiciously short inspection times and possible errors in inspector photos. To continuously improve "National Bridge Statistical Information Network" open data, we convened a "National Bridge Statistical Information Network Open Data Expansion Meeting" on May 31, 2023 with bridge management agencies (including ministries, the Highway Bureau, the Freeway Bureau, and various county and city governments). After discussions, five new data items of managing agency (maintenance unit), road grade, route, bridge mileage and deck material were added for external queries, and increased the open data items from 9 (bridge name, usage status, central competent authority, management agency, county/city, district/township, completion date, total bridge length and structural type) to 14, making bridge information available for public inquiry and understanding.

3. 優化港區環境資訊應用與設施管理功能

（1）精進港灣環境資訊應用功能，辦理港灣環境資訊系統維護，包含港灣風、波、潮、流觀測資訊、模擬資訊、腐蝕資訊、網站科普知識、公開資料及港灣環境資訊圖臺等6大功能。除持續提供9個商港區之風速、風向、波高、波向、流速、流向及潮位等即時資訊白金標章等級之介接服務，方便使用者查詢港區海氣象即時資訊外，並開放碳、銅、鋁及鋅等金屬材料腐蝕速率資料，做為辦理結構物防蝕設計與維護管理之參據。此外，亦持續優化港灣環境資訊圖臺之颱風期間即時海氣象資訊展示及查詢功能，提供臺灣港務股份有限公司、船舶業者及港區使用者颱風期間決策支援，提高港區使用安全。本系統提供港灣完整即時之動態與靜態環境資訊，港務相關單位與民眾皆可瀏覽查詢，不僅提供港務單位、船舶業者防災應變決策支援，港區旅客及釣客亦能參考應用。

（2）辦理臺北港區高精度三維數值地形模型建構，分析各種無人飛行載具並評估飛行能力及可應用範圍，開發人工智慧（AI）影像辨識技術，針對重要設施（如碼頭、堤面及港區變電設施）啟動自動化巡查管理，並將110-111年「無人機影像監測技術應用於臺中港區管理之研究」研擬之架構應用於臺北港，探討整體架構應用於不同港區差異性，做為未來推廣至其他港區之應用參考，達到應用創新科技，提升港區管理效能之目的。

（3）持續以滾動方式，依臺灣港務公司、金門及連江縣港務處實務需求，精進港灣構造物維護管理制度及擴充維護管理系統功能，並藉由辦理教育訓練，推廣落實研究成果。另蒐集國內外新興科技應用於碼頭巡查檢測案例，探討相關新興科技應用於碼頭巡查檢測之可行性，提供港務管理單位落實以智慧化、資訊化管理方式辦理港灣構造物維護管理工作。

3. Optimization of Harbor Environment Information Application and Facility Management Feature

(1) We have refined the application functions of harbor environment information, maintaining the harbor environment information system, which includes six major functions: harbor wind, wave, tide, current observation information, simulation information, corrosion information, popular science knowledge on the website, open data, and harbor environment information map. In addition to continuously providing platinum-standard real-time information interface services for wind speed, wind direction, wave height, wave direction, current speed, current direction, and tide levels for nine commercial port areas, and allowing users to query real-time marine meteorological information, we have also opened data on the corrosion rates of metals such as carbon, copper, aluminum and zinc for reference in structural corrosion-resistant design and maintenance management. Furthermore, the harbor environment information map's real-time marine meteorological information display and query functions during typhoons have been continuously optimized, providing decision support during typhoons for Taiwan International Ports Corporation, Ltd., ship operators and port area users, thus improving port area safety. This system offers comprehensive real-time dynamic and static environmental information for harbors, accessible to both port-related units and the public. It not only supports disaster response decision-making for port authorities and ship operators but also serves as a reference for port area passengers and anglers.

(2) We have constructed a high-precision three-dimensional numerical terrain model for the Taipei Port area, analyzed various unmanned aerial vehicles, assessed flight capabilities and application ranges, and developed AI image recognition technology for automated inspection and management of critical facilities such as docks, breakwaters, and port area substation facilities. We applied the framework developed in 2021–2022 "Research on the Application of Drone Image Monitoring Technology in Taichung Port Area Management" to Taipei Port and explored the differences in applying the overall framework to different port areas as a reference for future promotion to other ports. Our aim is to apply innovative technology to improve port area management efficiency.

(3) We will continuously refine the harbor structure maintenance management system and expand system functions according to the practical needs of Taiwan International Ports Corporation, Kinmen County Port Authority and Lienchiang County Port Authority, promoting and implementing research results through educational training. In addition, we collect domestic and international cases of emerging technologies applied to wharf inspection and detection, explore the feasibility of applying these emerging technologies to wharf inspection and detection, provide port management units with a smart and informatized approach to manage harbor structure maintenance.

4. 提升港區海氣象監測技術

（1）優化臺北港微波雷達的海氣象監測技術，運用臺北港附近海域測站之波流觀測數據，校驗微波雷達設備及改善演算方法，提高臺北港港域海象波流觀測品質準確性，並提升微波雷達於臺北港域的視覺化分析技術；此外，探討雙雷達系統平面海流之觀測特性，精進臺中港海洋陣列雷達作業化觀測之資料品管程序，提高雙雷達系統於平面海流觀測之準確度，達成輔助臺中港港埠管理單位應用之目標。

（2）112年除維護「臺灣近岸海象預測系統2.0」外，持續精進商港海域海象模擬技術，111年已完成提供未來5日風速及基隆海域小尺度風浪及水動力模擬等預測資訊，整體系統每日提供全臺9個主要商港未來2日之海氣象預測資訊。112年另因應中央氣象署資料格式變更，修改風場處理子系統，新建高雄港小尺度風浪及水動力模組，校修澎湖海域風浪及水動力模組，以提供較細緻之高雄及澎湖海域風浪及潮流模擬資訊，整體系統於113年起，每日可提供全臺10個主要商港未來2日之海氣象預測資訊。

5. 精進金屬材料腐蝕環境研究

持續進行臺灣地區大氣腐蝕因子調查與金屬材料現地曝露試驗，分析相關金屬腐蝕因子關聯性，及精進擴充「臺灣腐蝕環境分類資訊系統」，並藉由辦理研討會、教育訓練與發行年報，提供高速公路局、公路局、臺灣鐵路公司、台灣高鐵股份有限公司、工程顧問公司及民間業者辦理構造物防蝕設計及維護管理之應用參據。

4. Enhancement of Port Marine Meteorology Monitoring Technology

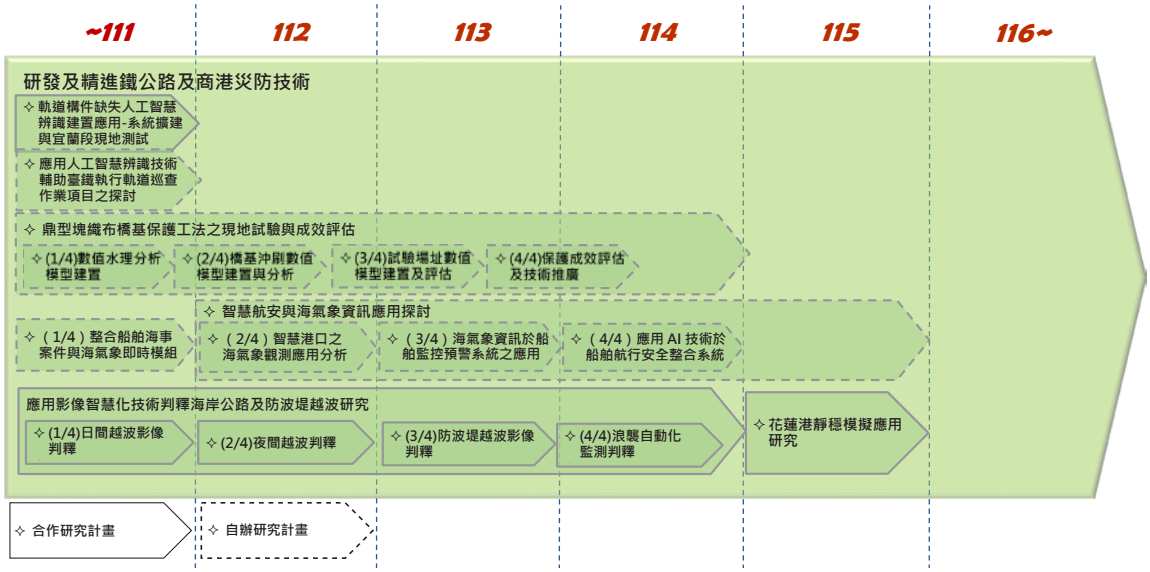
(1) Optimize Taipei Port's microwave radar technology for marine meteorological monitoring, utilize wave and current observation data from stations in the waters near Taipei Port to calibrate microwave radar equipment and improve calculation methods, enhance the accuracy of marine wave and current observations at Taipei Port and improve the visualization analysis technology of microwave radar in Taipei Port. In addition, we will explore the observation characteristics of planar ocean currents using a dual-radar system, refine the data quality control process for operational observations of ocean array radar at Taichung Port, and increase the accuracy of planar ocean current observations with the dual-radar system to support the application needs of Taichung Port's management unit.

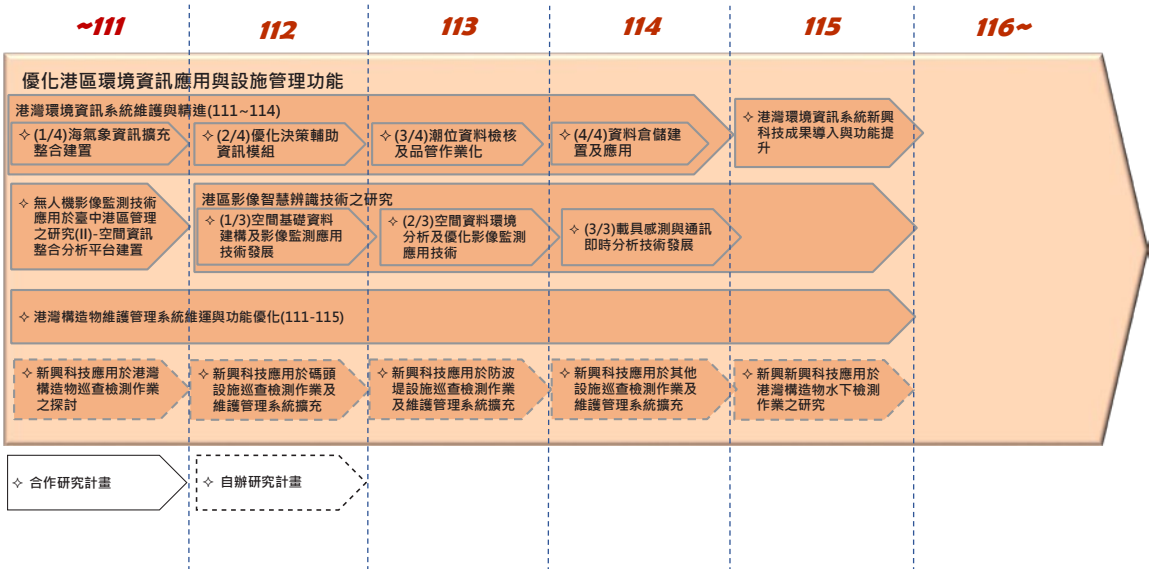
(2) In addition to maintaining "Taiwan Nearshore Wave Prediction System 2.0" in 2023, we are also refining the marine weather simulation technology for commercial port areas. The overall system provides daily marine meteorological forecasts for the next two days for nine major commercial ports in Taiwan. In 2022, the system began providing forecast information, including wind speeds for the next five days for nine ports, and small-scale wind wave and hydrodynamic simulations for the Keelung sea area for the next two days. In 2023, the system established small-scale wind wave and hydrodynamic modules for Kaohsiung sea area, and calibrated wind wave and hydrodynamic modules for Penghu sea area, providing more detailed wind wave and tidal flow simulation information for Kaohsiung and Penghu sea areas. Starting from 2024, the overall system will provide daily marine meteorological forecast information for the next two days for ten major commercial ports in Taiwan.

5. Advancement of Metal Material Corrosive Environment Study

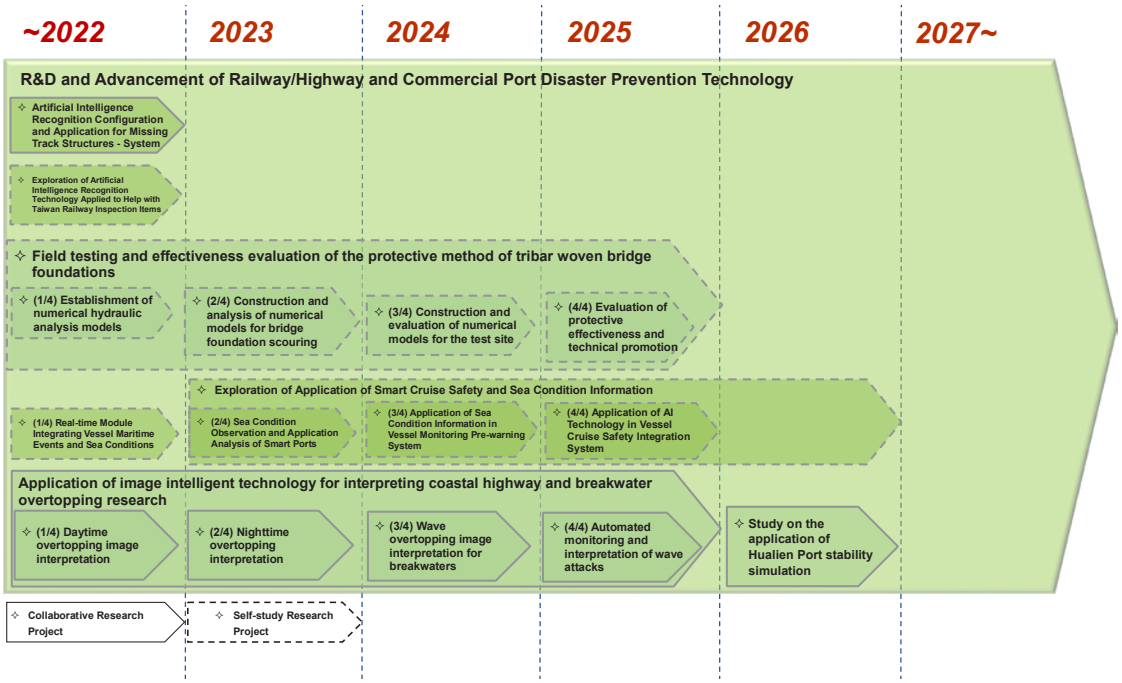
Continue to investigate atmospheric corrosion factors and conduct on-site exposure tests of metal materials in Taiwan, analyze the correlation of relevant metal corrosion factors, and improve and expand "Taiwan Corrosion Environment Classification Information System" through seminars, training sessions and annual reports, provide reference applications for corrosionresistant design and maintenance management of structures to the Freeway Bureau, Highway Bureau, Taiwan Railway Corporation, Taiwan High Speed Rail Corporation, engineering consulting companies and private sector entities.

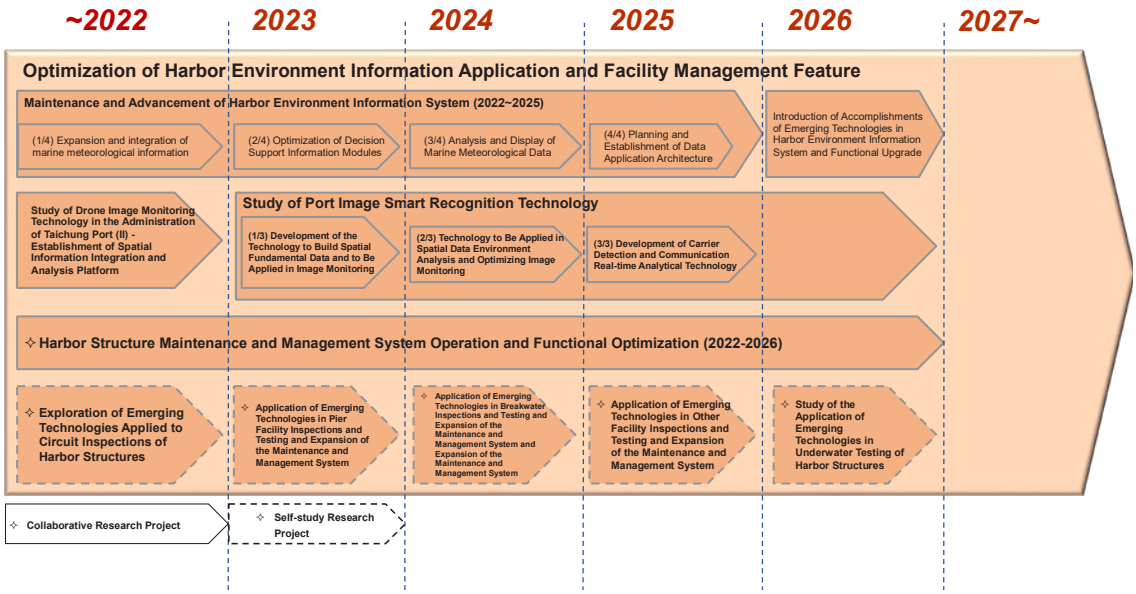
主軸7：精進交通設施維護管理與災防技術



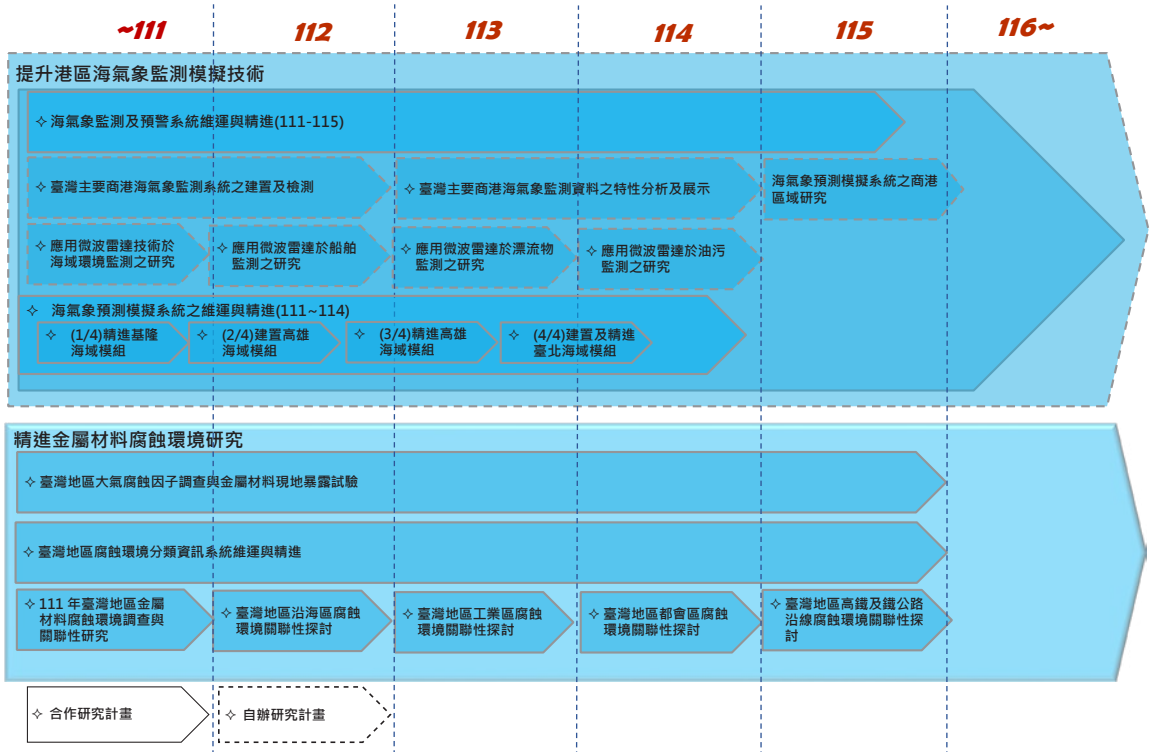


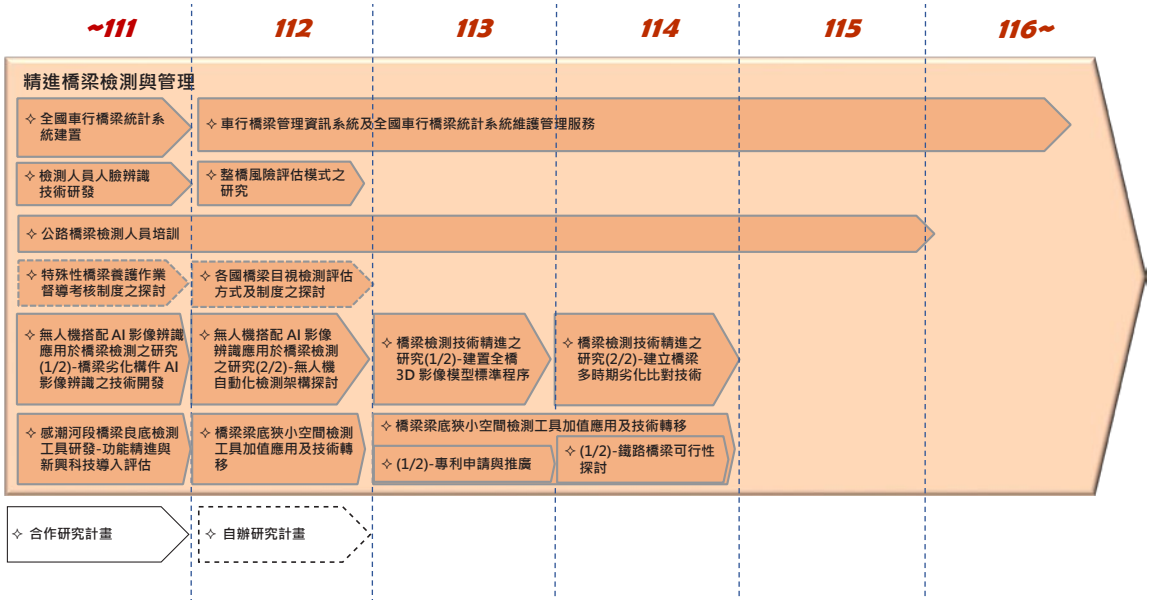
7. Improve the Transportation Facilities Maintenance Management and Disaster Prevention Technology





主軸7：精進交通設施維護管理與災防技術





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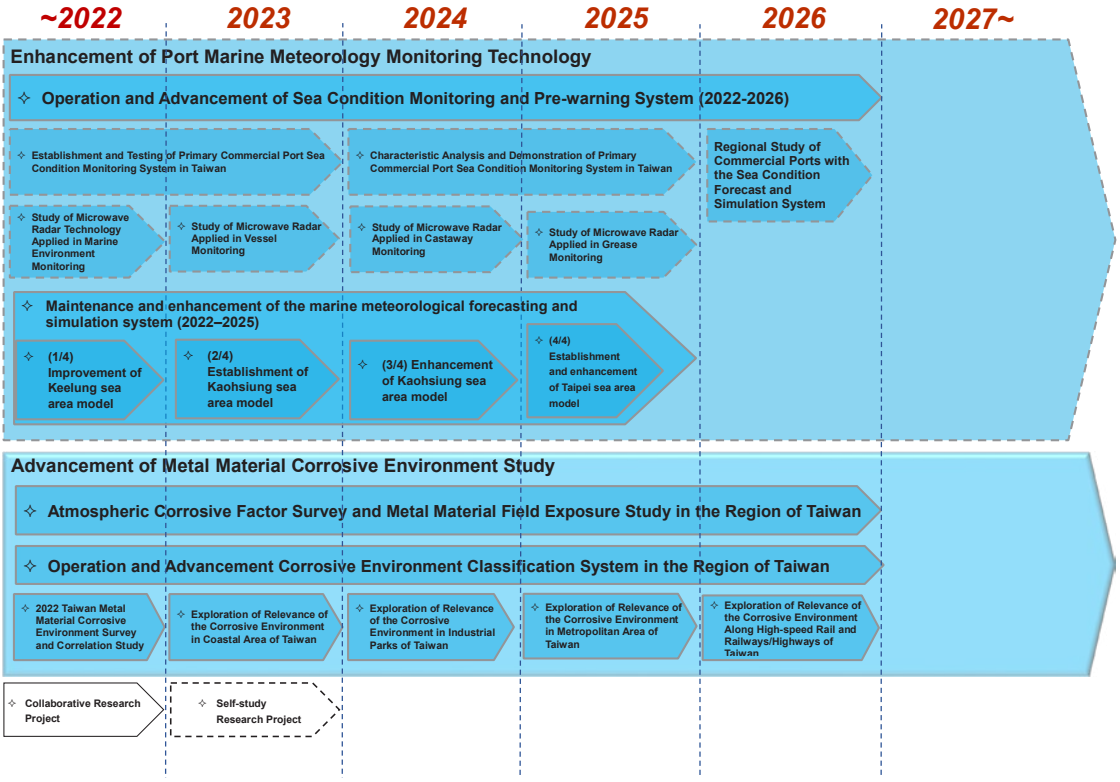
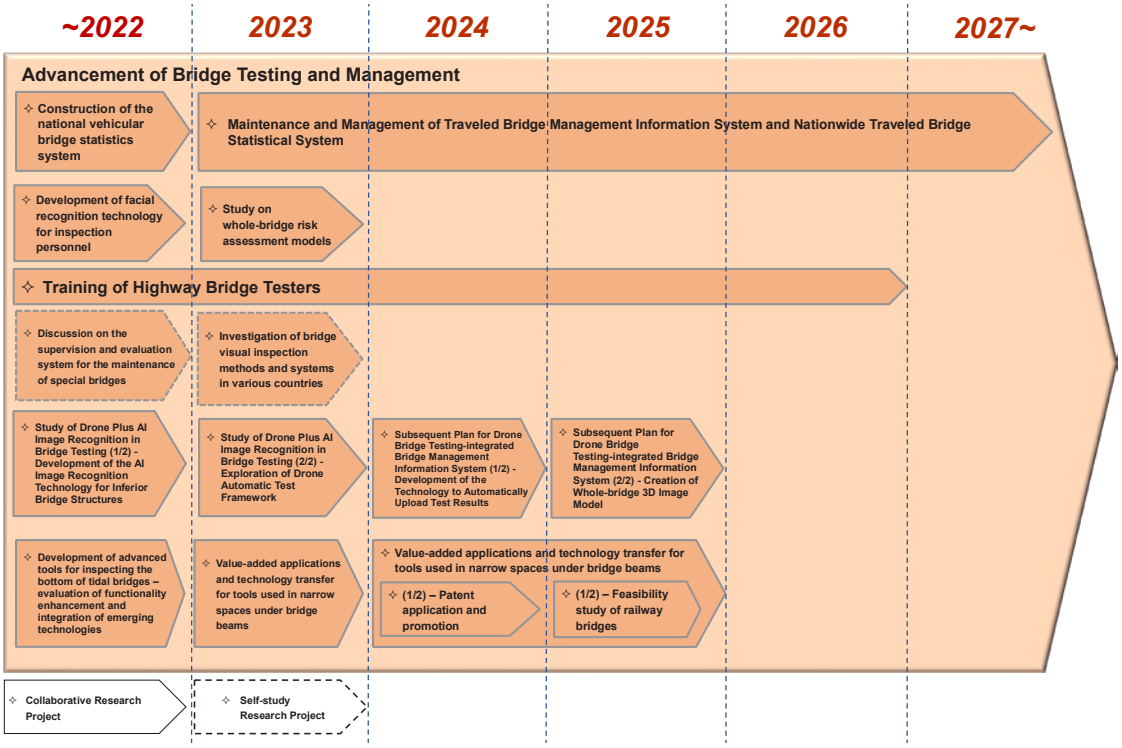




肆 04

重點研究成果

Key Research Results

依據前述112年之研究主軸與重點，本所配合研擬及執行相關研究計畫，以協助運輸政策之推動，並提供研究成果做為中央及地方政府交通單位施政之參據，說明如下：

一 強化運輸規劃與審議支援

(一)東臺區域整體運輸規劃

1. 計畫概述

本計畫為3年期計畫，主要係為掌握東臺區域(包含宜蘭縣、花蓮縣與臺東縣)平、假日之旅次特性，透過調查蒐集相關旅次特性資料，建立運輸需求模式，預測未來運輸系統之供需情形，針對東臺區域各運輸系統進行功能定位與檢討，並研提東臺區域陸路運輸系統發展策略。

本計畫第一年期（111年），蒐集東臺區域內重大建設與運輸議題，進行各縣市旅次特性及屏柵線交通量調查，以掌握區域內旅次行為之特性；第二年期（112年）進行東臺區域運輸需求模式之構建、目標年供需預測、課題探討、重大議題之政策敏感度及運輸計畫影響度分析；第三年期（113年）則根據前2年之計畫成果，進行東臺區域之運輸系統發展課題與對策、陸路運輸系統發展策略研析，以及未來展望與發展藍圖等。

2. 研究成果

（1）完成東臺區域旅次特性調查、屏柵線交通量調查及社會經濟趨勢預測與供需分析。

（2）構建「東臺區域運輸需求模式」，完成運輸系統供需預測分析。

（3）依據供需預測結果進行課題探討與相關政策意涵分析。

（4）相關產出為國發會、內政部(國土計畫)、交通機關(臺鐵公司、鐵道局、公路局、高公局等)與各地方政府辦理鐵公路運輸系統計畫與評估之參據。

According to the aforementioned 2023 Research Theme and Focus, the Institute of Transportation, MOTC collaborates with planning and implementing the relevant research projects, to assist in the promotion of transportation policies, and provides research outcomes as the reference for administration of central and local government transportation units; the descriptions are as follows:

I Enhance the Transportation Planning and Reviewing Support

(I) Overall transportation planning of Eastern Taiwan

1. Project Overview

This three-year project aims to understand the travel characteristics of Eastern Taiwan, including Yilan County, Hualien County, and Taitung County, on both weekdays and weekends. By collecting relevant travel data through surveys, we will establish a transportation demand model was established to forecast the future supply and demand of the transportation system. The project assessed and defined the functions of various transportation systems in the Eastern Taiwan region and will propose development strategies for the region's land transportation systems.

land transportation systems. In the first year of the project (2022), we collected data on major construction and transportation issues in the Eastern Taiwan region, conducted surveys on travel characteristics in each county and screen line traffic volume to understand regional travel behaviors. In the second year (2023), we constructed a transportation demand model for the Eastern Taiwan region, forecasted supply and demand for the target year, analyzed key issues, policy sensitivities, and the impacts of transportation plans. In the third year (2024), based on the results of the first two years, we will study transportation system development issues and strategies, develop land transportation system development strategies and outline future prospects and development blueprints.

2. Research Results

(1) Completed surveys on travel characteristics in the Eastern Taiwan region, screen line traffic volume surveys and socio-economic trend forecasts and supply-demand analysis.

(2) Constructed " Eastern Taiwan Regional Transportation Demand Model" and completed the supply – demand forecast analysis of transportation system.

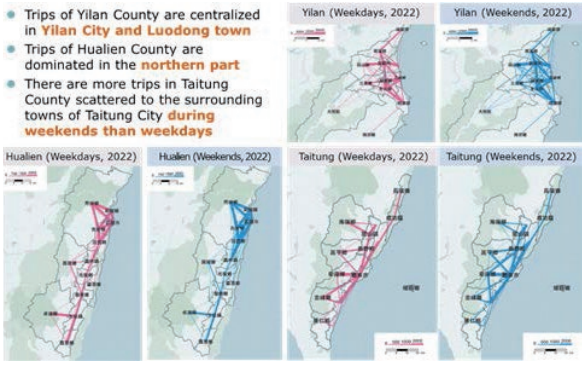
(3) Based on the supply-demand forecast results, we conducted issue discussions and analyzed relevant policy implications.

(4) The outputs of this project will serve as references for the National Development Council, Ministry of the Interior (National Land Planning), transportation agencies (Taiwan Railway Corporation, Railway Bureau, Highway Bureau, Freeway Bureau, etc.), and local governments in planning and evaluating railway and highway transportation systems.

3. 成果推廣與效益

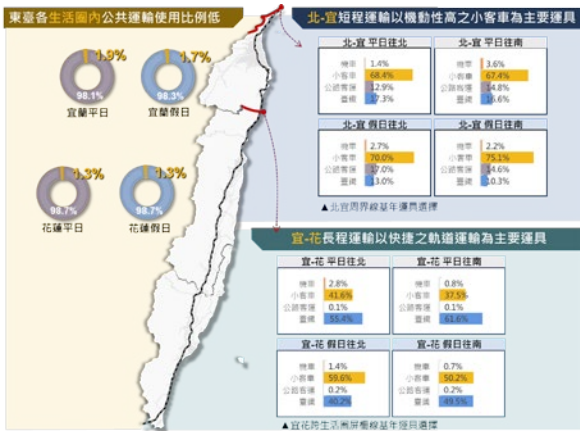
於中華民國運輸學會2023年會暨學術論文國際研討會發表「東臺區域旅次推估成果」論文。

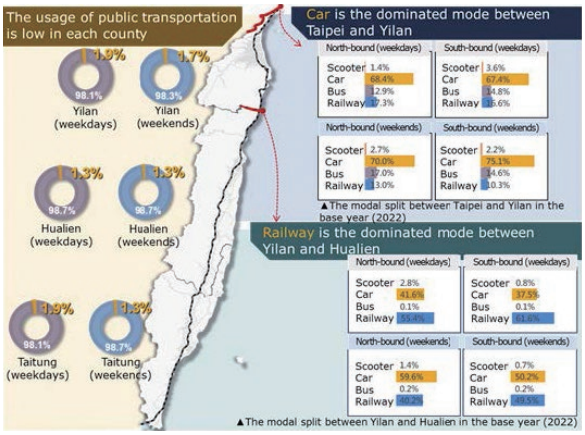
4. 研究成果精華摘整



東臺區域基年各生活圈旅次分布情形

Trip distribution in each counties in the base year of Eastern Taiwan region





東臺區域基年運具選擇比例

Modal split ratio in the base year for the Eastern Taiwan region

5. 研究成果報告

- 東臺區域整體運輸規劃系列研究（2/3）－供需預測分析（預計113年7月出版）。

5. Research Result Report

- A series of studies on the overall transportation planning of Eastern Taiwan (1/3) – investigation and analysis of travel characteristics (Scheduled to be published in July 2024).

(二) 運輸規劃支援系統維運技術服務(112年)

1. 計畫概述

本所長期辦理臺灣地區整體運輸規劃，累積了許多運輸規劃作業所需資料，為能有效保存資料，觀察全臺運輸市場趨勢，協助政策評估，自96年起辦理「運輸部門中長程計畫審議決策支援系統與整合資料庫建置之研究」案，完成運輸規劃支援系統之建置，主要包含1.運輸規劃整合資料庫；2.運輸規劃支援系統（網路版）；3.運輸規劃圖展示及出圖作業系統（單機版）。運輸規劃整合資料庫，依運輸規劃作業需求，彙集了計畫資料、規劃資料、規劃工具、手冊及審議要點、指標等四大類資料。提供網路版WEB版－快速資訊查詢，PC單機版-圖資編修、空間環域分析等功能服務。

2. 研究成果

（1）本系統以TGOS所提供豐富多樣之底圖為圖臺，與本系統自行數化產製交通建設計畫、重大土地開發計畫圖資，結合社會經濟資料、運輸營運資料、運輸需求模式基礎資料、計畫評估工具等，提供公部門運輸規劃單位、學術單位及民間顧問公司快速查詢、取得運輸規劃作業所需相關圖資及數據資料。

（2）整合交通部高速公路局國道、公路局省道之交通量，部外主計總處統計之社會經濟資料，及文化部、水利署、農業部、國家公園、國土署等單位Open Data，透過底圖疊合、查詢點位視覺化，提供使用者快速、正確查詢取得所需相關資料。

（3）112年完成以內政部TGOS服務取代GIS Server，建置新版圖台底層框架與圖台介面設計；強化數據庫資料查詢統計功能，新增生活圈運輸需求模式成果查詢功能。

(II) Maintenance service of the transportation planning support system (2023)

1. Project Overview

The institute has been conducting overall transportation planning for the Taiwan area for a long time and has accumulated a wealth of data required for transportation planning operations. To effectively preserve this data, observe trends in the transportation market across Taiwan, and assist with policy evaluations, we have been handling "Research on the Establishment of a Medium- and Long-term Plan Review Decision Support System and Integrated Database for Transportation Department" since 2007. This project has resulted in the establishment of a transportation planning support system, which mainly includes: 1. An integrated transportation planning database; 2. A transportation planning support system (web version); 3. A transportation planning map display and printing system (standalone version). Based on the needs of transportation planning operations, the integrated transportation planning database aggregates four main types of data: project data, planning data, planning tools, manuals and review points/indicators. It offers web-based quick information query services and PC standalone services for map editing, spatial analysis and more.

2. Research Results

(1) The system uses the diverse base maps provided by TGOS as its mapping platform, combining these with our self-produced digital maps of transportation construction projects, major land development project maps, socio-economic data, transportation operation data, transportation demand model basic data and project evaluation tools. It enables public transportation planning units, academic institutions and private consulting firms to quickly query and obtain relevant map and data necessary for transportation planning operations.

(2) It integrates traffic volumes from the Freeway Bureau of the MOTC, provincial road data from the Highway Bureau, socio-economic data from the Directorate General of Budget, Accounting and Statistics, open data from the Ministry of Culture, Water Resources Agency, Ministry of Agriculture, national parks, and National Land Management Agency of the Ministry of the Interior. Through map overlay and query point visualization, it provides users with quick and accurate access to the required data.

(3) In 2023, the system replaced GIS server with TGOS services provided by the Ministry of the Interior, establishing a new base framework and interface design for the mapping platform; enhanced data query and statistical functions, and added a function for querying transportation demand model results for living circles.

3. 成果推廣與效益

（1）107-112年持續提供圖形資料庫（運輸系統、運輸場站／交通建設計畫區位與重大土地開發計畫區位）予交通部公路局、內政部國土管理署及各縣市政府建立永續生活圈運輸評估模型、國土規劃（含都會區域計畫）之機制探討使用。

（2）112年6月21日及10月24日辦理「運輸規劃支援系統」之教育訓練」。

3. Result Promotion and Benefits

(1) From 2018 to 2023, it continuously provided graphic databases, including transportation systems, transportation stations/transportation construction project locations, and major land development project locations, to the Highway Bureau of the MOTC, National Land Management Agency of the Ministry of the Interior, and local governments. These databases were used to establish sustainable living circle transportation evaluation models and explore mechanisms for national land planning, including metropolitan area planning.

(2) On June 21 and October 24, 2023, educational training sessions for "Transportation Planning Support System" were conducted.

4. 研究成果精華摘整

運輸規劃支援系統架構

Structure of the transportation planning support system

4. Summary of Research Results

5. 研究成果報告

- 運輸規劃支援系統維運技術服務（112年）（預計113年7月出版）。

6. 相關網站

運輸規劃支援系統（https://ttdss.iot.gov.tw/ttdss/）

5. Research Result Report

- Maintenance service of the transportation planning support system (2023) (Scheduled to be published in July 2024).

6. Related Websites

Transportation planning support system

(三) 大漢溪兩岸整體交通路網規劃構想計畫

1. 計畫概述

行政院公共工程委員會於112年2月10日召開「大漢溪沿岸板橋至土城、三峽及龍潭交通改善策略」辦理情形追蹤會議，會議結論二、交通部於大漢溪兩岸應提早進行整體規劃澈底解決區域性交通問題：大漢溪兩岸規劃概念宜參考大台北都會區之基隆河與新店溪兩岸均為完整快速道路系統概念，提早進行整體規劃，俾澈底解決當地交通問題，因涉及國道、省道、地方道路及防汛道路等不同權責機關，惟多為交通部管轄範圍，爰請交通部責成所屬運輸研究所整體考量區域公路系統、國道及地方道路系統間均彼此串接、互為影響之交通資訊，並納入未來人口成長需求，宜就交通可及性、易行性等面向妥予考量，儘早提出區域性交通壅塞問題之整體解決策略，爰辦理本規劃構想計畫。

2. 研究成果

（1）本規劃以充分使用大漢溪兩岸空間之方式進行快速道路構想規劃，右岸快速道路：以新北市台64線（江子翠交流道）為起點往南布設快速道路，於台65線土城機廠附近設置匝道銜接台65線，往南經三鶯大橋、武嶺橋、崁津大橋，終點銜接桃園市大溪區台4線。至於左岸快速道路：以新北市新北環快為起點往南布設快速道路，設置匝道銜接國2鶯歌系統交流道及台66線大溪系統交流道，終點銜接桃園市龍潭區台4線。

（2）完成「大漢溪兩岸整體交通路網規劃構想計畫」提供公路局續辦可行性研究等相關作業及相關市政府配合參考應用。

(III) Conceptual plan for the overall traffic network on both sides of the Dahan River

1. Project Overview

On February 10, 2023, the Public Construction Commission of the Executive Yuan held a follow-up meeting on "Strategies for Improving Traffic along the Dahan River from Banqiao to Tucheng, Sanxia and Longtan" and reached conclusion two: the MOTC should conduct early overall planning on both sides of Dahan River to thoroughly solve regional traffic problems. The planning concept for Dahan River should refer to the complete expressway systems along Keelung River and Xindian River in the Greater Taipei Metropolitan Area. Given the involvement of various responsible agencies such as national highways, provincial roads, local roads and flood control roads, most of which fall under the jurisdiction of the MOTC; the Ministry is requested to task its Transportation Research Institute with considering the regional highway system, national highways and local road systems, which are interconnected and mutually influential. The institute should also take future population growth into account and consider factors such as traffic accessibility and feasibility to propose a comprehensive strategy for solving regional traffic congestion problems as soon as possible.

2. Research Results

(1) This plan involves the conceptual planning of expressways by fully utilizing the space on both sides of Dahan River. Right Bank Expressway: starting from Jiangzicui Interchange of the New Taipei City Provincial Highway 64, heading south to set up an expressway, connecting with Provincial Highway 65 near Tucheng Depot, continuing south through Sanying Bridge, Wuling Bridge, and Kanjin Bridge, and ending at Provincial Highway 4 in Daxi District of Taoyuan City. Left Bank Expressway: starting from the New Taipei City Ring Expressway, heading south to set up an expressway, with ramps connecting Yingge System Interchange of National Highway 2 and Daxi System Interchange of Provincial Highway 66, ending at Provincial Highway 4 in the Longtan District of Taoyuan City.

(2) "Conceptual Plan for the Overall Traffic Network on Both Sides of the Dahan River" has been completed, providing the Highway Bureau with information for subsequent feasibility studies and related work, and for the relevant city governments to use as a reference.

3. 成果推廣與效益

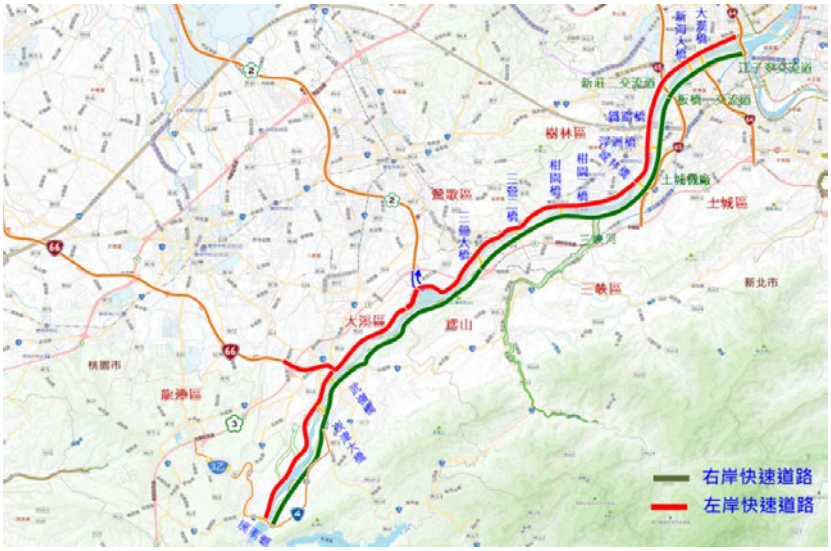
本規劃構想，從大臺北地區主要河川流域（淡水河、大漢溪、新店溪及基隆河）兩岸快速道路交通系統之整體串接思維予以規劃，未來完成後將可紓解三峽、鶯歌、土城及樹林地區尖峰時段之交通壅塞問題。

3. Result Promotion and Benefits

This planning concept is based on the overall connectivity of expressway traffic systems along the major river basins (Tamsui River, Dahan River, Xindian River and Keelung River) in the Greater Taipei area. Upon completion, it will alleviate peak hour traffic congestion in Sanxia, Yingge, Tucheng and Shulin areas.

4. 研究成果精華摘整

4. Summary of Research Results



大漢溪兩岸快速道路示意圖

Schematic diagram of the expressways on both sides of Dahan River

5. 研究成果報告

- 大漢溪兩岸整體交通路網規劃構想計畫（預計113年7月出版）。

5. Research Result Report

- Conceptual plan for the overall traffic network on both sides of the Dahan River (Scheduled to be published in July 2024).

(四) 高速公路交織路段容量及服務水準分析之研究（1／3）－典型路段

1. 計畫概述

本所於民國79年、90年、110年陸續出版更新「臺灣地區公路容量手冊」，惟其中第七章「高速公路交織區段」仍援引美國運輸研究委員會（Transportation Research Board, TRB）1985年公路容量手冊的分析方法，且該方法將交織路段型態分為三種類型，而第七章僅著重於其中一種。然而TRB 1985年之分析方法因不適用於美國的環境，後續版本亦已更新分析方法。

本所自民國80年起開始進行長期性之容量本土化研究工作，逐步修訂民國79年之公路容量手冊，以適用於國內之分析。由於多年來均尚未蒐集交織路段的資料並進行車流特性分析，因此並未檢討交織路段的容量分析方法的適用性，爰辦理本計畫探討高速公路交織路段之車流特性、容量及服務水準分析方法。

2. 研究成果

（1）完成典型交織路段（指進口匝道與出口匝道間以輔助車道連接、交織路段上下游主線車道數相等、且交織路段內沒有其他特殊設計之地點）之國內外文獻探討。

（2）完成4個地點之交織路段現場調查，並進行資料整理及車流特性之分析。

（3）相關產出提供未來公路容量手冊修正之依據，以提供交通部及高公局等相關單位參考應用。

3. 成果推廣與效益

（1）針對「適合國內情況之高速公路路段的容量估算方法」及「交織路段之服務水準評估指標及劃分標準」等議題於112年11月2日召開專家學者座談會。

（2）於空間數位生活2023 Vol.2發表「讓無人機『全新視角』監控車流，智慧化管理交通安全」。

(IV) Analysis of traffic capacity and level of service of freeway weaving segments (1/3) – typical segments

1. Project Overview

The institute has successively published and updated "Taiwan Highway Capacity Manual" in 1990, 2001 and 2021. However, chapter 7 "Highway Weaving Sections" still references the analysis method from the Transportation Research Board (TRB) 1985 Highway Capacity Manual. This method categorizes weaving sections into three types but chapter 7 only focuses on one type. Since the TRB 1985 analysis method was not suitable for the U.S. environment, subsequent versions have updated the analysis methods.

The institute began long-term localization research on capacity since 1991, gradually revising the 1990 highway capacity manual to suit domestic analysis. Due to the lack of data collection and analysis of traffic flow characteristics on weaving sections over the years, the applicability of the weaving section capacity analysis method has not been reviewed. Therefore, this project aims to study the traffic flow characteristics, capacity, and service level analysis methods of highway weaving sections.

2. Research Results

(1) Completed a literature review on typical weaving sections (defined as locations where the number of mainline lanes upstream and downstream of weaving section are equal, connected by auxiliary lanes between entrance and exit ramps and without other special design features) domestically and internationally.

(2) Conducted on-site surveys at four weaving section locations, organized the data and analyzed the traffic flow characteristics.

(3) The relevant outputs provide a basis for future revisions of the highway capacity manual, offering reference applications for the MOTC and the Freeway Bureau.

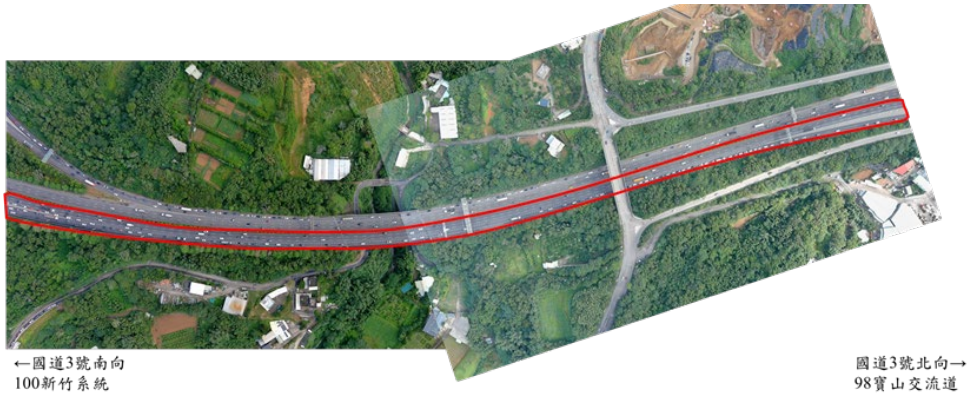
3. Result Promotion and Benefits

(1) On November 2, 2023, we held a seminar with experts and scholars on the topics of "Capacity Estimation Methods Suitable for Domestic Highway Sections" and "Service Level Evaluation Indicators and Classification Standards for Weaving Sections."

(2) Published the article "Using Drones as 'New Perspective' to Monitor Traffic Flow and Intelligently Manage Traffic Safety" in the 2023 Vol.2 of Spatial Digital Life.

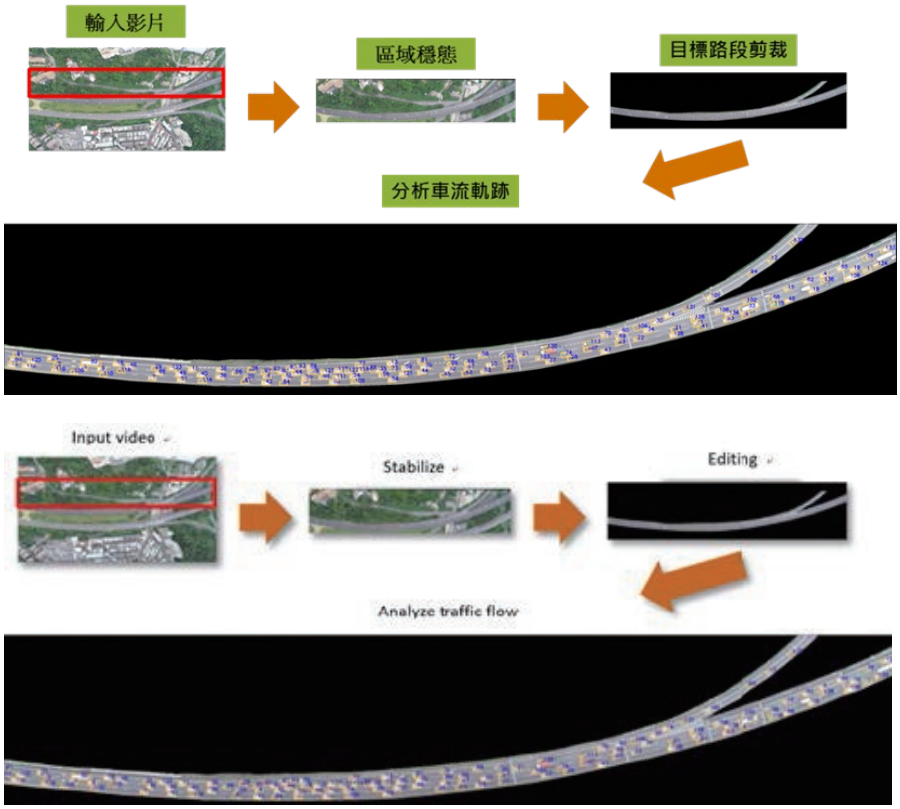
4. 研究成果精華摘整

4. Summary of Research Results



北上新竹系統~寶山交織路段拍攝畫面

Image of the northbound Hsinchu system – Baoshan weaving section



影像辨識分析流程圖

Image recognition analysis flow chart

5. 研究成果報告

- 高速公路交織路段容量及服務水準分析之研究(1/3)－典型路段（預計113年7月出版）。

5. Research Result Report

- Analysis of traffic capacity and level of service of freeway weaving segments(1/3) – typical segments (Scheduled to be published in July 2024).

(五) 鐵路供需診斷數位分身軟體平台之建置（1／2）－鐵路數位分身軟體平台雛型架構之規劃

1. 計畫概述

本所已於110、111年辦理鐵路系統供需診斷模式軟體之維護與擴充及策略分析之計畫，利用歷史售票及班表資料倉儲，並導入大數據分析技術，構建鐵路系統診斷模式軟體，可在假設條件與規劃面上，進行鐵路系統旅客運輸供需情形之診斷與情境分析。

政府刻正積極推動前瞻基礎建設，其中前瞻軌道建設涵蓋高鐵臺鐵連結成網、臺鐵升級及改善東部服務、鐵路立體化或通勤提速、都市推捷運及中南部觀光鐵路五大推動主軸，第三期交通部將編列388億元，重點項目包含辦理花東鐵路雙軌化、臺南市區鐵路地下化等計畫。此外，軌道運輸系統能源使用效率優於公路公共運輸系統及私人運具，且在2020運輸政策白皮書之順應國際綠色潮流下，交通部刻正推動建構環島高快速鐵路網，預期鐵路系統未來將更加重要。

國際間已有導入與研發數位分身技術應用於軌道領域之標竿案例，在規劃、建設、營運等均可發揮其效益。該技術主要係透過將資產可視化與蒐整運行資料，以及仿真模型與情境分析，可進行解決方案模擬分析與預測，除可應用於規劃設計方案選擇與驗證外，亦可應用於營運與維護等階段提升營運效能與節省成本。

隨著鐵路建設計畫之推動及新列車投入營運，將影響鐵路運輸，亟需數位化科技技術，協助掌握並情境模擬分析，輔助政策決策，並提升本所鐵路建設計畫經費審議能力。爰此，辦理本科技計畫，結合本所過去累積相關研發技術，開發可整合規劃面與實際列車運行之鐵路數位分身軟體平台雛型架構，可做為本所辦理鐵路建設計畫經費審議、政策研擬與方案評估之重要工具，軟體平台研發完成後可移轉鐵道局與臺鐵公司做為列車模擬與評估建設計畫方案之輔助工具。

(V) Establishment of the railway supply and demand diagnostic digital twin software platform (1/2) – planning of the prototype structure for railway digital twin software platform

1. Project Overview

The institute has completed the maintenance and expansion of railway system supply and demand diagnosis model software and strategic analysis projects in 2021 and 2022. Utilizing historical ticketing and schedule data warehouses, and incorporating big data analysis techniques, we developed a railway system diagnosis model software. This software can perform diagnosis and scenario analysis of passenger transport supply and demand in the railway system under assumed conditions and planning aspects.

The government is actively promoting forward-looking infrastructure, including five main aspects: integrating high-speed rail and conventional rail networks, upgrading and improving services in Eastern Taiwan, railway elevation or commuter speed enhancements, urban metro development, and southern and central tourism railways. The MOTC will allocate $38.8 billion in the third phase for key projects such as the double-tracking of Hualien-Taitung railway and undergrounding of Tainan city railway. Furthermore, the energy efficiency of rail transport systems is superior to that of road public transport and private vehicles. Under the 2020 transportation policy white paper, the MOTC is promoting the construction of a high-speed railway network around the island, anticipating that the railway system will become increasingly important in the future.

Internationally, there are benchmark cases where digital twin technology has been applied to the railway sector in planning, construction and operation, demonstrating significant benefits. This technology visualizes assets, collects operational data, and uses simulation models and scenario analysis to conduct solution simulations and predictions. It can be applied to planning and design solution selection and verification, as well as improving operational efficiency and reducing costs in operation and maintenance phases.

With the advancement of railway construction projects and the introduction of new trains, the impact on railway transportation necessitates digital technology to assist in monitoring and scenario analysis, supporting policy decision-making and enhancing the institute's capability in railway construction project budget reviews. Therefore, this technological project is being conducted by combining the institute's accumulated R&D technologies to develop a prototype framework for a railway digital twin software platform. This platform can integrate planning aspects with actual train operations, serving as an essential tool for the institute in railway construction project budget reviews, policy formulation, and program evaluation. Upon completion, the software platform can be transferred to the Railway Bureau and the Taiwan Railways Administration as a simulation and evaluation tool for construction project programs.

2. 研究成果

（1）已蒐整國際先進國家鐵路數位分身標竿案例文獻資料，並勾勒我國未來鐵路數位分身藍圖，進一步分析提出優先研發項目如平台架構及操作界面、自動解衝突、運轉模擬等部分，透過導入本所供需診斷模式軟體之核心技術，完成鐵路數位分身軟體平台雛型架構之規劃。

（2）技術發展部分除持續深化國際鐵路聯盟（UIC）班表壓縮法發展車站瓶頸分析技術及車站晚點量分析技術，再透過包含彰化市鐵路高架化、集集支線基礎設施改善、高鐵彰化站等跨鐵路建設計畫之情境案例分析驗證及展示相關功能，顯示數位分身軟體平台雛形架構已有初步運轉分析能力。

3. 成果推廣與效益

針對「未來鐵路數位分身發展架構」及「包含彰化市鐵路高架化、集集支線基礎設施改善、高鐵彰化站等跨鐵路建設計畫之情境案例分析預測成果」於112年11月23日召開專家學者座談會。

4. 研究成果精華摘整

2. Research Results

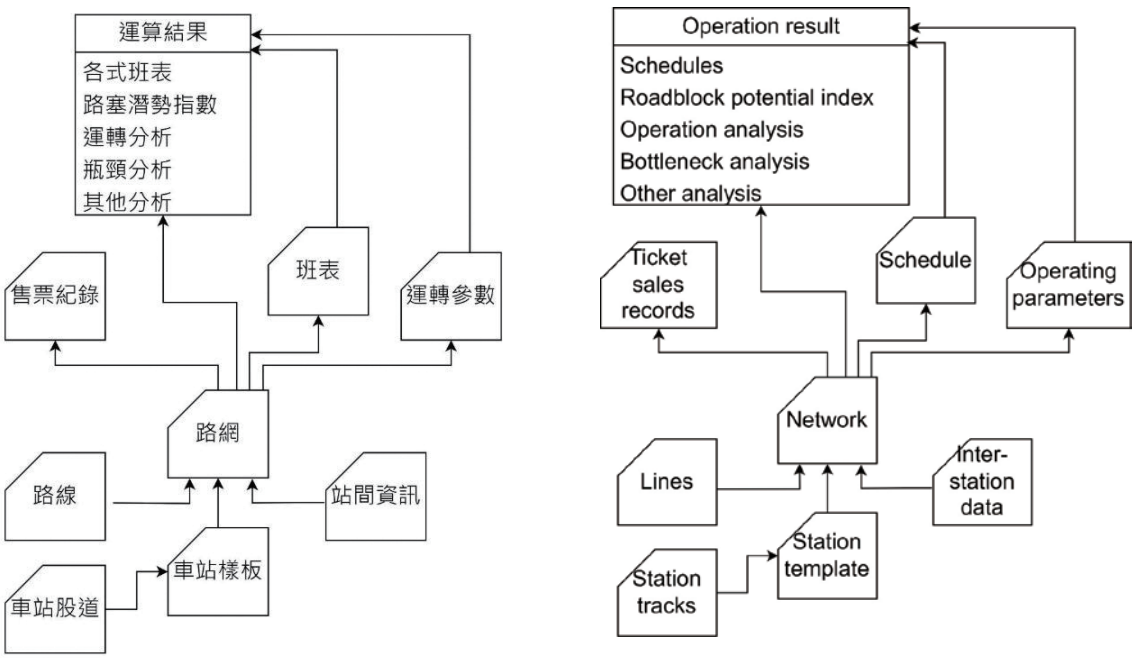
(1) We have collected documentation on benchmark cases of railway digital twins from advanced countries and outlined a future blueprint for Taiwan's railway digital twins. Further analysis has identified R&D priority projects such as platform architecture and interface, automatic conflict resolution and operation simulation. By incorporating the core technology of the institute's supply and demand diagnosis model software, we have completed the planning of a prototype framework for railway digital twin software platform.

(2) In terms of technical development, we have continued to deepen the development of station bottleneck analysis techniques and delay quantification techniques using UIC timetable compression method. Through scenario case analysis and validation, including Changhua City railway elevation, Jiji Line infrastructure improvements and Changhua high-speed rail station, we have demonstrated the initial operational analysis capabilities of digital twin software platform prototype framework.

3. Result Promotion and Benefits

On November 23, 2023, we held a seminar with experts and scholars on "Future Development Framework of Railway Digital Twins" and "Scenario Case Analysis and Prediction Results of Railway Construction Projects Including Changhua City Railway Elevation, Jiji Line Infrastructure Improvements and Changhua High-speed Rail Station."

4. Summary of Research Results



鐵路數位分身平台數據組織架構示意圖

Schematic diagram of the data organization structure for railway digital twin platform

5. 研究成果報告

- 鐵路供需診斷數位分身軟體平台之建置（1／2）－鐵路數位分身軟體平台雛型架構之規劃（預計113年7月出版）。

(六) 城際鐵道編組站及端末站之容量模式分析

1. 計畫概述

本計畫為2年期計畫，針對城際鐵道系統之編組站及端末站容量分析進行研究，端末站及編組站主要係列車營運的起迄點，列車抵達車站後必須進行整備後再折返開始下一趟車次，或進出車輛基地等整備工作，相較於一般車站更為複雜。

本計畫於112年之第1年期計畫，完成構建可分析編組站及端末站之傳統暨區域鐵路系統容量分析模式，考慮列車於編組站及端末站的折返行為以及相關影響容量之因素進行分析，做為後續113年進行鐵道容量分析軟體擴充之基礎。本計畫之成果，可做為交通部、鐵道局、臺鐵公司及各地方政府於辦理城際鐵道系統改善計畫評估之依據。

2. 研究成果

（1）構建可分析編組站及端末站之鐵路系統容量分析模式。

（2）研析編組站、端末站及一般路線中之車站軌道配置與軌道運用路徑對城際鐵道系統容量之影響相關議題。

（3）針對臺鐵系統列車於編組站及端末站之運轉規劃進行案例分析。

（4）相關成果可協助鐵道規劃機關（如鐵道局）及營運機構（如臺鐵公司）使用容量分析方法進行鐵路系統容量評估分析，並進行改善計畫研擬。

5. Research Result Report

- Establishment of the railway supply and demand diagnostic digital twin software platform (1/2) – planning of the prototype structure for railway digital twin software platform (Scheduled to be published in July 2024).

(VI) Capacity model analysis of intercity railway classification yard and terminal station

1. Project Overview

This project is a two-year project focusing on the capacity analysis of classification yard and terminal station in the intercity railway system. Terminal and classification stations are primarily the starting and ending points for train operations. After a train arrives at this kind of station, it must undergo preparation before starting the next trip or entering the depot, which is more complex compared to general stations.

In the first year of the project in 2023, we completed the construction of a capacity analysis model for conventional railway systems, which can analyze classification yard and terminal station. This model considers the turnaround behavior of trains at classification yard and terminal station, as well as factors affecting capacity, serving as the basis for expansion of railway capacity analysis software in 2024. The results of this project can serve as a basis for the MOTC the Railway Bureau, Taiwan Railway Corporation and local governments in evaluating intercity railway system improvement plans.

2. Research Results

(1) Construction of a capacity analysis model for classification yard and terminal station in the railway system.

(2) Research on issues related to the impact of track layout and track usage paths at classification yard, terminal station and general stations on the capacity of intercity railway system.

(3) Case analysis of train operation planning at classification yard and terminal station in Taiwan Railways system.

(4) The results can assist rai lway planning authorities (such as the Railway Bureau) and operaters (such as Taiwan Railway Corporation) in using capacity analysis methods to conduct railway system capacity evaluations and develop improvement plans.

3. 成果推廣與效益

（1）於112年7月7日及112年11月10日召開2次專家學者座談會。

（2）於112年6月9日及112年10月25日辦理2次教育訓練。

（3）於中華民國運輸學會2023年會暨學術論文國際研討會發表「城際鐵路場站容量評估模式」論文。

3. Result Promotion and Benefits

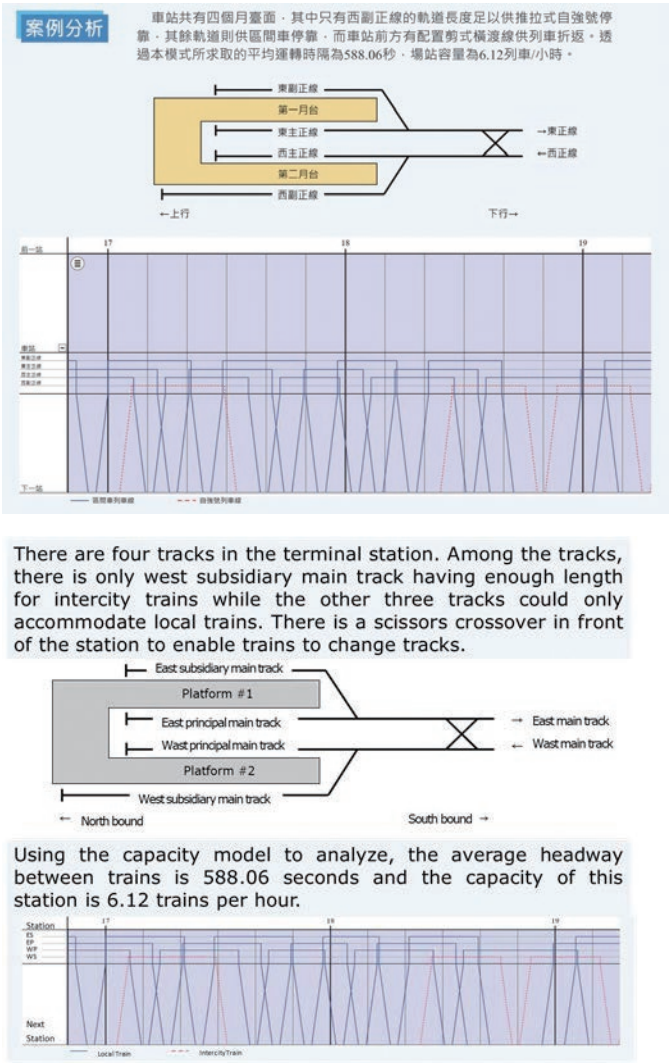
(1) Two expert symposiums held on July 7 and November 10, 2023.

(2) Two training sessions conducted on June 9 and October 25, 2023.

(3) Presentation of "Station Capacity Analysis Model for Intercity Railways" paper at the Chinese Institute of Transportation's 2023 annual meeting and international academic conference.

4. 研究成果精華摘整

4. Summary of Research Results



城際鐵道容量案例分析

Case analysis of intercity railway capacity

5. 研究成果報告

- 城際鐵道容量分析暨應用研究（1/2）－編組站及端末站之容量模式構建（預計113年7月出版）。

5. Research Result Report

- Research on capacity analysis of intercity railways and its applications (1/2) – rail capacity model for the classification yard and terminal station(Scheduled to be published in July 2024).

二 提升海空運競爭優勢

(一) 國際機場運作模擬分析軟體系統規劃與建置(1/2)－系統規劃設計與軟體單元確立

1. 計畫概述

機場空側模擬分析為民航機場營運規劃相當重要之一環，本計畫前期研究已建立機場空側容量評析方法，並通過桃園機場公司驗證，可進行機場空側運作模擬分析、釐清機場空側運作瓶頸、協助減少延滯、評估機場空側配置方案，使空側運作順暢而提高營運效能。

本計畫係在前期研究基礎上，進一步將上述評析方法研發為機場運作模擬分析軟體，並強化人機介面之操作親和性。本計畫為2年期研究之第1年期，已完成機場運作模擬軟體雛型，包括建立軟體平臺，並完成模擬引擎模組之軟體修正、資料庫模組、操作界面模組之設計與實作等。預計第2年期（113年）再進一步完成軟體研發，並強化人機介面操作親和性。

第2年期並將進行實際案例測試與教育訓練，增進民航局與桃園機場公司對本軟體之深入認識與實務操作，並藉由教育訓練蒐整各單位對本軟體使用經驗及回饋意見，俾增進軟體操作親和性，以利推廣本軟體在機場規劃面與營運面之實務應用，做為機場空側平日營運管理或營運期間工程變動時之政策評估工具。軟體研發完成後，預計將技術移轉提供民航局、桃園機場公司落地應用，使機場空側設施管制作為朝數據化及模式化發展，進而提升我國際門戶機場營運效能，以利符合機場長期發展需求。

2. 研究成果

（1）完成軟體系統需求文件，包括參數、場面數據、班表數據、數據管理、分析結果、跑道模擬邏輯、滑行道模擬邏輯、停機位模擬邏輯、航班模擬邏輯及模擬操作等。

II Improve the Competitive Advantage of Sea and Air Transportation

(I) Planning and development of the international airport operations simulation analysis software system (1/2) – system planning and design and software unit establishment

1. Project Overview

Airside simulation analysis is an important part of civil aviation airport operations planning. In previous research, we established an airside capacity evaluation method for airports, which was verified by Taoyuan International Airport Co., Ltd. This method can perform airside operations simulation analysis, identify airside operational bottlenecks, assist in reducing delays, and evaluate airside configuration plans to ensure smooth operations and improve operational efficiency.

Based on previous research, this project aims to further develop the evaluation method into airport operations simulation analysis software and enhance the user-friendliness of human-machine interface. In the first year of this two-year project, we completed a prototype of airport operations simulation software, including the establishment of software platform, and the design and implementation of simulation engine module, database module and user interface module. In the second year (2024), we plan to complete the software development and further enhance the user-friendliness of human-machine interface.

The second year will also involve actual case testing and training to improve the Civil Aeronautics Administration (CAA) and Taoyuan International Airport Co., Ltd.'s understanding and practical operation of the software. Through training, we will gather feedback on the software from various units to enhance its usability, facilitate its application in airport planning and operations, and serve as a policy evaluation tool during routine operations or construction changes. After the software development is completed, we plan to transfer the technology to the CAA and Taoyuan International Airport Co., Ltd. for practical application, making airport airside facility management more data-driven and model-based, thereby enhancing the operational efficiency of our international gateway airports to meet long-term development needs.

2. Research Results

(1) Completed the software system requirement documents, including parameters, site data, schedule data, data management, analysis results, runway simulation logic, taxiway simulation logic, parking position simulation logic, flight simulation logic and simulation operation.

（2）完成機場模擬雛型軟體研發，包含軟體撰寫與改寫、資料庫模組設計及實作、模擬引擎大部份設計調整及實作、場面編輯功能與操作界面大部份設計、控制中心模組設計、部份功能實作及後臺資料庫設計，可做為機場空側平日營運管理或營運期間工程變動時之政策評估工具，有助提升我國國際門戶機場營運效能。

3. 成果推廣與效益

（1）112年10月23日召開「國際機場模擬軟體建立與後續應用」專家學者座談會，研討議題包括機場模擬分析對象、需要進行模擬分析的機場類型及如何將模擬分析導入機場建設審議程序等，參與單位計有交通部航政司、民航局、民航局飛航服務總臺、桃園機場公司、中華機場協會及專家學者，進行議題探索與後續應用之意見交流，有助於我國國際機場空側營運朝數據化與模式化發展。

（2）本計畫為2年期研究之第1年期，已開發軟體雛型；第2年期（113年）將完成軟體研發，並強化人機介面之操作親和性。此外，藉由第2年期實際案例測試與教育訓練，將增進民航局與桃園機場公司對本軟體之深入認識與實務操作。桃園機場公司已規劃自114年起編列預算應用及維護本模擬軟體，俾提升機場營運效能。

4. 研究成果精華摘整

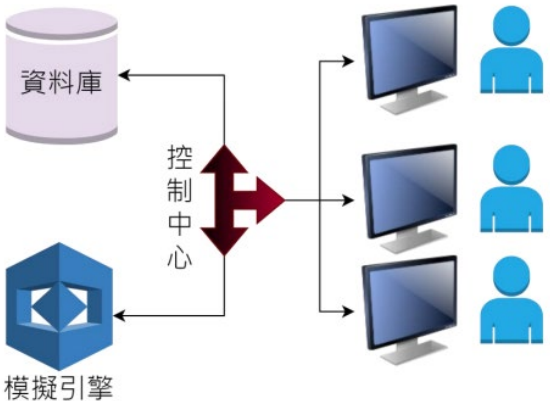
(2) Completed the development of airport simulation prototype software, including software writing and rewriting, database module design and implementation, major design adjustments and implementation of the simulation engine, site editing function and user interface design, control center module design, partial function implementation and backend database design. This software can be used as a policy evaluation tool during routine operations or construction changes, helping to enhance the operational efficiency of our international gateway airports.

3. Result Promotion and Benefits

(1) On October 23, 2023, we held an expert symposium on "Establishment and Subsequent Application of International Airport Simulation Software," discussing topics such as the objects of airport simulation analysis, the types of airports that need simulation analysis and how to integrate simulation analysis into airport construction review procedures. Participants included the Ministry of Transportation and Communications Aviation Department, CAA, CAA Flight Services Center, Taoyuan International Airport Co., Ltd., China Civil Airports Association, and experts and scholars, who exchanged opinions on topics and subsequent applications, promoting the data-driven and model-based development of airside operations at our international airports.

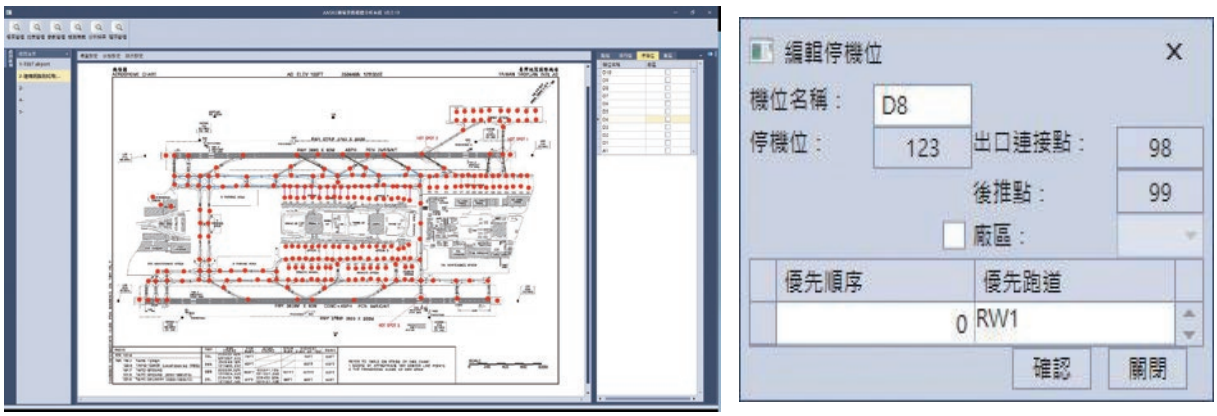
(2) In the first year of this two-year project, we developed a software prototype. In the second year (2024), we will complete the software development and enhance the user-friendliness of human-machine interface. In addition, through actual case testing and training in the second year, we will improve the CAA and Taoyuan International Airport Co., Ltd.'s understanding and practical operation of the software. Taoyuan International Airport Co., Ltd. plans to prepare budget for the application and maintenance of this simulation software from 2025 to enhance airport operational efficiency.

4. Summary of Research Results



機場運作模擬分析軟體基本架構示意圖

Schematic diagram of the basic framework of airport operation simulation analysis software



機場運作模擬分析軟體場面編輯功能圖
Diagram of the scene editing function of airport operation simulation analysis software

5. 研究成果報告

- 國際機場運作模擬分析軟體系統規劃與建置（1／2）－系統規劃設計與軟體單元確立（預計113年7月出版）。

5. Research Result Report

- Planning and development of the international airport operations simulation analysis software system (1/2) – system planning and design and software unit establishment (Scheduled to be published in July 2024).

(二) 應用大數據技術建構國際機場潛在市場評析方法之研究

1. 計畫概述

全球航空運輸蓬勃發展，旅客量及連結城市數持續增加，桃園機場及鄰近競爭機場（包括香港、仁川、成田、新加坡等）地處北美往返亞太地區之飛航路徑上，皆積極擴展機場容量，爭取航空公司飛航及擴增航點，以強化樞紐地位。

我國2020年版空運政策白皮書揭櫫「國際空運樞紐」為我國空運發展願景，欲成為樞紐機場之首要條件需有密集之航線航網，受限於主客觀環境因素，我國國際機場航線航網未若仁川、香港、新加坡等機場密集，且以起迄旅次占大宗，不利發展樞紐機場。

為提升我國國際機場競爭力，本計畫以桃園國際機場為研究標的，蒐整相關供需資料，透過大數據分析技術之應用，以建構適用於我國國際機場潛在航線市場開發之評析方法，並據以研提潛在市場航點建議分析。

2. 研究成果

（1）完成桃園機場與鄰近競爭機場（仁川、香港、成田等）之航網航線、航班等資料之比較及差異分析，並透過訪談民航主管單位、桃園機場公司和國籍業者，掌握目前對航線拓展之想法與未來發展方向。

（2）完成建構適用我國國際機場潛在市場開發之評析方法及架構，應用大數據工具進行分析，研提桃園機場可能之潛在航點建議，及開闢該些潛在航線之成本效益評估，供民航主管機關、營運單位及航空公司後續航線開發、新增之參考。

3. 成果推廣與效益

112年11月20日邀集交通部、民航局、桃園機場公司、航空公司等單位座談，分享本年成果，並蒐集與會單位需求建議，做為空運資料庫未來精進之參考應用。

(II) Research on the construction of a potential market evaluation method for international airports using big data technology

1. Project Overview

The global aviation industry is booming, with passenger numbers and the number of connected cities continuously increasing. Taoyuan Airport and nearby competing airports (including Hong Kong, Incheon, Narita, and Singapore) are located on the flight path between North America and the Asia-Pacific region, and are all actively expanding airport capacity to compete for airlines and increasing routes to strengthen their hub status.

The 2020 edition of our country's aviation policy white paper highlights the vision of developing an "International Aviation Hub." The primary condition for becoming a hub airport is having a dense route network but due to various environmental factors, our international airports' route networks are not as dense as those of Incheon, Hong Kong and Singapore, with the majority of trips being point-to-point, which is not conducive to developing a hub airport.

To enhance the competitiveness of our international airports, this project targets Taoyuan International Airport for research by collecting relevant supply and demand data and using big data analysis technology to construct a method for evaluating and analyzing the potential route markets for our international airports. Based on this, we propose recommendations for potential market routes.

2. Research Results

(1) Completed a comparison and difference analysis of the route networks and flights between Taoyuan Airport and nearby competing airports (Incheon, Hong Kong, Narita, etc.), and conducted interviews with Civil Aviation Authority, Taoyuan International Airport Co., Ltd. and domestic operators to understand current thoughts on route expansion and future development directions.

(2) Completed the construction of a method and framework suitable for evaluating the potential market development of our international airports. Big data tools were used for analysis, and potential route recommendations and cost-benefit evaluations were proposed for developing these potential routes. These recommendations now serve as references for the Civil Aviation Authority, operating units and airlines for subsequent route development and additions.

3. Result Promotion and Benefits

On November 20, 2023, a discussion was held with the MOTC, the CAA, Taoyuan International Airport Co., Ltd., airlines and other units to share the achievements of this year, and collected suggestions from participating units and used them as references for future improvement of aviation database application.

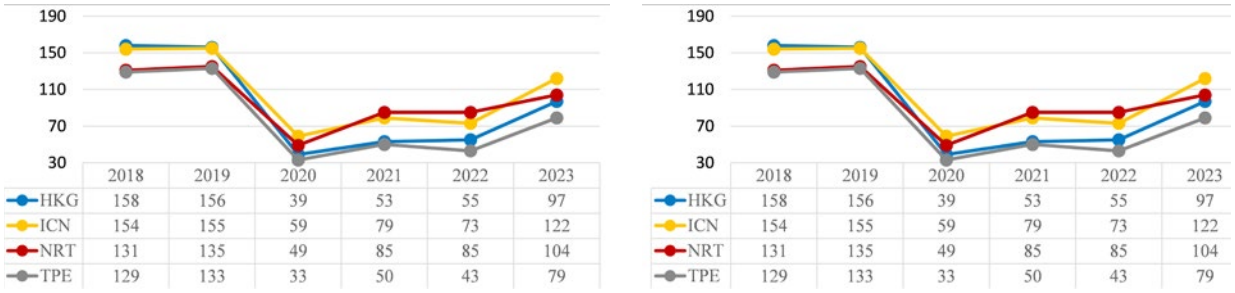
4. 研究成果精華摘整

4. Summary of Research Results

來源或目的機場（1-15名） Top 15 Source or destination airport	2018	2019	2018-2019 成長率 2018-2019 Growth rate	2021	2022
蘇黎世 Zurich	43,205	56,090	29.8%	1,264	7,237
巴塞隆納 Barcelona	33,332	46,831	40.5%	397	5,415
普吉 Phuket	40,173	44,116	9.8%	113	4,693
波士頓 Boston	41,654	41,856	0.5%	4,258	15,387
馬德里 Madrid	31,101	37,205	19.6%	1,904	6,531
台拉維夫 Tel Aviv	24,583	27,690	12.6%	1,254	5,906
開羅 Cairo	26,296	26,542	0.9%	437	2,245
基督城 Christchurch	–	26,134		175	2,787
波特蘭 Portland	26,858	25,520	-5.0%	2,208	6,254
華盛頓特區 Washington, D.C.	25,813	25,099	-2.8%	2,858	9,557
馬爾地夫 Maldives	18,668	24,655	32.1%	104	3,766
哥本哈根 Copenhagen	21,012	23,873	13.6%	1,058	4,124
伯斯（澳洲） Perth (Australia)	23,404	23,794	1.7%	354	4,691
班加羅爾（印度） Bangalore (India)	22,641	23,490	3.7%	351	4,514
達沃（菲律賓） Davao (Philippines)	20,643	22,751	10.2%	16	749

桃園機場未連結而以轉機方式往返旅客量前15大航點

Top 15 destinations for Taoyuan Airport passengers traveling via transfers without direct connections



各機場近年直接連結航點數比較

Comparison of the number of direct connection points at various airports

5. 研究成果報告

- 應用大數據技術建構國際機場潛在市場評析方法之研究（113年5月出版）。

5. Research Result Report

- Research on constructing a potential market evaluation method for international airports using big data technology (Published in May 2024).

(三) 國際海運資料庫維護精進及議題分析

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，雖曾經歷多年的海上運輸榮景，但近年來之變化對我國相當不利。近年全球貨櫃港排名，高雄港名次停滯不前，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，則為政策擬定所不可或缺之元素。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，「國際海運資料庫」透過長期蒐集全球海洋貨櫃運輸之主航線及區域航線資料，配合資料統計分析及繪圖等功能之建置並精進，並於各年年終依據當年各季資料變化，進行議題式分析，以掌握全球航運市場之概況與趨勢。此外系統也可應當前政策或業務的需求，例如新南向政策之研擬與成效評估等，從貨櫃航運供給面的角度提供具體而客觀的量化數據，以為支持。

2. 研究成果

（1）蒐集2011 Q2至2023 12月間國際定期貨櫃航線資料。

（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1,500至1,550條航線；2022年起改以月為頻率蒐集，每月約1,800條航線。

（3）收錄全球超過1,000個港口之中英文名稱、經緯度、所屬國家、所在洲別及國際標準碼等資料；航線上使用之船舶約5,200艘，涵蓋全球貨櫃船總數之97%。

（4）精進具資料統計分析及報表、圖表產製功能之單機版查詢軟體，並強化其資安防禦能力。

（5）完成全球疫情前後主航線部署變化、國籍航商之區域航線部署等分析。

(III) Maintenance and analysis of the international maritime database

1. Project Overview

The current global economic landscape is changing rapidly and maritime cargo transportation is experiencing significant fluctuations. Our country, located at the center of East Asia and surrounded by sea on all sides, has had many years of maritime transport prosperity but recent changes have been quite unfavorable for us. In recent years, Kaohsiung Port's ranking in global container ports has stagnated, which deserves high attention and proper response from the government.

The formation and evaluation of high-quality policies require high-quality scientific analysis, and high-quality data are essential elements for policymaking. Container transport is the focus of our maritime transport and maritime container transport is global in nature. The "International Maritime Database" continuously collects data on major global ocean container transport routes and regional routes, enhances functions for data statistical analysis and mapping, and conducts issue-based analysis at the end of each year based on quarterly data changes to grasp the overall situation and trends of the global shipping market. In addition, the system can meet current policy or business needs, such as the formulation and effectiveness evaluation of the New Southbound Policy, providing concrete and objective quantitative data from the perspective of container shipping supply as support.

2. Research Results

(1) Collect international regular container route data from 2011 Q2 to December 2023.

(2) Before 2016, about 600 routes data centered on the far east were collected each quarter. Starting from 2017, data collection expanded to include all regular container routes worldwide, with about 1,500 to 1,550 routes collected each quarter. From 2022, data collection frequency has been changed to monthly, with about 1,800 routes collected each month.

(3) The database includes information on over 1,000 ports worldwide, including their Chinese and English names, latitude and longitude, country, continent and international standard codes. Approximately 5,200 ships used on these routes, covering 97% of the world's container ships.

(4) Enhance the standalone query software with functions for data statistical analysis, report and chart generation, and strengthen its cybersecurity capabilities.

(5) Complete the analysis of changes in major route deployments before and after the global pandemic and regional route deployments of national shipping companies.

3. 成果推廣與效益

（1）112年8月31日為臺灣港務公司基隆港分公司辦理「國際海運資料庫」單機版查詢軟體教育訓練。

（2）112年11月8日為交通部航港局辦理「國際海運資料庫」單機版查詢軟體教育訓練。

（3）112年11月29召開「112年度國際海運資料庫議題分析成果交流座談會」，邀請海運業產官學界與會，介紹資料庫內容、功能及議題分析成果。

3. Result Promotion and Benefits

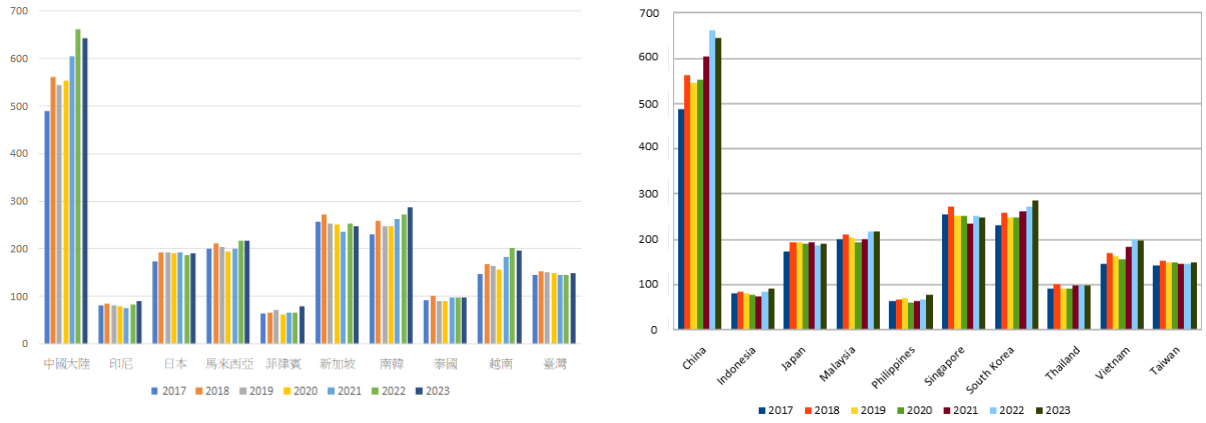
(1) On August 31, 2023, we conducted standalone query software training of "International Maritime Database" for Keelung Port branch of Taiwan International Ports Corporation.

(2) On November 8, 2023, we conducted standalone query software training of "International Maritime Database" for the Maritime and Port Bureau of the MOTC.

(3) On November 29, 2023, we held "2023 International Maritime Database Issue Analysis Results Exchange Symposium" and invited industry, government and academic representatives from maritime industry to introduce the database content, functions and issue analysis results.

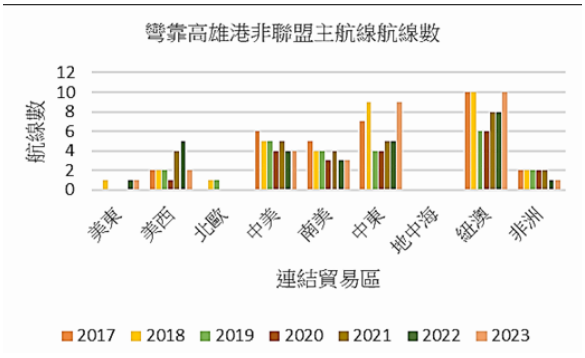
4. 研究成果精華摘整

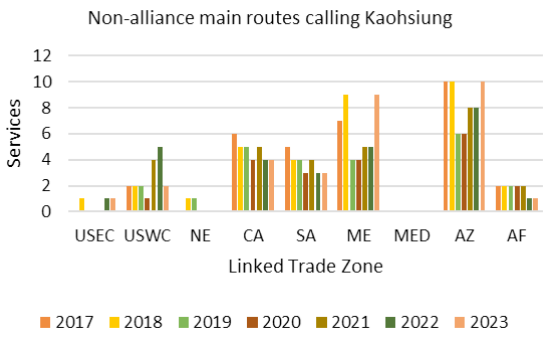
4. Summary of Research Results

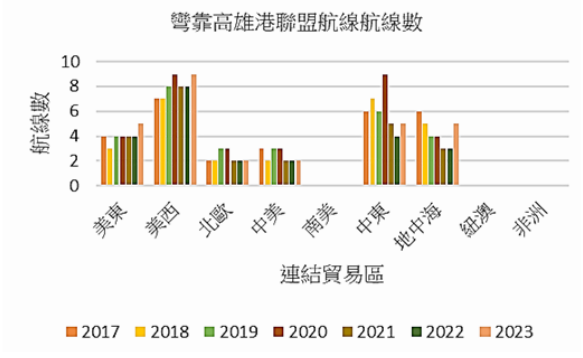


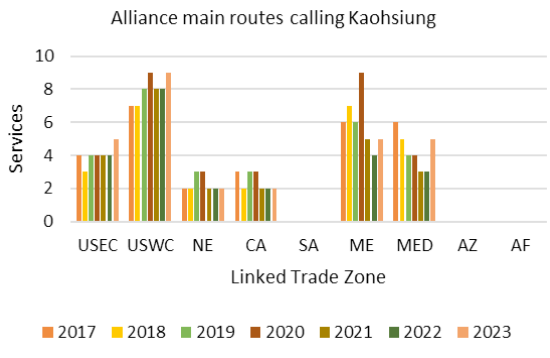
我國及鄰近9國2017-2023年第2季彎靠航線數

Number of routes calling at ports in our country and nine neighboring countries from the second quarter of 2017 to 2023.









彎靠高雄港之非聯盟主航線與非聯盟主航線數變化

Changes in the number of non-alliance main routes calling at Kaohsiung Port.

5. 研究成果報告

- 112年度「國際海運資料庫」維護精進及議題分析（預計113年7月出版）。

(四) 我國航港資訊整合與數位化發展架構之研究（1／2）－航港產業數位化調查與發展藍圖研擬

1. 計畫概述

近年來數位科技快速發展，數位轉型變成一個熱門話題，加上疫情催化，數位生活與數位經濟躍然成為各國主流發展趨勢，各行各業皆受到數位科技影響，而湧現轉型的需求，在航運業也是如此，海運數位化為航運界及資訊業長期討論的議題，近年大型航商等業者陸續自行開發數位化管理平臺，許多國家港口也建立自己的港口管理系統，以解決其經營管理上的議題，然與其他產業相較之下，航港產業的數位化發展較為緩慢，針對此一趨勢，有必要開展因應進行深入研究研擬相關策略。

本計畫目的在擘劃我國航港產業數位化發展方向，透過規劃數位化發展推動藍圖，擬訂相關推動策略，以協助公私部門應用數位化科技工具，藉由數據管理、分析及分享，以提高資料之可視化程度，共同提升管理及營運效率，並期能強化我國航港產業之國際競爭力。

2. 研究成果

（1）蒐集國際與國內航港數位化發展現況與趨勢，包括國際組織UNDP、UNCTAD、IMO、IAPH、IPCSA等，以及貨櫃航商或業者組成之聯盟GSBN／DCSA／TradeLens等、美國MIDI及FLOW計畫、歐盟iTerminal 4.0，並蒐集新加坡港、鹿特丹港、安特衛普港、洛杉磯港、上海港、釜山港、高雄港等港口端的推動計畫，由國際數位化發展趨勢中歸納出國內可借鏡之處。

5. Research Result Report

- 2023 annual "International Maritime Database" maintenance and issue analysis (Scheduled to be published in July 2024).

(IV) Research on the integration and digital development framework of our country's maritime information (1/2) – investigation of the digitalization of maritime industry and formulation of development blueprint.

1. Project Overview

In recent years, the rapid development of digital technology has made digital transformation a hot topic. Catalyzed by the pandemic, digital life and digital economy have become mainstream development trends in many countries. All industries are influenced by digital technology, leading to a surge in the need for transformation including the shipping industry. Digitalization in shipping has been a long-discussed topic in the maritime and information industries. In recent years, large shipping companies have independently developed digital management platforms, and many national ports have established their own port management systems to address operational and management issues. However, compared to other industries, the digital development of the maritime industry has been relatively slow. In response to this trend, it is necessary to conduct in-depth research and formulate relevant strategies.

This project aims to outline the direction of digital development for our country's maritime industry by planning a digital development blueprint and formulating relevant strategies. It will assist both public and private sectors in applying digital technology tools, utilizing data management, analysis and sharing to enhance data visualization, and collectively improve management and operational efficiency. The ultimate goal is to strengthen the international competitiveness of our maritime industry.

2. Research Results

(1) Collect information on the current state and trends of international and domestic maritime digital development, including international organizations such as UNDP, UNCTAD, IMO, IAPH and IPCSA, as well as alliances formed by container shipping companies like GSBN, DCSA, TradeLens, and projects such as the US's MIDI and FLOW initiatives and the EU's iTerminal 4.0. We will also gather information on the promotion plans of ports like Singapore, Rotterdam, Antwerp, Los Angeles, Shanghai, Busan and Kaohsiung, to identify aspects that can serve as references for domestic development.

（2）分析與調查國內航港產業資訊化現況，包括航業法中四大業別（包含船舶運送業、船務代理業、海運承攬運送業、貨櫃集散站經營業），以及涉及港埠物流作業的報關業、汽車貨櫃貨運業，另包括政府機關如交通部航港局及財政部關務署，以及臺灣港務股份有限公司與提供港口資訊流解決方案之資訊服務業等，並從組織、流程、技術三個構面，歸納出各產業的作業流程現況、瓶頸、對政府建議。

（3）研析我國航港資訊整合架構，蒐整我國現行運作航港資訊系統內容架構：蒐整標的包含「臺灣港棧服務網」（TPNet）、「關港貿單一窗口」（CPT）、「航港單一窗口服務平臺」（MTNet）、「AIoT物聯網全時監控」、「貨櫃物動態查詢系統等」等，研析提出我國航港資訊整合架構。

（4）研提我國航港產業數位化發展藍圖雛型，以上述各階段蒐集之資料與分析成果為基礎，提出我國航港產業數位化發展藍圖雛型。

3. 成果推廣與效益

112年11月10日召開「航港產業數位轉型藍圖專家學者座談會」，邀請相關產官學研專家學者座談交流，包括財政部關務署、交通部、航港局、臺灣港務公司、航運公司、海運承攬產業公會、貨櫃集散站經營業者及學研單位等進行座談，藉以釐清藍圖雛型的合理性和適用性，並凝聚推動共識

(2) Analyze and investigate the current state of information technology in domestic maritime industry, including the four major sectors defined in the shipping industry law (shipping companies, shipping agents, sea freight forwarders, container terminal operators), as well as customs brokerage and automotive container freight industries involved in port logistics operations. Government agencies such as the Maritime and Port Bureau of the MOTC, the Customs Administration of the Ministry of Finance, and Taiwan International Ports Corporation, along with information service providers offering port information flow solutions will also be included. We will summarize the current operational processes, bottlenecks and suggestions for the government from the perspectives of organization, process and technology.

(3) Analyze the framework for integration of maritime information in our country by collecting and organizing the content and structure of current maritime information systems, including "Taiwan Port Services Network" (TPNet), "Customs Port Trade Single Window" (CPT), "Maritime and Port Service Platform" (MTNet), "AIoT Full-time Monitoring" and "Container Movement Tracking System," and propose a framework for the integration of maritime information in our country.

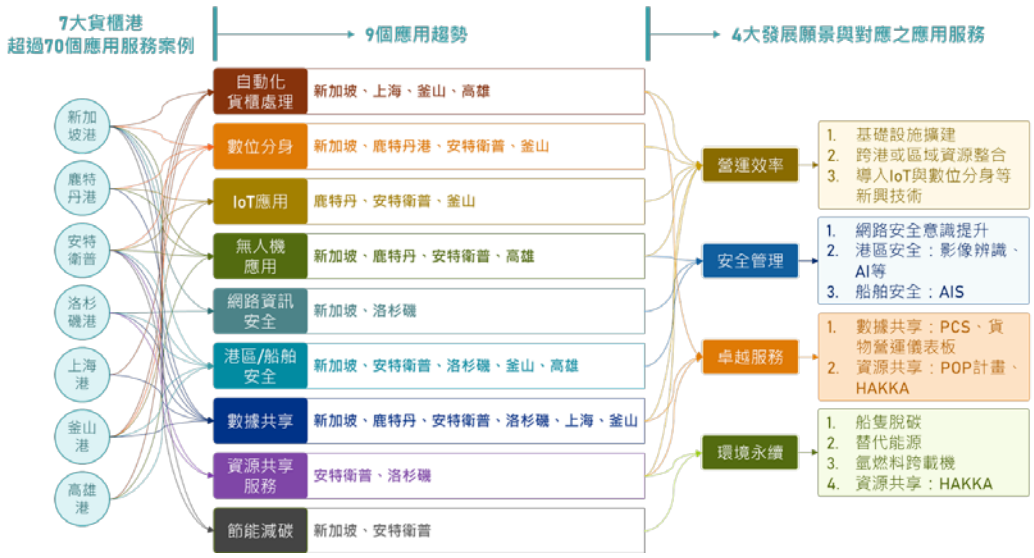
(4) Based on the data and analysis results collected in the previous stages, draft a blueprint for the digital development of our country's maritime industry.

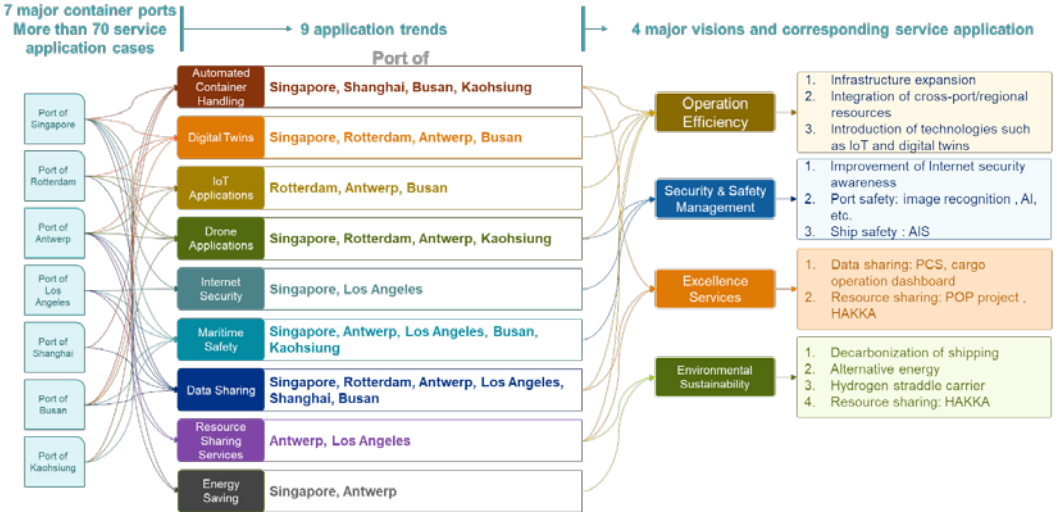
3. Result Promotion and Benefits

On November 10, 2023, we held "Expert Symposium on the Digital Transformation Blueprint for the Maritime Industry" and invited relevant experts and scholars from the public and private sectors including Customs Administration, the MOTC, the Maritime and Port Bureau, Taiwan International Ports Corporation, shipping companies, sea freight forwarding industry association, container terminal operators, and academic and research institutions to discuss and exchange ideas. This will help clarify the rationality and applicability of the draft blueprint and build consensus for its implementation.

4. 研究成果精華摘整

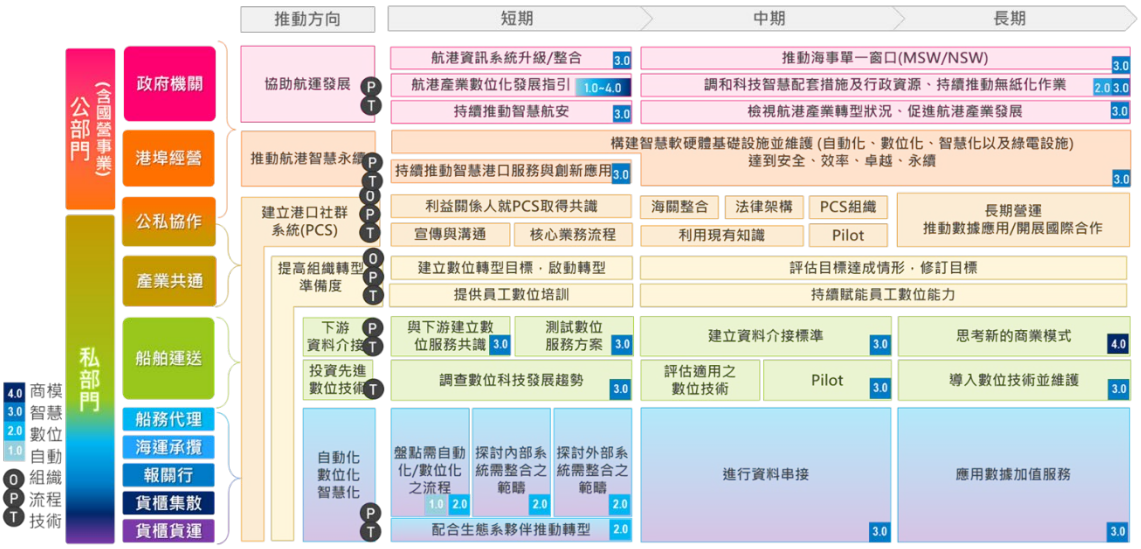
4. Summary of Research Results



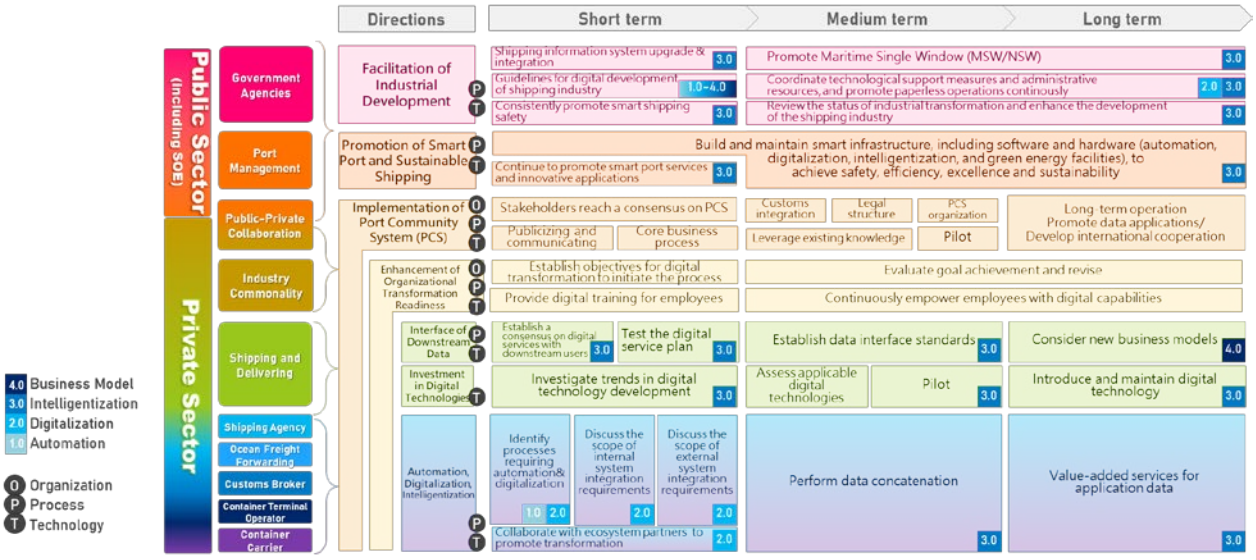


國際與國內航港數位化發展趨勢

Digital development trend of international and domestic maritime and port Industry



我國航港產業數位轉型發展藍圖雛型



A prototype of digital development blueprint of maritime and port Industry

5. 研究成果報告

- 我國航港資訊整合與數位化發展架構之研究（1／2）－航港產業數位化調查與發展藍圖研擬（預計113年7月出版）。

5. Research Result Report

- Research on the integration and digital development framework of our country's maritime information (1/2) – investigation of the digitalization of maritime industry and formulation of the development blueprint (Scheduled to be published in July 2024).

(五) 國際空運資料庫維護精進及議題分析

1. 計畫概述

全球航空運輸重心移往亞洲地區，亞太國家門戶機場包括桃園、香港、仁川、成田、新加坡等機場，均以發展為區域樞紐機場為目標，積極提升機場軟硬體設施，鼓勵航空公司增加連結航點、增飛班次，也爭取新業者加入。為利發展樞紐機場，需持續掌握國際空運市場發展趨勢及相關機場變化情形。

「國際空運資料庫」建置目的在長期蒐集相關機場之營運／設施及旅客起迄等資料，主要包括兩大部分資料，其一為全球207座重要機場之基礎設施、客貨運量、航網等基本資料；其二為包括桃園機場、亞太與北美地區8座重要機場之旅客起迄路徑資料，藉由統計分析掌握航空市場發展變化及趨勢，並據以進行重要空運議題分析，協助本所空運相關研究之進行。

(V) Maintenance and analysis of the international aviation database

1. Project Overview

The global aviation industry is shifting its focus to the Asia-Pacific region, with gateway airports in countries like Taoyuan, Hong Kong, Incheon, Narita and Singapore aiming to develop into regional hub airports. They are actively enhancing their software and hardware facilities, encouraging airlines to increase connecting routes and flight frequencies, and attracting new operators. To develop hub airports, it is necessary to continuously monitor the development trends of the international aviation market and changes at relevant airports.

The purpose of establishing "International Aviation Database" is to collect long-term data on the operations/facilities and passenger origins and destinations of relevant airports. The database mainly includes two parts: basic data on the infrastructure, passenger and cargo volumes, and route networks of 207 major global airports, and passenger origin and destination data for eight key airports in the Asia-Pacific and North America regions, including Taoyuan Airport. Statistical analysis will be used to monitor market development trends and changes, and conduct important aviation issue analyses to support the institute's aviation-related research.

2. 研究成果

（1）更新我國及全球共207座主要機場之基礎設施、客貨運量、航網等資料，並持續蒐集桃園、香港、仁川、東京成田、上海浦東、新加坡、曼谷及洛杉磯等亞太及北美地區重要機場之旅客移動路徑資料，就旅客移動路徑變化進行分析。

（2）完成使用者自行訂義區域功能。

（3）透過大數據分析資料庫檢索機場資料，就政策與產業面議題進行議題式分析，包括「東南亞中轉往返北美旅客」、「桃園-洛杉磯航線中轉連結分析」，研析成果供交通部航政司、民航局、桃園機場公司及航空公司做為策略研擬評估參據。

3. 成果推廣與效益

112年11月27日邀集交通部、民航局、桃園機場公司、航空公司等單位座談，分享本年成果，並蒐集與會單位需求建議，做為空運資料庫未來精進之參考應用。

4. 研究成果精華摘整

2. Research Results

(1) Update the infrastructure, passenger and cargo volumes, and route network data of 207 major airports worldwide, continue to collect passenger movement data at key airports in the Asia-Pacific and North America regions, including Taoyuan, Hong Kong, Incheon, Tokyo Narita, Shanghai Pudong, Singapore, Bangkok and Los Angeles, and analyze changes in passenger movement patterns.

(2) Complete the user-defined region function.

(3) Use big data analysis to retrieve airport data from the database and conduct issue-oriented analyses on policy and industry topics, including "Southeast Asia Transit Passengers to and from North America" and "Taoyuan-Los Angeles Route Transit Connection Analysis." The analysis results will be provided to the Department of Aviation, the CAA, Taoyuan International Airport Co., Ltd. and airlines for strategic planning and evaluation.

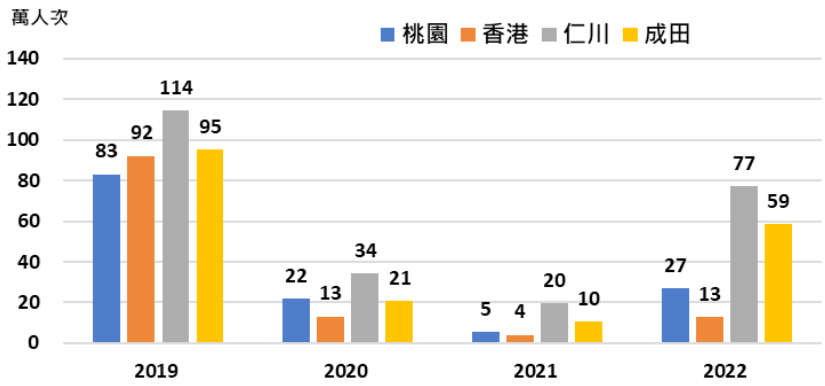
3. Result Promotion and Benefits

On November 27, 2023, a discussion was held with the MOTC, the CAA, Taoyuan International Airport Co., Ltd., airlines and other units to share the achievements of this year, collect suggestions from participating units, and use them as references for future improvements to the aviation database.

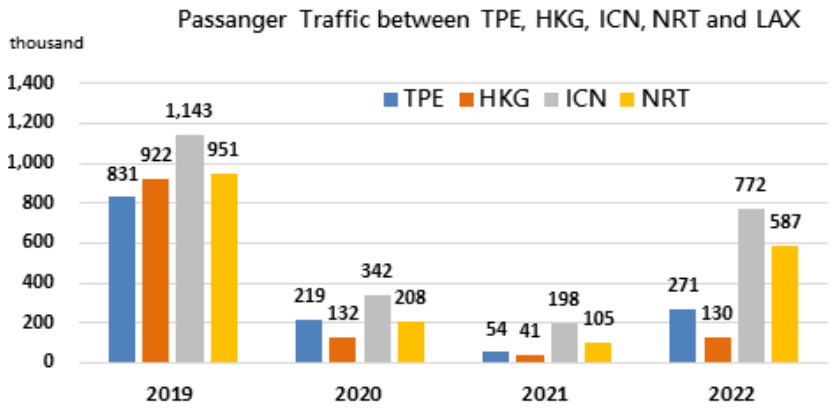
4. Summary of Research Results

資料庫使用者自行訂義區域功能畫面

Image for user-defined region function in the database



2019～2021年各機場往返洛杉磯航線旅客量比較



Comparison of passenger volumes on routes to and from Los Angeles at various airports from 2019 to 2021

5. 研究成果報告

- 112年度「國際空運資料庫」維護精進及議題分析（113年5月出版）。

5. Research Result Report

- 2023 annual "International Aviation Database" maintenance and issue analysis (Published in May 2024).

三 優化公共運輸服務及產業轉型

(一) 推動區域運輸發展研究中心服務升級2.0計畫（112-113年）

1. 計畫概述

為落實公共運輸發展，鼓勵大學院校運用豐沛之基礎研發設施及研究資源，協助交通部相關政策之推動，以及補足地方政府於推動公路公共運輸時欠缺之人力及能力，交通部於104年起匡列經費，責成本所辦理「交通部補助學界成立區域運輸發展研究中心」計畫，藉由區域運輸發展研究中心（以下簡稱區域中心）強化地方政府能力建構，促進學界與產業、政府部門的合作發展，落實在地公共運輸之永續發展。

區域中心計畫自104年10月起執行迄今，主要工作項目多已完成階段性任務，為賡續前期計畫之辦理成果及執行成效，本所奉交通部核定於112年接續實施「區域運輸發展研究中心服務升級2.0計畫」（112-113年），深化中央政府、地方政府、產業界及學界合作，除共同推動並執行公路公共運輸服務升級計畫及道安改善相關計畫外，並連結國家重大政策，包含環島高快速鐵公路網、智慧交通、觀光旅遊及地方創生等，以擴大計畫之實施範圍及成效。

2. 研究成果

（1）辦理交通運輸專業人才培訓課程：112.3-112.12共開設24門實體課程，參與學員達850人次。另線上課程部分，共開設12門，觀看人次約達1,900人次。

（2）協助地方政府進行公共運輸案例研析：112.3-112.12共協助地方政府進行公共運輸案例研析計18案，六大區域中心共同就「偏鄉公共運輸跨部會資源整合之示範推動」課題進行規劃與實作，著重探討各地方政府偏鄉公共運輸服務與跨部會資源整合之可行性，並研議對應策略及具體改善行動方案。

III Optimize Public Transportation Services and Industrial Transformation

(I) Implement the service upgrade plan 2.0 for the regional transportation development research centers (2023–2024)

1. Project Overview

Since 2015, the MOTC has allocated funds and tasked the MOTC with the "Establishing Public Transportation Development" task in order to implement public transportation development, encourage universities and colleges to use rich basic R&D facilities and research resources, assist the MOTC in related policy promotion, and compensate for manpower and capability shortages in promoting road public transportation. Through the regional transportation development research centers (henceforth the regional center), local governments' capacities can be strengthened while promoting the collaborative development of academia, industries, and government sectors, resulting in the implementation of sustainable local public transportation development.

The regional center project has been implemented since October 2015,the phased tasks of the principal work items have been completed. To continue the achievements and effectiveness of the previous project, the Institute, with the approval of the MOTC, has continued to implement the "Implement the Service Upgrade Plan 2.0 for the Regional Transportation Development Research Centers (2023-2024)" in 2023. This project aims to enhance collaboration among the central government, local governments, industry and academia, jointly promote and implement public road transportation service upgrade plans and road safety improvement projects, and link major national policies, including the national highway and rapid transit network, intelligent transportation system, tourism and regional revitalization, in order to expand the scope and effectiveness of the project implementation.

2. Research Results

(1) Professional transportation talent training courses: From March to December 2023, a total of 24 courses were offered, with approximately 850 participants. In addition, 12 online courses were offered, with approximately 1,900 views.

(2) Assist local governments in conducting public transportation case studies: From March to December 2023, a total of 18 public transportation case studies were conducted. The six regional centers jointly planned and implemented "Demonstration of Cross-ministerial Resource Integration for Rural Public Transportation," focusing on the feasibility of integrating cross-ministerial resources for rural public transportation services and developing corresponding strategies and specific improvement action plans.

(3) 提供地方諮詢服務：112.3-112.12已提供117次之諮詢服務，其中64次有地方政府局處長（或三級行政區之鄉、鎮、市、區長）層級人員參與。

(4) 輔導地方政府研提前瞻性公共運輸提案：112.3-112.12共協助研提12案提案計畫書，將於113年輔導地方政府向交通部公路局（或相關補助單位）提案申請補助經費。

(5) 跨域合作並整合跨部會資源，除推動公路公共運輸外，亦輔導區域內產業升級、落實服務創新及制度建構。

(6) 透過召開區域交通首長論壇及研析公共運輸發展趨勢，以掌握各區域公共運輸現況，據以研提政策方針，俾供中央及地方作為改善公共運輸之參考依據。

(7) 競爭型計畫部分：配合國家重大政策，112年就區域特色研提5項次亮點計畫之示範計畫，將於113年進行推廣執行計畫，並檢討各計畫示範成果，做為未來跨區擴大成果之推廣應用。

(8) 道安改善計畫部分：

a. 配合交通部「道安提升行動小組」，112年完成完成輔導臺中、彰化、臺南、雲林、嘉義縣、南投、宜蘭、屏東、臺北等9縣市，於交通部道安會報提報該縣市「道路交通事故防制策略作為」；

b. 協助地方政府診斷道安問題及研提道路交通事故防制策略，112年共計完成3處易肇事路口之安全改善檢查與改善方案研提，以及15處路口之交通工程改善規劃設計方案。

c. 112年完成辦理1場「易肇事路口安全改善檢查表」專家座談會，與5場次「人行與車行交通工程改善教育訓練」，參與人次約264人，以提升並輔導縣市提升道安專業能力。

(3) Provide local consultation services: From March to December 2023, a total of 117 consultation services were provided, with 64 involving participation from department heads of local government (or leaders of townships, towns, cities or districts at the third administrative level).

(4) Assist local governments in developing forward-looking public transportation proposals: From March to December 2023, a total of 12 proposal plans were assisted, which will guide local governments in applying for subsidy funds from the Highway Bureau of the MOTC (or relevant subsidy units) in 2024.

(5) Cross-domain cooperation and integration of cross-ministerial resources: Promote public road transportation, assist in upgrading regional industries, implement service innovation and construct systems.

(6) Through regional transportation director forums and public transportation development trend analysis, grasp the current status of public transportation in each region, and propose policy directions for the central and local governments as references for improving public transportation.

(7) Competitive projects: In line with major national policies, five regional highlight demonstration projects were proposed in 2023 and will be promoted and implemented in 2024. The demonstration results of each project will be reviewed as a basis for expanding and applying future cross-regional results.

(8) Road safety improvement projects:

a. In cooperation with the MOTC "Road Safety Enhancement Task Force," in 2023, guidance was provided to Taichung, Changhua, Tainan, Yunlin, Chiayi County, Nantou, Yilan, Pingtung, Taipei, and other nine counties and cities to report on their "Road Traffic Accident Prevention Strategies" at the MOTC' road safety meeting;

b. Assist local governments in diagnosing road safety problems and developing road traffic accident prevention strategies. In 2023, completed safety improvement inspections and improvement plans for 3 accident-prone intersections and traffic engineering improvement design plans for 15 intersections.

c. In 2023, completed one expert seminar on "Safety Improvement Checklists for Accident-prone Intersections" and five "Pedestrian and Vehicle Traffic Engineering Improvement Training Sessions," with approximately 264 participants to improve and guide counties and cities in enhancing their road safety professional capabilities.

3. 成果推廣與效益

（1）中區區域中心持續輔導臺中市政府推動梨山幸福巴士，除提供當地基本民行服務外，於112年試辦觀光交通接駁服務。另本案成果以「梨山幸福巴士2.0-補足台中山城最後一哩路」為題，榮獲112年中華民國運輸學會「傑出交通運輸計畫獎」。

（2）本所分別與各區域中心共同辦理6場「區域交通首長論壇」，邀集區域內負責公共運輸發展之交通正副首長、業界相關代表及學者專家，共同集思廣益及經驗分享，針對公共運輸跨域合作相關課題，提出建議解決方向，達到中央與地方雙向溝通交流之目的及促成跨域合作機會。各場次辦理日期及主題說明如下：

a. 112年11月3日辦理「雲嘉南區域交通首長論壇-公共運輸發展趨勢與生活圈發展及偏鄉運輸資源整合」。

b. 112年11月13日辦理「東部區域交通運輸課題分析與未來發展方向、跨部會運輸資源整合實務與挑戰及公共運輸與地方創生鏈結」。

c. 112年11月17日辦理「高屏澎公共運輸課題分析與地方交通行動服務推動展望」。

d. 112年11月22日辦理「中彰投公共運輸發展趨勢觀察與公共運輸運量推升策略」。

e. 112年11月23日辦理「北區區域公共運輸發展趨勢及面臨挑戰」。

f. 112年12月15日辦理「桃竹苗公共運輸趨勢觀察與後疫情時代公共運輸因應策略-攜手發展桃竹苗地區公共運輸大生活圈」。

3. Result Promotion and Benefits

(1) The central regional center continues to assist Taichung City Government in promoting Lishan happiness bus, which not only provides basic civil services to the local community but also launched a tourist shuttle service on a trial basis in 2023. This project, titled "Lishan Happiness Bus 2.0 – Bridging the Last Mile in Taichung's Mountain City" won the "Outstanding Transportation Project Award" from the Chinese Institute of Transportation in 2023.

(2) In collaboration with each regional center, the institute organized six "Regional Transportation Chief Forums," inviting the chief and deputy chiefs responsible for public transportation development, relevant industry representatives, and scholars and experts to brainstorm and share experiences. The forums addressed cross-domain cooperation issues in public transportation and proposed solution directions, achieving the goal of two-way communication between central and local governments and facilitating cross-domain cooperation opportunities. The dates and themes of each session are as follows:

a. On November 3, 2023, organized "Yunlin-Chiayi-Tainan Regional Transportation Chief Forum – Trends in Public Transportation Development and Integration of Transportation Resources in Living Circles and Rural Areas."

b. On November 13, 2023, organized "Eastern Region Transportation Issues Analysis and Future Development Directions, Practical Integration of Cross-department Transportation Resources, and the Linkage between Public Transportation and Local Revitalization."

c. On November 17, 2023, organized "Kaohsiung-Pingtung-Penghu Public Transportation Issues Analysis and Prospects for Promoting Local Transportation Services."

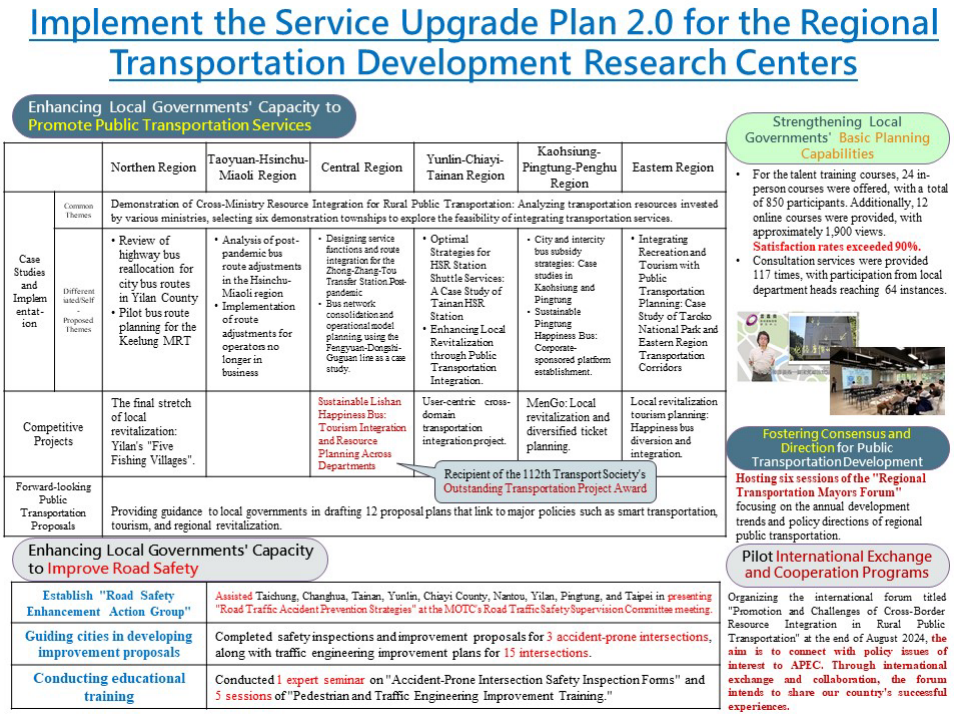
d. On November 22, 2023, organized "Central Region Transportation Trends Observation and Strategies for Boosting Public Transportation Volume."

e. On November 23, 2023, organized "Northern Region Public Transportation Development Trends and Challenges."

f. On December 15, 2023, organized "Taoyuan-Hsinchu-Miaoli Public Transportation Trends Observation and Post-pandemic Public Transportation Response Strategies – Jointly Developing a Large Living Circle for Public Transportation in the Taoyuan-Hsinchu-Miaoli Area."

4. 研究成果精華摘整

4. Summary of Research Results



112年區域運輸發展研究中心推動成果圖

Achievement Diagram of the 2024 Regional Transportation Development Research Center Implementation

5. 研究成果報告

- 區域運輸發展研究中心服務升級2.0計畫（112-113年）（本計畫屬兩年期計畫，執行至114年初，預計114年3月出版）。

5. Research Result Report

- Service upgrade plan 2.0 for regional transportation development research centers (2023-2024) (this is a two-year project, with implementation until early 2025 and publication expected in March 2025).

(二) 推動通用計程車特約制度（2/2）－成效檢討及服務優化

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。本所於109年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，來滿足行動不便者日常交通需求，並以「愛接送」為服務品牌，推動預約式通用計程車服務。

本計畫銜接前期110-111年「推動通用計程車特約制度（1/2）－系統擴充及跨部會合作策略規劃與執行」，執行期間自111年12月至112年8月，持續與六都合作試辦預約式通用計程車制度，配合交通部檢討通用計程車永續營運之政策，回顧檢討推動通用計程車特約制度之成效，進行服務優化之研究，俾利制度健全發展，以積極開展高齡及行動不便者友善的交通服務，為我國即將進入超高齡社會預為準備。

2. 研究成果

（1）完成「愛接送－預約式通用計程車」系統擴充，以及乘客端、司機端、特約業者端及預約整合系統之優化。

（2）完成通用計程車營運調查分析，包括營運成本、車隊行政作業成本，及使用者問卷調查及業者深度訪談，以及辦理2場學者專家座談會。

（3）完成通用計程車駕駛人職前與在職教育訓練制度規劃建議。

（4）完成通用計程車發展策略分析及研擬，提供交通部政策規劃參考。

3. 成果推廣與效益

（1）完成臺北市、新北市、臺中市、桃園市、高雄市、臺南市共6都導入，納入11家通用計程車特約業者405輛車參與計畫。自109年9月2日～112年12月31日，完成約57萬服務趟次。

(II) Implement the contract system of accessible taxis (2/2) – the effectiveness and service optimization

1. Project Overview

According to estimates by the National Development Council, our country is gradually transitioning from an "Aging Society" to a "Super-aged Society." Aging population will increase the demand for long-term care, medical treatment and rehabilitation, which will indirectly cause an increase in transportation demand. In 2020, the institute planned a development environment and promotion strategy for barrier-free small passenger car transportation services to meet future social needs. We integrated information and communication technology to create a barrier-free friendly environment to meet the daily transportation needs of people with mobility issues and promoted a reservation-based universal taxi service under the brand "Love Pick-up."

This project follows the previous "Implement the Contract System of Accessible Taxis (1/2) - System Expansion and Cross-ministerial Cooperation Strategy Planning and Implementation" from 2021 to 2022, with an implementation period from December 2022 to August 2023. We continued to cooperate with the six municipalities to pilot a reservation-based universal taxi system, in conjunction with the MOTC' review of policies for the sustainable operation of universal taxis. We reviewed and evaluated the effectiveness of universal taxi affiliation system and conducted service optimization research to promote the sound development of the system, thereby actively developing friendly transportation services for the elderly and people with mobility issues as our country prepares to enter a superaged society.

2. Research Results

(1) Completed the expansion of "Love Pick-up – Reservation-based Universal Taxi" system and optimized the passenger, driver, affiliated operator, and reservation integration systems.

(2) Conducted an operational survey analysis of universal taxis, including operational costs, fleet administrative costs, user questionnaires and in-depth interviews with operators, and held two scholar-expert seminars.

(3) Completed the planning and recommendations for pre-job and on-the-job training system for universal taxi drivers.

(4) Completed the analysis and development strategy for universal taxis, providing policy planning references for the MOTC.

3. Result Promotion and Benefits

(1) Implemented the project in six municipalities of Taipei, New Taipei, Taichung, Taoyuan, Kaohsiung and Tainan, involving 405 vehicles from 11 affiliated universal taxi operators. From September 2, 2020 to December 31, 2023, we completed approximately 570,000 service trips.

（2）「愛接送」預約整合系統之服務特色包括：（1）節省民眾時間：各地方政府設置單一預約入口；（2）資訊公開透明：各特約車隊預先提供服務趟次供乘客預約；（3）強調公平交易：預估車資先有數，按表收費很安心；（4）掌握潛在需求：系統平台具候補機制，可提供車隊配置車輛與設定服務趟次之參考；（5）落實補助稽核：透過系統化標準作業流程，各環節資訊互相自動勾稽，輔以行車軌跡資料及大數據分析，交易紀錄難以造假；（6）提供API介面：連結業者既有系統，讓車隊業者發揮專業職能；（7）守護乘客安心搭乘：服務流程新增乘客輪椅固定後照相，配合行車軌跡全紀錄，可保障司機、乘客雙方權利義務關係。

（3）從上述特色得知系統已針對身心障礙與行動不便者提供單一入口網站預約用車並承諾愛接送服務公平且不加價；針對主管機關的部分透過系統化管理與電子稽核，落實營運補助成效、優化服務及產業提升，以建構行動不便者友善運輸環境，解決其日常生活交通需求，擴大生活及社交領域，融入社會。

(2) The service features of "Love Pick-up" reservation integration system include: (1) Saving time for the public: Each local government has set up a single reservation entry; (2) Information transparency: Affiliated fleets provide service trips in advance for passenger reservations; (3) Emphasizing fair transactions: Estimated fares are provided in advance, ensuring peace of mind with meter-based charges; (4) Identifying potential demand: The system platform has a waitlist mechanism to assist fleet vehicle allocation and service trip planning; (5) Implementing subsidy audits: Through systematic standard operating procedures, information from each link is automatically cross-referenced, supplemented with driving trajectory data and big data analysis, making transaction records difficult to falsify; (6) Providing API interfaces: Linking existing systems of operators to allow fleet operators to utilize their professional functions; (7) Ensuring passenger's peace of mind: Service processes include photographing the fixation of passenger wheelchairs and recording the full driving trajectory to protect the rights and obligations of both drivers and passengers.

(3) These features indicate that the system provides a single-entry website of vehicle reservations for people with disabilities and mobility issues, promising fair service without extra charges. For regulatory authorities, systematic management and electronic audits ensure the effectiveness of operational subsidies, optimize services, and upgrade the industry. This creates a friendly transportation environment for people with mobility issues, solving their daily transportation needs, expanding their living and social realms, and integrating them into society.

4. 研究成果精華摘整

4. Summary of Research Results

特約制度運作機制

The operation mechanism of the affiliation system

愛接送宣傳影片

Love Pick-up promotional video

5. 研究成果報告

- 推動通用計程車特約制度（2／2）－成效檢討及服務優化（113年5月出版）。

(三) 先進公車智慧化營運管理先導運行計畫（2／2）－整合車載設備之駕駛數位履歷管理系統研發

1. 計畫概述

為驗證透過公路客運業者營運車輛之車載設備（OBD、數位行車紀錄器、ADAS、CAN Bus、4G或5G等），直接蒐集所需車輛營運資訊，以協助業者疫後進行數位治理及數位轉型工作之可行性，本所自民國110年起推動「先進公車智慧化營運管理先導運行計畫（110-111年）」。本計畫為第2年期計畫，屬擴大構想驗證階段，計畫主軸是開發一套整合區塊鏈車載網路與先進駕駛輔助系統（ADAS）之「駕駛數位履歷管理系統（以下簡稱本系統）」，期望協助國內客運業者疫後進行強化數據治理及數位轉型工作，打造SMART的公共運輸發展環境。

2. 研究成果

（1）完成國內外有關公路客運在區塊鏈、車載網路（OBD、CAN Bus）與ADAS之車載設備功能整合之應用案例及相關文獻與資料之蒐集。

（2）完成一套「整合區塊鏈車載網路與先進駕駛輔助系統（ADAS）之駕駛數位履歷管理系統」，包含車載模組雛型機與雲端後台資料庫。

a. 「車載模組雛型機」包含：OBD、GPS、4G無線網路傳輸模組、晶片讀卡機、攝影機、ADAS訊號解析等周邊裝置，可執行駕駛員身分識別、駕駛工時紀錄、及OBD車輛行駛資訊與ADAS動作資訊儲存，並可將前述資料即時透過行動網路傳輸到區塊鏈系統與雲端後台資料庫。

5. Research Result Report

- Implement the contract system of accessible taxis (2/2) – the effectiveness and service optimization (Published in May 2024).

(III) The advanced intelligent operation and management pilot project for smart bus (2/2) – development of an integrated driver digital resume management system for onboard devices

1. Project Overview

To verify the feasibi l ity of directly col lecting necessary vehicle operat ion informat ion through onboard devices (OBD, digital tachographs, ADAS, CAN Bus, 4G or 5G, etc.) of highway bus operators to assist operators in post-pandemic digital governance and digital transformation, the institute has been promoting "The Advanced Intelligent Operation and Management Pilot Project for Smart Bus (2021-2022)" since 2021. In its second year, this project is in the expanded concept validation stage. The main focus is to develop a "Driver Digital Resum Management System (hereinafter referred to as the system)" integrating blockchain, onboard network, and advanced driver assistance systems (ADAS), aiming to assist domestic bus operators in strengthening post-pandemic data governance and digital transformation, and to create a SMART public transportation development environment.

2. Research Results

(1) Completed the collection of relevant case studies and literature on the function integration of blockchain, onboard network (OBD, CAN Bus), and ADAS in highway bus operations both domestically and internationally.

(2) Developed "Driver Digital Resum Management System Prototype Integrating Blockchain Onboard Network and Advanced Driver Assistance Systems (ADAS)," including the onboard module prototype and cloud backend database.

a. The "Onboard Module Prototype" includes OBD, GPS, 4G wireless transmission module, chip card reader, camera, ADAS signal analysis, and other peripheral devices. It can execute driver identification, record driving hours, and store OBD vehicle driving information and ADAS action information. The aforementioned data can be transmitted in real-time through mobile network to the blockchain system and cloud backend database.

b. 「雲端後台資料庫暨管理介面」可讓管理者查詢受監控車輛之駕駛行車與車輛狀態，並具備車輛故障預警功能，可針對可能發生危險駕駛或是可能發生故障的車輛提出警示。建立職業駕駛之評鑑分級制度，提供政府主管單位制訂法規的參考依據。

（3）選定臺南、高雄地區之府城客運公司、高雄客運公司，以及臺中地區之台中客運公司、中鹿客運公司等4家客運業者進行整合車載網路系統（OBD/CAN Bus）與區塊鏈功能之車載設備模組在客運駕駛數位履歷管理之道路實測，共派遣4輛公車、4位駕駛，行駛5條路線，共計行駛5,033趟次，累計行駛時數達2,900小時，174萬筆資料量，各項測試結果顯示，本系統可達到預期目標。另依據實車測試結果，對不良駕駛行為參數及駕駛分級計算提供以下建議：（1）依道路型態調整「多次變換車道」和「頻繁變換車道」的參數；（2）依道路型態和車型調整「急加減速」的參數。

（4）另為協助業者達成數位治理及數位轉型之目標，本計畫規劃完成「公共運輸數位轉型核心模組」整體架構，俾利後續據以研發數位轉型所需各項工具，以協助業者疫後能迅速復甦及振興。

3. 成果推廣與效益

（1）執行期間與府城客運公司、高雄客運公司、台中客運公司及中鹿客運公司等4家客運業者進行實測作業。

（2）分別在112年1月18日、112年7月7日、以及112年7月13日舉行3場產官學三方交流座談會，邀請專家學者、客運業者及相關主管機關對於汽車運輸業應用新科技（如ADAS、駕駛數位履歷管理系統等）營運管理進行探討。

b. The "Cloud Backend Database and Management Interface" allows managers to query the driving and vehicle status of monitored vehicles, with vehicle fault pre-warning functions that can alert to potentially dangerous driving or possible vehicle failures. Established an evaluation and grading system for professional drivers to provide a reference basis for government authorities in formulating regulations.

(3) Selected four bus operators in Tainan, Kaohsiung, and Taichung regions, namely Fucheng bus company, Kaohsiung bus company, Taichung bus company, and Zhonglu bus company, to conduct road tests for the integration of onboard network systems (OBD/CAN Bus) and blockchain functionality in the driver digital resume management of buses. A total of 4 buses and 4 drivers were dispatched to drive 5 routes, with a total of 5,033 trips, accumulating 2,900 hours of driving time and 1.74 million data entries. The test results showed that the system could achieve the expected goals. Based on the actual vehicle test results, we provide the following suggestions for poor driving behavior parameters and driver grading calculation: (1) Adjust the parameters of "multiple lane changes" and "frequent lane changes" according to road types; (2) Adjust the parameters of "rapid acceleration and deceleration" according to road types and vehicle types.

(4) To assist operators in achieving digital governance and digital transformation goals, this project has planned and completed the overall framework of "Public Transportation Digital Transformation Core Module," which will facilitate the development of various tools needed for digital transformation, helping operators quickly recover and revitalize after the pandemic.

3. Result Promotion and Benefits

(1) During the execution period, practical testing was conducted with four bus operators: Fucheng bus company, Kaohsiung bus company, Taichung bus company, and Zhonglu bus company.

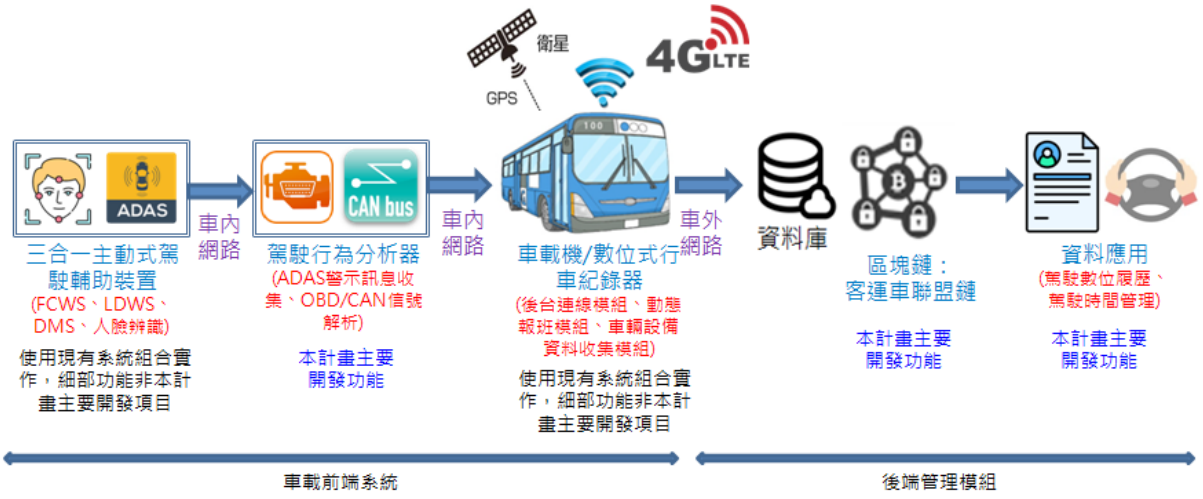
(2) Three industry-government-academia exchange seminars were held on January 18, July 7, and July 13, 2023, invited experts, scholars, bus operators, and relevant authorities to discuss the application of new technologies (such as ADAS, Driver Digital Resume Management System) in the operation management of bus services industry.

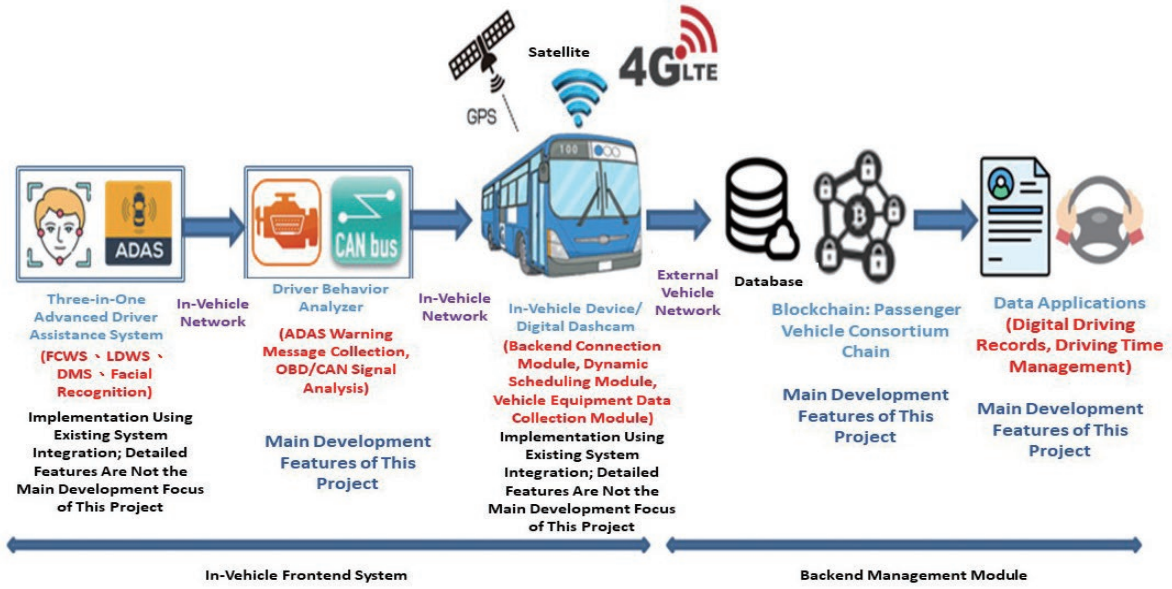
（3）「駕駛數位履歷管理系統」於113年1月23日獲得經濟部智慧財產局「新型專利權」。

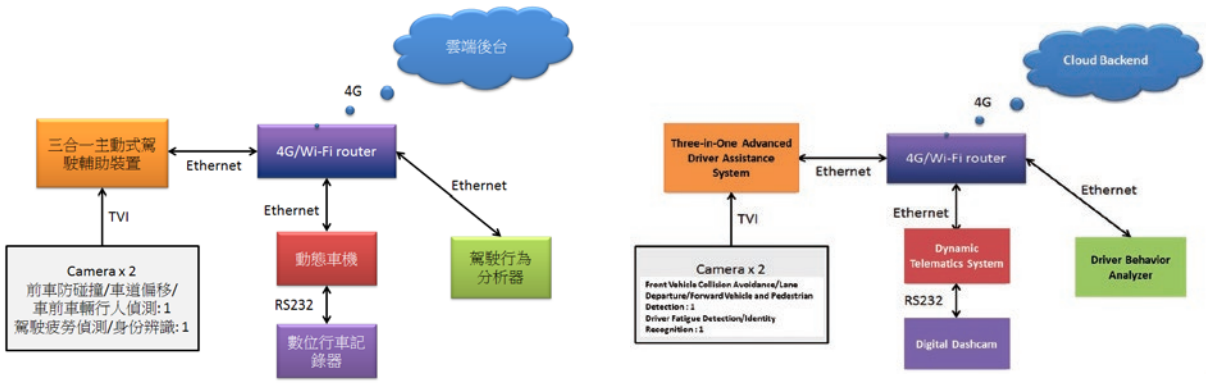
(3) The "Driver Digital Resume Management System" was granted a "new patent" by the Intellectual Property Office of the Ministry of Economic Affairs on January 23, 2024.

4 研究成果精華摘整

4. Summary of Research Results







本計畫開發之駕駛數位履歷管理系統之硬體架構圖

The hardware architecture diagram of driver digital Resume management system developed in this project

舉辦3場專家學者座談會及宣傳海報

Three expert seminars and promotional posters were held

5. 研究成果報告

- 先進公車智慧化營運管理先導運行計畫（2／2）—整合車載設備之駕駛數位履歷管理系統研發（113年5月出版）。

5. Research Result Report

- The advanced intelligent operation and management pilot project for smart bus (2/2) – development of an integrated driver digital resume management system for onboard devices (Published in May 2024).

(四) 交通行動服務(MaaS)跨域合作與應用優化之研究(1/2)－應用探討與推動規劃

1. 計畫概述

近年來由於經濟發展帶動民眾生活水準提升，傳統都市公共運輸服務型態（定線、定班）已無法滿足民眾「行」的需求。因此芬蘭赫爾辛基於2014年提出交通行動服務（Mobility as a Service, MaaS）概念：整合多元運具成為單一運輸移動服務，透過長期套票優惠以及行動裝置，提供符合民眾需求的運輸服務。MaaS整合運輸的創新理念不僅受到全世界交通運輸領域的高度重視，歐美先進國家（如英國、德國、瑞典、比利時、美國）更競相啟動MaaS計畫。

有鑑於MaaS服務日益受到各國重視與推動，交通部2020年版運輸政策白皮書亦宣示MaaS為重要發展策略之一；為能循序擴展國內MaaS服務，使國內各地區民眾均能享受MaaS服務的便捷與永續，交通部智慧運輸系統發展建設計畫（110至113年）接受地方政府針對交通行動服務建設計畫進行補助計畫之申請，期使MaaS服務效益擴展至更多地區／縣市。考量交通行動服務屬創新服務型態，涉及面向廣大，且隨著越來越多城市推動MaaS服務及其發展演進，亦衍生許多值得進一步探討及擴充應用之議題；因此為促進我國MaaS服務之推動及應用發展，本計畫持續蒐集國外應用案例，並以國內外之推動經驗為基礎，探討MaaS使用者數據資料應用面向、跨域合作、服務永續提供、節能減碳、包容性等議題，滾動式更新MaaS服務相關應用發展及落實應用服務，以加速構建我國MaaS服務之發展及應用環境。

(IV) A study of mobility as a service (maas) with cross-border cooperation and application optimization (1/2) – application discussion and implement planning

1. Project Overview

In recent years, economic development has led to an improvement in the standard of living, and traditional urban public transportation services (fixed routes and schedules) can no longer meet people's mobility needs. Therefore, in 2014, Helsinki, Finland proposed the concept of mobility as a service (MaaS): Integrating various means of transportation into a single mobility service and providing transportation services that meet people's needs through long-term ticket discounts and mobile devices. The innovative idea of MaaS integration has not only garnered significant attention in the field of transportation worldwide, but also led advanced countries in Europe and America (such as UK, Germany, Sweden, Belgium, and the US) to initiate MaaS projects.

In light of the increasing importance and promotion of MaaS services globally, the MOTC included MaaS as one of the key development strategies in its 2020 transportation policy white paper. To gradually expand domestic MaaS services, ensuring that people in various regions can enjoy the convenience and sustainability of MaaS, the MOTC's intelligent transportation system development and construction project (2021–2024) accepts applications from local governments for subsidies to MaaS construction projects, aiming to extend the benefits of MaaS services to more regions/counties and cities. Considering that mobility as a service is an innovative service model with broad implications, and as more cities promote MaaS services and their development evolves, many issues worth further exploration and application expansion arise. Therefore, to promote and develop MaaS services and applications in our country, this project continues to collect international application cases and, based on domestic and international experiences, explores issues such as the application of MaaS user data, cross-domain cooperation, sustainable service provision, energy conservation and carbon reduction, and inclusiveness. This ongoing update aims to accelerate the development and application of MaaS services in our country.

2. 研究成果

112年以MaaS基礎應用研究及國際交流與合作等2項為研究主軸，分別深入探討MaaS使用者數據資料應用探討、MaaS服務永續提供，以及MaaS跨域合作可能方式、MaaS APEC國際論壇等子議題，說明如下：

（1）在使用者數據應用方面，提出中央／地方政府、MaaS營運商、運輸業者及使用者等5大利害關係人，所關注之MaaS使用者數據應用項目及其分析方式共25項，另112年以臺中MaaS為案例探討對象，擇定8項議題進行第一階段之試作分析。

（2）在MaaS服務永續提供方面，將MaaS生命週期區分為建置期、推廣期及服務永續期3階段，並導入企業ESG及其他社會資源之應用概念，提出各階段中，中央／地方政府、民間企業、使用者、票證公司、驗票機業者等8大利害關係人之角色職責與其執行重點。

（3）在MaaS跨域合作可能方式方面，提出特約合作、通路整合及MaaS會員整合等3種跨域合作方式，並進一步提出適用條件及營運面及系統面之相關配套建議；另亦協助高雄市政府交通局與日本小田急電鐵株式會社推動實質合作。

（4）在國際論壇方面，辦理APEC「提昇移動力整合新紀元」第二場次國際論壇，邀請國內外MaaS領域相關之政府機關、專家學者、產業代表與會，共同探討APEC會員體在MaaS領域推動跨域合作及提供包容性服務所可能面臨之挑戰與願景。

3. 成果推廣與效益

（1）113.1.18-19於高雄地區辦理APEC「提昇移動力整合新紀元」第二場次國際論壇。

（2）計畫研究成果發表於中興工程季刊及中華民國運輸學會學術論文研討會。

2. Research Results

In 2023, the research focused on two main themes: foundational MaaS application research and international exchange and cooperation. These themes will delve into subtopics such as MaaS user data application, sustainable MaaS service provision, possible methods for cross-domain cooperation in MaaS, and the MaaS APEC international forum. The explanation is as follows:

(1) Regarding user data application, 25 items of concern and analysis methods from five key stakeholders (central/local governments, MaaS operators, transportation providers, and users) will be proposed. In addition, in 2023, Taichung MaaS was used as a case study to select eight issues for the first phase of trial analysis.

(2) in terms of sustainable MaaS service provision, MaaS life cycle will be divided into three stages: construction, promotion, and sustainable service. Incorporating the concepts of corporate ESG and other social resources, the roles and responsibilities of eight key stakeholders (central/local governments, private enterprises, users, ticketing companies, and verification machine providers) will be outlined for each stage.

(3) For possible cross-domain cooperation methods in MaaS, three types of cooperation methods – special cooperation, channel integration, and MaaS membership integration will be proposed, along with relevant supporting suggestions for operational and system aspects. In addition, the project will assist the Transportation Bureau of Kaohsiung City Government in promoting substantial cooperation with Odakyu Electric Railway Co., Ltd. of Japan.

(4) In the aspect of international forums, the project will organize the second APEC international forum on "Enhancing Mobility Integration in a New Era," inviting government agencies, experts, scholars, and industry representatives related to the MaaS field from home and abroad to jointly discuss the challenges and visions that APEC member economies may face in promoting cross-domain cooperation and providing inclusive services in the MaaS field.

3. Result Promotion and Benefits

(1) From January 18 to 19, 2024, the second session of APEC "New Era of Mobility Integration" international forum was held in Kaohsiung.

(2) The project's research findings were published in Sinotech Engineering Quarterly and at the academic conference of the Chinese Institute of Transportation.

（3）112.10.26，邀集六都交通單位代表，辦理「MaaS使用數據應用需求座談會」，交流MaaS使用者數據應用經驗與需求。

（4）112.11.8，邀請相關專家、MaaS營運商、運輸業者及政府部門代表，辦理「我國MaaS服務永續提供之探討」座談會，就為達MaaS可永續服務，各利害關係人之角色義務及可能作為等，進行探討與意見交流。

（5）112.9.27協助高雄市政府交通局與日本小田急電鐵株式會社啟動實質交流合作，共同召開「臺日交通行動服務（MaaS）跨境合作啟動記者會」。

(3) On October 26, 2023, representatives from the transportation departments of six special municipalities were invited to hold "MaaS User Data Application Requirements Symposium" to exchange experiences and needs regarding MaaS user data applications.

(4) On November 8, 2023, relevant experts, MaaS operators, transportation industry representatives, and government officials were invited to hold a symposium on "Exploring the Sustainable Provision of MaaS Services in Taiwan" to discuss and exchange opinions on the roles, obligations, and possible actions of various stakeholders to achieve sustainable MaaS services.

(5) On September 27, 2023, the Kaohsiung City Transportation Bureau and Odakyu Electric Railway Co., Ltd. of Japan assisted in initiating substantive exchanges and cooperation, and jointly held "Taiwan-Japan MaaS Cross-border Cooperation Kick-off Press Conference."

4. 研究成果精華摘整

4. Summary of Research Results

112年9月27日協助高雄市政府交通局與日本小田急電鐵株式會社
共同召開「臺日交通行動服務（MaaS）跨境合作啟動記者會」

On September 27, 2023, the Kaohsiung City Transportation Bureau and Odakyu Electric Railway Co., Ltd. jointly held "Taiwan–Japan MaaS Cross-border Cooperation Kick-off Press Conference"

113.1.18-19 APEC「提昇移動力整合新紀元」第二場國際論壇

From January 18 to 19, 2024, the second session of APEC "New Era of Mobility Integration" international forum was held

5. 研究成果報告

- 交通行動服務（MaaS）跨域合作與應用優化之研究（1／2）－應用探討與推動規劃（預計113年7月出版）。

(五) 汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫(2/2)

1. 計畫概述

交通部為協助汽車客運業者釐清各條營運虧損補貼路線實際成本項目，以提高經營管理績效，於89年1月1日起試辦，並於89年7月1日起正式實施汽車客運業路線別成本計算制度（以下簡稱本制度），並列為促進大眾運輸發展方案配合措施之一，且同時間本所配合本制度之實施開發完成汽車客運業路線別成本計算制度應用軟體（包含客運業者端及主管機關端，以下合併簡稱「本應用軟體」）。其後因應各客運業者對軟體之使用意見與需求，本應用軟體於91年12月更新至第2版，於96年12月再度更新軟體至第3版，以提供業者及主管機關進行成本計算分析及陳報使用，期間持續提供客運業者及主管機關在成本分析及審查管理上使用，至109年因應電腦作業環境再升級為4.0版，於110年3月完成更為windows 10作業系統，以維持原功能正常運作。

隨著近年來公共運輸經營環境上朝向智慧化、電動化及自動化發展，包括先進公共運輸系統全面建置完成、需求反應式及多元型態路線服務方式、電動大客車推廣政策等，原89年實施至今之汽車客運業路線別成本計算制度所定義18項成本項目，已逐漸無法涵蓋各成本項歸納及分析之需求，因此本計畫檢討修訂汽車客運業路線別成本計算制度，提出建議修訂方式並配合建置成本分析應用軟體，以因應公共運輸經營管理數位轉型及決策支援之需求。

2. 研究成果

（1）完成「汽車客運業路線別成本計算修正版」之成本分攤公式調整內容與成本分析應用軟體架構。

5. Research Result Report

- A study of mobility as a service (maas) with crossborder cooperation and application optimization (1/2) – application discussion and implement planning (Scheduled to be published in July 2024).

(V) Project to review route-based costing systems and developing software applications for bus services industry

1. Project Overview

To assist bus operators in clarifying the actual cost items for each subsidy route's operating loss and to improve management performance, the MOTC initiated a trial implementation of bus operator route-based costing system (hereinafter referred to as "the system") on January 1, 2000, and officially implemented it on July 1, 2000. The system was included as one of the measures to promote the development of public transportation. At the same time, the institute developed an application software for bus operator's route-based costing system (including the operator and supervisory authority versions, hereinafter collectively referred to as "the application software") to align with the system's implementation. Subsequently, in response to user feedback and requirements from bus operators, the appl ication software was updated to version 2.0 in December 2002 and further updated to version 3.0 in December 2007, providing operators and supervisory authorities with cost calculation, analysis and reporting capabilities. This software has been continuously used by bus operators and supervisory authorities for cost analysis and review management. In 2020, the software was upgraded to version 4.0 in response to advancements in computer operating environments, with completion of the upgrade to Windows 10 operating system in March 2021 to maintain normal functionality.

With the recent trends in public transportation toward intelligent, electric and automated development, including the comprehensive implementation of advanced public transportation systems, demand-responsive and multi-modal route services and the promotion of electric buses, the original 18 cost items defined by the bus operator route-specific cost calculation system implemented in 2000 have gradually become inadequate for encompassing the requirements for cost item classification and analysis. Therefore, this project reviews and revises the bus operator route-based costing system, proposes recommended revisions, and develops the cost analysis application software to meet the needs of digital transformation in public transportation management and decision support.

2. Research Results

(1) Completed the adjustment of cost-sharing formula and the architecture of cost analysis application software for "Revised Cost Calculation for Bus Routes."

（2）完成「汽車客運業路線別成本計算修正版」應用軟體之客運業者端單機軟體與主管機關端分析平台開發建置。

3. 成果推廣與效益

（1）112.2.16舉辦1場專家學者座談會，根據前期研究成果，進一步探討柴油大客車成本計算制度修正之建議、電動大客車和需求反應式服務之成本計算方式建議，以及對於客運業路線別成本計算制度調整之看法和建議，促成產、官、學三方對於汽車客運業路線別成本之重視及意見交流。

（2）112.4.20及112.6.12舉辦2場應用軟體說明會，分別對將來實際操作路線別成本分析軟體之客運業者員工，與承辦相關工作之各縣市政府交通局、公路局各區監理所等單位說明調整後之本應用軟體之修改內容與操作方式，同時提供持續的軟體使用資訊服務，持續回應各單位於操作試用版軟體時之意見回饋與問題排解。

（3）提供交通部、公路局、地方政府等主管機關後續推動策略建議，針對法規調整、技術支援、平台維運與相關配套措施均提出相關時程、經費與方法之建議，有助於後續推動新版成本計算制度與成本分析軟體。

4. 研究成果精華摘整

(2) Completed the development and implementation of standalone software for operators and analysis platform for the competent authority of "Revised Cost Calculation for Bus Routes" application software.

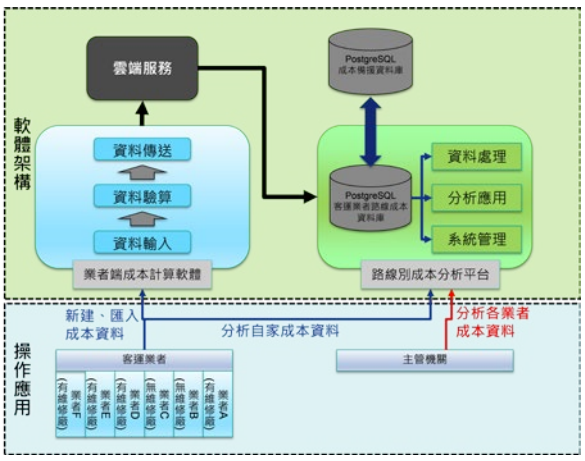
3. Result Promotion and Benefits

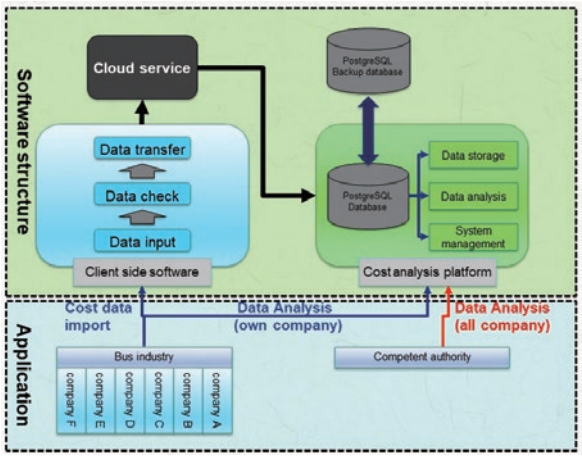
(1) On February 16, 2023, we held an expert symposium to further discuss the recommendations for revising the diesel bus cost calculation system, the cost calculation methods for electric buses and demand-responsive services, and opinions and suggestions for adjusting the cost calculation system for bus routes, facilitating the exchange of opinions among industry, government, and academia.

(2) On April 20 and June 12, 2023, we held two application software briefings to explain the modifications and operation of the adjusted application software to employees of bus operators and units responsible for related work in the transportation bureaus of various counties and cities and the district motor vehicles offices of the Highway Bureau, providing continuous software usage information services and responding to feedback and issues encountered during trial operation of the software.

(3) Provided subsequent promotion strategy recommendations to the MOTC, the Highway Bureau and local governments, including suggestions on regulatory adjustments, technical support, platform maintenance and related supporting measures, with relevant timelines, costs and methods, to assist in the subsequent promotion of new cost calculation system and cost analysis software.

4. Summary of Research Results





「汽車客運業路線別成本計算修正版」應用軟體架構調整

Adjustment of the application software architecture for "Revised Cost Calculation for Bus Routes"

「汽車客運業路線別成本計算修正版」單機端軟體畫面1

Standalone software interface for "Revised Cost Calculation for Bus Routes" – Picture 1

「汽車客運業路線別成本計算修正版」分析平台建置畫面2

Analysis platform construction for "Revised Cost Calculation for Bus Routes" – Picture 2

5. 研究成果報告

- 汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫（2／2）（112年11月出版）。

5. Research Result Report

- Project to review route-based costing systems and developing software applications for busservices industry (2/2) (Published in November 2023).

(六) 電動大客車數據分析與應用計畫(1/2)－數據研析與關鍵指標建立

1. 計畫概述

行政院為改善空氣汙染，已於106年12月21日宣布於2030年前將1萬輛市區大客車全面電動化。為落實此政策目標，交通部於107年研擬我國電動大客車推動策略與作法，提出各策略執行工作及部會分工，持續落實電動大客車進展。本所於108年建置電動大客車營運數據監控管理平台與建立資料傳輸作業機制，提供後續電動大客車營運績效數據之持續蒐集與分析。

本計畫藉由車輛端與充電端的營運數據資料，可運算統計營運關鍵指標，提供客運業者做為營運績效觀察之基礎，亦可整合外部數據影響因子，評估分析不同營運情境下對於營運關鍵指標之影響程度。本計畫針對電動大客車路線包括用電效率、SOC使用量、低電量比率等指標特性進行分析；並藉由個案分析結果與客運業者進行交流，蒐集指標參數之相關影響因子，以建立數據驅動模型，提供客運業者參考與應用。

2. 研究成果

(1) 完成與合作客運業者擇定路線之用電效率、SOC使用量、低電量比率等指標之建立。

(2) 完成擇定路線每班次用電效率及SOC使用量分析（含各車輛及駕駛分時用電效率分析、每班次SOC使用量分析、各充電站SOC分析）。

(3) 建立能耗（用電效率）數據驅動模型，篩選出重要變數包含氣溫、車輛速率平均值、起始SOC、時段、班次實際里程、電池溫度最大值、電池年齡（月）、停靠號誌化路口數、停靠站數、及平假日。其中起始SOC為本計畫發現一重要且可提供業者參考的變數，因發車起始SOC低時，車輛處於電壓較低狀態，需要較高電流輸出以維持電機設備運作與動力輸出，故會增加電量消耗。

(VI) Electric bus data analysis and application (1/2) – data analysis and key indicators establishment

1. Project Overview

To improve air quality, the Executive Yuan announced on December 21, 2017 that 10,000 city buses would be fully electrified by 2030. To achieve this policy goal, the MOTC formulated the strategy and implementation methods for promoting electric city buses in 2018, outlining the execution tasks and departmental responsibilities to ensure continuous progress. In 2019, the institute established an operational data monitoring and management platform for electric buses and developed a data transmission mechanism to continuously collect and analyze operational performance data of electric buses.

This project uses operational data from both vehicles and charging stations to calculate and statistically analyze key performance indicators, providing a foundation for bus operators to observe operational performance and integrate external data factors, and to assess the impact of various operational scenarios on key performance indicators. The project analyzes indicators such as power efficiency, SOC usage, and low battery ratio for electric bus routes. Through case study results and exchanges with bus operators, relevant influencing factors of the indicators are collected to establish a data-driven model for operators' reference and application.

2. Research Results

(1) Established indicators for selected routes including power efficiency, SOC usage, and low battery ratio with cooperating bus operators.

(2) Completed analysis of power efficiency and SOC usage for each trip on selected routes (including hourly power efficiency analysis of each vehicle and driver, SOC usage analysis for each trip, and SOC analysis at each charging station).

(3) Developed a data-driven energy consumption (power efficiency) model, identifying key variables such as temperature, average vehicle speed, initial SOC, time period, actual mileage of trips, maximum battery temperature, battery age (months), number of signalized intersections stopped at, number of stops, and holidays. Among these, initial SOC was found to be an important variable that can serve as a reference for operators. When the initial SOC is low, the vehicle is in a lower voltage state, requiring higher current output to maintain motor operation and power output, thus increasing power consumption.

3. 成果推廣與效益

（1）當發車起始SOC在低區間（40~45%）時，班次用電效率低於平均值、SOC使用量高於平均值的比率增加，本計畫已建議客運業者出車時起始SOC維持至少45%以上（或單趟行駛需求電量加計安全電量之總值），可有效增加用電效率。

（2）經業者實際營運電動大客車經驗，車輛出廠之能耗數值並無法對應實際路線環境下之耗電需求，本計畫建立之能耗關鍵指標，可協助業者藉由營運經驗進行數據化分析，對應不同時段、不同季節、不同路線建立更貼近實際營運的能耗數值，使班次耗電需求更準確，以滿足營運需求與及早應變。

（3）本計畫所建立之數據驅動模型，可協助客運業者掌握SOC使用量歷史資料與預測值，增加客運業者日常調度與充電規劃作業之助益。

3. Result Promotion and Benefits

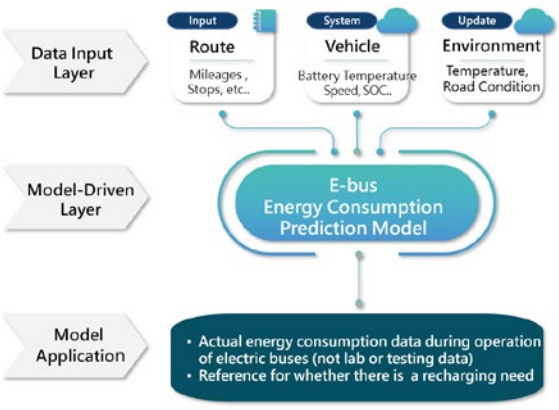
(1) When the initial SOC is in the low range (40–45%), the ratio of trips with lower-than-average power efficiency and higher-than-average SOC usage increases. The project recommends maintaining an initial SOC of at least 45% at the start of a trip (or the total of the required power for a single trip plus safety power) to effectively increase power efficiency.

(2) Based on actual operational experience with electric buses, the energy consumption values from the factory do not correspond to the power demand under actual route conditions. The key energy consumption indicators established by this project can assist operators in conducting data-driven analysis based on operational experience, establishing more accurate energy consumption values for different times of the day, seasons and routes, thereby meeting operational needs and allowing for early response.

(3) The data-driven model established by this project can help operators grasp historical and predicted SOC usage, enhancing daily scheduling and charging planning operations.

4. 研究成果精華摘整

4. Summary of Research Results



電動大客車能耗預測分析模型

Electric bus energy consumption forecast analysis model

電動大客車營運數據分析與智慧充電系統-成果發表會
Electric bus operational data analysis and smart charging system – results presentation

5. 研究成果報告

- 電動大客車數據分析與應用計畫（1/2）－數據研析與關鍵指標建立（113年3月出版）。

(七) 電動大客車智慧充電服務驗證(1/2)－智慧充電管理系統實證

1. 計畫概述

行政院為改善空氣汙染，已於106年12月21日宣布於2030年前將1萬輛市區公車全面電動化。當車隊逐漸全面改換為電動大客車時，由於停車場充電站安裝位置等條件限制，部分電動大客車將會產生充電供給與需求匹配問題，因此如何建立合理的電動大客車和充電站數量配比，提供最適當的充電站安排與營運管理需要預先詳細分析規劃，爰本所於110-111年開始於示範場域規劃與建置電動大客車智慧充電管理系統。為強化電動大客車智慧充電管理系統功能，並發展客運業者電動大客車充電班表及契約容量最佳充電策略，本計畫利用110-111年所建置電動大客車智慧充電管理系統，開始導入客運業者班表、契約容量與電動大客車營運數據監控管理平台資訊，進行智慧充電管理系統實證，協助業者進行示範，並於未來加以推廣至其他電動大客車充電場站，以促進我國電動大客車政策之推動。

2. 研究成果

（1）強化電動大客車智慧充電管理系統功能，提升控制及資訊蒐集效率及系統可靠度。

5. Research Result Report

- Electric bus data analysis and application (1/2) – data analysis and key indicators establishment (Published in March 2023)

(VII) Electric bus smart charging service verification (1/2) – smart charging management system demonstration

1. Project Overview

To improve air quality, the Executive Yuan announced on December 21, 2017 that 10,000 city buses would be fully electrified by 2030. As the fleet gradually transitions to electric buses, limitations such as the installation locations of charging stations in parking lots can lead to mismatches between the supply and demand for charging electric buses. Therefore, how to establish a reasonable ratio of electric buses to charging stations and provide the most appropriate charging station arrangements and operational management requires detailed pre-analysis and planning. Hence, in 2021–2022, the institute began planning and establishing an intelligent charging management system for electric buses in demonstration fields. To enhance the functions of intelligent charging management system for electric buses and develop optimal charging schedules and contract capacity strategies for bus operators, this project utilized the intelligent charging management system established in 2021–2022. The system began integrating bus operators' schedules, contract capacities, and operational data monitoring platform information for electric buses to conduct smart charging management system demonstrations. This helps operators perform demonstrations and, in the future, promotes the system to other electric bus charging sites to advance the country's electric bus policies.

2. Research Results

(1) Strengthen the functions of intelligent charging management system for electric buses to improve control and information collection efficiency and system reliability.

（2）整合智慧充電管理系統控制策略所需之車機資料，如：車牌號碼、GPS、SOC及電池溫度並完成系統串接，以使業者可於場域端透過看板掌握車輛即將進站資訊、是否需要充電以及最佳之充電量。

（3）完成發展客運業者之電動大客車充電班表及契約容量最佳充電策略，透過110年電動大客車智慧充電示範計畫建置電動大客車智慧充電管理系統之客運業者建構應用程式介面（API），智慧充電管理系統可與示範場域內電動大客車日間動態班表進行資訊整合，針對即將進站之車輛對應查找該車下次離站服務之時間及里程，並透過智慧充電排程判斷充電資格、優先權、充電功率及充電時間等功能。

3. 成果推廣與效益

（1）藉由我國電動大客車車隊之智慧充電管理系統監控資料分析，提供客運業者提升車輛稼動率、維運成本最佳化等經營管理及滾動檢討電動大客車推動政策之依據，提升電動大客車整體營運品質以及安全性。

（2）透過本計畫於112年12月5日舉辦電動大客車營運數據分析與智慧充電系統-成果發表會推廣，降低客運業者對電動公車之疑慮並提高執行成效。

4. 研究成果精華摘整

(2) The system integrates necessary vehicle data for smart charging management control strategies, such as license plate numbers, GPS, state of charge (SOC) and battery temperature, and completes system integration. This allows operators to use a display board at the site to grasp information on vehicles about to enter the station, whether they need charging and the optimal charging amount.

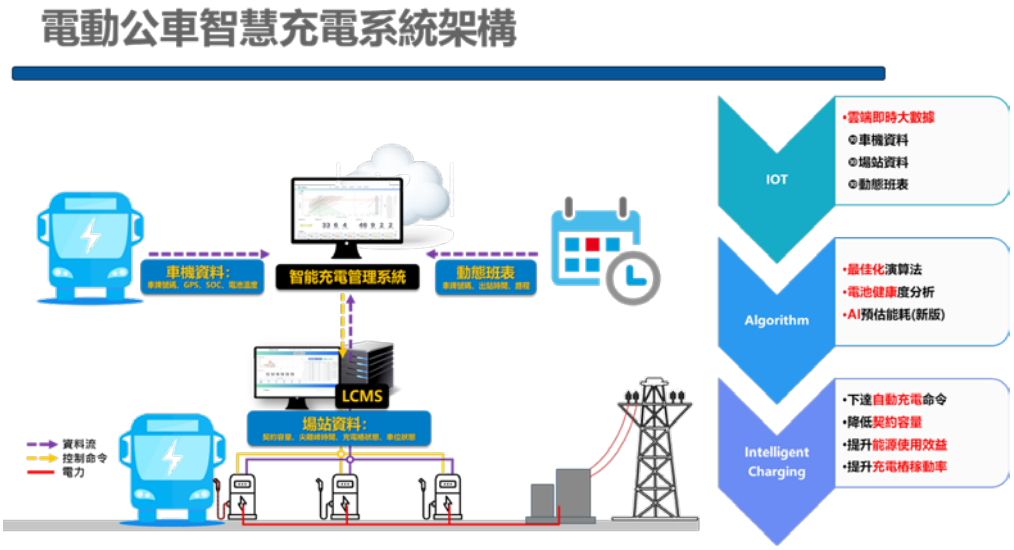
(3) Develop optimal charging schedules and contract capacity strategies for bus operators' electric buses. Through the 2021 electric bus smart charging demonstration project, an application programming interface (API) was constructed for the intelligent charging management system. The smart charging management system can integrate information with the dynamic daytime schedules of electric buses in the demonstration field. It can match vehicles about to enter the station with the time and mileage of their next departure service and determine charging eligibility, priority, charging power and charging time through scheduling of smart charging.

3. Result Promotion and Benefits

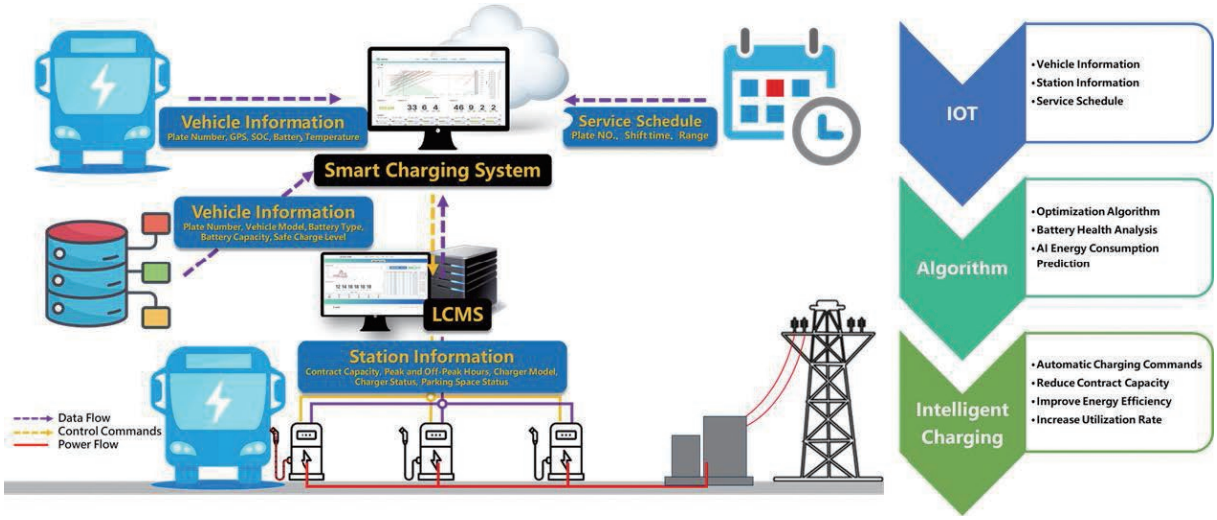
(1) Through the analysis of smart charging management system monitoring data of Taiwan's electric bus fleet, operational management, and rolling review of the electric bus promotion policy, bus operators are provided with a basis for improving vehicle utilization rates and optimizing maintenance and operating costs, thereby enhancing the overall operational quality and safety of electric buses.

(2) On December 5, 2023, through this project, an electric bus operation data analysis and smart charging system results presentation was held to reduce bus operators' concerns about electric buses and improve implementation effectiveness.

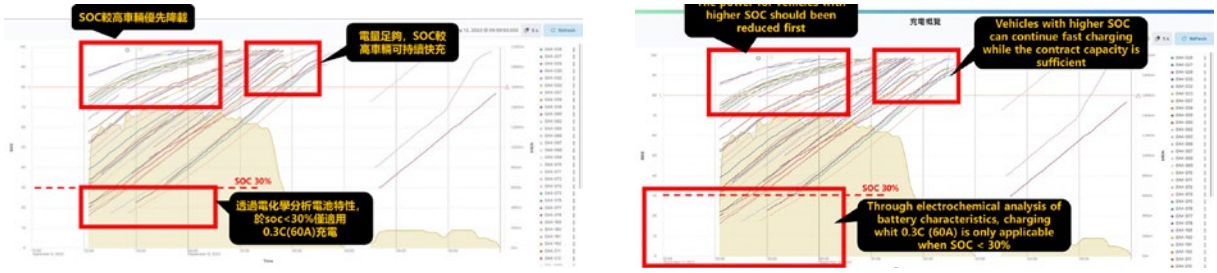
4. Summary of Research Results



電動公車智慧充電系統架構



The architecture of smart charging system for electric buses



電動大客車智慧充電驗證
Verification of the smart charging of electric buses

5. 研究成果報告

- 電動大客車智慧充電服務驗證（1/2）－智慧充電管理系統實證（預計113年7月出版）。

5. Research Result Report

- Electric bus smart charging service verification (1/2) – smart charging management system demonstration (Scheduled to be published in July 2024).

四 營造潔淨且具韌性的運輸環境

(一) 運輸部門淨零排放與溫室氣體減量推動工作暨評估模型強化（1/2）－建構淨零排放評估模型暨評估111年行動方案成效

1. 計畫概述

為配合國家推動溫室氣體減量政策，交通部依112年2月15日公布之「氣候變遷因應法」暨112年12月29日修正發布之「氣候變遷因應法施行細則」規定，以5年為一階段，訂修運輸部門溫室氣體減量行動方案，做為我國運輸部門推動溫室氣體減量之依循，並做為直轄市、縣（市）政府訂定溫室氣體減量執行方案之依據。

運輸部門110年溫室氣體排放約3,546.4萬公噸CO_2e，占國家溫室氣體排放總量約11.94%，為我國溫室氣體排放第4大部門，經推估其中以公路運輸排放為最大宗，占約達96.82%；公路運輸中又以小客車排放占比最高，占整體公路運輸約49.26%最高、其次為大貨車約16.27%。為推動溫室氣體減量工作，第二期（110-114年）運輸部門採取「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14項措施。每年滾動檢討行動方案執行成效及研提執行成果報告。

另配合行政院淨零轉型關鍵戰略行動計畫推動作業，研提相關具體行動納入交通部主政之關鍵戰略7「運具電動化及無碳化」行動計畫及環境部主政之關鍵戰略10「淨零綠生活」行動計畫；其後並依據永續會淨零轉型關鍵戰略管制制度，配合交通部及環境部之半年執行情形報告與年執行成果報告撰擬作業。配合淨零轉型關鍵戰略行動計畫之工作項目，研析國際運輸能源與減碳與運具電動化之政策與法規發展趨勢，並辦理綠運輸生活推廣誘因機制之推動方向研析及運輸場站能源消耗與標竿案例盤點與研析。

IV Build up a Clean and Resilient Transportation Environment

(I) To promote net-zero emissions and greenhouse gas reduction in the transportation sector and to enhance the evaluation model (1/2) – constructing the net-zero emissions evaluation model and evaluating the effectiveness of 2022 action plan

1. Project Overview

In line with the national greenhouse gas reduction policy, based on "Climate Change Response Act" announced on February 15, 2023, and the "Implementation Rules of the Climate Change Response Act" revised and announced on December 29, 2023, the MOTC sets and revises greenhouse gas reduction action plan for the transportation sector every five years. This serves as guideline for the national transportation sector's greenhouse gas reduction efforts and provides a basis for the central and local governments to formulate their own greenhouse gas reduction execution plans.

In 2021, the transportation sector emitted approximately 35.464 million metric tons of CO_2e, accounting for about 11.94% of the national greenhouse gas emissions, making it the fourth largest emitter in the country. Of this, road transport was the largest contributor, accounting for about 96.82%, with passenger cars being the highest at about 49.26% of total road transport emissions, followed by heavy trucks at about 16.27%. To promote greenhouse gas reduction, the second phase (2021-2025) of the transportation sector's plan adopted three major strategies with 14 measures: "developing public transportation systems and strengthen transportation demand management," "build the green transportation network, promote the use of low-carbon vehicles, and create a green vehicleoriented traffic environment," and "enhance transportation systems and the energy use efficiency of transport systems and vehicles." The action plan is reviewed and the implementation results are reported annually.

In coordination with the Executive Yuan's key strategic action plan for net-zero transition, related specific actions are integrated into the MOTC's seven key strategy No.7 "Carbon Free and Electric Vehicles" action plan and the Ministry of Environment's key strategy No.10 "Net zero Green Living" action plan. Following the Sustainable Development Committee's net-zero transition key strategic control system, the MOTC and the Ministry of Environment prepare semi-annual and annual implementation reports. To align with the key strategic action plan for net-zero transition, we analyzed international trends in transport energy, carbon reduction, and vehicle electrification policies and regulations. We conducted a study on the promotion directions of green transport lifestyle incentive mechanisms and analyzed the energy consumption and benchmark cases of transport hubs.

2. 研究成果

（1）完成彙提「運輸部門溫室氣體減量行動方案成果報告（112年9月版）」送環境部轉陳行政院核定。

（2）完成推估運輸部門第3期溫室氣體排放基線、能源需求及減碳目標，做為行政院後續協商六大部門第3期減碳目標之基礎。

（3）配合行政院淨零轉型關鍵戰略行動計畫推動作業，研提相關具體行動納入交通部主政之關鍵戰略7「運具電動化及無碳化」行動計畫及環境部主政之關鍵戰略10「淨零綠生活」行動計畫，均已奉行政院於112年4月21日核定。

3. 成果推廣與效益

（1）透過交通部、環境部、經濟部等部會執行相關措施，運輸部門溫室氣體排放量已較基準年（94年，3,796.8萬公噸）下降：

① 108年、109年運輸部門溫室氣體排放量分別為3,699.8萬公噸及3,727.4萬公噸，且105~109年運輸部門排放量合計為187.040百萬公噸CO_2e，低於第1期全期管制目標189.663百萬公噸CO_2e，顯示運輸部門推動溫室氣體減量工作已見成效。

② 依據經濟部能源署112.8.25發布之能源平衡表-運輸部門能源消費統計，推估運輸部門111年溫室氣體排放量約為3,627.9萬公噸（實際統計值需以環境部公布為主），綜上，推測係因疫情趨緩，並伴隨疫後經濟復甦，民眾運輸活動正常化，爰運輸部門111年公共運輸及私人機動運具運量（延人公里）皆較110年提升，惟公共運輸運量（延人公里）增加幅度相較私人機動運具為高，而公共運輸能源消耗量增加幅度相

2. Research Results

(1) Completed "Implementation Results of the Sectoral GHG Emission Control Action Program for the Transportation Sector (September 2023 edition) submitted to the Ministry of Environment and forwarded to the Executive Yuan for approval.

(2) The baseline greenhouse gas emissions, energy demand, and carbon reduction targets for the third phase of the transportation sector were estimated to form the basis for the Executive Yuan's subsequent negotiations on the carbon reduction targets for six major sectors in the third phase.

(3) The specific actions proposed in the MOTC's key strategy No.7 "Carbon Free and Electric Vehicles" action plan and the Ministry of Environment's ten key strategy No.10"Net zero Green Living" action plan have been approved by the Executive Yuan on April 21, 2023.

3. Result Promotion and Benefits

(1) Through the implementation of related measures by the MOTC, the Ministry of Environment, the Ministry of Economic Affairs, and other ministries, the transportation sector's greenhouse gas emissions have decreased compared to the base year (2005, 37.968 million metric tons):

① In 2019 and 2020, the greenhouse gas emissions from the transportation sector were 36.998 million metric tons and 37.274 million metric tons, respectively. From 2016 to 2020, the total emissions from the transportation sector amounted to 187.040 million metric tons of CO_2e, which was below phase 1 overall control target of 189.663 million metric tons of CO_2e, indicating that the efforts to reduce greenhouse gas emissions in the transportation sector have been effective.

② According to the energy balance table for the transportation sector's energy consumption statistics released by the Energy Administration of the Ministry of Economic Affairs on August 25, 2023, it is estimated that greenhouse gas emissions from the transportation sector in 2022 were approximately 36.279 million metric tons (actual statistical value should be based on the announcement by the Ministry of Environment). Overall, it is speculated that the easing of the pandemic and post-pandemic economic recovery has normalized people's transportation activities. The passenger-kilometers of public and private motorized transport in the transportation sector in 2022 both increased compared to 2021. However, the increase in passenger-kilometers for public transport was higher than that for private motorized transport, while the increase in energy consumption for public transport was lower than that for

較私人機動運具為低，爰推測111年運輸部門排碳量較110年增加主要係因私人機動運具之運量（延人公里）增加所致。是以，減少私人機動運具之使用（移轉至公共運輸）為運輸部門減碳努力方向。

（2）配合行政院淨零轉型關鍵戰略行動計畫推動作業，於研討會中與產官學界交流綠運輸生活推廣誘因機制之推動方向，做為後續年研議誘因機制及具體作法之依據。

private motorized transport. Therefore, it is speculated that the increase in carbon emissions from the transportation sector in 2022 compared to 2021 is mainly due to the increase in passenger-kilometers of private motorized transport. Therefore, reducing the use of private motorized transport (shifting to public transport) is the direction for the transportation sector's carbon reduction efforts.

(2) To align with the Executive Yuan's key strategic action plan for net-zero transition, we have engaged in discussions with industry, government, and academia at seminars to exchange ideas on the promotion directions for green transport lifestyle incentive mechanisms, serving as the basis for subsequent annual deliberations on incentive mechanisms and specific measures.

4. 研究成果精華摘整

4. Summary of Research Results

單位：萬公噸CO_2e　Unit: $MtCO_2e$

運輸部門110年實際排放量（A） The actual greenhouse gas emissions of the transportation sector in 2021 (A)	運輸部門111年推估排放量（B） The estimated greenhouse gas emissions of the transportation sector in 2022 (B)	運輸部門110年至114年全期管制目標排放量（C） The total greenhouse gas emissions of the transportation sector from 2021 to 2025 (C)	運輸部門112年至114年剩餘可排放量（C-B-A） The total remaining greenhouse gas emissions allowed for the transportation sector from 2023 to 2025 (C-B-A)
3,546.4	3,627.9 註 note	18,162.6	10,988.3

註：　依經濟部能源署112年7月14日資料，111年電力排放係數為0.493公斤CO_2e／度，爰據以進行估算。另運輸部門111年實際排放值需以環境部公布為主。

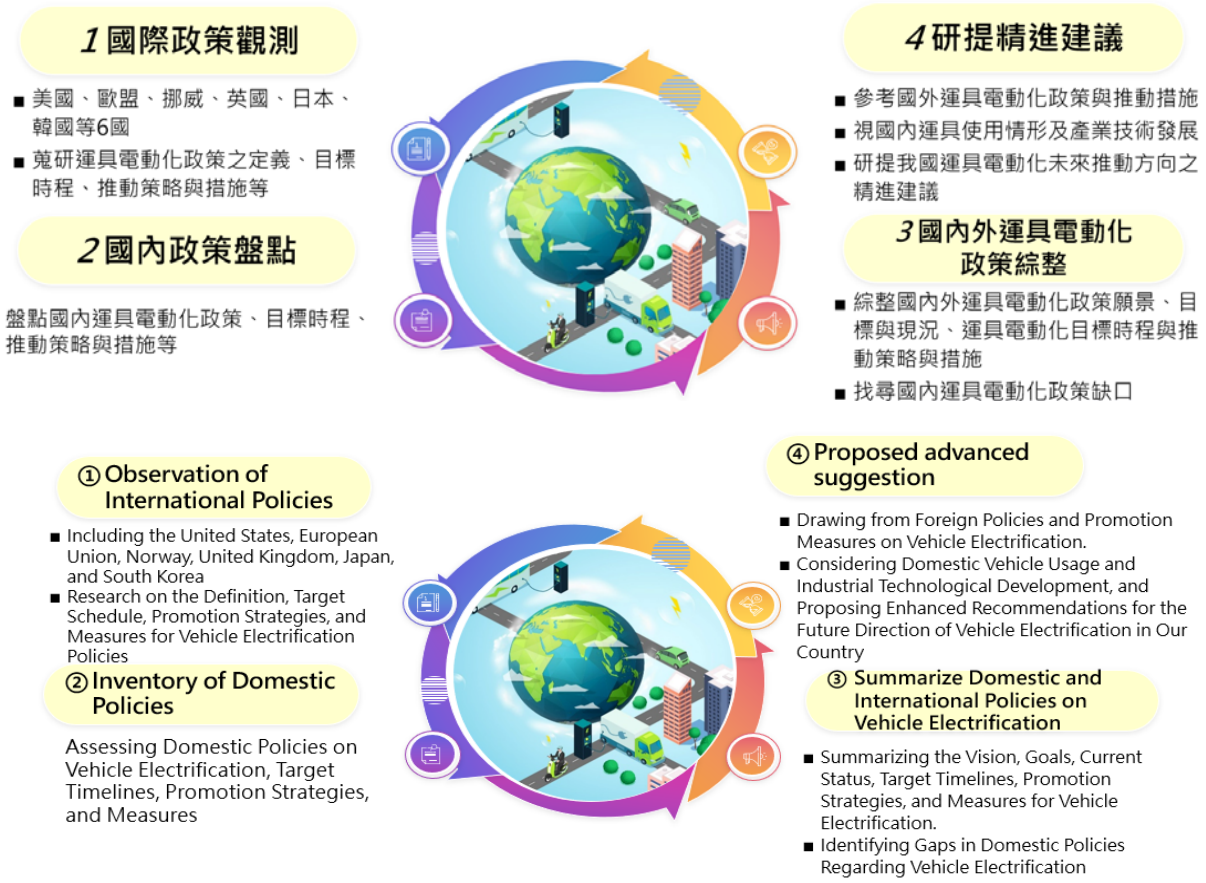
Note:　According to data from the Energy Administration, Ministry of Economic Affairs on July 14, 2023, the electricity carbon emission factor for the year 2022 was 0.493 kilograms of CO_2e per kilowatt-hour, and this was used for estimation purposes. Additionally, actual greenhouse gas emissions from the transportation sector in 2022 should primarily rely on figures published by the Ministry of Environment.

運輸部門第二期溫室氣體之排放情形

The greenhouse gas emissions situation under the regulatory goal for the second stage in the sector of transportation

「綠運輸生活型態體驗」推廣活動剪影

Pictures of "Green Transportation Lifestyle Experience" promotion activity



運具電動化政策研究架構

Framework for Research on Electrification Policies for Transportation

5. 研究成果報告

- 運輸部門淨零排放與溫室氣體減量推動工作暨評估模型強化（1/2）－建構淨零排放評估模型暨評估111年行動方案成效（預計113年7月出版）。

(二) 低碳交通區推動機制之研究（1/2）－設置之評估與配套措施

1. 計畫概述

隨著世界各國競逐淨零排放成為減碳趨勢，我國於111年3月30日發布「臺灣2050淨零排放路徑及策略總說明」，將低碳交通區納入淨零轉型措施，交通部亦於臺灣2050淨零轉型「運具電動化及無碳化」及「淨零綠生活」關鍵戰略行動計畫將低碳交通區納入具體行動，並請本所於112年至113年期間研究低碳交通區之推動機制，提供公共運輸及監理司應用及補助地方政府規劃設置低碳交通區參考。

5. Research Result Report

- Enhancing the net-zero emissions and greenhouse gas reduction promotion and assessment model for the transportation sector (1/2) - building a net-zero emissions assessment model and evaluating the effectiveness of the 2022 action plan (Scheduled to be published in July 2024).

(II) Research on the promotion mechanism of low-carbon transportation zones (1/2) - evaluation and supporting measures for implementation

1. Project Overview

As countries around the world race toward net-zero emissions, becoming a trend in carbon reduction, our country released the "Taiwan 2050 Net-Zero Emissions Pathway and Strategy Overview" on March 30, 2022, incorporating lowcarbon transportation zones into net-zero transformation measures. The MOTC also included low-carbon transportation zones in the key strategic action plans of "Carbon Free and Electric Vehicles" and "Net Zero Green Life" in Taiwan's 2050 net-zero transformation. The Institute of Transportation was requested to study the promotion mechanism of low-carbon transportation zones from 2023 to 2024, providing applications and subsidies for local governments to plan and establish lowcarbon transportation zones as a reference for the Public Transportation and Supervision Department.

公路運輸於運輸部門溫室氣體排放占比約97%，欲達到淨零排放目標需大幅減少公路運具之能源使用。本計畫藉由蒐整及分析國內外低碳交通區類似案例，提出我國低碳交通區推動機制建議，包含法規與制度等配套，除引導中央及地方政府及早因應啟動相關法制作業外，並促進地方政府未來施政方向符合國家淨零轉型關鍵戰略，規劃試辦低碳交通區，以促成社會及民眾交通運具使用行為改變，邁向淨零生活轉型。

2. 研究成果

（1）完成研提低碳交通區分期推動建議；短期採試辦先行，強化綠運輸使用環境；中期採循序漸進，管制前依試辦經驗完善中央法規，試辦區轉型為正式低碳交通區，形塑標竿案例；長期採擴大推廣，加嚴排碳車輛管制措施，擴大實施範圍，獎勵措施退場，擴大實施邁向淨零

（2）完成法制規劃建議；在試辦階段，地方政府可在地方制度法第18條第7款（自然保育）、第9款（環境保護）、第10款（交通及觀光）授權內推動（例如：停車差別費率）。建議未來交通部可協調環境部修訂氣候變遷因應法納入低碳交通區，中長期才有適當之中央法規依據供地方政府循序推廣。

（3）完成地方政府配套措施建議；在車輛管制方面，應邀集利害關係人參與規劃管制相關配套措施，並給予當地居民及弱勢團體彈性管制或豁免；在綠運輸方面，提升公共運輸服務品質與水準，建立人本交通環境，提供電動車輛補助；在公民溝通與宣導方面，依影響力及受影響程度界定利害關係人類型，透過專業團隊協助與民眾溝通，提前宣導實施內容。

Highway transportation accounts for about 97% of greenhouse gas emissions in the transportation sector. To achieve the net-zero emission target, it is necessary to significantly reduce the energy use of road vehicles. This project aims to collect and analyze similar cases of low-carbon transportation zones domestically and internationally and propose recommendations for promoting low-carbon transportation zones in our country, including supporting regulations and systems. Besides guiding the central and local governments to initiate related legislative work early, the project also promotes the future direction of local government policies to align with the national key strategic net-zero transformation, planning pilot low-carbon transportation zones to encourage social and public changes in transportation behavior toward a net-zero lifestyle transformation.

2. Research Results

(1) Completed recommendations for the phased promotion of low-carbon transportation zones: In the short term, pilot projects should be conducted first to strengthen the green transportation environment; in the medium term, regulations should be improved based on pilot experiences before implementing formal low-carbon transportation zones and creating benchmark cases; in the long term, promotion should be expanded, with stricter control measures on carbon-emitting vehicles, broader implementation areas, phasing out incentive measures, and moving toward net-zero.

(2) Legal planning suggestions have been completed; during the pilot stage, local governments can promote under the authorizations of Article 18, Paragraph 7 (Natural conservation), Paragraph 9 (Environmental protection), and Paragraph 10 (Transportation and tourism) of the Local Government Act (e.g. differential parking fees). It is suggested that in the future, the MOTC could coordinate with the Ministry of Environment to amend the Climate Change Response Act to include low-carbon transportation zones, providing appropriate central regulations for local governments to promote sequentially in the mid to long term.

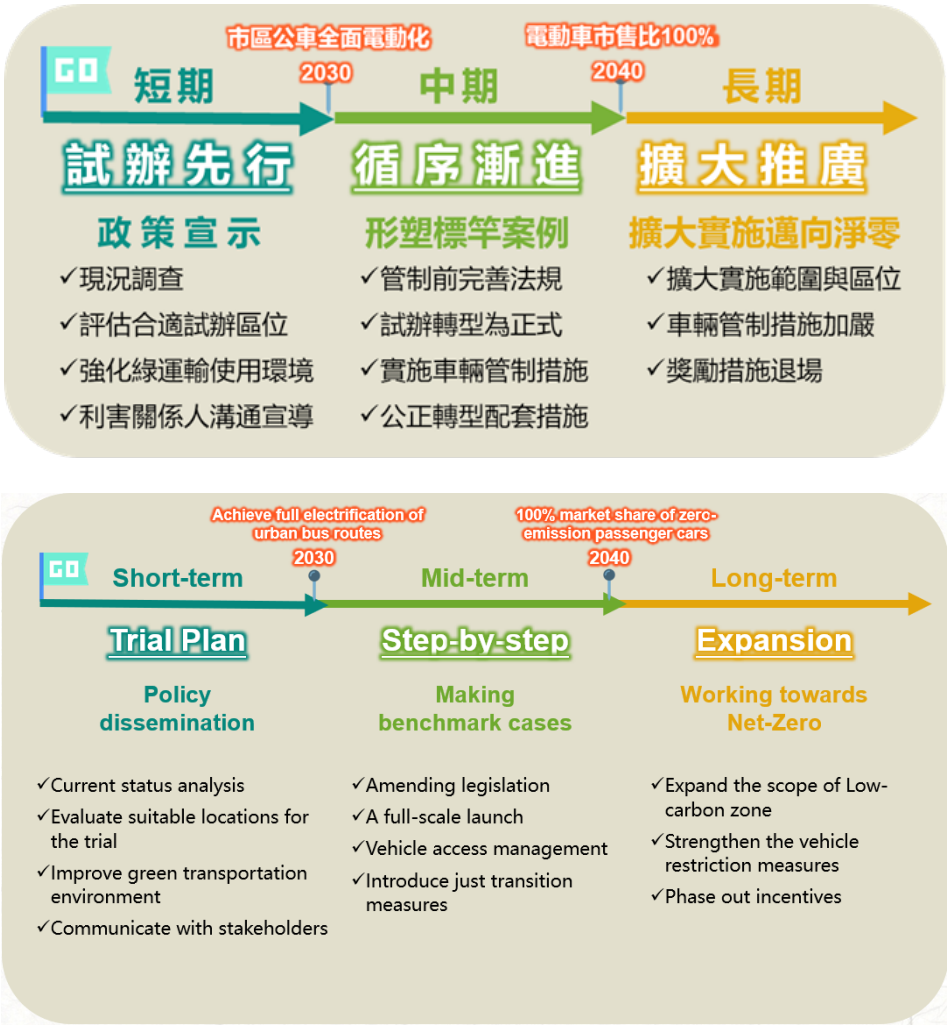
(3) Recommendations for supporting measures for local governments have been completed; in terms of vehicle control, stakeholders should be invited to participate in planning relevant supporting measures, with flexible control or exemptions for local residents and disadvantaged groups; in terms of green transportation, the quality and standards of public transportation services should be improved, establishing a people-oriented transportation environment and providing subsidies for electric vehicles; in terms of public communication and promotion, stakeholders should be identified based on their influence and impact, with professional teams assisting in communication with the public and early promotion of implementation content.

3. 成果推廣與效益

（1）於112年11月3日、11月6日及11月8日完成辦理北、中、南地方交流會，與六都交通及環保單位進行意見交流。

（2）於112年12月8日中華民國運輸學會112年會暨學術論文研討會發表112年研究成果。

4. 研究成果精華摘整



低碳交通區分期推動建議

Recommendations for the phased promotion of low-carbon transportation zones

5. 研究成果報告

- 低碳交通區推動機制之研究（1/2）－設置之評估與配套措施（預計113年7月出版）。

3. Result Promotion and Benefits

(1) On November 3, November 6, and November 8, 2023, we completed local exchange meetings in the northern, central, and southern regions, exchanging opinions with transportation and environmental units of the six major cities.

(2) Research results for 2023 were presented at "2023 Annual Conference and Academic Paper Symposium of the Chinese Institute of Transportation" on December 8, 2023.

4. Summary of Research Results

5. Research Result Report

- Research on the promotion mechanism of low-carbon transportation zones (1/2) – evaluation of setup and supporting measures (Scheduled to be published in July 2024).

(三) 公路系統因應氣候變遷強化調適能力案例研析

1. 計畫概述

公路系統為國家重要維生基礎設施，伴隨氣候變遷及極端氣候事件頻率增加，提高公路系統阻斷之風險。然而，我國的公路系統規劃機制和相關規範對於氣候變遷調適考量仍有不足，若公路系統規劃階段能融入氣候變遷調適理念，將有效提升未來面臨極端事件之因應能力。

因此，本所於前期計畫完成「公路系統因應氣候變遷調適指引」，協助公路系統權責主管機關及實務從業人員於規劃階段更全盤性、系統性地納入氣候變遷調適概念。為進一步提升調適指引之可用性及易讀性，本計畫蒐集實務案例，提供公路設施權責主管機關具體落實應用公路系統規劃階段調適指引，以提升公路系統因應氣候變遷之調適能力。

2. 研究成果

（1）蒐整國外運輸系統調適最新發展趨勢，以及蒐集包含國外之沿海公路調適案例（美國紐澤西）、內陸公路調適案例（荷蘭埃因霍溫）及山區公路調適案例（美國維吉尼亞），進行研析並提出應用建議。

（2）完成公路系統規劃階段調適指引案例蒐集與研析，並納入ISO 14090氣候變遷調適系列標準，提出實務應用建議。

（3）邀請國內公路主責單位、氣候變遷調適專家及民間工程顧問公司辦理專家工作坊，並規劃及辦理2場公路系統規劃階段調適指引應用推廣教育訓練。

3. 成果推廣與效益

（1）完成「公路系統規劃階段融入氣候變遷調適考量之框架」論文，發表於「中華民國運輸學會2023年年會暨學術論文國際研討會（112年12月7~8日）。

(III) Case studies of enhancing highway system's adaptive capabilities to climate change

1. Project Overview

The highway system is an essential infrastructure for the country's livelihood. However, with climate change and the increasing frequency of extreme weather events, the risk of disruption to the highway system is rising. Our country's highway system planning mechanisms and related regulations still lack sufficient consideration for climate change adaptation. If climate change adaptation concepts could be integrated into the planning stages of the highway system, it would significantly enhance the ability to respond to extreme events in the future.

Therefore, in a previous project, we completed "Guidelines for Climate Change Adaptation for the Highway System," which helps highway system authorities and practitioners more comprehensively and systematically incorporate climate change adaptation concepts into the planning stages. To further enhance the usability and readability of the adaptation guidelines, this project collects practical cases to provide specific applications of adaptation guidelines during the planning stages of highway systems for the responsible highway authorities.

2. Research Results

(1) Collected the latest development trends in adaptation for foreign transportation systems and gathered adaptation cases for coastal highways (New Jersey, USA), inland highways (Eindhoven, Netherlands), and mountainous highways (Virginia, USA) for analysis and application suggestions.

(2) Completed the collection and analysis of adaptation guideline cases for the planning stages of highway systems and incorporated ISO 14090 series standards for climate change adaptation, providing practical application suggestions.

(3) Invited domestic highway authorities, climate change adaptation experts, and private engineering consulting firms to conduct expert workshops and conduct two educational training sessions on applying the adaptation guidelines during planning stages of highway systems.

3. Result Promotion and Benefits

(1) Completed the "Framework for Integrating Climate Change Adaptation Considerations into the Planning Stages of Highway Systems" paper presented at "2023 Annual Conference and International Symposium of the Chinese Institute of Transportation" (December 7 to December 8, 2023).

（2）完成「公路系統因應氣候變遷強化調適能力案例研析－公路規劃階段調適指引導讀」2場次（112年5月25日及112年10月20日）專業知識教育訓練，輔助公路主管機關（構）配合公路系統調適指引規劃階段氣候變遷調適指引，將調適知識應用於調適業務之推動。

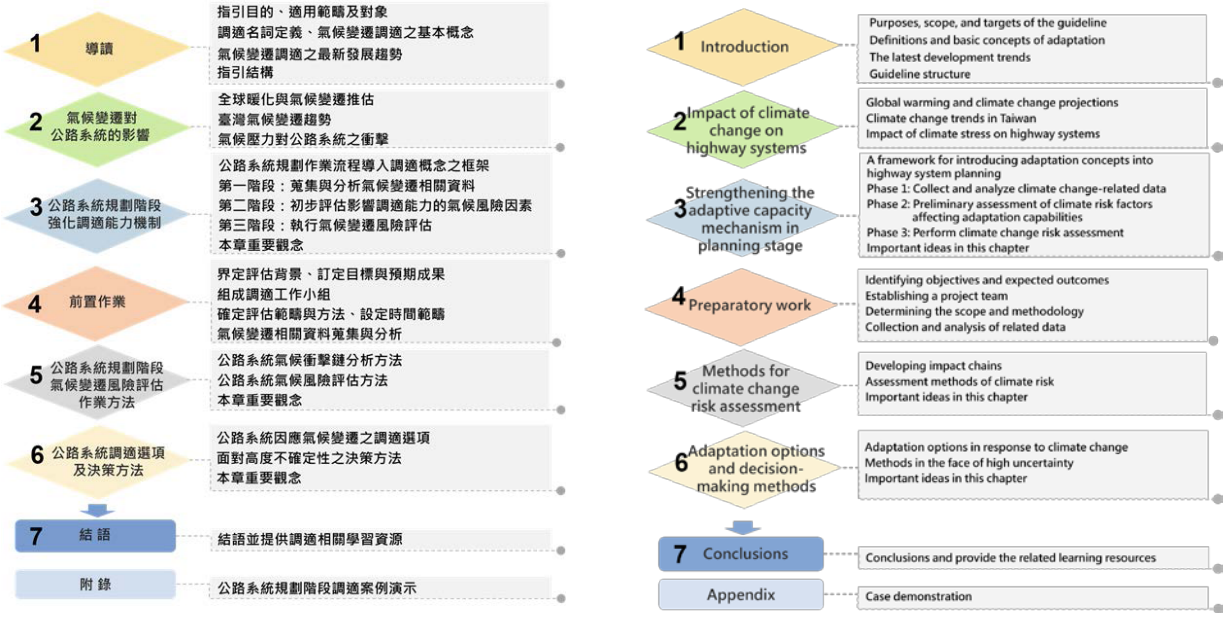
（3）辦理「公路系統因應氣候變遷強化調適能力案例研析」（112年10月12日）專家工作坊，邀請專家學者、國內公路主管機關（構）及民間工程顧問公司共同研商調適指引架構及內容，並另提供國內實務案例操作說明，以提升公路系統實務單位辦理氣候變遷調適工作之執行及應用。

(2) Conducted two educational training sessions, "Case Study and Analysis of Enhancing Adaptation Capacity for Climate Change in Highway Systems – Introduction to Planning Stage Adaptation Guidelines" (May 25, 2023 and October 20, 2023), to assist highway authorities in applying the adaptation guidelines to planning stages and promoting the application of adaptation knowledge in their operations.

(3) Organized an expert workshop, "Case Study and Analysis of Enhancing Adaptation Capacity for Climate Change in Highway Systems" (October 12, 2023), and invited experts, scholars, domestic highway authorities and private engineering consulting firms to jointly discuss the framework and content of the adaptation guidelines, and provided explanations of practical domestic cases to enhance the implementation and application of climate change adaptation work by highway system practitioners.

4. 研究成果精華摘整

4. Summary of Research Results



公路系統因應氣候變遷調適指引架構

Guidelines for Climate Change Adaptation for the Highway System

5. 研究成果報告

- 公路系統因應氣候變遷強化調適能力案例研析（預計113年7月出版）。

5. Research Result Report

- Case studies of enhancing highway system's adaptive capabilities to climate change (Scheduled to be published in July 2024).

(四)「自行車通勤路線示範計畫」－臺北都會區

1. 計畫概述

依據交通部統計處中華民國107年「自行車使用狀況調查摘要分析」國人自行車使用情形最主要活動型態以「休閒、運動」（41.8%）最多，其次是「個人活動」（36.6%），再其次為「通勤學」（21.1%）。國內12歲以上民眾經常騎自行車人口約為511萬人，以通勤學為最主要活動型態者約有120萬人，以「北部地區」59萬人（占49.2%）最多，而騎士在從事主要活動型態時，有15.8%轉乘接駁其他交通運具，其中以轉乘捷運者最多（35.5%），其次為公路客運／市區公車（32.7%），再其次為臺鐵（17.8%）。基此，對於自行車的生活與通勤使用尚有可加以提升之空間，惟在自行車通勤之騎乘旅次目的、行為特性及需求與觀光休閒運動的狀況不同，因此需就自行車通勤者之旅運行為進行探討，並就目前市區自行車路線發展現況與面臨問題加以蒐集，以利後續自行車通勤路線規劃與策略推動。

由前述統計資料可知自行車通勤以「北部地區」59萬人所占比例最多，且其人本環境建設及公共自行車租借系統使用人次比例最高，加上擁有完善連續之河濱系統，故本計畫以雙北為計畫範圍，並以主要捷運站周邊及雙北目前主要推動區域為規劃對象

2. 研究成果

對民眾而言，自行車道整體環境是否友善影響民眾使用的意願，唯有提供安全、舒適、友善的騎乘環境，才能吸引民眾以自行車搭配其他運具，達成第一／最後一哩路的目標，爰本計畫以自行車路線的連續性、安全性、便利性為考量，規劃並完成下列項目：

（1）就雙北跨河橋梁及與市區道路銜接路段、進出水門等規劃並建置一致性導引系統。

（2）優化沿線騎乘環境，加強騎乘連續性、安全性。

（3）製作自行車通勤示範路線圖，提供民眾參考使用。

(IV) "Bicycle Commuting Route Demonstration Project" – Taipei metropolitan area

1. Project Overview

According to the statistical office of the MOTC's "Summary Analysis of the 2018 Survey on Bicycle Usage in Taiwan," the primary activity for bicycle use among Taiwanese people was "Leisure and exercise" (41.8%), followed by "Personal activities" (36.6%), and "Commuting to work or school" (21.1%). The population of frequent bicycle riders aged 12 and above is approximately 5.11 million, with about 1.2 million primarily using bicycles for commuting. Among these, the northern region has the highest number at 590,000 people (49.2%). When engaging in their primary activities, 15.8% of cyclists transfer to other modes of transportation, with the highest transfer rate to the metro (35.5%), followed by highway buses/urban buses (32.7%), and Taiwan railways (17.8%). Based on this, there is still room to enhance the use of bicycles for daily life and commuting. However, the purposes, behaviors, and needs of bicycle commuting trips differ from those of recreational and exercise activities. It is necessary to investigate the travel behaviors of bicycle commuters and collect information on the current development and issues of urban bicycle routes to facilitate future planning and promotion strategies for bicycle commuting routes.

From the aforementioned statistics, it is evident that the northern region has the highest proportion of bicycle commuters (590,000 people), and this region also has the highest usage rates of human-centric infrastructure and public bicycle rental systems, in addition to a well-developed continuous riverside system. This project focuses on the twin northern cities (Taipei and New Taipei) as the planning area, targeting major metro station surroundings and key promotion areas

2. Research Results

For the public, whether the overall environment of bicycle lanes is friendly affects their willingness to use bicycles. Only by providing a safe, comfortable, and friendly riding environment can we attract people to use bicycles in conjunction with other transportation modes, achieving the goal of first/last mile. therefore, this project considers the continuity, safety, and convenience of bicycle routes to plan and complete the following tasks:

(1) Plan and establish a consistent guidance system for cross-river bridges and sections connecting with urban roads, including entrances and exits of floodgates in the twin northern cities.

(2) Optimize the riding environment along the routes, enhancing continuity and safety.

(3) Create a demonstration map of bicycle commuting routes for public reference.

研擬自行車通勤路線規劃原則，納入「自行車道系統規劃設計參考手冊」修正版，提供相關單位推動自行車通勤路線規劃時之參據。

3. 成果推廣與效益

（1）112年5月5日辦理「自行車通勤路線示範計畫-臺北都會區」成果發表記者會。

（2）112年5月8日~7月7日辦理騎乘集章活動，以鼓勵及養成民眾利用自行車通勤（學）習慣。

4. 研究成果精華摘整

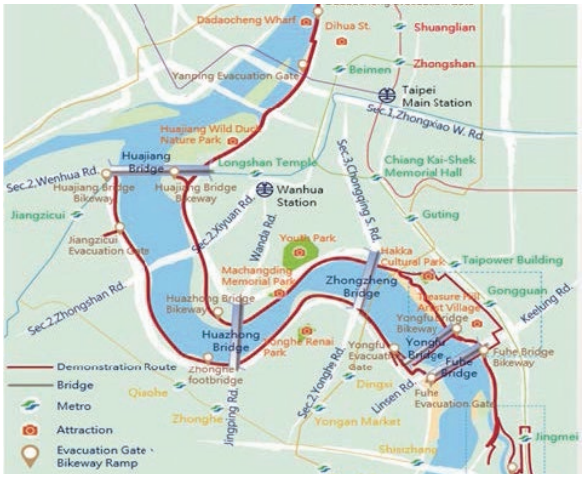
Develop planning principles for bicycle commuting routes, incorporating them into the revised "Bicycle Lane System Planning and Design Reference Manual" for use by relevant units in promoting bicycle commuting route planning.

3. Result Promotion and Benefits

(1) On May 5, 2023, held a press conference to present the results of "Bicycle Commuting Route Demonstration Project – Taipei Metropolitan Area."

(2) From May 8 to July 7, 2023, organized a riding stamp collection event to encourage and cultivate the habit of using bicycles for commuting (or school) among the public.

4. Summary of Research Results



自行車通勤示範路線圖

Demonstration map of bicycle commuting routes

「自行車通勤路線示範計畫-臺北都會區」成果發表記者會

Press conference for the results of "Bicycle Commuting Route Demonstration Project – Taipei Metropolitan Area"

5. 研究成果報告

- 「自行車通勤路線示範計畫」－臺北都會區（預計113年7月出版）。

(五) 建構運輸管理機關（構）之調適專業能力（1/2）－課題研析及課程規劃

1. 計畫概述

我國「氣候變遷因應法」於112年2月公布施行，第17條「為因應氣候變遷，政府應推動調適能力建構之事項」中包含應強化氣候變遷調適之教育與人才培育。考量運輸系統為國家重要基礎設施，與民眾生活息息相關，本計畫期透過辦理運輸系統調適專業課程，強化各運輸管理機關（構）面對未來極端氣候事件之調適專業知識。

本（112）年為計畫第1年期，已滾動檢討我國運輸系統氣候變遷調適四大策略15項措施，並透過訪談及問卷調查盤點運輸設施管理機關（構）人員調適專業知能之缺口，據以規劃符合實際需求的調適課程。112年先辦理調適基礎課程，113年將賡續辦理調適專業課程，期藉以提升運輸管理機關（構）人員對於所屬設施因應氣候變遷之調適專業能力，俾能即早因應，降低設施面對氣候變遷衝擊之風險，維持運輸服務不中斷。

2. 研究成果

（1）經彙集分析氣候變遷因應法調適專章規範之事項、國際氣候變遷調適發展趨勢，完成運輸系統氣候變遷調適四大策略15項措施滾動檢討，在措施重點部分新增跨領域及跨層級整合機制、國家綠色金融政策應配合全面考量、脆弱族群、社區及原住民族為本之調適策略，以及自然為本之調適解決方案等內容，以使運輸系統氣候變遷調適策略措施能依國內外調適發展情勢全面考量，與時俱進。

5. Research Result Report

- "Bicycle Commuting Route Demonstration Project" – Taipei metropolitan area (Scheduled to be published in July 2024).

(V) Construction the professional adaptability of transportation governing authority (Agency) (1/2) – topic investigation & analysis and course planning

1. Project Overview

The "Climate Change Response Act" was promulgated and implemented in February 2023. Article 17 "To respond to climate change, the government should promote the construction of adaptation capabilities," includes strengthening education and talent cultivation for climate change adaptation. Considering that transportation system is a critical infrastructure for the country and closely related to people's lives, this project aims to enhance the professional knowledge of various transportation management agencies in adapting to future extreme climate events through specialized courses.

In the first year of the project (2023), we conducted a rolling review of four major strategies and 15 measures for climate change adaptation in the transportation system of our country. Through interviews and questionnaires, we identified the gaps in adaptation professional knowledge among personnel of transportation facility management agencies, and based on this, we planned courses that meet practical needs. In 2023, we held basic adaptation courses and will continue with specialized adaptation courses in 2024. These courses aim to enhance the professional adaptation capabilities of transportation management personnel, enabling early response and reducing the risk of transportation facilities facing climate change impacts, thereby maintaining uninterrupted transportation services.

2. Research Results

(1) By analyzing the regulations of the adaptation chapter of the Climate Change Response Act and international climate change adaptation development trends, we completed a rolling review of four major strategies and 15 measures for climate change adaptation in the transportation system. In key measures, we added cross-domain and cross-level integration mechanisms, comprehensive consideration of national green finance policies, adaptation strategies based on vulnerable groups, communities and indigenous peoples, and nature-based adaptation solutions. This ensures that the transportation system's climate change adaptation strategies and measures fully consider domestic and international adaptation development trends and keep pace with the times.

（2）參考國際氣候變遷調適發展趨勢、聯合國氣候變化綱要公約（UNFCCC）運輸部門氣候行動關鍵願景各階段目標，以及國內外運輸系統調適專業課程，完成運輸管理機關（構）應具備之調適專業能力探討，以做為調適課程規劃之基礎。

（3）透過問卷調查及訪談，盤點運輸管理機關（構）調適專業知識之缺口，並調查各機關（構）對調適專業知識之需求性及優先性，據以完成規劃符合實際需求的調適課程。

3. 成果推廣與效益

（1）完成「運輸管理機關（構）調適素養與專業知識需求調查」論文，發表於「2023臺灣災害管理研討會（112年12月8日）。

（2）完成辦理「因應氣候變遷調適基礎課程」2場次教育訓練（112年10月27日及112年11月13日），第1場次課程內容包含氣候變遷及氣候災害、氣候變遷風險評估與調適案例，第2場次課程內容包含國家法規與政策、自然解方（Nature-based Solution, NbS）概念。透過調適基礎課程培訓，強化運輸從業人員對氣候變遷調適的知能，以降低運輸設施面對氣候變遷衝擊之風險。

4. 研究成果精華摘整

(2) Referring to international climate change adaptation development trends, the UNFCCC's key vision for climate action in the transportation sector, and domestic and international professional adaptation courses for transportation systems, we explored the professional adaptation capabilities required by transportation management agencies as a basis for course planning.

(3) Through questionnaires and interviews, we identified the gaps in adaptation professional knowledge among transportation management agencies and surveyed their needs and priorities for adaptation professional knowledge, thus completing the planning of courses that meet practical needs.

3. Result Promotion and Benefits

(1) Completed the "Survey on the Adaptation Literacy and Professional Knowledge Needs of Transportation Management Agencies" paper presented at "2023 Taiwan Disaster Management Conference" (December 8, 2023).

(2) Conducted two educational training sessions on "Basic Courses on Climate Change Adaptation" (October 27, 2023 and November 13, 2023). The first session included topics on climate change, climate disasters, climate change risk assessment and adaptation cases, while the second session covered national regulations and policies and the concept of Nature-based Solutions (NbS). These basic adaptation courses strengthened the knowledge and skills of transportation professionals in climate change adaptation, reducing the risk of transportation facilities facing climate change impacts.

4. Summary of Research Results

「因應氣候變遷調適基礎課程」教育訓練剪影

Pictures of "Foundation Courses on Climate Change Adaptation" training workshop

5. 研究成果報告

- 建構運輸管理機關（構）之調適專業能力（1/2）－課題研析及課程規劃（預計113年7月出版）。

(六) 路口交通環境特性對空氣品質影響及改善指引之研訂（1/2）－調查計畫與資料蒐集

1. 計畫概述

近年空氣污染議題深受民眾關注，而車輛所產生之空氣污染，對於駕駛人本身、行人以及環境，皆會產生負面影響。而路口為民眾經常往來的地方，與日常生活息息相關，故如從路口優先進行交通空污改善，可使民眾減少空污暴露，對保障民眾健康最為直接。

過往路口交通改善之目的大多為減少壅塞、提升運作效率或安全性等考量，本計畫則以減少交通空污為出發點，透過調查與分析路口空污情形，研擬減污推動策略，並進一步研訂改善指引，供交通主管機關參考應用。

本計畫為2年期計畫，第1年（112年）辦理蒐集及整理過往路口交通空污相關之研究成果，研提交通及空污資料調查計畫，並辦理4處路口之現地調查。後續第2年（113年）則將進行資料分析、研提改善指引等工作項目。

2. 研究成果

（1）文獻蒐集與成果研究回顧發現，相對於與路口的距離，交通號誌控制、車輛密度、車輛停留時間及建築物群存在等因子，更容易影響路口環境空氣污染物的濃度變化。

（2）就行人穿越道線退縮的路口，當尖峰時段車流量增加時，因行人穿越道線退縮後，行人等候區域遠離路口機車待轉區，相較退縮前區域的PM2.5平均濃度略有減量。

5. Research Result Report

- Construction the professional adaptability of transportation governing authority (Agency) (1/2) – topic investigation & analysis and course planning (Scheduled to be published in July 2024).

(VI) The development of guidelines for the impact of intersection traffic environment characteristics on air quality and improvement measures (1/2) – investigation plan and data collection

1. Project Overview

In recent years, the issue of air pollution has garnered significant attention from the public. The air pollution generated by vehicles negatively impacts drivers, pedestrians, and the environment. Intersections, being areas frequented by the public and closely tied to daily life, are crucial starting points for improving traffic-related air pollution. By prioritizing the reduction of air pollution at intersections, the public's exposure to pollution can be minimized, which directly safeguards their health.

In the past, the primary goals of improving traffic at intersections have been to reduce congestion, enhance operational efficiency, or improve safety. This project focuses on reducing traffic-related air pollution. Through investigating and analyzing the air pollution at intersections, the project aims to develop strategies to reduce pollution and establish improvement guidelines for transportation authorities.

This is a two-year project. In the first year (2023), the project involved collecting and organizing previous research findings on intersection-related traffic air pollution, drafting plans for investigating traffic and air pollution data, and conducting on-site surveys at four intersections. In the second year (2024), the focus will shift to data analysis and the development of improvement guidelines.

2. Research Results

(1) Literature review and research findings indicate that factors such as traffic signal control, vehicle density, vehicle idling time, and the presence of buildings have a more significant impact on the concentration of air pollutants at intersections than the distance from the intersection.

(2) At intersections where pedestrian crossings have been set back, when the traffic volume increases during peak hours, the waiting areas for pedestrians are further away from motorcycle waiting areas and the average PM 2.5 concentration is slightly reduced compared to the areas before the setback.

3. 成果推廣與效益

（1）蒐集及整理過往路口交通空污相關之研究成果，初步掌握影響路口交通空污之關鍵因素，瞭解路口交通空污改善之研究及發展趨勢，提供相關主管機關做為減污工作推動之參考應用。

（2）研提交通環境特性及空污資料蒐集及調查計畫，並依據計畫內容辦理現地調查，監測路口之細懸浮微粒及一氧化碳濃度，可做為第2年期辦理分析與評估之依據。

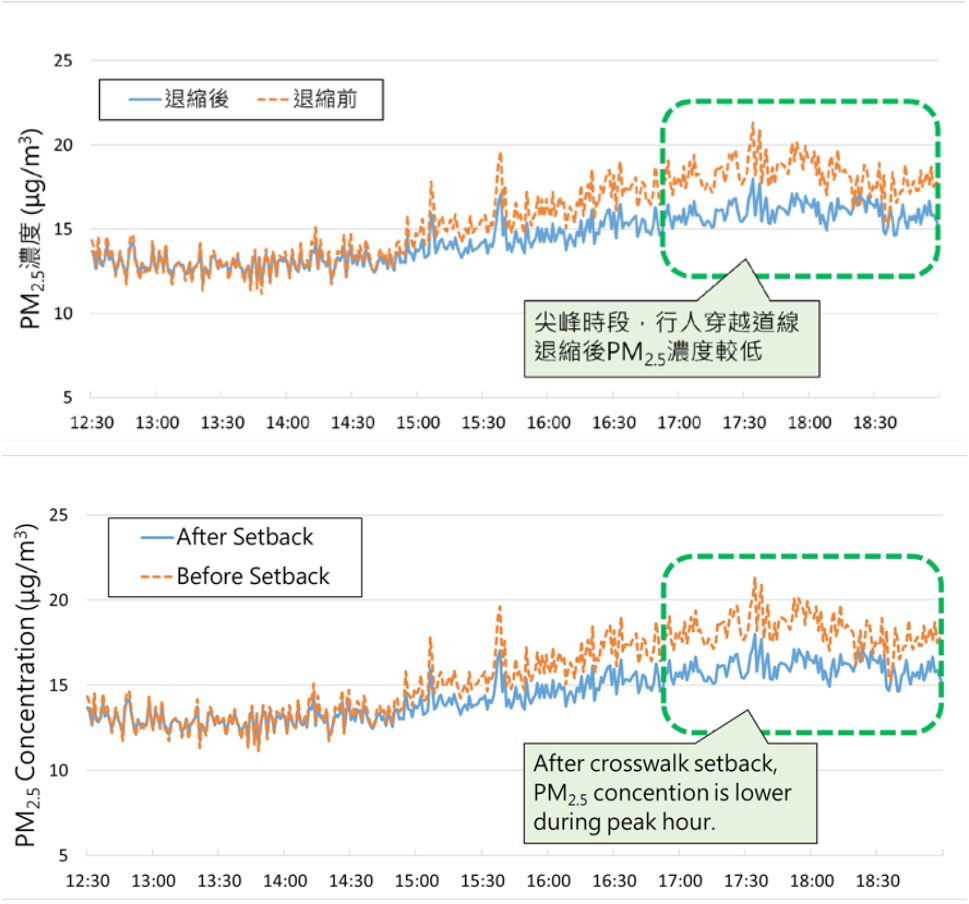
4. 研究成果精華摘整

3. Result Promotion and Benefits

(1) The project will collect and organize previous research findings related to traffic air pollution at intersections, preliminarily identifying key factors influencing intersection traffic air pollution and understanding the research and development trends in intersection traffic air pollution improvement. This will provide relevant authorities with references for promoting pollution reduction efforts.

(2) The project will propose a plan for collecting and investigating traffic environment characteristics and air pollution data, conduct on-site surveys according to the plan, and monitor fine particulate matter and carbon monoxide concentrations at intersections. This data will serve as the basis for analysis and evaluation in the second year.

4. Summary of Research Results



路口行人穿越道線退縮前後PM2.5濃度調查結果

The results of PM2.5 concentration surveys before and after the setback of pedestrian crossings at intersections

5. 研究成果報告

- 路口交通環境特性對空氣品質影響及改善指引之研訂（1/2）－調查計畫與資料蒐集（預計113年7月出版）。

5. Research Result Report

- The development of guidelines for the impact of intersection traffic environment characteristics on air quality and improvement measures (1/2) – investigation plan and data collection(Scheduled to be published in July 2024).

五 深化運輸安全管理

(一) 研提「道路交通安全基本法」草案

1. 計畫概述

有鑑國內道路交通安全提昇受到國人殷切期盼，交通部借鏡日本「交通安全對策基本法」經驗及我國相關基本法規定，推動「道路交通安全基本法」立法程序，除宣示國家道路交通安全基本政策外，亦明定推動組織、經費及計畫等重要事項，以加速改善道路交通安全。部長指示本所於112年2月23日道安記者會，簡報研擬推動「道路交通安全基本法」草案相關內容，於112年4月前完成草案研擬，再由交通部召開會議研商草案內容及辦理法制作業程序，完成後陳報行政院函請立法院審查。

2. 研究成果

（1）於112年3月28日召開第1次座談會，邀請中央相關部會完成討論，再於112年4月18日召開第2次座談會，邀請委員國會辦公室、專家學者、專業團體、中央部會（單位）及地方政府與會討論交流。

（2）完成「道路交通安全基本法（草案）」，並整理日本「交通安全對策基本法」、本所91年研究案研擬之「交通安全基本法」、游毓蘭委員及民眾黨黨團（邱臣遠委員）各自擬具之「交通安全基本法草案」條文之對照表。

3. 成果推廣與效益

（1）以本所提報之「道路交通安全基本法（草案）」協助交通部召開會議研商及辦理法制作業程序。

（2）協助立法過程溝通及討論條文內容，俾使本法順利完成審查。

V Deepen Transportation Safety Management

(I) Drafting the "Road Traffic Safety Basic Act."

1. Project Overview

In response to the high public expectation for improved road traffic safety in our country, the MOTC, drawing on Japan's experience with the "Traffic Safety Measures Basic Act" and our country's relevant basic laws, has initiated the legislative process for "Road Traffic Safety Basic Act." This law not only declares the national road traffic safety policies but also specifies important matters such as the promotion organization, funding, and planning to accelerate the improvement of road traffic safety. The minister instructed the institute to present the draft proposal of "Road Traffic Safety Basic Act" at the road safety press conference on February 23, 2023, and to complete the draft by April 2023. The MOTC will then convene meetings to discuss the draft and proceed with the legislative process, after which it will be submitted to the Executive Yuan for forwarding to the Legislative Yuan for review.

2. Research Results

(1) On March 28, 2023, the first symposium was held, inviting central government agencies to complete the discussions. On April 18, 2023, the second symposium was held, inviting congressional office representatives, experts, scholars, professional groups, central government agencies, and local governments for discussion and exchange.

(2) The "Road Traffic Safety Basic Act (Draft)" was completed, along with a comparative table of Japan's "Traffic Safety Measures Basic Act," the institute's 2002 research project draft "Traffic Safety Basic Act," and the draft proposals from legislator You Yu-Lan and Taiwan People's Party caucus (Legislator Chiu Chen-Yuan).

3. Result Promotion and Benefits

(1) Using the institute's proposed "Road Traffic Safety Basic Act (Draft)," we assisted the MOTC in convening meetings to discuss and proceed with the legislative process.

(2) Facilitating communication and discussion during the legislative process to ensure the smooth completion of the law's review.

4. 研究成果精華摘整

4. Summary of Research Results

「道路交通安全基本法」主架構

The "Road Traffic Safety Basic Act" main structure

5. 研究成果報告

- 「道路交通安全基本法」草案，經112.12.01立院三讀、112.12.15總統公告及113.01.01行政院公告施行。

5. Research Result Report

- The "Road Traffic Safety Basic Act" draft was passed by the Legislative Yuan on December 1, 2023, announced by the President on December 15, 2023, and promulgated by the Executive Yuan on January 1, 2024.

(二) 統籌研擬「國家道路交通安全綱要計畫」草案

1. 計畫概述

因應道路交通安全基本法（以下簡稱基本法）通過立法及實行，交通部依據基本法第18條規定，於112年啟動「國家道路交通安全綱要計畫」之研擬作業，由本所統籌交通部各機關（構）、單位，以及內政部、教育部、衛生福利部、金融監督管理委員會、國家科學及技術委員會等各部會，共同研提「國家道路交通安全綱要計畫（113-116年）」，並於113年2月獲行政院核定通過，做為未來4年中央各部會、直轄市、縣（市）政府推動道安工作之參據。

2. 研究成果

（1）完成「國家道路交通安全綱要計畫（113-116年）」草案撰擬。

（2）研擬「建立道路交通安全檢核制度及推動機制」、「推動道路交通標誌標線號誌設置參考指引」及「道安改善專業人力及技術提升」等3項行動計畫，並納入「國家道路交通安全綱要計畫（113-116年）」據以賡續推動。

3. 成果推廣與效益

（1）協助交通部於112年11月27日、112年11月28日辦理專家學者、中央部會、地方政府及公民團體座談會，凝聚共識並據以推動「國家道路交通安全綱要計畫（113-116年）」撰擬作業。

（2）協助交通部向行政院提報「國家道路交通安全綱要計畫（113-116年）」草案，及相關審議作業。

(II) Coordinated the drafting of "National Road Traffic Safety Guideline and Action Plan"

1. Project Overview

In response to the passage and implementation of Road Traffic Safety Basic Act (hereinafter referred to as the Basic Act), the MOTC in accordance with Article 18 of the Basic Act, initiated the drafting of "National Road Traffic Safety Guideline and Action Plan" in 2023. This effort was coordinated by the institute, involving various agencies and units under the MOTC, as well as the Ministry of Interior, Ministry of Education, Ministry of Health and Welfare, Financial Supervisory Commission, National Science and Technology Council, and other ministries. Together, they formulated "National Road Traffic Safety Guideline and Action Plan (2024–2027)," which was approved by the Executive Yuan in February 2024. This plan will serve as a reference for promoting road safety efforts by central ministries, municipalities, and county (city) governments over the next four years.

2. Research Results

(1) Completed the drafting of "National Road Traffic Safety Guideline and Action Plan (2024–2027)."

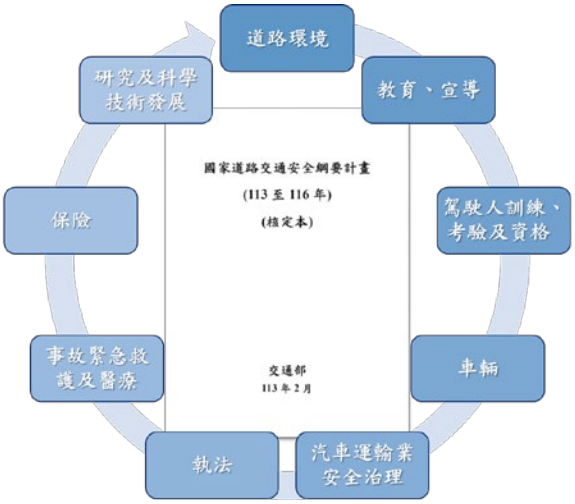
(2) Developed three action plans: "Establishment of a Road Traffic Safety Inspection System and Promotion Mechanism," "Promotion of Reference Guidelines for the Installation of Road Traffic Signs, Markings, and Signals," and "Enhancement of Professional Manpower and Technical Skills for Road Safety Improvement," which were incorporated into the "National Road Traffic Safety Guideline and Action Plan (2024–2027)" for continued promotion.

3. Result Promotion and Benefits

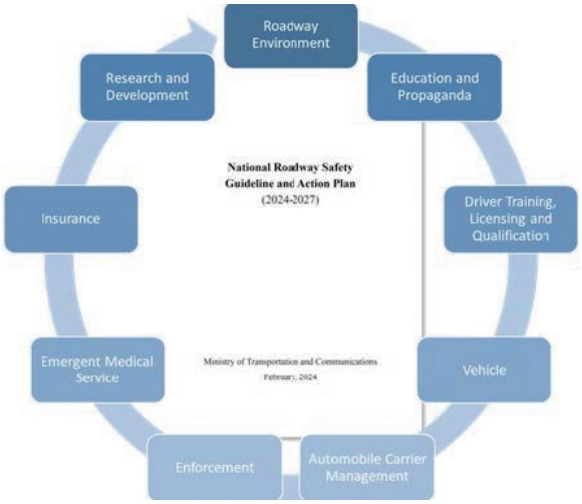
(1) Assisted the MOTC in holding expert and scholar forums, central ministry meetings, local government meetings, and civic group discussions on November 27 and 28, 2023, to build consensus and facilitate the drafting of "National Road Traffic Safety Guideline and Action Plan (2024–2027)."

(2) Assisted the MOTC in submitting the draft of "National Road Traffic Safety Outline Plan (2024–2027)" to the Executive Yuan and related review works.

4. 研究成果精華摘整



4. Summary of Research Results



國家道路交通安全綱要計畫架構

Structure of the national road traffic safety Guideline and Action plan

5. 研究成果報告

- 國家道路交通安全綱要計畫（113-116年）（113年2月7日行政院核定）。

5. Research Result Report

- National road traffic safety Guideline and Action plan (2024–2027) (approved by the Executive Yuan on February 7, 2024).

(三) 研擬重要道安改善原則及指引

1. 計畫概述

為改善道路交通安全，洗刷行人地獄惡名，本所依交通部指示研擬主題式交通工程改善的實務做法與相關原則，包含概念原則、改善圖例、與適用情境等，提供各級道路主管機關進行交通工程改善的參考應用，有助於提高行人安全，降低人車衝突，促進道路系統的運轉安全與效率。

2. 研究成果

（1）完成「人行空間改善原則」。

（2）完成「改善機車交通環境之原則及作法」。

（3）完成「有聲號誌設置指南」。

（4）完成「行人專用時相與行人早開時相設置原則」。

（5）完成「校園周邊人行空間改善參考指引」。

(III) Developing key principles and guidelines for road safety improvement

1. Project Overview

To improve road traffic safety and eliminate the reputation of pedestrian hell, under the direction of the MOTC, the institute has developed practical methods and related principles for themed traffic engineering improvements, including conceptual principles, improvement illustrations, and applicable scenarios. These are provided to road management authorities at all levels as references for traffic engineering improvements, which will help enhance pedestrian safety, reduce vehicle-pedestrian conflicts, and promote the safety and efficiency of road system operations.

2. Research Results

(1) Completed "Principles for pedestrian space improvement."

(2) Completed "Principles and practices for improving motorcycle traffic environments."

(3) Completed "Audible signal installation guidelines."

(4) Completed "Principles for the installation of pedestrian-only phases and pedestrian early start phases."

(5) Completed "Reference guidelines for improving pedestrian spaces around schools."

3. 成果推廣與效益

（1）各項研究成果已於112年4~12月間經交通部函頒各道路主管機關使用。

（2）相關改善措施可有效區分行人通行空間，減少人車衝突危險，並提供車輛合理的運行空間，統一各縣市相關作法，創造更人本與安全的交通環境。

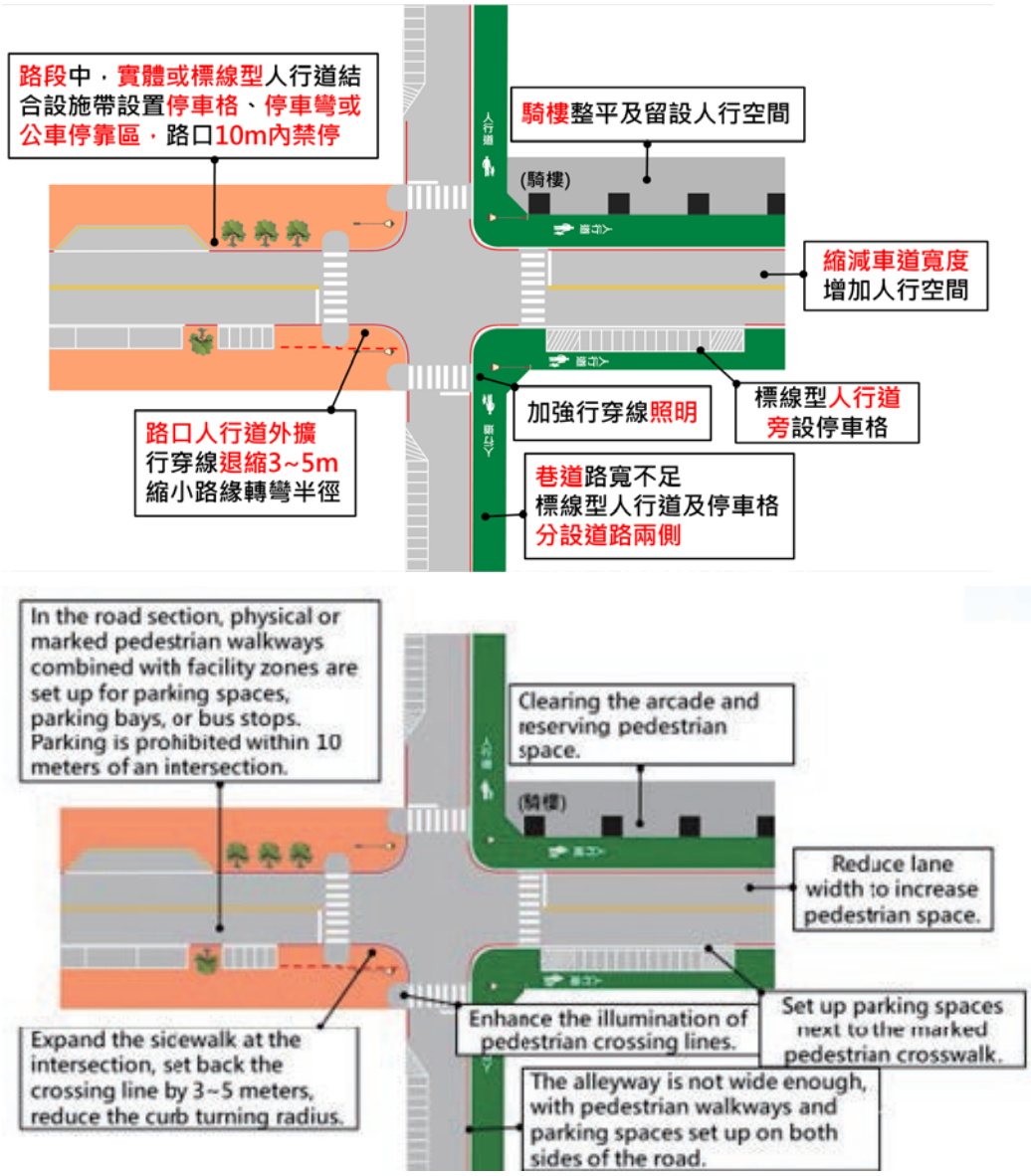
4. 研究成果精華摘整

3. Result Promotion and Benefits

(1) The results of various studies have been issued by the MOTC to road management authorities from April to December 2023.

(2) Related improvement measures can effectively distinguish pedestrian passage spaces, reduce the risk of vehicle-pedestrian conflicts, provide reasonable operating space for vehicles, unify related practices across counties and cities, and create a more human-centered and safe traffic environment.

4. Summary of Research Results



人行空間設計圖例

Examples of pedestrian space design pictures.

5. 研究成果報告

- 112年4月12日函頒「人行空間改善原則」。
- 112年5月4日函頒「改善機車交通環境之原則及作法」。
- 112年6月26日函頒「有聲號誌設置指南」。
- 112年7月5日函頒「行人專用時相與行人早開時相設置原則」。
- 112年12月27函頒「校園周邊人行空間改善參考指引」。

5. Research Result Report

- "Principles for pedestrian space improvement" issued on April 12, 2023.
- "Principles and practices for improving motorcycle traffic environments" issued on May 4, 2023.
- "Audible signal installation guidelines" issued on June 26, 2023.
- "Principles for the installation of pedestrian-only phases and pedestrian early start phases" issued on July 5, 2023.
- "Reference guidelines for improving pedestrian spaces around schools" issued on December 27, 2023.

(四) 研析國家鐵道安全計畫之安全績效與目標管理（1/2）－安全指標規劃與資料分析

1. 計畫概述

依據國家鐵道安全計畫（SSP），透過研訂具體之國家安全績效指標與目標值，引導鐵道營運機構自訂有效的安全領先指標，係鐵道監理推動績效目標管理的重要對策。112年透過國內外文獻蒐集、國內安全資料實證分析，已研提國家鐵道安全績效指標內容與目標值、鐵道營運機構安全領先指標，以及相關配套措施等短、中、長期之建議。

2. 研究成果

（1）完成先進國家鐵道監理機關與營運機構安全資料類型與績效指標內涵回顧。

（2）完成研析國家鐵道安全績效指標內容與目標值，以及鐵道營運機構安全領先指標。

（3）完成第1年實證分析，並提出所需法規修訂、未來安全資料蒐集、管理與分析等有效配套措施之建議。

(IV) Analyzing the safety performance and objective management of the railway state safety program (1/2) – development of safety indicators and data analysis

1. Project Overview

Based on the Railway State Safety Program (SSP), the formulation of specific national safety performance indicators and target values guides railway operating agencies to establish effective leading safety indicators, which are an important strategy for promoting performance goal management in railway supervision. In 2023, through the collection of domestic and international literature and empirical analysis of domestic safety data, we have proposed the contents and target values of national railway safety performance indicators, leading safety indicators for railway operating agencies, and related short-, medium-, and long-term recommendations.

2. Research Results

(1) Completed the review of types of safety data and the content of performance indicators from regulatory agencies and operating organizations in advanced countries.

(2) Completed the analysis of national railway safety performance indicators and target values, as well as the leading safety indicators for railway operating agencies.

(3) Completed the first year's empirical analysis and proposed effective supporting measures for the required regulatory amendments, future safety data collection, management, and analysis.

3. 成果推廣與效益

（1）辦理一場次成果說明會暨教育訓練以向鐵道監理機關、營運機構說明本計畫成果，協助更具體了解我國鐵道績效導向安全管理與監理（含安全績效指標）的現況以及後續規劃，並藉由實務交流與回饋，做為後續精進的參考。

（2）供國內鐵道營運機構了解所修訂之指標、評估流程、評估結果意義、營運機構配合作業方式（如資料蒐集）等，並說明我國營運機構如何從其現有的危害登記冊或其他營運安全風險管理作為中，研訂或精進內部安全績效指標（領先指標）。

（3）可提供鐵道監理機關掌握國家安全績效指標內容與目標值，並做為後續修正國家鐵道安全計畫（SSP）之參考應用。

（4）協助鐵道營運機構提昇安全管理系統作業水準。

4. 研究成果精華摘整

3. Result Promotion and Benefits

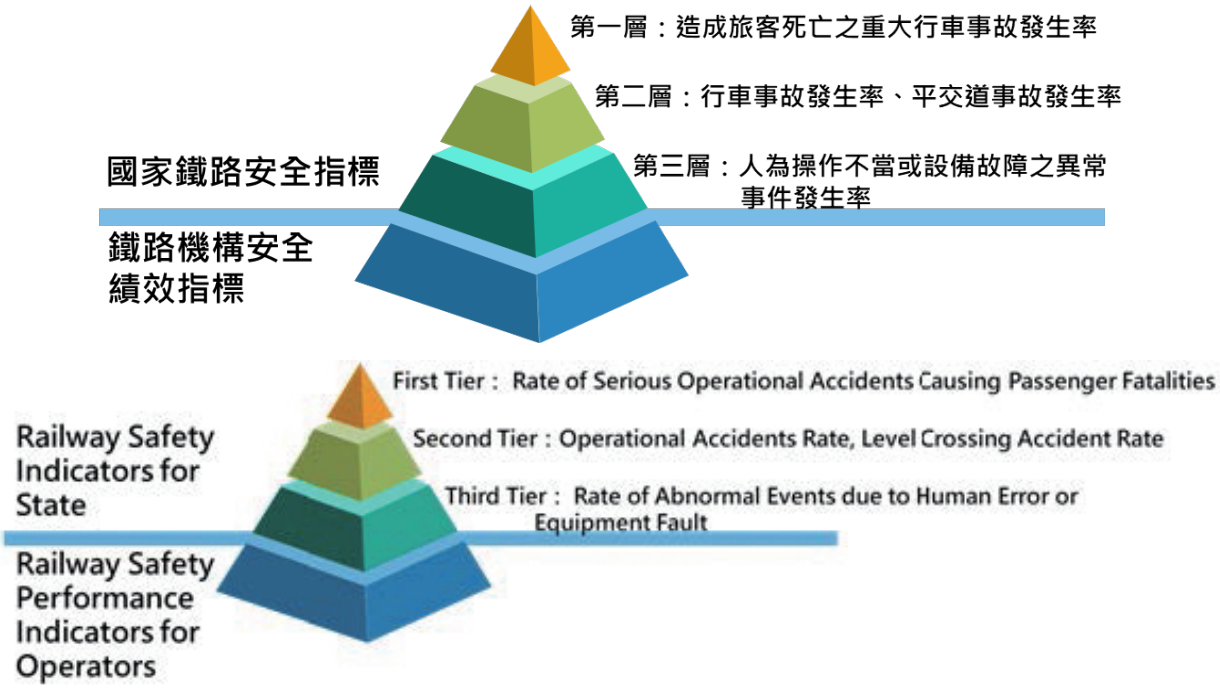
(1) Conducted a results briefing and training session to explain the project's outcomes to railway regulatory agencies and operating organizations, helping them better understand the current status and future planning of performance-oriented safety management and supervision (including safety performance indicators) in our country's railway system. Through practical exchanges and feedback, this serves as a reference for further improvement.

(2) Provided domestic railway operating agencies with information on the revised indicators, evaluation processes, the meaning of evaluation results, and how operating agencies can cooperate in tasks such as data collection. Explained how domestic operating agencies can develop or improve internal safety performance indicators (leading indicators) from their existing hazard registers or other operational safety risk management practices.

(3) This information allows railway regulatory agencies to grasp the content and target values of national safety performance indicators and serves as a reference for subsequent revisions to the Railway State Safety Program (SSP).

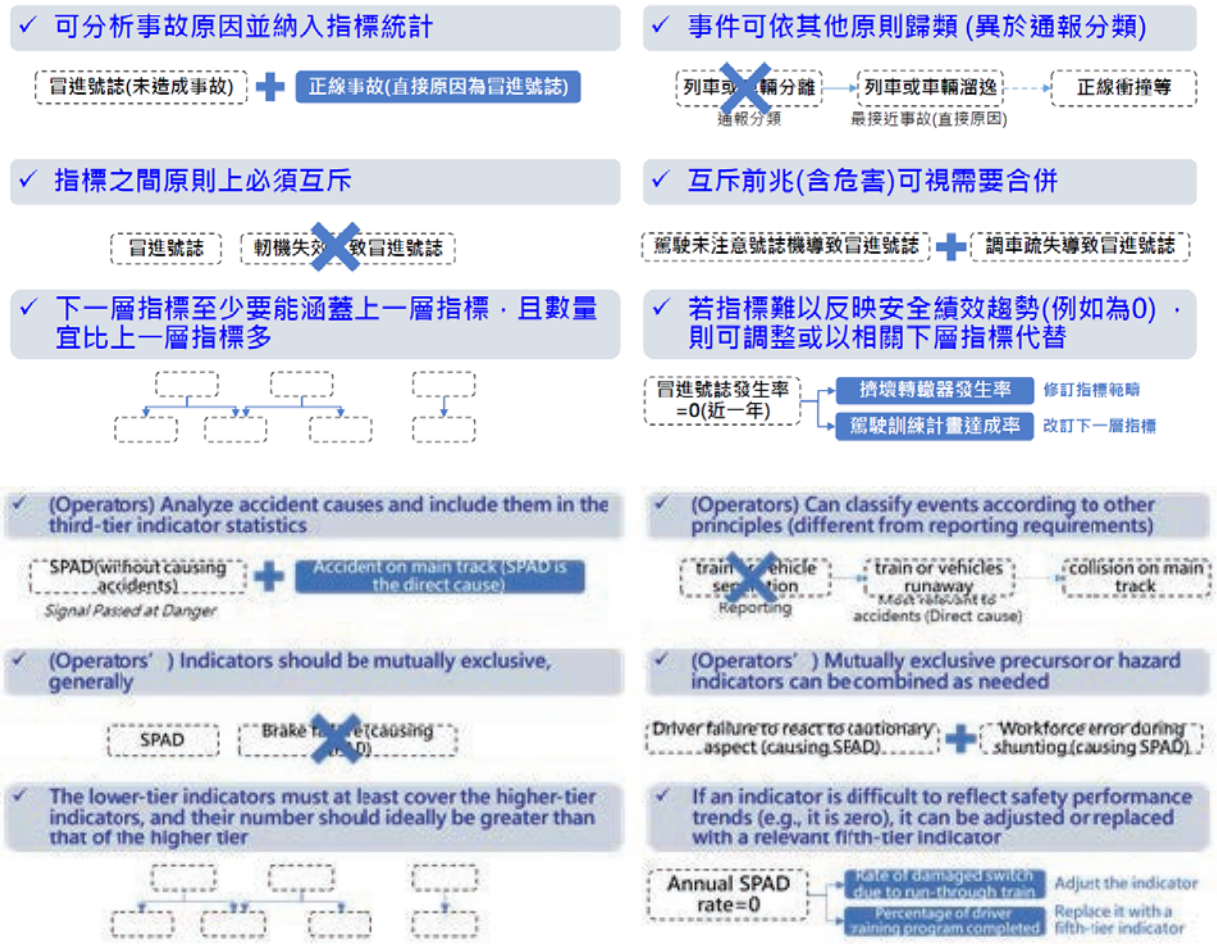
(4) It helps railway operating agencies enhance the operational level of their safety management systems.

4. Summary of Research Results



安全指標架構及現況

Safety indicator structure and current status



營運機構自訂指標之注意事項

Considerations for the self-determined indicators of operating agencies

5. 研究成果報告

- 研析國家鐵道安全計畫之安全績效與目標管理（1/2）－安全指標規劃與資料分析（期末報告已送委辦機關交通部鐵道局，不另出版報告）。

5. Research Result Report

- Application of Safety Performance Management by Objectives in Railway State Safety Program (1/2) – Development of Safety Indicators and Data Analysis (the final report has been submitted to the Commissioning Agency, the Railway Bureau of the MOTC, and will not be published separately).

(五) 大型車輛裝設主動預警輔助系統之試運行使用成效評估(2/4)－評估方法之先導測試

1. 計畫概述

行政院與交通部為協助國內科技研發業者，整合大型車輛相關主動預警輔助系統、訂定認驗證規範、提供試運行機會、帶動先進駕駛輔助系統(Advanced Driver Assistance System，ADAS)產業發展，以提升行車安全，爰辦理「交通部大型車輛裝設主動預警輔助系統」科研計畫(110-113年)。本計畫為該科研計畫之子計畫，目的為評估主動預警輔助系統裝設於試運行之大型車輛後，於實際道路上應用的使用成效。

本年度為110-113年之第2年期計畫，以110年(第1年期)建立之使用成效評估架構(包含成效評估資料需求、蒐集計畫、指標架構等)，111-112年依據「交通部大型車輛裝設主動預警輔助系統」之成效評估需求，設計使用成效評估方法(確立抽樣方法、受測者定義、實驗設計、實驗程序、資料分析及統計方法)，並配合設備研發、裝設期程啟動相關調查及資料蒐集程序，113年將進行試運行成效評估及4年計畫成果之綜整。

2. 研究成果

(1) 完成建立大型車輛裝設主動預警輔助系統之試運行使用成效評估方法。

(2) 完成建立成效評估資料蒐集計畫。

3. 成果推廣與效益

(1) 提供交通部科研計畫後續年度(111-113)成效評估架構規劃。

(2) 提供交通部納入「大型車輛裝設主動預警輔助系統補助要點」附件3受補助人應配合計畫執行事項。

(V) Evaluation of the trial operation of large vehicles installed with active warning assist system (2/4) – pilot testing of assessment methods

1. Project Overview

The Executive Yuan and the Ministry of Transportation have implemented the "MOTC's Scientific Research Project for the Installation of Active Warning Auxiliary Systems on Large Vehicles" (2021–2024) to assist domestic technology research and development companies. This project aims to integrate active warning auxiliary systems for large vehicles, establish certification and validation standards, provide trial operation opportunities, and promote the development of the advanced driver assistance system (ADAS) industry to enhance driving safety. This project is a sub-project of the aforementioned scientific research project, with the purpose of evaluating the effectiveness of active warning auxiliary systems installed on large vehicles during trial operations on actual roads.

This year is the second phase of the 2021–2024 project. Based on the effectiveness evaluation framework established in 2021 (the first phase), which included data requirements, collection plans, and indicator frameworks, the evaluation methods for 2022–2023 were designed according to the effectiveness evaluation needs of the "MOTC's Active Warning Auxiliary Systems Installation for Large Vehicles" project. These methods include determining sampling methods, defining test subjects, designing experiments, outlining experimental procedures, and specifying data analysis and statistical methods. In coordination with the equipment development and installation schedule, relevant surveys and data collection procedures will be initiated. In 2024, the trial operation effectiveness evaluation and the summary of four-year project results will be conducted.

2. Research Results

(1) Completed the establishment of trial operation effectiveness evaluation methods for installation of active warning auxiliary systems on large vehicles.

(2) Completed the development of a data collection plan for effectiveness evaluation.

3. Result Promotion and Benefits

(1) Provision of the evaluation framework planning for subsequent years (2022-2024) of the MOTC's scientific research project.

(2) Provision of guidelines for Appendix 3 "Large Vehicle Active Warning Auxiliary Systems Installation Subsidy" for recipients to cooperate with the project execution.

4. 研究成果精華摘整

成效評估指標圖
Effectiveness evaluation indicator chart

5. 研究成果報告

- 「大型車輛裝設主動預警輔助系統之試運行使用成效評估（2/4）：評估方法之先導測試」（預計113年7月陳報交通部）。

4. Summary of Research Results

5. Research Result Report

- "Evaluation of the trial operation of large vehicles installed with active warning assist system (2/4) – pilot testing of assessment methods" (expected to be reported to the MOTC in July 2024)

(六) 事故碰撞型態導向之路口設計範例推廣示範計畫（3/3）—非直轄市推廣應用（II）

1. 計畫概述

本所已於109年初步完成「事故型態導向之路口交通工程設計範例」，以路口常見的肇事型態為應用對象，彙整各肇事型態的交通工程改善設計範例，可直接應用於路口特定肇事型態的改善。為有效降低國內道路交通事故的發生，本計畫推動該研究成果設計範例的應用，訓練各交通主管機關之交通工程從業人員，熟悉各類型設計範例的應用情境，以及交通診斷學的整套作業流程，從而協助各級道路主管機關提昇易肇事路段改善的技術水準，帶動整體交通工程環境更趨於安全與友善。

(VI) The promotion of "traffic safety engineering design guidance for intersection based on accident types (3/3)" – application in non-municipality (II)

1. Project Overview

The institute initially completed "Intersection Traffic Engineering Design Examples Based on Accident Types" in 2020, targeting common intersection accident types. This compilation of traffic engineering improvement design examples can be directly applied to specific intersection accident types. To effectively reduce road traffic accidents in Taiwan, this project promotes the application of these design examples, training traffic engineers from various traffic management agencies to become familiar with the application scenarios of different design examples and the entire process of traffic diagnostics. This initiative aims to assist road management agencies at all levels in enhancing their techniques for improving accident-prone road sections, leading to a safer and more user-friendly traffic engineering environment.

2. 研究成果

（1）本計畫推動過去累積的易肇事交叉口改善設計範例之應用，以訓練各交通主管機關之交通工程從業人員，使相關人員可熟悉各種設計範例的應用情境，以及肇事診斷學的作業流程，進而提升交通工程環境之安全水準。

（2）配合「第41期台灣地區易肇事路段改善計畫」在宜蘭縣、花蓮縣、臺東縣、澎湖縣、金門縣、連江縣、雲林縣、屏東縣所建議之示範改善地點，進行分析與初擬改善方案，並於現場會勘檢討會議中，協助對示範改善地點的改善方案進行討論。

（3）各示範地點的改善項目，主要以適當車道配置與導引、縮小面積過大的交叉口、改善車流動線與提供行人適當穿越空間為原則。

3. 成果推廣與效益

（1）本計畫於8縣市研議的示範改善地點，部分獲地方政府納入「第41期臺灣地區易肇事路段改善計畫」並辦理交通工程改善，並將於113年陸續完成改善施工，實質改善當地交通安全。

（2）112年6月9日～30日於宜蘭縣、花蓮縣、澎湖縣、金門縣、雲林縣、屏東縣辦理6場次之推廣教育訓練座談會，訓練各交通主管機關之交通工程從業人員熟悉各種設計範例的應用情境，以及肇事診斷學的作業流程，進而提升交通工程環境之安全水準。

2. Research Results

(1) The project promotes the application of accumulated improvement design examples for accident-prone intersections by training traffic engineers from various traffic management agencies. This training helps them become familiar with different design scenarios and the operational processes of accident diagnostics, thereby improving the safety level of traffic engineering environment.

(2) In conjunction with the "The 41st Project for Improving Accident-Prone Road Sections in Taiwan," analysis and preliminary improvement plans were conducted for the recommended demonstration improvement sites in Yilan County, Hualien County, Taitung County, Penghu County, Kinmen County, Lienchiang County, Yunlin County, and Pingtung County. During on-site inspection meetings, we assisted in discussing improvement plans for these demonstration sites.

(3) The main improvement items at each demonstration site focused on appropriate lane configuration and guidance, reducing the size of overly large intersections, improving traffic flow lines, and providing adequate pedestrian crossing spaces.

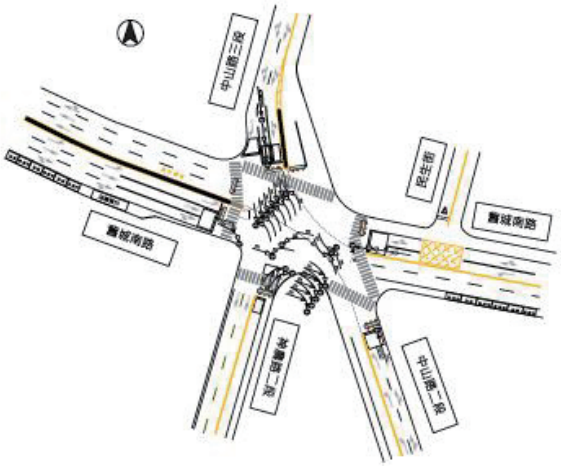
3. Result Promotion and Benefits

(1) Some of the demonstration sites discussed under the project in 8 counties were adopted by local governments into the "41st Phase of Taiwan Accident-prone Road Improvement Project" and have undergone traffic engineering improvements, which are expected to be completed in 2024, significantly enhancing local traffic safety.

(2) From June 9 to 30, 2023, six promotion and education training seminars were held in Yilan County, Hualien County, Penghu County, Kinmen County, Yunlin County, and Pingtung County. These seminars trained traffic engineers from various traffic management agencies to become familiar with the application scenarios of various design examples and the operational processes of accident diagnostics, thereby improving the safety level of traffic engineering environment.

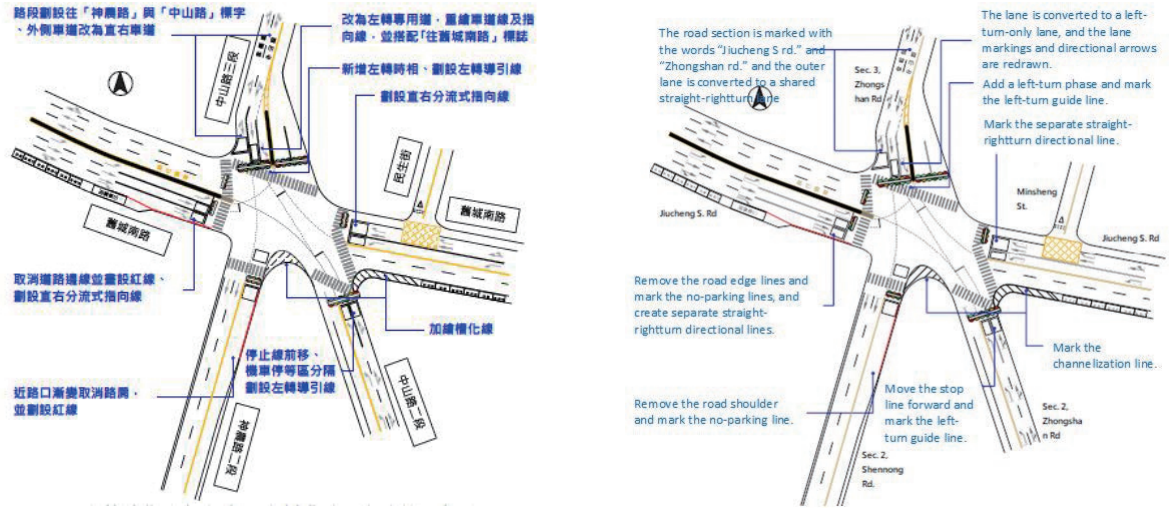
4. 研究成果精華摘整

4. Summary of Research Results



宜蘭縣舊城南路/中山路/神農路碰撞構圖

Collision diagram of Jiuchengnan Road/Zhongshan Road/Shennong Road, Yilan County.



宜蘭縣舊城南路/中山路/神農路研究改善示意圖

Illustrative improvement diagram for Jiuchengnan Road/Zhongshan Road/Shennong Road, Yilan County

5. 研究成果報告

- 事故碰撞型態導向之路口設計範例推廣示範計畫(3/3)－非直轄市推廣應用(II)(預計113年7月出版)。

5. Research Result Report

- The promotion of "traffic safety engineering design guidance for intersection based on accident types (3/3)" – application in non-municipality (II) (Scheduled to be published in July 2024).

(七) 臺灣地區易肇事路段改善計畫

1. 計畫概述

隨著我國經濟發展，道路周邊的土地使用及產業活動等不斷隨著時間變化下，道路建設、交通狀況與交通流量也不斷地遞移。因此，為因應道路環境與交通狀況的改變，並且有效降低可能衍生的更多交通事故狀況，以維護道路安全及有效、持續不斷地改進道路交通設施，臺灣地區易肇事路段改善計畫已列為交通部每年提昇道路安全之重要工作。

本計畫係依據院頒「道路交通秩序與交通安全改進方案」，由交通部列為長期性之任務，並責由本所自民國69年開始辦理第1期計畫，至111年已完成40期，並持續辦理報告研提及執行。

本計畫主要針對各縣市政府轄區內易肇事路段做為改善範圍，自第37期開始，由交通部投入相關補助經費機制引導改善，結合本所107年至109年「事故型態導向之路口交通工程設計範例」系列研究成果，及110年辦理「事故碰撞型態導向之路口設計範例推廣示範計畫(1/3)－直轄市推廣應用」計畫等，致力提升各道路主管機關的易肇事路段改善技術能力。另自第39期計畫起，為協助各縣市道安會報自行登入交通部道安資訊平台篩選出20處易肇事路段及下載相關資料，改由本所製作操作範例，提供各縣市政府自行參考其道路狀況、交通特性及肇事紀錄等需求列入改善地點，並據以研提改善方案送本所彙整。此外，於第40期計畫起，本所結合事故碰撞型態導向之路口設計範例推廣示範計畫、區域運輸發展研究中心及交通部道安會院頒「道路交通秩序與交通安全改進方案」等，以進一步協助各縣市道安會報提升道安改善能量。

(VII) The project for improving accident-prone road sections in taiwan area

1. Project Overview

With the development of our country's economy, land use and industrial activities around roads have continuously changed over time, and consequently, road construction, traffic conditions, and traffic flow have also been constantly evolving. Therefore, to respond to changes in the road environment and traffic conditions, and to effectively reduce the potential for more traffic accidents, the improvement plan for accident-prone road sections in Taiwan has been listed as an important annual task by the MOTC to enhance road safety and continuously improve road traffic facilities.

This project, based on the "Road Traffic Order and Traffic Safety Improvement Program" issued by the Executive Yuan, has been listed as a long-term task by the MOTC. It has been implemented by the institute since 1980 with the first phase, and by 2022, 40 phases have been completed with ongoing reporting, proposals, and execution.

The project primarily targets accident-prone road sections within the jurisdictions of various county and city governments. Starting from the 37th phase, the MOTC has provided funding mechanisms to guide improvements, integrating research results from the institute's "Intersection Traffic Engineering Design Examples Oriented by Accident Types" series from 2018 to 2020 and "Promotion and Demonstration Plan of Intersection Design Examples Oriented by Accident Collision Types (1/3) – Promotion and Application in Special Municipalities" project in 2021, to enhance the technical capabilities of road authorities in improving accident-prone road sections. Also, starting from the 39th phase, to assist county and city road safety committees in independently logging into the MOTC's road safety information platform to select 20 accident-prone road sections and download related data, the institute has created operational examples for each county and city government to reference based on their road conditions, traffic characteristics, and accident records to include in improvement plans. These plans are then submitted to the institute for consolidation and approval. In addition, starting from the 40th phase, the institute has combined "Promotion and Demonstration Plan of Intersection Design Examples Oriented by Accident Collision Types," the regional transportation development research center, and the MOTC's road safety committees' "Road Traffic Order and Traffic Safety Improvement Program" to further assist county and city road safety committees in enhancing their road safety improvement capabilities.

2. 研究成果

（1）完成蒐集歷年臺灣地區道路交通事故資料，並分析易肇事路段之肇事次數、死亡人數、受傷人數等資料。

（2）完成易肇事路段現地會勘工作，並提出改善方案彙整成報告書報部核定後，送各道路主管機關據以執行。

3. 成果推廣與效益

（1）透過「事故型態導向之路口交通工程設計範例」、「事故碰撞型態導向之路口設計範例推廣示範計畫」及「區域運輸發展研究中心服務升級2.0計畫」指定型計畫之推動，有效將本所歷年交通工程技術發展計畫之相關成果推廣至第一線交通工程從業人員，實際協助易肇事路口改善，並可進一步精進其易肇事路段改善技術。整體而言，可達到中央地方協力改善道路交通安全，降低交通事故死傷人數之效益。

（2）如期如質完成第41期易肇事路段改善計畫，以陳報交通部核定，做為各縣市之改善依據，提升道路交通安全。

4. 研究成果精華摘整

2. Research Results

(1) Completed the collection and analysis of historical road traffic accident data in Taiwan, examining accident frequency, fatalities, and injuries on accident-prone road sections.

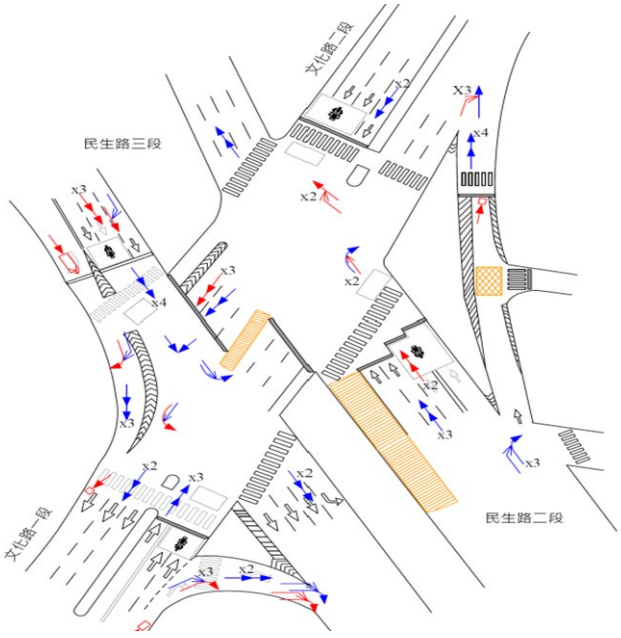
(2) Field inspections are conducted for these sections, and improvement proposals are compiled into reports and submitted to the Ministry for approval before being executed by the respective road authorities.

3. Result Promotion and Benefits

(1) Through the promotion of "Intersection Traffic Engineering Design Examples Oriented by Accident Types," "Promotion and Demonstration Plan of Intersection Design Examples Oriented by Accident Collision Types," and the "Regional Transportation Development Research Center Service Upgrade Plan 2.0," the institute has effectively disseminated the results of its traffic engineering development plans to front-line traffic engineers, assisting in the practical improvement of accident-prone intersections and enhancing their technical capabilities. Overall, these efforts aim to achieve collaborative improvement of road traffic safety between central and local governments, reducing the number of traffic accident fatalities and injuries.

(2) The 41st project for improving accident-prone road sections is to be completed on schedule, submitted to the MOTC for approval, and used as a basis for improvement by county and city governments to enhance road traffic safety.

4. Summary of Research Results



易肇事路段事故型態分析技術－事故碰撞構圖

Accident-prone road section accident type analysis technology – accident collision diagrams

5. 研究成果報告

- 第41期臺灣地區易肇事路段改善計畫（預計113年7月出版）。

(八) 建立自行車環島、多元及串聯路線之自行車事故分析及改善機制

1. 計畫概述

本計畫為建立自行車環島、多元及串聯路線之自行車事故分析及改善機制，藉由蒐集內政部警政署道路交通事故資料與全國自行車路網圖資，以進行空間疊合確立研究範圍與對象，並於計畫執行期間將分別挑選10處（111年期）及20處（112年期）事故熱區進行碰撞構圖分析，以掌握國內自行車路線之自行車事故樣態。最終依據分析成果彙整成專章分析報告，從而研提自行車路線之自行車事故分析改善機制，可提供自行車路線管理機關改善參考應用。

2. 研究成果

（1）開發「自行車路網事故分析平台」且併入交通部道安資訊平台。

（2）分析及會勘30處自行車路線事故熱點，並完成112年診斷報告、研提自行車路線之自行車事故分析及改善機制。

3. 成果推廣與效益

（1）「自行車路網事故分析平台」併入交通部道安資訊平台之自行車路線專區，可提供交通部及自行車路網管理機關使用，以快速掌握自行車路線事故狀況及特性。

（2）完成自行車路線之自行車事故分析及改善機制及診斷報告，可提供交通部及管理機關後續推動自行車路線之交通安全管理，據以改善自行車路線之交通安全。

5. Research Result Report

- The 41st project for improving accident-prone road sections in taiwan area (Scheduled to be published in July 2024).

(VIII) The establishment of a bicycle accident analysis and improvement mechanism for island-wide, diverse, and connected bicycle routes

1. Project Overview

This project aims to establish a mechanism for analyzing and improving bicycle accidents on round-the-island, diverse, and interconnected routes. By collecting road traffic accident data from the National Police Agency of the Ministry of Interior and the national bicycle network map data, spatial overlay will be used to determine the research scope and targets. During the project implementation period, 10 accident hotspots will be selected for analysis in 2022 and 20 in the 2023 to understand the accident patterns on domestic bicycle routes. The final analysis results will be compiled into a specialized analysis report, proposing a mechanism for analyzing and improving bicycle accidents on bicycle routes, which can be used as a reference for bicycle route management authorities.

2. Research Results

(1) The "Bicycle Network Accident Analysis Platform" will be developed and integrated into the MOTC's road safety information platform.

(2) Thirty bicycle route accident hotspots will be analyzed and inspected, and a diagnostic report will be completed in 2023, proposing a mechanism for analyzing and improving bicycle accidents on bicycle routes.

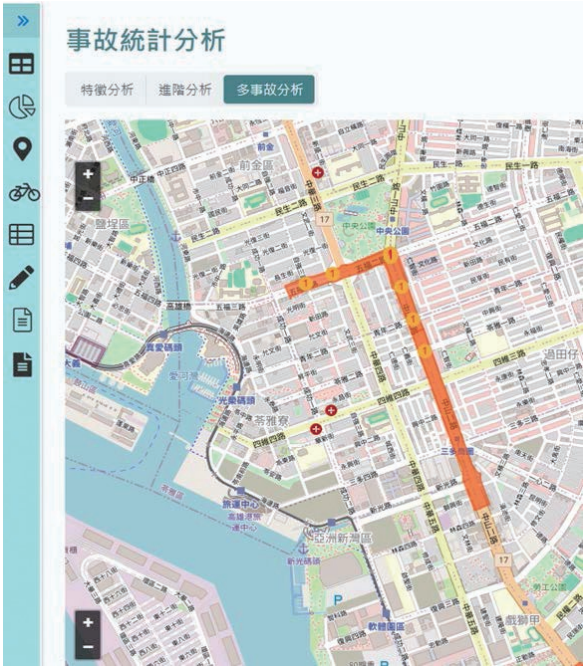
3. Result Promotion and Benefits

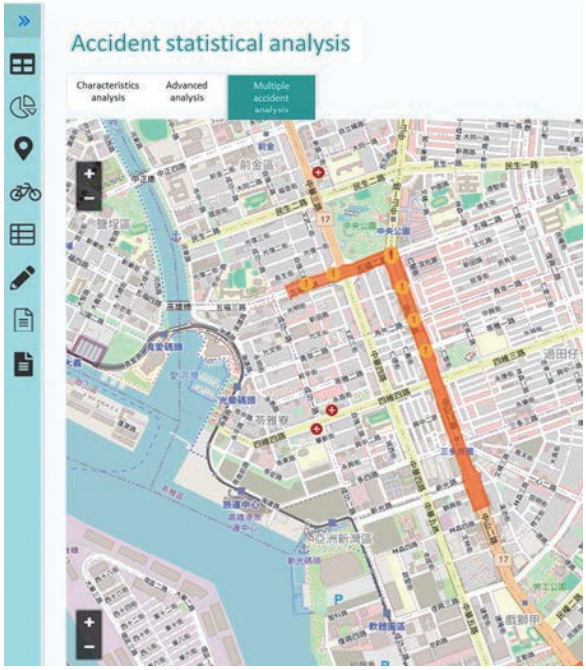
(1) The "Bicycle Network Accident Analysis Platform" integrated into the MOTC's road safety information platform's bicycle route section will enable the MOTC and bicycle network management authorities to quickly grasp the status and characteristics of bicycle route accidents.

(2) The completion of bicycle accident analysis and improvement mechanism and diagnostic report on bicycle routes can provide the MOTC and management agencies with the subsequent promotion of traffic safety management on bicycle routes, thereby improving traffic safety on these routes.

4. 研究成果精華摘整

4. Summary of Research Results





「自行車路網事故分析平台」之事故統計分析

Statistical Analysis of bicycle accidents on "Bicycle Network Accident Analysis Platform"

5. 研究成果報告

- 「建立自行車環島、多元及串聯路線之自行車事故分析及改善機制」（預計113年7月出版）。

5. Research Result Report

- "Establishing a mechanism for analyzing and improving bicycle accidents on round-the-island, diverse, and interconnected routes" (Scheduled to be published in July 2024).

六 推動交通科技創新應用與產業發展

(一) 構建5G智慧交通數位神經中樞－功能擴充與精進

1. 計畫概述

交通部依據「數位國家•創新經濟發展方案」、「臺灣5G行動計畫」等重要施政重點，責成本所、公路局與鐵道局共同擬具「推動5G提升智慧交通服務效能與安全計畫」（行政院109年9月3日院臺科會字第1090098342號函核定），計畫期程自110年至114年8月。其中由本所負責執行構建5G智慧交通數位神經中樞規劃與實作等系列計畫。本計畫係承續110年至111年完成之相關研究規劃與階段性推動執行成果，辦理112-113年智慧交通數位神經中樞系統之功能擴充與精進作業，持續擴充示範城市實證場域範圍與所需偵測設備、提升緊急救援車輛智慧優先號控功能、發展人工智慧交通管理／公共運輸之相關模式庫與知識庫，並將所研發之相關關鍵技術整合於112年完成第一階段智慧交通數位神經中樞系統，113年亦將持續發展智慧交通管理所需相關決策支援模式，並完成概念性驗證及實作，俾利交通管理單位提供最佳緊急應變與交管決策，以提升車流運作效率及交通安全。

2. 研究成果

（1）整合所研發的相關關鍵技術，應用數位雙生（Digital Twins）模型，完成第一階段智慧交通數位神經中樞系統。透過數位雙生模型以視覺化呈現各項交通監控與預測成果，所發展之交通管理相關模式庫已可預測車流即將壅塞，並於30分鐘前提出示警，以利交通管理單位即時採行應變作為。

（2）完成因應5G車聯網與人工智慧需求之都市交通控制通訊協定3.0版檢討作業，並擬訂都市交通控制通訊協定3.5版（草案）。

VI Promote the Innovative Application of Transportation Technology and Industrial Development

(I) Construction of 5G intelligent transportation digital nerve center – function expansion and enhancement

1. Project Overview

In line with key government policies such as the "Digital Nation and Innovative Economic Development Program" and "Taiwan 5G Action Plan," the MOTC tasked the institute, along with the Highway Bureau and the Railway Bureau, to jointly formulate "Plan to Enhance Smart Transportation Service Efficiency and Safety through 5G" (approved by the Executive Yuan on September 3, 2020, Document No. 1090098342). The project period is from 2021 to August 2025. The institute is responsible for planning and implementing the series of projects to build 5G smart transportation digital nerve center. This project continues the related research planning and phased implementation results completed from 2021 to 2022, and carries out the function expansion and refinement of the smart transportation digital nerve center system in 2023–2024. It continues to expand the scope of demonstration city pilot sites and the necessary detection equipment, enhance the smart priority control functions for emergency rescue vehicles, develop relevant model and knowledge bases for AI-based traffic management/public transportation, and integrate the key technologies developed into the first phase of the smart transportation digital nerve center system completed in 2023. In 2024, the development of related decision support models required for smart traffic management will continue, and conceptual verification and implementation will be completed to assist traffic management units in providing optimal emergency response and traffic management decisions, thereby improving traffic flow efficiency and safety.

2. Research Results

(1) The integration of developed key technologies and applying the digital twins model to complete the first phase of smart transportation digital nerve center system. Using the digital twins model to visualize various traffic monitoring and forecasting results, the developed traffic management model library can predict impending traffic congestion and issue warnings 30 minutes in advance, allowing traffic management units to take timely response measures.

(2) The review of the urban traffic control communication protocol version 3.0 in response to 5G vehicular networks and AI needs has been completed, and the draft of version 3.5 has been formulated.

（3）本計畫相關成果同時榮獲中華智慧運輸協會「2023年智慧運輸論文獎」以及中華民國運輸學會112年度「傑出交通運輸計畫獎」。

3. 成果推廣與效益

（1）112年11月22日舉辦「構建5G智慧交通數位神經中樞-功能擴充與精進」112年成果交流座談會，邀請國內各縣市交通管理與實務應用單位參加，以案例情境方式說明智慧交通數位神經中樞系統功能擴充成果，以推廣本計畫重要研究成果與應用經驗。

（2）112年11月22日辦理完成「都市交通控制通訊協定3.0版檢討成果」交流工作坊，以實務案例應用情境說明新版通訊協定相關指令使用方式、協定使用時機與順序，以及如何透過協定的組合來達成交通控制與管理目標，以支援未來城市智慧移動之各式創新應用服務。

（3）計畫成果已摘錄論文於「中華民國運輸學會2023年會暨學術論文國際研討會」、「運輸學刊」發表相關研究成果共計2篇，以提供各界瞭解及研討與應用。

4. 研究成果精華摘整

(3) The project results have also won "2023 Smart Transportation Thesis Award" from ITS Taiwan and "2023 Outstanding Transportation Project Award" from the Chinese Institute of Transportation.

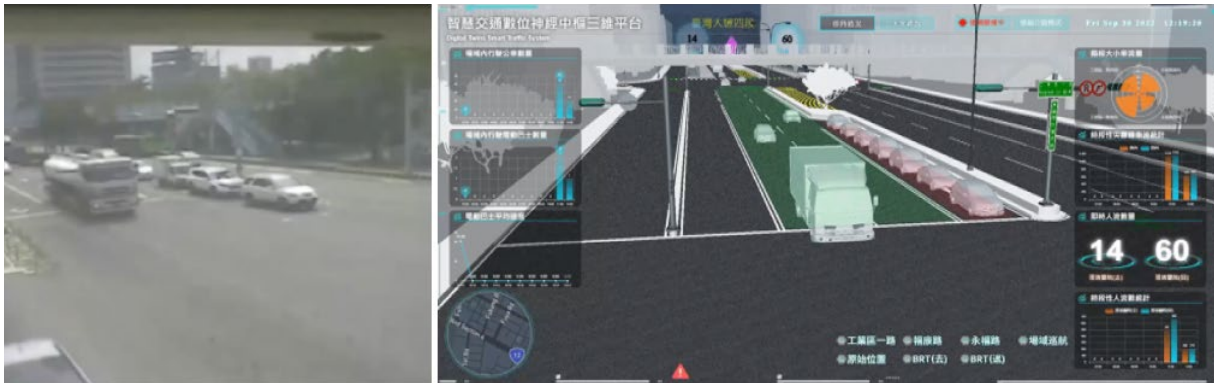
3. Result Promotion and Benefits

(1) On November 22, 2023, a results exchange s emina r on " Construction of 5G Intelligent Transportation Digital Nerve Center – Function Expansion and Enhancement" was held, inviting traffic management and practical application units from various counties and cities to participate. The seminar explained the function expansion results of the smart transportation digital nerve center system through case scenarios, promoting the important research results and application experiences of this project.

(2) On November 22, 2023, a workshop on "Urban Traffic Control Communication Protocol Version 3.0 Review Results" was also held, explaining the use of new communication protocol commands, the timing and sequence of protocol usage, and how to achieve traffic control and management goals through protocol combinations using practical case application scenarios, to support various innovative applications of smart urban mobility in the future.

(3) The project results have been excerpted and published in two papers presented at "2023 Annual Conference and International Symposium on Transportation Research" and the "Journal of Transportation," providing insights and discussions for various sectors.

4. Summary of Research Results



智慧交通數位神經中樞系統－數位雙生示意畫面
左圖為AICam影像現況；右圖為數位雙生平台（路段顏色會依據車流量以紅綠呈現）

Intelligent transportation digital nerve center system – digital twin schematic
The left image shows the current status from AICam; and the right image displays the digital twin platform (with road segment colors indicating traffic volume in red and green)

5. 研究成果報告

- 構建5G智慧交通數位神經中樞－功能擴充與精進（本計畫屬兩年期計畫，執行至113年底，預計114年4月出版）。

（二）我國人工智慧車聯網之號誌控制（1/2）－都會區幹道實作與交流道區域模式發展

1. 計畫概述

近年來人工智慧在軟硬體技術的突飛猛進與各領域應用的迅速發展，可預期未來運用人工智慧（AI）、影像辨識、資通訊（ICT）、車聯網（V2X）與5G等技術，特別有助於紓緩因交通號誌控制不夠智慧，導致民眾行的痛點。本計畫延續111年「我國人工智慧車聯網之號誌控制模式探討」之研究計畫，進行與縣市政府合作之現場實驗測試，實作測試過程中持續精進AI強化學習（RL）號誌控制模式，透過強化學習通用環境之探討與建置、導入多目標強化學習演算法、以及探討車流模擬測試模型於各種車流場景之泛用性，期望能提升人工智慧號誌控制模式之運作效率。此外，同時納入高速公路交流道區域之人工智慧號誌協控課題、優先構建交流道區域號誌協控車流模擬環境、以及進行分散式AI號誌協控模型（多代理人機制）初步發展設計，以期逐步構建我國在人工智慧號誌控制實力，期能支援我國都市智慧號誌控制在人工智慧導入後之車流運作效率及交通安全提升。

2. 研究成果

（1）與臺北市政府、臺南市政府合作分別於「中山北路-德行東路」多路口幹道、「台86-19甲」單一路口等2個實驗場域完成多目標強化學習都會區號誌控制模型的發展與訓練、強化學習號誌控制核心運作模組開發、實測與量化績效評估。

（2）進行交流道區域之高速公路與市區道路號誌協控文獻回顧與實驗場域評估，遴選國道1號楊梅交流道為實驗場域，以及進行AI RL號誌協控模型之交通參數與績效指標等設計。

5. Research Result Report

- Construction of 5G intelligent digital nerve center – function expansion and enhancement (this project is a two-year plan, executed until the end of 2024, scheduled to be published in April 2025).

(II) Study of artificial intelligence traffic signal control (1/2) – urban main roads and highway interchange areas implementation

1. Project Overview

In recent years, rapid advancements in both hardware and software technologies, as well as the swift development of applications across various fields, have led to the anticipation that the future use of artificial intelligence (AI), image recognition, information and communication technology (ICT), vehicle-to-everything (V2X), and 5G technologies will be particularly helpful in alleviating the pain points caused by insufficiently intelligent traffic signal control. This project continues the 2022 study of "Exploring AI-based Traffic Signal Control Models in Taiwan," conducting field experimental tests in collaboration with county and city governments. During these tests, AI reinforcement learning (RL) traffic signal control models were continuously improved by exploring and building a general environment for reinforcement learning, introducing multi-objective reinforcement learning algorithms, and exploring the applicability of traffic simulation test models in various traffic scenarios to improve the efficiency of AI-based traffic signal control models. In addition, the project included topics on AI signal coordination and control in freeway interchange areas, prioritizing the construction of traffic signal coordination and control simulation environments for interchange areas, and preliminary development and design of distributed AI signal coordination and control models (multi-agent mechanism) to gradually build Taiwan's AI-based traffic signal control capabilities, aiming to enhance the efficiency and safety of urban traffic operations with the introduction of AI.

2. Research Results

(1) In cooperation with the Taipei City government and the Tainan City government, the development and training of multi-objective reinforcement learning urban traffic signal control models, the development of core operational modules for reinforcement learning traffic signal control, and field tests and quantitative performance evaluations were completed at these two experimental sites: "Zhongshan North Road – Dexing East Road" multi-intersection arterial road and "Tai 86-19A" single intersection in Taipei and Tainan cities, respectively.

(2) Literature reviews and experimental site evaluations for traffic signal coordination and control in freeway and urban road interchange areas were conducted, selecting Yangmei Interchange of National Freeway No. 1 as the experimental site and designing AI RL signal coordination and control models' traffic parameters and performance indicators.

3. 成果推廣與效益

（1）於112年11月27日辦理「我國人工智慧車聯網之號誌控制（1/2）－都會區幹道實作與交流道區域模式發展探討成果分享會」邀請各縣市政府、學術界與產業界參與。

（2）透過成果分享會來推廣本計畫之研究成果，並於112年11月29日辦理教育訓練。透過中華民國運輸學會2023年學術論文國際研討會，進行參展與「應用多目標深度強化學習於號誌控制策略-都會區幹道發展與探討」論文發表與各界分享計畫成果。

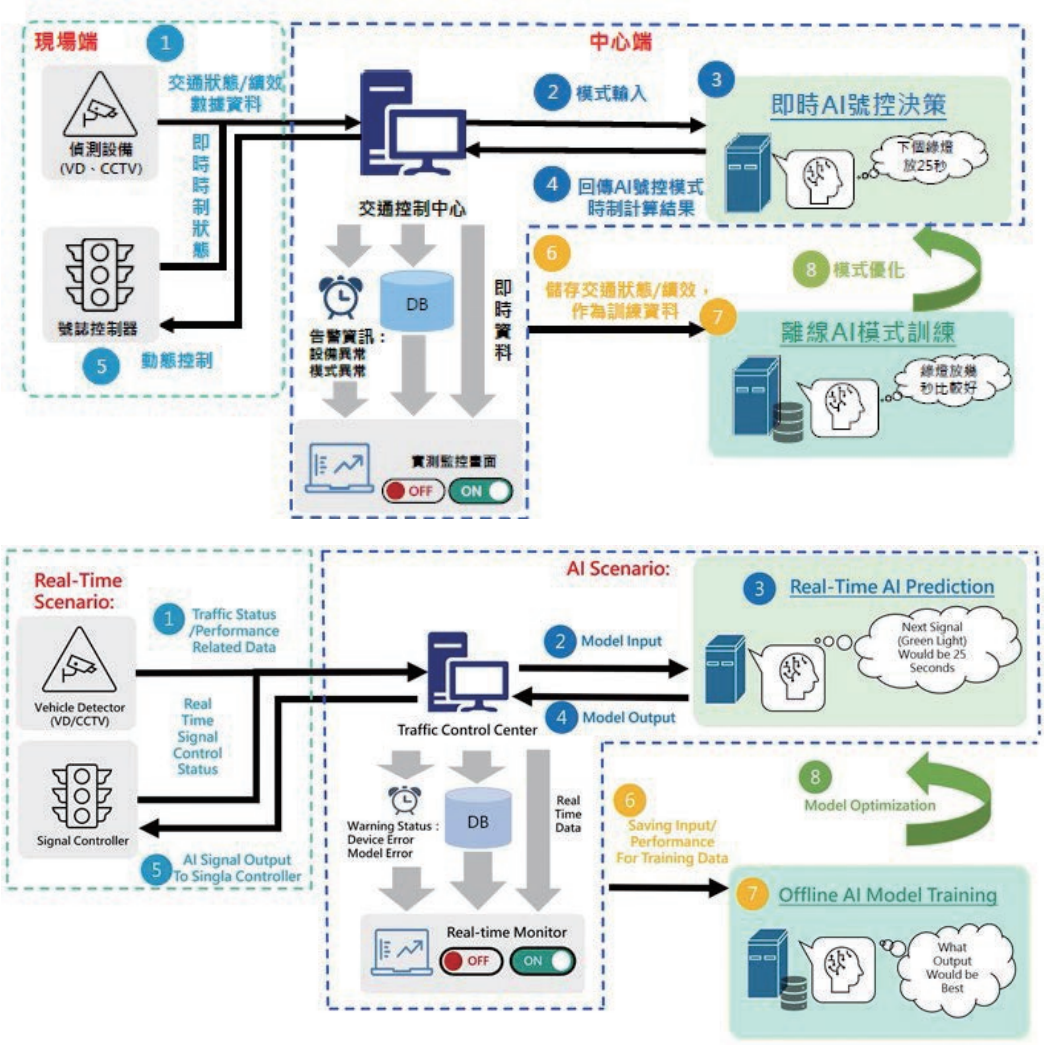
3. Result Promotion and Benefits

(1) On November 27, 2023, "AI-based traffic signal control in Taiwan (1/2) – implementation on urban arterial roads and development of interchange area model results sharing conference" was held, inviting participation from county and city governments, academia, and industry.

(2) The results sharing conference promoted research outcomes of the project, followed by a training session on November 29, 2023. Through the 2023 international academic conference of the Chinese Institute of Transportation, the project exhibited and presented the "Application of multi-objective deep reinforcement learning in traffic signal control strategies – development and exploration on urban arterial roads" paper, sharing the project's outcomes with various sectors.

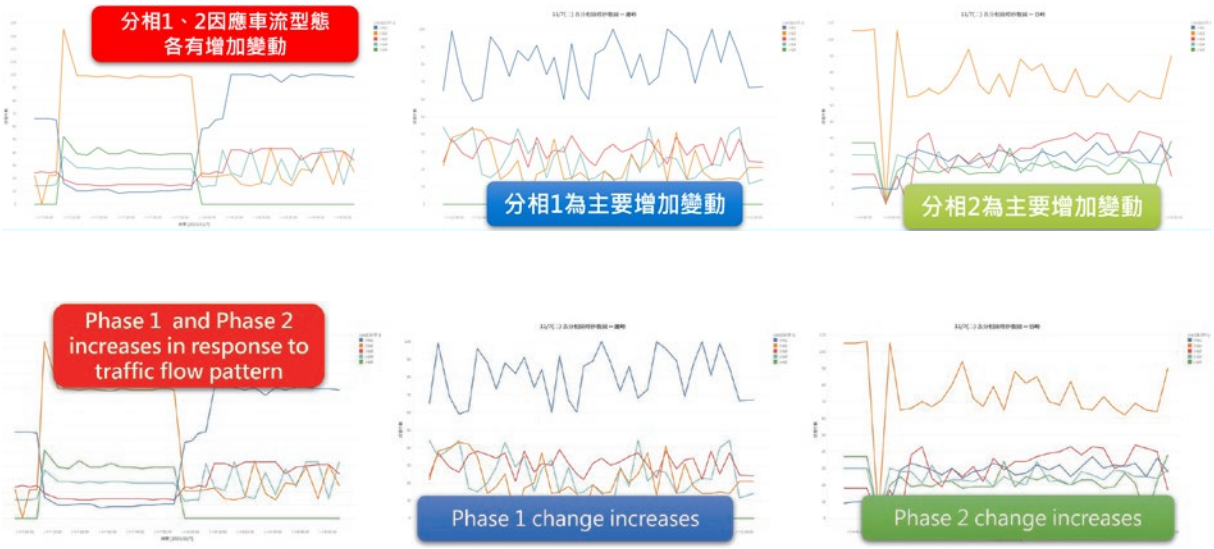
4. 研究成果精華摘整

4. Summary of Research Results



強化學習號誌控制核心模組

Reinforcement learning traffic signal control core module



臺南市實驗場域強化學習號誌控制實測時各時段分相綠燈秒數變化

Changes in green light seconds for each phase during different time periods in Tainan experimental field reinforcement learning signal control test

5. 研究成果報告

- 我國人工智慧車聯網之號誌控制（1/2）－都會區幹道實作與交流道區域模式發展（預計113年7月出版）。

5. Research Result Report

- Study of artificial intelligence traffic signal control (1/2) – urban main roads and highway interchange areas implementation (Scheduled to be published in July 2024).

(三)應用人工智慧分析技術探勘高風險路段(3/4)－行車異常事件及高風險駕駛行為分析

1. 計畫概述

近年先進駕駛輔助系統（ADAS）日益普遍，越來越多運輸業者於轄下車輛加裝相關設備，以在危險狀況下警示駕駛人，避免事故發生。為優化ADAS系統於安全分析之應用，本4年期計畫與國道客運業者合作蒐集大量行車影像、駕駛行為及行車安全警示紀錄，應用影像辨識技術分析車外、車內異常事件，從大量的警示當中找出真正具有安全風險的異常事件，並進而從空間層面探討異常事件的好發熱區，以及研提行為導向之高風險路段改善（道路主管機關）及整合至安全管理系統（運輸業者）的可行方案。

(III) Applying artificial intelligent method for exploring risk-prone road section (3/4) – aberrant events and risky driving behavior analysis

1. Project Overview

In recent years, advanced driver assistance systems (ADAS) have become increasingly common, with more and more transportation operators equipping their vehicles with related devices to warn drivers of dangerous situations and prevent accidents. To optimize the application of ADAS in safety analysis, this four-year project collaborates with national highway bus operators to collect a large amount of driving footage, driver behavior, and driving safety alert records. Image recognition technology is used to analyze abnormal events outside and inside the vehicle, identify genuinely risky abnormal events from numerous alerts, and explore high-risk areas spatially. It also proposes behavior-oriented high-risk road segment improvements (for road authorities) and feasible solutions integrated into the safety management system (for transportation operators).

本計畫之第1年期（110年）已針對車外異常事件進行影像辨識技術開發，並以國道客運實際營運的車外行車影像與ADAS警示為基礎，從2,531件ADAS警示當中，找出當中僅占23%的行車異常事件；第2年期計畫進一步整合車內行車影像，開發車內異常事件影像辨識技術，觀察駕駛人手部、頭部及軀體動態，藉以分析潛在分心行為，並其對各項ADAS警示、行車異常事件的影響；第3年期整合車內、外行車影像辨識技術，進一步以業者落地應用為目標，開發高風險駕駛行為分析工具，以及建立高風險駕駛行為管理雛型系統，做為後續建立完整工具及成果推廣之基礎。研究成果可以協助運輸業者了解駕駛人行為特性及事故風險，以利對症下藥。

2. 研究成果

（1）整合車內、外行車影像、駕駛行為、ADAS警示事件及外在道路幾何、環境資料及駕駛人潛在分心行為，探索行車異常事件與高風險駕駛行為之好發特性。

（2）對應不同類型汽車運輸業者所擁有設備類型及安全管理需求，開發高風險駕駛行為分析模式，以及定義風險層級門檻。

（3）整合階段性成果，開發高風險駕駛行為管理雛型系統。

3. 成果推廣與效益

（1）應用車內、外行車異常事件影像辨識技術之階段性成果，分析各項行車異常事件及高風險駕駛行為之好發特性，可提供汽車運輸業者參考應用，做為教育訓練及其他安全改善策略研擬之基礎。

（2）112年11月16日辦理「應用人工智慧分析技術探勘高風險路段（3/4）－行車異常事件及高風險駕駛行為開發」高風險駕駛行為管理雛型系統說明會，推廣本計畫之研究成果。

In the first year of the project (2021), image recognition technology for abnormal events outside the vehicle was developed. Based on the actual driving footage and ADAS alerts from national highway bus operations, only 23% of 2,531 ADAS alerts were identified as driving abnormal events. In the second year, the project further integrated in-vehicle driving footage, developed image recognition technology for in-vehicle abnormal events, and observed the dynamics of the driver's hands, head, and body to analyze potential distraction behaviors and their impact on various ADAS alerts and driving abnormal events. In the third year, the project integrated image recognition technology for both inside and outside the vehicle, aimed at practical application by operators. It developed high-risk driving behavior analysis tools and established a prototype system for high-risk driving behavior management as the basis for future complete tools and result promotion. The research results can help transportation operators understand driver behavior characteristics and accident risks for targeted interventions.

2. Research Results

(1) Integrating inside and outside driving footage, driver behavior, ADAS alert events, external road geometry, environmental data, and potential driver distraction behaviors, the project explores the characteristics of driving abnormal events and high-risk driving behaviors.

(2) According to the equipment types and safety management needs of different types of automotive transport operators, it develops high-risk driving behavior analysis models and defines risk level thresholds.

(3) Integrating the phased results, it develops a prototype system for high-risk driving behavior management.

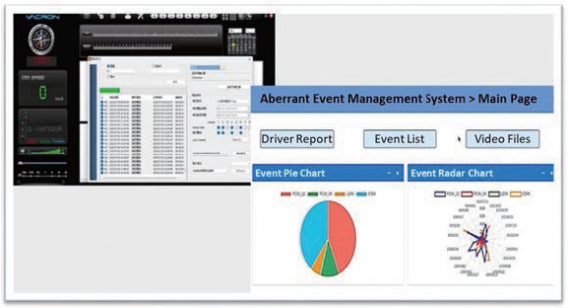
3. Result Promotion and Benefits

(1) Applying the phased results of in-vehicle and out-of-vehicle abnormal event image recognition technology, the project analyzes the characteristics of various driving abnormal events and high-risk driving behaviors, providing reference applications for automotive transport operators as a basis for educational training and other safety improvement strategies.

(2) On November 16, 2023, the project held a briefing on "Applying artificial intelligent method for exploring risk-prone road section (3/4) – aberrant events and risky driving behavior analysis" to promote the research results.

4. 研究成果精華摘整

4. Summary of Research Results



高風險駕駛行為管理雛型系統開發展示

Development of a prototype system for high-risk driving behavior management

5. 研究成果報告

- 應用人工智慧分析技術探勘高風險路段（3/4）－行車異常事件及高風險駕駛行為分析（預計113年7月出版）。

5. Research Result Report

- Applying artificial intelligent method for exploring risk-prone road section (3/4) – aberrant events and risky driving behavior analysis (Scheduled to be published in July 2024).

(四)以無人機探勘人車流動資訊之應用情境規劃與先導測試(3/3)－斜交及多岔路口

1. 計畫概述

以往路口交通安全改善係分析事後之事故資料，本所近年來發展交通衝突分析工具，結合無人機（UAV）空拍攝影及人工智慧（AI）影像辨識技術，將路口行人、車輛流動影像自動轉換成軌跡資料，再透過軟體分析路口易發生交通衝突之地點及型態，以防範事故於未然。本計畫為110-112年3年期計畫之最後一年，為應用並驗證此分析工具，除進行兩項先導測試計畫，並選擇4處易肇事路口進行分析，做為地方政府後續改善路口之依據。

2. 研究成果

（1）在物件偵測技術方面，縮短空拍影片穩定化處理時間，並就提升行人偵測、修正自行車分類情況、車輛偵測框偏斜問題進行研究。

(IV) Application scenarios and pilot run of vehicle and pedestrians traffic flow information using UAV aerial videography (3/3) – diagonal intersections and multi-fork intersections

1. Project Overview

In the past, traffic safety improvements at intersections were based on post-accident data analysis. In recent years, the institute has developed a traffic conflict analysis tool, combining UAV aerial photography and AI image recognition technology. This tool automatically converts images of pedestrian and vehicle movements at intersections into trajectory data and uses software to analyze locations and patterns prone to traffic conflicts, preventing accidents before they happen. This project is in its final year of a three-year term (2021–2023). To apply and verify this analysis tool, we conducted two pilot projects and analyzed four high-risk intersections, providing a basis for local governments to improve these intersections.

2. Research Results

(1) In terms of object detection technology, we shortened the time required for stabilizing aerial footage and researched enhancements in pedestrian detection, correction of bicycle classification issues, and the adjustment of vehicle detection frame biases.

（2）分析軟體優化軌跡／車速繪製功能升級、衝突熱區影像疊合、衝突影片回放功能升級。

（3）與桃園市、臺南市及公路局合作挑選14處路口，進行「機會左轉進階分析」及「人車衝突」兩項先導測試計畫，除研提風險駕駛行為及判斷邏輯外，並於分析軟體新增相關功能。

（4）在桃園市、宜蘭縣、雲林縣選擇4處易肇事路口進行分析，並提供分析資料做為地方政府後續改善路口之依據。

3. 成果推廣與效益

（1）完成「機會左轉進階分析」及「人車衝突」兩項先導測試計畫，將14處路口分析資料提供桃園市、臺南市及公路局參考，以進行後續路口改善。

（2）完成4處易肇事路口交通衝突分析，並提供分析資料做為桃園市、宜蘭縣、雲林縣後續改善路口之依據。

（3）112年10月27日辦理本案成果發表暨教育訓練講習會，宣導研究成果。

4. 研究成果精華摘整

(2) The analysis software was upgraded to improve trajectory/speed plotting functions, conflict hotspot image overlays, and conflict video playback functions.

(3) Collaborated with Taoyuan City, Tainan City, and the Highway Bureau to select 14 intersections for two pilot projects: "Advanced analysis of opportunistic left turns" and "Vehicle-pedestrian conflicts." In addition to proposing risky driving behaviors and judgment logic, we added relevant features to the analysis software.

(4) Selected four high-risk intersections in Taoyuan City, Yilan County, and Yunlin County for analysis, providing the analysis data as a basis for local governments to improve these intersections.

3. Result Promotion and Benefits

(1) Completed two pilot projects, providing the analysis data of 14 intersections to Taoyuan City, Tainan City, and the Highway Bureau for subsequent intersection improvements.

(2) Completed traffic conflict analysis at four high-risk intersections and provided the analysis data as a basis for Taoyuan City, Yilan County, and Yunlin County to improve these intersections.

(3) On October 27, 2023, we held a results presentation and training workshop to promote the research findings.

4. Summary of Research Results

路口人車流動的AI影像辨識結果

AI image recognition results of pedestrian and vehicle movements at intersections

5. 研究成果報告

- 以無人機探勘人車流動資訊之應用情境規劃與先導測試（3/3）－斜交及多岔路口（預計113年7月出版）。

(五) 推動無人機於交通領域之創新應用與產業發展規劃

1. 計畫概述

交通部為有效導入無人機於我國交通運輸領域的創新應用以及促進相關產業的發展，責成運輸研究所召集成立「交通科技產業會報-無人機科技產業小組」。本所已於交通部「2021交通科技產業政策白皮書」中提出我國無人機科技產業發展策略及路徑圖（Roadmap）2.0版，並提出「2025我國無人機在交通領域發展之里程碑」，針對橋梁巡檢以及偏鄉物流兩項重點領域積極推動研發與應用，並持續推動人才培育與產業發展。

2. 研究成果

（1）推動無人機偏鄉物流運送服務驗證計畫，本所前已辦理二期整合示範計畫，完成概念驗證（POC）階段成果。112年聚焦「偏鄉緊急運補」及「離島物流配送」2類情境，與國內頂尖業者合作，導入4型物流無人機，進行嘉義亞創中心、花蓮、澎湖等場域試飛，進一步驗證服務模式（POS）。

（2）辦理無人機搭配AI影像辨識應用於橋梁檢測之研究，112年結合無人機技術，利用無人機機動性、即時性及便利性等特點，自動化飛行拍攝橋梁影像並利用AI影像辨識橋梁構件劣化狀況，以增進橋梁檢測品質與效率。另於112年11月7日於臺南國道3號頭前溪河川橋辦理「橋檢新工具-無人機結合AI技術成果觀摩會」，邀請國內各橋管機關及橋檢公司共同參與交流，以利未來成果之推動。

5. Research Result Report

- Application scenarios and pilot run of vehicle and pedestrians traffic flow information using UAV aerial videography [3/3] - diagonal intersections and multi-fork intersections (Scheduled to be published in July 2024).

(V) Promoting innovative applications and industry development planning for UAVs in the transportation industry

1. Project Overview

To effectively introduce UAVs into Taiwan's transportation sector and promote related industry development, the MOTC tasked the Transportation Research Institute to convene "Transportation Technology Industry Advisory Committee – UAV Technology Industry Group." The institute proposed Taiwan's UAV technology industry development strategy and roadmap version 2.0 in the MOTC's "2021 Transportation Technology Industry Policy White Paper," and presented "2025 Milestone for UAV Development in the Transportation Sector in Taiwan." Focusing on bridge inspections and rural logistics, we actively promoted research and application while continuously advancing talent cultivation and industry development.

2. Research Results

(1) Promoting the UAV rural logistics delivery service verification project, the institute previously conducted two phases of integrated demonstration projects and completed the proof of concept (POC) stage. In 2023, we focused on two scenarios: "Emergency supplies in rural areas" and "Island logistics distribution." We collaborated with top domestic companies, introducing four types of logistics UAVs for test flights at Chiayi Innovation Center, Hualien, and Penghu, further verifying the service model (POS).

(2) Conducted research on UAVs combined with AI image recognition for bridge inspection in 2023, leveraging the mobility, immediacy, and convenience of UAVs to automatically capture bridge images and use AI image recognition to detect structural deterioration, enhancing the quality and efficiency of bridge inspections. In addition, on November 7, 2023, we held a "New bridge inspection tools – UAV combined with AI technology results demonstration meeting" at Touqian River Bridge on National Highway No. 3 in Tainan, inviting domestic bridge management agencies and bridge inspection companies to participate and exchange ideas, and facilitating the promotion of future results.

（3）推動無人機人才培育與產業發展，辦理領航盃無人機創意應用競賽，鼓勵大專院校及公務機關（構）投入無人機研發應用；並依循行政院性平政策，成立交通部木蘭無人機隊，輔導女性同仁取得無人機操作證。協同臺灣無人機大聯盟推動產業國際交流，見證無人機大聯盟與美國國際無人機系統協會AUVSI、加州聖伯納迪諾郡無人機中心簽署MOU，以及訪談交通部部屬機關（構）業務結合無人機之需求，持續輔導導入實際應用。

3. 成果推廣與效益

（1）112年11月7日於臺南國道3號頭前溪河川橋辦理「橋檢新工具-無人機結合AI技術成果觀摩會」。

（2）112年12月6日於花蓮縣瑞穗鄉辦理「無人機偏鄉物流服務驗證計畫試飛暨座談會」。

（3）112年12月29日辦理「無人機暢遊實境-交通部無人機研發與應用成果發表會」。

4. 研究成果精華摘整

(3) Promoting UAV talent cultivation and industry development, we held "Pilot Cup UAV Creative Application Competition" to encourage universities and public institutions to engage in UAV research and application. Following the Executive Yuan's gender equality policy, we established the MOTC's Mulan UAV Team to assist female colleagues in obtaining UAV operation licenses. Collaborated with the Taiwan UAV Alliance to promote international industry exchanges, witnessed the signing of MOUs between the UAV Alliance and US AUVSI and the UAV Center of San Bernardino County, California, and interviewed agencies under the MOTC to understand their needs for UAV applications, continuously supporting their practical application.

3. Result Promotion and Benefits

(1) On November 7, 2023, we held "New Bridge Inspection Tool – UAV Combined with AI Technology Results Demonstration Meeting" at Touqian River Bridge on National Highway No. 3 in Tainan.

(2) On December 6, 2023, we held "UAV Rural Logistics Service Verification Project Test Flight and Symposium" in Ruishui Township, Hualien County.

(3) On December 29, 2023, we held "UAV Virtual Reality Experience – the MOTC's UAV R&D and Application Results Presentation."

4. Summary of Research Results

112年11月7日橋檢新工具－無人機結合AI技術成果觀摩會

On November 7, 2023, we held "New Bridge Inspection Tool – UAV Combined with AI Technology Results Demonstration Meeting."

112年12月6日辦理無人機偏鄉物流服務驗證計畫試飛暨座談會
On December 6, 2023, we held "UAV Rural Logistics Service Verification Project Test Flight and Symposium."

112年12月29日無人機暢遊實境－交通部無人機研發與應用成果發表會
UAV virtual reality experience – the MOTC's UAV R&D and application results presentation on December 29, 2023

5. 研究成果報告

- 無人機偏鄉物流服務驗證計畫（1/2）－服務模式規劃與系統發展（預計113年7月出版）。
- 無人機搭配AI影像辨識應用於橋梁檢測之研究（2/2）－無人機自動化檢測架構探討（預計113年7月出版）。

5. Research Result Report

- Proof-of-Service for UAS delivery in rural areas (1/2) – service model planning and system development (Scheduled to be published in July 2024).
- Research on applying UAV with AI image recognition in bridge inspection (2/2) – exploring the UAV automated inspection framework (Scheduled to be published in July 2024).

七 精進交通設施維護管理與災防技術

(一) 橋梁梁底狹小空間檢測工具研發

1. 計畫概述

全國正常使用與維修中之車行橋梁約2萬3千多座，本計畫發現較小型或橋下淨高不足之橋梁，檢測人員無法使用橋檢車及UAV等常見之橋檢工具進行檢測，需冒著危險涉水、穿著潛水裝或乘坐船艇，進入橋梁梁底的底部空間進行勘查檢測，增加橋檢人員的工作風險。

爰此，108年起本所研發出推車型橋檢工具，利用多節可伸縮之臂桿，將鏡頭探入狹暗橋梁底部空間，橋檢人員僅需於橋面上操作橋檢工具，即可透過即時回傳影像，檢查並記錄橋梁梁底狀況，克服橋梁檢測之問題。本橋檢工具具備鏡頭轉向模組，可拍攝橋梁底部側向構件（包含帽梁、支承、墩柱等），透過轉動鏡頭、增加光源及提高照相解析度，取得梁間構件之清晰影像。111年導入影像拼接技術，可呈現完整之橋面底板影像，讓橋檢人員可標記劣化構件位置，以利後續修繕追蹤。112年持續調整及優化橋檢工具相關構件與操作，並研訂橋檢工具使用手冊及規劃辦理技術移轉，提供橋梁維護管理單位未來實務應用。

2. 研究成果

（1）完成開發可用於檢測橋梁梁底狹小空間之工具，並進行相關檢測構件精進，如：桿臂變位控制、輔助照明、機電化控制…等，經測試驗證6座橋梁，本橋檢工具已能穩定伸展並移動至橋梁下方拍攝梁底影像。

（2）完成調整及優化橋檢工具相關構件與操作，並研訂橋檢工具使用手冊及辦理推廣活動，規劃技術移轉作業，提供橋梁維護管理單位未來實務應用。

（3）研提「助您一臂之力~橋梁梁底檢測機械手臂」參加交通部112年創新提案制度，獲得甲等獎。

VII Improve the Transportation Facilities Maintenance Management and Disaster Prevention Technology

(I) Development of narrow-space bridge bottom inspection tools

1. Project Overview

There are more than 23,000 vehicle bridges currently in use and being maintained across the country. However, this project found that smaller bridges or those with inadequate clearance underneath cannot be inspected through conventional bridge inspection tools such as bridge inspection vehicles and UAVs. Rather, inspection personnel have to face risks of wading through water, wearing diving suits, or using boats to enter the bottom space of the bridge for inspection, increasing the working risk for bridge inspection personnel.

Therefore, starting from 2019, the institute developed a pushcart-type bridge inspection tool. It utilizes a multi-segment extendable arm to insert the camera into the narrow and dark bottom space of the bridge. Inspection personnel only need to operate the bridge inspection tool on the bridge surface. They can check and record the condition of the bridge bottom through real-time image feedback, overcoming the problems of bridge inspection. This bridge inspection tool has a camera turning module that can capture side components of the bridge bottom (including cap beams, supports, and piers). By rotating the camera, increasing light sources, and improving photo resolution, clear images of components between beams are obtained. In 2022, image stitching technology was introduced, which can present complete images of the bridge deck bottom. This allows bridge inspection personnel to mark the positions of deteriorated components for subsequent repair tracking. In 2023, continuous adjustments and optimization of bridge inspection tool components and operations were made, and a bridge inspection tool manual was developed along with plans for technical transfer to provide practical applications for bridge maintenance management units in the future.

2. Research Results

(1) The development of tools for inspecting narrow-space bridge bottoms has been completed, along with enhancements to related inspection components such as arm displacement control, auxiliary lighting, electromechanical control, etc. After testing and verifying on six bridges, this bridge inspection tool can now stably extend and move under the bridge to capture bottom images.

(2) Adjustments and optimizations of bridge inspection tool components and operations were completed, along with the development of a bridge inspection tool manual and promotion activities. Plans for technical transfer operations were also made to provide practical applications for bridge maintenance management units in the future.

(3) A proposal titled "Lend a Hand: Bridge Bottom Inspection Mechanical Arm" was submitted to the MOTC's Innovation Proposal System in 2023 and received first-class recognition.

3. 成果推廣與效益

（1）112年12月4日辦理「橋梁梁底狹小空間檢測工具研發與應用」研究成果推廣。

（2）研究成果可提供公路橋梁管理機關（如高公局、公路局、各縣市政府等）橋梁檢測作業實務運用，提升我國公路橋梁檢測之品質及效率。

3. Result Promotion and Benefits

(1) On December 4, 2023, a research results promotion event titled "Development and Application of Narrow-space Bridge Bottom Inspection Tools" was held.

(2) The research results can be utilized in the practical operations of bridge inspection for highway bridge management agencies (such as the Taiwan Area National Expressway Engineering Bureau, the Taiwan Area National Highway Engineering Bureau, various county and city governments), enhancing the quality and efficiency of highway bridge inspections in Taiwan.

4. 研究成果精華摘整

橋梁檢測工具整體架構

Bridge inspection tool overall framework

橋檢人員於橋面上操作橋檢工具

Bridge inspection personnel operate the bridge inspection tool on the bridge surface

橋梁檢測工具拍攝梁底影像

Bridge inspection tool captures images of the bridge bottom

4. Summary of Research Results

5. 研究成果報告

- 橋梁梁底狹小空間檢測工具加值應用及技術轉移（113年3月出版）。

5. Research Result Report

- Value-added applications and technology transfer for bridge inspection tools in narrow bridge bottom spaces (Published in March 2024).

(二) 橋梁整橋風險評估模式之研究

1. 計畫概述

橋梁係跨越山河溪谷、維繫民生需求及經濟發展之重要關鍵設施，該設施除會因長期使用而疲勞劣化外，亦會因洪水沖刷或地震搖晃而損壞劣化，故需定期檢測，並籌編足額經費適時改善。目前我國車行橋梁約2.3萬座，主要由交通部臺灣區國道高速公路局、交通部公路局、各部會及各縣市政府負責管養，依據公路法及相關規定，橋梁養護首重檢測，因此各橋梁管理機關除應適時針對所轄橋梁實施各項橋梁安全檢測作業外，並應針對損壞部分採取適當維修對策，方能確保橋梁及用路人行車安全。依據「公路養護規範」及「公路橋梁檢測及補強規範」之規定，前述橋梁檢測可概分成「定期檢測」、「特別檢測」及「詳細檢測」等3類。橋梁實際定期檢測作業是逐跨逐構件進行，D.E.R.U檢測方式強調的是大規模、快速地進行龐大數量橋梁的初步普檢與篩選評估，故檢測記錄方式甚為精簡、快速，評定結果僅能針對構件進行維修處置之建議，並無橋梁整體狀況之評估。

為評估橋梁整體狀況，本計畫利用目視檢測結果D.E.R.U值，配合構件對橋梁重要性之權重，建立理論模式計算橋梁之評況，以利橋梁維護管理作業及資源分配。

2. 研究成果

(1) 本計畫已蒐集並回顧美國、日本、南非、中國大陸、芬蘭及德國之檢測法及橋梁狀況評估方式，亦針對國內橋梁管理及檢測單位之10位專家進行訪談，汲取各國及專家之寶貴經驗，提出「整橋風險評估模式」。「整橋風險評估」結果分為I~IV共四個等級，I為良好、II為尚可、III屬較差、IV則為嚴重。

(II) Study on the overall bridge risk assessment model

1. Project Overview

Bridges are critical infrastructure that span mountains, rivers, and valleys, supporting both the needs of daily life and economic development. These structures not only deteriorate due to long-term use but can also be damaged by floods and earthquakes, necessitating regular inspections and timely improvements funded by adequate budgets. Currently, there are approximately 23,000 vehicular bridges in Taiwan, mainly managed and maintained by the National Freeway Bureau, the Highway Bureau of the MOTC, various ministries, and local governments. According to the highway law and related regulations, the primary focus of bridge maintenance is inspection. Bridge management agencies should conduct various safety inspections on their respective bridges in a timely manner and implement appropriate repair strategies for any damaged parts to ensure the safety of the bridges and the motorists using them. According to "Highway Maintenance Specifications" and "Highway Bridge Inspection and Reinforcement Specifications," bridge inspections are generally classified into three categories: "Regular inspections," "Special inspections," and "Detailed inspections." Regular inspection work on bridges involves inspecting each span and component individually. The D.E.R.U. inspection method emphasizes large-scale, rapid preliminary screening and evaluation of a vast number of bridges. The inspection recording method is quite simple and quick, and the evaluation results can only suggest maintenance actions for individual components without assessing the overall condition of the bridge.

To assess the overall condition of the bridge, this project utilizes the D.E.R.U. values from visual inspections, combined with the weighting of importance of components to the bridge, to establish a theoretical model for calculating the bridge's condition. This model aids in bridge maintenance management and resource allocation.

2. Research Results

(1) This project has collected and reviewed inspection methods and bridge condition assessment approaches from the United States, Japan, South Africa, Mainland China, Finland, and Germany. It also conducted interviews with ten experts from domestic bridge management and inspection units to gather valuable experiences from various countries and experts, leading to the proposal of an "Overall bridge risk assessment model." The "Overall bridge risk assessment" results are categorized into four levels: I (good), II (acceptable), III (poor), and IV (severe).

（2）考量臺灣橋梁受地震及基礎沖刷而毀損者為數不少，因此「整橋風險評估」結果是由「結構安全評等」及「耐洪安全評等」中取較差者為代表。「結構安全評等」係透過SCI（結構性指標）與RIS（結構安全風險指標）組合而成之結構安全與風險矩陣決定。「耐洪安全評等」僅對跨水橋進行評估，透過FCI（耐洪性指標）與RIF（耐洪安全風險指標）組合而成之耐洪安全與風險矩陣決定。

（3）本計畫篩選混凝土一般性橋梁共10座（7座梁式橋及3座板橋），做為案例評估橋梁，團隊派檢測員對案例評估橋梁進行現地檢測，再將團隊之檢測員所評之整橋風險與使用本計畫「整橋風險評估模式」所評出之結果進行驗證及校正。

（4）驗證後可得本計畫所建立之「整橋風險評估模式」具相當參考價值，能確實呈現出橋梁狀況，供橋梁管理機關後續處置及管理決策參考應用。

3. 成果推廣與效益

（1）112年10月26日召開「橋梁整橋風險評估模式」專家學者座談會，邀請橋梁安全維護管理相關的產官學研專家學者座談交流，包括橋梁檢測工程顧問工程司、公路局、高速公路局、臺灣營建研究院等進行座談，參與專家均肯定本計畫之方向及成果，同時也提出寶貴建議。

（2）112年11月9日召開「橋梁整橋風險評估模式」學術會議進行成果推廣，邀請橋梁管理機關（包括公路局、高速公路局及各縣市政府）、顧問公司及學術機構，與會人數共58人。

(2) Considering that many bridges in Taiwan are damaged by earthquakes and foundation scour, the "Overall bridge risk assessment" result is represented by the poorer rating between "Structural safety rating" and "Flood safety rating." The "Structural safety rating" is determined by the structural safety and risk matrix, which combines the SCI (structural condition index) and RIS (structural safety risk index). The "Flood safety rating" is evaluated only for water-crossing bridges, determined by the flood safety and risk matrix, which combines the FCI (flood condition index) and RIF (flood safety risk index).

(3) This project selected ten concrete general bridges (seven beam bridges and three slab bridges) as case study bridges for evaluation. The project team sent inspectors to conduct on-site inspections of these case study bridges, and then validated and calibrated the overall bridge risk assessments performed by the team's inspectors against the results obtained using the "Overall bridge risk assessment model" developed by this project.

(4) The validation confirmed that the "Overall bridge risk assessment model" established by this project has considerable reference value and can accurately reflect the bridge condition, providing useful information for bridge management agencies in their subsequent management decisions and applications.

3. Result Promotion and Benefits

(1) On October 26, 2023, we held an expert scholars symposium on "Overall Bridge Risk Assessment Model," and invited experts and scholars from government, academia, and industry related to bridge safety maintenance, including bridge inspection consulting engineering firms, the Highway Bureau, the Expressway Bureau, and the Taiwan Institute of Construction Research, for discussions. The participating experts acknowledged the direction and achievements of this project and also provided valuable suggestions.

(2) On November 9, 2023, we held an academic conference on "Overall Bridge Risk Assessment Model" to promote the results, and invited bridge management agencies (including the Highway Bureau, Expressway Bureau, and local governments), consulting firms, and academic institutions, with a total of 58 participants.

4. 研究成果精華摘整

4. Summary of Research Results

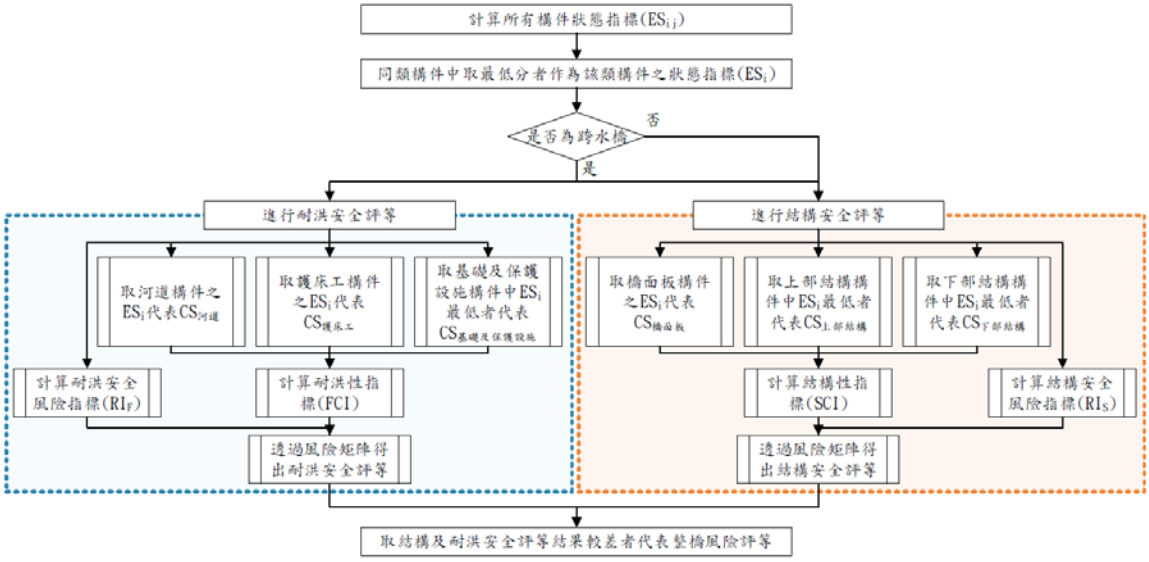
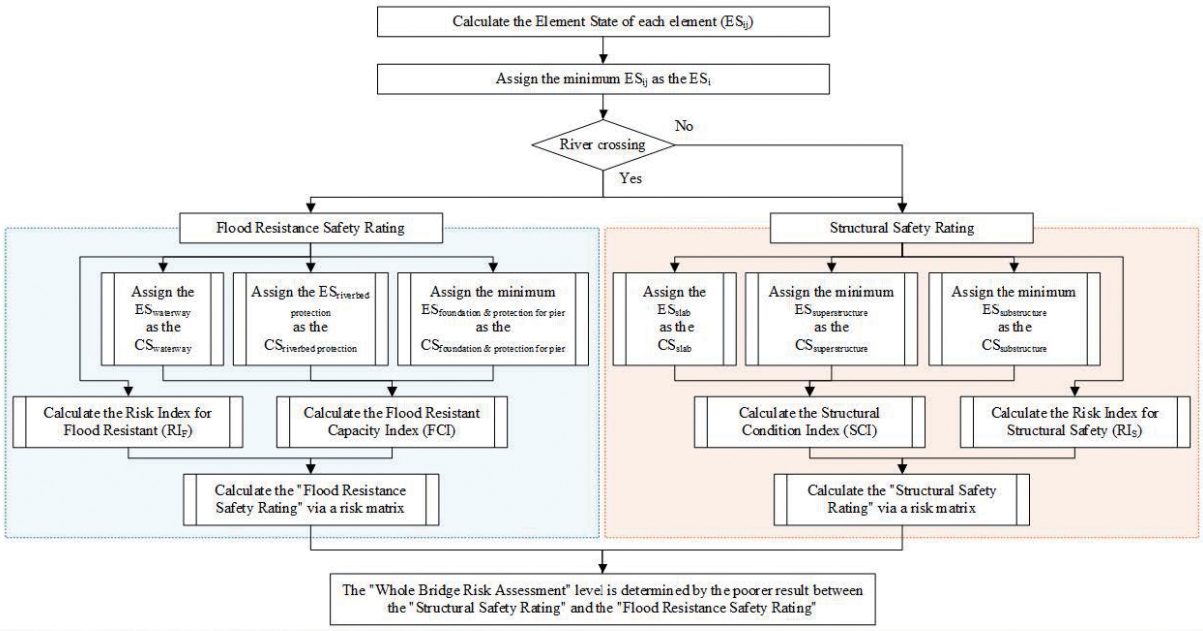


圖 3.1 整橋風險評估流程



整橋風險評估流程

The process of overall bridge risk assessment

橋梁代號 Bridge No	SCI 分數 SCI	SCI 分類 SCI Level	RIs 分類 RIs	結構安全評等 Structural Safety Rating	FCI 分數 FCI	FCI 分類 FCI Level	RIF 分類 RIF	結構安全評等 Flood Resistance Safety Rating	整橋風險評等 Whole Bridge Risk Assessment
01	87.89	輕微 Fair	低 Low	II	98.48	良好 Good	低 Low	I	II
02	87.89	輕微 Fair	低 Low	II	100.00	良好 Good	低 Low	I	II
03	61.85	中等 Poor	中 Moderate	III	100.00	良好 Good	低 Low	I	III
04	94.00	輕微 Fair	低 Low	II	100.00	良好 Good	低 Low	I	II
05	46.73	嚴重 Severe	高 High	IV	92.03	輕微 Fair	中 Moderate	II	IV
06	87.73	輕微 Fair	低 Low	II	100.00	良好 Good	低 Low	I	II
07	49.82	嚴重 Severe	中 Moderate	IV	73.85	中等 Poor	低 Low	II	IV
08	47.09	嚴重 Severe	中 Moderate	IV	100.00	良好 Good	低 Low	I	IV
09	38.80	嚴重 Severe	高 High	IV	40.20	嚴重 Severe	高 High	IV	IV
10	90.36	輕微 Fair	低 Low	II	100.00	良好 Good	低 Low	I	II

案例評估橋梁整橋風險評等結果

Case assessment of overall bridge risk assessment results

5. 研究成果報告

- 橋梁整橋風險評估模式之研究（預計113年7月出版）。

5. Research Result Report

- Study on the overall bridge risk assessment model (Scheduled to be published in July 2024).

(三) 車行橋梁管理資訊系統精進及全國橋梁統計資訊網

1. 計畫概述

配合行政院「橋梁維護管理作業要點」規定，交通部責成本所建置「全國車行橋梁統計系統」（「全國車行橋梁統計系統」分為「全國橋梁統計資訊網」及「車行橋梁統計系統」雙首頁）介接各級橋梁主管機關所轄橋梁資料，合併編製成果統計。另由本所88年起建置之「臺灣地區橋梁管理資訊系統」提供各橋梁主管機關協商使用，該系統並自111年1月1日起更名為「車行橋梁管理資訊系統」。

為提升橋梁檢測作業及資料之正確性，避免檢測單位誤傳或為圖利而上傳造假之檢測資料，本所於111年1月25日召開「車行橋梁管理資訊系統功能及作業程序調整說明研商會議，並於會中向各部會及縣市政府說明系統及作業程序調整之內容，續於111年7月25日函文各部會及縣市政府，說明系統及作業程序已完成調整，所屬委外橋梁檢測單位可進行相關測試。

「全國橋梁統計資訊網」經彙整車行橋、鐵道橋及人行天橋相關橋梁資訊建置完成，並依院頒「橋梁維護管理作業要點」第5點資料開放精神，公布全國橋梁統計資料，讓外界有獲得橋梁資訊之管道。統計資訊網的介接來源包括運研所建置車行橋梁統計系統、交通部鐵道局建置鐵道橋梁統計系統及內政部營建署建置人行天橋統計系統。

2. 研究成果

（1）車行橋梁管理資訊系統精進

a. 改善檢測人員頭像拍攝問題:目前檢測人員僅能使用平板電腦拍攝頭像之照片上傳；為避免檢測人員在非現場以平板電腦拍攝開始前及結束後之頭像照片，因此已修正須在距離橋頭、橋尾或橋中心GPS座標1公里之範圍內，才允許平板電腦操作「開始檢測」及「檢測完成」功能鍵。

(III) Refinement of the Vehicle Bridge Management Information System and the national bridge statistics information network

1. Project Overview

In accordance with the Executive Yuan's "Bridge Maintenance Management Operation Guidelines," the MOTC has tasked the institute with establishing "National Vehicle Bridge Statistics System" (comprising the "National Bridge Statistics Information Network" and "Vehicle Bridge Statistics System") to interface with bridge data under the jurisdiction of various levels of bridge management authorities, compiling and preparing statistical results. Starting from 1999, the institute developed "Taiwan Region Bridge Management Information System" for consultation by various bridge management authorities. This system was renamed as "Vehicle Bridge Management Information System" from January 1, 2022.

To enhance the accuracy of bridge inspection operations and data, and prevent inspection units from transmitting falsified inspection data for personal gain, the institute convened a meeting on January 25, 2022 to explain adjustments to the functions and operational procedures of Vehicle Bridge Management Information System. During this meeting, we explained the content of the system and operational procedure adjustments to various departments, municipalities, and county governments. Subsequently, on July 25, 2022, we sent letters to various departments, municipalities, and county governments, informing them that the system and operational procedures had been adjusted, and that affiliated outsourced bridge inspection units could conduct relevant tests.

The "National Bridge Statistics Information Network" has completed the compilation of relevant bridge information for vehicle bridges, railway bridges, and pedestrian footbridges, and in accordance with the spirit of data openness in Point 5 of "Bridge Maintenance Management Operation Guidelines" issued by the Executive Yuan, nationwide bridge statistics have been published to provide a channel for obtaining bridge information from the outside world. The sources of information integration on the statistical information network include the Vehicle Bridge Statistics System built by our institute, the Railway Bridge Statistics System built by the Railway Bureau of the MOTC, and the Pedestrian Footbridge Statistics System built by the Construction Agency of the Ministry of the Interior.

2. Research Results

(1) Refinement of the Vehicle Bridge Management Information System

a. Improvements in the photographing of inspection personnel portraits have been made: Currently, inspection personnel can only use tablet computers to upload photos of their portraits. To prevent inspection personnel from taking photos of their portraits with tablet computers before and after the inspection off-site, it has been corrected that they must be within a range of 1 kilometer from the bridgehead, bridge tail, or bridge center GPS coordinates before being allowed to operate the "Start Inspection" and "Inspection Completed" function keys on the tablet computer.

b. 改善檢測構件照片拍攝問題:已修正平板電腦現場作業程序及功能，檢測人員須將所有橋梁構件以平板電腦逐一拍攝完成後，方能以自備其他相機輔助拍攝，並將其照片上傳系統，做為補充構件相片之用；同時前述補充構件相片僅能選取一定時間內所拍攝之照片。

c. 為協助橋梁管理機關覆核橋檢相關資料，已針對整座橋梁檢測時間過短者，標註警示以利檢視，同時如有檢測人員現場照片與資料庫照片不符者，亦利用AI影像辨識技術標註警示。

（2）全國橋梁統計資訊網

統計資訊網目前有三大功能可供查詢，分別為地圖搜尋、橋梁分類統計、部會及縣市轄管橋梁統計，相關功能摘述說明如下:

a. 地圖搜尋:結合地理資訊系統功能，民眾可利用橋梁所在縣市（區鄉）或橋名搜尋車行、鐵道或人行天橋等橋梁，並於電子地圖上顯示符合條件之橋梁所在位置。

b. 橋梁分類統計:提供車行橋梁、鐵道橋梁、人行天橋之使用狀態及橋齡統計資訊，點選統計數字後，即可得到橋梁清單明細資料，包括橋梁管理機關、所在縣市、竣工年月、橋梁總長、結構形式等。

c. 部會及縣市轄管橋梁統計:提供各部會及縣市政府轄管之車行橋梁、鐵道橋梁及人行天橋之統計資訊，可讓民眾查詢瞭解各部會或縣市政府轄管橋梁之數量。

b. Improvements in the photographing of inspection components have been made: The on-site operation procedures and functions of tablet computers have been corrected. Inspection personnel must photograph all bridge components one by one with a tablet computer before using another camera to supplement and upload the photos as supplementary component photos. Only photos taken within a certain time period can be selected for the aforementioned supplementary component photos.

c. To assist bridge management authorities in reviewing bridge inspection-related data, warnings have been marked for bridges with excessively short inspection times for easier viewing. Also, if there are discrepancies between on-site photos of inspection personnel and database photos, AI image recognition technology is used to mark warnings.

(2) National bridge statistics information network

The current statistics information network has three major functions for inquiry: map search, bridge classification statistics, and statistics of bridges under ministries and county governments. The relevant functions are described as follows:

a. Map Search: Integrating Geographic Information System functionality, the public can search for vehicle, railway, or pedestrian bridges based on the county (district or township) where the bridge is located or its name, and the electronic map will display the locations of bridges that meet the criteria.

b. Bridge Classification Statistics: Providing usage status and age statistics for vehicle, railway, and pedestrian bridges. Clicking on the statistical numbers will provide detailed information about the bridge, including the managing agency, location, completion date, total length, and structure type.

c. Ministry and County Government Managed Bridge Statistics: Providing statistics on vehicle, railway, and pedestrian bridges managed by various ministries and county governments, allowing the public to inquire about the number of bridges managed by each ministry or county government.

3. 成果推廣與效益

（1）「車行橋梁管理資訊系統」相關精進功能已測試完成，並於112年2月1日上線使用。

（2）「全國橋梁統計資訊網」已於112年2月1日對外開放供民眾查詢。

3. Result Promotion and Benefits

(1) The enhancements related to "Vehicle Bridge Management Information System" have been tested and implemented, going live on February 1, 2023.

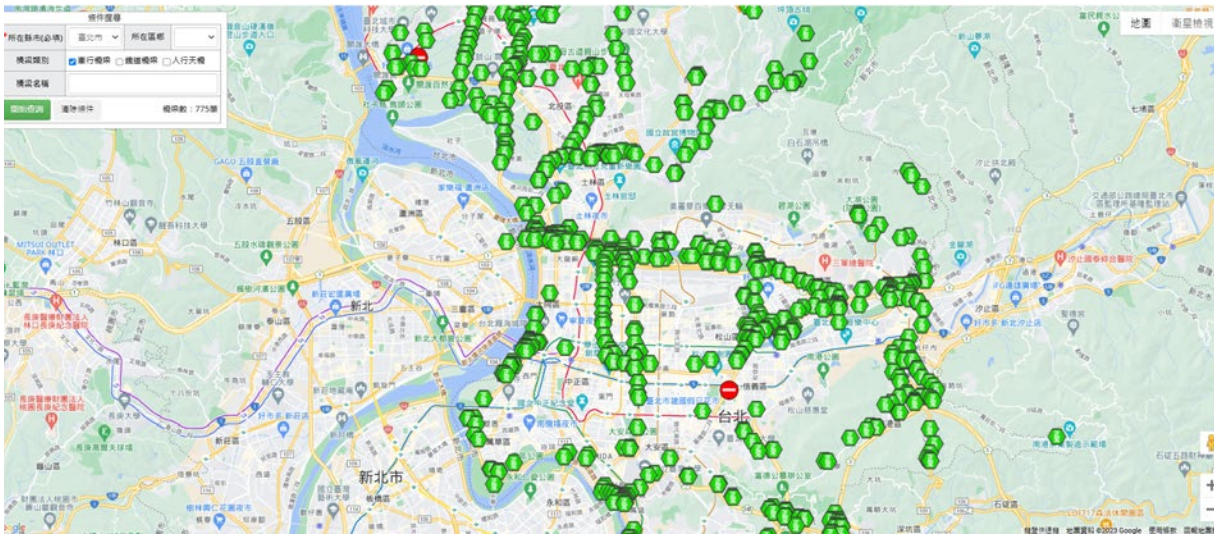
(2) The "National Bridge Statistics Information Network" was made available for public inquiry on February 1, 2023.

4. 研究成果精華摘整

4. Summary of Research Results

車行橋梁管理資訊系統功能精進

Enhancements to the functionality of the Vehicle Bridge Management Information System



「全國橋梁統計資訊網」地圖搜尋(GIS)功能

"National Bridge Statistics Information Network" map search (GIS) functionality

使用狀態統計

放大檢視

橋梁類別	所有橋梁			鋼索型橋梁		
	正常使用	維修中	停用	正常使用	維修中	停用
車行橋梁	22,800	131	54	161	3	1
鐵道橋梁	1,380	17	86	4	0	0
人行天橋	1,598	N/A	50	182	N/A	6
小計	25,778	148	190	347	3	7
合計	26,116			357		

*鐵道橋為管理單元

橋齡統計

放大檢視

橋梁類別	所有橋梁							鋼索型橋梁						
	<2年	2~10年	11~20年	21~30年	31~40年	>40年	不詳	<2年	2~10年	11~20年	21~30年	31~40年	>40年	不詳
車行橋梁	74	1,589	3,254	5,839	3,795	2,966	5,468	2	61	67	24	4	3	4
鐵道橋梁	1	211	326	156	339	358	92	0	2	2	0	0	0	0
人行天橋	16	131	136	77	44	58	1,191	6	15	32	10	3	9	113
小計	91	1,931	3,716	6,072	4,178	3,382	6,751	8	78	101	34	7	12	117
合計	26,121							357						

*鐵道橋為管理單元

資料更新日期 車行橋梁：2023-02-01 鐵道橋梁：2023-01-16 人行天橋：2023-02-01

案例評估橋梁整橋風險評等結果

"National Bridge Statistics Information Network" bridge classification statistics functionality

5. 研究成果報告

- 規劃建置全國車行橋梁統計系統（113年4月出版）。

5. Research Result Report

- Planning and implementation of a national vehicle bridge statistics system (Published in April 2024).

(四) 應用影像智慧化技術判釋海岸公路及防波堤越波研究

1. 計畫概述

花蓮台11線浪襲路段易受颱風浪襲，碎波波浪更可能直接淘刷路基，影響公路通行安全。本所於106至110年陸續建置臺東及花蓮海岸公路浪襲預警系統，研擬改善對策提供公路總局應用參採，惟越波及浪襲仍無現場觀測資訊，故本計畫藉由攝影機及影像判釋技術的應用，提供公路單位浪襲示警資訊，並可做為本所未來精進浪襲預警系統之參據。

本計畫於111年與交通部公路局第四區養護工程處合作，於花蓮縣豐濱鄉台11線人定勝天路段設置影像設備及安裝波浪溯升計，蒐集海岸公路影像，發展波浪溯升、浪襲之影像判釋技術，112年發展夜間波浪溯升、浪襲之影像判釋技術及完成自動化判釋，並波浪數值模式進行波浪溯升模擬，發展越波機器學習模型，做為精進本所建置之花蓮海岸公路浪襲預警系統之依據。

2. 研究成果

（1）於花蓮縣豐濱鄉台11線人定勝天路段設置影像設備，蒐集海岸公路影像，透過影像校正、色彩空間轉換與分群、邊緣偵測，發展日間及夜間波浪溯升/浪襲之影像判釋方法並建立自動化判釋流程，可由影像判釋水線位置變化及波浪溯升高程，經波浪溯升計感測資料驗證判釋結果，可由影像判釋水線位置變化及波浪溯升高程。

（2）本計畫亦於人定勝天路段海岸設置波浪溯升計，以波浪溯升感測資料分析、驗證影像判釋結果，111年經梅花、軒蘭諾等颱風等案例驗證，本計畫發展之影像判釋方法具有可行性。

（3）112年完成波浪溯升、浪襲之影像自動化判釋，建置越波機器學習模型。

(IV) Application of image intelligence technology for coastal highway and breakwater wave crossing research

1. Project Overview

The wave attack-likely section of Provincial Highway No.11 Highway is frequently affected by typhoon waves, with breaking waves potentially eroding the roadbed and compromising highway traffic safety. From 2017 to 2021, the institute gradually established a wave attack early warning system for the coastal highways of Taitung and Hualien, developing improvement strategies for the Highway Bureau's reference. However, on-site observation data for overtopping and wave attacks is lacking. This project utilizes cameras and image interpretation technology to provide wave attack warning information to highway units and serve as a reference for future enhancements to our wave attack early warning system.

In 2022, in cooperation with Easter Region Branch Office of Highway Bureau of the MOTC, this project installed imaging equipment and wave run-up gauges along Ren-Ding-Sheng-Tian section, Provincial Highway No.11 in Fengbin Township, Hualien County. The project collected coastal highway images, developed image interpretation technology for wave run-up and wave attacks, and advanced this technology for nighttime conditions in 2023, achieving automated interpretation. Wave run-up simulations using numerical wave models and the development of overtopping machine learning models will refine the wave attack early warning system for Hualien's coastal highways.

2. Research Results

(1) The imaging equipment installed along the Ren-Ding-Sheng-Tian section of Provincial Highway No.11 collected coastal highway images, and through image calibration, color space conversion and clustering, and edge detection, the project developed daytime and nighttime image interpretation methods for wave run-up and wave attacks and established an automated interpretation process. This process can detect changes in waterline position and wave run-up elevation from images, with validation from wave run-up gauge sensor data confirming the interpretation results.

(2) Wave run-up gauges were installed on the coast along the Ren-Ding-Sheng-Tian section to analyze and verify image interpretation results using wave run-up sensor data. Validation through typhoon cases like Muifa and Hinnamnor in 2022 confirmed the feasibility of the developed image interpretation methods.

(3) In 2023, the project achieved automated interpretation of wave run-up and wave attacks, and established overtopping machine learning models.

3. 成果推廣與效益

（1）111年11月17日於第44屆海洋工程研討會發表論文「花蓮海岸公路越波影像判釋之研究」。

（2）112年10月6日於第45屆海洋工程研討會發表論文「花蓮海岸公路越波影像判釋之研究」。

（3）研究成果提供本所與精進本所建置之海岸公路浪襲預警系統之依據，預計可提供公路局東區養護工程分局於颱風浪襲封路決策應用參採，強化通行安全管理。

3. Result Promotion and Benefits

(1) A paper titled "Study on Overtopping Image Interpretation of Hualien Coastal Highway" was presented at the 44th marine engineering conference on November 17, 2022.

(2) A paper titled "Applying the K-means Clustering Method to Interpret Overtopping Images of Coastal Highway in Hualien" was presented at the 45th marine engineering conference on October 6, 2023.

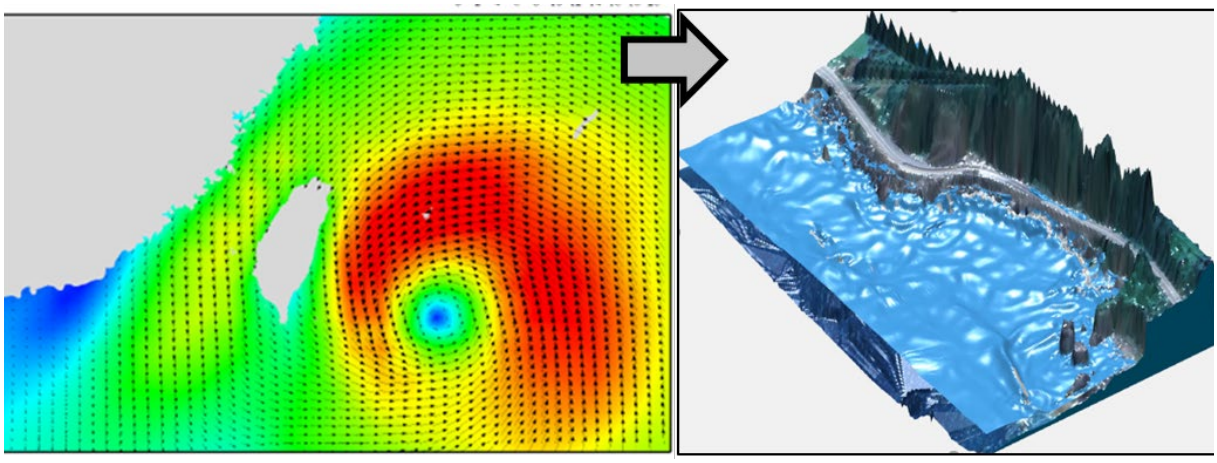
(3) The research outcomes provide a basis for refining our wave attack early warning system for coastal highways and are expected to support the decision-making process for road closures during typhoon wave attacks by the eastern district maintenance engineering branch of the Highway Bureau, enhancing traffic safety management.

4. 研究成果精華摘整

4. Summary of Research Results

光學、熱成像（夜間）影像判釋水線位置、高程

Optical and thermal (nighttime) image interpretation of waterline position and elevation



波浪數值模式進行波浪溯升模擬，建立機器學習模型

Wave run-up simulations using wave numerical models, establishment of machine learning models

5. 研究成果報告

- 應用影像智慧化技術判釋海岸公路及防波堤越波研究（2/4）－夜間越波判釋（113年4月出版）。

5. Research Result Report

- Intelligent image recognition analyses for wave overtopping on coastal highway and seawalls (2/4) – Image recognition of wave overtopping at the nighttime (Published in April 2024).

(五) 港灣設施巡查檢測作業精進

1. 計畫概述

港區幅員廣大，港灣設施又長年處在惡劣的海洋及水下未知的環境，在執行港灣設施之日常巡查與檢測時，常需投入大量的人力及時間來進行巡查與檢測工作。近年來自動化巡檢的興盛，讓機器從事繁複的任務及判識設施的劣化狀況，可提供設施維護管理的重要輔助。為提升巡檢工作的效率，本計畫精進港灣構造物之巡查與檢測作業，以更有效率且資訊化方式，協助維護管理人員落實維護管理工作與提升維護管理效率。

本計畫於112年持續擴充及滾動精進港灣設施維護管理系統，並開發各項巡查功能模組，提供臺灣港務公司、金門縣港務處及連江縣港務處辦理港灣設施巡查、檢測、維修、稽核與督導等作業應用，另因應現地巡查之實務需求，持續精進巡查行動應用程式（APP）功能，達成協助各港務單位提升港灣設施巡查效率之目的。

2. 研究成果

（1）完成定期檢測劣化紀錄、送審及維護系統功能精進，並新增公共基礎設施巡查模組。

（2）配合臺灣港務公司、金門縣港務處及連江縣港務處巡查、檢測及維護實務需求，針對港灣設施巡查檢測技術問題、管理制度與劣化判定標準，完成港灣設施維護管理手冊修訂並持續滾動檢討。

（3）辦理3場次教育訓練，說明港灣設施維護管理制度，港灣設施巡查檢測方法及進行系統操作訓練，以利落實港灣設施維護管理工作。

3. 成果推廣與效益

（1）112年10月23日、11月14日及11月17日辦理3場次教育訓練，參與單位包括臺灣港務公司、金門縣與連江縣港務處等，並彙整學員回饋意見，納為後續制度改善及系統擴充精進之參據。

(V) Enhancement of harbor facility inspection and detection operations

1. Project Overview

The port area is vast, and port facilities have long been subjected to harsh marine and underwater environments. Performing routine inspections and checks of port facilities often requires significant manpower and time. In recent years, the rise of automated inspections has enabled machines to undertake complex tasks and assess facility deterioration, providing critical support for facility maintenance management. To improve inspection efficiency, this project enhances the inspection and testing operations of port structures in a more efficient and information-based manner, assisting maintenance personnel in implementing maintenance tasks and improving efficiency.

In 2023, the project continues to expand and refine the port facilities maintenance management system, developing various inspection function modules for use by Taiwan International Ports Corporation, Kinmen County port bureau, and Lienchiang County port bureau. These modules facilitate port facility inspections, testing, repairs, audits, and supervision. To meet the practical needs of on-site inspections, the project continues to improve the functionality of inspection mobile application (APP), aiming to assist various port authorities in enhancing inspection efficiency.

2. Research Results

(1) The project has completed the enhancement of regular inspection deterioration recording, review submission, and maintenance system functions, and added public infrastructure inspection modules.

(2) In line with the practical needs of inspections, testing, and maintenance by Taiwan International Ports Corporation, Kinmen County port bureau, and Lienchiang County port bureau, the project addresses technical issues, management systems, and deterioration assessment standards related to port facility inspections. It has revised the port facilities maintenance management manual and continues to review and update it.

(3) The project held three training sessions to explain the port facilities maintenance management system, port facility inspection methods, and system operation training to facilitate the implementation of port facilities maintenance management.

3. Result Promotion and Benefits

(1) On October 23, November 14, and November 17, 2023, three training sessions were held, with participants including Taiwan International Ports Corporation, Kinmen County port authority, and Lienchiang County port authority. The feedback from the trainees was collected and used as a reference for subsequent system improvements and expansions.

（2）協助臺灣港務公司、金門縣港務處與連江縣港務處落實港灣設施維護管理工作，確保港灣設施使用功能及營運安全，提升港埠服務品質與競爭力，達到永續經營之目標。

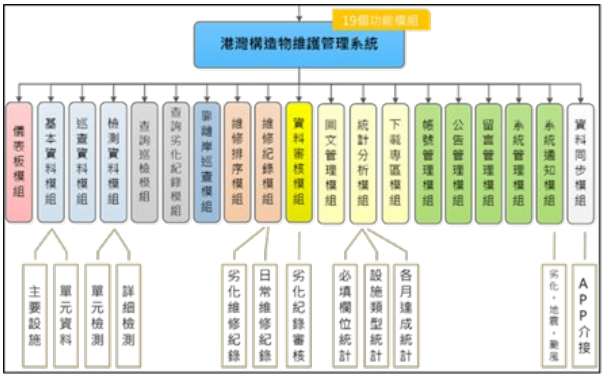
(2) To assist Taiwan International Ports Corporation, Kinmen County port authority, and Lienchiang County port authority in implementing the maintenance and management of port facilities, ensuring the functionality and operational safety of port facilities, improving the quality and competitiveness of port services, and achieving the goal of sustainable operation.

4. 研究成果精華摘整

4. Summary of Research Results

教育訓練

Education and training



港灣設施維護管理系統功能模組

定期檢測劣化紀錄功能精進

系統新增公共基礎設施巡查項目

行動應用程式擴充與精進

港灣設施維護管理系統功能擴充

Expansion of functionality for harbor facility maintenance management systems

5. 研究成果報告

- 港灣構造物巡查檢測作業精進（2/4）－新興科技應用於碼頭設施巡查檢測作業（113年4月出版）。

(六) 港區設施智慧化巡查技術研發

1. 計畫概述

考量我國商港區域幅員廣大，且人力有限，如何快速掌握港區各項設施使用狀況，並巡查港區使用環境及設施安全及穩定性，實為重要施政課題。無人飛行載具在近年快速發展，具有高度的移動性及遠距遙控功能，能取代人力快速且輕易到達過去不容易接近之區域，因此，本所接續110-111年計畫之成果架構，辦理112年「港區影像智慧辨識技術之研究（1/3）－空間基礎資料建構及影像檢監測應用技術發展」計畫，期能結合無人載具影像處理優勢，建立一套能快速涵蓋大範圍港區地表資訊的蒐集技術，並藉由開發影像自動化辨識功能，針對港區重要設施進行巡查與管理，達到應用創新科技，提升智慧化管理效能之目的。

2. 研究成果

完成臺北港區高精度三維數值地形模型建構，分析各種無人飛行載具並評估飛行能力及可應用範圍，且開發合適的人工智慧（AI）影像辨識技術，針對重要設施（如碼頭、堤面及港區變電設施）啟動自動化巡查管理，並將110-111年臺中港之成果架構應用於臺北港，探討整體架構應用於不同港區差異性，做為未來移至其他港區之測試。

3. 成果推廣與效益

（1）1112年10月於第45屆海洋工程研討會發表論文「基於Yolov8與無人機影像達成港區岸邊設施自動辨識」。

（2）112年11月9日辦理「港區無人機影像檢監測應用技術研發成果」教育訓練，推廣無人機影像監測技術應用於臺北港區管理之研究成果。

5. Research Result Report

- Improvement of harbor structure inspection and detection operations (2/4) – application of emerging technologies to pier facility inspection and detection operations (Published in April 2024).

(VI) Smart inspection technology development for harbor facilities

1. Project Overview

Considering the vast area of our country's commercial ports and limited manpower, quickly grasping the usage status of various facilities in the port area and inspecting the environmental and facility safety and stability is an important policy issue. Unmanned aerial vehicles have rapidly developed in recent years, with high mobility and long-distance remote control capabilities. They can replace manpower to quickly and easily reach areas that were difficult to access in the past. Therefore, following the results of 2021-2022 project framework, the institute conducted the 2023 "Research on Port Image Intelligent Recognition Technology (1/3) – Spatial Basic Data Construction and Application of Image Inspection and Monitoring Technology" project. The aim is to combine the advantages of unmanned aerial vehicle image processing to establish a collection technology that can quickly cover a wide range of surface information in the port area. By developing automated image recognition functions, we aim to inspect and manage important facilities in the port area, achieve innovative application of technology, and enhance the efficiency of intelligent management.

2. Research Results

A high-precision 3D digital terrain model for the Taipei Port area has been constructed. Various unmanned aerial vehicles (UAVs) were analyzed, and their flight capabilities and applicable ranges were evaluated. Suitable artificial intelligence (AI) image recognition technology was developed, enabling automated inspection and management of critical facilities such as piers, embankments, and port substations. The results framework from the 2021-2022 Taichung Port project was applied to the Taipei Port. This framework was tested for its applicability in different port areas, providing a basis for potential future migration to other ports.

3. Result Promotion and Benefits

(1) In October 2023, we presented a paper titled "Automatic Recognition of Port Shore Facilities Based on Yolov8 and UAV Images" at the 45th Ocean Engineering Symposium.

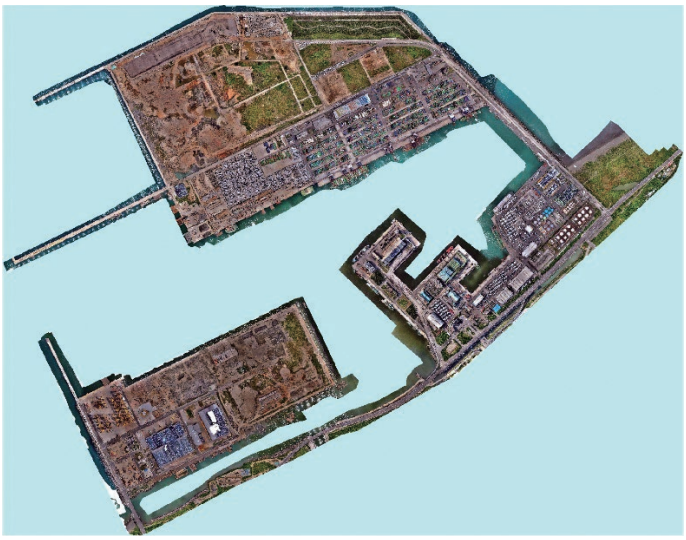
(2) On November 9, 2023, we conducted an educational training on "Research and Development Achievements of Unmanned Aerial Vehicle Image Inspection and Monitoring Technology in Port Areas" to promote the application of unmanned aerial vehicle image monitoring technology in the management of Taipei Port.

（3）研究成果可協助臺灣港務股份有限公司瞭解如何以自動化方式掌握港區之使用狀況與異動，並在人力持續簡化的長期趨勢之下，確保港區營運管理品質，並落實智慧化管理。

(3) The research results can assist Taiwan International Ports Corporation in understanding how to grasp port usage and changes in an automated manner, ensuring the quality of port operation and management in the long term under the trend of continuous manpower simplification, and implementing intelligent management.

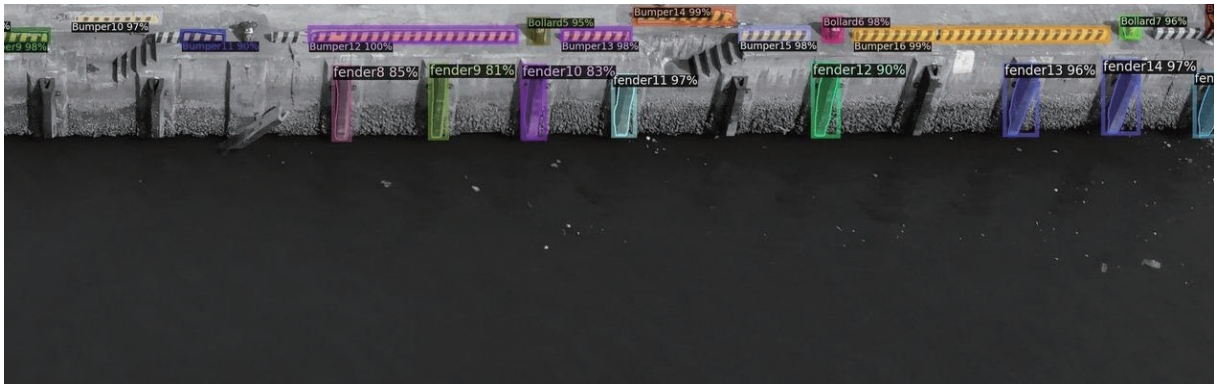
4. 研究成果精華摘整

4. Summary of Research Results



臺北港區高精度三維數值地形模型建構

Construction of a high-precision 3D numerical terrain model for the Taipei Harbor area



臺北港岸邊設施（碰墊、反光板及車擋）多物件辨識模組應用測試

Application testing of multi-object recognition modules for Taipei Harbor shoreline facilities (such as fenders, reflectors, and barriers)

5. 研究成果報告

- 港區影像智慧辨識技術之研究（1/3）－空間基礎資料建構及影像檢監測應用技術發展（113年4月出版）。

5. Research Result Report

- Research on Harbor Image Intelligence Recognition Technology (1/3) – development of spatial data construction and image inspection monitoring application techniques (Published in April 2024).

(七) 船舶特高頻資料交換系統之技術發展

1. 計畫概述

近20年來，雖然船舶自動識別系統（Automatic Identification System, AIS）提供了海域內各船隻的即時資訊，然而，海上事故卻仍常造成人身安全及船舶財產嚴重損失。隨著AIS越來越普及且大量部署，其運作所承受的壓力也越來越大，AIS技術之擴展應用也導致VHF（Very high frequency）數據鏈路負載顯著增加。

船舶特高頻資料交換系統（VHF Data Exchange System, VDES）可視為AIS的擴充版本，旨在解決船舶通訊系統面臨的限制。船舶間有效的通訊和資料交換，對於確保航行安全、提高航運效率與支援海上作業至關重要。然而，傳統的船舶通訊系統存在著一些限制，例如，通訊範圍受限、頻率利用效率低，易受到干擾等問題。

本計畫主要探討發展船舶特高頻資料交換系統的相關技術，以克服上述問題並提升系統性能。為測試VDES相關訊號，本計畫於彰化芳苑燈塔（王功燈塔）設置一固定測試訊號站，及另一移動裝置，發展訊號技術分析、系統設計，推動VDES的技術發展，透過雙邊VDES測試，通信連接的穩定性，包括定期測試移動裝置與附近船舶之間的通信連接，以確保資料的正確傳輸，提供更安全、高效率和可靠的通訊解決方案，提升航海通訊技術，保障航行安全，並提高航運效率。

2. 研究成果

（1）完成彙整國外VDES系統發展與應用技術，整合新一代船舶通訊設備和電子海圖資料庫，同時結合現有的VDES設備和ECDIS系統，完成VDES測試站的基礎建置，提供未來評估國內發展VDES系統之需求與可行性應用參考。

(VII) Technical development of VHF Data Exchange System for ships

1. Project Overview

Over the past 20 years, although the Automatic Identification System (AIS) has provided real-time information for vessels in the sea area, maritime accidents still frequently cause severe personal safety risks and property losses for ships. With the increasing prevalence and extensive deployment of AIS, the system is facing growing pressure, and the expansion of AIS technology applications has significantly increased the load on very high frequency (VHF) data link.

The VHF Data Exchange System (VDES) can be seen as an extended version of AIS, aimed at addressing the limitations faced by ship communication systems. Effective communication and data exchange among vessels are crucial for ensuring navigation safety, improving shipping efficiency, and supporting maritime operations. However, traditional ship communication systems have some limitations, such as restricted communication range, low frequency utilization efficiency, and susceptibility to interference.

This project primarily explores the development of VDES-related technologies to overcome these issues and enhance system performance. To test VDES-related signals, this project has set up a fixed test signal station at Fangyuan Lighthouse in Changhua (Wanggong Lighthouse) and another mobile device, developing signal technology analysis and system design, and promoting VDES technology development. Through bilateral VDES testing, the stability of communication connections, including regular testing of communication connections between mobile devices and nearby vessels, is ensured to guarantee the correct transmission of data, providing a safer, more efficient, and reliable communication solution, enhancing maritime communication technology, ensuring navigation safety, and improving shipping efficiency.

2. Research Results

(1) The completion of consolidating foreign VDES system development and application technologies, integrating next-generation ship communication equipment and electronic chart databases, combined with existing VDES equipment and ECDIS systems, establishes the foundation of VDES testing station to provide a reference for evaluating the domestic demand and feasibility of developing VDES systems in the future.

（2）完成VDES測試站建置，包含彰化芳苑燈塔（王功燈塔）設置一處固定測試訊號站及另一移動裝置，將探討訊號解讀及資訊應用，未來能促進我國海域航行安全並提升搜救效能，協助航港局推動智慧航安相關計畫。

3. 成果推廣與效益

112年10月於第45屆海洋工程研討會發表論文「彰化風場航道船舶交通流量分析」。

4. 研究成果精華摘整

(2) The establishment of the VDES testing station, including setting up a fixed test signal station at Fangyuan Lighthouse in Changhua (Wanggong Lighthouse) and another mobile device, will explore signal interpretation and information application, which can promote maritime navigation safety and enhance search and rescue efficiency in our country's waters, assisting the Maritime Port Bureau in advancing related smart maritime safety projects.

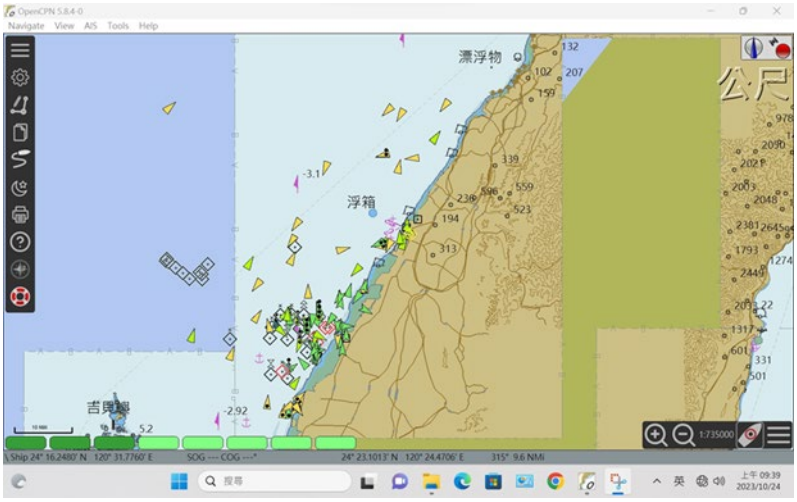
3. Result Promotion and Benefits

In October 2023, a paper titled "Analysis of Ship Traffic Flow in Changhua Wind Farm Channels" was presented at the 45th Ocean Engineering Conference.

4. Summary of Research Results

VDES接收站設備及訊號傳輸應用軟體

Equipment for VDES reception stations and application software for signal transmission



電子海圖平台展示畫面

Display screen for electronic nautical charts platform

5.研究成果報告

- 智慧航安與海氣象資訊應用探討（2/4）－智慧港口之海氣象觀測應用分析（113年4月出版）。

5. Research Result Report

- Application of smart aviation safety and marine meteorological information (2/4) – analysis of marine meteorological observation applications in smart ports (Published in April 2024).

(八) 應用雷達技術於商港海象觀測

1. 計畫概述

海象會受到大氣、地形水深及近岸結構物等影響變化萬千，常用海象觀測設備，如浮標及底碇波流儀，僅能呈現單點資訊且維護不易，不同於浮標及底碇波流儀，若採用如微波雷達及高頻雷達等遙測方式進行觀測，除可獲取平面波流場之觀測資料，無須至海上佈放觀測儀器，可於岸基上進行維護工作，降低作業人員之職安風險外，其應用層面也較為廣泛。本所應用雷達遙測技術於商港海象調查，於臺中港建置高頻海洋陣列雷達觀測系統，另於臺北港建置微波雷達測系統，共同建構商港平面海象觀測網絡，利用不同雷達設備擷取回波訊號，分別演算得到約3公里近域與約40公里遠域不同解析度之平面波浪及海流觀測資訊，輔助並精進國內現行之海象觀測作業。

2. 研究成果

（1）評估改善臺北港微波雷達觀測之影響因子，並利用已設立臺北港北防波堤外之浮標與觀測樁優化觀測系統與應用技術，驗證臺北港微波雷達觀測波流之結果；另外，發展窗格函數處理雷達訊號，提供最適化之海氣象資訊。

（2）延續美國綜合海洋觀測系統（IOOS/QARTOD）高頻雷達表面流品管方法，精進海洋陣列雷達海流作業化觀測之資料品管程序，並完成觀測系統校驗，以提高雙雷達系統於平面海流觀測之準確度，輔助臺中港港埠管理單位應用。

3. 成果推廣與效益

（1）112年10月5日於第45屆海洋工程研討會發表論文「利用波束合成與MUSIC演算法估計高頻陣列雷達資料獲取丹娜絲颱風徑向表面海流速度之比較」。

(VIII) Application of radar technology in commercial port marine observation

1. Project Overview

Marine conditions are influenced by a myriad of factors such as atmospheric conditions, underwater topography, water depth, and nearshore structures. Traditional marine observation equipment like buoys and bottom-mounted wave and current meters can only provide point-specific information and are difficult to maintain. Unlike buoys and bottom-mounted meters, using remote sensing methods like microwave radar and high-frequency radar for observations can provide data on the sea surface wave and current fields without the need to deploy instruments at sea. Maintenance can be conducted onshore, which reduce occupational safety risks for personnel and widen the application scope. The institute applied radar remote sensing technology to marine meteorological surveys in commercial ports. We established a high-frequency marine radar observation system at Taichung Port and a microwave radar system at Taipei Port, collectively constructing a network for planar marine observation in commercial ports. Using different radar equipment to capture echo signals, we computed sea surface wave and current observation information with resolutions of about 3 kilometers for the near field and about 40 kilometers for the far field, aiding and improving current marine observation operations in the country.

2. Research Results

(1) Evaluated and improved the impact factors of microwave radar observation at Taipei Port, optimized the observation system and application technology using buoys and observation piles outside the north breakwater of Taipei Port, verified the results of microwave radar observation of wave and current flows at Taipei Port, and developed grid function processing of radar signals to provide optimized marine meteorological information.

(2) Building on the Integrated Ocean Observing System (IOOS/QARTOD) surface current quality control method, we enhanced the data quality control process for operational marine array radar current observation and completed the verification of the observation system to improve the accuracy of sea surface current observation by the dual-radar system, assisting the port management units at Taichung Port.

3. Result Promotion and Benefits

(1) On October 5, 2023, we presented a paper titled "Comparison of Estimating Radial Surface Current Velocity of Typhoon Danas using Beamforming and MUSIC Algorithm with High-Frequency Array Radar Data" at the 45th Ocean Engineering Conference.

（2）112年10月5日於第45屆海洋工程研討會發表論文「高頻陣列雷達系統之天線場型檢校」。

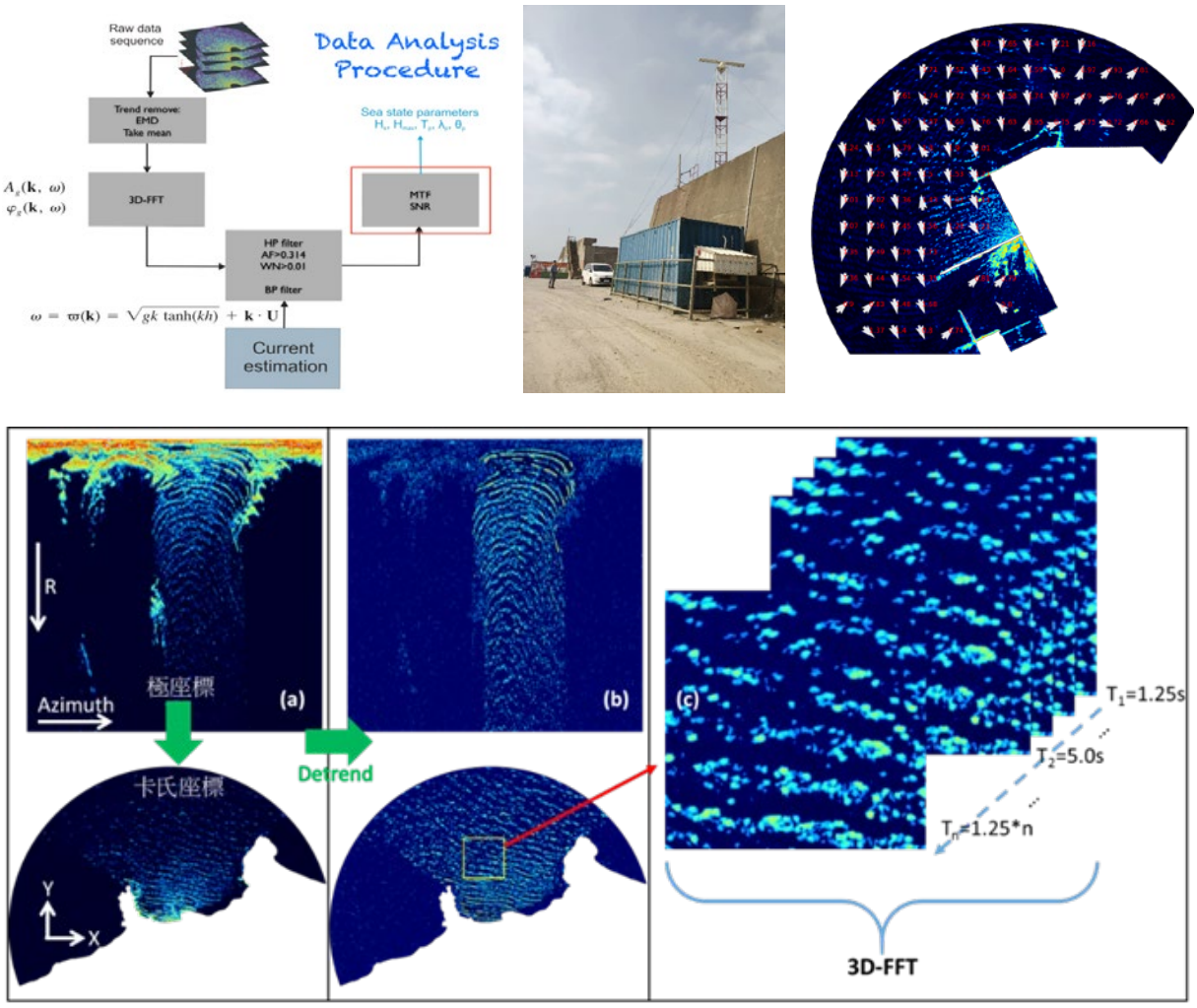
（3）112年10月24日協助海洋委員會國家海洋研究院舉辦「2023海洋達人工作坊之臺灣海洋雷達遙測發展與技術交流會議」，邀請國立成功大學、高雄海洋科技大學、國家實驗研究院台灣海洋科技研究中心等單位技術交流及應用分享，促成國內雷達觀測技術交流、資源整合與跨部會合作。

(2) On October 5, 2023, a paper titled "Antenna Pattern Calibration of High-Frequency Array Radar Systems" was presented at the 45th Ocean Engineering Conference.

(3) On October 24, 2023, we assisted in organizing "Taiwan Ocean Radar Remote Sensing Development and Technology Exchange Conference" as part of the "Ocean Experts Workshop 2023" held by the National Academy of Marine Research, under the auspices of the Ocean Affairs Council. The event included technical exchanges and application sharing among units such as National Cheng Kung University, National Kaohsiung University of Science and Technology, and the National Applied Research Laboratories Taiwan Ocean Research Institute, facilitating domestic radar observation technology exchanges, resource integration, and inter-agency cooperation.

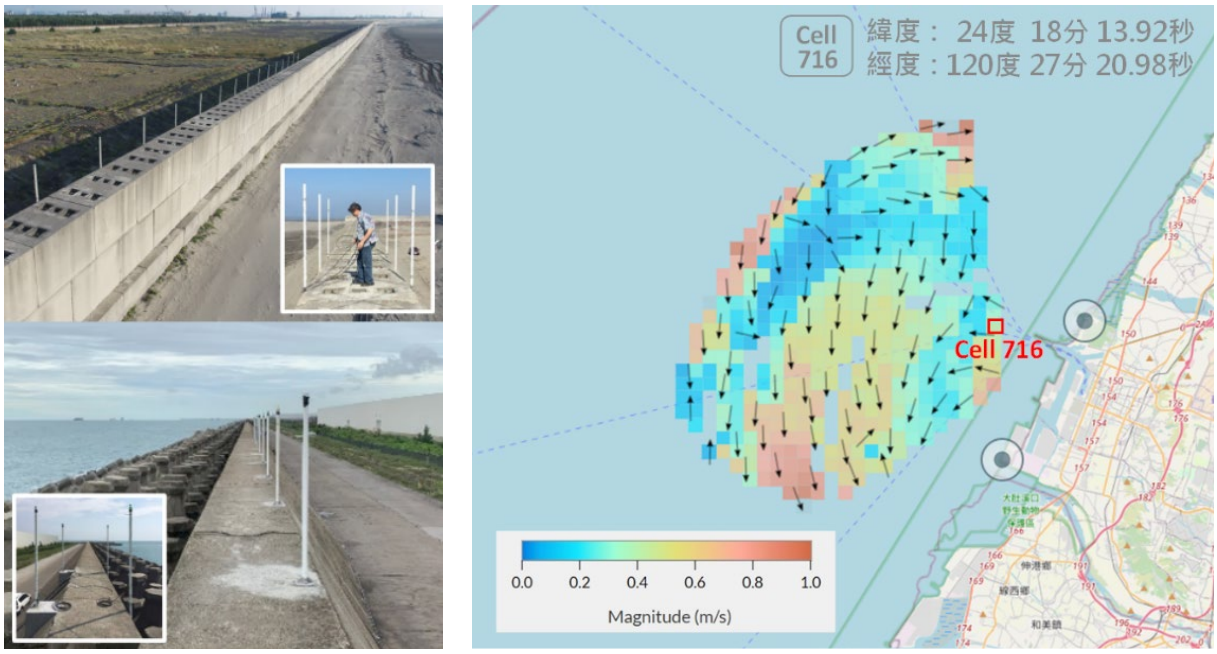
4. 研究成果精華摘整

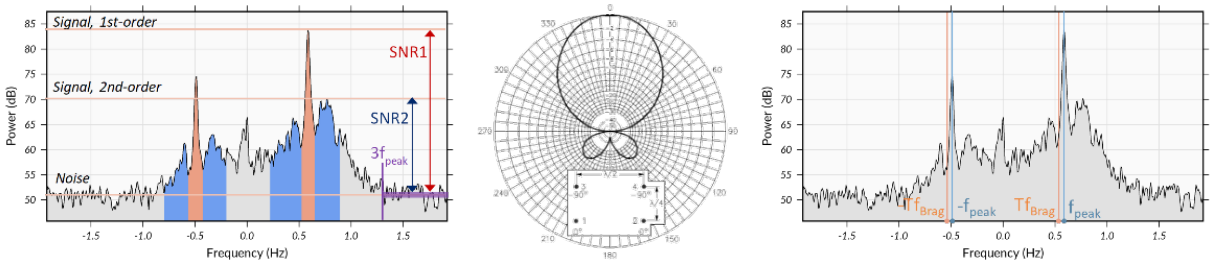
4. Summary of Research Results

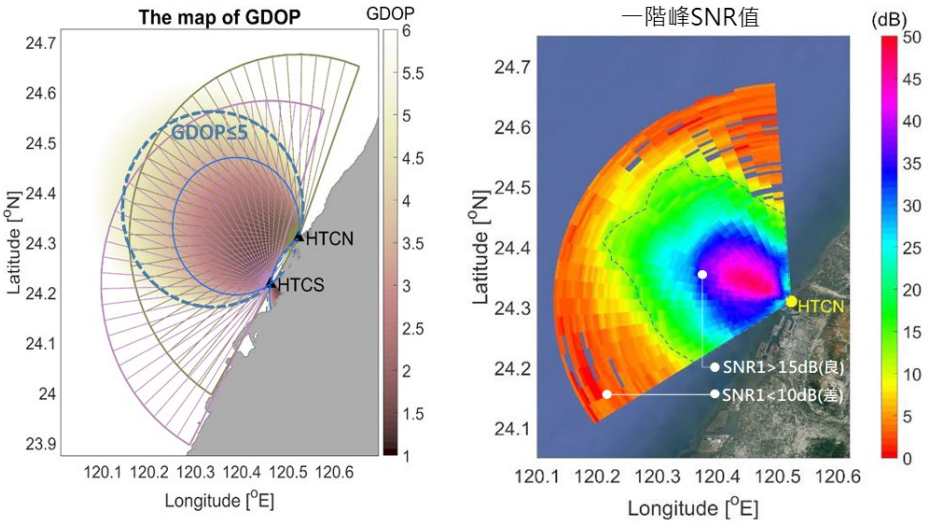


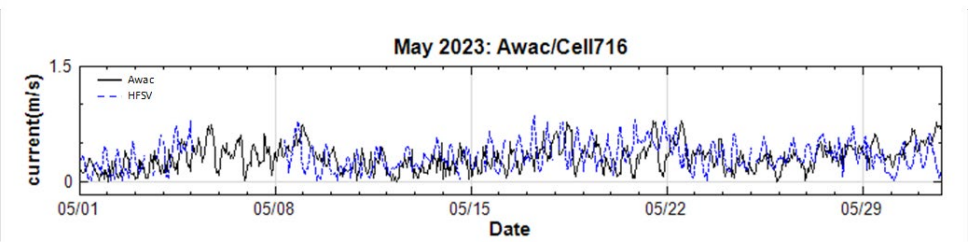
臺北港微波雷達觀測站及平面波浪資訊展示

Taipei Harbor microwave radar observation station and display of sea surface wave information



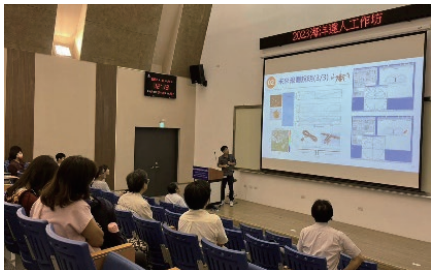






臺中港陣列雷達觀測站應用及平面海流資訊展示

Application and display of sea surface current information for Taichung Harbor radar observation station



112年10月24日2023海洋達人工作坊活動剪影

Highlights of the 2023 Ocean Master Workshop activities on October 24, 2023

5. 研究成果報告

- 臺中港海洋陣列雷達訊號應用分析（1/3）－表面流觀測分析（113年4月出版）
- 應用微波雷達於臺北港域環境監測之研究（2/4）－微波雷達海象監測技術優化（113年4月出版）

5. Research Result Report

- Analysis of ocean array radar signals at Taichung Harbor (1/3) – surface flow observation analysis (Published in April 2024).
- Research on the application of microwave radar for environmental monitoring in the Taipei Harbor area (2/4) – optimization of microwave radar marine monitoring technology (Published in April 2024).

(九) 港灣環境及防災資訊服務應用研究

1. 計畫概述

臺灣四周海域海氣象環境資料，係船舶航行及海域作業活動安全的關鍵，亦能提供擬定港灣環境短期劇烈變化的防災預警，以及長期演變趨勢之因應對策等應用參考。港區內外水理特性，常因港灣結構物影響產生局部性效應，進而影響船舶進出港口操航安全。因此，本所整合港灣即時海氣象觀測與數值模擬預測結果，發展即時性與預測性之港區海氣象環境資訊，並結合港區海嘯、港區地震及港區大氣腐蝕資訊，提供港埠管理單位、船舶業者、引水人等查詢應用，使其迅速、確實、完整的掌握風力、潮位、波浪、海流、港區地震、港區海嘯等港區環境資訊。

爰此，本所完成港灣環境資訊網建置，提供9商港、12海域之風、波、潮、流即時觀測及未來48小時模擬資訊，以期達到「資料整合」、「應用加值」、「資料開放」與「成果推廣」四大目標，進而提供即時、正確、穩定之資訊服務。港灣環境資訊網除綜整運研所歷年港灣環境相關研究成果外，亦整合運研所、中央氣象署、以及水利署等機構的海氣象即時觀測數據，提供臺灣商港區最全面、即時的環境資訊，包括商港之海氣象觀測及模擬、海嘯、地震、港區金屬材料腐蝕資訊、網站科普、公開資料及港灣環境資訊圖臺，112年於港灣環境資訊圖臺精進颱風期間的即時海氣象資訊展示及查詢功能，顯示海氣象風力、波浪、潮汐、海流資訊和中央氣象署颱風行進、預測軌跡及暴風圈侵襲機率等資訊，提供臺灣港務股份有限公司、船舶業者及港區使用者颱風期間決策支援，提高港區使用安全。此外，金屬腐蝕環境資訊新增「臺灣腐蝕環境分類資訊—綜合比較」功能，可瞭解不同地區金屬腐蝕速率的差異性，提供臺灣各港口和沿海地區腐蝕環境詳細分析數據，可研析金屬腐蝕速率對於港口設施等公共工程之長期影響，提供港區結構物金屬防蝕設計參考，提高港區結構物安全。

(IX) Research on the application of harbor environmental and disaster prevention information services

1. Project Overview

The maritime meteorological and environmental data around Taiwan's waters are crucial for the safety of vessel navigation and maritime operations. They can also provide disaster prevention warnings for short-term dramatic changes in port environments and serve as references for long-term trend coping strategies. The hydrological characteristics inside and outside port areas often experience localized effects due to port structures, which can impact the safe navigation of vessels entering and leaving ports. Therefore, the institute integrates real-time maritime meteorological observations and numerical simulation predictions to develop real-time and predictive port maritime environmental information. We also combine port tsunami, port earthquake, and port atmospheric corrosion information to provide querying applications for port management units, ship operators, pilots, and others. This enables them to quickly, accurately, and comprehensively grasp information on wind, tide, waves, currents, port earthquakes, port tsunamis, and other port environmental information.

To achieve this, the institute has completed the construction of port environmental information network, providing real-time observations and future 48-hour simulation information on wind, waves, tides, and currents for 9 commercial ports and 12 sea areas. This aims to achieve four major goals: "Data integration," "Value-added applications," "Data openness," and "Results promotion," thereby providing real-time, accurate, and stable information services. The harbor environmental information website not only consolidates the institute's research results related to port environments over the years but also integrates real-time maritime meteorological observation data, the Central Weather Bureau, and the Water Resources Agency. This provides the most comprehensive and real-time environmental information for Taiwan's commercial port areas, including maritime meteorological observations and simulations, tsunamis, earthquakes, port metal corrosion information, website popularization, public data, and harbor environmental information map. In 2023, during the typhoon period, improvements were made to the real-time maritime meteorological information display and querying functions on the harbor environmental information map. This included displaying information on wind force, waves, tides, currents, and the Central Weather Bureau's typhoon path progress, forecast trajectory, and storm circle invasion probability. These enhancements provide decision-making support for Taiwan International Ports Corporation, ship operators, and port users during typhoon periods to enhance port safety. "Taiwan Corrosion Environment Classification Information – Comprehensive Comparison" function was added to the metal corrosion environmental information, enabling an understanding of the differences in corrosion rates in different regions and providing detailed analysis data on corrosion environments for various ports and coastal areas in Taiwan. This can analyze the long-term impact of metal corrosion rates on public engineering such as port facilities, and provide references for port structure metal corrosion prevention designs and improve port structure safety.

2. 研究成果

（1）建構GIS颱風資訊儀表板專區，於颱風侵臺期間，展示港區海氣象觀測及模擬歷線圖資訊，及套疊臺灣近岸海象預測系統（TaiCOMS）所產出之海氣象模擬平面分佈圖、氣泡資訊與襲港機率，進而提供颱風路徑上各中心點對各商港海氣象資訊變化影響，可幫助港埠管理、營運人員及使用者因應惡劣環境之參考。

（2）優化臺灣腐蝕環境分類資訊查詢功能，提供臺灣各港口和沿海地區腐蝕環境詳細分析數據，以利瞭解港區環境之腐蝕趨勢或變化，作為港區結構物金屬防蝕設計參考，提昇港區結構物安全。

3. 成果推廣與效益

（1）112年11月3日舉辦「港灣環境資訊網使用者說明會」，邀請交通部航港局、臺灣港務股份有限公司、連江縣港務處、金門縣港務處、交通部中央氣象署、交通部觀光署、經濟部水利署、國家海洋研究院、引水人辦事處以及水域遊憩活動等相關單位，除介紹港灣環境資訊網及圖臺功能外，另透過問卷調查，蒐集港區各使用單位對系統功能和資訊服務需求的建議，俾利系統推廣應用及持續優化。

（2）112年10月於第45屆海工研討會發表論文摘要「港灣環境資訊網－颱風資訊儀表板」。

（3）本所港灣環境資訊網內容包括港灣風、波、潮、流觀測資訊、模擬資訊、腐蝕資訊、網站科普、公開資料及港灣環境資訊圖臺6大查詢功能，提供整體性、即時性海象資訊供政府單位及一般民眾參考。

2. Research Results

(1) The construction of GIS typhoon information dashboard section displays maritime meteorological observation and simulation history line chart information during typhoon invasion periods, overlaid with the Taiwan Coastal Operational Modeling System (TaiCOMS) generated maritime meteorological simulation plane distribution maps, bubble information, and port invasion probability. This provides information on how each center point along the typhoon path affects changes in maritime meteorological information for each commercial port, aiding port management, operational personnel, and users in responding to adverse environmental conditions.

(2) The Taiwan Corrosion Environment Classification Information query function was optimized to provide detailed analysis data on corrosion environments for various ports and coastal areas in Taiwan, facilitating an understanding of trends or changes in port environments. This serves as a reference for port structure metal corrosion prevention designs and enhances port structure safety.

3. Result Promotion and Benefits

(1) In November 3, 2023, "User Conference of Harbor Environmental Information System" was held, invi t ing relevant uni ts such as the Maritime Port Bureau of the MOTC, Taiwan International Ports Corporation, Ltd., Harbor Bureau of Lienchiang County, Harbor Bureau of Kinmen County, Central Weather Bureau of the MOTC, Tourism Bureau of the MOTC, Tourism Administration of the MOTC, Water Resources Agency of Ministry of Economic Affairs, National Academy of Marine Research, Pilot office, and water recreational activities. Besides introducing the harbor environmental information website and Geographic Information System functions, a questionnaire survey was conducted to collect suggestions from various port users on system functionality and information service needs, facilitating system promotion, application, and continuous optimization.

(2) In October 2023, a paper abstract titled "Harbor Environmental Information Website-Typhoon Information Dashboard" was presented at the 45th Ocean Engineering Conference

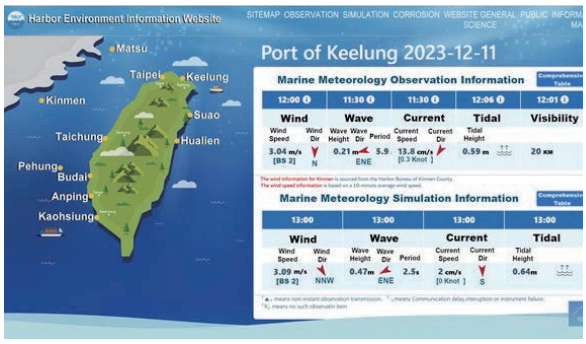
(3) The content of the institute's harbor environmental information website includes six major query functions: port wind, wave, tide, and current observation information, simulation information, corrosion information, website popularization, open data, and harbor environmental information map. This provides comprehensive and realtime maritime information as a reference for government agencies and the general public.

4. 研究成果精華摘整

4. Summary of Research Results

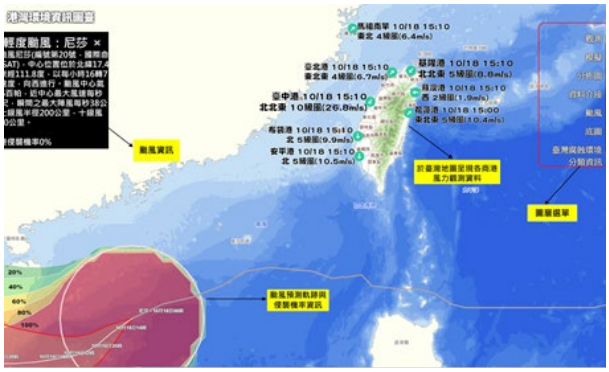
港灣環境資訊平臺之六項子系統

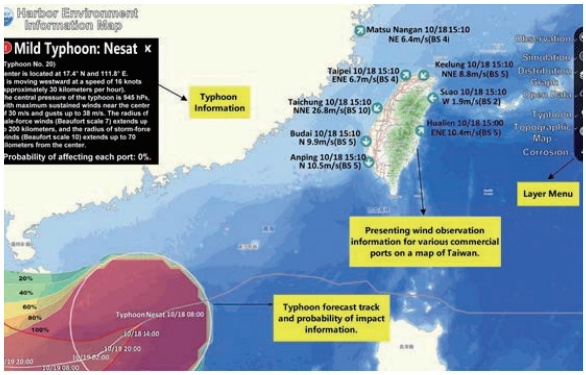
The six subsystems of the harbor environmental information platform



港灣環境資訊網

Harbor Environmental Information Website





港灣環境資訊圖臺颱風圖層

Typhoon layer of harbor environmental information map

5. 研究成果報告

- 港灣環境資訊系統維護與精進（2/4）－優化決策輔助資訊模組（113年4月出版）。

5. Research Result Report

- Maintenance and function upgrades of the harbor environmental information system (2/4) – optimization of decision support information modules(Published in April 2024).

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研討與成果推廣活動

Seminars and Achievements Promotion Activities

項次	日期	主題	Topic
1	1月18日	「先進公車智慧化營運管理先導運行計畫（2/2）－整合車載設備之駕駛數位履歷管理系統研發」第1場「汽車客運業數位轉型及運輸安全」產官學三方交流座談會	Tripartite Exchange Symposium between Industry, Government and Academia: The Advanced Intelligent Operation and Management Pilot Project for Smart Bus (2/2) – Development of an Integrated Driver Digital Resume Management System for Onboard Devices.The 1st "Digital Transformation and Transportation Safety of Automotive Passenger Transport Industry".
2	2月14日	112年2月海運期刊研討會	Seminar: February 2023 Maritime Journal
3	2月16日	「汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫（2/2）」專家學者座談會	Expert and Scholar Symposium: Project to Review Route-Based Costing Systems and Developing Software Applications for Bus Services Industry (2/2)
4	3月15日	112年3月空運期刊研討會	Seminar: March 2023 Air Transport Journal
5	3月20日	交通部臉書貼文「港灣環境資訊平臺，港灣資訊一應俱全」	MOTC Facebook Post: "Harbor Environment Information Platform Provides Comprehensive Harbor Information."
6	3月28日 ~3月31日	參與「2050淨零城市展」－交通部展攤	Exhibition: 2050 Net Zero City Expo.
7	4月11日	112年4月海運期刊研討會	Seminar: April 2023 Maritime Journal
8	4月14日	「推動通用計程車特約制度（2/2）－成效檢討及服務優化」第1次專家學者座談會	Expert and Scholar Symposium: The 1st Expert and Scholar Symposium on "Implement the Contract System of Accessible Taxis (2/2) – The Effectiveness and Service Optimization"
9	4月20日	「汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫（2/2）」第1次應用軟體說明會	Application Software Briefing I: Project to Review Route-Based Costing Systems and Developing Software Applications for Bus Services Industry (2/2)
10	4月26日	112年4月運技中心期刊研討會	Seminar: April 2023 Transportation and Harbors Journal
11	4月28日	人行與車行交通工程改善教育訓練	Training Workshop: Improving road traffic environment for Pedestrian and vehicular
12	5月2日	專題演講「Covid-19疫情對公共運輸之影響及因應對策」（成功大學交通管理科學系教學與應用合作計畫）	Keynote Speech: "The Impact of Covid-19 Pandemic on Public Transport and Response Measures" (Teaching Cooperation Program with the Department of Transportation & Communication Management Science, NCKU)
13	5月5日	「環騎圓夢APP」教育訓練－北區	Training Workshop: "Taiwan Cycling Route App" for Northern Area Team Leaders.
14	5月8日	「環騎圓夢APP」教育訓練－南區	Training Workshop: "Taiwan Cycling Route App"for Southern Area Team Leaders.
15	5月9日	「環騎圓夢APP」教育訓練－東區	Training Workshop: "Taiwan Cycling Route App"for Eastern Area Team Leaders
16	5月11日	「環騎圓夢APP」教育訓練－中區	Training Workshop: "Taiwan Cycling Route App" for Central Area Team Leaders
17	5月12日	「環騎圓夢APP」教育訓練－線上	Training Workshop: "Taiwan Cycling Route App" – Online
18	5月17日	112年5月空運期刊研討會	Seminar: May 2023 Air Transport Journal
19	5月25日	「公路系統因應氣候變遷強化調適能力案例研析-公路規劃階段調適指引導讀」（第1場）	Training Workshop: Case Studies of Enhancing Highway System's Adaptive Capacity to Climate Change (1st Session).

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20	5月25日	112年運輸安全期刊研討會議第1場次	Seminar: 2023 Transportation safety Journal (1st Session)
21	5月29日	112年5月運技中心期刊研討會	Seminar: May 2023 Transportation and Harbors Journal
22	5月30日	「建立自行車環島、多元及串聯路線之自行車事故分析及改善機制」分析平台需求訪談座談會	Symposium: "Establishing Bike Accident Analysis and Improvement Strategies of cycling routes" - Analysis platform requirements interview.
23	6月9日	「傳統區域鐵路系統容量分析技術」第1次教育訓練	Training Workshop: Research on Capacity Analysis of Intercity Railways and Its Applications (1st Session)
24	6月9、20、26、27、29、30日	「事故碰撞型態導向之路口設計範例」教育訓練座談會	Education and Training Symposium: The Guide Manual on Traffic Engineering Safety Design Based on the Accident Types at Intersections
25	6月12日	「汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫（2/2）」第2次應用軟體說明會	Application Software Briefing II: Project to Review Route-Based Costing Systems and Developing Software Applications for Bus Services Industry
26	6月13日	112年6月海運期刊研討會	Seminar: June 2023 Maritime Journal
27	6月17日	112年6月運技中心期刊研討會	Seminar: June 2023 Transportation and Harbors Journal
28	6月21日	「運輸規劃支援系統維運技術服務（112年）」第1次教育訓練	Training Workshop: Maintenance Service of the Transportation Planning Support System (2023) (1nd Session)
29	6月26日	「交通科技產業會報無人機科技產業小組」第7次諮詢委員會議	Meeting: Board of Transportation Technology Industries – UAV Technology Task Group 7th Consultation Meeting
30	7月5日	「推動通用計程車特約制度（2/2）－成效檢討及服務優化」第2次專家學者座談會	Expert and Scholar Symposium: The 2nd Expert and Scholar Symposium on "Implement the Contract System of Accessible Taxis (2/2) – The Effectiveness and Service Optimization "
31	7月7日	第2場「公路客運業者數位轉型需求與智慧化營運管理」產官學三方交流座談會－ADAS相關產業	Tripartite Exchange Symposium between Industry, Government and Academia - ADAS Related Industries :The 2nd "Highway Passenger Transport Industry's Digital Transformation Demand and Intelligent Operation Management".
32	7月12日	112年7月空運期刊研討會	Seminar: July 2023 Air Transport Journal
33	7月13日	「ISO55001國際標準導入鐵道資產管理實務之研究（1/3）－制度架構建立」第1次專家學者座談會	Expert and Scholar Symposium: The 1st Expert and Scholar Symposium on "A Study on Implementation of Railway Asset Management Practices through ISO 55001 (1/3) - Establishment for Framework"
34	7月13日	第3場「公路客運業者數位轉型需求與智慧化營運管理」產官學三方交流座談會-運輸業	Tripartite Exchange Symposium between Industry, Government and Academia – Transportation Industry: The 3rd "Highway Passenger Transport Industry's Digital Transformation Demands and Intelligent Operation Management".
35	7月17日	「路口交通環境特性對空氣品質影響及改善指引之研訂」專家諮詢會議	Expert Consultation Meeting: The Impact of Traffic Environmental Characteristics at Intersections on Air Quality and the Development of Improvement Guidelines
36	7月18日	專題演講「結合IoT與資料探勘於環境監測與管理之應用」	Keynote Speech:Application of IoT and Data Mining in Environmental Monitoring and Management
37	7月17日~7月23日	「2023亞太永續行動博覽會」	Exhibition: 2023 SDGs Asia Exhibition
38	7月31日	112年7月運技中心期刊研討會	Seminar: July 2023 Transportation and Harbors Journal

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39	8月15日	112年8月海運期刊研討會	Seminar: August 2023 Maritime Journal
40	8月23日	112年8月運技中心期刊研討會	Seminar: August 2023 Transportation and Harbors Journal
41	9月13日	112年9月空運期刊研討會	Seminar: September 2023 Air Transport Journal
42	9月13日	112年度金門港維護管理系統教育訓練（第1場）	Training Workshop:2023 Kinmen Harbor Structure Maintenance and Management System Education and Training (1st Session)
43	9月18日	112年臺灣公路容量分析軟體教育訓練－臺北場	Training Workshop: Taiwan Highway Capacity Analysis Software (THCS) for Northern Area 2023
44	9月20日	112年臺灣公路容量分析軟體教育訓練－高雄場	Training Workshop: Taiwan Highway Capacity Analysis Software (THCS) for Southern Area 2023
45	9月27日	運輸計畫及陸運組期刊研討會議	Seminar: Transportation Planning and Land Transport Journal
46	9月27日	112年9月運技中心期刊研討會	Seminar: September 2023 Transportation and Harbors Journal
47	9月27日	臺日交通行動服務（MaaS）跨境合作啟動記者會	Press Conference:MaaS Cross-Border Collaboration Launch Press Ceremony between Taiwan and Japan
48	10月12日	「公路系統因應氣候變遷強化調適能力案例研析」專家工作坊	Experts Symposium: Case Studies of Enhancing Highway System's Adaptive Capacity to Climate Change
49	10月16日	「偏鄉交通行動服務MaaS服務範疇界定與推動策略規劃」專家學者座談會	Expert and Scholar Symposium: The 1st Expert and Scholar Symposium on "Defining the Scope of Service and Promoting Strategic Planning of MaaS in Rural Areas "
50	10月17日	112年10月海運期刊研討會	Seminar: October 2023 Maritime Journal
51	10月19日	112年運輸安全期刊研討會議第2場次	Seminar: 2023 Transportation safety Journal (2nd Session)
52	10月20日	「公路系統因應氣候變遷強化調適能力案例研析－公路規劃階段調適指引導讀」（第2場）	Training Workshop: Case Studies of Enhancing Highway System's Adaptive Capacity to Climate Change (2nd Session).
53	10月23日	交通部運輸研究所112年度馬祖研究計畫成果交流暨系統教育訓練	Training Workshop: Matsu Zu Research Project Results Exchange and System Education Training
54	10月23日	專題演講「Covid-19疫情對公共運輸之影響及因應對策」（陽明交通大學運輸與物流管理學系教學與應用合作計畫）	Keynote Speech: "The Impact of Covid-19 Pandemic on Public Transport and Response Measures" (Teaching Cooperation Program with the Department of Transportation & Logistics Management, NYCU)
55	10月24日	2023海洋達人工作坊之臺灣海洋雷達遙測發展與技術交流會議	Exchange activity: 2023 Ocean Experts Workshop, Conference on the Development and Technical Exchange of Taiwan's Ocean Radar Remote Sensing
56	10月24日	「運輸規劃支援系統維運技術服務（112年）」第2次教育訓練	Training Workshop: Maintenance Service of the Transportation Planning Support System (2023) (2nd Session)
57	10月25日	「傳統區域鐵路系統容量分析技術」第2次教育訓練	Training Workshop: Research on Capacity Analysis of Intercity Railways and Its Applications (2nd Session)
58	10月26日	「MaaS使用數據應用需求座談會」	Symposium: Application of MaaS Data-Based on MaaS Stakeholder Demand
59	10月26日	「自行車環島路線（含替代路線）及多元路線標誌標線設置原則」說明暨討論會議	Meeting: Cycling route(including alternative route) and Bike tour sign, markings' setting principles

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60	10月27日	「因應氣候變遷調適基礎課程」教育訓練（第1場）	Training workshop: Climate Change Adaptation Basic Course (1st Session)
61	10月27日	「自行車環島路線（含替代路線）及多元路線標誌標線設置原則」說明暨討論會議	Training Workshop: Cycling route(including alternative route) and Bike tour sign, markings' setting principles
62	10月27日	「以無人機空拍及AI影像辨識技術探討路口交通衝突」研究成果說明暨教育訓練	Training workshop: Education and Training of seeded lecturer: The Guide Manual on Traffic Engineering Safety Design Based on the Accident Types at Intersections
63	10月27日	112年10月運技中心期刊研討會	Seminar: October 2023 Transportation and Harbors Journal
64	11月2日	新興科技導入學校交通安全教育之研發示範計畫成果發表會	Symposium:Incorporating Emerging Technology into School Traffic Safety Education R&D Demonstration.
65	11月3日	「港灣環境資訊網」使用者說明會	Meeting: 2023 User Conference of Harbor Environmental Information System
66	11月3日	低碳交通區推動機制之研究－中部交流會	Meeting: Policy Analysis on Low-Carbon Traffic Zone (The Central Taiwan Session)
67	11月6日	低碳交通區推動機制之研究－南部交流會	Meeting: Policy Analysis on Low-Carbon Traffic Zone (The Southern Taiwan Session)
68	11月7日	橋檢新工具－無人機結合AI技術成果觀摩會	Outcome Presentation: Symposium on the Application of UAV with AI image recognition for bridge inspection
69	11月7日	綠運輸生活型態推廣活動	Promotion of Green Transportation Life Style
70	11月8日	低碳交通區推動機制之研究－北部交流會	Meeting: Policy Analysis on Low-Carbon Traffic Zone (The Northern Taiwan Session)
71	11月8日	「ISO55001國際標準導入鐵道資產管理實務之研究（1/3）－制度架構建立」第2次專家學者座談會	Expert and Scholar Symposium: The 2nd Expert and Scholar Symposium on "A Study on Implementation of Railway Asset Management Practices through ISO 55001 (1/3) - Establishment for Framework"
72	11月8日	「我國MaaS服務永續提供之探討」	Symposium: MaaS Service Sustainable Provision in Taiwan
73	11月9日	「港區無人機影像檢監測應用技術研發成果」教育訓練	Training Workshop: The Achievements of UAV Image inspection Development in theHarbor
74	11月9、10日	道安從業人員專業能力提升訓練	Training Workshop: Professional Competency Enhancement Training for Road Safety Practitioners
75	11月10日	航港產業數位轉型藍圖專家學者座談會	Experts and Scholar Symposium: Digital Development Blueprint of Maritime and Port Industry
76	11月13日	「因應氣候變遷調適基礎課程」教育訓練（第2場）	Training Workshop: Climate Change Adaptation Basic Course (2nd Session)
77	11月13日	「112年度港灣海氣象觀測作業及分析與應用技術研習會」	Workshop: Harbor Marine Meteorological Observation, Analysis, and Application Technology of 2023
78	11月14日	112年度金門港維護管理系統教育訓練（第2場）	Training Workshop:2023 Kinmen Harbor Structure Maintenance and Management System Education and Training (2nd Session)
79	11月16日	「應用人工智慧分析技術探勘高風險路段（3/4）－行車異常事件及高風險駕駛行為開發」高風險駕駛行為管理雛型系統說明會	Symposium: Prototype of Risky Driving Behavior Management System

項次	日期	主題	Topic
80	11月17日	「港灣構造物維護管理系統」教育訓練	Training Workshop: Harbor Structure Maintenance and Management System
81	11月17日	112年11月空運期刊研討會	Seminar: November 2023 Air Transport Journal
82	11月20日	應用大數據技術建構國際機場潛在市場評析方法之研究座談會	Experts Symposium: A Study on Developing Market Analysis Methods for International Airports through the Use of Big Data Technology
83	11月22日	「構建5G智慧交通數位神經中樞－功能擴充與精進」成果交流座談會	Achievements Exchange Symposium : Construction of 5G intelligent transportation digital nerve center - Function Expansion and Refinement.
84	11月27日	112年度「國際空運資料庫」議題分析成果交流座談會	Experts Symposium: Maintaining and Data Analyzing Services of International Air Transport Database of 2023
85	11月27日	辦理「我國人工智慧車聯網之號誌控制（1/2）－都會區幹道實作與交流道區域模式發展探討成果分享會」	Outcome Presentation:Seminar on AI-based Traffic Signal Control (1/2) - Implementation in Urban Arterial Roads and Development of Interchange Area Models.
86	11月29日	112年度國際海運資料庫議題分析成果交流座談會	Experts Symposium: Maintaining and Data Analyzing Services of International Maritime Database of 2023
87	12月1日	水利及海洋港灣工程業務交流會	Meeting: Hydraulic, Ocean and Marine Harbor Engineering Business Exchange Meeting
88	12月4日	「ISO55001國際標準導入鐵道資產管理實務之研究」教育訓練與成果推廣會	Training and Promoting Workshop: A Study on Implementation of Railway Asset Management Practices through ISO 55001
89	12月4日	「橋梁梁底狹小空間檢測工具研發與應用」成果推廣	Outcome Presentation: Promotion of the results of "Development and Application of Detecting Tools for Narrow Spaces at the Bridge Bottom"
90	12月4日	「研析國家鐵道安全計畫之安全績效與目標管理（1/2）－安全指標規劃與資料分析」教育訓練課程	Training Workshop: A Study on Application of Safety Performance Management by Objectives in Railway State Safety Program (1/2): Development of Safety Indicators and Data Analysis
91	12月6日	無人機偏鄉物流服務驗證計畫試飛暨座談會	Experts and Scholar Symposium: Symposium on Drone Delivery Testing in Rural Areas
92	12月7日	交通部臉書貼文「都市交通管理新思維－智慧交通數位神經中樞系統」	MOTC Facebook post: "New thinking on urban traffic management-intelligent transportation digital nerve center."
93	12月8日	中華民國運輸學會2023年學術論文國際研討會「應用多目標深度強化學習於號誌控制策略－都會區幹道發展與探討」論文發表	Paper published: Application of multi-objective deep reinforcement learning in traffic signal control strategies for urban arterial roads; 2023 International Conference on Transportation Research organized by the Chinese Institute of Transportation
94	12月22日	「從小紮根，多元學習，新興科技導入學校交通安全教育」交通部例行記者會	MOTC Press Conference: Enhancing Traffic Safety Education Starting at Young Ages; Diverse learning. Incorporating Emerging Technology into School Traffic Safety Education.
95	12月27日	「需求反應式公共運輸服務（DRTS）營運成本、補貼制度及收費制度之研究（1/2）－合理成本與營運績效探討」專家學者座談會	Expert and Scholar Symposium: The 1st Expert and Scholar Symposium on " An Investigation of Operation, Subsidy and Fare System of Demand Responsive Transport Service Scheme (DRTS) (1/2) – Operation Cost Analysis and Performance Evaluation "
96	12月29日	無人機暢遊實境－交通部無人機研發與應用成果發表會	Outcome Presentation: Symposium on the Achievements in UAS Research and Development by the MOTC

陸 06

大事紀要

Memorabilia

日期 Date	重要記事Event

112年 01 January

04

交通部陳彥伯政務次長率本所出席立法院游錫堃前院長主持之「立法院朝野黨團協商溫管法修正草案會議」。

Deputy Minister Chen Yen-Po of the MOTC led the institute to attend "Meeting on the Revision Draft of the Greenhouse Gas Management Act" hosted by former Legislative Yuan President You Si-Kun.

10

本所出席交通部王國材部長召開之「愛接送預約式通用計程車營運試辦計畫推動情形會議」，會議結論有關愛接送試辦計畫，維持本階段獎勵機制繼續辦理至113年1月底止，請本所儘速研議下一階段所需經費簽報交通部。

The institute attended "Meeting on the Promotion Status of the Trial Operation Plan for Love Pick-up Reservation-based Universal Taxis" convened by Minister Wang Kwo-Tsai of the MOTC. The meeting concluded that the reward mechanism for the love pick-up trial operation plan would be maintained until the end of January 2024, and the institute was requested to promptly research the funding required for the next stage and report to the MOTC.

11

本所出席交通部陳彥伯政務次長召開之「通用計程車永續營運策略初步構想」討論會議，決議有關愛接送試辦計畫，請本所於經費規模3,000萬元額度內及維持現行試辦車隊車輛數規模，規劃下一階段之各工作項目之具體做法報部核定。

The institute attended "Discussion Meeting on the Preliminary Concept of Sustainable Operation Strategy for Universal Taxis" convened by Deputy Minister Chen Yen-Po of the MOTC. It was decided that for the love pick-up trial operation plan, the institute would plan specific actions for the next stage within the funding limit of NTD 30 million and maintain the current scale of the trial fleet, and report to the ministry for approval.

11

本所召開桃園航空城核心計畫「聯外運輸系統」工作小組第29次會議，除賡續追蹤本工作小組前次會議決議事項及列管計畫辦理進度外，並依據第27次會議結論，於新台15線、新台4線案工地附近召開該會議，會後工作小組與會代表實地勘查前揭工程推動情形。

The institute held the 29th meeting of Taoyuan aerotropolis core project "External Transportation System" working group, and continued to track the resolutions of previous meetings and the progress of listed projects. According to the conclusion of the 27th meeting, the meeting was held near the construction sites of new Taiwan route 15 and new Taiwan route 4 projects, and the working group representatives conducted an on-site inspection of the project promotion status.

日期 Date	重要記事Event

02 February

本所於交通部例行記者會發表「橋梁梁底檢測機械手臂提升橋梁檢測品質」，將本所研發適用於橋梁梁底淨空狹小的機械檢測手臂階段性研發成果，透過記者會及新聞稿方式發布，會後計有多家電子媒體刊登。

At the regular press conference of the MOTC, the institute released the phased research and development results of "Mechanical Inspection Arm Suitable for Improving the Quality of Narrow Spaces under Bridge Girders," and published the results through the press conference and press releases, which were subsequently reported by multiple electronic media outlets.

10

本所召開6場次「區域運輸發展研究中心服務升級2.0計畫」（112-113年）評選委員會議，分別評選出六大區域中心之獲選學校。

13

The institute held six selection committee meetings for "Service Upgrade Plan 2.0 for Regional Transportation Development Research Centers" (2023–2024), and selected the winning schools for six regional centers.

本所召開「智慧公共運輸服務發展策略規劃」產官學研座談會，邀集中央與地方政府、運輸產業、資通訊產業及學界專家進行跨域討論。會中就新一期公運計畫之政策主軸進行討論，並就智慧公共運輸服務發展推動策略及行動方案初步構想之妥適性與完整性，以及應納入補助項目進行確認，做為本所後續規劃新一期公運計畫之參據。

20

The institute held "Strategic Planning for the Development of Intelligent Public Transportation Services" symposium, inviting experts from central and local governments, the transportation industry, the information and communications industry, and academia for cross-disciplinary discussions. The meeting discussed policy themes of the new public transportation plan, confirmed the appropriateness and completeness of the preliminary concepts for promoting the development strategies and action plans for intelligent public transportation services, and identified the items to be included in the subsidy program, providing references for the institute's subsequent planning of new public transportation plan.

本所於交通部召開由王國材部長主持之道路交通安全說明記者會中，由林繼國所長提報依部長指示將借鏡日本經驗及我國相關基本法規定，研擬推動「道路交通安全基本法」立法程序，以宣示國家道路交通安全基本政策、明定推動組織、經費及計畫等重要事項，加速改善道路交通安全，並提升改善成效。

23

During the road traffic safety briefing press conference hosted by Minister Wang Kwo-Tsai of the MOTC, Director-General Lin Chi-Kuo of the institute reported that, following the minister's instructions, we would draw on Japan's experience and our country's relevant basic laws to develop the legislative process for "Road Traffic Safety Basic Act," aiming to declare the national road traffic safety basic policy, specify important matters such as the promotion organization, funding, and plans, to accelerate road traffic safety improvements and enhance the effectiveness of these improvements.

日期 Date	重要記事Event

02 February 24

奉交通部指示召開「高雄國際機場聯外道路改善規劃研商平臺」第1次會議，邀集交通部航政司、路政及道安司、交通部民用航空局及高雄市政府，共同研商機場周邊聯外道路改善規劃可行作法。

Under the direction of the MOTC, the institute held the first meeting of "Kaohsiung International Airport External Road Improvement Planning Platform," and invited the Department Navigation and Aviation, Department of Railways,Highways,and Road Safety, the Civil Aviation Administration under the MOTC, and Kaohsiung City government to jointly discuss feasible methods for improving the external roads around the airport.

03 March 14

參與APEC運輸工作小組（TPTWG） 2023年政策主題視訊會議（Virtual Thematic Sessions），協助交通部業管單位與會交流，掌握國際運輸領域近期重要政策主題發展趨勢：

（1）3月14日：陸運專家小組（LEG）：「APEC區域邁向智慧、韌性與低／零排放運輸（Digital Solutions for Road Safety: Towards Smart, Resilient, and Low/Zero Emissions Transport in the APEC Region）」

（2）3月16日：海運專家小組（MEG）：「確認整合新興、智慧與永續海運科技與服務（Supporting the Identification and Integration of New, Emerging, Smart, and Sustainable Maritime Technologies and Services）」

（3）3月21日：空運專家小組（AEG）：「無人航空系統：航向未來的途徑（Unmanned Aerial Systems（UAS）: Flightpath to the Future）」

（4）3月23日：複合運輸與智慧型運輸系統專家小組（IIEG）：「以新興運輸科技改善可及性與包容性（Improving Accessibility and Inclusivity in the Use of New and Emerging Transport Technologies）」

Participated in the "2023 APEC transportation working group (TPTWG) policy Virtual Thematic Sessions," assisting the MOTC's business management units to engage in exchanges and understand recent important policy theme development trends in the international transportation field:

(1) March 14: Land transport experts group (LEG): "Toward Smart, Resilient, and Low/Zero Emissions Transport in the APEC Region (Digital Solutions for Road Safety: Toward Smart, Resilient, and Low/Zero Emissions Transport in the APEC Region)

(2) March 16: Maritime experts group (MEG): "Supporting the Identification and Integration of New, Emerging, Smart, and Sustainable Maritime Technologies and Services"

(3) March 21: Aviation experts group (AEG): "Unmanned Aerial Systems(UAS): Flightpath to the Future"

(4) March 23: Intermodal and intelligent transport systems experts group (IIEG): "Improving Accessibility and Inclusivity in the Use of New and Emerging Transport Technologies"

24

本所出席交通部與內政部「行人安全改善聯合記者會」，由交通部王國材部長及內政部花敬群政務次長共同主持，會中由林繼國所長就「人行空間改善原則及教育訓練」進行簡報，對外說明如何改善國內人行空間。

The institute attended "Pedestrian Safety Improvement Joint Press Conference" hosted by the MOTC and the Ministry of Interior, co-chaired by MOTC Minister Wang Kwo-Tsai and MOI Deputy Minister Hua Ching-Chun. At the meeting, Director-General Lin Chi-Kuo gave a presentation on "Principles of Pedestrian Space Improvement and Training," and explained how to enhance pedestrian spaces in the country.

日期 Date	重要記事Event

03 March

國家發展委員會與台北市電腦公會於112年3月28日至31日共同主辦「2050淨零城市展」，由本所統籌交通部之展攤規劃，以背版靜態展覽方式，說明交通部淨零關鍵戰略7及戰略10之推動策略。總統府林佳龍秘書長於28日開幕典禮結束後親臨交通部展攤參觀，由交通部陳彥伯政務次長及本所黃新薰副所長接待，並由曾佩如組長說明交通部展攤重點。

The national development council and Taipei computer association co-hosted "2050 Net-Zero City Exhibition" from March 28 to 31, 2023, with the Institute of Transportation coordinating the MOTC's exhibition booth planning. The booth featured a static exhibition explaining the promotion strategies for MOTC's key net-zero strategies No.7 and No.10. After the opening ceremony on the 28th, Secretary-General to the President Lin Chia-Lung visited the MOTC booth, where he was received by MOTC Deputy Minister Chen Yen-Po and our Deputy Director-General Huang Hsin-Hsun. The booth's highlights were explained by Division director Tseng Pei-Ju.

28

本所於1866次部務會報中報告「國道客運高風險駕駛行為分析工具開發與應用」，說明本所近年應用影像辨識技術協助汽車運輸業者應用行車影像及ADAS警示精進安全管理能量之研究成果，部長指示請本所與汽車運輸業者、主管機關持續合作，了解實際需求並落實推動。

30

At the 1866th MOTC meeting, the institute reported on the "Development and Application of a High-risk Driving Behavior Analysis Tool for National Highway Passenger Transportation" and explained our recent research achievements in using image recognition technology to assist automotive transport operators in improving safety management through driving image and ADAS alerts. The minister instructed the institute to continue collaborating with automotive transport operators and regulatory authorities to understand practical needs and promote implementation.

本所出版品配合文化部相關規定辦理寄存服務，近10年送存國家圖書館近千冊圖書且送存率達100%，獲邀參加國家圖書館所舉辦之「國圖90，感謝有您一資源共建共享，知識永續傳承」活動，並由蘇振維主任秘書代表擔任貴賓致詞並受頒感謝狀。

Our publications comply with the Ministry of Culture's regulations for depository services. In the past 10 years, we have deposited nearly 1,000 books in the National Central Library, achieving a 100% deposit rate. We were invited to participate in "90th Anniversary of the National Central Library: Thanks to you – Building and Sharing Resources, Sustaining Knowledge" event, where our Chief Secretary Su Cheng-Wei delivered a speech as an honored guest and received a certificate of appreciation.

31

日期 Date	重要記事Event

04 April

20

辦理汽車客運業路線別成本計算制度新版應用軟體說明會，進行制度說明及軟體安裝與操作方式教學展示，共計有46家客運業者參加。

Held a new software application briefing for the route-based costing system for bus services industry, explaining the system and demonstrating software installation and operation. A total of 46 transport operators participated.

27

本所與逢甲大學合作研提「道路交通安全基本法（草案）」，於3月28日及4月18日召開兩場座談會，邀請委員國會辦公室、專家學者、專業團體、中央部會（單位）及地方政府與會討論交流。會後並綜整各界意見修正「道路交通安全基本法（草案）」，並於4月27日將草案及相關資料函陳交通部，做為後續研訂法案之參據。

In collaboration with Feng Chia University, the institute developed a draft of "Road Traffic Safety Basic Act" and held two symposiums on March 28 and April 18, inviting representatives from legislative offices, experts, scholars, professional groups, central government ministries, and local governments to discuss and exchange ideas. Consolidated opinions from various sectors and revised the draft of "Road Traffic Safety Basic Act," submitted it and related materials to the MOTC on April 27 as a reference for subsequent legislation.

28

陳彥伯次長出席本所辦理之「人行與車行交通工程改善教育訓練」，期許學員們將人行與車行交通工程改善之原則與作法帶回各單位加以運用，打造更友善與安全的交通環境。教育訓練於本所國際會議廳舉行，邀請國內各道路主管機關、民間交通工程專業人員共計約180人參加。

Deputy Minister Chen Yen-Po attended "Pedestrian and Vehicular Traffic Engineering Improvement Training" organized by the institute, encouraging participants to apply the principles and practices of traffic engineering improvements in their respective units to create a more friendly and safe traffic environment. The training was held in our international conference hall, with about 180 participants from various road authorities and private sector traffic engineering professionals.

28

王國材部長主持「112年4月道路交通安全說明」記者會，由本所陳天賜副所長就「改善機車交通環境之原則及作法」進行簡報，對外說明如何改善國內機車交通環境。

Minister Wang Kwo-Tsai presided over "April 2023 Road Traffic Safety Briefing" press conference, where our Deputy Director-General Chen Tien-Tsyh gave a presentation on "Principles and Practices for Improving Motorcycle Traffic Environments" and explained to the public how to enhance motorcycle traffic conditions in the country.

05 May

04

本所於交通部第1870次部務會報提報「臺灣鐵道容量手冊之發展與應用」，王國材部長肯定本所長期持續投入鐵道容量研究，逐步累積本土研究成果並滾動發展國內統一的鐵道容量手冊及軟體，亦請鐵道局運用鐵道發展基金持續協助本所相關研究經費。另請鐵道局、臺鐵公司及其他機關(構)於辦理各鐵道系統之規劃、營運改善或重大鐵道建設計畫時，務必依照臺灣鐵道容量手冊的分析方法進行容量瓶頸及營運衝擊相關評估，並提出適切之配套改善措施，以確保鐵道系統規劃設計成果能符合供給容量限制及營運需要。

At the 1870th MOTC meeting, the institute reported on "Development and Application of the Taiwan Railway Capacity Manual." Minister Wang Kwo-Tsai commended the institute's long-term commitment to railway capacity research, gradually accumulating local research results and continuously developing a unified domestic railway capacity manual and software. The minister requested the Railway Bureau to continue supporting our related research funding using the railway development fund. Furthermore, he instructed the Railway Bureau, Taiwan Railway Corporation and other relevant agencies to use the capacity manual's analysis methods for capacity bottleneck and operational impact assessments in planning, operational improvements, or major railway construction projects, and proposed appropriate improvement measures to ensure that railway system planning and design meet capacity constraints and operational needs.

日期 Date	重要記事Event

05 May

本所奉交通部指示完成「自行車通勤路線示範計畫-臺北都會區」規劃，經辦理路線完工檢視確認臺北市及新北市政府完工後，於112年5月5日舉辦成果發表記者會及騎乘體驗活動，活動後持續於112年5月8日至112年7月7日辦理騎乘集章活動，以鼓勵民眾培養騎乘自行車通勤之習慣。

Under the MOTC's instruction, we completed the planning for "Bicycle Commuting Route Demonstration Project – Taipei Metropolitan Area." After inspecting and confirming the completion of the routes by Taipei City and New Taipei City governments, we held a results presentation press conference and a cycling experience event on May 5, 2023. Following the event, we continued to conduct a cycling stamp collection activity from May 8 to July 7, 2023, to encourage the public to develop the habit of commuting by bicycle.

05

交通部訂於112年6月3日辦理「世界自行車日-環騎遊台活動」，本所奉示以「環騎圓夢APP」記錄軌跡並顯示騎乘熱點圖，共同繪製出臺灣輪廓路線。為期世界自行車日當天活動順利進行，本所遂辦理北區、中區、南區、東區之APP教育訓練，除宣達種子教師與小隊長須擔任之工作，確保熟悉「環騎圓夢」App操作流程，希望號召更多民眾於活動當天騎乘，提升參與熱度。

The MOTC scheduled the "World Bicycle Day – Around Taiwan Cycling Event" on June 3, 2023. The institute was instructed to use "Taiwan Cycling Route App" to record routes and display heat maps of cycling hotspots, jointly drawing the outline of Taiwan. To ensure the smooth conduct of the event on world bicycle day, we held App training sessions in the northern, central, southern, and eastern regions, and informed seed teachers and team leaders of their roles to ensure familiarity with the "Taiwan Cycling Route App" operation, aiming to encourage more public participation on the event day.

05

日期 Date	重要記事Event

05 May

「APEC第11次運輸部長會議（11th APEC Transportation Ministerial Meeting, TMM11）」於2023年5月15日至5月17日在美國底特律Westin Detroit Book Cadillac Hotel舉辦，邀集APEC 21個會員體之運輸部門部長、官員與產業代表與會。我方由交通部王國材部長率團參與TMM11會議及兩場次周邊活動：「少數族裔銀行電動車融資」與「啟動APEC綠色海運合作」，本所綜理團務工作。

在會議期間，王部長積極爭取發言機會，分享我國在疫情衝擊下維持海空運正常運作及強化關鍵基礎設施韌性之重要成果；我國為達淨零排放目標，持續落實綠色港埠發展、積極推動離岸風電關聯產業等工作；以及強調我國照護行動不便民眾與偏鄉之運輸可及性，如愛接送APP、偏鄉幸福巴士等重要相關政策成果。

此次運輸部長會議我方共計與日、美、澳、星、越、韓、菲 等7個會員體進行雙邊/場邊會談與意見交流，成果斐然。其中，伴隨近年臺美在經貿合作交流益趨密切，我國也在此次會議中首次達成在APEC運輸領域與美國運輸部長層級進行實質交流，由王部長與美國運輸部長Pete Buttigieg先生就促進臺灣與美西港口間綠色海運合作 、無人機管理等議題，由雙方有關單位持續交流事宜達成共識。另外與日本國土交通省水嶋智審議官（相當於次長層級）就關於促進臺日間航線與修約事宜持續由有關單位洽商，及後續就運輸包容性之技術與經驗開啟雙方交流等事宜達成共識，成果十分豐碩。

15

The "11th APEC Transportation Ministerial Meeting (TMM11)" was held from May 15 to May 17, 2023, at Westin Detroit Book Cadillac Hotel in Detroit, USA, inviting transportation ministers, officials, and industry representatives from APEC's 21 member economies. Our delegation, led by Minister Wang Kwo-Tsai, participated in the TMM11 meeting and two side events: "Electric Vehicle Financing for Minority Banks" and "Launching APEC Green Maritime Cooperation" with the institute managing the delegation's tasks.

During the meeting, Minister Wang actively sought speaking opportunities to share our achievements in maintaining normal maritime and air transportation operations and strengthening critical infrastructure resilience during the pandemic, our efforts toward achieving net-zero emissions, including the development of green ports and offshore wind power industries, and emphasized our policies on transportation accessibility for people with mobility impairments and rural areas, such as Love Pick-up APP and rural happiness buses.

During the transportation ministers' meeting, our delegation engaged in bilateral/side discussions and exchanges with seven member economies, including Japan, the US, Australia, Singapore, Vietnam, South Korea, and the Philippines, yielding significant results. With the recent increase in Taiwan-US economic and trade cooperation, our country achieved substantive exchanges at the ministerial level with the US Department of Transportation in APEC transportation sector for the first time. Minister Wang and US Transportation Secretary Pete Buttigieg reached a consensus on continuing exchanges between relevant departments regarding green maritime cooperation between Taiwan and West Coast ports of the US, and drone management. In addition, we reached a consensus with Japan's Ministry of Land, Infrastructure, Transport and Tourism senior official Tomohiro Mizushima (equivalent to deputy minister level) to continue discussions on promoting Taiwan-Japan air routes and treaty amendments, as well as initiating technical and experience exchanges on inclusive transportation.

06 June

本所協助觀光局舉辦「世界自行車日-環騎遊台活動」活動，參與騎乘人員透過本所開發之「環騎圓夢APP」記錄並經裝置的網路訊號回傳熱點資料至熱點圖分析伺服器，將回傳之騎乘位置即時分析後呈現於全臺騎乘熱點圖，順利串聯成完整的臺灣圖形，達到自行車環台騎遊宣導的目的。

03

The institute assisted the Tourism Bureau in organizing "World Bicycle Day – Around Taiwan Cycling Event." Participants used "Taiwan Cycling Route App" developed by the institute to record routes, and data was transmitted via network signals to a hotspot map analysis server. The real-time analysis of cycling positions created a complete Taiwan map, achieving the goal of promoting cycling around Taiwan.

日期 Date	重要記事Event

06 June

本所林繼國所長接受中華顧問工程司邀請於112年6月7日（星期三）上午10:00-12:00擔任「中華技術講座」之演講人，講題為「運研所鐵道發展政策規劃及主要研究成果分享」，中華顧問工程司與台北科技大學簽署合作備忘錄，開設「智慧鐵道產業人才學院」及辦理「中華技術講座」，即希望藉此讓雙方在協助軌道人才培育上有更多合作，深具意義。

07

Our Director-General Lin Chi-Kuo, was invited by China Engineering Consultants, Inc. to deliver a lecture at "China Technology Lecture" on Wednesday, June 7, 2023, from 10:00 to 12:00. The topic was "The Institute's Railway Development Policy Planning and Main Research Achievements." China Engineering Consultants, Inc. signed a memorandum of cooperation with National Taipei University of Technology to establish "Smart Railway Industry Talent Academy" and held the "China Technology Lecture," aiming to enhance cooperation in cultivating railway talent.

07

奉交通部指示召開「高雄國際機場聯外道路改善規劃研商平臺」第2次會議，邀集交通部航政司、路政及道安司、高公局、公路局、民用航空局及高雄市政府，共同研商機場周邊聯外道路改善規劃可行作法。

Following the MOTC's instruction, we held the second meeting of "Kaohsiung International Airport Access Road Improvement Planning Platform," and invited the MOTC's Department Navigation and Aviation, Department of Railways, Highways, and Road Safety, the Freeway Bureau, Highway Bureau, Civil Aviation Administration, and Kaohsiung City government to jointly discuss feasible approaches for improving airport access road planning.

09

本所辦理「傳統區域鐵路系統容量分析技術」教育訓練，介紹鐵道容量分析技術，推廣鐵道容量分析軟體開發成果。本次訓練參與者包括交通部路政司、鐵道局、臺鐵公司、各縣市政府、大學相關科系，以及各大顧問公司等約20餘人，透過意見交流回饋，做為後續研究與分析軟體精進優化之依據。

The institute conducted training workshop on "Capacity Analysis of Intercity Railways and Its Applications," which introduced railway capacity analysis techniques and promoted the development achievements of railway capacity analysis software. Participants included Department of Railways, Highways, and Road Safety of the MOTC , Railway Bureau, Taiwan Railway Corporation, local governments, universities, and major consulting firms, totaling about 20 people. Feedback from the participants will be the basis for subsequent research and future software developments.

09

本所與東部區域運輸發展研究中心就基礎型計畫自提主題公共運輸案例「花蓮縣公路公共運輸路網的改善與整合」辦理座談會，邀集交通部公路局、臺北區監理所、花蓮監理站、花蓮縣政府建設處、花蓮客運、統聯運通、興東客運等相關單位，就「未來花蓮公路客運的路線整併及優化」議題進行交流。

In collaboration with the eastern regional transportation development research center, the institute held a seminar on "Improvement and Integration of the Highway Public Transportation Network in Hualien County," and invited the Highway Bureau, Taipei motor vehicle office, Hualien motor vehicle station, Hualien County government construction office, Hualien bus company, Ubus company, and Hsing Tung bus company to discuss "Future Integration and Optimization of Hualien Highway Passenger Transport Routes."

日期 Date	重要記事Event

06 June

本所與中區區域運輸發展研究中心就競爭型計畫辦理「梨山幸福巴士永續發展座談會」，邀集臺中公車聯營管理委會羅乙棋主委、臺中市政府、臺中區監理所、梨山社區發展協會、幸福巴士駕駛與旅宿業者等，討論梨山幸福巴士推動觀光服務之定價與營運規則，以及蒐集當地對於客貨共載機制導入之需求及看法。

In collaboration with the central regional transportation development research center, the institute held a seminar on "Sustainable Development of Lishan Happiness Buses," and invited Luo Yi-Chi, Chairman of Taichung bus joint operation management committee, Taichung City government, Taichung motor vehicle office, Lishan community development association, happiness bus drivers, and hospitality industry representatives to discuss pricing and operating rules for promoting tourism services, and to gather local needs and opinions on the introduction of a passenger and cargo co-loading mechanism.

10

本所辦理汽車客運業路線別成本計算制度新版應用軟體說明會，進行制度說明及軟體安裝與操作方式教學展示，共計有28個主管機關人員參加。

12

The institute held a new software application briefing for route-based costing system of bus services industry, and explained the system while demonstrating software installation and operation. A total of 28 officials from relevant regulatory authorities participated.

本所與北區區域運輸發展研究中心就基礎型計畫「公共運輸案例研析與實作」之差異化主題，「宜蘭縣公路移撥市區客運路線改善計畫檢討」，辦理宜蘭地區座談會，邀集宜蘭縣政府交通處、公路局臺北區監理所、宜蘭監理站、國光客運與葛瑪蘭客運等相關單位，就宜蘭地區「公路移撥市區客運路線現況盤點」、「公路移撥市區客運路線資源整合可行性」及「公路移撥市區客運路線整合收費機制」等議題進行交流。

21

In collaboration with the northern regional transportation development research center, the institute held a seminar on "Public Transportation Case Study and Implementation" focusing on the differentiated theme "Evaluation of the Highway-to-urban Passenger Transport Route Improvement Plan in Yilan County," and invited Yilan County government transportation department, Directorate General of Highways, Taipei motor vehicle office, Yilan motor vehicle station, Kuo-Kuang motor transport company, and Kamalan bus company to discuss "Inventory of Highway-to-urban Passenger Transport Routes in Yilan," "Feasibility of Resource Integration of Highway-to-urban Passenger Transport Routes," and "Integrated Fare Mechanism for Highway-to-urban Passenger Transport Routes."

日期 Date	重要記事Event

06 June

本所參與及推動「行政院災害防救科技創新服務方案（108-111）」4年期計畫有功，國家科學與技術委員會於112年6月27日（星期二）「行政院災害防救科技創新服務方案108-111年度總成果發表暨研討會」表揚並頒獎予本所及本所運輸技術研究中心，活動會場亦展示本所參與方案計畫之研究成果。

27

The institute was commended for its outstanding participation in "Executive Yuan's Disaster Prevention and Rescue Technology Innovation Service Program (2019–2022)" and received an award from the National Science and Technology Council during the "Executive Yuan's Disaster Prevention and Rescue Technology Innovation Service Program (2019–2022) Annual Results Presentation and Seminar" on Tuesday, June 27, 2023. The research achievements of the institute and our transportation technology research center were also displayed at the event.

本所與東部區域運輸發展研究中心就競爭型計畫辦理「幸福達仁、圓夢達人：達仁鄉地方創生與交通運輸交流座談會」，邀集社團法人臺東南迴健康促進關懷服務協會、南迴永續旅行聯盟、臺東縣政府交通及觀光發展處、邸Tai Dang等相關單位，就「部落產業發展與生活談論運輸需求以及開創不同型態公共運輸發展的可能性」議題進行交流。

29

In collaboration with the eastern regional transportation development research center, the institute held "Happiness Daren, Dream Achiever: Daren Township Local Revitalization and Transportation Exchange Seminar," and invited Taitung Nanhui health promotion and care service association, Nanhui sustainable travel alliance, Taitung County government transportation and tourism development department, and Di Tai Dang to discuss "Transportation Needs and the Possibility of Developing Different Types of Public Transportation for Tribal Industry Development and Livelihood."

07 July

本所協助交通部規劃辦理「行政院國家永續發展委員會永續運輸工作分組112年第1次分組會議」，由陳彥伯政務次長主持，邀集永續會委員、國發會及交通部相關單位／機關（構），報告分組主政之臺灣永續發展目標各對應指標執行進度及未達標之對應指標檢討。

12

The Institute of Transportation assisted MOTC in planning and organizing the "Executive Yuan's National Sustainable Development Committee Sustainable Transportation Working Group 2023 First Meeting," chaired by Deputy Minister Chen Yen-Po, and invited sustainable development committee members, national development council, and relevant units/ agencies of the MOTC to report on the progress of sustainable development goals and review the indicators that have not been achieved.

日期 Date	重要記事Event

07 July

21

本所統籌規劃交通部展攤，路政司暨相關部屬機關與民間單位展出交通部淨零關鍵戰略7及戰略10之推動策略及相關計畫成果，參與行政院與台灣永續能源研究基金會於112年7月21日至23日共同主辦「2023亞太永續行動博覽會」，交通部黃荷婷主任秘書代表出席開幕典禮。行政院林子倫發言人於21日開幕典禮結束後親臨交通部展攤參觀，由交通部黃荷婷主任秘書及本所林繼國所長接待，並由朱珮芸組長說明交通部展攤重點。

The Institute of Transportation coordinated the MOTC exhibition booth, showcasing the strategies and related project achievements for key strategies No.7 and No.10 of the ministry's net-zero initiative. This exhibition was part of "2023 Asia-Pacific Sustainable Action Expo" coorganized by the Executive Yuan and the Taiwan Institute for Sustainable Energy from July 21 to 23, 2023. Secretary-General Huang He-Ting of the MOTC attended the opening ceremony on behalf of the ministry. Spokesperson Lin Tzu-Lun of the Executive Yuan visited the ministry's booth after the opening ceremony on the 21st, accompanied by Secretary-General Huang Ho-Ting and our Director-General Lin Chi-Kuo, with Division director Chu Pei-Yun explaining the key highlights of the ministry's booth.

21

交通部祁文中常務次長主持「區域運輸發展研究中心服務升級2.0計畫」（112-113年）第1次諮議委員會議，邀集各諮議委員及交通部內單位及部屬機關與會，會議首先由本所承辦單位進行業務報告，接續為六大區域中心「區域公共運輸發展趨勢觀察與課題分析」及「本期工作重點及預期成果說明」重點報告，以及「亮點訪視行程」規劃報告，由各諮議委員提供指導意見，並請本所就各諮議委員指導意見督導六大區域中心納入參考辦理。

Deputy Minister Chi Wen-Jong chaired the first advisory committee meeting for "Service Upgrade Plan 2.0 for Regional Transportation Development Research Centers" (2023–2024), inviting advisory committee members, ministry departments, and affiliated agencies to participate. The meeting began with a business report from the institute, followed by key reports on "Regional Public Transportation Development Trends and Issue Analysis" and "Key Work Focus and Expected Outcomes for this Period," and "Highlight Visit Schedule" plan. Advisory committee members provided guidance, and the institute was tasked with ensuring that six regional centers incorporate the feedback into their plans.

08 August

04

本所與高屏澎區域運輸發展研究中心就基礎型計畫之差異化主題「市區公車與公路客運營運補貼策略-以高雄市及屏東縣為例」，辦理「高雄市與屏東縣市區公車營運補貼機制評估與研究」座談會，邀集高雄市政府交通局、屏東縣政府交通旅遊處、客運業者等相關單位及專家學者，就「高雄市與屏東縣市區公車營運補貼機制現況與課題」及「高雄市與屏東縣市區公車營運補貼機制方案建議提案」等議題進行交流。

The institute and Kaohsiung-Pingtung-Penghu regional transportation development research center held a seminar on the differentiated theme of basic project "Subsidy Strategies for Urban and Highway Passenger Transport Operations – The Case of Kaohsiung City and Pingtung County," and invited the Transportation Bureau of Kaohsiung City government, Pingtung County transportation and tourism development department, bus operators, and experts to discuss the current status and issues of the subsidy mechanisms for urban bus operations in Kaohsiung City and Pingtung County, as well as proposals for improving these mechanisms.

日期 Date	重要記事Event

08 August

本所與台中市小客車租賃商業同業公會於8月10日完成本所「『小客車租賃服務整合旅遊生態系平台』軟體著作權」非專屬授權契約用印，確認台中市小客車租賃商業同業公會繳納簽約授權金後，已於8月17日交付授權標的清單內容光碟予台中市小客車租賃商業同業公會運用。

10

The institute and Taichung car rental business association completed the non-exclusive licensing agreement for "Tourism Ecosystem Platform for Integrating Car Rental Services" software copyright on August 10. After confirming the payment of the licensing fee by Taichung car rental business association, we delivered a CD containing the authorized content list to the association on August 17.

15

路政林福山前司長及本所黃新薰前副所長陪同交通部王國材部長出席行政院陳建仁院長主持之「行政院國家永續發展委員會第35次委員會議」。

Former director of the department of railways and highways, Lin Fu-Shan, and our former deputy director, Huang Hsin-Hsun, accompanied Minister Wang Kwo-Tsai to attend the "35th Meeting of the Executive Yuan's National Sustainable Development Committee," which was chaired by Premier Chen Chien-Jen.

17

本所於第1881次部務會報提報「精進鐵道安全管理系統—建立自主評估與監理查核機制與工具」，王國材部長肯定本所長期持續投入鐵道安全管理系統研究，亦請鐵道營運機構參考本計畫的評估工具落實推動SMS自主評估。另請鐵道局參考應用本計畫的成果，執行鐵道SMS查核機制，並請本所持續關注國際發展趨勢並適時進行相關研究，以精進我國鐵道安全管理系統。

At the 1881st ministry meeting, the institute reported on "Enhancing the Railway Safety Management System – Establishing Self-assessment and Audit Mechanisms and Tools." Minister Wang Kwo-Tsai commended the institute's long-term dedication to railway safety management system research and requested that railway operators refer to our project's assessment tools to implement self-assessment of their safety management systems (SMS). He also asked the Railway Bureau to apply the project's results in executing the SMS audit mechanism and instructed the institute to continuously monitor international trends and conduct related research to improve our national railway safety management system.

18

本所與高屏澎區域運輸發展研究中心就基礎型計畫「公共運輸案例研析與實作」之六區域中心共同主題：「偏鄉公共運輸跨部會資源整合之示範推動」，辦理「偏鄉公共運輸跨部會資源之整合與推動：如何打造兼具效能、包容、永續、創新的協作平台？」座談會，邀集高雄市政府交通局、屏東縣政府城鄉發展處、交通旅遊處、澎湖縣政府文化局、高雄市桃園區公所、屏東縣枋山鄉公所、屏東縣來義鄉公所及高雄市區監理所等相關單位及專家學者，就「偏鄉各部會資源現況」及「跨部會資源整合與協作之推動」等議題進行交流。

The institute and Kaohsiung-Pingtung-Penghu regional transportation development research center held a seminar on the common theme of basic project "Public Transportation Case Study and Implementation" for the six regional centers: "Demonstration Promotion of Inter-ministerial Resource Integration for Rural Public Transportation," focusing on "Integration and Promotion of Inter-ministerial Resources for Rural Public Transportation: How to Create a Collaborative Platform that is Efficient, Inclusive, Sustainable, and Innovative?" The seminar invited relevant units and experts, including Transportation Bureau of Kaohsiung City government, Pingtung County government urban and rural development department, transportation and tourism development department, Penghu County government cultural affairs bureau, Kaohsiung City Taoyuan District office, Pingtung County Fangshan Township office, Pingtung County Laiyi Township office, and Kaohsiung City motor vehicles office, to discuss topics such as "Current Status of Resources from Various Ministries in Rural Areas" and "Promotion of Inter-ministerial Resource Integration and Collaboration."

日期 Date	重要記事Event

08 August

立法委員賴瑞隆辦公室考察「高雄國際機場暨周邊聯外交通系統建設」，邀請交通部、民航局、高公局、公路局、臺灣港務公司、鐵道局、本所及高雄市政府出席。交通部與部內機關係由祁常務次長率隊參加，並簡報「高雄國際機場航廈改建後所衍生之交通衝擊及改善配套措施」，其中本所說明「高雄國際機場周邊聯外道路改善規劃平臺會議」之建立緣由與辦理情形。

Legislator Lai Jui-Lung's office conducted an inspection of "Kaohsiung International Airport and Surrounding External Transportation System Construction," and invited the MOTC, Civil Aviation Administration, Freeway Bureau, Directorate General of Highways, Taiwan International Ports Corporation, Railway Bureau, the institute, and Kaohsiung City government to attend. The MOTC's team led by Deputy Minister Chi Wen-Jong, presented "Impact of Transportation Changes Following the Terminal Reconstruction of Kaohsiung International Airport and Improvement Measures," with the institute explaining the establishment and implementation of "Kaohsiung International Airport External Road Improvement Planning Platform."

18

本所召開運輸計劃季刊編輯指導會112年度會議，報告111年稿務運作辦理情形及相關討論事項，俾利後續季刊編務作業推動參採。

21

The institute held 2023 editorial guidance meeting for the transportation planning quarterly, reported on the manuscript operations for 2022 and discussed related issues to facilitate the promotion of subsequent quarterly editorial work.

本所與東部區域運輸發展研究中心就基礎型計畫之差異化主題「遊憩觀光結合公共運輸規劃-以太魯閣國家公園為例」，辦理「後疫情時代太魯閣遊園專車的角色與發展」座談會，邀集太魯閣國家公園處、花蓮縣政府建設處、花蓮監理站、太魯閣客運、統聯客運、華聯遊覽車客運股份有限公司、花蓮縣公共汽車客運商業同業公會、練習曲文創有限公司等單位就「遊園專車之角色與營運方式調整」及「短中長期之發展目標」等議題進行交流。

29

The institute and the eastern regional transportation development research center held a seminar on the differentiated theme of basic project "Recreational Tourism Combined with Public Transportation Planning – The Case of Taroko National Park," and invited Taroko National Park headquarters, Hualien County government construction office, Hualien motor vehicle station, Taroko bus company, Ubus company, Hualien tour bus company, Hualien County public bus operators association, and Etude Workshop Co., Ltd. to discuss the "Role and Operational Adjustments of Park Shuttle Buses" and "Short, Medium, and Long-term Development Goals."

本所與東部區域運輸發展研究中心就基礎型計畫之共同性主題「偏鄉公共運輸跨部會資源整合示範推動」，辦理「搭乘幸福巴士參加豐年祭暨公共運輸運量提升」座談會，邀集花蓮縣政府原民處、花蓮監理站、壽豐鄉公所、吉安鄉公所、雷門數據服務股份有限公司等單位就「歲時祭儀（豐年祭）交通接駁」、「花東地區公路公共運輸既有服務待改善處」、「花蓮縣公路公共運輸路網優化的建議策略」等議題進行交流。

29

The institute and the eastern regional transportation development research center held a seminar on the common theme of basic project "Demonstration of Inter-ministerial Resource Integration for Rural Public Transportation," and organized "Ride the Happiness Bus to the Harvest Festival and Increase Public Transportation Ridership" seminar. The seminar invited units such as Hualien County government's indigenous peoples department, Hualien motor vehicles office, Shoufeng Township office, Ji'an Township office, and Raygate Co., Ltd. to discuss topics such as "Transportation Shuttles for Seasonal Ceremonies (Harvest Festival)," "Areas Needing Improvement in Existing Highway Public Transportation Services in Hualien-Taitung Region," and "Suggested Strategies for Optimizing Hualien County's Highway Public Transportation Network."

日期 Date	重要記事Event

08 August

本所於交通部第1883次部務會報提報「推動自行車通勤路線示範計畫-以臺北都會區為例」，王國材部長請本所依本次辦理經驗妥為研擬「通勤路線規劃原則」，納入「自行車道系統規劃設計參考手冊」，並研議具吸引力之示範型獎勵機制，找有意願之地方政府共同響應。

At the 1883rd MOTC meeting, the institute reported on "Demonstration Project for Promoting Bicycle Commuting Routes – Taking the Taipei Metropolitan Area as an Example." Minister Wang Kwo-Tsai requested the institute to formulate "Principles for Commuting Route Planning" based on this experience, to be included in "Reference Manual for Bicycle Path System Planning and Design," and to consider an attractive demonstration reward mechanism in cooperation with willing local governments.

09 September

本所林繼國所長獲邀擔任「大交通大未來科技展暨國際論壇」與談人，介紹本所船舶自動識別系統（AIS）與低軌衛星系統應用，淺談低軌衛星通訊應用與發展，未來將實現港口範圍的全球船舶動態監控，並提供精確的位置數據，活動與談圓滿完成。

Director-General Lin Chi-Kuo was invited to speak at "2023 Smart Mobility, GREAT FUTURE Expo & International Forum," where he introduced the institute's automatic identification system (AIS) for ships and low earth orbit satellite system applications, and briefly discussed the applications and development of low earth orbit satellite communications. The future vision includes global ship dynamic monitoring within port areas, providing precise location data. The forum participation was successfully completed.

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08

09

交通部責成本所就東部區域運輸發展研究中心競爭型計畫「推動公共運輸連結地方創生及觀光旅遊」成果辦理亮點訪視行程。交通部祁文中召集委員率本所林繼國執行秘書兼委員、張學孔委員、交通部觀光署代表實地至花東地區訪視，除進行在地部落文化與產業之探索與體驗外，並與地方創生團隊、在地協會團體、地方政府、交通部公路局監理所等單位，進行「地方創生與交通運輸」議題交流。

The MOTC tasked the institute with conducting a highlight inspection tour for the eastern regional transportation development research center's competitive project "Promoting Public Transportation to Connect Local Revitalization and Tourism." Deputy Minister Chi Wen-Jong led the delegation, including the Executive Secretary and Commissioner Lin Chi-Kuo, Commissioner Chang Hsueh-Kung, and representatives from the MOTC Tourism Administration, to visit Hualien-Taitung area. The tour included exploring and experiencing local tribal culture and industries, and exchanging views on "Local Revitalization and Transportation" with local revitalization teams, local associations, local governments, and the MOTC Highway Bureau's motor vehicles office.

09

日期 Date	重要記事Event

09 September

14

本所提案「助您一臂之力~橋梁梁底檢測機械手臂」，參加112年度交通部創新提案獲得「甲等獎」。

The institute proposal "Lending a Hand Robotic Arm for Bridge Underside Inspection" won "Grade A Award" in the 2023 MOTC innovation proposal competition.

14

本所提案「『布』可沒有你~地工織布橋梁基礎保護工法」，參加112年度交通部創新提案獲得「甲等獎」

The institute proposal "Can't Do Without You Geotextile Bridge Foundation Protection Method" also won "Grade A Award" in the 2023 MOTC innovation proposal competition.

19

「APEC第53次運輸工作小組會議（TPTWG53）」於2023年9月19日至10月11日期間以線上會議形式舉行，我國代表團共54位成員，分別於相關專家小組報告申辦APEC計畫內容及分享我國施政成果，提出5份正式簡報，分別為：

「APEC韌性及永續郵輪產業論壇（Building a Resilient and Sustainable Cruise Industry Post COVID-19）」、「無人機於都市之運行（Enabler for UAS Urban Operations）」、「偏鄉公共運輸跨域資源整合之推動與挑戰（Promoting and Addressing Challenges of Cross-Sector Resource Integration in Rural Public Transportation）」、「運用GPT/AI科技發展可及性及包容性公共運輸資訊服務（Developing Accessible and Inclusive Public Transport Information Service in the Use of GPT/AI technique）」、「提昇移動力整合新紀元國際論壇（Exploring the new age for mobility integration）」，我國與會人員於會中與各會員體充分交流，圓滿達成任務。

The "53rd APEC Transportation Working Group Meeting (TPTWG53)" was held online from September 19 to October 11, 2023. Our delegation, consisting of 54 members, reported on APEC project proposals and shared our governance achievements in various expert group sessions. Five formal presentations were made, including:

"Building a Resilient and Sustainable Cruise Industry Post COVID-19," "Enabler for UAS Urban Operations," "Promoting and Addressing Challenges of Cross-Sector Resource Integration in Rural Public Transportation," "Developing Accessible and Inclusive Public Transport Information Service in the Use of GPT/AI technique," and "Exploring the new age for mobility integration." Our representatives had extensive exchanges with other member economies during the meetings, successfully completing their tasks.

26

商用車技術發展協會主辦及本所協辦「第六屆商業車智能研討會（II）-『淨零碳排與ESG實踐：綠色運輸轉型經驗分享與交流』」，由交通部陳彥伯政務次長與本所林繼國所長開幕致詞，共約130名產官學界專家出席，會中本所計畫團隊報告綠運輸生活型態推廣機制研究成果，並由朱珮芸組長分享實踐綠運輸之誘因機制，本所陳其華主任秘書亦就綠色貨運轉型新思維進行分享。

The "6th Commercial Vehicle Intelligent Seminar (ii) – Net-zero Carbon Emissions and ESG Practices: Sharing and Exchanging Green Transportation Transformation Experiences" was organized by the commercial vehicle technology development association and co-organized by the institute. The seminar was opened with speeches by Deputy Minister of the MOTC Chen Yen-Po and the institute's Director-General Lin Chi-Kuo. Approximately 130 experts from industry, government, and academia attended. Our project team reported on the research results of promoting green transportation lifestyle mechanisms, with group leader Zhu Pei-Yin sharing incentive mechanisms for practicing green transportation. Our chief secretary Chern Chi-Hwa also shared new ideas for green freight transformation.

日期 Date	重要記事Event

09 September

本所主辦、高雄市政府交通局協辦舉行「臺日交通行動服務（MaaS）跨境合作啟動記者會」，林繼國所長、高雄市政府交通局張淑娟局長、日本臺灣交流協會枝憲一郎副所長（代表小田急電鐵公司）及高雄捷運公司林誌銘副總經理出席致詞，對外宣傳高雄MeNGo與日本小田急電鐵EMOT啟動跨境合作並以觀光旅遊票券進行交流互惠。

The institute, with the cooperation of Kaohsiung City government transportation bureau, held "Taiwan-Japan Mobility as a Service (MaaS) Cross-border Cooperation Kick-off Press Conference." The event featured speeches from our Director-General Lin Chi-Kuo, Director of Kaohsiung City government transportation bureau Chang Shu-Chuan, Deputy Director of Japan-Taiwan exchange association Kenichiro Eda (representing Odakyu Electric Railway Co., Ltd.), and Deputy General Manager of Kaohsiung Rapid Transit Corporation Lin Chih-Ming. The press conference announced the cross-border cooperation between Kaohsiung's MeNGo and Japan's Odakyu Electric Railway Co., Ltd.'s EMOT, facilitating mutual exchange and benefits through tourism tickets.

27

10 October

奉交通部指示召開「高雄國際機場聯外道路改善規劃研商平臺」第3次會議，邀集內政部國土管理署、交通部航政司、路政及道安司、交通部民用航空局、高雄市政府及副知立法委員賴瑞隆國會辦公室，共同研商後續作法及進一步釐清高雄市政府所提事項。

At the instruction of the MOTC, the third meeting of "Kaohsiung International Airport External Road Improvement Planning and Discussion Platform" was held. Attendees included the national land surveying and mapping center of the Ministry of Interior, the department of aviation and navigation, the department of road and traffic safety, the Civil Aeronautics Administration, the Kaohsiung City government, and Legislator Lai Jui-Lung's office. The meeting discussed follow-up actions and further clarified the matters proposed by Kaohsiung City government.

11

12

本所於交通部第1888次部務會報提報「都市交通管理創新思維-智慧交通數位神經中樞規劃與實作」，王國材部長肯定本所依據都市交通治理之痛點及智慧城市數位治理的核心價值，以神經元結合神經網路傳導至數位神經中樞的整體運作概念，應用5G結合跨領域技術，研發未來智慧交管所需之模式庫與知識庫，提供交通管理預測與示警以及決策建議，並請本所就本案研究成果，與高公局、觀光署及公路局研議落實應用的方式，期能透過創新的智慧交通作為，提升其交通管理工作的執行成效。

The institute reported "Innovative Thinking in Urban Traffic Management – Planning and Implementation of the Intelligent Transportation Digital Nerve Center" at the 1888th MOTC meeting. Minister Wang Kwo-Tsai affirmed the institute's concept of integrating neurons with neural network conduction into the digital nerve center based on the pain points of urban traffic governance and the core values of digital governance in smart cities. The project involves developing future intelligent traffic management models and knowledge bases using 5G combined with cross-disciplinary technologies, providing traffic management predictions, warnings, and decision-making suggestions. Minister Wang requested the institute to collaborate with the Freeway Bureau, Tourism Administration and Highway Bureau to discuss the practical application of the research results, aiming to enhance traffic management effectiveness through innovative intelligent transportation measures.

日期 Date	重要記事Event

10 October

本所召開「國際機場模擬軟體建立與後續應用」專家學者座談會，研討議題包括機場模擬分析對象、需要進行模擬分析的機場類型及如何將模擬分析導入機場建設審議程序等，參與單位計有交通部航政司、民航局、民航局飛航服務總臺、桃園機場公司、中華機場協會及專家學者，進行議題探索與後續應用之意見交流，有助於我國國際機場空側營運朝數據化與模式化發展。

23

The institute held an expert and scholar symposium on "Establishing and Subsequent Application of International Airport Simulation Software," discussing topics such as the objects of airport simulation analysis, types of airports requiring simulation analysis, and how to integrate simulation analysis into the airport construction review process. Participants included the department of Navigation and Aviation, the Civil Aviation Administration, the flight service station, Taoyuan International Airport Corporation, Chung-Hua Airport Council, and experts and scholars. The symposium facilitated the exploration of topics and exchange of opinions on subsequent applications, contributing to the digital and modular development of airside operations at our international airports.

本所辦理「交通部運輸研究所112年度馬祖研究計畫成果交流暨系統教育訓練」，除介紹馬祖港維護管理制度、巡檢作業外，並展示及操作馬祖海情資訊系統精進功能模組、說明海氣象觀測系統維運、112年系統功能精進及未來精進規劃，提供連江縣政府、連江縣港務處實務應用本所研發成果並回饋使用意見，持續優化系統功能。

23

The institute conducted "2023 Matsu Research Project Results Exchange and System Education Training" by the MOTC. The training introduced Matsu Port maintenance management system and inspection operations, demonstrated and operated the advanced functional modules of Matsu marine information system, and explained the maintenance and operation of the marine meteorological observation system, system function enhancements for 2023, and future improvement plans. The training provided practical application feedback to Lienchiang County and Lienchiang County port authority, continuously optimizing system functions.

本所舉辦「運輸規劃支援系統」教育訓練，包括內政部國土管理署、高公局、公路局、各縣市政府交通局、處等共30餘位人員參加。本次教育訓練針對運輸規劃支援系統架構、功能與本年度新增（生活圈模式）模組功能進行介紹，藉由教育訓練課程，推廣建置成果，促進公部門運輸規劃資源之共享及應用，並經由意見交流回饋，做為後續系統發展精進優化參據。

24

The institute held "Transportation Planning Support System" education training, attended by over 30 participants from the National Land Management Agency of the Ministry of the Interior, Freeway Bureau, Highway Bureau, and Transportation Bureau and offices of various city governments. The training introduced the framework and functions of the transportation planning support system and the new modules (living circle mode) for this year. Through the education training course, the results of the system's establishment were promoted, facilitating the sharing and application of transportation planning resources in the public sector, and feedback from opinion exchanges will serve as a reference for subsequent system development and optimization.

日期 Date	重要記事Event

10 October

本所協助海洋委員會國家海洋研究院舉辦「2023海洋達人工作坊之臺灣海洋雷達遙測發展與技術交流會議」，邀請國立成功大學、高雄海洋科技大學、國家實驗研究院台灣海洋科技研究中心等單位進行技術交流及應用分享，促成國內雷達觀測技術交流、資源整合與跨部會合作。

The institute assisted the National Academy of Marine Research of the Ocean Affairs Council in organizing "2023 Marine Expert Workshop on Taiwan Marine Radar Remote Sensing Development and Technology Exchange," and invited National Cheng Kung University, National Kaohsiung University of Science and Technology, Taiwan Ocean Research Institute of the national applied research laboratories, and other units for technical exchanges and application sharing. The workshop promoted domestic radar observation technology exchanges, resource integration, and cross-ministerial cooperation.

24

本所與交通部鐵道局共同辦理「傳統區域鐵路系統容量分析技術」第2場次教育訓練，進行傳統暨區域鐵道系統容量分析軟體之介紹、應用範例演練及實際鐵路高架容量檢核案例操作等。本次訓練參與者包括交通部路政及道安司、鐵道局、臺鐵公司、各縣市政府、大學相關科系，以及各大顧問公司等約30餘人，透過意見交流回饋，做為後續研究與分析軟體精進優化之依據。

In collaboration with the Railway Bureau of the MOTC, the institute conducted the second session of the "Capacity Analysis of Intercity Railways and Its Applications" training workshop, introducing traditional and regional railway system capacity analysis software, and practicing application examples and actual railway elevated capacity verification case operations. Participants included Department of Railways, Highways, and Road Safety of the MOTC, Railway Bureau, Taiwan Railway Corporation, local governments, universities, departments, and major consulting firms, totaling over 30 people. Feedback from participants will be the basis for subsequent research and future software developments.

25

日期 Date	重要記事Event

10 October

本所於臺中市舉辦2場次之「自行車環島路線（含替代路線）及多元路線標誌標線設置原則」說明暨討論會議，針對自行車環島路線（含替代路線）及多元路線之標誌標線設置原則、布設實例研析及常見錯誤範例等進行說明，另以工作坊形式選取實例進行分組討論，並配合現地騎乘以檢視該實例之路線，參與人數每場次約40-80餘人，讓各自行車路線之規劃執行單位能熟悉各類自行車路線標誌標線之設置原則及相關規範，以利各自行車路線之指示系統能有一致的識別與設置標準。

26

The institute held two sessions in Taichung City of the "Principles for the Establishment of Signage and Markings for Round-the-island Bicycle Routes (Including Alternative Routes) and Diverse Routes" explanation and discussion meeting to explain the principles of signage and markings for round-the-island bicycle routes (including alternative routes) and diverse routes, and analyze actual layout examples and common errors. In addition, a workshop format was used to select actual examples for group discussions, and on-site riding was conducted to review the routes of these examples. Each session was attended by about 40–80 participants, allowing the planning and executing units of various bicycle routes to familiarize themselves with the principles and regulations for setting up signage and markings for different bicycle routes, and ensuring a consistent identification and setup standard for the signage systems of all bicycle routes.

27

本所辦理「因應氣候變遷調適基礎課程」第1場次教育訓練，講授「氣候變遷及氣候災害」、「氣候變遷風險評估概論」。透過調適基礎課程培訓，強化運輸管理機關（構）人員調適專業知能。本次訓練包括交通部暨相關部屬機關（構）、高鐵公司及捷運公司等約20餘人參加。

The institute conducted the first session of "Basic Training Course on Climate Change Adaptation" to teach "Climate Change and Climate Disasters" and "Overview of Climate Change Risk Assessment." Through the basic training course, we aimed to strengthen the adaptation expertise of personnel in transportation management agencies. Approximately 20 participants from the MOTC and its affiliated agencies, the High-speed Rail company, and metro companies attended this training.

27

本所辦理「以無人機空拍及AI影像辨識技術探討路口交通衝突」研究成果說明暨教育訓練，邀請交通安全從業人員共68人參與，推廣應用分析工具於路口交通安全診斷及改善，以提升路口安全。

The institute held a presentation and training session on the research results of "Exploring Traffic Conflicts at Intersections Using Drone Aerial Photography and AI Image Recognition Technology," invited 68 traffic safety practitioners to participate, and promoted the application of analytical tools for diagnosing and improving intersection safety.

11 November

本所辦理「新興科技導入學校交通安全教育之研發示範計畫」成果說明會，邀請專家學者、中央相關單位、縣市政府教育機關、教育部挑選之科技導入重點學校等參與，以對教學輔助軟體設計內容、應用技術及推廣方式進行交流討論。

The institute conducted a result briefing session for "Demonstration Project for Integrating Emerging Technologies into School Traffic Safety Education," and invited experts and scholars, central relevant units, county and city government education agencies, and key schools selected by the Ministry of Education to participate. The session focused on exchanging and discussing the design content of educational auxiliary software, application technologies, and promotion methods.

02

日期 Date	重要記事Event

11 November

本所假國家地震工程研究中心舉辦「港區無人機智慧化巡查技術研發成果」教育訓練，分享適用於臺中港區之無人飛行載具及飛控邏輯技術、影像自動化辨識技術，以及無人飛行載具影像管理與分析平台操作，並說明目前國內外智慧港口發展之現況，藉由透過教育訓練課程和參與單位互相交流，拓展應用領域，提升我國港埠智慧化發展，並協助臺灣港務股份有限公司以自動化方式快速掌握港區設施使用狀況。

The institute organized an educational training session at the national center for research on earthquake engineering research "The Development Results of Smart Inspection Technology for Port Areas Using Drones," sharing the suitable unmanned aerial vehicles and flight control logic technology, automated image recognition technology, and the operation of image management and analysis platform for Taichung Port area. The session also covered the current development status of smart ports both domestically and internationally. Through the educational training course and interaction with participating units, the application areas were expanded, enhancing the smart development of our country's ports and assisting Taiwan International Ports Corporation in quickly understanding the usage status of port facilities through automated methods.

09

本所與財團法人中華顧問工程司合作辦理「道安從業人員專業能力提升訓練」，邀請美國馬里蘭大學張金琳教授講授美國FARS系統、道安改善對策專家建議系統、行人安全改善科技措施、道安專業人員訓練課程及道路交通安全查核等課程，協助提升國內道安從業人員專業知能。

The institute, in collaboration with the China Engineering Consultants, Inc., conducted a "Professional Capacity Enhancement Training for Traffic Safety Practitioners," and invited Professor Chang Chin-Lin from the University of Maryland to teach courses on the U.S. FARS system, expert advice system for traffic safety improvement strategies, pedestrian safety improvement technologies, professional training courses for traffic safety personnel, and road traffic safety audits, helping to improve the professional knowledge and skills of domestic traffic safety practitioners.

09

日期 Date	重要記事Event

11 November

本所辦理「因應氣候變遷調適基礎課程」第2場次教育訓練，講授「自然解方（NbS）概念」、「國家法規與政策」。透過調適基礎課程培訓，強化運輸管理機關（構）人員調適專業知能。本次訓練包括交通部暨相關部屬機關（構）、高鐵公司及捷運公司等約30餘人參加。

The institute conducted the second session of "Basic Training Course on Climate Change Adaptation," teaching the concepts of "Nature-based Solutions (NbS)" and "National Regulations and Policies." Through the basic training course, we aimed to strengthen the adaptation expertise of personnel in transportation management agencies. Approximately 30 participants from the MOTC and its affiliated agencies, the High-speed Rail company, and metro companies attended this training.

13

本所與社團法人臺灣海洋工程學會合作辦理「112年度港灣海氣象觀測作業及分析與應用技術研習會」，邀請專家學者專題演講並進行交流討論，提供與會單位瞭解近年來港灣海氣象觀測資料蒐集與分析之技術、實際應用之情形，以及未來發展方向，促進國內港灣海氣象觀測技術與分析應用之發展。

The institute, in collaboration with the Taiwan society of ocean Engineering, organized "2023 Harbor Meteorological Observation Operations and Analysis and Application Technology Seminar," invited experts and scholars for special lectures and discussions, provided participating units with an understanding of the recent techniques for collecting and analyzing harbor meteorological observation data, the actual application situation and future development directions, and promoted the development of harbor meteorological observation technology and its analytical applications in the country.

13

本所於臺灣港務股份有限公司高雄港務分公司舉辦112年度「港灣構造物維護管理系統」教育訓練，針對精進「巡查檢測維護作業要點」、「港灣構造物維護管理系統」新增模組、巡檢作業與維修作業功能等成果進行說明與實機操作，提供港務維管單位落實現地巡查檢測及維護應用。

The institute held 2023 educational training session on "Harbor Structure Maintenance Management System" at Kaohsiung branch of Taiwan International Ports Corporation. The session covered the refinement of "Inspection and Maintenance Operations Guidelines," new modules of "Harbor Structure Maintenance Management System," and the functions of inspection and maintenance operations, providing practical explanations and hands-on operation, and helping port management units implement on-site inspections and maintenance applications.

17

日期 Date	重要記事Event

11 November

本所合作計畫彙整「花蓮海岸公路浪襲預警及防災應用技術之研究」成果榮獲中華民國道路協會112年度論文獎。

17

The collaborative project of the institute "Research on Early Warning and Disaster Prevention Applications of Wave Overtopping on the Hualien Coastal Highway" won 2023 thesis award from the the China Road Federation.


中華民國道路協會論文獎證書

[redacted]生、劉俊志先生、蔡立宏先生、林雅雯女士、陳鈞彥先生、陳[redacted]女士，合著「花蓮海岸公路[redacted]天路段之海岸防護探討」論文[redacted]本會評選為112年度得獎論文[redacted]獎金新臺幣參萬元，以資鼓勵。

理事長 趙興華

中華民國 112 年 11 月 17 日

12 December

本所辦理「水利海洋港灣工程業務交流會」並邀請長期有功於臺灣水利、海洋及港灣工程發展之經濟部水利署水利規劃分署、國立臺灣大學水工試驗所、國立成功大學水工試驗所與會交流研討，除互相簡介執掌業務推動成果外，同時達成未來持續增進業務交流、分享等之共識，俾利彼此業務推動順利。

The institute conducted "Hydraulic, Ocean, and Marine Harbor Engineering Business Exchange Meeting" and invited the Water Resources Planning Institute of the Water Resources Agency, Ministry of Economic Affairs, the Hydrotech Research Institute, National Taiwan University, and the Tainan Hydraulics Laboratory, National Cheng Kung University, who have long contributed to the development of water conservancy, marine, and harbor engineering in Taiwan, to participate in discussions. Apart from introducing their respective business promotion results, a consensus was reached on continuous business exchanges and sharing in the future to facilitate the smooth promotion of their respective businesses.

01

本所與國立臺灣大學合作之「無人機影像監測技術應用於臺中港區管理之研究」計畫成果獲得「中國土木水利工程學會-2023工程數位創新應用獎」。

The collaborative project between the institute and National Taiwan University, "Research on the Application of Drone Image Monitoring Technology in Taichung Port Management" won "2023 Engineering Digital Innovation Application Award" from the Chinese Institute of Civil and Hydraulic Engineering.

01

日期 Date	重要記事Event

12 December

本所為協助落實橋梁梁底狹小空間檢測工作，辦理研究成果線上推廣，邀請內政部國土管理署、交通部高速公路局、公路局及縣市政府等橋梁維護管理機關（構）與專業廠商，超過70人參與，交流分享橋梁檢測工具研發成果及實地測試案例，並展示橋檢工具操作及功能，提供橋梁維護管理機關（構）參考應用，提升橋梁檢測品質與安全。

In order to assist with the inspection work of narrow spaces under bridge girders, the institute held an online promotion of research results. We invited bridge maintenance and management agencies and professional firms, including National Land management agency, Ministry of the Interior's, Freeway Bureau of the MOTC, Highway Bureauof the MOTC and local governments. Over 70 participants joined to share and exchange the development results of bridge inspection tools and field test cases, demonstrating the operation and functions of the tools, and providing references for bridge maintenance and management agencies to enhance the quality and safety of bridge inspections.

04

陳彥伯政務次長出席本所辦理「電動大客車營運數據分析與智慧充電系統發表會」致詞並向各界持續努力與協助政府「2030年市區公車全面電動化」之推動表示感謝，強調當日的成果發表會是交通部在實現「2030年市區公車全面電動化」政策目標上的一個重要里程碑。本發表會除介紹「電動大客車營運數據分析與智慧充電系統」的應用與管理服務創新思維，同時亦安排中興巴士北士科站之技術參訪，展示智慧充電系統的建置成果與實際應用效益。

Deputy Minister Chen Yen-Po attended and delivered a speech at "Analysis of Electric Buses' Operational Data and Smart Charging System Presentation," expressing gratitude for the continued efforts and support from all sectors in promoting the government's goal of "Full Electrification of Urban Buses by 2030," and emphasizing that the day's presentation was an important milestone in achieving this policy goal. The presentation introduced innovative application and management services of "Electric Bus Operational Data Analysis and Smart Charging System" and arranged a technical visit to Zhongxing bus Beishike Station to demonstrate the construction results and practical benefits of the smart charging system.

05

日期 Date	重要記事Event

12 December

與中華民國運輸學會共同辦理2023年會暨學術論文國際研討會之「重大交通政策未來研究課題專題研討」專題場次，共規劃8個場次，胡湘麟政務次長蒞臨致詞，藉由與會各界專家學者針對重大交通政策未來面臨課題探討交流，以提供交通部施政參考及運輸領域創新研究之方向。

The institute and the Chinese Institute of Transportation jointly organized "Future Research Topics of Major Transportation Policies" session at the 2023 annual meeting and international academic conference, and planned for 8 sessions. Deputy Minister Hu Hsiang-Ling attended and delivered a speech, exchanging views with experts and scholars on future challenges of major transportation policies to provide references for the MOTC and directions for innovative research in the transportation field.

07

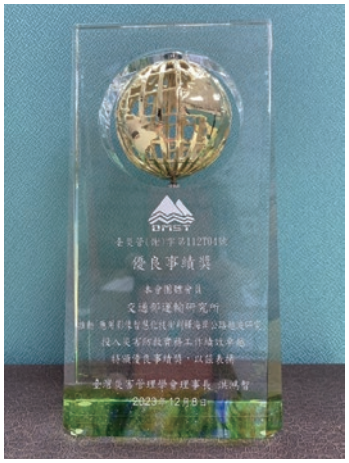
構建5G智慧交通數位神經中樞系統計畫以「5G-AIoT智慧交通數位神經中樞之規劃與實證」榮獲中華民國運輸學會「112年度傑出交通運輸計畫獎」。

The "Planning and Verification of the 5G-AIoT Smart Transportation Digital Nerve Center" project won "2023 Outstanding Transportation Project Award" from the Chinese Institute of Transportation.

08

本所「應用影像智慧化技術判釋海岸公路越波研究」參選社團法人臺灣災害管理學會「2023獎賞活動」獲頒「優良事績」獎。

The institute project "Intelligent image recognition analyses for wave overtopping on coastal highway" was awarded "Excellence in Performance" award by the Disaster Management Society of Taiwan in "2023 Reward Activities."



20

召開「高雄國際機場聯外道路改善規劃研商平臺」第4次會議，邀集內政部國土管理署、交通部航政司、路政及道安司、交通部民用航空局、高速公路局、公路局、高雄市政府及副知立法委員賴瑞隆國會辦公室，追蹤前次會議決議辦理情形，共同研商高雄國際機場聯外道路改善後續辦理方向，並於會中達成共識。

Held the 4th meeting of "Kaohsiung International Airport Access Road Improvement Planning Platform," invited the Ministry of Interior's National Land Management Agency , the MOTC's Department Navigation and Aviation , Department of Railways,Highways,and Road Safety, the Civil Aviation Administration, Freeway Bureau, Highway Bureau , Kaohsiung City government, and Legislator Lai Jui-Lung's office to track the implementation of previous meeting resolutions and jointly discussed the subsequent directions for Kaohsiung International Airport access road improvement, reaching a consensus during the meeting.

日期 Date	重要記事Event

12 December

奉交通部指示研擬新一期公運計畫草案，於112年12月11日向部長簡報計畫草案內容，參照部長指示修訂相關內容後，於112年12月22日將修訂完成之「公路公共運輸永續及交通平權計畫（114-117年）」草案陳報交通部，交通部已於113年1月2日函請行政院核定。

22

Under the direction of the MOTC, we drafted a new public transport plan and reported the content to the minister on December 11, 2023. After revising the relevant content according to the minister's instructions, we submitted the revised draft of "Highway Public Transportation Sustainability and Mobility Equality Plan (2025–2028)" to the MOTC on December 22, 2023. The ministry has requested the Executive Yuan to approve it as of January 2, 2024.

26

召開桃園航空城核心計畫「聯外運輸系統」工作小組第30次會議，除賡續追蹤前次會議決議事項及列管計畫辦理進度外，並共同研商「桃園機場公司建議國1甲線航翔路匝道取消」、「增設國1甲線貨運聯絡道」及「桃園國際機場第三跑道及基礎建設工程與新台15線工程界面協調情形」等案，俾使各計畫能順利推動，以利達成預期效益。

Held the 30th meeting of Taoyuan aerotropolis core project "External Transportation System" working group, continued to track the implementation progress of previous meeting resolutions and discussed cases such as "Cancellation of the Ramp on Hangxiang Road of National Highway No. 1A Recommended by Taoyuan International Airport Co., Ltd.," "Addition of a Cargo Connection Road on National Highway No. 1A," and "Coordination of the Interface between the Third Runway and Infrastructure Project of Taoyuan International Airport and the New Taiwan Route 15 Project" to ensure the smooth promotion and expected benefits of each project.

28

高雄市政府與本所完成「通用計程車預約整合系統」授權簽約。

Kaohsiung City government and the institute completed the signing authorization of "Universal Taxi Reservation Integration System."

29

本所辦理「無人機暢遊實境–交通部無人機研發與應用成果發表會」，呈現無人機科技產業小組推動無人機在交通領域之研發與應用成果，並授證予交通部木蘭無人機隊成員，以及頒獎表揚「無人機在交通領域之創意應用競賽」獲獎團隊。

The institute held the "Drone Immersive Experience – the MOTC's Drone R&D and Application Results Presentation," showcasing the research and application results of drone technology industry group in the transportation field, and awarded certificates to members of the MOTC's Mulan drone team, and presented awards to the winning teams of "Creative Application Competition of Drones in the Transportation Field."

柒 07

附錄：
年度研究計畫

Appendix: Annual Research Project

項次	計畫名稱	Project Title
1	東臺區域整體運輸規劃系列研究（2/3）－供需預測分析	A Series of Studies on the Overall Transportation Planning of Eastern Taiwan (2/3)-Intercity Travel Supply and Demand Forecast Analysis
2	城際鐵道容量分析暨應用研究（1/2）－編組站及端末站之容量模式構建	Research on Capacity Analysis of Intercity Railways and Its Applications (1/2) – Rail Capacity Model for the Classification Yard and Terminal Station
3	電動車公共充電樁設施設置需求評估之研究	The Study of the Public Charger's Demand Assessment for Electric Vehicles
4	高速公路交織路段容量及服務水準分析之研究（1/3）－典型路段	Analysis of Traffic Capacity and Level of Service of Freeway Weaving Segments(1/3) – Typical Segments
5	運輸規劃支援系統維運技術服務（112年度）	Maintenance Service of the Transportation Planning Support System (2023)
6	111-112年臺灣公路容量分析軟體（THCS）與專區網站推廣維運服務（112年度）	2023Taiwan Highway Capacity Analysis Software and Website Promotion and Maintenance Service
7	新一代公路交通系統模擬（HTSS）模式開發規劃（1/2）－功能設計	Development Planning for the New Generation Highway Traffic System Simulation (HTSS) Model (1/2) - Functional Design
8	環島自行車道升級暨多元路線整合規劃與評估（IV）	An Integrated Technical Planning and Evaluation of Upgrading and Diversifying Island Round Cycling Routes (IV)
9	107~111年城際運輸消長觀察	Observations of Inter-city Transportation Growth and Decline from 2018 to 2022
10	112年春節連假高速公路與鐵公路客運旅次特性變化分析	Observations on the Trip Characteristics of Freeway and Railway of 2023 Chinese New Year Holidays
11	我國工作年齡人口減少對於長期交通規劃之衝擊與因應計畫	The Impact and Responding Plan of the Decreasing Working Age Population in Taiwan
12	「自行車通勤路線示範計畫」－臺北都會區	"Bicycle Commuting Route Demonstration Project" – Taipei metropolitan area
13	新北市五股地區周邊運輸系統改善措施初探	Exploration of Transportation System Improvement Measures in the Vicinity of Wugu District, New Taipei City: A Preliminary Study
14	高雄環狀輕軌全線營運之可靠度暨容量瓶頸改善分析	Reliability and Capacity Bottleneck Improvement Analysis of the Kaohsiung Circular Light Rail Full Line Operation
15	大漢溪兩岸整體交通路網規劃構想計畫	Conceptual Plan for the Overall Traffic Network on Both Sides of the Dahan River
16	國際民航減碳趨勢發展探討	Study on Carbon Deduction of International Civil Aviation Industry
17	112年度「國際海運資料庫」維護精進及議題分析	Maintaining and Data Analyzing of International Maritime Database of 2023
18	112年度「國際空運資料庫」維護精進及議題分析	Maintaining and Data Analyzing of International Air Transportation Database of 2023
19	國際機場運作模擬分析軟體系統規劃與建置（1/2）－系統規劃設計與軟體單元確立	International Airport Operation Simulation Analysis Software System Planning and Construction (1/2)-System Planning, Design and Software Unit Establishment
20	應用大數據技術建構國際機場潛在市場評析方法之研究	A Study on Developing Market Analysis Methods for International Airports through the Use of Big Data Technology

項次	計畫名稱	Project Title
21	我國航港資訊整合與數位化發展架構之研究（1/2）－航港產業數位化調查與發展藍圖研擬	Research on Maritime and Port Information Integration and Digital Development Framework in Taiwan(1/2)- Survey on digitization and Development Blueprint of Maritime and Port Industry Ecosystem
22	鐵路供需診斷數位分身軟體平台之建置（1/2）－鐵路數位分身軟體平台雛型架構之規劃	Construction of railway supply and demand diagnosis digital twin software platform (1/2)-Planning of prototype architecture of railway digital twin software platform
23	擴充「國際海運資料庫」數據源之探討	Exploration of expanded sources for the data in the "International Sea Freight Database"
24	亞太國際樞紐機場疫後環境永續發展趨勢探討	Discussion on the Environmentally Sustainable Development Trend of Asia-Pacific International Hub Airport after the Pandemic
25	國際發展港口協調整合決策系統現況探討	Status and Development of International Port Collaborative Decision Making System
26	建立自行車環島、多元及串聯路線之自行車事故分析及改善機制	Establishing Bike Accident Analysis and Improvement Strategies of cycling routes
27	以無人機探勘人車流動資訊之應用情境規劃與先導測試（3/3）－斜交及多岔路口	Application Scenarios and Pilot Run of Vehicle and Pedestrians Traffic Flow Information Using UAV Aerial Videography (3/3) - Diagonal Intersections and Multi-Fork Intersections
28	大型車輛裝設主動預警輔助系統之試運行使用成效評估（2/4）：評估方法之先導測試	Evaluation of the Trial Operation of Large Vehicles Installed with Active Warning Assist System (2/4): Pilot testing of Assessment Methods
29	新興科技導入學校交通安全教育之研發示範計畫（1/2）－教學輔助軟體規劃與開發	Incorporating Emerging Technology into School Traffic Safety Education R&D Demonstration (1/2)–Plan and Development of teaching assistant software
30	應用人工智慧分析技術探勘高風險路段（3/4）－行車異常事件及高風險駕駛行為分析	Applying Artificial Intelligent Method for Exploring Risk-prone Road Section (3/4) –Aberrant Events and Risky Driving Behavior Analysis
31	研析國家鐵道安全計畫之安全績效與目標管理（1/2）－安全指標規劃與資料分析	A Study on Application of Safety Performance Management by Objectives in Railway State Safety Program (1/2): Development of Safety Indicators and Data Analysis
32	事故碰撞型態導向之路口設計範例推廣示範計畫（3/3）－非直轄市推廣應用（II）	The Promotion of "Traffic Safety Engineering Design Guidance for Intersection Based on Accident Types (3/3)"-Application in Non-Municipality (II)
33	汽車客運業路線別成本計算制度檢討規劃及應用軟體建置計畫（2/2）	Project to Review Route-Based Costing Systems and Developing Software Applications for Bus Services Industry (2/2)
34	先進公車智慧化營運管理先導運行計畫（2/2）－整合車載設備之駕駛數位履歷管理系統研發	The Advanced Intelligent Operation and Management Pilot Project for Smart Bus (2/2) - Development of an Integrated Driver Digital Resume Management System for Onboard Devices
35	推動通用計程車特約制度（2/2）－成效檢討及服務優化	Implement the Contract System of Accessible Taxis (2/2) – The Effectiveness and Service Optimization
36	ISO55001國際標準導入鐵道資產管理實務之研究（1/3）－制度架構建立	A Study on Implementation of Railway Asset Management Practices through ISO 55001(1/3)-Establishment for Framework
37	物流前瞻發展趨勢初探-環境永續	A Preliminary Study on Forward-looking Trends of Freight Delivery-Environmental Sustainability Field
38	運輸經營管理組業務決策支援系統規劃（2/2）－架構規劃	Planning of Decision Support System for Transportation Operations and Management Division (1/2) - Architecture planning

項次	計畫名稱	Project Title
39	國道客運經營困境與疫後振興措施之探討	Exploration of the Operating Difficulties and Post-Pandemic Revitalization Measures for National Highway Passenger Transportation
40	我國人工智慧車聯網之號誌控制（1/2）－都會區幹道實作與交流道區域模式發展	Study of Artificial Intelligence Traffic Signal Control (1/2)- Urban Main Roads and Highway Interchange Areas Implementation
41	無人機偏鄉物流服務運送驗證計畫（1/2）－服務模式規劃與系統發展	Proof-of-Service for UAS Delivery in Rural Areas (1/2) – Service Model Planning and System Development
42	交通行動服務（MaaS）跨域合作與應用優化之研究（1/2）－應用探討與推動規劃	A Study of Mobility as a Service (MaaS) Discussion with Cross-Border Cooperation and Application Optimization (1/2) - Application Discussion and Implement Planning
43	構建5G智慧交通數位神經中樞－功能擴充與精進	Construction of 5G intelligent transportation digital nerve center - Function Expansion and Refinement
44	運輸部門淨零排放與溫室氣體減量推動工作暨評估模型強化（1/2）－建構淨零排放評估模型暨評估111年行動方案成效	To promote net-zero emissions and greenhouse gas reduction in the transportation sector and to enhance the evaluation model (1/2) – constructing the net-zero emissions evaluation model and evaluating the effectiveness of 2022 action plan
45	低碳交通區推動機制之研究（1/2）－設置之評估與配套措施	Research on the promotion mechanism of low-carbon transportation zones (1/2) – evaluation and supporting measures for implementation
46	公路系統因應氣候變遷強化調適能力案例研析	Case studies of enhancing highway system's adaptive capabilities to climate change
47	建構運輸管理機關（構）之調適專業能力（1/2）－課題研析及課程規劃	Construction the Professional adaptability of Transportation Governing Authority (Agency) (1/2) – Topic Investigation & Analysis and Course Planning.
48	路口交通環境特性對空氣品質影響及改善指引之研訂（1/2）－調查計畫與資料蒐集	The development of guidelines for the impact of intersection traffic environment characteristics on air quality and improvement measures (1/2) – investigation plan and data collection
49	研析氣候變遷因應法及其子法修法重點與交通主管機關因應建議	Analyzing the Highlights of the Climate Change Response Act and its Sub-Laws and Recommendations for the Transportation Authorities
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51	運輸能源及環境組業務決策支援系統之規劃（2/2）－架構規劃	A Preliminary Discussion on the Planning of the Decision Support System for Transportation Energy and Environment Division (2/2) – Architecture Planning
52	電動車輛用電量數據來源及推估方法之先期研究	Preliminary Study on Data Sources and Estimation Methods for Electric Vehicle Energy Consumption.
53	112年運輸能源及環境組期刊研討計畫	The Study on Journals related to Transportation Energy and Environment (2023)
54	運輸部門導入ISO14090氣候變遷調適系列標準之初步探討及因應建議	Discussion on the Introduction of ISO 14090 Climate Change Adaptation Series Standards in the Transportation Sector
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