交通部運輸研究所

# 2020

交通部運輸研究所年報
INSTITUTE OF TRANSPORTATION, MOTC
ANNUAL REPORT 2020

專業領航╳追求卓越
Professional Navigation X Pursuit of Excellence

# 2020

## 交通部運輸研究所年報

INSTITUTE OF TRANSPORTATION, MOTC
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# 壹 所長的話

交通部以服務民眾為中心的「人本交通」做為施政願景，並以「安全」、「效率」、「品質」及「綠色」等為當前四大施政主軸。簡言之，交通部秉持「做實事、接地氣、讓民眾有感」的施政態度做為當前努力的施政目標，提供安全、效率、品質，以及符合環境永續的綠色交通服務，將人民感受放在最優先位置，朝「與民同行」、「連結共好」方向努力，成為名符其實能「交流」、會「溝通」的部會。

本所長期扮演交通部智庫角色，肩負三大任務，包括支援交通部擬訂運輸政策及帶動科技創新應用、協助部屬機關及地方政府落實運輸政策並結合產學各界擴大推廣能量、以及建立運輸系統技術標準與資訊平臺，並進行人才培育。本所全體同仁皆當自我期勉，以「專業領航、追求卓越」做為團隊共識，以「政策、前瞻、基礎」三個面向研究，做為創新思維與深化專業的技能，同時兼顧經濟發展、環境保育及社會公平等永續發展方向，善用與整合最新的資通訊技術，以有效支援交通部提升整體運輸系統的安全與服務品質。

回顧過去一年，本所在交通部的指導下，積極推動「交通科技產業會報-無人機科技產業小組」相關行動計畫，包括「推動我國無人機科技產業先期研究規劃」、「無人機整合示範計畫」及「無人機創意應用競賽」等，共同推動無人機產業發展，以擴大無人機在交通領域的應用；另協助交通部辦理「2020運輸政策白皮書」整合行銷作業，製作宣傳動畫影片，有助與民眾溝通，並使民眾能更深度瞭解政府當前及未來運輸施政方向。此外，本所亦持續協助交通部擔任APEC運輸工作小組、行政院永續會綠色運輸工作分組、交通部交通費率委員會、桃園航空城聯外運輸系統工作小組及自行車督導小組之綜合規劃分組與資訊分組幕僚，充分展現交通專業智庫角色。總結來說，面對交通部揭示的四大施政主軸，本所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 takes the "People-oriented Transportation" centered on serving the people as its administrative vision, and takes "Safety," "Efficiency," "Quality" and "Eco-green" as the current four major policies of administration. In simple terms, the Ministry of Transportation and Communications upholds the administration attitude of "Doing Practical Works, Connecting with People, and Making People Feel the Effects" as the administration goal of the current efforts to provide safe, efficient, high-quality, and environmentally sustainable eco-green transportation services, put the people's feelings first and work hard towards the direction of "Walking with People" and "Connecting for the Common Good" to become a Ministry capable of "Connecting" and "Communicating."

As the think tank of the Ministry of Transportation and Communications for a long period of time, the Institute of Transportation (IOT) undertakes three major duties, including supporting the Ministry of Transportation and Communications in formulating transportation policies and driving technological innovation and application, assisting subordinate agencies and local governments in implementing transportation policies, and combining all sectors of industry and academia to expand the promotion energy, as well as establishing transportation system technological standards and information platforms, and conducting talent cultivation. All colleagues of the Institute of Transportation (IOT) shall self-encourage ourselves based on "Professional Navigation, Pursuit of Excellence" as the team's consensus, and research on the three aspects of "Policy, Foresight, and Foundation" as innovative thinking and deepening professional skills, while taking the sustainable development directions of economic development, environmental conservation and social equity into account, making good use of and integrating the latest information and communication technologies to effectively support the Ministry of Transportation and Communications in improving the safety and service quality of the overall transportation system.

Looking back on the past year, under the guidance of the Ministry of Transportation and Communications, the IOT has actively promoted the "Transportation Technology and Industry Committee – UAV Technology Industry Group" related action plans, including "Preliminary Research on Promoting our Country's UAV Technology Industry", "UAV Integration Pilot Program" and "UAV Creative Application Competition ," etc., to promote the development of the UAV industry and expand the application of UAVs in the transportation sector. It has also assisted the Ministry of Transportation and Communications in the integrated marketing of the "2020 Transportation Policy White Paper" and produced promotional animation videos, to assist in public communication, and enable the public to have a deeper understanding of the government's current and future transportation administration directions. Furthermore, IOT has been continuing to take on responsibility of serving as the contact point to the APEC Transportation Working Group(TPT-WG), and served as the secretariats of several task forces supporting MOTC, including the Green Transportation Working Group of the National Sustainable Development Committee under Executive Yuan, the Transportation Fare Rate Committee of the Ministry of Transportation and Communications, the Ground Access Transportation System Working Group of the Taoyuan Aerotropolis, and Comprehensive Planning group and Information group under the Bicycle Supervision Working Group, These tough tasks fully demonstrate the IOT's role as the transportation professional think

一、**在安全方面**：完成「橋梁維護管理作業要點」草案，並經行政院於109年7月21日頒布、完成「事故碰撞型態導向之路口設計範例」、完成鐵道行車安全保證之實務操作指引與案例說明，協助臺灣鐵路管理局及國內鐵道營運單位精進鐵道安全管理系統作法、完成高雄市與臺南市「交通事件整合資訊流通服務平臺」，協助縣市政府交通主管機關提升交通事件管理效能、利用人工智慧影像辨識技術，賡續辦理軌道扣件缺失辨識系統建置，提升軌道巡檢及管理效能、協助臺灣港務公司研訂港灣構造物維護管理手冊及精進港灣構造物維護管理系統、配合行政院「向海致敬」政策，完成開發各商港海氣象資訊網頁及QR Code功能，提供民眾從事海上活動時，便於查詢應用，以及完成「海洋及交通運輸防災技術研究」及「離岸風電海下工程技術研發計畫」，以促進港區發展及提升船舶航行安全。

二、**在效率方面**：協助交通部辦理「高雄港洲際貨櫃中心聯外交通改善計畫」、持續發展並精進計畫評估工具，完成輕軌系統A、B型路權容量及可靠度分析、編訂「捷運路網規劃設計參考手冊」、完成國內行車成本調查與分析、完成商港整體發展規劃（111-115年），研擬國際商港及國內商港因應策略與中長期發展方針、持續維護更新國際海空運資料庫並強化統計分析功能、完成「數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究」，以及應用人工智慧AI技術進行適應性號誌控制測試與效益評估。

三、**在品質方面**：完成「南臺區域整體運輸規劃系列研究（2/2）－供需預測及發展策略分析」、啟動中臺區域整體運輸規劃系列研究之旅次特性及屏柵線交通量調查作業、賡續推動「交通部補助學界成立區域運輸發展研究中心計畫（108-109年度）」，以「偏鄉（或離島）公共運輸環境之健全」及「提升都市公共運輸載客量策略之檢討與規劃」為主題，結合六大區域中心聯合辦理成果發表會、完成「公路公共運輸服務升級計畫

tank. In conclusion, facing up the four major administration policies promulgated by the Ministry of Transportation and Communications, the IOT has successively completed major of related projects, including:

(1) **Safety-related Projects:** Completed the draft of "Directions for Bridge Maintenance and Management Operations," and promulgated by the Executive Yuan on July 21, 2020, completed the "Accident Collision Type Oriented Intersection Design Example,"and completed the practical operation instructions and case description of the railway safety assurance, to assist the Taiwan Railway Administration and domestic railway operating units to improve the practices of the Railway Safety Management System, completed the "Traffic Event Integration and Information Circulation Service Platform" for Kaohsiung City and Tainan City, to assist the county and city government transportation competent authorities to improve the efficiency of traffic event management, continue the implementation of track fastener defective identification system using the artificial intelligence image recognition technology to improve track inspection and management efficiency, assisted Taiwan International Ports Corporation to research and develop the harbor structure maintenance management manual and improve the harbor structure maintenance management system, cooperated with the Executive Yuan's "Ocean Taiwan" policy, completed the development of marine meteorological information web pages for various commercial ports and QR Code functions, to provide people with easy access to inquiries and applications when engaging in marine activities, as well as completed the "Marine and Transportation Disaster Prevention Technology Research" and the "Offshore Wind Power Subsea Engineering Technology Research and Development Project" to promote the development of harbor area and enhance the safety of ship navigation.

(2) **Efficiency-related Projects:** Assisted the Ministry of Transportation and Communications in conducting the "Kaohsiung Intercontinental Container Terminal Access Traffic Improvement Project," continued to develop and improve the project evaluation tools, completed the analysis of the capacity and reliability of the A, B-Type Right-of-Way of the light rail system, compiled the "Reference Manual for MRT Network Planning and Design," completed the domestic driving cost survey and analysis, completed the Integrated Overall Development Planning of Commercial Ports (2022-2026), proposed policies for the international and domestic commercial port response strategies and medium - to long-term development, continued to maintain and update the international maritime and air transportation database and strengthen statistical analysis functions, completed the "Research on the Application of Digitization and Blockchain Technology in the Operation Chain of Container Transportation," and applied Artificial Intelligence (AI) technology to perform adaptive signal control testing and benefit evaluation.

(3) **Quality-related Projects:** Completed the "Series Study on the Southern-Taiwan Regional Overall Transportation Planning Series(2/2) – Supply and Demand Forecast and Development Strategy Analysis," started the Trip Characteristics and Screen Line Traffic Volume survey of the Central Taiwan Regional Overall Transportation Planning Series Study, continued to promote the "Ministry of Transportation and Communications Subsidizes the Academia to Establish Regional Transportation Development and Research Center Project (2019–2020)", combined with six Regional Centers to jointly organize the results presentation with the topics of "Sound Public Transportation Environment in Remote Rural (Off-shore Islands)" and "Review

（110-113年）」研擬並奉行政院核定實施、完成「公共運輸供需契合與轉乘縫隙之研究-以鐵公路轉乘為例」研究計畫、推動「愛接送－預約式通用計程車」試辦及推廣運用計畫、持續協同高雄市政府推動交通行動服務（MaaS）2.0計畫、完成港灣構造物設計案例（碼頭及防波堤）彙編，以及協助連江縣政府完成「國內商港未來發展及建設計畫（106-110年）－馬祖港埠建設計畫」。

**四、在綠色方面**：協助交通部執行4年期（109-112年）「環島自行車道升級暨多元路線整合推動計畫」、協助交通部訂定「2030電動大客車推動策略」與「交通部電動大客車示範計畫補助作業要點」、協助交通部會同相關部會積極推動第一期（105-109年）運輸部門溫室氣體減量並提前達成目標、配合行政院協商第二期各部門減量目標，協助交通部研議運輸部門減量目標，並獲行政院採納，以及持續精進「臺灣附近海域及港區船舶排放量對空氣品質影響預測系統」，建立臺灣排放源之即時排放量資料與海域分區船舶排放預測，提供航港局及臺灣港務公司進行空污防制措施之參據，共同維護環境永續。

展望未來，配合交通部與本所的組織與功能調整，本所仍將持續扮演及強化交通部智庫角色，並持續精進交通基礎研究、前瞻技術研發及支援運輸政策規劃等核心任務，以提升重大政策研擬與支援決策實力；此外，更將在「2020運輸政策白皮書」的指導之下，持續關注國際趨勢，強化海 、空運輸規劃能力，以及運輸安全、公共運輸、智慧運輸、綠運輸、防災與調適等研究，以支援運輸施政與技術創新並促進交通科技產業發展，奠立我國運輸服務優質升級之堅實基礎。

交通部運輸研究所 所長

林繼國

and Planning of Improving the Public Transportation Passenger Volume Strategies in Urban Areas," completed the research and planning of the "Highway Public Transportation Service Upgrade Project (2021–2024)" and approved by the Executive Yuan for implementation, completed the research project of the "Transfer Time Gap Evaluation and Enhancement Mechanism for Taiwan Railways, Taiwan High Speed Rail, and Their Shuttle Buses," promoted the trial of "i-Taxi – Reservation Accessible Taxi Service" and promoted the application project, continued to cooperate with the Kaohsiung City Government to promote Mobility as a Service (MaaS) 2.0 project, completed the compilation of Harbor Structure Design cases (wharfs, breakwaters), and assisted the Lienchiang County Government to complete the "Future Development and Construction Project of the Domestic Commercial Ports (2017–2021) – Matsu Port Construction Project."

**(4) Eco-green-related Projects:** Assisted the Ministry of Transportation and Communications in implementing the 4-year (2020–2023) "Plan of Upgrading and Diversifying Island Round Cycling Routes Integration and Promotion," assisted the Ministry of Transportation and Communications in formulating the "2030 Electric Bus Promotion Strategy" and "Guidelines of Electric Bus Demonstration Project Subsidies by the Ministry of Transportation and Communications," to assist the Ministry of Transportation and Communications jointly with relevant departments to actively promote the Phase-1 (2016–2020) of the greenhouse gas reduction by the transportation sector and achieve the target ahead of time, and cooperated with the Executive Yuan to negotiate the Phase-2 reduction target for all sectors, and assisted the Ministry of Transportation and Communications in researching and discussing the reduction target of the transportation sector, which has been adopted by the Executive Yuan, and continued to improve the "Prediction System for the Impact of Ship Emissions on Air Quality in the Waters and Port Areas Near Taiwan" to establish real-time emission data of Taiwan's emission sources and the ship emission prediction by the region of sea areas, to provide the reference for the Maritime and Port Bureau, Taiwan International Ports Corporation to carry out the air pollution control measures, and jointly maintain environmental sustainability.

Looking to the future, cooperating with the organizational and functional adjustments of the Ministry of Transportation and Communications and the Institute of Transportation, the IOT will continue to play and strengthen the role as the think tank of the Ministry of Transportation and Communications, and continue to improve the core tasks of fundamental research for transportation, forward-looking technology research and development, and supporting the transportation policy planning to enhance the research and planning of major policies and the strength of decision-making support. Furthermore, under the guidance of the "2020 Transportation Policy White Paper," we will continue to pay attention to international trends and strengthen sea and air transportation planning capabilities, as well as the research of transportation safety, public transportation, intelligent transportation, green transportation, disaster prevention and adaptation, to support transportation administration and technological innovation and promote the development of the transportation technology industry, laying a solid foundation for the excellent quality upgrade of our Country's transportation services.

Institute of Transportation, MOTC
Director General

Lin, Chi-Kuo

# 組織與職掌
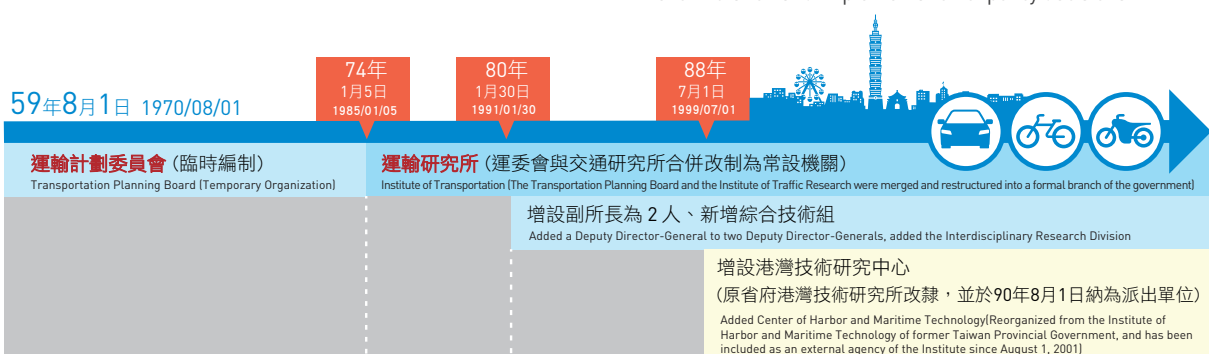
## 02. Organization and Functions

# 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，且在整體經濟的考量下，可供運用的資金究屬有限，因此對於投資決策的研提及優先順序的釐定，便須由一個統一的運輸規劃機構來承擔；其次，由於運輸事業係屬公用事業，政府對其費率、加入、退出、能量等等，均有必要參與管理，而參與的方法是否適當、是否需要修正，亦須由一個統籌的運輸規劃機構進行研究；　再次，各種運輸事業彼此均具有競爭性，如何減少其相互間的競爭性而加強其輔助性，以完成最具效益的整體運輸系統，更須由一個運輸規劃機構來統籌完成。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，其舉舉大者計有：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 Ministry of Transportation and Communications established the Transportation Planning Board on August 1, 1970. Over a period of fourteen years since its inception, the Transportation Planning Board had completed a number of planning projects. Notable examples of such projects include: Taiwan Area Integrated Transportation Systems Planning Study; Plan for Integration of Freeway Interchanges and Connecting Highway Systems; Preliminary Plan of Taipei Area Public Transportation Systems; Taipei City Area Railway Improvement Plan; Plan of Taipei Metropolitan Area MRT System; and long-range Development Plan of Kaohsiung Metropolitan Area Public Transportation System. In addition, the Transportation Planning Board was also instrumental in conducting studies to assist the government in the formulation and implementation of policy decisions.

59年8月1日 1970/08/01

74年 1月5日 1985/01/05

80年 1月30日 1991/01/30

88年 7月1日 1999/07/01

運輸計劃委員會 (臨時編制)
Transportation Planning Board (Temporary Organization)

運輸研究所 (運委會與交通研究所合併改制為常設機關)
Institute of Transportation (The Transportation Planning Board and the Institute of Traffic Research were merged and restructured into a formal branch of the government)

增設副所長為 2 人、新增綜合技術組
Added a Deputy Director-General to two Deputy Director-Generals, added the Interdisciplinary Research Division

增設港灣技術研究中心
(原省府港灣技術研究所改隸，並於90年8月1日納為派出單位)
Added Center of Harbor and Maritime Technology(Reorganized from the Institute of Harbor and Maritime Technology of former Taiwan Provincial Government, and has been included as an external agency of the Institute since August 1, 2001)

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

The Transportation Planning Board, however, was a provisional organization; it had very limited funding and manpower to tackle the increasingly complex transportation problems. Therefore, the Institute of Transportation was created on January 5, 1985 by merging the Transportation Planning Board with the former Institute of Traffic Research, which had the mandate to conduct traffic research and personnel training, manage battlefield equipment and supplies, and collect intelligence on Mainland China. Being a formal branch of the government, the Institute of Transportation is funded through a normal budgeting process. Because of the increased demand for its services, the organizational structure of the Institute was expanded, on January 30, 1991, by adding a Deputy Director-General, an Interdisciplinary Research Division, and intermediate-level planners. And since July 1, 1999, due to the adjustment of government functions, the Institute of Harbor and Maritime Technology has become affiliated to the Institute of Transportation and renamed as Harbor and Maritime Technology Center . 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 Harbor and Maritime Technology Center 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.

## 二、 組織及人力

本所設置運輸計畫、運輸工程、運輸安全、運輸經營管理、運輸資訊、綜合技術6個組與港灣技術研究中心等計7個業務單位，及秘書室、人事室、主計室等行政單位。依照本所組織條例，編制員額計177人，預算員額151人（含約聘人員3人，技工、工友及駕駛共18人）。

## II. Organization and Human Resources

The Institute of Transportation comprises seven divisions and a Secretariat, a Personnel Office, and an Accounting Office. The seven divisions include Planning, Engineering, Operations and Management, Safety, Information Systems, Interdisciplinary Research and the Harbor and Maritime Technology Center. According to the organization act of the Institute, the total authorized staff is 177 and the budgetary staff is 152 (including 3 contracted research employees and 18 technicians, office workers and drivers).
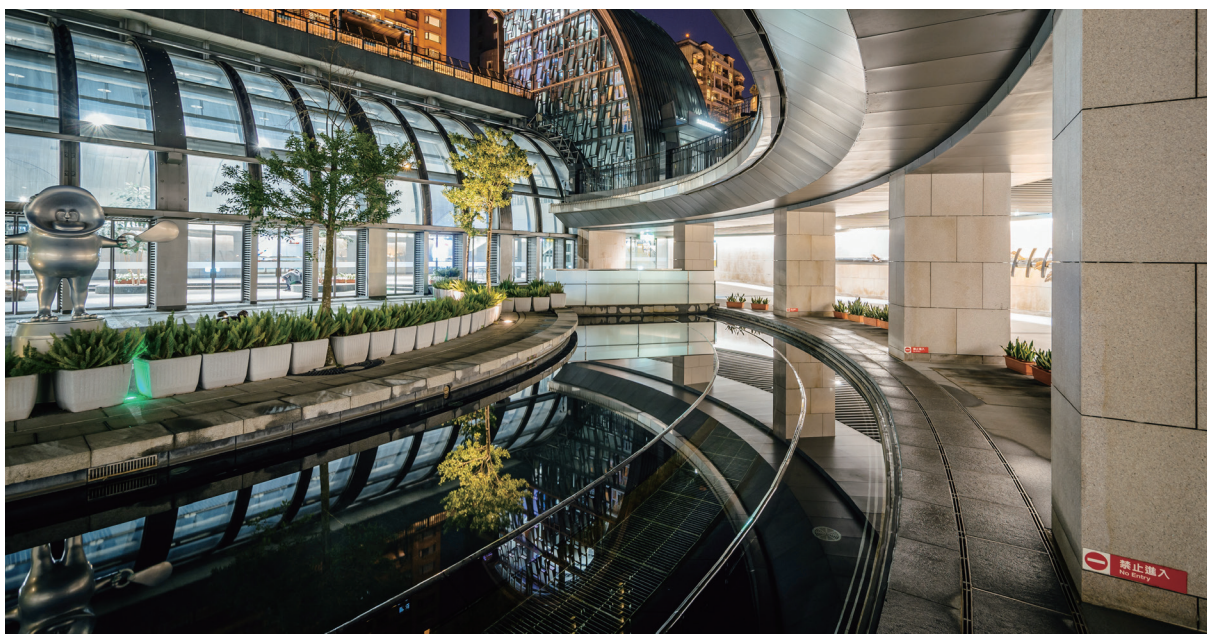
## 三、 本所職掌

依據本所組織條例第二條規定，本所掌理下列事項：

1. 運輸政策之研究及建議事項。

2. 運輸系統規劃配合及運輸計畫之研擬、評估事項。

3. 運輸發展與政治、經濟、國防及社會關係之研究與配合事項。

4. 運輸工程之設計、研究及發展事項。

5. 運輸經營及管理效率之研究發展事項。

6. 運輸安全之研究及規劃事項。

7. 運輸研究成果之應用及指導事項。

8. 國內外運輸研究之聯繫及合作事項。

9. 運輸資料之蒐集、整理、編譯及提供事項。

10. 港灣技術之研究及建議事項。

11. 其他運輸研究事項。

## III. Functions

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

1. Studying transportation policies and providing suggestions;

2. Coordinating planning, evaluation and project programming of transportation systems;

3. Studying the interrelationships among transportation development, political functions, socio-economic activities, and national defense;

4. Designing, researching and developing transportation engineering;

5. Studying the efficiency of transportation systems operation and management;

6. Studying and planning of transportation safety;

7. Applications of transportation research findings and guidance;

8. Liaison and cooperation of local and foreign transportation research;

9. Collection, compilation, translation and dissemination of transportation information;

10. Studying harbor and Maritime technologies and providing suggestions;

11. Other matters related to transportation research.

## 四、 組織架構

## IV. Organization Framework

本所組織架構如下圖：

Organization of the Institute is shown below:

所長 Director General
林繼國
Lin, Chi-Kuo

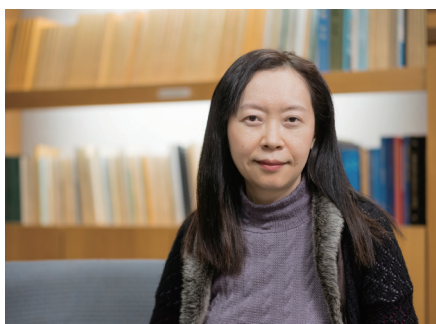副所長 Deputy Director General
黃新薰
Huang, Hsin-Hsun

副所長 Deputy Director General
陳天賜
Chen, Tien-Tsyh

主任秘書 Chief Secretary
蘇振維
Su, Cheng-Wei

| 人事室 主任 | 秘書室 主任 | 主計室 主任 | 公關室 主任 |
|---|---|---|---|
| 林立曼 Lin, Li-Man<br>Director of Personnel Office | 李淑惠 Lee, Shu-Hwui<br>Director of Secretariat | 許程晏 Hsu, Cheng-Yen<br>Director of Accounting Office | 曹瑞和 Tsaur, Ray-Her<br>Director of Public Relation Office |

| 港灣技術研究中心 主任 | 運輸計畫組 組長 | 運輸安全組 組長 | 運輸工程組 組長 |
|---|---|---|---|
| 蔡立宏 Tsai, Li-Hung<br>Director of Harbor<br>and Marine Technology Center | 張舜淵 Chang, Shuen-Yuan<br>Director of<br>Transportation Planning Division | 張開國 Chang, Kai-Kuo<br>Director of<br>Transportation Safety Division | 許書耕 Hsu, Shu-Keng<br>Director of Transportation<br>Engineering Division |

| 運輸經營管理組 組長 | 運輸資訊組 組長 | 綜合技術組 組長 |
|---|---|---|
| 陳其華 Chen, Chi-Hwa<br>Director of<br>Transportation Operations<br>& Management Division | 吳東凌 Wu, Tung-Ling<br>Director of<br>Transportation Information<br>Systems Division | 曾佩如 Tseng, Pei-Ju<br>Director of<br>Interdisciplinary Research<br>Division |

所長 Director General  **林繼國 Lin, Chi-Kuo**



副所長Deputy Director General **黃新薰 Huang, Hsin-Hsun**



副所長Deputy Director General **陳天賜 Chen, Tien-Tsyh**



主任秘書Chief Secretary  **蘇振維 Su, Cheng-Wei**

人事室 主任 Director of Personnel Office
**林立曼 Lin, Li-Man**



秘書室 主任 Director of Secretariat
**李淑惠 Lee, Shu-Hwui**



主計室 主任 Director of Accounting Office
**許程晏 Hsu, Cheng-Yen**



公關室 主任 Director of Public Relation Office
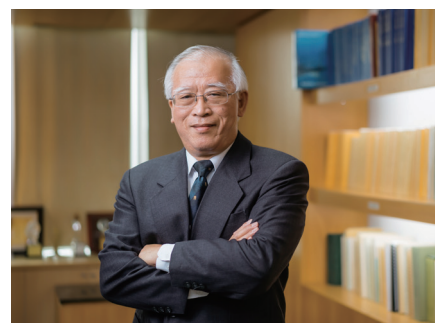**曹瑞和 Tsaur, Ray-Her**



港灣技術研究中心 主任
Director of Harbor and Marine Technology Center
**蔡立宏 Tsai, Li-Hung**



運輸計畫組 組長
Director ofTransportation Planning Division
**張舜淵 Chang, Shuen-Yuan**



運輸安全組 組長
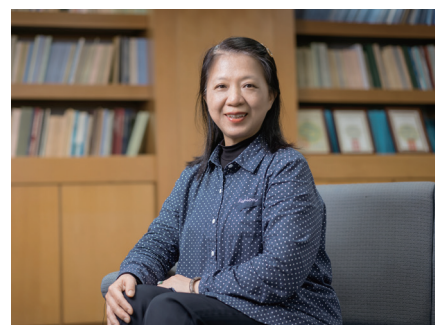Director of Transportation Safety Division
**張開國 Chang, Kai-Kuo**



運輸工程組 組長
Director of Transportation Engineering Division
**許書耕 Hsu, Shu-Keng**



運輸經營管理組 組長
Director of Transportation Operations &
Management Division
**陳其華 Chen, Chi-Hwa**



運輸資訊組 組長
Director of Transportation Information
Systems Division
**吳東凌 Wu, Tung-Ling**



綜合技術組 組長
Director of Interdisciplinary Research Division
**曾佩如 Tseng, Pei-Ju**

# 年度研究主軸

03. Main Scheme of Annual Research

109年是本所成果豐碩的一年，有關6組1中心之年度研究主軸分述如下：

## 一、 健全整體運輸規劃

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

### 1.辦理區域運輸規劃

（1）建立南臺區域（雲嘉南高屏）運輸需求模式，109年完成供需預測分析，深入瞭解區域內重要路廊供需問題。

（2）中臺區域（苗中彰投雲）整體運輸規劃系列研究，109年已完成社經發展分析及預測、交通分區劃分及運輸系統路網建構。

### 2.精進計畫評估工具

（1）辦理109年度運輸規劃整合資料庫維護與更新，進行運輸規劃支援系統未來發展之功能定位探討與界定。

（2）109年度辦理A、B型路權輕軌系統之容量及可靠度應用研究，構建分析模式及開發分析軟體，辦理3場次教育訓練進行軟體操作演練與推廣，並擴充編訂臺灣鐵道容量手冊「輕軌系統篇」，逐步完備整體臺灣鐵道容量系列研究。

（3）辦理高速公路非獨立進出口分匯流區之車流特性調查，建立非獨立進出口匝道類型之容量及服務水準分析方法。

（4）針對大眾捷運路網規劃流程與評估準則，編訂「捷運路網規劃參考手冊」，俾提供予地方政府做為捷運整體路網規劃之應用依據。此外亦針對中央主管機關進行捷運路網規劃報告審查時之項目與指標提出建議。

### 3.優化自行車環島路網並擴充路線圖資

（1）協助交通部研提「環島自行車道升級暨多元路線整合推動計畫（109~112年）」，並規劃未來4年自行車路網優化項目與期程，供路權單位施作，強化自行車路網的安全性與友善性。

The year 2020 was a fruitful year for the IOT. The main annual research themes of six Groups and one Center are as follows:

## I. Improve the Overall Transportation Planning

Conduct comprehensive transportation planning research, improve project evaluation tools, optimize bike route networks, and do so with the vision of improving overall transportation development. The main themes of the annual research of the Transportation Planning Division are as follows:

### 1. Conduct Regional Transportation Planning

(1) Establish the Transportation Demand Model for the Southern Taiwan Region (Yunlin, Chiayi, Tainan, Kaohsiung and Pingtung), complete the prediction and analysis of supply and demand in 2020, and have an in-depth understanding of the supply and demand problems of important road corridors in the Region.

(2) Conducted series of studies on the overall transportation planning of the Central Taiwan Region (Miaoli, Taichung, Changhua, Nantou and Yunlin), and has completed the analysis and prediction of socioeconomic development, division of traffic sections and construction of transportation system road network in 2020.

### 2. Improve Project Evaluation Tools

(1) Manage the maintenance and update of the 2020 Transportation Planning Integrated Database, and conduct the discussion and definition of the functional positioning for the future development of the Transportation Planning Support System.

(2) Manage the application research on the capacity and reliability of A, B-Type Right-of-Way light rail systems in 2020, construct analysis models and develop analysis software, organize three training sessions for software operation exercises and promotion, and expand the compilation of the "Light Rail Volume" of "Taiwan Railway Capacity Manual,"and complete the series of studies on the overall capacity of Taiwan's railways step by step.

(3) Manage the traffic characteristics survey in the non-isolated merging areas for on-ramp and non-isolated diverging areas for off-ramp of the expressway, and establish the capacity and level of service analysis methods of the non-isolated on-ramp and non-isolated off-ramp types.

(4) Compile the "Rapid Transit Network Planning Manual" according to the planning process and evaluation criteria for MRT network planning, to provide Local Governments as the application basis for the overall rapid transit network planning. In addition, it also proposes suggestions on the items and indicators when the Central Competent Authorities conducts the review of the MRT network planning report.

### 3. Optimize the Island Round Cycling Route Network and expand the route map information

(1) Assist the Ministry of Transportation and Communications in researching and proposing the "Plan of Upgrading and Diversifying Island Round Cycling Routes Integration and Promotion (2020–2023)," and plan the cycling route network

## 研究主軸一、健全整體運輸規劃
## Main Scheme I - Improve the Overall Transportation Planning
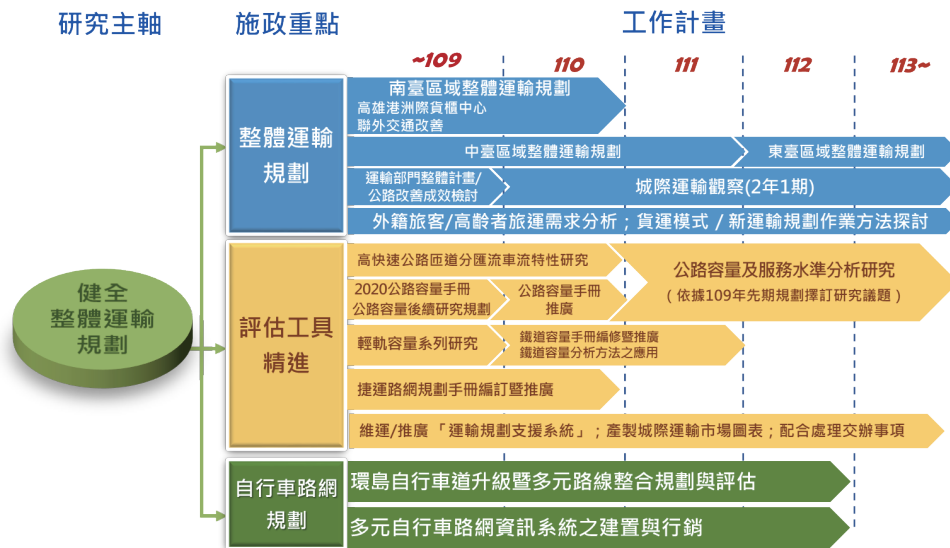


（2）研提國際化及在地化的多元自行車路線，供主責單位於後續4年改善及觀光部門辦理行銷推廣，帶動自行車與觀光產業發展，109年已完成7條多元自行車路線，預計於110年持續辦理其餘9條多元路線。

（3）整併本所「環騎圓夢」與觀光局「台灣騎跡」網站為「臺灣自行車旅遊網」，並於109年12月15日移轉予觀光局辦理後續維運。

## 二、 提升海空運及陸運（軌道、橋梁）運輸發展

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

### 1.掌握國際海空運發展趨勢

（1）持續進行國際海空運資料庫維護更新，透過數據量化分析，提供決策應用。成果方面在海運部分，提供航港局及港務公司在政策評估所需之全球貨櫃航線數據，例如：全球貨櫃航線大趨勢分析、洲際貿易路線之部署趨勢分析、遠東主航線及區域航線之部署趨勢分析、遠東主要港口歐美

optimization items and schedule for the next four years, for implementation by the right-of-way authority, and strengthen the safety and friendliness of the Cycling Route Network.

(2) Research and propose international and localized diversified leisure cycling routes for the responsible authority to improve in the next four years and the tourism department to conduct marketing promotion, to promote the development of cycling and tourism industries. Seven diversified leisure cycling routes have been completed in 2020 and it is expected to continue in managing the remaining nine diversified leisure cycling routes in 2021.

(3) Merged the IOT's website "Taiwan Cycling Route" and the Tourism Bureau's website "Taiwan Bike" into the "Taiwan Cycling Tourism" website, and transferred to the Tourism Bureau for follow-up maintenance on December 15, 2020.

## II. Enhance the Development of Marine, Air and Land (Rail, Bridge) Transportation

　　Sea and air transportation are important transportation modes of external connection for our Country, and the establishment of the marine and air transportation hubs is the vision of our Country's marine and air transportation development; furthermore, rail transportation also requires advanced technology to improve operational efficiency. The main themes of the annual research of the Transportation Engineering Division are as follows:

### 1. Grasp the Development Trend of International Marine and Air Transportation

(1) Continue maintaining and updating the international marine and air transport database, to provide the application for decision-making through quantitative data analysis. In terms of results on the part of marine transportation, provide the global container route data required by the

航線之部署趨勢分析等;空運部分,提供民航局、桃園機場公司在政策評估所需分析資料,例如:我國與日本主要國際機場市場深度分析(包括日本旅客來臺中轉之潛在市場分析)、低成本航空公司之中轉營運分析(包括臺灣低成本旅客海外中轉之路徑分析)、松山/臺中/高雄機場之營運分析。

(2)因應內外在環境激烈變化,定期辦理國際海空運期刊研讀與研討,並掌握國際先進技術及產業發展情勢,進行自行研究與資料蒐集,提供重要海空運議題之研析,支援交通部及部屬機關進行政策研擬,包括:郵輪旅遊發展與經濟產值、中美貿易戰對航運市場之影響、我國港口貨櫃航線變化趨勢、各國政府對IMO 2020限硫令之因應準備、全球主要貨櫃港口營運績效評析、新冠肺炎疫情對國際貨櫃航運之可能影響、低成本航空公司在亞太地區之營運分析、華航與長榮兩大國籍航空之營運比較分析、亞洲主要轉運機場競爭關係分析-以東南亞中轉北美為例、國際機場智慧化發展趨勢、國際民航組織推動公共衛生廊帶等議題。

## 2.促進海空運發展

(1)完成「商港整體發展規劃(111-115年)」,整體檢視我國港埠面臨的內外在環境變化之影響,分析我國商港整體發展面臨課題,研擬我國港埠中長期發展方向及前瞻的具體策略,作為各商港進 未來發展及建設計畫之上位計畫,使港埠資源能作最有效 用,提升港埠服務水準, 低產業運輸成本,以強化我國港口國際競爭 。

(2)完成「數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究」,檢視我國貨櫃運輸作業流程與涉及之節點,盤點當前數位化與應用區塊鏈技術之現況與需求,蒐集與探討我國貨櫃運輸作業導入數位化與區塊鏈技術所面臨之課題,以研擬我國航港發展導入數位化與應用區塊鏈技術之具體策略與建議,促成我國航港產業與管理部門邁向數位化及智慧化。

Maritime and Port Bureau and Taiwan International Ports Corporation in policy evaluation, such as global container route trend analysis, intercontinental trade route deployment trend analysis, Far East main route and regional route deployment trend Analysis, and deployment trend analysis of European and American routes in major ports of the Far East; on the part of air transportation, provide the analysis data required by the Civil Aeronautics Administration and the Taoyuan International Airport Corporation in policy evaluation, such as in-depth analysis of the major international air passenger markets between our country and Japan (including the potential market analysis for the Japanese passengers transiting through Taiwan), low-cost airlines transit operation analysis (including the transit route analysis of Taiwan's low-cost passengers), and operation analysis of Songshan/Taichung/Kaohsiung Airport.

(2) In response to the drastic changes in the internal and external environment, regularly conduct international marine and air transport journal studies and discussions, grasp the international advanced technology and industrial development situation, conduct self-research and data collection, to provide research and analysis on important marine and air transport issues, and support the Ministry of Transportation and Communications and the Subordinate Agencies to perform policy research and planning, including the issues of cruise tourism development and economic value of output, the impact of the China–US trade war on the shipping market, the changing trend of our country's port container routes, the preparations in response to the IMO 2020 limit on sulfur, the operation performance evaluation of major container ports in the world, the possible impact of the COVID-19 epidemic on international container shipping, the operation analysis of low-cost airlines in the Asia-Pacific region, the comparative analysis of the operations of the two major national airlines - China Airlines and Eva Air, the analysis of the competitive relationship between major connected airports in Asia Pacific - transit from Southeast Asia to North America as the example, the development trend of smart international airports, and the promotion of public health corridors by the International Civil Aviation Organization.

## 2. Promote the Development of Marine and Air Transportation

(1) Complete the "Integrated Overall Development Plan of Commercial Ports (2022–2026)," comprehensively examine the impacts of internal and external environmental changes facing Taiwan's ports, analyze the issues facing the overall development of Taiwan's commercial ports, and research and plan for the medium- to long-term development direction and forward-looking specific strategies of Taiwan's ports as the master plan for the future development and construction project of all commercial ports, to enable the most effective use of port resources, improve level of service for ports, reduce industrial transportation costs, and strengthen the international competitiveness of Taiwan's ports.

(2) Complete the "Research on the Application of Digitization and Blockchain Technology in the Operation Chain of Container Transportation" review the operation process and nodes involved in our country's container transportation, inventory the current status and demands of digitization and

## 研究主軸二、提升海空運及陸運（軌道、橋梁）運輸發展
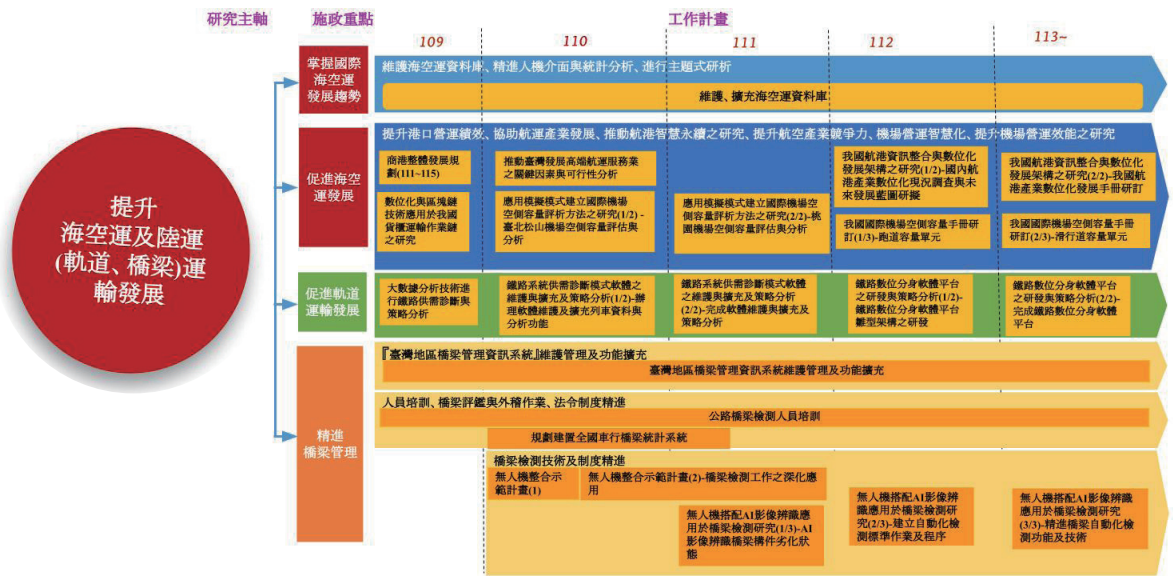


（3）完成「高雄港貨櫃碼頭營運績效評析」，以量化方式評估高雄港各貨櫃碼頭的營運績效，做為未來碼頭營運模式調整參考。經分析高雄港近5年貨櫃裝卸量呈現震盪微增，各貨櫃中心裝卸量增減不一，四櫃明顯增加，三櫃則明顯降低；若以各貨櫃中心營運商別，四櫃長榮明顯增加，三櫃APL則明顯減少。各貨櫃中心裝卸量、靠港船數與船舶總噸數之變化趨勢並不相同。依分析結果顯示各貨櫃中心營運商之貨櫃裝卸量表現不一，部分已呈現明顯下降趨勢，且效率排名亦不佳，應探究其原因，並配合未來碼頭營運模式調整。

（4）完成「應用5G技術加強國際機場智慧化發展之研究」，初步研析機場智慧化主要架構，分析5G技術特性、優缺點、應用面向、政府政策與對於機場智慧化助益，蒐整國際標竿機場智慧化推動經驗，並透過訪談民航局、臺北國際航空站與桃園國際機場公司，了解我國國際機場智慧化規劃與執行現況，綜整研提我國國際機場智慧化推動架構、核心技術及需因應重要課題，俾利相關單位後續實務應用參考。

the application of blockchain technology, collect and discuss the problems faced by the introduction of digitalization and blockchain technology in our country's container transportation operations, to research and develop specific strategies and suggestions for the introduction of digitalization and application of blockchain technology in the development of our country's ports, so as to facilitate our country's port industry and management department in moving toward digitalization and intelligence.

(3) Complete the "Evaluation and Analysis of the Operational Performance of Port of Kaohsiung Container Terminals" to quantitatively evaluate the operational performance of all container terminals in Port of Kaohsiung as the reference for future terminal operation model adjustments. According to the analysis, the container loading and unloading volume of Port of Kaohsiung has increased slightly in the past five years, and the loading and unloading volume of each container center has been increased or decreased differently – when the volume of Fourth Container Terminal increases significantly, the volume of Third Container Terminal decreases significantly; if based on the carriers of each Container Terminal, when the volume of Fourth Container Terminal Evergreen increases significantly, the volume of Third Container Terminal APL decreases significantly. The changing trends of the loading and unloading volume of each Container Terminal, the number of ships at port of call and the total tonnage of ships are not the same. According to the analysis results, the performance of container loading and unloading of the carriers of all Container Terminals is different, some of them have shown a significant downward trend, and their efficiency rankings are also poor. The reasons should be investigated and adjusted in accordance with future terminal operating models.

(4) Complete the "Study on the Application of 5G Technology to Strengthen Smart Development of International Airports," preliminary study and analysis of the main architecture of smart airport, analysis of 5G technical characteristics, advantages and disadvantages, application aspects, government policies and benefits for airport intelligence,

## 3.促進軌道運輸發展

　　109年度研究重點在導入大數據分析技術，並以前期研發之軟體雛型架構為基礎，完成鐵路供需診斷模式軟體，同時優化（1）需求模式、（2）供給模式、（3）乘客選擇行為模擬模式、（4）乘客選擇參數校估模式、（5）解衝突模式及（6）系統運轉模擬模式之解析能力，據以進行全島鐵路系統投入運轉資源與運能產出之情境分析，掌握臺鐵系統達成環島快速鐵路網所需投入資源與關鍵路段，經案例分析，顯示本軟體已具有整合分析臺鐵全系統供給與需求之能力，可據以診斷運輸供需現況，進行運能供給最佳化，達到提升軌道運輸效能之目標。

## 4.推動橋梁維護管理制度精進作為

　　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。在技術面部分，現行臺灣地區橋梁管理資訊系統也逐步精進相關功能，包括開發統計儀表板功能，整合統計相關數據，供系統內各橋梁主管機關快速掌握轄管橋梁狀況，確保橋梁安全；系統智慧判斷功能，如DRU差異過大、無維修紀錄但U值下降等，檢測資料可能存在不合理部分，提醒橋管機關能做適時的檢視與處理；系統登入頁面及每月電子郵件提醒各橋管機關之轄管橋梁維管資訊，發揮預警提示功能。

search and collect the international benchmark airport smart promotion experience, and through interviews with the Civil Aeronautics Administration, Taipei International Airport (Songshan) and Taoyuan International Airport Corporation, understand the current status of smart planning and implementation of our country's international airports, and comprehensively organize, research and propose the architecture and core technology of promoting smart international airports of our country, as well as the important issues to responded to, as the reference to facilitate the related units in follow-up practical application.
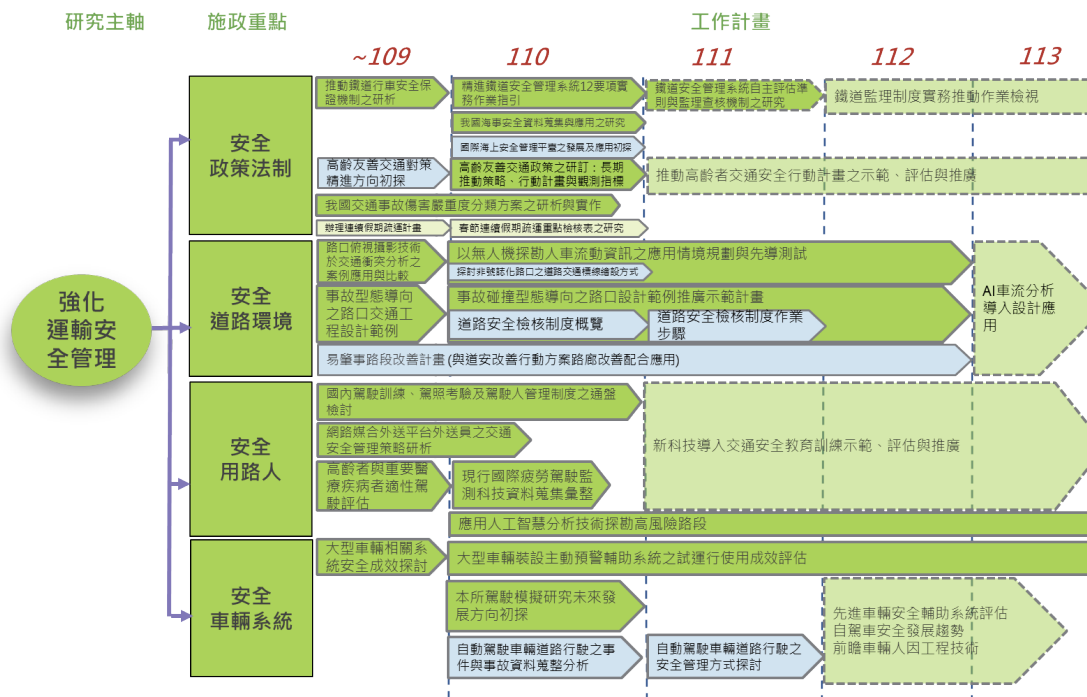
## 3. Promote the Development of Rail Transportation

The research focus of 2020 was to introduce big data analysis technology, and complete the software of the railway supply and demand diagnosis model based on the software prototype architecture developed in the previous period, while optimizing the analysis capabilities of (1) demand mode, (2) supply mode, (3) passenger selection behavior simulation mode, (4) passenger selection parameter estimation mode, (5) conflict resolution mode, and (6) system operation simulation mode, as the basis to conduct situation analysis of the operating resources invested in the island-wide railway system and the output of transportation capacity to grasp the investment resources and key road sections required by the Taiwan Railways system to reach the round-island express railway network. Case analysis shows that this software has the ability to integrate and analyze the supply and demand of the entire Taiwan Railways system. It can diagnose the current status of transportation supply and demand and optimize transportation capacity, to achieve the goal of improving the efficiency of rail transportation.

## 4. Promote the Improvement Actions of Bridge Maintenance and Management System

After the rupture of Nanfangao Bridge, in order to improve the safety maintenance and management system of the national bridges in terms of the system, the IOT researched, planned and completed the "Directions for Bridge Maintenance and Management Operation (Draft)" instructed by the the Ministry of Transportation and Communications and promulgated by the Executive Yuan on July 21, 2020 to take effect. Focusing on the "Improve the System and Practice the Execution" as the main theme, through the Directions, enable various Ministries, County and City Governments, Public Schools, and Government-operated Enterprise Organizations to introduce the three-level management mechanism under the existing legal framework, as the basis to establish an appropriate system and continue to strengthen bridge maintenance operation. In the part of technical aspect, the related functions of the current Taiwan bridge management information system have also gradually improved, including the development of statistical instrument panel functions and the integration of statistical data, so that all Bridge Management Agencies in the system can quickly grasp the status of the bridges under their management to ensure bridge safety; system intelligence judgment function, such as excessive DRU difference, no maintenance record but U value drop, etc., there may be unreasonable parts in the test data, reminding the Bridge Management Agency to conduct timely inspection and processing; system login page and monthly email reminding all Bridge Management Agencies regarding the bridge maintenance and management information under their management, to bring the early warning prompting function into full play..

## 研究主軸三、強化運輸安全管理
### Main Scheme III - Enhance the Transportation Safety Management



研究主軸　施政重點　　　　　　　　　　工作計畫

| 強化運輸安全管理 | | ~109 | 110 | 111 | 112 | 113 |

**安全政策法制**
- 推動鐵道行車安全保證機制之研析 → 精進鐵道安全管理系統12要項實務作業指引 → 鐵道安全管理系統自主評估準則與監理查核機制之研究 → 鐵道監理制度實務推動作業檢視
- 我國海事安全資料蒐集與應用之研究
- 國際海上安全管理平臺之發展及應用初探
- 高齡友善交通對策精進方向初探 → 高齡友善交通政策之研訂：長期推動策略、行動計畫與觀測指標 → 推動高齡者交通安全行動計畫之示範、評估與推廣
- 我國交通事故傷害嚴重度分類方案之研析與實作
- 辦理連續假期疏運計畫 → 春節連續假期疏運重點檢核表之研究

**安全道路環境**
- 路口錄影攝影技術於交通衝突分析之案例應用與比較 → 以無人機探勘人車流動資訊之應用情境規劃與先導測試 / 探討非號誌化路口之標準線繪設方式
- 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 → 道路安全檢核制度作業步驟 → AI車流分析導入設計應用
- 道路安全檢核制度概覽
- 易肇事路段改善計畫（與道安改善行動方案路廊改善配合應用）

**安全用路人**
- 國內駕駛訓練、駕照考驗及駕駛人管理制度之通盤檢討
- 網路媒合外送平台外送員之交通安全管理策略研析 → 新科技導入交通安全教育訓練示範、評估與推廣
- 高齡者與重要醫療疾病者適性駕駛評估 → 現行國際疲勞駕駛監測科技資料蒐集彙整
- 應用人工智慧分析技術探勘高風險路段

**安全車輛系統**
- 大型車輛相關系統安全成效探討 → 大型車輛裝設主動預警輔助系統之試運行使用成效評估
- 本所駕駛模擬研究未來發展方向初探
- 自動駕駛車輛道路行駛之事件與事故資料蒐整分析 → 自動駕駛車輛道路行駛之安全管理方式探討 → 先進車輛安全輔助系統評估 自駕車安全發展趨勢 前瞻車輛人因工程技術

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## 三、　強化運輸安全管理

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

### 1.安全政策法制

（1）為推廣安全管理系統（SMS）以改善我國鐵道行車安全，參考過去研究成果（鐵道安全管理系統12要項），深入探討其中與安全保證相關之5要項，並研擬適用於我國鐵道機構的實務操作指引及教育訓練教材。

（2）利用各種運輸事故資料，建立海事安全資料蒐集機制、事故傷害嚴重度分類體系等，進一步分析應用，以做為安全管理之基礎。

### 2.安全道路環境

（1）利用諸如無人機、AI人工智慧影像辨識等先進技術，辨識道路風險型態與集中情形，以利於事故發生前先行分析改善其交通工程配置，以收防微杜漸的預防功效。

（2）完成各種不同事故型態的交通工程改善設計範例，以應用於路口事故之改善，提升道路交通安全改善能量，支援易肇事路段改善工作。

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## III.　Enhance the Transportation Safety Management

　　Strengthen transportation safety management, with the vision of building a safe and human-oriented transportation environment. The main themes of the annual research of the Transportation Safety Division are as follows:

### 1. Safety Policy & Legal Affairs

(1) In order to promote the Safety Management System (SMS) to improve railway safety in our country, referring to the past research results (12 key items of the Railway Safety Management System), discussed the five key items related to safety assurance in depth, and researched and planned the practical operation guidelines and education training materials suitable to our country's railway organizations.

(2) Used various transportation accident data to establish a maritime safety data collection mechanism, accident injury severity classification system, etc., and further analyze and apply them as the basis for safety management.

### 2. Safer Road Environment

(1) Using advanced technologies such as Unmanned Aerial Vehicles and AI artificial intelligence image recognition to identify road risk patterns and concentration situations, facilitate the analysis and improvement of the traffic engineering configuration in advance before accidents, and achieve the effect of taking preventive measures from the outset.

(2) Complete various traffic engineering improvement design examples for different types of accidents to apply in the improvement of intersection accidents, enhance road traffic safety improvement capability, and support the improvement works for road sections prone to accidents.

### 3.安全用路人

（1）依據2020年運輸政策白皮書，以建構駕駛人實際安全道路駕駛能力為目標，透過研修完善駕駛人之訓、考、用制度，進行相關法規及安全管理之研究，以有效降低新手駕駛等高風險族群事故風險。

（2）針對安全駕駛能力如何受到老化與重要醫學狀況之影響、國內外在新領/更新駕照制度，以及如何進行適性駕駛評量等議題，藉由文獻回顧與資料蒐集方式進行比較分析與討論，並提出國內駕照制度方面的建議。

### 4.安全車輛系統

針對各種新型式運具及先進車輛設備，進行管理制度研析，做為政策推動參據。

### 四、 優化陸路運輸產業

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

### 1.政策面改善經營環境

（1）研提第四期公運計畫草案（「公路公共運輸服務升級計畫」）向行政院爭取經費，賡續推動公共運輸發展，並落實2020年版運輸政策白皮書行動方案。

（2）賡續辦理區域運輸發展研究中心計畫，開設交通運輸專業人才培訓課程、輔導地方政府解決公共運輸問題、接受地方政府諮詢並協助地方向公路總局提案申請經費，促成在地公共運輸之永續發展。另在公共運輸案例研析部分，針對「偏鄉（或離島）公共運輸環境之健全」與「提升都市公共運輸載客量策略之檢討與規劃」兩個重要課題進行研析，並於109.10.13舉辦「公共運輸跨域發展策略論壇」，就中央及地方政府作為、發展課題、研析成果及推動策略，與外界分享與交流。

（3）蒐集分析國外汽車貨運相關產業之整體法律體制，與利害關係人之意見，並配合新興科技載具與商業模式為產業帶來的影響觀察，納入行政管制原則之思維，檢視管制目的與手段之必要性與合理性。考量各

### 3. Safer Road Users

(1) Pursuant to the 2020 Transport Policy White Paper, aiming to build the actual safe road driving ability of drivers, through the research and study to improve the training, test, and use systems of drivers, and conduct research on relevant laws and regulations and safety management, so as to effectively reduce the risk of accident for the beginner driver and high-risk driver groups.

(2) Targeting the issues of how a safe driving ability is affected by aging and important medical conditions, the domestic and foreign new/renewed driver's license system, and how to conduct appropriate driving evaluation, conduct comparative analysis and discussion through literature review and data collection methods, and propose the suggestions on the domestic driving license system.

### 4. Safer Vehicle Systems

Targeting various new types of transportation vehicles and advanced vehicle equipment, conduct the management system studies and analysis as the reference for policy promotion.

### IV. Optimize the Land Transport Industry

Advance the development of land passenger and cargo transportation, improve the operating environment and enhance operating performance with the vision of optimizing the land transportation industry. The main themes of the annual research of the Transportation Operations and Management Division are as follows:

### 1. Policy Aspect – Improve Operation Environment

(1) Propose the draft of the Fourth Phase of Public Transportation of Highways Project ("Highway Public Transportation Service Upgrade Project") to seek funding from the Executive Yuan in order to keep promoting the development of public transportation and implement the 2020 Transportation Policy White Paper Action Plans.

(2) Continue to manage the Regional Transportation Development Research Center Project, set up training courses for transportation professionals, counsel local governments to solve public transportation problems, accept local government inquiries, and assist the local governments in applying for funding from the Directorate General of Highways to promote the sustainable development of local public transportation. In addition, on the part of public transportation case study, conducted study and analysis on the two important topics of "The Soundness of Rural (or Offshore Island) Public Transportation Environment" and "The Review and Planning of Strategies for Increasing the Passenger Capacity of Urban Public Transportation," and organized the "Public Transportation Cross-domain Development Strategy Forum" on October 13, 2020, to share and exchange with the external sectors on the actions of the Central and Local Governments, development topics, research and analysis results, and promotion strategies.

## 研究主軸四、優化陸路運輸產業
## Main Scheme IV - Optimize the Land Transport Industry
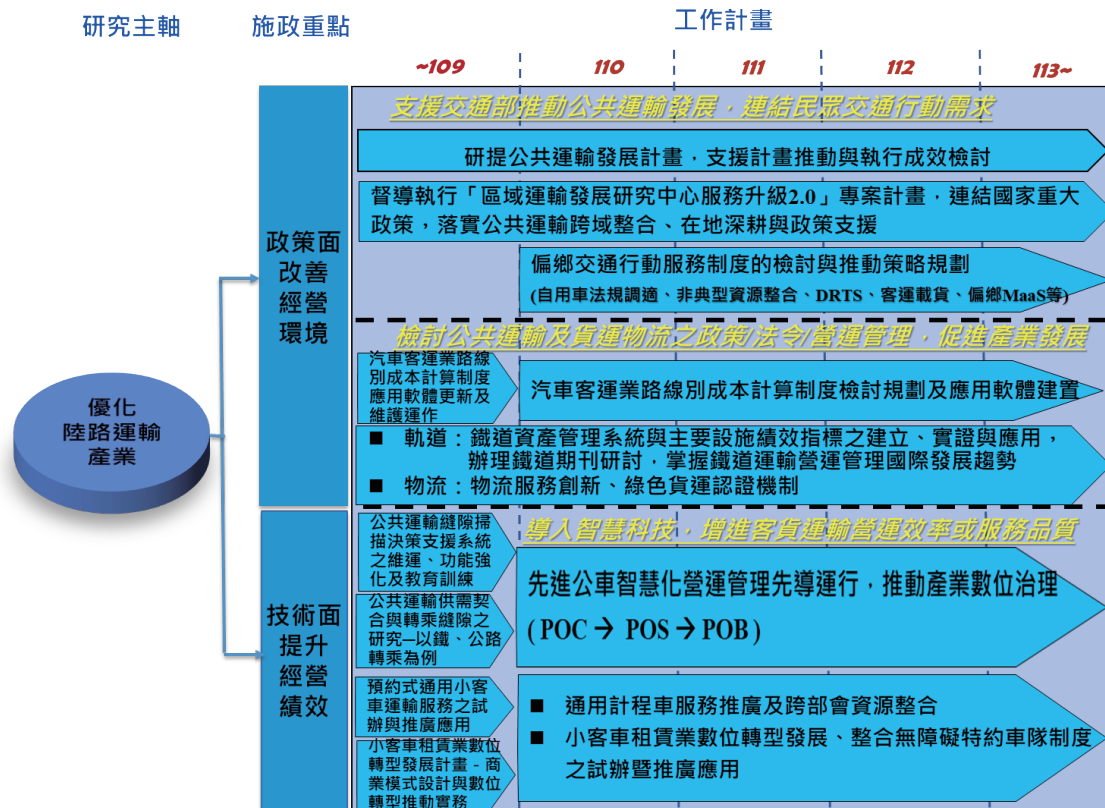


項制度變革之成本等因素，將法規調適構想規劃為短中長期建議方案，供交通部政策擬訂參考。

（4）進行汽車客運業路線別成本計算制度應用軟體更新及維護運作，並辦理教育訓練，協助業者及主管機關分析路線成本，並探討實務運作課題，提出改善建議。

## 2.技術面提升經營績效

（1）與臺北市、新北市、桃園市、臺中市等4個直轄市政府合作，推動通用計程車特約制度，並協助地方政府完成統一預約平台之建置及執行試營運計畫，著重提升消費者便利性、優化行政監管效率。藉由制度重新設計與應用先進資通訊技術，以建構身心障礙者、高齡者及行動不便者之友善運輸環境，提升其行動自主性，解決日常生活交通需求，擴大生活及社交領域，融入社會。進行「公共運輸縫隙掃描決策支援系統」維運、資料庫更新及系統功能強化，並舉辦6場次教育訓練協助使用者熟悉
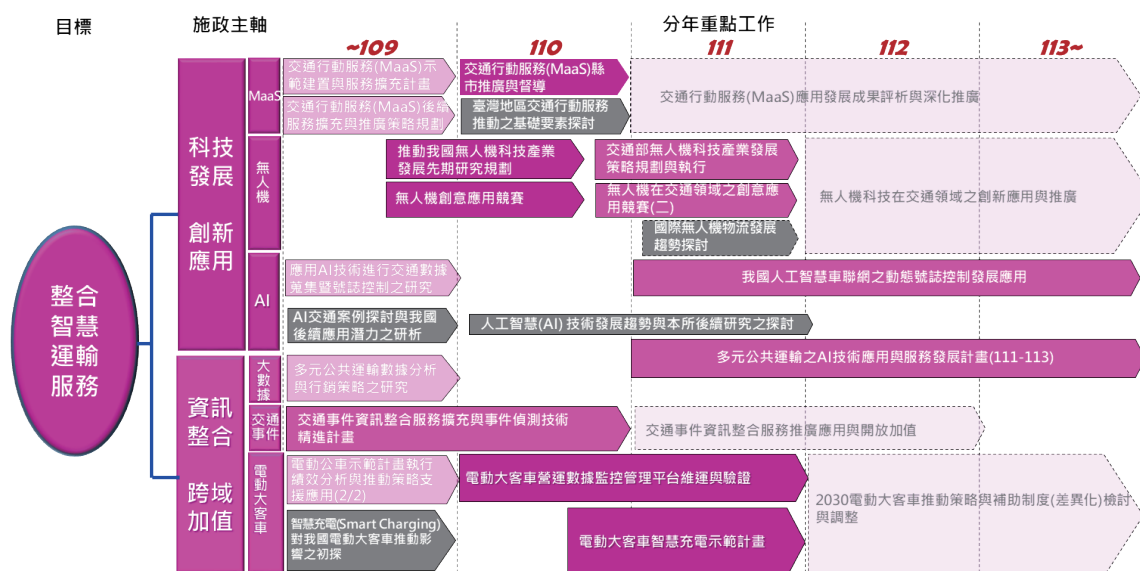
(3) Collect and analyze the overall legal system of foreign trucking carrier related industries and the opinions of stakeholders, cooperate with the observation of the impact of emerging technology vehicles and business models on the carrier, incorporate the thinking of administrative control principles, and review the purpose of control and the necessity and rationality of the measures. Take the cost of various system reforms and other factors into consideration and plan the concept of legal adaptation into the short-, medium- and long-term recommendation programs, to provide the reference for the Ministry of Transportation and Communications in formulating policies.

(4) Conduct the application software update and maintenance operation of the route-specific cost calculation system for the automobile passenger transportation industry, and organize education and training to assist the Carrier Operators and the Competent Authorities to analyze the route cost, and discuss practical operational topics and propose suggestions for improvement.

## 2. Technology Aspect – Improve Operation Performance

(1) Cooperate with the Governments of four Municipalities including Taipei City, New Taipei City, Taoyuan City, and Taichung City to promote the special system of accessible taxi, and assist Local Governments in completing the establishment of a unified reservation platform and implementing a trial operation project, focusing on improving consumer convenience and optimizing administrative supervision efficiency. By redesigning the system and applying advanced information and communication technologies, to construct a friendly

## 研究主軸五、整合智慧運輸服務
## Main Scheme V – Integrate the Intelligent Transportation Services

目標　施政主軸　　　　　　　　　　　　　　　　分年重點工作

| | | ~109 | 110 | 111 | 112 | 113~ |
|---|---|---|---|---|---|---|
| | MaaS | 交通行動服務(MaaS)示範建置與服務擴充計畫 / 交通行動服務(MaaS)後續服務擴充與推廣策略規劃 | 交通行動服務(MaaS)縣市推廣與督導 / 臺灣地區交通行動服務推動之基礎要素探討 | 交通行動服務(MaaS)應用發展成果評析與深化推廣 | | |
| 科技發展 創新應用 | 無人機 | 推動我國無人機科技產業發展先期研究規劃 / 無人機創意應用競賽 | 交通部無人機科技產業發展策略規劃與執行 / 無人機在交通領域之創意應用競賽(二) / 國際無人機物流發展趨勢探討 | | 無人機科技在交通領域之創新應用與推廣 | |
| | AI | 應用AI技術進行交通數據蒐集暨號誌控制之研究 / AI交通案例探討與我國後續應用潛力之研析 | 人工智慧(AI)技術發展趨勢與本所後續研究之探討 | 我國人工智慧車聯網之動態號誌控制發展應用 | | |
| 資訊整合 跨域加值 | 大數據 | 多元公共運輸數據分析與行銷策略之研究 | | 多元公共運輸之AI技術應用與服務發展計畫(111-113) | | |
| | 交通事件 | 交通事件資訊整合服務擴充與事件偵測技術精進計畫 | | 交通事件資訊整合服務推廣應用與開放加值 | | |
| | 電動大客車 | 電動公車示範計畫執行績效分析與推動策略支援應用(2/2) / 智慧充電(Smart Charging)對我國電動大客車推動影響之初探 | 電動大客車營運數據監控管理平台維運與驗證 / 電動大客車智慧充電示範計畫 | | 2030電動大客車推動策略與補助制度(差異化)檢討與調整 | |

整合智慧運輸服務

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如何操作本系統應用於檢核公車路網服務缺口及評估改善方案之成效。

（2）在前期「鐵、公路轉乘無縫運輸檢核系統」之基礎上，優化系統功能，並透過分析現有電子票證資料，分析不同時段、不同地域之旅客屬性，瞭解旅客確實之旅運需求，同時運用系統之檢核結果，提供相關單位公車路線班次時間調整之建議，使無縫銜接轉乘以提升公共運輸運量，達到節能減碳之效。

## 五、　整合智慧運輸服務

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

### 1.科技發展與創新應用

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

（2）應用AI技術進行道路即時交通參數蒐集與號誌控制，以及未來AI在交通陸運領域之發展趨勢探討。

（3）研提我國無人機在交通領域之發展藍圖與推動策略。

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transportation environment for the physically and mentally disabled persons, the elderly, and persons with disability, enhance their autonomy in mobility, solve their transportation needs of daily life, expand the areas of life and social interaction, and integrate into society. Carry out the maintenance of the "Public Transportation Gap Scanning Decision Support System," database update and enhancement of system functions, and organize six sessions of education training to help users familiarize themselves with how to operate the system to check the gaps in the bus network services and evaluate the effectiveness of the improvement plans.

(2) Based on the previous phase of "System for Detecting Public Transit Transfer Time Gap," optimize the system functions, analyze the attributes of passengers in different time periods and different regions through the analysis of the existing Electronic Stored Value Cards data to understand the actual travel needs of passengers, and use the system's evaluation results to provide recommendations to the relevant units on the adjustment of bus route schedules, so as to achieve the effect of energy conservation and carbon reduction with seamless connection transfer to increase the public transportation volume.

## V.　Integrate the Intelligent Transportation Services

Promote the development of smart transportation, with the vision of establishing a human-oriented and sustainable smart transportation living environment. The main themes of the annual research of the Transportation Information System Division are as follows:

### 1. Technology Development and Innovative Application

(1) Apply information and communication technology to meet the needs of people's mobile services, and combine the resources of the Kaohsiung City Government to promote

（4）針對國內跨縣市及風景區之地理特性、用路人需求特性、現有運具組成特性等面向進行探討，研擬後續擴展國內MaaS服務之推動策略，使MaaS服務效益擴展至更多地區。

## 2.資訊整合與跨域加值

（1）應用高雄市交通行動服務（MaaS）產生之大量旅運資料，透過巨量資料探勘分析，分析目標族群之旅運移動行為與現有大眾運輸服務缺口，同時發展整合式數據視覺化分析介面，提出MaaS營運改善策略建議。

（2）完成道路交通事件資料標準制訂、建置全國與地方（包括高雄市及臺南市）「交通事件整合資訊流通服務平台」，持續辦理各類事件資料介接擴充作業，並持續執行事件通報內容品質優化之精進研究，以提升道路即時資訊的透通性、行車便捷性和安全性。

（3）協助交通部研擬電動大客車推動策略與示範計畫，並進行示範計畫執行績效分析，逐步落實2030年電動大客車全面電動化目標。

## 六、 營造潔淨運輸環境

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

## 1.運輸部門減碳

（1）協助交通部統合經濟部、環保署及主計總處，共同推動第一期「運輸部門溫室氣體排放管制行動方案」三大策略及11項措施。

（2）陳報「運輸部門溫室氣體排放管制行動方案執行成果」（109年9月版），108年運輸部門溫室氣體排放量為3,700萬噸CO2e，已較94年（基準年）降低2.16%，並低於第一期（105-109年）109年溫室氣體排放管制目標（3,721.1萬噸）。

（3）研議第二期（110-114年）運輸部門溫室氣體排放管制行動方案（草案）推動措施精進建議，蒐集民眾及專家意見，研提行動方案草案初稿。

the demonstration construction and service expansion projects of Mobility as a Service (MaaS).

(2) Apply AI technology for road real-time traffic parameter collection and signal control, as well as the future development trend discussion of AI in the field of land transportation.

(3) Research and propose our Country's development roadmap and promotion strategy of UAV in transportation sector.

(4) Explore the aspects of geographic characteristics of domestic cross-counties, cities, and scenic areas, the demand characteristics of road users, and the characteristics of existing transportation vehicles composition, to research and plan forward the promotion strategies of subsequent expansion of the domestic MaaS services, and expand the Maas service benefits to more areas.

## 2. Information Integration and Cross-domain Added Value

(1) Use the massive travel data generated by Kaohsiung City Mobility as a Service (MaaS) to analyze the travel mobility behavior of target groups and the gaps in existing public transportation services through massive data exploration and analysis, and develop the integrated data visualization analysis interface at the same time, to propose the suggestions on MaaS operation improvement strategies.

(2) Complete the establishment of road traffic event data standards, establish the national and local (including Kaohsiung City and Tainan City) "Traffic Event Integration and Information Circulation Service Platform," continue to manage various event data interface expansion operations, and continue to implement the improvement research of event report content quality optimization, to improve the transparency of real-time road information, convenience and safety of driving.

(3) Assist the Ministry of Transportation and Communications to research and plan for the strategies and demonstration projects for the electric buses, conduct the implementation performance analysis of the demonstration projects, and gradually implement the goal of overall electrification of electric buses by 2030.

## VI. Build Up a Clean Transportation Environment

Create a clean transportation environment, with the vision of establishing a clean transportation and living environment. The main themes of the annual research of the Transportation Interdisciplinary Research Division are as follows:
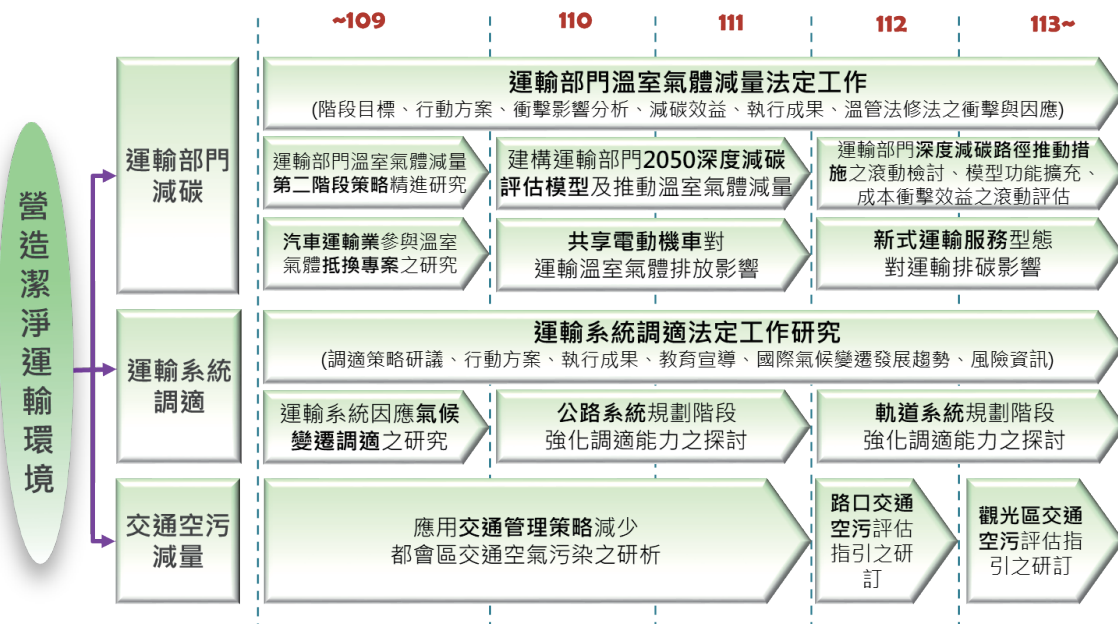
## 1. Carbon Reduction in the Transportation Sector

(1) Assist the Ministry of Transportation and Communications to integrate the Ministry of Economic Affairs, the Environmental Protection Administration and the Directorate General of Budget, Accounting and Statistics to jointly promote the 3 strategies and 11 measures of the Phase-1 of the "Transportation Sector Greenhouse Gas Emission Control Action Plan."

## 研究主軸六、營造潔淨運輸環境
## Main Scheme VI - Build up a Clean Transportation Environment

| 研究主軸 | 施政重點 | 工作計畫 |
|---|---|---|

| | | ~109 | 110 | 111 | 112 | 113~ |
|---|---|---|---|---|---|---|
| 營造潔淨運輸環境 | 運輸部門減碳 | 運輸部門溫室氣體減量法定工作<br>(階段目標、行動方案、衝擊影響分析、減碳效益、執行成果、溫管法修法之衝擊與因應) | | | | |
| | | 運輸部門溫室氣體減量**第二階段策略**精進研究 | 建構運輸部門**2050深度減碳評估模型**及推動溫室氣體減量 | | 運輸部門**深度減碳路徑推動措施**之滾動檢討、模型功能擴充、成本衝擊效益之滾動評估 | |
| | | 汽車運輸業參與溫室氣體**抵換專案**之研究 | **共享電動機車**對運輸溫室氣體排放影響 | | **新式運輸服務**型態對運輸排碳影響 | |
| | 運輸系統調適 | 運輸系統調適法定工作研究<br>(調適策略研議、行動方案、執行成果、教育宣導、國際氣候變遷發展趨勢、風險資訊) | | | | |
| | | 運輸系統因應**氣候變遷調適**之研究 | **公路系統**規劃階段強化調適能力之探討 | | **軌道系統**規劃階段強化調適能力之探討 | |
| | 交通空污減量 | 應用**交通管理策略**減少都會區交通空氣污染之研析 | | | 路口交通**空污**評估指引之研訂 | 觀光區交通**空污**評估指引之研訂 |

## 2.交通空污減量

（1）完成都會區私人汽機車使用者對空氣污染減量交通管理措施之行為反應分析架構探討。

（2）以問卷調查方式針對都會區內通勤族群解析其使用私人運具因素，並探討交通管理策略推動下對於運具轉移或選用的影響。

（3）辦理焦點團體座談會，聚焦並提出減少都會區私人運具使用及空污減量之交通管理策略的通案性建議。

## 3.運輸系統調適

（1）完成運輸系統調適策略滾動檢討，包括四大策略15項措施，做為交通部與部屬機關研提行動方案之參據。

（2）完成鐵公路系統因應極端氣候事件之新科技運用趨勢探討及建議，做為交通部相關部屬機關研提調適行動計畫之參據。

（3）完成「鐵公路氣候變遷調適資訊平台」之維護及風險資訊之應用移轉作業。

(2) Report the "Implementation Results of the Greenhouse Gas Emission Control Action Plan for the Transportation Sector" (September 2020 Edition); the transportation sector's greenhouse gas emissions in 2019 was 37 million tons of $CO_2e$, which has been reduced by 2.16% compared to 2005 (base year), and is lower than the Phase-1 (2016–2020) greenhouse gas emission control target (37.211 million tons) for 2020.

(3) Develop the Phase-2 (2021–2025) Transportation Sector Greenhouse Gas Emission Control Action Plan (Draft) to promote measure improvement recommendations, collect opinions from the public and experts, research and submit the first draft of the Action Plan.

### 2. Traffic Air Pollution Reduction

(1) Complete the discussion on the behavioral response analysis framework of private automobile and motorcycle users in the metropolitan area on air pollution reduction traffic management measures.

(2) Analyze the factors in the use of private transportation vehicles for commuters in the metropolitan area by means of questionnaire surveys, and explore the impact of promoting transportation management strategies on the transfer or selection of transportation vehicles.

(3) Organize focus group symposiums, focus on and put forward general proposals for traffic management strategies to reduce the use of private transportation vehicles and reduce air pollution in metropolitan areas.

### 3. Transportation System Adaptation

(1) Complete the rolling review of the transportation system adaptation strategy, including 4 major strategies and 15 measures, as the reference for the Ministry of Transportation and Communications and Subordinated Agencies to develop action plans.

## 七、 強化運輸技術研發

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

### 1.研發防災技術

**（1）檢監測技術研發：** 在軌道防災研究上，建置軌道扣件缺失辨識系統，建立軌道扣件影像的蒐集設備，利用人工智慧辨識軌道扣件是否有缺失，定位缺失扣件並於Google Map上顯示，可達到軌道扣件影像辨識檢測的目的，亦開發雲端儲存、辨識、與查詢等功能，於109年10月16日至臺鐵局臺中工務段辦理一場系統教育訓練，提供軌道管理單位巡檢實務應用。在公路邊坡防災研究上，研發具無線通訊功能且可監測地表傾角、土中分層濕度及孔隙水壓之監測模組，應用於公路總局之公路邊坡（阿里山公路五彎仔路段、臺南南化台20線52K）崩塌預警模式之雛型，後續待降雨事件驗證研發之依時預警監測模組可靠度並予以精進後，將移轉公路總局應用。

**（2）港灣海象模擬：** 維運海象模擬預測系統，建置東部海域（含花蓮港、蘇澳港）小尺度風浪模組，以及蘇澳港靜穩分析模組；針對花蓮港 105至108年度颱風期間波浪觀測資料進行特性分析，探討花蓮港避湧作業

(2) Complete the discussion and recommendations on the new technology application trend of the railway and highway system in response to extreme weather events, as the reference for the research, and propose the adaptation action plans of the relevant Subordinated Agencies of the Ministry of Transportation and Communications.

(3) Complete the maintenance of the "Railway and Highway Climate Change Adaptation Information Platform" and the application and transfer of risk information.

## VII. Enhance the Transportation Technology Research and Development

Use the emerging technologies to strengthen transportation disaster prevention capabilities and management efficiency to enhance the safety of marine and land transportation and implement sustainable development. The main themes of the annual research of the Harbor and Marine Technology Center are as follows:

### 1. Research and Development of Disaster Prevention Technology

(1) **Research and Development of Detection and Monitoring Technology:** In the research of railway disaster prevention, build the track fastener defective identification system, establish the track fastener image collection device, use artificial intelligence to identify whether the track fastener is defective, position the defective fastener and upload to Google Maps for display, to achieve the purpose of image identification and detection of track fasteners; also, developed the functions of cloud storage, identification, and inquiry, organized one session of system education training at the Taichung Branch of the Taiwan Railway Administration on October 16, 2020, to provide the Track Management Unit with inspection practical applications. In the research of highway slope disaster prevention, developed a monitoring module with wireless communication function that can monitor the inclination of the ground surface, the layered moisture in the soil and the pore water pressure, to be used as the prototype of the collapse early warning module of the highway slope (Woo-

與觀測長浪波高關係，並提供避湧機制之參考指標；另完成建置「花蓮海岸公路浪襲預警系統」，提供花蓮台11線人定勝天路段浪襲預警資訊，提供公路總局於颱風期間封路之決策輔助應用。

**（3）金屬材料腐蝕環境研究：**持續進行大氣腐蝕因子調查與金屬材料現地曝露試驗與相關分析，並精進擴充「臺灣腐蝕環境分類資訊系統」及發行年報，提供高速公路局、公路總局、臺鐵局、台灣高鐵公司、工程顧問公司及民間業者辦理公共工程防蝕設計及維護之應用。

**（4）離岸風電區防災：**配合離岸風電發展，於臺中港及鄰近海域進行 109年度海氣象觀測及數值模擬，建立整合性觀測資料庫及控管資料品質，同時探討基地母港（臺中港）之漂沙機制並進行水工模型試驗。另彙整分析臺中港區風與波浪觀測資料，探討港區風場分布特性與海氣象環境之關聯特性，並建置臺中港區與離岸風電區之高精度風場預測模式，以及分析其對離岸風電區船舶航行之影響，強化對該區域海氣象環境資訊掌握及船舶航行安全管理。

wan-chai section of Alishan Highway, Taiwan Provincial Highway 20 Nanhua 52K in Tainan) of the Directorate General of Highways, which will transfer to the Directorate General of Highways for application after the reliability of the developed time-based early warning monitoring module is verified and improved pending the subsequent rainfall events.

**(2) Harbor Oceanographic Phenomena Simulation:** Operation and maintenance of the Oceanographic Phenomena Simulation and Forecast System – construct the small-scale wind and wave module in the eastern sea areas (including Hualien Port and Suao Port), and the Suao Port static stability analysis module; perform characteristics analysis of wave observation data during typhoon for Hualien Port from 2016 to 2019, to explore the relationship between Hualien Port's avoiding wave surge operation and observing wave heights of swell, and provide reference indicators for avoiding wave surge mechanisms; complete the construction of the "Wave Attack Early Warning System for Hualien Coastal Highway," provide the wave attack early warning information for the "Man Can Conquer Nature" Highway Section of the Hualien Taiwan Provincial Highway 11 Coastal Highway, and provide the auxiliary application for decision-making of road closures by the Directorate General of Highways during typhoons.

**(3) Research on the Corrosion Environment of Metal Materials:** Continue to carry out atmospheric corrosion factor investigations, on-site exposure tests of metal materials and related analysis; improve and expand the "Taiwan Corrosion Environment Classification Information System" and issue annual reports to provide the application of anti-corrosion design and maintenance for public works managed by the Freeway Bureau, the Directorate General of Highways, Taiwan Railways Administration, Taiwan High Speed Rail Corporation, engineering consulting companies and private business operators.

**(4) Disaster Prevention for Offshore Wind Power Areas:** Cooperate with the development of offshore wind power, conduct 2020 marine meteorological observations and numerical simulations in Taichung Port and adjacent sea areas, to establish the integrated observation database and control data quality, while exploring the sand drifting mechanism of the base home port (Taichung Port), and

## 2.建立智慧航運

**（1）船舶航行安全預測模組：** 介接中央氣象局
風浪預報資料及航港局船舶自動識別系
統，建立颱風時期臺灣周邊海域颱風波浪
的自動化整合生成模組，透過風浪示警區
域分析，列出應提出警示的船舶資訊，提
供交通部航港局於颱風期間加強船舶航行
安全管理，以及港務公司辦理船舶航行規
劃與離港疏散之參考應用。

**（2）港灣環境資訊應用：** 完成109年度港灣環境
資訊系統維護，提供港區海象（海象觀測
及海象模擬）、全國海象、港區海嘯、港
區地震及港區腐蝕等5項資訊子系統功能，
並綜整全臺12海域之海象即時觀測資訊。
另為因應災防需求，發展颱風預警資訊運
用開放性圖台技術，友善訊息查詢服務，
提供整體與即時之港灣動態與靜態環境完
整資訊，並配合行政院推行數位國家雲端
化，移轉系統至機房（IDC）租用服務，維
持網站服務不中斷及正常運作。

**（3）港區即時潮位資訊系統：** 完成國際及國內
商港（基隆港、臺北港、蘇澳港、花蓮
港、臺中港、布袋港、安平港、高雄港、
澎湖馬公港及龍門尖山港）各自建置之船
席即時水深資訊系統，以供各港之即時潮
位、船席、航道及迴船池等之即時水深與預
測之顯示及查詢，進而提昇船舶進出港及停
泊之航行安全性，增加各港營運競爭力。

## 3.落實永續發展

**（1）港灣構造物設計案例編彙：** 完成拋石斜坡
堤、沉箱式合成堤、方塊式碼頭、板樁式碼
頭、棧橋式碼頭等5種型式的防波堤及碼頭
的本土化設計案例，對於相關參數之引用、
外力條件的決定、設計流程等均詳細說明，
提供相關工程人員設計與審核的應用。

**（2）港灣構造物維護策略研析與管理資訊系統
應用推廣：** 研訂碼頭、防波堤、海堤、護
岸等「港灣構造物維護管理手冊」，於109
年6月19日函送臺灣港務股份有限公司，
並經該公司核定做為各分公司辦理港灣構
造物巡查及檢測作業之依據。109年6月
30日、7月3日、7月6日、7月10日前往高
雄、基隆、臺中、花蓮等港務分公司，舉

conducting hydraulic model tests. In addition, collect and analyze the observation data of wind and waves in the Taichung Port area to explore the correlation between the distribution characteristics of the wind farm in the port area and the marine meteorological environment, and construct the high-precision wind farm prediction model for the Taichung port area and the offshore wind power area, as well as analyzing the impact of the ship navigation in offshore wind power areas, to strengthen the control of marine meteorological and environmental information and the safety management of ship navigation in the area.

## 2. Build Smart Maritime Transportation

**(1) Ship Navigation Safety Prediction Module:** Interface with the wind and wave forecast data of the Central Weather Bureau and the Ship Automatic Identification System of the Maritime and Port Bureau to establish an automated integrated generation module for typhoon waves in the sea areas surrounding Taiwan during typhoons, list the ship information shall be warned through the analysis of wind and wave warning areas, and provide reference applications for the Maritime and Port Bureau of the Ministry of Transportation and Communications to strengthen the ship navigation safety management during typhoons, as well as for the Taiwan International Ports Corporation to manage the ship navigation planning and departure evacuation.
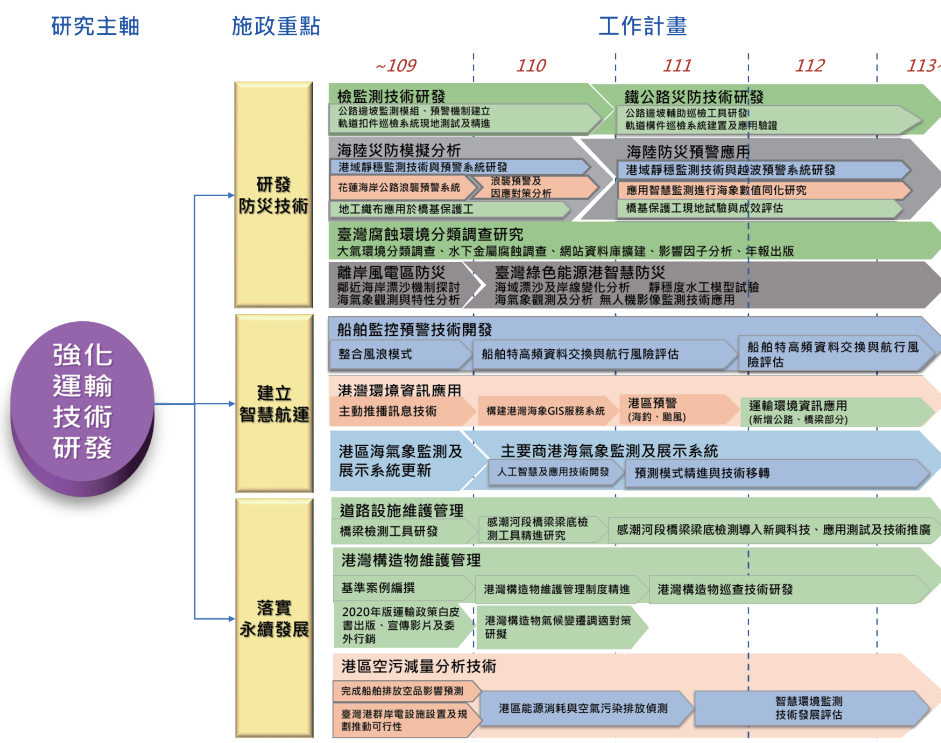
**(2) Harbor Environment Information Application:** Complete the maintenance of the Harbor Environment Information System of 2020, provide five information subsystem functions including oceanographic phenomena in the port area (oceanographic phenomena observation and simulation), national oceanographic phenomena, tsunami, earthquakes and corrosion in the port area, and integrate the real-time observation information of the oceanographic phenomena in 12 sea areas of Taiwan. In addition, in response to the needs of disaster prevention, develop the typhoon warning information using open map technology and friendly information query services, provide overall and complete real-time information for the harbor dynamics and static environments, and cooperate with the Executive Yuan to implement digital national cloud, transfer the system to the Internet Data Center (IDC) rental service, and maintain the uninterrupted and normal operation of website services.

**(3) Port Area Real-time Tide Level Information System:** Complete berth real-time water depth information system constructed by each international and domestic commercial port (Keelung Port, Taipei Port, Suao Port, Hualien Port, Taichung Port, Budai Port, Anping Port, Kaohsiung Port, Penghu Magong Port and Longmen Jianshan Port), to display and query the real-time water depth and forecast of the real-time tide level, berth, navigation channel and turning basin of each port, to further improve the navigation safety of ships entering and leaving the port and berthing and increase the operational competitiveness of the ports.

## 3. Practice Sustainable Development

**(1) Compilation of the Design Cases for Harbor Structures:** Complete localized design cases of five types of breakwaters and wharfs, including rubble sloping dike,

## 研究主軸七、強化運輸技術研發
## Main Scheme VII - Enhance the Transportation Technology Research and Development

研究主軸　　施政重點　　　　　　　　工作計畫

| | ~109 | 110 | 111 | 112 | 113~ |
|---|---|---|---|---|---|

**強化運輸技術研發**

### 研發防災技術

**檢監測技術研發**
公路邊坡監測模組、預警機制建立
軌道扣件巡檢系統現地測試及精進
→ **鐵公路災防技術研發**
公路邊坡輔助巡檢工具研發/
軌道構件巡檢系統建置及應用驗證

**海陸災防模擬分析**
港域靜穩監測技術與預警系統研發
花蓮海岸公路浪壓預警系統　浪壓預警及因應對策分析
地工織布應用於橋基保護工
→ **海陸防災預警應用**
港域靜穩監測技術與越波預警系統研發
應用智慧監測進行海象數值同化研究
橋基保護工現地試驗與成效評估

**臺灣腐蝕環境分類調查研究**
大氣環境分類調查、水下金屬腐蝕調查、網站資料庫擴建、影響因子分析、年報出版

**離岸風電區防災**
鄰近海岸漂沙機制探討
海氣象觀測與特性分析
→ **臺灣綠色能源港智慧防災**
海域漂沙及岸線變化分析　靜穩度水工模型試驗
海氣象觀測及分析　無人機影像監測技術應用

### 建立智慧航運

**船舶監控預警技術開發**
整合風浪模式　船舶特高頻資料交換與航行風險評估　船舶特高頻資料交換與航行風險評估

**港灣環境資訊應用**
主動推播訊息技術　構建港灣海象GIS服務系統　港區預警（海氣、颱風）　運輸環境資訊應用（新增公路、橋梁部分）

**港區海氣象監測及展示系統更新**
→ **主要商港海氣象監測及展示系統**
人工智慧及應用技術開發　預測模式精進與技術移轉

### 落實永續發展

**道路設施維護管理**
橋梁檢測工具研發　感潮河段橋梁梁底檢測工具精進研究　感潮河段橋梁梁底檢測導入新興科技、應用測試及技術推廣

**港灣構造物維護管理**
基準案例編撰　港灣構造物維護管理制度精進　港灣構造物巡查技術研發

2020年版運輸政策白皮書出版、宣傳影片及委外行銷　港灣構造物氣候變遷調適對策研擬

**港區空污減量分析技術**
完成船舶排放空品影響預測
臺灣港群岸電設施設置及規劃推動可行性
→ 港區能源消耗與空氣污染排放偵測　智慧環境監測技術發展評估

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辦教育訓練，推廣港灣構造物之維護管理制度、手冊及資訊系統等研究成果，提供各分公司應用。

（3）**港區空污減量**：結合交通部航港局船舶自動識別系統、即時氣象資料、行政院環境保護署空氣品質測站資料，109年完成臺灣附近海域及港區船舶排放量對空氣品質影響預測，估算未來48小時船舶排放量，並評估港口船舶燃油使用低硫油時之差異，最後提出商港區空氣污染物減量之短中長期因應對策。

caisson type composite breakwater, block type wharf, sheet pile type wharf, and trestle bend wharf, and explain the quotation of parameters, the determination of external force conditions and the design process in detail, to provide the application of design and review by relevant engineering personnel.

**(2) Research and Analysis of Harbor Structure Maintenance Strategy and Application Promotion of Management Information System:** Research and develop the "Harbor Structure Maintenance Management Manual"for wharfs, breakwaters, seawalls, and revetments, and sent the manual to the Taiwan International Ports Corporation on June 19, 2020, approved by the corporation to be used by its branch companies as the basis to manage the inspection and testing operations for the harbor structures. Held education and trainings at Port of Kaohsiung, Keelung, Taichung, and Hualien on June 30, July 3, July 6, and July 10, 2020 to promote the research results of the Harbor Structure's Maintenance Management System, Manual and Information System, for the use of each branch company.

**(3) Port Area Air Pollution Reduction:** Combined with the Ship Automatic Identification System of the Maritime and Port Bureau of the Ministry of Transportation and Communications, real-time meteorological data, and data from the Air Quality Monitoring Station of the Environmental Protection Administration of the Executive Yuan, complete the 2020 impact forecast of ship emissions on air quality in the sea areas near Taiwan and port areas, estimate the ship emissions in the next 48 hours, assess the differences for the ships using low-sulfur fuel in the port, and finally propose short-, medium- and long-term countermeasures to reduce air pollutants in the commercial port areas.

本所6組1中心配合交通部當前重點政策及國內交通問題，研擬及執行相關研究計畫，以協助完成國內交通政策之推動，並提供研究成果做為中央及地方政府交通單位施政之參據，這些當前交通政策重點包含：

（一）運輸規劃評估研究

（二）海空運及鐵路決策支援應用工具之創新發展

（三）道路交通安全創新研究與應用

（四）公路客貨運輸創新研究與應用

（五）智慧運輸科技發展與創新應用

（六）氣候變遷環境下運輸部門之因應作為

（七）港灣環境與船舶航行安全研究發展

以下即針對本所配合執行之重點研究項目擇要進行介紹。

## 一、 運輸規劃評估研究

### （一）南臺區域整體區域運輸規劃

#### 1.計畫概述

本計畫為3年期計畫，主要係為掌握南臺區域（包含雲林縣、嘉義縣、嘉義市、臺南市、高雄市、屏東縣）平常日之通勤、通學及商務旅次特性，透過調查蒐集相關旅次特性資料，以建立運輸需求模式，預測未來運輸系統之供需情形，針對南臺區域各運輸系統進行功能定位與檢討，並研提南臺區域陸路運輸服務均衡發展策略。

其中第1年期（108年）主要進行旅次特性調查與分析，透過旅次特性調查及屏柵線交通量調查，掌握區域內旅次行為之變化，並完成目標年社經預測；第2年期（109年）則建立南臺區域運輸需求模式，完成供需預測分析，深入瞭解區域內重要路廊供需問題；第3年期（110年）則檢視南部區域運輸發展趨勢與課題，並就未來年供需預測結果進行整體運輸功能定位與檢討，以研擬南部區域整體運輸發展策略。

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

(1) Transportation Planning and Evaluation Research

(2) Innovative Development of Decision Support Tools for Sea, Air and Rail Transportation

(3) Creative Research and Application on Road Traffic Safety

(4) Creative Research and Application on Highway Passenger and Cargo Transportation

(5) Development and Innovative Application of Intelligent Transportation Technology

(6) Response of Transportation Sectors in Climate Change Environment

(7) Research and Development of Harbor and Maritime Environment and Ship Navigation Safety

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

## I. Transportation Planning and Evaluation Reaserch

### (1) A Series of Studies on the Overall Transportation Planning of Southern Taiwan Region

#### 1. Project Overview

This project is a three-year project, mainly to grasp the characteristics of daily commute, school and business trips in the southern Taiwan region (including Yunlin County, Chiayi County, Chiayi City, Tainan City, Kaohsiung City, Pingtung County), to establish a transportation demand model through survey and collection of the relevant travel characteristics data, and to forecast the supply and demand situation of the transportation system in the future, conduct functional positioning and review of all transportation systems in the southern Taiwan region, and develop a balanced development strategy for the land transportation services in the southern Taiwan region.

Among these, the first year (2019) was mainly to conduct survey and analysis of travel characteristics to grasp the changes in travel behavior in the region through the travel characteristics survey and screen line traffic volume survey, and completed the social and economic forecasts for the target year; the second year (2020) was to establish the southern Taiwan region transportation demand model, complete the supply and demand forecast analysis, and deeply understand the supply and demand issues of important road corridors in the region; the third year (2021) is to review the southern region's transportation development trends and topics, and to carry out the overall transportation function positioning and review based on the forecast results of supply and demand in the future, so as to formulate the overall transportation development strategy of the southern region.

## 2.研究成果

（1）掌握區域運輸旅次特性（旅次起迄分布、旅次長度、運具使用狀況），可反映不同政策下的各運輸市場變化。

（2）構建「2020南臺區域運輸需求模式」，完成運輸系統供需預測分析，可了解主要運輸走廊運具競合關係、分析區域間路廊運量、觀察點/屏柵線通過量，滿足地區間連結道路之乘載能力檢討的需求，做為政策實施及工程改善方向的依據。

（3）提出南臺區域整體運輸規劃成果，研提運輸系統供需分析與發展策略，提供交通部暨部屬機關及北部縣市政府辦理相關運輸系統規劃與評估參考。

（4）相關產出為國發會、內政部（國土計畫）、交通機關（臺鐵局、鐵道局、公路總局、高公局等）與各地方政府（捷運與都會整體運輸規劃等）辦理鐵公路運輸系統計畫與評估之參據。

## 3.成果推廣與效益

（1）針對「南臺區域運輸系統供需預測成果課題探討」及「南臺區域運輸系統整體發展策略研擬」於109年10月16日及109年11月12日召開2次專家學者座談會。

（2）辦理1場次教育訓練進行模式操作演練。

（3）辦理1場次成果説明會進行成果推廣。

（4）發表「南臺區域旅次特性分析與基年旅次推估成果」，中華民國運輸學會109年學術論文研討會。

## 2. Research Outcomes

(1) Grasp the characteristics of regional transportation trips (start-to-end distribution of trips, length of trips, condition of transportation vehicles), which can reflect changes in various transportation markets under different policies.

(2) Construct the "2020 Southern Taiwan Region Transportation Demand Model," complete the forecast analysis of the supply and demand of the transportation system to understand the competition and cooperation relationship of major transportation corridors, analyze the traffic volume of the road corridors between regions, and the throughput of observation points/screen line to meet the demand of reviewing the carrying capacity of the connection roads between the regions as the basis for policy implementation and engineering improvement directions.

(3) Put forward the results of the overall transportation planning in the southern Taiwan region, research and propose transportation system supply–demand analysis and development strategies, and provide reference for related transportation system planning and evaluation by the Ministry of Transportation and Communications and the Subordinate Agencies as well as the northern County and City Governments.

(4) The relevant output is the reference for the National Development Council, the Ministry of the Interior (National Spatial Planning), Transportation Agencies (Taiwan Railways Administration, Railway Bureau, Directorate General of Highways, Freeway Bureau, etc.) and local governments (MRT and metropolitan overall transportation planning, etc.) to manage the planning and evaluation of the railway and highway transportation systems.

## 3. Promotion of Outcomes and Benefits

(1) Two expert symposiums were held on October 16, 2020 and November 12, 2020 for the "Topic Discussion on the Achievements of the Supply and Demand Forecast of the Southern Taiwan Regional Transportation System" and the "Research on the Overall Development Strategy of the Southern Taiwan Regional Transportation System."

(2) Organized one session of Education and Training for Model Operation drills.

(3) Organized one session of Results Presentation for results promotion.

(4) Published "Analysis of Trip Characteristics in South Taiwan Region and Results of Base Year Trip Estimates" in the 2020 Academic Paper Seminar of the Chinese Institute of Transportation.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes

### 運具選擇預測成果

| 108年 | 機車 | 小汽車 | 公車 | 臺鐵(軌道) | 高鐵 |
|---|---|---|---|---|---|
| 跨生活圈 | 14.9% | 78.2% | 0.2% | 6.0% | 0.8% |
| 雲林 | 67.6% | 32.1% | 0.1% | 0.1% | - |
| 嘉義 | 75.2% | 24.3% | 0.2% | 0.3% | - |
| 臺南 | 69.0% | 26.8% | 3.3% | 0.9% | - |
| 高雄 | 68.9% | 24.4% | 4.0% | 2.8% | - |
| 屏東 | 69.6% | 28.6% | 1.1% | 0.8% | - |

| 140年 | 機車 | 小汽車 | 公車 | 臺鐵(軌道) | 高鐵 |
|---|---|---|---|---|---|
| 跨生活圈 | 13.7% | 78.7% | 0.2% | 6.4% | 1.0% |
| 雲林 | 66.5% | 33.1% | 0.1% | 0.3% | - |
| 嘉義 | 74.4% | 24.4% | 0.4% | 0.8% | - |
| 臺南 | 69.0% | 25.0% | 3.4% | 2.6% | - |
| 高雄 | 66.2% | 26.0% | 4.3% | 3.5% | - |
| 屏東 | 64.8% | 33.0% | 1.4% | 0.8% | - |

南臺區域各運輸系統市場占比
Market Share of Each Transportation System in Southern Taiwan Region
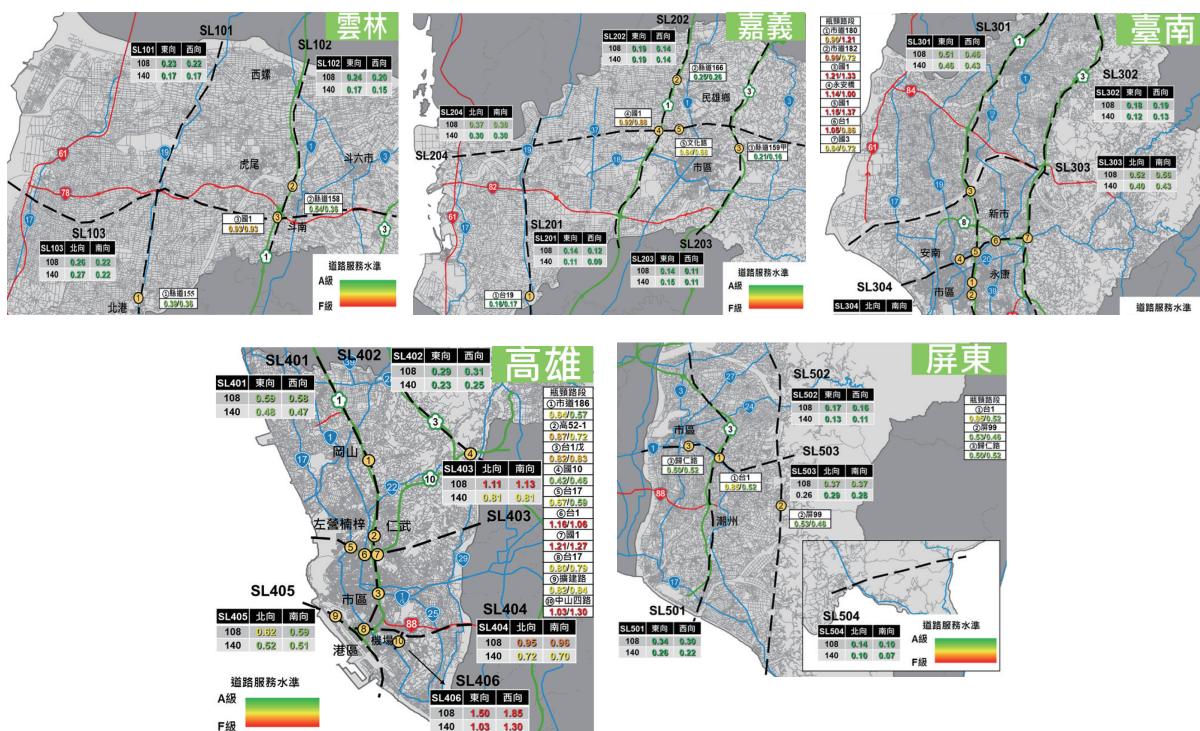


南臺區域公路屏柵線交通服務水準
The Level of Service of Highway Screen Line Traffic in Southern Taiwan Region

## 5.研究成果報告

- 南臺區域整體運輸規劃系列研究（1/2）—旅次特性調查分析（109年10月出版）
- 南臺區域整體運輸規劃系列研究（2/2）—供需預測及發展策略分析（預計110年11月出版）

## 5. Report of Research Outcomes

- A Series of Studies on the Overall Transportation Planning of Southern Taiwan Region (1/2) - Investigation and Analysis of Trip Characteristics (Published in October 2020)
- A Series of Studies on the Overall Transportation Planning of Southern Taiwan Region (2/2) - Transportation Demand and Supply Analysis (To be published in November 2021)

## （二）高快速公路匝道分匯流區容量及服務水準分析之研究

### 1.計畫概述

本所出版之「臺灣公路容量手冊」方法主要引用美國 Transportation Research Board（TRB）1985 年之公路容量手冊，提供規劃、設計及評估公路容量及服務水準之參考，當中關於進出口匝道路段的分析方法是基於有限之現場資料訂定，已無法滿足目前的分析需求。因此，本所於民國108年開始進行為期3年的研究工作，以發展高快速公路進出口匝道的分析方式。第1年期（108年）分析對象為獨立進出口分匯流區，此類型之分匯流區運作不受上下游匝道之影響，可先釐清影響車流之幾何型態關鍵因素；第2年期（109年）分析對象為非獨立進出口分匯流區；第3年期（110年）將彙整前2期研究成果，發展適合國內車流情況之主線分匯流區與匝道之容量及服務水準分析方法。

### 2.研究成果

（1）了解高快速公路分匯流區車流特性，建立高快速公路主線分匯流區與匝道之容量及服務水準分析方法。

（2）預期110年完成「臺灣公路容量手冊」第五、六章之修訂工作。

（3）更新之分析方法可做為高公局、公路總局、縣市政府等各級公路主管機關與顧問公司於交通建設計畫、道路規劃設計及交通管理改善等評估之依據。亦可做為交通建設、都市計畫、區域計畫、環境影響、基地開發道路衝擊評估等相關主管單位審查應用之依據。

### 3.成果推廣與效益

（1）第1年期及第2年期研究工作，分別於108年10月23日及109年10月23日召開專家學者座談會。

（2）辦理2場次研究成果說明會。

（3）本研究之「無人機交通調查系統及其交通調查方法」，於109年8月21日申請發明專利。

## (2) Capacity and Level of Service Analysis of Freeway and Expressway Merging and Diverging Area

### 1. Project Overview

The method of the "Taiwan Highway Capacity Manual" published by the IOT mainly quotes the 1985 Highway Capacity Manual of the Transportation Research Board (TRB) of the United States, which provides references for planning, design and evaluation of highway capacity and level of service, among these the analysis method for the on-ramp and off-ramp section was based on limited on-site data and cannot meet the current analysis needs. Therefore, the IOT began a three-year research work in 2019 to develop the analysis method of highway and expressway on-ramp and off-ramp. The analysis object for the first year (2019) was the isolated merging areas for on-ramp and isolated diverging areas for off-ramp. The operation of this type of merging and diverging area is not affected by the upstream and downstream ramps, and the key geometric factors affecting the traffic flow can be clarified first. The analysis object for the second year (2020) was the non-isolated merging areas for on-ramp and non-isolated diverging areas for off-ramp, and the third year (2021) will consolidate the research results of the first two phases to develop the capacity and level of service analysis method for the main line merging and diverging areas and ramps suitable for domestic traffic flow conditions.

### 2. Research Outcomes

(1) Understand the characteristics of the traffic flow in the merging and diverging areas of the highway and expressway to establish the capacity and level of service analysis method of the main line merging and diverging areas and ramps of the highway and expressway.

(2) It is expected that the revision of Chapters 5 and 6 of the "Taiwan Highway Capacity Manual" will be completed in 2021.

(3) The updated analysis method can be used as the basis for the assessment of transportation construction plan, road planning and design, and traffic management improvement by all levels of highway competent authorities and consulting companies of the Freeway Bureau, the Directorate General of Highways, and the County and City Governments. It can also be used as a basis for the review and application of relevant competent authorities of transportation construction, urban planning, regional planning, environmental impact, and road impact assessment of base development.

### 3. Promotion of Outcomes and Benefits

(1) For the research work in the first and second years, two expert symposiums were held on October 23, 2019 and October 23, 2020 respectively.

(2) Organized 2 sessions of Results Presentations.

(3) Apply invention patent for the "UAV Traffic Investigation System and Traffic Investigation Method" of this study on August 21, 2020.
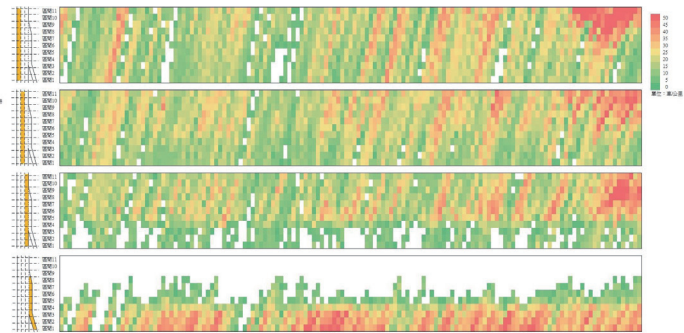
**4.研究成果精華摘整**
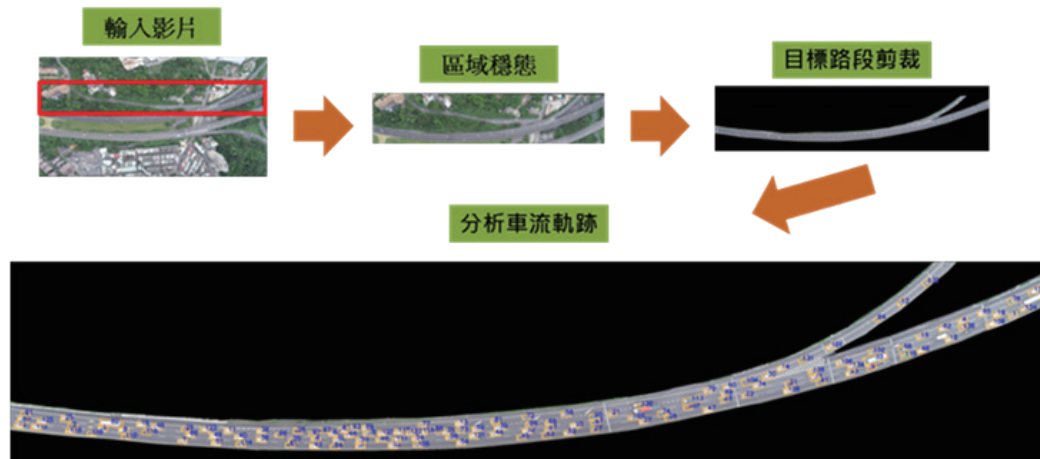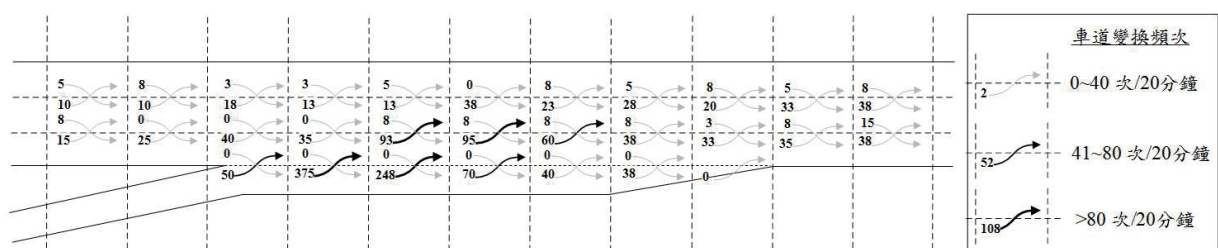
高速公路車流分析流程
UAV Aerial Videography for Highway Traffic Flow Analysis Process
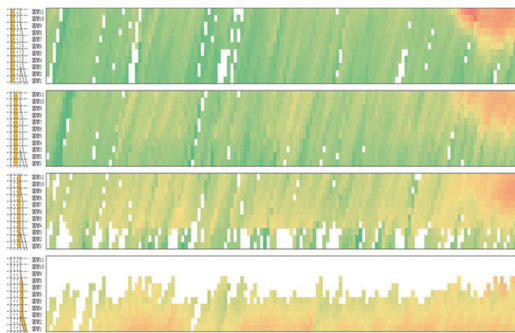


高速公路調查地點分車道速率時空圖
Time-Space Diagram of Divided Lane Speed of Highway Survey Locations



高速公路調查地點分車道密度時空圖
Time-Space Diagram of Divided Lane Density of Highway Survey Locations



高速公路調查地點車道變換位置及頻次
Lane Change Location and Frequency of Highway Survey Locations

**5.研究成果報告**

・高快速公路匝道分匯流區容量及服務水準分析之研究（1/3）-獨立進出口分匯流區（109年10月出版）

・高快速公路匝道分匯流區容量及服務水準分析之研究（2/3）-非獨立進出口分匯流區（110年8月出版）

**5. Report of Research Outcomes**

・ Capacity and Level of Service Analysis of Freeway and Expressway Merging and Diverging Area (1/3) – Isolated Merging Area for On-ramp and Isolated Diverging Area for Off-ramp(Published in October 2020)

・ Capacity and Level of Service Analysis of Freeway and Expressway Merging and Diverging Area (2/3) – Non-isolated Merging Area for On-ramp and Non-isolated Diverging Area for Off-ramp(Published in August 2021)

## （三）輕軌系統容量分析暨應用研究－A、B型路權容量及可靠度分析

### 1.計畫概述

為因應國內各種鐵道系統建設需要，本所進行了一系列軌道容量研究計畫，本計畫之目的在於完備國內的鐵道容量分析技術，藉由發展輕軌運輸系統的鐵道容量分析模式，作為鐵道容量系列研究之輕軌運輸系統部分的重要依據。有鑑於政府前瞻基礎建設計畫將於各都會區規劃推動輕軌系統且部分計畫已陸續完工通車，例如高雄臨港輕軌及淡海輕軌，為利後續規劃推動之輕軌系統皆能有效掌握其供給容量，並及時提供後續輕軌系統計畫於規劃、興建及營運各階段之決策參考應用，因此辦理輕軌系統容量分析研究。

本計畫為2年期計畫，其中第1年期（108年）主要辦理A、B型路權輕軌系統之容量模式構建；第2年期（109年）則辦理A、B型混合路權連續路段之輕軌容量及可靠度分析模式構建與軟體開發，並辦理臺灣鐵道容量手冊擴充編訂及教育訓練，以推廣應用成效。

### 2.研究成果

（1）藉由A、B型混合路權連續路段之輕軌容量及可靠度分析模式之構建，有效釐清影響其容量之因素及程度。

（2）完成A、B型混合路權連續路段輕軌容量及可靠度之分析軟體開發，並將「A、B型混合路權連續路段之可靠度分析軟體」整合併入「A、B型混合路權連續路段輕軌容量分析軟體」，使整合後之輕軌容量分析軟體更為周延完整。

（3）擴充編訂臺灣鐵道容量手冊，彙整本系列研究完成之「連續路段輕軌容量分析模式」及「連續路段輕軌列車可靠度分析模擬模式」，編訂鐵道容量手冊之「輕軌系統篇」內容，以供各界參考應用。

### 3.成果推廣與效益

（1）第1年期及第2年期研究工作，分別於108年6月24日、108年10月22日及109年6月12日、109年10月27日召開專家學者座談會。

## (3) Light Rail Transit Capacity Analysis and Applications Study

### 1. Project Overview

In response to the construction needs of all types of domestic railway systems, the IOT has conducted a series of track capacity research projects. The purpose of this project is to complete the domestic railway capacity analysis technology and go through the development of railway capacity analysis model of the light rail transit, as the important basis for the light rail transit system part of the railway capacity series studies. In view of the government's Forward-looking Infrastructure Development Program to promote the light rail transit in various metropolitan areas, some of the projects have been completed and opened to traffic in succession, such as the Kaohsiung Harbor Light Rail and Danhai Light Rail, in order to facilitate the light rail transit promoted by subsequent planning can effectively control its supply capacity, and also provides timely decision-making reference applications for subsequent light rail transit projects in all phases of planning, construction and operation, hence, the analysis and research of light rail system capacity are conducted.

This project is a two-year project. The first year (2019) was mainly to manage the construction of the capacity model of the A, B-Type Right-of-Way Light Rail Transit; the second year (2020) was to manage the construction and software development of the Light Rail Capacity and Reliability Analysis Model for the A, B-Type Mixed Right-of-Way Continuous Sections, and manage the expansion and compilation of the Taiwan Railway Capacity Manual as well as the education and training to extend the effectiveness of the application.

### 2. Research Outcomes

(1) Through the construction of the Light Rail Capacity and Reliability Analysis Model for the A, B-Type Mixed Right-of-Way Continuous Sections, to effectively clarify the factors and extent of affecting its capacity.

(2) Completed the analysis software development of the Light Rail Capacity and Reliability Analysis Model for the A, B-Type Mixed Right-of-Way Continuous Sections, and integrates the "Reliability Analysis Software of the A, B-Type Mixed Right-of-Way Continuous Sections" into the "Capacity Analysis Software of the A, B-Type Mixed Right-of-Way Continuous Sections" to allow the integrated light rail capacity analysis software to be more comprehensive and complete.

(3) Expanded the compilation of the Taiwan Railway Capacity Manual, organized the "Continuous Section Light Rail Capacity Analysis Model" and "Continuous Section Light Rail Train Reliability Analysis Simulation Model" completed in this series of study, and compiled the content of the "Light Rail Transit Chapter" of the Railway Capacity Manual, for the reference and applications from all sectors.

### 3. Promotion of Outcomes and Benefits

(1) For the research work in the first and second years, four expert symposiums were held on June 24, 2019; October 22, 2019; June 12, 2020; and October 27, 2020 respectively.

（2）辦理3場次教育訓練進行軟體操作演練與推廣及1場研究成果説明會。

（3）發表「輕軌運輸系統連續路段容量分析」，中華民國運輸學會109年學術論文研討會。

(2) Organized three sessions of Education and Training for software operation drills and promotion, and one session of Results Presentation.

(3) Published "Analysis of the Capacity of Light Rail Transit System Continuous Sections," in the 2020 Academic Paper Seminar of the Chinese Institute of Transportation.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
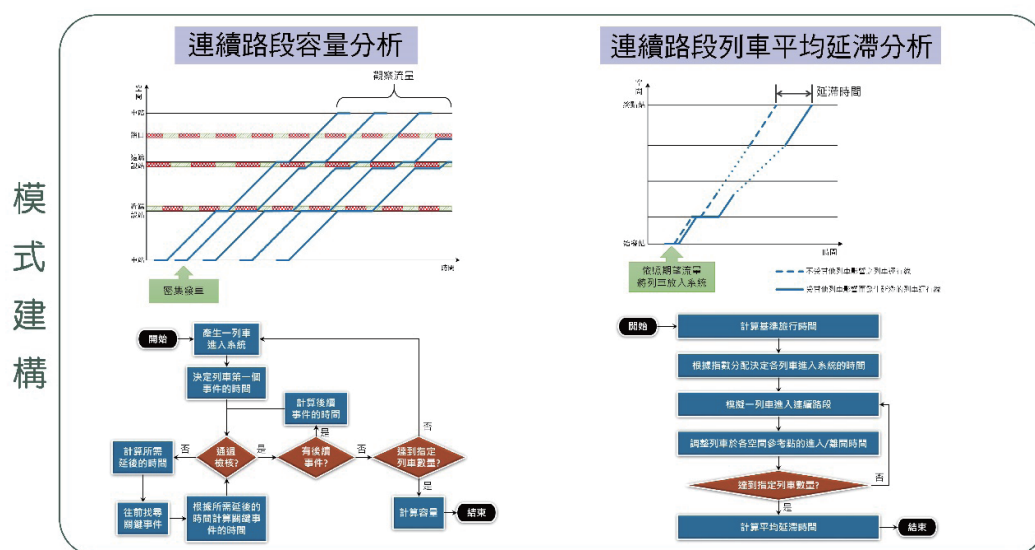


A、B 型連續路段之輕軌容量及可靠度分析模式
Light Rail Capacity and Reliability Analysis Mode of A, B-Type Continuous Sections
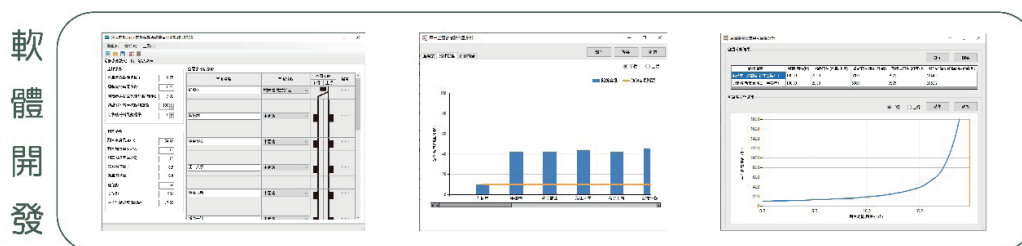


A、B 型連續路段之輕軌容量及可靠度分析結果
Analysis Results of Light Rail Capacity and Reliability of A, B-Type Continuous Sections

## 5.研究成果報告

・輕軌系統容量分析暨應用研究（1/2）—A、B型路權容量模式構建（109年7月出版）

・輕軌系統容量分析暨應用研究（2/2）—A、B型路權容量及可靠度分析（110年7月出版）

## 5. Report of Research Outcomes

・Light Rail Transit Capacity Analysis and Applications Study (1/2) - Capacity Model Development for Type A and B Right-of-Way (Published in July 2020)

・Light Rail Transit System Capacity Analysis and Applications Study (2/2) - Capacity and Reliability Analysis for Type A and B Right-of-Way (Published in July 2021)

## 二、 海空運及鐵路決策支援應用工具之創新發展

### （一）商港整體發展規劃（111~115年）

#### 1.計畫概述

　　商港整體規劃係依據商港法第6條辦理，交通部以往責成本所負責執行上位計畫「商港整體發展規劃」，航港局及臺灣港務公司分別執行下位計畫「國際及國內商港未來發展及建設計畫」，自84 起每5 滾動檢討規劃，已辦理5期。第6期（111至115年）由本所、臺灣港務公司與航港局於108年同步展開。

#### 2.研究成果

（1）本計畫提出未來國際商港發展目標為「強化智慧創新與多元服務，鞏固海運樞紐地位」，國內商港未來發展目標為「提供優質服務，支援客、貨、觀光發展」。

（2）為落實國際及國內商港發展目標，提出整體策略研擬方向為「創量增值，服務升級」，並針對未來港口發展五大重點面向，分別提出18項因應策略與中長期發展方針，以全面顧及港口發展之多元價值。

#### 3.成果推廣與效益

（1）完成我國港埠中長期發展方向、發展目標及前瞻可行的具體策略等之研擬。另所研擬之我國商港中長期發展方向、發展目標及發展策略，做為國際及國內商港進 「未來發展及建設計畫」之上位計畫，使港埠資源能做最有效用，提升港埠服務水準， 低產業運輸成本，以強化我國港口國際競爭 。

（2）本計畫成果已提報交通部將做為我國商港發展方向之參據，並提供航港局及臺灣港務公司，做為其執行國內商港與國際商港未來發展及建設計畫之研擬依據，指引我國商港未來發展方向，提升商港整體競爭力。

## II. Innovative Development of Decision Support Tools for Sea, Air and Rail Transportation

### (1) The Integrated Overall Development Plan of Commercial Ports (2022-2026)

#### 1. Project Overview

　　The overall commercial port planning is managed in accordance with Article 6 of the Commercial Port Law. The Ministry of Transportation and Communications instructed IOT to be responsible for the implementation of the master plan "The Integrated Planning of Commercial Port Development," and the Maritime Port Bureau and the Taiwan International Ports Corporation, Ltd. are responsible for the implementation of the subordinate plan "International and Domestic Commercial Ports Future Development and Construction Plan" respectively; five phases have been completed with rolling review planning every five years since 1995. The sixth phase (from 2022 to 2026) was unfolded with the IOT and the Taiwan International Ports Corporation, Ltd. and the Maritime Port Bureau simultaneously in 2019.

#### 2. Research Outcomes

(1) This project proposes the development goals of future international commercial ports are "Strengthen Smart Innovation and Diversified Services, Consolidate the Status of Marine Transportation Hub," and the future development goals of domestic commercial ports are "Provide Excellent Quality Services to Support the Development of Passengers, Cargoes, and Tourism."

(2) In order to practice the development goals of international and domestic commercial ports, the overall strategic research direction is proposed to "Create Value-added, Service Upgrade," and aim at the five key aspects of future port development, and 18 corresponding strategies and medium- and long-term development policies are proposed respectively to fully take the diversified value of port development into account.

#### 3. Promotion of Outcomes and Benefits

(1) Completed the research and planning of the medium- and long-term development direction, development goals, and forward-looking feasible specific strategies of our country's ports. In addition, the researched and planned medium- and long-term development direction, development goals and development strategies of our country's commercial ports are used as the master plan for implementing the "Future Development and Construction Plan" of international and domestic commercial ports, so as to make the most effective use of port resources and improve the port level of service and reduce industrial transportation costs, to strengthen the international competitiveness of our country's ports.

(2) The results of this project have been reported to the Ministry of Transportation and Communications to be used as the reference for the development of our country's commercial ports, and be provided to the Maritime Port

Bureau and the Taiwan International Ports Corporation, Ltd. as the basis for them to implement the research and planning of the future development and construction project of domestic and international commercial ports, to guide the future development direction of our country's commercial ports, and enhance the overall competitiveness of commercial ports.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes

| | 國際商港 | 國內商港 |
|---|---|---|
| 目標 | 強化智慧創新與多元服務，鞏固海運樞紐地位 | 提供優質服務，支援客、貨、觀光與關聯產業發展 |
| 貨運發展 | 1. 因應市場變革調整各港貨運發展定位，港群共同對外發展<br>2. 調配各類碼頭作業能量與使用機能，強化港區資源使用效率<br>3. 增加集貨誘因，強化轉口競爭力<br>4. 提升加值服務內涵，持續創量增值<br>5. 加強業者合作經營，增加港口服務面向 | 善用既有設施，維持基本貨運服務 |
| 客運發展 | 1. 結合地方觀光資源，吸引國際郵輪來臺<br>2. 協助推動藍色公路政策，發展國內跳島郵輪及渡輪服務<br>3. 拓展港區多元遊憩服務，提升觀光服務品質 | 1. 持續推動國內跳島郵輪，提升旅運設施服務水準<br>2. 推動民間參與建設開發多元設施，增加港口遊憩豐富度<br>3. 配合國家觀光政策，偕同地方政府推廣港市觀光服務 |
| 環保能源因應 | 1. 因應國家能源政策，彈性調整港口LNG相關設施<br>2. 因應離岸風電產業需求，提供集中配置之發展腹地<br>3. 因應國內外環保公約，推廣綠能設備與相關措施 | 維持環境永續，推廣低碳運輸及再生能源設施 |
| 科技應用 | 1. 規劃智慧化藍圖與試驗場域機制，落實數位轉型<br>2. 建構優質資通訊設施，擴大科技應用範疇<br>3. 與利害關係人共同推動數位平臺，強化國際鏈結 | 1. 導入科技，提升港口航行安全<br>2. 善用科技行銷，推廣客運觀光 |
| 組織與經營管理 | 1. 因應市場變化，調整港口發展戰略層級<br>2. 促進航港合作，確保運作效率與財務永續<br>3. 因應港口轉型發展，強化人才培育<br>4. 促進部會合作，共謀港口發展綜效 | |

國際與國內商港 111-115 年發展目標與策略
2022–2026 Development Goals and Strategies of International and Domestic Commercial Ports

## 5.研究成果報告

· 商港整體發展規劃（111~115年）報告（預計110年12月出版）

## 5. Report of Research Outcomes

· The Integrated Overall Development Plan of Commercial Ports (2022-2026) (To be published in December 2021)

## （二）數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究

### 1.計畫概述

　　智慧化為國際航運發展趨勢，其中數位化係提升競爭力基礎之一環，可減少人為延誤及大幅節省文件作業流程之成本。本計畫為引領航港產業與管理部門達成航運數位化及智慧化，爰進行檢視我國貨櫃運輸作業流程與涉及之節點，並盤點當前數位化與應用區塊鏈技術之現況與需求。

　　透過訪談產官學研之專家，蒐集與探討我國貨櫃運輸作業導入數位化與區塊鏈技術所面臨之課題，藉以研擬我國航港發展導入數位化與應用區塊鏈技術之具體策略，並提出策略推動過程中，我國政府部門與海運相關產業扮演之角色與應辦事項之建議。

### 2.研究成果

（1）完成國內外航港領域數位化與應用區塊鏈技術之相關文獻回顧與案例蒐集，並檢視我國貨櫃運輸作業之詳細流程，同時瞭解各流程節點數位化的現況。

（2）完成蒐集當前航運業既有區塊鏈相關資訊平台與聯盟之內涵與運作方式，以及國際上當前跨鏈整合與標準化趨勢。

（3）完成我國海運相關產業及政府部門應用區塊鏈技術之策略與推動步驟。

### 3.成果推廣與效益

（1）本計畫執行過程中，廣邀交通部、關務署、警政署保三總隊、國內外航商、承攬業者、銀行、保險業者、港務公司、航港局等航港領域之利害關係人參與，進行跨部會協調溝通與執行成果分享。

（2）本計畫辦理3場座談會與1場國際研討會並邀請航港領域產官學研各界參與，以及蒐集對於數位化與區塊鏈技術應用於貨櫃運輸流程上之意見與建議。與會專家學者包含TradeLens海運聯盟平台商、區塊鏈平台建置與技術應用產業先進及專家學者進行專題演講與報告，共同分享區塊鏈技術之建置經驗與前瞻應用之洞見。

## (2) Research on the Application of Digitization and Blockchain Technology in the Operation Chain of Container Transportation

### 1. Project Overview

　Intelligence is the development trend of international shipping, among which digitization is one of the foundations for enhancing competitiveness, which can reduce human delays and greatly save the cost of paperwork operation processes. This project is to lead the maritime port industry and management departments to achieve digitalization and intelligence of shipping, and hence inspect our country's container transportation operation process and related connection nodes, and inventory the current status and requirements of digitalization and the application of blockchain technology.

　Through interviews with experts of government, industry, academia and institute, collect and discuss the topics faced by the introduction of digitalization and blockchain technology in our country's container transportation operations, so as to develop specific strategies for the introduction of digitalization and application of blockchain technology in the development of our country's maritime ports, and put forward suggestions on the roles played by our government departments and marine transportation-related industries and what should be done in the process of promoting strategies.

### 2. Research Outcomes

(1) Complete the literature review and case collection related to the digitization and application of blockchain technology in the field of domestic and foreign maritime ports, and review the detailed process of our country's container transportation operations, and understand the current status of the digitization of each process connection node.

(2) Complete the collection of the meaning and operation methods of the current shipping industry's existing blockchain-related information platforms and alliances, as well as the trends of current international cross-chain integration and standardization.

(3) Complete the strategies and promotion steps for the application of blockchain technology in our country's marine transportation-related industries and government departments.

### 3. Promotion of Outcomes and Benefits

(1) During the implementation of this project, the stakeholders of the Ministry of Transportation and Communications, Customs Administration, the Third Special Police Corps of National Police Agency, domestic and foreign ocean carriers, contractors, banks, insurance companies, port corporations, Maritime Port Bureau, and other maritime port fields are invited to participate in the cross-ministry and department coordination communication and implementation results sharing.

(2) This project organized three sessions of symposiums and one international seminar, and invited all sectors of industry, government, academia, and institute in the field of maritime ports to participate, as well as to collect opinions and suggestions on the application of digitalization and blockchain technology to the container transportation process. Experts and scholars participating in the conference include TradeLens Shipping Alliance

Platform providers, blockchain platform construction and technology application industry predecessors, experts and scholars to give lectures and reports to share the construction experience of blockchain technology and insights into forward-looking applications.
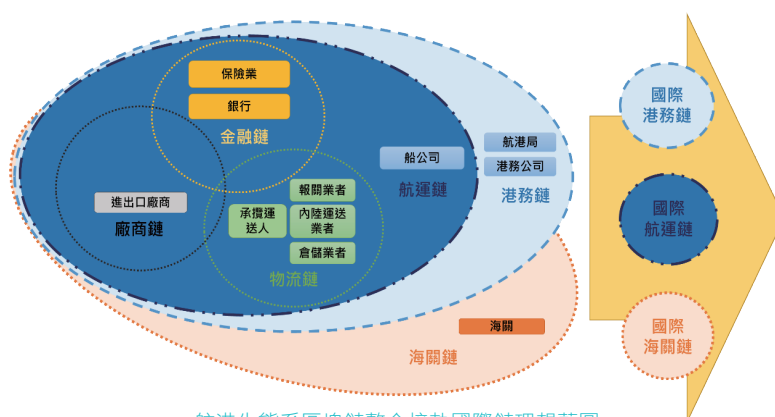
## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
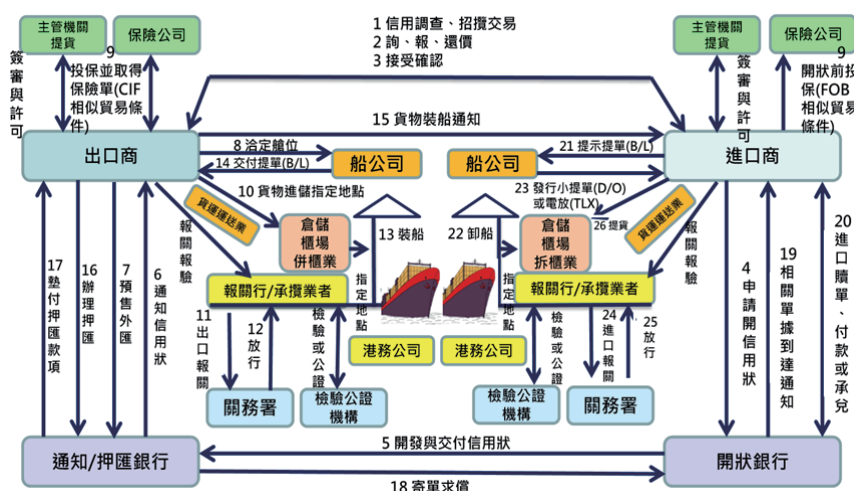


貨櫃運輸進出口貿易流程圖
Flow Chart of Container Transportation Import and Export Trade
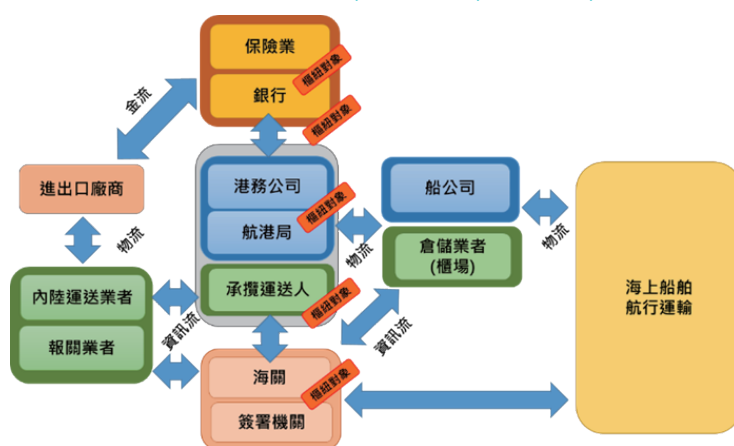


國內航港生態系與貨櫃運輸作業樞紐關係圖
The Relationship Diagram between the Domestic Maritime Ports Ecosystem and the Container Transportation Hub



航港生態系區塊鏈整合接軌國際鏈理想藍圖
The Ideal Blueprint for the Maritime Port Ecosystem Blockchain Integration and Connection to the International Chain

## 5.研究成果報告

· 數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究報告（110年7月出版）

## 5. Report of Research Outcomes

· Research on the Application of Digitization and Blockchain Technology in the Operation Chain of Container Transportation (Published in July 2021)

## （三）國際海運資料庫更新擴充及資料分析服務

### 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，並於各年度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2020 Q4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。

（3）收錄全球1,015處港口之英文名稱、中文名稱、經緯度、所屬國家、所屬貿易區等資料；航線上使用之船舶約5,203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）完成韓國航商HMM加入THE聯盟對我國港口影響，及我國與各新南向國家間航線變遷比較等分析。

### (3) Expanding, Updating and Data Analyzing of International Maritime Database

### 1. Project Overview

The current global economic landscape changes rapidly, and the situation of maritime cargo transportation is also moving ups and downs violently. As an ocean-surrounded country located at the center of East Asia, we have experienced many years of maritime transport prosperity. However recent years have seen unfavorable changes. As a result, the ranking of Kaohsiung Port in global container liftings has declined, a warning that deserves high attention and proper response by the government.

The formation and evaluation of high-quality policies requires high-quality scientific analysis, and high-quality data is an indispensable element for policy formulation. Container transportation is the key point of our country's maritime transportation, and maritime container transportation is global. Through the long-term collection of data on the main routes and regional routes of global ocean container transportation, the "International Maritime Transportation Database" cooperates with the establishment and improvement of data statistical analysis and mapping functions, to conduct issue-based analysis based on the changes in the quarterly data of the year at the end of each year, to grasp the overview and trends of global shipping market. Furthermore, the system can also provide specific and objective quantitative data from the perspective of container shipping supply, to support current policy forming or business needs, such as the research and planning on the new southbound policy and its effectiveness assessment.

### 2. Research Outcomes

(1) Collect information on international regular container routes from Q2 2011 to Q4 2020.

(2) Before 2016, covers approximately 600 routes each quarter centered at the far east region; which was extended to all regular container routes worldwide, covering roughly 1,500 to 1,550 routes each quarter starting from 2017.

(3) Include the English name, Chinese name, latitude and longitude, country, and trade zone of 1,015 ports around the world; about 5,203 ships are used on the route, covering 97% of the total number of container ships in the world.

(4) Improve the stand-alone query software with data statistical analysis, reports, and chart production functions, and strengthen its information security defense capabilities.

(5) Complete the analysis of the impact of Korean ocean carrier HMM's entry into THE alliance on our country's ports, and the comparison of route changes between our country and the new southbound countries.
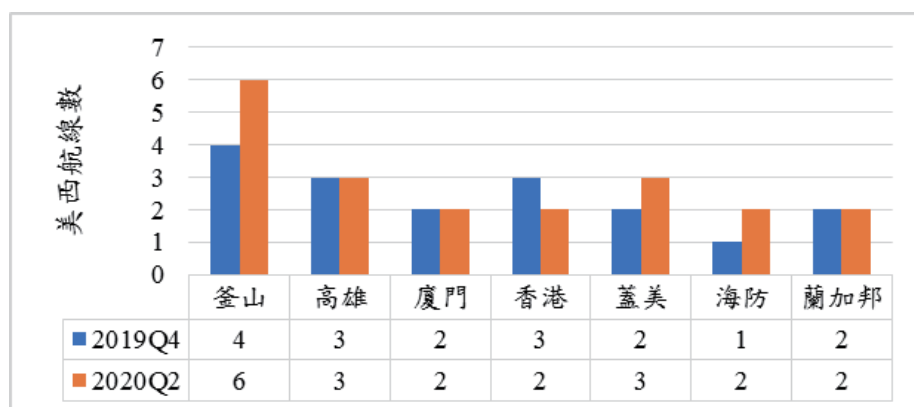
## 3.成果推廣與效益

（1）配合航港局業務需要，提供國籍航商經營起迄港位於東協10國及印度之航線統計資料。

（2）支援商港發展整體規劃（111-115年）之編撰，綜析全球主要國際港口近3年各類航線統計數據。

（3）配合臺灣港務公司辦理國際（內）商港未來發展及建設計畫需要，提供近年遠歐航線、亞美航線等航線數、運能統計資料。

（4）於2020年11月16日召開「國際海運資料庫」座談會，邀請海運業產官學界與會，介紹資料庫內容及功能。

## 4.研究成果精華摘整

## 3. Promotion of Outcomes and Benefits

(1) Cooperate with the business needs of the Maritime Port Bureau; provide statistical data on routes from the ports with origin and destination in ASEAN 10 countries and India that have been operated by national ocean carriers.

(2) Support the compilation of the overall "The Integrated Plan of Commercial Port Development" (from 2022 to 2026), and comprehensively analyze all types of route statistics of major international ports around the world in the past three years.

(3) Cooperate with Taiwan International Ports Corporation, Ltd. to manage the needs of future development and construction projects for the international (domestic) commercial ports, and provide statistics on the number of routes and capacity of Asia–Europe routes, Asia–America routes, etc., during the recent years.

(4) Hold the "International Maritime Transportation Database" symposium on November 16, 2020, and invite the industry, government, and academia of the maritime transportation industry to participate and introduce the content and functions of the database.

## 4. Summary of Research Outcomes



| | 釜山 | 高雄 | 廈門 | 香港 | 蓋美 | 海防 | 蘭加邦 |
|---|---|---|---|---|---|---|---|
| 2019Q4 | 4 | 3 | 2 | 3 | 2 | 1 | 2 |
| 2020Q2 | 6 | 3 | 2 | 2 | 3 | 2 | 2 |

THE 聯盟美西航線於遠東主要港口之部署變化
Changes in the Deployment of THE Alliance West America Route in Major Ports in the Far East
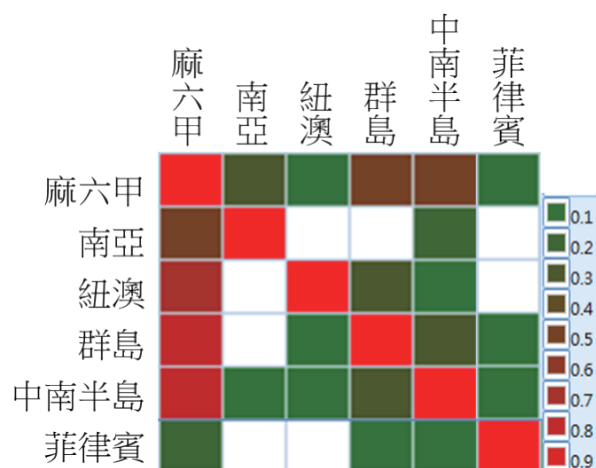


新南向各區間區域航線依存度熱圖（2017-2020 之 Q3）
New Southbound Regional Route Dependency Heat Map (Q3 of 2017–2020)

## （四）國際空運資料庫之更新擴充及資料分析服務

### 1.計畫概述

　　全球航空業重心已逐漸移至亞太地區，我國門戶桃園機場及包括香港、仁川、上海浦東、東京成田在內之臨近競爭機場，皆積極擴增機場容量及完善機場設施，期更進一步強化樞紐地位，持續關注掌握國際空運市場發展趨勢及相關機場運量變化，始能知己知彼百戰百勝。

　　「國際空運資料庫」之建置即在逐年蒐集包括機場營運及旅客起迄相關資料，機場營運部分包含全球200座主要機場之運量、航網等資料；旅客起迄資料部分，係向具公信力及代表性之國際航空運輸協會（IATA）購置旅客起迄路徑及運量資料，據以進行統計分析，並參考空運市場發展變化及趨勢，進行議題式分析，協助本所空運相關研究之進行。

### 2.研究成果

（1）掌握全球200座機場（包括我國、新南向國家、兩岸及全球重要航點）之基礎設施、營運、航網及運量資料。

（2）除持續蒐集桃園機場、亞太（如香港、仁川、東京成田、上海浦東等）及北美（包括洛杉磯、舊金山、紐約甘乃迪及溫哥華）地區重要機場旅客起迄移動資料，掌握桃園及重要營運往來機場與鄰近競爭機場之旅運變化情形，另針對我國與日本主要國際機場市場進行深度分析。

（3）完成彈性管理查詢視窗及起迄航程之類別資料檢索功能、新增佈告欄管理功能。

（4）透過大數據分析資料庫檢索機場資料（超過200萬筆），就政策與產業面議題進行議題式分析，包括「低成本航空公司之中轉營運分析」、「我國與日本主要機場市場深度分析」、「松山、臺中、高雄機場之營運分析」等議題分析，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考。

## (4) Expanding, Updating and Data Analyzing of International Air Transport Database

### 1. Project Overview

　　The focus of the global aviation industry has gradually shifted to the Asia-Pacific region. The gateway of our country, Taoyuan International Airport, and nearby competing airports including Hong Kong, Incheon, Shanghai Pudong, and Tokyo Narita are actively expanding airport capacity and improving airport facilities, expecting to further strengthen their position as a hub. Continuing to paying attention to and grasping the development trend of international air transport market and the changes in related airport traffic will allow you to know yourself, your enemy and to emerge victoriously in every battle.

　　The establishment of the "International Air Transportation Database" is to collect relevant data of airport operations and passenger origin and destination year by year. The airport operation segment includes traffic volume, network and other data of 200 major airports around the world; for the part of passenger origin and destination, purchases the passenger origin and destination routes and traffic volume data from the credible and representative International Air Transport Association (IATA) as the basis to conduct statistical analysis, and refer to the development changes and trends of the air transportation market to conduct issue-based analysis, to assist the IOT in conducting air transportation related researches.

　　The establishment of the "International Air Transportation Database" is to collect relevant data of airport operations and passenger origin and destination year by year. For the airport operation segment, it includes traffic volume, network and other data of 200 major airports around the world; for the passenger origin and destination segment, it contains data of passenger origin and destination routes and traffic volume purchased from the International Air Transport Association (IATA). Issued-oriented analysis are conducted based on data statistical analysis and the development changes and trends of air transportation market.

### 2. Research Outcomes

(1) Grasp the infrastructure, operation, aviation network and traffic data of 200 airports around the world (including airports of our country, new southbound countries, cross Strait region and important destinations around the world).

(2) In addition to continuous collection of data on passenger origin and destination movement of Taoyuan International Airport and some important airports in Asia Pacific (such as Hong Kong, Incheon, Tokyo Narita, Shanghai Pudong) and North America (including Los Angeles, San Francisco, New York Kennedy and Vancouver) areas, we grasp the changes in travel transportation among Taoyuan International Airport, important incoming/outgoing airports and neighboring competing airports. Also we conduct in-depth analysis on major international air traffic between us and Japan.

(3) Complete flexible management query window and category data retrieval function of the origin and destination flights, and add bulletin board management function.

(4) With the use of big data analytics, issue-oriented analysis on policy and industry issues, including "Analysis of Low-

## 3.成果推廣與效益

　　空運資料庫建置迄今，已蒐集近幾年桃園機場及鄰近競爭機場與北美重要門戶機場旅運資料，除對桃園及相關機場航空市場有所掌握，同時運用資料庫資料研析重要課題，於109年11月27日邀集交通部、民航主管機關、桃園機場公司、航空公司等座談，分享本年度研究成果，並蒐集與會單位需求建議，做為未來精進之參考。在資料產製部分，將於合於契約約定範疇內，產製統整式圖表供相關單位參考。

Cost Airline Transit Operations," "In-Depth Analysis of Main Airport Markets between our Country and Japan", "Operation Analysis of the Songshan, Taichung and Kaohsiung Airport" were conducted, and provided to the Ministry of Transportation and Communications, the Civil Aeronautics Administration, Taoyuan International Airport Corporation Ltd. and Airlines as a reference for strategic research, planning and evaluation.

## 3. Promotion of Outcomes and Benefits

　　Since the establishment of the Air Transportation Database, it has collected travel transportation data for Taoyuan International Airport and neighboring competing airports as well as the important gateway airports in North America in recent years. On November 27, 2020, the Ministry of Transportation and Communications, the Civil Aeronautics Administrtion, Taoyuan International Airport Corporation Ltd. and Airlines were invited to discuss and share the research results of this year, and the needs and suggestions of the participating units are collected as reference for future improvement. In the part of the data production, integrated graphic and chart will be produced within the scope of the contract agreement for the relevant units' reference.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
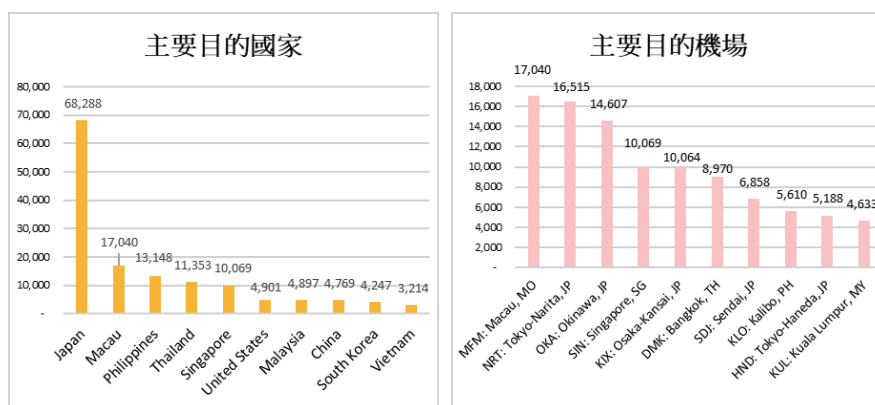


2019 年桃園機場低成本中轉主要目的國家與目的機場
Main Destination Countries and Destination Airports for Low-cost Transit at Taoyuan International Airport in 2019

| 機場 | 2018年 | | 機場 | 2019年 | | 年成長率 |
|---|---|---|---|---|---|---|
| | 旅客量(萬) | 占比 | | 旅客量(萬) | 占比 | |
| **KUL: Kuala Lumpur, MY** | 14.5 | 18.3% | **SGN: Ho Chi Minh City** | 17. 1 | 18.0% | 37.4% |
| **MNL: Manila, PH** | 12.7 | 16.0% | **MNL: Manila, PH** | 14.7 | 15.4% | 15.8% |
| **SGN: Ho Chi Minh City** | 12.5 | 15.7% | **KUL: Kuala Lumpur, MY** | 13.6 | 14.3% | -6.2% |
| **SIN: Singapore, SG** | 7.6 | 9.5% | **SIN: Singapore, SG** | 8.2 | 8.6% | 8.3% |
| **HAN: Hanoi, VN** | 5.8 | 7.3% | **HAN: Hanoi, VN** | 7.6 | 7.9% | 29.7% |
| **KIX: Osaka-Kansai, JP** | 4.1 | 5.2% | **DMK: Bangkok, TH** | 6.7 | 7.1% | 88.4% |
| **NRT: Tokyo-Narita, JP** | 4.0 | 5.0% | **KIX: Osaka-Kansai, JP** | 5.4 | 5.6% | 30.7% |
| **DMK: Bangkok, TH** | 3.6 | 4.5% | **PVG: Shanghai, CN** | 3.1 | 3.2% | 18.0% |
| **PVG: Shanghai, CN** | 2.6 | 3.3% | **NRT: Tokyo-Narita, JP** | 2.7 | 2.9% | -31.2% |
| **ICN: Seoul, KR** | 1.6 | 2.0% | **TAE: Daegu, KR** | 1.7 | 1.8% | 13.6% |
| **TAE: Daegu, KR** | 1.5 | 1.9% | **BKI: Kota Kinabalu, MY** | 1.6 | 1.7% | 24.5% |
| **BKI: Kota Kinabalu, MY** | 1.3 | 1.7% | **HKG: Hong Kong, HK** | 1.6 | 1.6% | 33.1% |
| **HKG: Hong Kong, HK** | 1.2 | 1.5% | **OKA: Okinawa, JP** | 1.3 | 1.4% | 23.2% |
| **OKA: Okinawa, JP** | 1.1 | 1.4% | **ICN: Seoul, KR** | 1.2 | 1.3% | -25.5% |
| **GMP: Seoul-Gimpo, KR** | 1.0 | 1.3% | **CNX: Chiang Mai, TH** | 1.0 | 1.0% | -6.3% |
| ... | ... | | ... | ... | ... | ... |
| **總計** | 79.4 | 100% | **總計** | 95.2 | 100% | 20.2% |

近兩年以臺灣為起迄點之低成本航線主要中轉機場
Main Transit Airports for Low-cost Routes with Taiwan as the Origin and Destination in the Past Two Years

## （五）大數據分析技術進行鐵路供需診斷與策略分析（2/2）-完成鐵路系統供需診斷模式系統

### 1.計畫概述

前瞻基礎建設特別條例業於106年7月7日由總統公布施行，其中前瞻軌道建設涵蓋五大推動主軸。我國在未來這幾年中將執行多項軌道相關建設。然而在同一個臺鐵系統中執行多項建設時，交通部及相關單位必須由系統面之立足點對臺鐵系統之供給、需求、與運轉作整體評估。

考量前瞻軌道基礎建設中含有多項鐵路相關建設工程，不但將同時影響臺鐵系統之運轉，而且彼此之間亦可能有相互影響之情形。因此本所辦理本計畫，研發可整體檢視、分析臺鐵全系統供需能力之軟體工具，以協助本所辦理相關鐵路建設計畫之經費審議。109年為計畫第2年度，以前期（108年）研發之軟體雛型架構為基礎，完成鐵路供需診斷模式軟體，據以進行全島鐵路系統投入運轉資源與運能產出之情境分析，引領鐵路發展並達成節能減碳之政策目標。

### 2.研究成果

（1）蒐集臺鐵第4代票務系統票務紀錄及對應之每日班表資料，進行資料清洗及資料擷取、轉換、載入，建立歷史售票及班表資料倉儲。

（2）以108年度研發軟體雛型架構為基礎，並獲得數值求解之技術突破，據以完成鐵路供需診斷模式軟體之設計。

（3）針對田中支線建設計畫進行案例分析，分析結果確認本軟體具有整體分析之能力，可進行符合旅客需求之運能供給最佳化、建設計畫運能改善效益評估等情境分析功能，以引領鐵路發展並達成節能減碳之政策目標。

### 3.成果推廣與效益

（1）研究期間邀請臺鐵局相關單位參與各項工作會議，並已納入臺鐵局及本所需求意見，確保研究成果符合實務需求，及有助於未來成果推廣。

（2）建立整體鐵路系統供需評估工具，協助

## (5) Railway Supply and Demand Diagnosis and Strategy Analysis with Big Data Technology (2/2) –Completion of the Diagnostic Model Software

### 1. Project Overview

The "Special Act for Forward-Looking Infrastructure" was promulgated and implemented by the President on July 7, 2017, of which, the forward-looking railway infrastructure covers the five major driving themes. Our country will implement multiple railway-related infrastructure constructions in the next few years. However, when multiple constructions are implemented in the same Taiwan Railway system, the Ministry of Transportation and Communications and related units must make an overall assessment of the supply, demand, and operation of the Taiwan Railway system from a systematic standpoint.

Considering that there are multiple railway-related construction projects in the forward-looking railway infrastructure, which will not only affect the operation of the Taiwan Railway system at the same time, but also may affect each other. Therefore, the IOT conduct this project, researches and develops software tools that can comprehensively view and analyze the supply and demand capabilities of the entire system of Taiwan Railways to assist the IOT in conducting the funding review of related railway construction projects. The second year of this project was 2020, and based on the software prototype architecture developed in the previous phase (2019), to complete the railway supply and demand diagnosis model software, as the basis to conduct situational analysis of the invested operation resources and transportation capacity out for the overall island railway system, to lead the railway development and achieve the policy objectives of energy conservation and carbon reduction.

### 2. Research Outcomes

(1) Collect the ticket records of the 4th generation ticketing system of Taiwan Railways and the corresponding daily schedule data, perform data cleaning, data capturing, conversion, and loading, and establish historical ticket sales and schedule data storage.

(2) Based on the software prototype architecture, developed in 2019 and received technological breakthroughs in numerical solution, as the basis to complete the design of the Railway Supply and Demand Diagnosis Model software.

(3) Conduct case analysis on Tianzhong Branch Line construction project. The analysis result confirms that this software has the ability of comprehensive analysis, and can perform situational analysis functions for the optimization of transportation capacity in compliance with the demand of passengers, and the evaluation of the transportation capacity improvement benefit of the construction project, to lead the development of railways and achieve the policy objectives of energy conservation and carbon reduction.

### 3. Promotion of Outcomes and Benefits

(1) During the research period, the relevant units of the Taiwan Railway Administration were invited to participate in various working meetings, and the opinions of the Taiwan Railway Administration and the IOT have been included to ensure that the research results are in compliance with

臺鐵局提升軌道運輸運載能量及列車營運排點自動化。

the practical demands and contribute to the promotion of future results.

(2) Establish a supply–demand assessment tool for the overall railway system to assist the Taiwan Railway Administration in improving the capacity of railway transportation and the automation of train operation scheduling.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
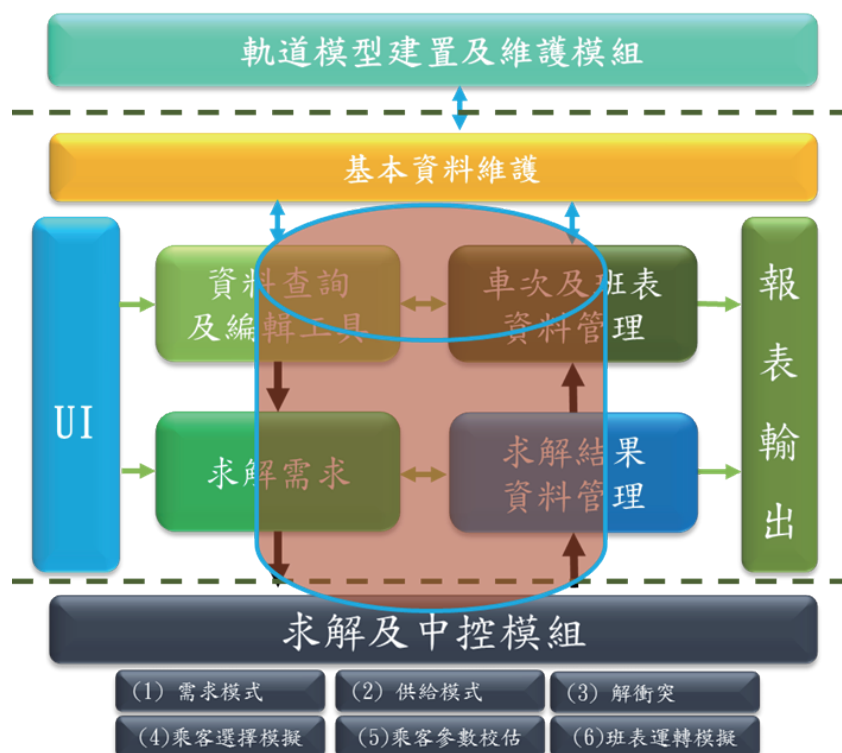


鐵路供需診斷模式軟體系統架構圖
Software System Architecture Diagram of Railway Supply and Demand Diagnosis Model
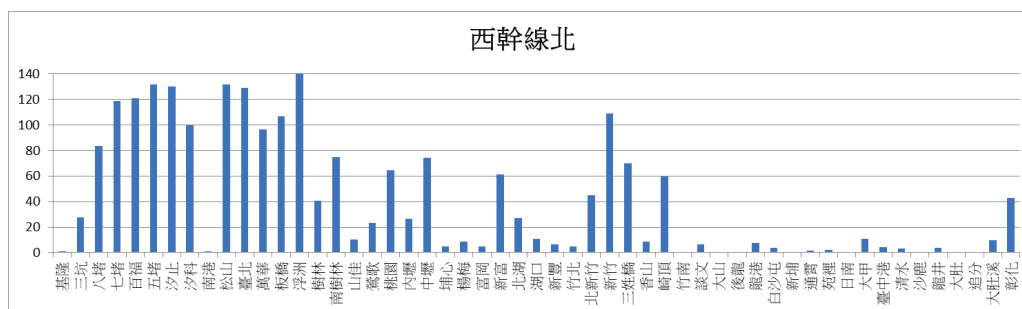


臺鐵西幹線北之現況路塞潛勢指數
Current Road Congestion Potential Index of the North of Taiwan Railway West Main Line

## 5.研究成果報告

- 大數據分析技術進行鐵路供需診斷與策略分析（1/2）-診斷模式軟體雛型之建置（109年7月出版）
- 大數據分析技術進行鐵路供需診斷與策略分析（2/2）-完成鐵路系統供需診斷模式系統（110年7月出版）

## 5. Report of Research Outcomes

- Railway Supply and Demand Diagnosis and Strategy Analysis with Big Data Technology (1/2)–Development of the Diagnostic Model Software Prototype (Published in July 2020)

- Railway Supply and Demand Diagnosis and Strategy Analysis with Big Data Technology (2/2)–Completion of the Diagnostic Model Software (Published in July 2021)

# 三、 道路交通安全創新研究與應用

## （一）事故型態導向之路口交通工程設計範例

### 1.計畫概述

　　臺灣近十年之肇事件數約成長90%，顯示交通安全問題已是刻不容緩的改善重點。本計畫針對混合車流情境下各種常發生的事故型態，分年探討各事故型態發生的原因與改善方式，並進行實地試辦改善，再彙析改善設計範例。104年針對右轉側撞，105年針對左轉側撞，106年針對左轉穿越側撞與同向擦撞，107年針對追撞與交岔撞、108年針對非號誌化路口，109年就前述所有路口常見事故型態，彙整各種改善設計範例，並檢討示範路口執行成效，再進一步精進改善示範案例使用手冊。

### 2.研究成果

　　國內路口之道路交通事故之主要碰撞事故型態，包括側撞、擦撞、交叉撞及追撞，彙整對應各事故型態的改善設計範例，並彙編設計範例參考手冊，歸納易肇事路口改善作業流程，應用肇事診斷學的程序，整理各型設計範例的使用方式與應用情境，供第一線的交通工程從業人員使用。

### 3.成果推廣與效益

（1）各事故型態改善設計範例，可供各級道路主管機關於完成易肇事路口事故特性分析後，精準掌握路口肇事型態，發掘肇事原因，並提出有效改善方案，提升易肇事地點改善品質與效率。

（2）本所於109年分別於北、中、南辦理分區教育訓練，邀集中央機關、各縣市政府、各工程顧問公司等，以推廣研究成果，供各界應用。

## (1) Study on Traffic Engineering Safety Design Based on the Accident Types at Intersections

### 1. Project Overview

The number of accidents in Taiwan in the past ten years has increased by about 90%, showing that traffic safety has become an urgent priority for improvement. This project aims at various accident types that frequently occur in the mixed traffic flow situation, discusses the causes and improvement methods of each accident type by the year, and conducts field trials to improve, and then analyzes the improvement design examples. The year 2015 was aiming at right-turning side collision; left-turning side collision for 2016; left-turning crossing side collision and same direction collision for 2017; rear-end collision and cross collision for 2018; non-signal intersection for 2019; and in 2020, all aforementioned commonly seen accident types at intersections were collected and organized into various types of improvement design examples, and the implementation effects of the demonstration intersections were reviewed, and the improvement demonstration case manual further enhanced.
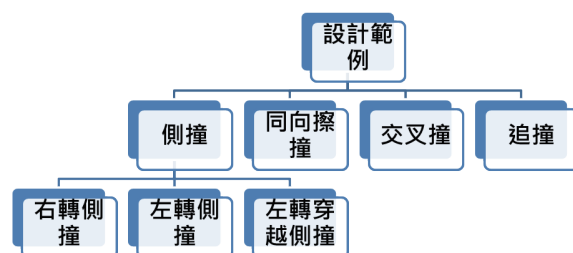
### 2. Research Outcomes

The main collision accident types of road traffic accidents in domestic intersections include side collision, fender bender, cross collision, and rear-end collisions. The improvement design examples corresponding to each accident type are collected and organized, and the design example reference manuals compiled, to summarize the improvement operation process at the accident-prone intersections, apply the accident diagnostic procedures to organize usage method and application situation of various types of design examples to be used by the front-line traffic engineering workers.

### 3. Promotion of Outcomes and Benefits

(1) The improvement design examples of various accident types can be used by all levels of road Competent Authorities to accurately grasp the types of intersection accidents, discover the causes of accidents, after completing the characteristics analysis of accident-prone intersections, and propose effective improvement programs to improve the quality and efficiency of the accident-prone locations.

(2) In 2020, the IOT conducted regional education and training in North, Central, and South Regions, and invited the Central Government Agencies, all County and City Governments, and all engineering consulting companies to promote research results for applications by all sectors.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes



設計範例架構圖
Design Example Architecture Diagram
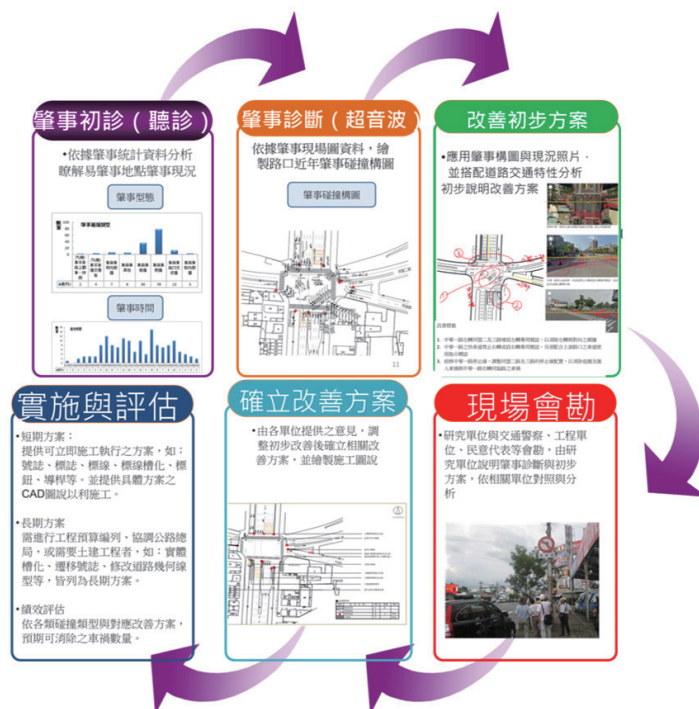


肇事診斷程序
Accident Diagnostic Procedure

## 5.研究成果報告

· 混合車流情境之機車交通安全工程設計方法研究驗證與推廣（107年6月出版）

· 混合車流情境路口交通工程設計範例（107年3月出版）

· 混合車流路口道路與交通工程設計範例（1/4）-非號誌化路口（107年11月出版）

· 混合車流路口道路與交通工程設計範例（2/4）-非號誌化路口（108年12月出版）

· 混合車流路口道路與交通工程設計範例（3/4）-非號誌化路口（109年10月出版）

· 事故型態導向之路口交通工程設計範例（110年7月出版）。

## 5. Report of Research Outcomes

· Typical Examples for Traffic Engineering Design in Mixed-Traffic Situation (Published in June 2018)

· Typical Examples for Traffic Engineering Design in Mixed-Traffic Situation (Published in March 2018)

· Typical Examples for road and Traffic Engineering Design in Mixed-Traffic Situation(1/4) (Published in November 2018)

· Typical Examples for road and Traffic Engineering Design in Mixed-Traffic Situation(2/4) (Published in December 2019)

· Typical Examples for road and Traffic Engineering Design in Mixed-Traffic Situation(3/4)-Unsignalized Intersection (Published in October 2020)

· Study on Traffic Engineering Safety Design Based on the Accident Types at Intersections (Published in July 2021)

## （二）路口俯視攝影技術於交通衝突分析之案例應用與比較

### 1.計畫概述

交通事故發生，輕者造成車損及交通阻塞，重者導致人員傷殘甚至喪失生命，使得家庭破碎，因此世界各國皆致力於新型道安防治技術的開發。本計畫為跨年計畫，106-107年測試運用交通衝突分析技術，並結合無人機空中拍攝、影像分析等新興技術的整合，108年將前述技術的整合成果應用於找出人車流衝突事件及熱區，建立高交通事故風險地點的診斷分析工具，109年將前述診斷分析工具應用於實地路口進行測試。該分析診斷工具的分析結果可供交通管理單位與道路設計者，評估交叉路口衝突或風險，俾能在交通事故發生前診斷出交通衝突問題，並做為研擬預防性交通改善之參考資訊，降低交通事故發生數及嚴重性。

### 2.研究成果

（1）本研究採用無人機進行交通觀測，充分運用無人機滯空拍攝無死角的優勢，提供影像分析最佳來源，同時針對無人機機型選擇、無人機任務現場作業標準程序等課題彙整成果。

（2）引進以1024 × 1024為輸入的YOLOv4模型，以增加小物件的資訊量，並引入最新的偵測架構，逐步強化深度學習領域的技術開發能力，以針對本案未來需求來修改架構需求。

（3）建立衝突型態分類與肇事型態的對應連結，由交通衝突分析之結果可引導至採用「事故型態導向之路口交通工程設計範例」，提出改善措施之建議。並探討4個案例路口的改善前、後分析，分析改善方案之執行及成效，以及是否尚有其他交通安全上的潛在問題。

### 3.成果推廣與效益

（1）本研究之衝突分析軟體主要能協助肇事診斷及初步改善方案，自動化的分析衝突事件及熱區圖，找出頻率及嚴重程度較高的衝突類型，協助交通工程師進行肇事診斷。

## (2) Case Application and Comparison of Intersection Overlook Videography Technology in Traffic Conflict Analysis

### 1. Project Overview

When a traffic accident occurs, a less severe one causes car damage and traffic congestion, while a severe one causes disability or even loss of life and broken family; therefore, countries all over the world are committed to the development of new road safety prevention and control technologies. This project is a project crossing over multiple years. From 2017 to 2018, the project tested the integration of emerging technologies with the use of traffic conflict analysis technology and combined with UAV aerial photography and image analysis. In 2019, the project applied the integration results of the aforementioned technologies to find out the conflict incidents between people and vehicles and hot spots to establish diagnostic analysis tools for high traffic accident risk locations. In 2020, the project applied the aforementioned diagnostic analysis tools in the field intersections for testing. The analysis results of this analysis and diagnosis tool can be used by the traffic management units and road designers to assess intersection conflicts or risks, so as to diagnose traffic conflicts before traffic accidents occur, and serve as reference information for the research and planning for the preventive traffic improvement to reduce the number and severity of traffic accidents.

### 2. Research Outcomes

(1) This study uses an Unmanned Aerial Vehicle to conduct traffic observation, makes full use of the advantages of Unmanned Aerial Vehicle Videography in the air without blind spots to provide the best source of image analysis, and summarizes the results for topics aiming at the Unmanned Aerial Vehicle model selection and Unmanned Aerial Vehicle mission field operation standard procedures.

(2) Introduced the YOLOv4 model with 1024 × 1024 input to increase the amount of information of small objects, and introduced the latest detection architecture to gradually strengthen the technology development capabilities in the field of deep learning to modify the architecture requirements for the future needs of this project.

(3) Established a corresponding link between the conflict type classification and the accident type, and the results of the traffic conflict analysis can be guided to adopt the "Accident Type-oriented Intersection Traffic Engineering Design Example" and propose the recommendations for improvement measures. It also discusses the pre- and post-improvement analysis for four case intersections, analyzes the implementation and effectiveness of the improvement program, and whether there are other potential traffic safety issues.

### 3. Promotion of Outcomes and Benefits

(1) The conflict analysis software of this study can mainly assist in the diagnosis of accidents and preliminary improvement programs, automatically analyze conflict events and heat maps to find out the conflict types with higher frequency and severity, and assist traffic engineers in the diagnosis of accidents.

（2）本研究軟體也適合用於實施與評估，透過改善前、改善後的衝突分析比較，能立刻評估出改善方案的成效，以及是否有使用者行為發生改變，導致事故風險轉移至其他型態的效應。

（3）109年11月9日辦理本案成果發表暨教育訓練講習會，宣導本計畫研究成果。

(2) The software of this study is also suitable for implementation and evaluation, and can immediately assess the effectiveness of the improvement program through the conflict analysis and comparison before and after improvement, and whether there is a change in user behavior that causes the effect of accident risk to be transferred to other types.

(3) Organized the Results Presentation and Education Training Seminar of this project on November 9, 2020, to publicize the research results of this project.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
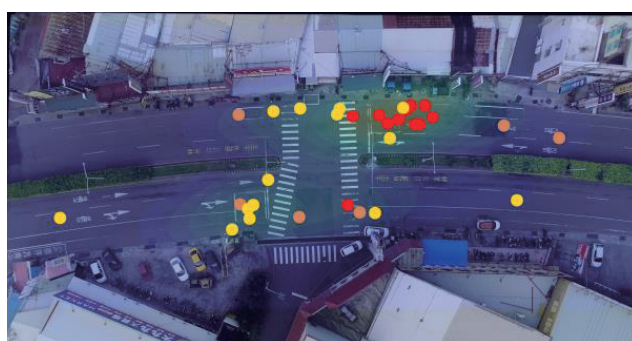


改善前



改善後

註（Note）：●瀕危風險(TTC<=1)、●高風險(1<TTC<=2)、●中風險(2<TTC<=3)、●低風險(3<TTC<=5)

4.2.1 案例路口交通工程改善前後熱點圖
Conflict Heat Map before and after the Improvement of the Traffic Engineering at the Intersection of this Case

## 5.研究成果報告

- 道路交通車流及事故風險偵測與分析工具之發展應用（108年11月出版）

- 路口無人機交通攝影及衝突分析技術開發（109年7月出版）

- 路口俯視攝影技術於交通衝突分析之案例應用與比較（110年7月出版）。

## 5. Report of Research Outcomes

- Development and Application of the Road Traffic Flow and Accident Risk Detection and Analysis Tools (Published in November 2019)

- Development of Traffic Collision Analysis Technology using UAV Aerial Videography at Intersections (Published in July 2020)

- Case Application and Comparison of Intersection Overlook Videography Technology in Traffic Conflict Analysis (Published in July 2021)

## （三） 探討道路交通標線之防滑特性

### 1.計畫概述

本研究目的在探討道路交通標線之防滑特性，特別針對道路主管機關近年來試辦抗滑能力65BPN以上之標線，透過現地標線抗滑能力試驗及實驗室標線加速磨耗試驗進行監測及分析，以瞭解其抗滑能力衰退幅度且能否長期維持一定的抗滑能力，作為後續交通部調整標線抗滑能力規範，以及道路主管機關推廣繪設65BPN標線之參考。

### 2.研究成果

（1）現地試驗選擇臺北市、新北市、臺中市及公路總局共101個道路標線試驗位置，進行連續5個月追蹤試驗。由於現地試驗受限於標線劃設品質不一及現場環境變數過多（如油污、落塵等）試驗數據顯示並無明確的關聯性。

（2）實驗室則參考美國佛羅里達州的試驗規範 FM5-622，並運用三輪式旋轉磨耗儀進行標線加速磨耗試驗。試驗結果發現絕大多數的標線在前期磨耗階段，抗滑能力均大幅下降近8-10BPN左右；中後期抗滑能力則下降幅度不大，可能因標線內含的抗滑粒料支撐後續的抗滑能力。此外，標線表面若產生水膜，抗滑能力則大約會降低一至兩成。

### 3.成果推廣與效益

（1）本研究透過現地及實驗室試驗，探討65BPN標線之抗滑能力衰退情形之研究成果，可提供交通部後續修正交通工程規範之標線抗滑規定之參據，以減少機車等車輛行駛於標線發生打滑，而導致交通事故情形。

（2）研究成果可提供道路管養機關，用以提升後續標線繪設及養護之作為及品質。此外，本研究所建立追蹤標線抗滑能力衰退之研究方法，後續可提供其他類似研究議題之參考引用。

## (3) A Study on Skid Resistance in Pavement Marking Materials

### 1. Project Overview

The objective of this study was to explore the skid resistance of the thermoplastic pavement marking materials, especially aiming at the trail testing sites where the pavement markings were more than 65BPN or above in recent years. The research scope was to monitor and analyze the skid resistance of pavement marking materials through the field and laboratory testing in order to evaluate their loss of skid resistance and long term durability. The research outcomes serve the reference for the Ministry of Transportation and Communications to adjust the skid resistance specifications of pavement markings materials subsequently, as well as for the road agencies as posed to installing pavement marking materials with 65BPN or above.
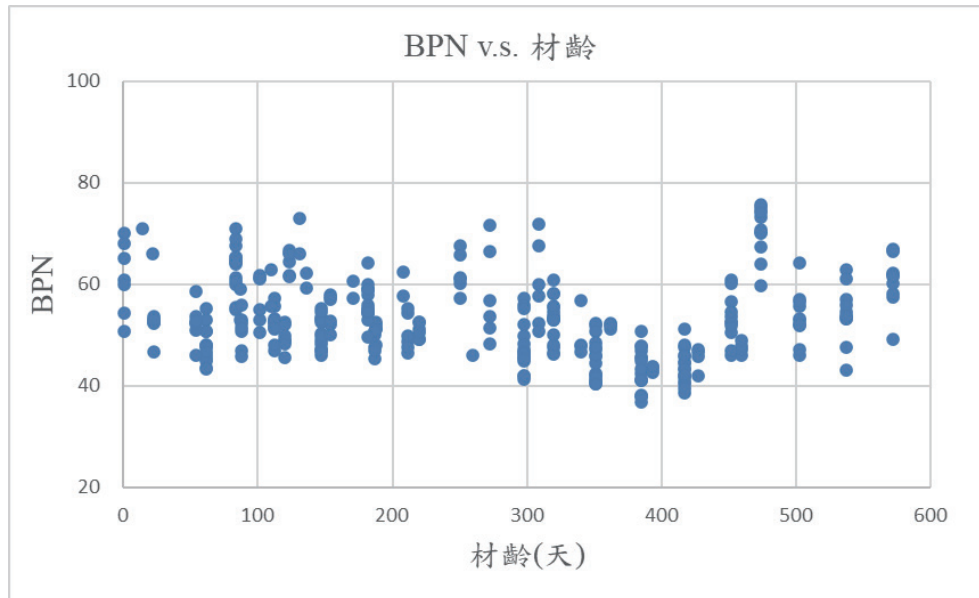
### 2. Research Outcomes

(1) A total of 101 field test locations in Taipei City, New Taipei City, Taichung City and the Directorate General of Highways were selected for the field testing, and to conduct British Pendulum Test in accordance with ASTM E303 during five consecutive months. The analysis unveiled that the field test was limited by the uneven quality of pavement marking materials and the excessive environment variables (such as oil contaminations and dusts). Hence, the testing data showed that there was no clear correlation.

(2) The laboratory test took the reference of the Florida Test Method FM5-622 and utilized the Wheel-Tracking Polishing Device to conduct the accelerated polishing test for the pavement marking materials. The test results found that the skid resistance of most of the markings decreased significantly by about 8-10BPN in the early polishing stage; on the other hand, the skid resistance of the middle and late stages did not decrease much. The possible reason would be that the thermoplastic pavement materials contain certain ingredient that would support the middle and late stage of skid resistance. In addition, it was also found that the existence of thin water film reduced the skid resistance of pavement marking materials at most about ten to twenty percent.

### 3. Promotion of Outcomes and Benefits

(1) This study explores the loss of the skid resistance of the 65BPN thermoplastic pavement marking through field and laboratory tests. The research outcomes provide the reference for the follow-up revision of the Traffic Engineering Specifications of the Ministry of Transportation and Communications and reduce the possibilities motorcycle and other vehicles sliding over the pavement marking materials, which resulted in traffic accidents.

(2) The research results deliver a practical testing method to evaluate the long term performance of the pavement marking materials for road agencies' strategies to improve the installation and maintenance tasks. Furthermore, this testing method of evaluating loss in skid resistance established by this study serve a practical evaluating method for other similar research topics in the future.

## 4.研究成果精華摘整

「65BPN 標線」現地試驗 BPN 值與材齡之散佈圖
Scatter Diagram of the "65BPN Marking" Field Test BPN Value and Age of the Material



加速磨耗實驗之三輪式旋轉磨耗儀
Wheel-Tracking Polishing Device of the Accelerated Polishing Test

## 5.研究成果報告

· 探討道路交通標線之防滑特性（110年7月出版）。

## 5. Report of Research Outcomes

· A Study on Skid Resistance in Pavement Marking Materials (Published in July 2021)

## （四）鐵路安全管理系統之推動

### 1.計畫概述

107年10月21日臺鐵普悠瑪出軌事故，造成旅客多人死傷，是近30年來死傷最慘重事故，行政院針對臺鐵總體檢指示臺鐵局推行安全管理系統（Safety Management System, SMS）。

為使國內鐵路營運單位發揮預防事故發生之功效，本所參考歐盟及各國鐵道SMS之理論與實務，並於107年深入研究適用國內鐵道業界的SMS機制。此外，依據立法院108年度總預算案決議，業於108年6月至109年5月辦理「推動鐵道行車安全保證機制之研析」案，協助臺鐵局強化其內部安全稽核審查及評估、變革管理作業與持續改進SMS等。

### 2.研究成果

（1）規劃我國鐵路運輸SMS應涵蓋12要項，並提出落實國內鐵路營運機構SMS之方向與策略，例如提出可供管理營運機構落實SMS之指引及檢核表。

（2）提出鐵道行車安全保證之審查與評估作法，並訂定「變革管理」的程序、相關作業之實務操作指引及其教育訓練教材（含案例），提供鐵路營運機構發揮安全保證功能之措施。

### 3.成果推廣與效益

（1）臺鐵局參考本所建議之鐵路安全管理系統12要項，發展合用之安全管理系統（SMS），並依臺鐵總體檢委員會建議，於107年12月11日成立專責安全部門「營運安全處」，負責推動SMS。臺鐵局參考本所建議，持續精進SMS。

（2）鐵道局參考本所研究成果，將建置SMS之要求，納入鐵路法及鐵路行車規則修正草案中，強化監理鐵道營運系統。

## (4) Promoting Railway Safety Management System

### 1. Project Overview

The derailment accident of Taiwan Railway Puyuma Express on October 21, 2018 caused many deaths and injuries to passengers. It was the most tragic accident of the past 30 years. The Executive Yuan instructed the Taiwan Railway Administration to implement a Safety Management System (SMS) aiming at the Taiwan Railway Overall Inspection.

In order to enable domestic railway operation units to elaborate the efficacy of preventing accidents, the IOT refers to the theory and practice of SMS in the European Union and other countries' railways, and conducted in-depth research on SMS mechanisms suitable to the domestic railway industry in 2018. Furthermore, in accordance with the Legislative Yuan's 2019 general budget resolution, the case of "Research and Analysis of Promoting Railway Safety Assurance Mechanism" was conducted from June 2019 to May 2020, to assist the Taiwan Railway Administration in strengthening its internal safety audit review and evaluation, changing the management operation and continuing to improve the SMS, etc.
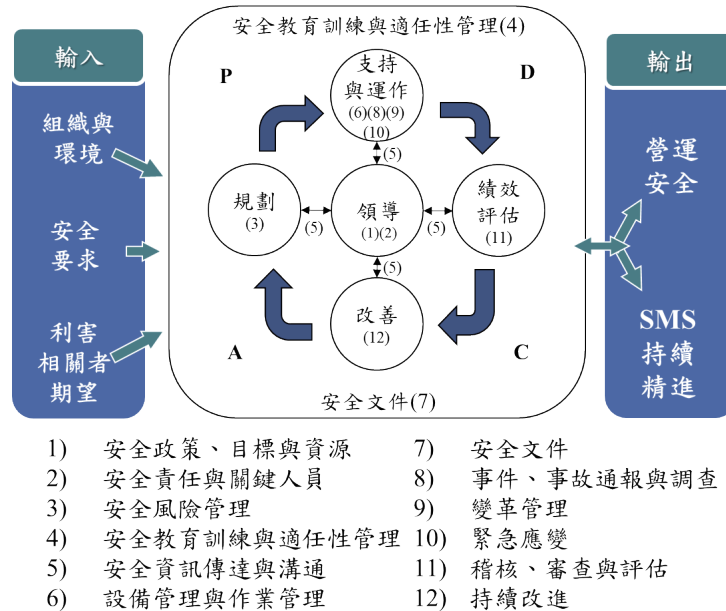
### 2. Research Outcomes

(1) The planning of our country's railway transportation SMS shall cover 12 key points, and propose the directions and strategies to implement the SMS for domestic railway operation organizations, for example, proposing guidelines and checklists for the implementation of SMS by the management operation organizations.

(2) Propose methods for review and evaluation of railway safety assurance, and formulate procedures for "Change Management," practical operation guidelines for related operations and the educational training materials (including cases), to provide measures for the railway operation organizations to elaborate the safety assurance functions.

### 3. Promotion of Outcomes and Benefits

(1) The Taiwan Railway Administration has developed a suitable Safety Management System (SMS) with reference to the 12 key items of the Railway Safety Management System recommended by the IOT, and established a dedicated safety department "Operation Safety Division" in accordance with the recommendations by the Taiwan Railways Comprehensive Inspection Committee on December 11, 2018, responsible for promoting SMS. The Taiwan Railway Administration refers to the recommendations of IOT, keeps improving SMS.

(2) With reference to the research results of the IOT, the Railway Bureau incorporates the requirements of establishing SMS into the draft amendments to the Railway Act and Railway Train-Control Rules to strengthen the supervision of the railway operation system.

## 4.研究成果精華摘整

| | |
|---|---|
| 1) 安全政策、目標與資源 | 7) 安全文件 |
| 2) 安全責任與關鍵人員 | 8) 事件、事故通報與調查 |
| 3) 安全風險管理 | 9) 變革管理 |
| 4) 安全教育訓練與適任性管理 | 10) 緊急應變 |
| 5) 安全資訊傳達與溝通 | 11) 稽核、審查與評估 |
| 6) 設備管理與作業管理 | 12) 持續改進 |

我國鐵道安全管理系統整體架構及其 12 要項
The Overall Structure of our Country's Railway Safety Management System and its 12 Key Items
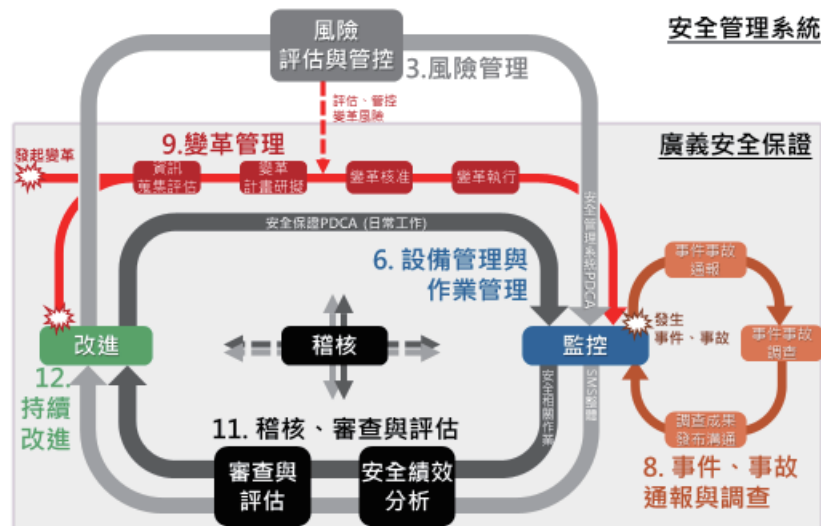


我國鐵道 SMS 與安全保證架構
Our Country Railway SMS and Safety Assurance Structure

## 5.研究成果報告

· 鐵路運輸安全管理系統（SMS）制度化策略之研擬（108年8月出版）。

· 推動鐵道行車安全保證機制之研析（109年10月出版）。

## 5. Report of Research Outcomes

· A Study in Railway Safety Management System – the Development of Strategies for Building the Mechanism (Published in August 2019)

· A Study on Railway Safety Assurance Mechanism Promotion (Published in October 2020)

## （五）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之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，已列為交通部每年提昇道路安全之首要工作。

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，並委由本所自民國69年開始辦理第1期計畫，至109年已完成38期，並持續辦理報告研提及執行，第39期計畫，交通部已於110年1月13日核定啟動執行。

本計畫主要係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，另結合本所「事故型態導向之路口交通工程設計範例之研究」，針對交通部及縣市政府所屬各級道路交通管理單位、各交通工程顧問公司有關交通工程從業人員為對象，進行易肇事路段改善技術方法提升的教育訓練。本計畫同時邀集交通部、內政部警政署、各縣市政府警察局、交通部公路總局、各縣市政府交通管理單位對於易肇事地點進行會勘，研議改善方式。

### 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

本計畫以106年（第35期）易肇事地點改善計畫之改善地點共計76處為例，其改善前之年肇事（105年）件數合計1,055件、死亡4人、受傷1,424人，改善工程完成後之年肇事（108年）件數959件、死亡0人、受傷1,161人，故改善前後之績效顯示，死亡人數減少4人、受傷人數減少435人，並歸納肇事件數減少9.1％、死亡人數減少100％、受傷人數減少18.47％。

## (5) Improvement Plan for the Road Sections Prone to Accidents

### 1. Project Overview

With the development of our Country's economy, the use of land around roads and industrial activities has continued to change over time, and road construction, traffic conditions and traffic flow have also continued to be in transition. Therefore, in order to respond to changes in the road environment and traffic conditions, and to effectively reduce the number of possible traffic accidents, to maintain road safety and to effectively, continuously improve road traffic facilities, it has been listed as the top priority work of the Ministry of Transportation and Communications to improve road safety every year.

This project is based on the "Road Traffic Order and Traffic Safety Improvement Program" approved by the Executive Yuan, which is listed by the Ministry of Transportation and Communications as a long-term task, and was entrusted to the IOT to manage the 1st project in 1980, which has completed 38 projects by 2020, and continues to conduct the report research proposal and implementation. The 39th project was approved to start implementation by the Ministry of Transportation and Communications on January 13, 2021.

This project is mainly aimed at the accident-prone road sections within the jurisdiction of each County and City Government as the scope of improvement. Starting from the 37th project, the Ministry of Transportation and Communications has invested in relevant subsidy funding mechanisms to guide the improvement, and combined with the IOT's "Research of the Accident Type-oriented Intersection Traffic Engineering Design Examples," targeting the traffic engineering works from all levels of Road Traffic Management Units under the Ministry of Transportation and Communications, County and City Governments, and traffic engineering consulting companies to conduct the enhancing education and training on the improvement technical methods for the accident-prone road sections. The project also invites the Ministry of Transportation and Communications, the National Police Agency of the Ministry of the Interior, the Police Departments of each County and City Government, the Directorate General of Highways of the Ministry of Transportation and Communications, and the Traffic Management Units of the County and City Governments to conduct joint inspections on the accident-prone locations to discuss the way of improvement.

### 2. Research Outcomes

(1) Completed the collection of data on road traffic accidents in Taiwan over the years, and analyzed the number of accidents, the number of deaths and injuries on the accident-prone road sections.

(2) Completed the field joint inspections of the accident-prone road sections, and proposed the improvement program, consolidated into the report and submitted to the Ministry for approval, and sent to various Road Competent Authorities for implementation.

### 3. Promotion of Outcomes and Benefits

This project takes the 2017 (35th project) accident-prone locations of the Project for Improving Accident-

Prone Locations with a total of 76 locations as an example. The total number of accidents in the year (2016) before the improvement was 1,055 with 4 deaths and 1,424 injuries. After the completion of the improvement project, the number of accidents in the year (2019) was 959 with 0 deaths and 1,161 injuries; therefore, the performance before and after the improvement showed that the number of deaths decreased by 4, the number of injuries decreased by 435, and the concluded number of incidents decreased by 9.1%, the number of deaths decreased by 100% and the number of injuries decreased by 18.47%.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
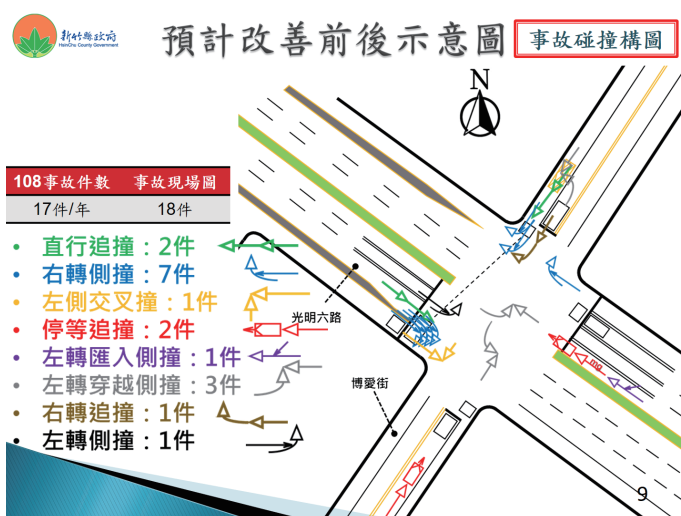


易肇事路段肇因分析技術 - 事故碰撞構圖
Cause Analysis Technology for Accident-Prone Road Sections – Accident Collision Composition Diagram



第 38 期臺灣地區易肇事路段改善計畫路口
The 38th Project for Improving Accident-Prone Locations in the Taiwan Area

## 5.研究成果報告

· 第38期臺灣地區易肇事路段改善計畫（110年7月出版）。

## 5. Report of Research Outcomes

· The 38th Project for Improving Accident-Prone Locations in the Taiwan Area (Published in July 2021)

# 四、 公路客貨運輸創新研究與應用

## （一）公共運輸縫隙掃描決策支援系統之維運、功能強化及教育訓練

### 1.計畫概述

為協助地方政府快速瞭解轄管地區之公車服務缺口狀況及評估運輸資源配置調整之影響，本所自101年起將交通部公路總局及各縣市公車動態資訊系統資料庫，結合地理資訊系統、人口分布資料及公車營運資料等進行加值應用，研發「公共運輸縫隙掃描決策支援系統」；系統可產製相關評估指標值及分析圖表，具有協助交通主管機關進行公車路網規劃之決策支援功能，可克服過去因相關資訊不足只能仰賴經驗法則所導致的管理盲點，使公車服務供給更符合民眾需求。本系統除供本所及交通部公路總局相關業務應用外，本所於103年11月起公告無償授權交通主管機關使用，截至109年已有19個縣市政府及6個區域運輸發展研究中心向本所申請授權使用。為利110年起將本系統維運工作移轉交通部公路總局負責，本所於108-109年進行本系統之維運、功能強化及教育訓練工作。

### 2.研究成果

（1）更新系統資料庫內容。

（2）強化系統功能：

 a.提升系統運算效能，縮短系統產製相關分析圖表所需時間。

 b.精進系統之畫面呈現與操作介面。

 c.精進服務涵蓋率分析功能、可及性分析功能、移動性分析功能、新闢路線/站位及調整路線/站位之評估功能、應用成效填報功能。

 d.增加系統後臺統計功能。

（3）提供技術諮詢服務與教育訓練。

（4）依系統最新功能架構編撰操作手冊。

（5）完備系統移轉公路總局所需相關工作。

# IV. Creative Research and Application on Highway Passenger and Cargo Transportation

## (1) Maintenance, Functional Enhancement and Education Training of the Decision Support System for the Scanning of Public Transit Service Gaps

### 1. Project Overview

In order to help local governments quickly understand the bus service gaps in their jurisdictions and assess the impact of adjustments in the allocation of transportation resources, The Institute of Transportation (IOT), MOTC has developed a "Decision Support System for the Scanning of Public Transit Service Gaps"(DSS) since 2012, which integrates the Real-Time Bus Information System Databases of the Directorate General of Highways (DGH), MOTC and all Counties and Cities with GIS, population distribution, bus operation data to carry out value-added applications. DSS has the decision support function to assist the transportation competent authorities in the planning of the bus route network by offering relevant evaluation index data and analysis charts, which can overcome the management blind spots caused by the lack of relevant information and can only rely on the rules of experience in the past, so that the supply of bus services can be more in line with the needs of people. In addition to providing DSS to IOT and DGH for relevant business applications, IOT has announced the authorization of free using DSS for the transportation competent authorities starting November 2014. By the end of 2020, there are 19 County and City Governments and 6 Regional Transportation Development Research Centers which have applied for the authorization of using DSS from IOT. In order to transfer the maintenance work of DSS to DGH since2021,IOT carried out the maintenance, functional enhancement, and education training tasks of DSS from 2019 to 2020.

### 2. Research Outcomes

(1) Update the database content of DSS.

(2) Strengthen the functions of DSS:

 a. Enhance the computing performance of the system and shorten the time required for the system to produce relevant analysis charts.

 b. Improve the screen presentation and operation interface of the system.

 c. Improve the service coverage analysis function, accessibility analysis function, mobility analysis function, evaluation function of adding and adjusting bus routes/stops, and reporting function of system application outcomes.

 d. Increase the system background statistics function of DSS.

(3) Provide technical consulting services and education training.

(4) Compile operation manuals based on the latest functional architecture of DSS.

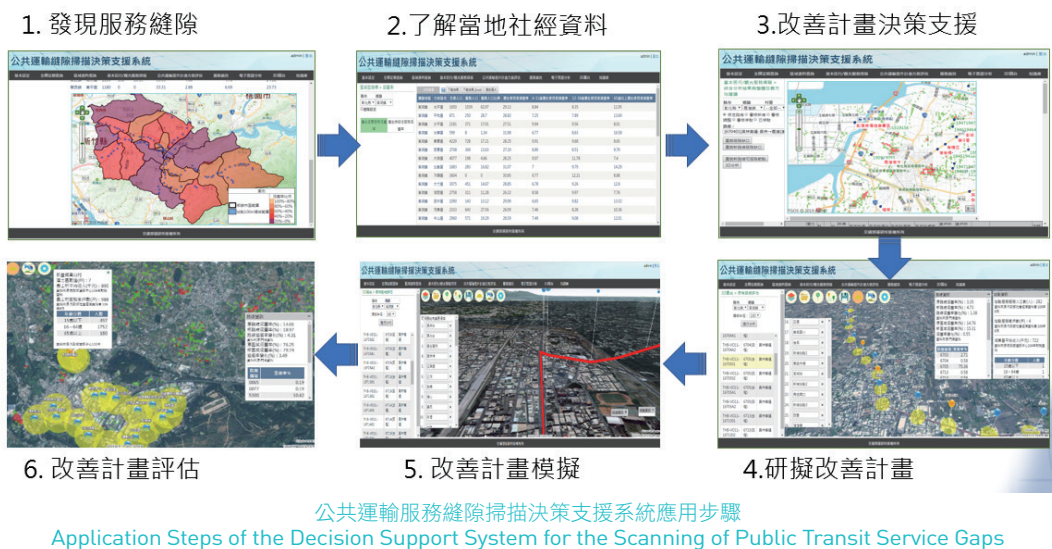(5) Complete the relevant work required for transferring DSS to DGH.

## 3.成果推廣與效益

（1）109年11月辦理6場次教育訓練，協助系統使用者（中央與地方交通主管機關人員以及6個區域運輸發展研究中心人員）熟悉如何操作本系統，以利應用於檢核公車路網服務缺口及評估改善方案之成效。

（2）109年12月10-11日參加2020臺灣地理資訊學會年會暨學術研討會發表論文並進行系統展示。

（3）109年新增二縣市申請授權使用本系統。

## 4.研究成果精華摘整

## 3. Promotion of Outcomes and Benefits

(1) Organized six sessions of education training in November 2020, to assist DSS users (personnel from the central and local transportation competent authorities and from six Regional Transportation Development Research Centers) to familiarize themselves with how to operate DSS in order to apply it to check the service gaps of bus route networks and evaluate the effectiveness of the improvement program.

(2) Participated in the 2020 Taiwan Geographic Information Society Annual Meeting and Academic Seminar on December 10–11, 2020 to publish a paper and demonstrate DSS.

(3) In 2020, two county and city governments were added in the list of applying for authorization of using DSS.

## 4. Summary of Research Outcomes



1. 發現服務縫隙　　2.了解當地社經資料　　3.改善計畫決策支援

6. 改善計畫評估　　5. 改善計畫模擬　　4.研擬改善計畫

公共運輸服務縫隙掃描決策支援系統應用步驟
Application Steps of the Decision Support System for the Scanning of Public Transit Service Gaps

## 5.研究成果報告

· 公共運輸縫隙掃描決策支援系統之維運、功能強化及教育訓練（1/2）（110年7月出版）

· 公共運輸縫隙掃描決策支援系統之維運、功能強化及教育訓練（2/2）（110年10月出版）

## 5. Report of Research Outcomes

· Maintenance, Functional Enhancement and Education Training of the Decision Support System for the Scanning of Public Transit Service Gaps (1/2) (Published in July 2021)

· Maintenance, Functional Enhancement and Education Training of the Decision Support System for the Scanning of Public Transit Service Gaps (2/2) (Published in October 2021)

## （二）公共運輸供需契合與轉乘縫隙之研究─以鐵、公路轉乘為例

### 1.計畫概述

公車路線之規劃有在地之考量，如通勤、通學等需求，導致行經臺鐵車站之公車路線非完全可配合轉乘。進一步與業界、主管機關等單位進行座談後，得知受限於駕駛員工時與混合調度排班等因素，班次無法大幅度調整，僅能以數分鐘為單位進行微調。另為提昇可靠度而推動之班次準點率相關規定，反而可能造成班車無法彈性調派，而可能使誤點之班次旅客轉乘產生問題。

另在公車路線特性上，部分地區之路線行經複數個軌道車站，如針對其中一站調整班次時間，將產生「牽一髮而動全身」之效果，導致後續車站可能產生更大的時間縫隙。而如公車路線非始發站者，可能因道路狀況等因素，導致公車無法如時刻表所訂準時到站，將造成班次無法銜接轉乘的狀況。不論是靜態的針對時刻表調整，或針對班次即時狀況進行機動發車的動態調整，依據公車路線狀況不同，皆有諸多條件需要考量。而營運單位的條件限制，將使時間縫隙狀況變得更為複雜。

爰此，如為提昇旅客轉乘品質，縮短轉乘時間縫隙，在供給端有限條件之狀況下，必須進一步分析旅客之細部需求，輔以現有盤點行經軌道車站公車路線之成果，方能統整公車服務路網並推測實際轉乘需求。另透過電子票證之分析，亦可進一步釐清旅客進出站後之實際轉乘方向，及各時段之潛在需求。

綜上，為進一步使公共運輸轉乘時間無縫，符合旅客運輸需求，本計畫於現有「鐵、公路轉乘無縫運輸檢核系統」之基礎上，優化系統功能，並透過分析現有電子票證資料，分析不同時段、不同地域之旅客屬性，瞭解旅客確實之旅運需求，同時運用系統之檢核結果，給予相關單位公車路線班次時間調整之建議，以達無縫銜接轉乘以及節能減碳之效。

## (2) Transfer Time Gap Evaluation and Enhancement Mechanism for Train and Bus Transfers

### 1. Project Overview

The planning of bus route has local considerations, such as needs of commuting to work, commuting to school, which results in the bus routes passing through the Taiwan Railway Station not being fully cooperated with transfers. After further discussions with the industry operators, the Competent Authorities and other Units, it was understood that due to factors of drivers and mixed scheduling, the number of runs of scheduled buses cannot be adjusted significantly, and can only be adjusted by minutes. In addition, the relevant regulations on punctuality of the number of runs of scheduled buses promoted by improving reliability may make the bus unable to be flexibly scheduled, which may cause problems for passengers transferring due to the delayed bus schedules.

In addition, in terms of the characteristics of bus routes, routes in some areas pass through multiple rail stations. If the bus schedule is adjusted for one station, it will have the effect of "to pull one hair and the whole body is affected," resulting in larger time gaps in subsequent stations. If the bus route is not the departure station, the bus may not arrive at the station on time as specified in the timetable due to road conditions and other factors, which will result in the situation where the scheduled bus cannot be connected for transfer. Whether it is a static adjustment to the timetable, or a dynamic adjustment of the bus departure by the real-time status of the scheduled buses, there are many conditions that need to be considered depending on different situations of the bus route, and the condition limit of the operating unit will make the time gap situation more complicated.

Therefore, in order to improve the quality of passenger transfers and shorten the transfer time gap, under the condition of limited supply end, the detailed needs of passengers must be further analyzed, supplemented by the results of the existing inventory of bus routes passing through rail stations in order to integrate the bus service route network to estimate the actual transfer demand. In addition, the analysis of electronic stored value cards can further clarify the actual transfer direction of passengers after entering and exiting the station, and the potential demand at each time period.

In summary, in order to further make the transfer time of public transportation seamless and meet the needs of passenger transportation, this project is based on the current "Evaluation System of the Railway and Bus Seamless Transportation," to optimize the system functions, and analyze the attributes of passengers in different time periods and different regions through the analysis of the existing electronic stored value cards data, to understand the actual travel needs of passengers, and use the system's evaluation results to provide recommendations to the relevant units on the adjustment of bus route schedules, so as to achieve the effect of seamless connection transfer as well as energy conservation and carbon reduction.

### 2. Research Outcomes

## 2.研究成果

（1）本研究班次實際調整成果顯示，在民眾可接受轉乘時間條件下，媒合更多的鐵道班次數，及服務更多轉乘民眾之需求，以拓展運輸可及性。

（2）本研究依臺鐵彰化站實際增加轉乘人數效益16%進行碳排放量效益計算，結果發現臺鐵一等車站每年可降低6,496餘噸的碳排放量，並節省約37萬美元之碳金價格。

（3）針對彰化地區5個知名觀光熱點進行旅次鏈型（含去返程與遊玩時間）的時間縫隙進行評估，若觀光客透過搭乘臺鐵至彰化車站後，再轉乘當地公車至5個觀光景點，雖有2條客運班次路線可達到A級服務水準（時間縫隙低於10分鐘），然而絕大多數主要班次屬於C、D級的服務水準（時間縫隙介於20至59分鐘與60分鐘以上），仍有相當的改善空間與價值。

（4）透過鐵、公路轉乘無縫運輸檢核系統新增之功能，降低業者排班所需時間，同時並提供相對客觀之鐵公路縫隙指標，供其進行參考與比對；同時透過PTX即時鐵道資訊，再以郵件形式通知業者，針對誤點之客運班次進行鐵道誤點因應策略，以達到快速反應之效果。

## 3.成果推廣與效益

（1）本研究於計畫期間內於逢甲大學舉行1場教育訓練，並針對自動介接班表、時間縫隙評估、縫隙差異警示與主動發信通知等新增功能，以情境範例式的模式進行教育訓練，共計有8家客運業者出席，並針對第一線實際需求提出相關意見與建議，做為本計畫改善之目標。

（2）彰化客運以本計畫提出之轉乘班次建議為基準，經內部評估後執行調整班次作業，並於109年9月1日起調整8路線18班次之發車時間，初步電子票證資料分析中得知，改善前後實際於彰化車站上車之人數增長約16%，有助於提升大眾運輸整體使用效率。

(1) The actual adjustment results of the number of runs of scheduled buses in this study show that under the condition that people can accept the transfer time, a greater number of runs of scheduled trains can be matched and serve the needs of more people in transfer to expand accessibility of transportation.

(2) This study calculated the carbon emissions benefit based on the 16% benefit of actually increasing the number of transfers at the Changhua Station of Taiwan Railways. The results found that the first-class station of Taiwan Railways can reduce carbon emissions by more than 6,496 tons per year and save approximately US$370,000 of carbon credit value.

(3) Evaluate the time gap of trip chain type (including travel time and play time) for five well-known tourist hotspots in Changhua area. If tourists take the Taiwan Railway to Changhua Station, then transfer to local buses to five tourist attractions, although there are two passenger transportation scheduled bus routes that can reach the A-level service standard (the time gap is less than 10 minutes), most of the main scheduled buses are C- and D-level service standards (the time gap is between 20 to 59 minutes and more than 60 minutes, respectively), there is still considerable room and value for improvement.

(4) Through the newly added functions of the "Evaluation System of the Railway and Bus Seamless Transportation," the time required for scheduling by the carriers is reduced, and the relatively objective indicator of the gap between railways and buses is provided at the same time, for their reference and comparison; meanwhile, go through PTX Real-time railway information, and then notify the carriers in the form of e-mail, to implement the railway delay response strategies for the delayed passenger transportation scheduled buses, to achieve the effect of rapid response.

## 3. Promotion of Outcomes and Benefits

(1) During the project period, this study organized one session of education and training at the Feng Chia University, and aims at new functions of auto connection schedule, time gap evaluation, gap difference warning, and active mail notification, etc., using the situational model to conduct education and training, with a total of eight passenger transportation carriers attended, and put forward relevant opinions and suggestions for the actual needs of the first line, as the goal of the improvement of this project.

(2) Chang Hua Bus is based on the recommendations of transfer schedules proposed by this project, to implement bus schedule adjustments through internal evaluation, and adjust the departure time for 8 routes and 18 scheduled buses starting September 1, 2020. According to the preliminary analysis of electronic stored value cards data, it is known that the number of people actually boarding at Changhua Station before and after the improvement increased by about 16%, which is helpful in improving the overall efficiency of public transportation.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes



鐵、公路轉乘無縫運輸檢核系統實際功能示意
The Actual Function Diagram of the Evaluation System of the Railway and Bus Seamless Transportation
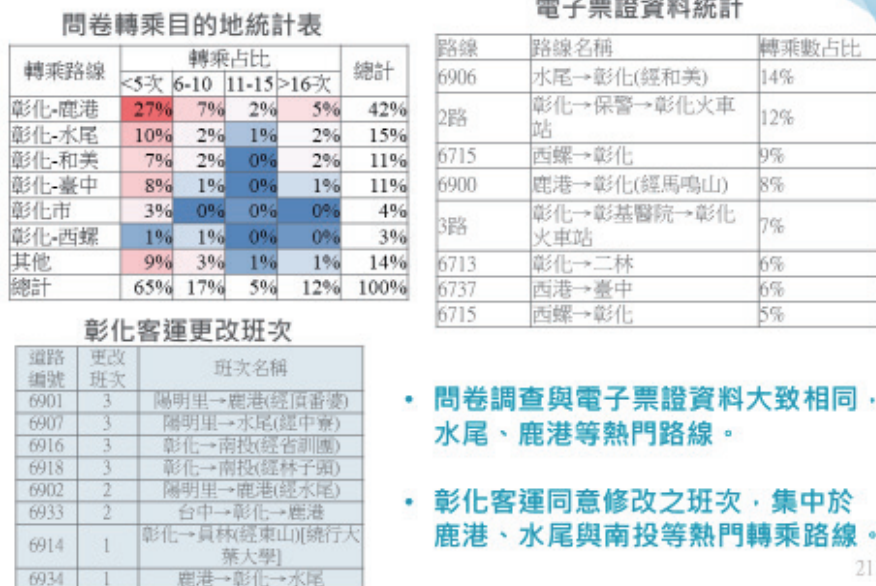


鐵、公路轉乘班次調整實作成果示意
The Implementation Results Diagram of the Railway and Bus Transfer Schedule Practices

## 5.研究成果報告

· 公共運輸供需契合與轉乘縫隙之研究—以鐵、公路轉乘為例 （110年7月出版）

## 5. Report of Research Outcomes

· Transfer Time Gap Evaluation and Enhancement Mechanism for Train and Bus Transfers (Published in July 2021)

## （三）汽車客運業路線別成本計算制度 應用軟體更新及維護運作計畫

### 1.計畫概述

　　汽車客運業路線別成本計算制度（以下簡稱「本制度」）於89年7月1日起正式實施，同時間配合該制度之實施，本所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」），其後於91年12月完成第2版更新，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。

　　近年來陸續有業者反映因電腦作業系統更新，以致本應用軟體運作異常，交通部公路總局函請本所協助辦理更新作業，本計畫即配合目前電腦作業系統作業環境更新本應用軟體至第4版，以達到原本功能之正常運作，軟體更新後並針對汽車客運業者及主管機關進行教育訓練課程，協助落實汽車客運業路線別成本計算制度之執行，以提升路線經營效能。

### 2.研究成果

（1）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）更新，使其相容於現有電腦作業系統環境。

（2）完成新軟體操作手冊及教育訓練，提升客運業者及主管機關操作軟體效能。

### 3.成果推廣與效益

（1）本計畫於109年10月20日至23日期間，共舉辦7場軟體實作教育訓練，邀請客運業者及主管機關，共計108個單位，其中參與客運業者共計61人，主管機關共計23人，實體課程成果推廣率達78%，另並將軟體及使用手冊放置網路上供使用者下載及參考，並持續提供諮詢服務。

（2）提供客運業者分析及陳報路線別成本資訊，以提升經營管理效能。

（3）提供主管機關掌握客運路線別成本資訊，做為補貼或費率審議之參考，提高資源分配運用之效能。

## (3) Routed-based Costing System for Motor Carrier Industry Application Software Upgrade and Maintenance Operation Project

### 1. Project Overview

The route-specific cost calculation system for the automobile passenger transportation industry (hereinafter referred to as the "system") was formally implemented on July 1, 2000. At the same time, in coordination with the implementation of the system, the IOT developed and completed the application software for the route-specific cost calculation system for the bus passenger transportation carriers (including the bus passenger transportation carrier end and the competent authorities end, hereinafter combined and abbreviated as "this Application Software"). The second edition update was completed in December 2002, and the software was updated again to the third edition in December 2007 to provide the carriers and competent authority agencies to conduct agency cost calculation analysis and report use.

In recent years, there were carriers who reported abnormalities in the operation of this application software due to computer operating system updates. The Directorate General of Highways of the Ministry of Transportation and Communications has requested the IOT to assist in the update operation. This project is to cooperate with the operating environment of the existing computer operating system to update this application software to Edition 4 to achieve the normal operation of the original functions. After the software is updated, aiming at the bus passenger transportation carriers and the competent authorities to conduct education and training courses to assist in implementing the execution of the route-specific cost calculation system for the bus passenger transportation carriers, to improve the efficiency of route operation.

### 2. Research Outcomes

(1) Complete the update of the application software for the route-specific cost calculation system for the bus passenger transportation carriers (including the bus passenger transportation carrier end and the competent authority end) to make it compatible with the existing computer operating system environment.

(2) Complete the new software operation manuals and education training to improve the efficiency of operating software by the bus passenger transportation carriers and the competent authorities.

### 3. Promotion of Outcomes and Benefits

(1) During the period from October 20th to 23rd, 2020, this project organized a total of seven sessions of software practice education and training, invited a total of 108 Units from the bus passenger transportation carriers and competent authorities, of which a total of 61 participants were from bus passenger carriers, and 23 from the competent authorities. The promotion rate of the physical course results reached 78%, and the software and user manual were placed on the internet for users to download and make reference, IOT also continued to provide consulting services.

(2) Provide the information for the bus passenger transportation carriers to analyze and report the route-specific cost to improve the operation and management efficiency.

〔3〕Provide the competent authorities with information to grasp the route-specific cost of the bus passenger transportation, as the reference for the review of subsidies or rates, and improve the efficiency of resource allocation and utilization.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
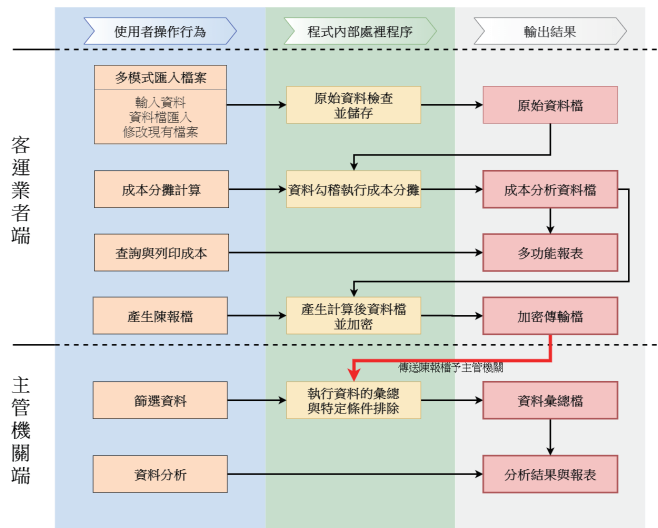


汽車客運業路線別成本計算制度應用軟體系統架構圖
The Architecture Diagram of the Application Software System for the Route-specific Cost Calculation System for the Bus Passenger Transportation Carriers



教育訓練實況
Education and Training

| 類　別 | 項　目 | 第3版以前 | 本計畫開發升級第4版 |
|---|---|---|---|
| 使用者介面重構 | 畫面重構 | 舊版畫面不知支援高解析度顯示器與視窗縮放，字體大小9px | 軟體外觀翻新，支援多解析度顯示與視窗縮放功能，字體放大至12px |
| | 視窗解析度調整 | 大部分頁面視窗鎖定800*600解析度 | 所有頁面支援 1024*768 到 1920*1080 解析度視窗，使用者可依自身需求調整 |
| | 資料輸入流程 | 具有錯誤提示、新增存儲刪除機制 | 將新增存儲按鈕獨立建置、並對必須資料進行特別註明 |
| | 資料輸入自動化 | 新增項目時自動補0 | 對於欄位如未填寫自動補0 |
| | 車牌號碼限制 | 6碼車牌號碼限制 | 對應新型車牌，開放到8碼輸入 |
| 資料驗證機制 | 資料庫連結 | 直接連結，允許直接更改資料庫 | 更改流程，必須驗證完後才可寫入資料庫 |
| | 資料檢查 | 提供LOG文件描述檢查結果 | 對於資料填寫不完全的欄位在軟體程式檢查中直接註明，方便使用者自行修正 |
| | 資料匯入 | 以CSV檔作為唯一匯入標準 | 保持支援第3版匯入標準，額外支援依據多檔案類型匯入 |
| 報表匯出 | 報表樣式 | 提供Word與Excel | 提供Word、Excel、PDF檔案格式支援任意版型列印匯出功能 |

應用軟體開發升級第 4 版更新項目說明
Description of Edition 4 Updated Items in the Application Software Development Upgrade

## 5.研究成果報告

・汽車客運業路線別成本計算制度應用軟體更新及維護運作計畫（110年7月出版）

## 5. Report of Research Outcomes

・Routed-based Costing System for Motor Carrier Industry Application Software Upgrade and Maintenance Operation Project (Published in July 2021)

## （四）預約式通用小客車運輸服務之試辦與推廣應用

### 1.計畫概述

通用計程車為行動不便者之重要交通工具，我國自102年起辦理通用計程車補助措施迄今已逾7年，通用計程車營運市場仍有搭車資訊欠透明、績效指標待檢討、補助款稽核繁瑣等議題待改善。本計畫嘗試從行動不便者、車隊業者、司機以及主管機關等各利益關係人的角度切入分析後，設計「通用計程車特約業者」制度，並開發執行面所需之工具以提升訂車資訊透明度，協助並輔導臺北、新北、桃園、臺中等4個直轄市政府試辦導入通用計程車特約業者制度，透過新制度與新工具協助地方政府強化通用計程車推動策略，提升民眾對於施政信賴度，也為我國即將進入超高齡社會預為準備。

### 2.研究成果

（1）完成日本、澳洲、美國、英國等4個國家推動通用計程車之期程、配套措施、補助方式與相關法規等資料蒐集與評析。

（2）完成通用計程車特約業者制度設計與工具開發建置，並輔導4個直轄市導入試辦計畫，透過客製化之特約車隊整合系統，提供民眾統一預約入口（便民）及主管機關自動化稽核作業，減少行政作業成本（減政）。

（3）完成「交通部鼓勵購置通用計程車補助要點」、「交通部鼓勵通用計程車營運補助作業要點」、「通用計程車特約業者行政作業費及營運獎勵金發給作業要點」、「通用計程車特約業者管理要點」、「通用計程車特約業者合約範本」、「通用計程車特約業者使用者服務須知」等草案，提供交通部與地方政府加速完成法制作業程序，縮短導入通用計程車特約業者時程，精進並加速通用計程車推動成效。

## (4) Trial Operation and Promotion Application of Pre-arranged General-Purpose Passenger Car Transportation Service

### 1. Project Overview

Accessible taxis are an important means of transportation for people with limited mobility. It has been more than seven years since our Country began to provide subsidies for accessible taxis in 2013; however, there are still issues such as lack of transparency in ride information, performance indicators to be reviewed, and complicated subsidy audits in the accessible taxi operating market pending improvement. This project attempts to design the "Accessible Taxi Special Carrier" system after analysis from the perspectives of various stakeholders such as persons with disabilities, fleet carriers, drivers, and competent authorities, and then develop the tools required for implementation to enhance the transparency of taxi booking information, assist and counsel four municipal governments of Taipei, New Taipei, Taoyuan, and Taichung to pilot and introduce the accessible taxi schedule carrier system, and through new systems and new tools to assist local governments in strengthening the accessible taxi promotion strategy, enhance the public's trust in governance, and also prepare our Country to enter the super-aged society in advance.

### 2. Research Outcomes

(1) Complete the collection, evaluation and analysis of the schedule, supporting measures, subsidy methods, and relevant laws and regulations for the promotion of accessible taxis in four countries including Japan, Australia, the United States, and the United Kingdom.

(2) Complete the system design and tool development and establishment of accessible taxi special carriers, and counsel four municipalities to introduce pilot projects, through the customized special fleet integration system, to provide unified reservation portal (convenience) for the public and automated audits by the competent authorities, and reduce the cost of administrative operations (administration reduction).

(3) Complete the draft of "Direction for Encouraging Purchase of Accessible Taxi Subsidies by the Ministry of Transportation and Communications," "Guidelines for Encouraging Accessible Taxi Operation Subsidies by the Ministry of Transportation and Communications," "Guidelines for Issuing Accessible Taxi Special Carrier Administrative Operating Expenses and Operating Incentives," "Guidelines for Accessible Taxi Special Carrier Management," "Contract Template for Accessible Taxi Special Carriers" and "Accessible Taxi Special Carriers User Service Instructions"; provide the Ministry of Transportation and Communications and local governments to speed up the completion of the legal system process, shorten the time for introducing the accessible taxi special carriers, and improve and speed up the effectiveness of promoting accessible taxis.

### 3.成果推廣與效益

本所以「愛接送」為服務品牌推動之預約式通用計程車服務，係以中央跨部會（交通部、教育部、衛福部）與地方跨縣市（臺北市、新北市、桃園市、臺中市）攜手合作方式，由本所設計通用計程車特約業者制度與研發預約整合系統，交由4個直轄市設置單一預約入口網，並與合作車隊簽訂特約業者行政契約，將各車隊14日內每小時可服務之車趟數公開予民眾預約，有需要的民眾只要在乘車前一日下午2時前完成預約，業者必須派車且一律按計程車計費表收費，提供行動不便者公平、貼心又方便的運輸服務。透過整合後的供需資訊，提升通用計程車載客率增加司機收入、減少空駛里程以提升載送行動不便者意願；另一方面對政府而言，亦可減少行政稽核成本並落實營運補助成效。

### 4.研究成果精華摘整

### 3. Promotion of Outcomes and Benefits

The reservation accessible taxi service promoted by the IOT with "i-Taxi" as the service brand is with the cooperation of the central cross-ministries (Ministry of Transportation and Communications, Ministry of Educations and Ministry of Health and Welfare) and the local cross-counties and cities (Taipei City, New Taipei City, Taoyuan City, Taichung City). The IOT designs the accessible taxi special carrier system, researches and develops the reservation integration system, delivers the system to four municipalities to set up a single reservation portal, and signs the special carrier administrative contract with the carriers in cooperation, to open the number of taxi trips that can be in service every hour within 14 days to the public for reservation for the people in need only to complete the reservation before 2 pm the day before riding. The carrier must dispatch the taxi and charge the fare based on the taxi meter to provide fair, caring and convenient transportation for the person with disability. Through the integrated supply and demand information, the passenger rate of accessible taxis can be enhanced to increase the income of drivers, and reduce the mileage driven without passengers to increase the willingness to carry a person with disability; on the other hand, in terms of the government, it can also reduce the cost of administrative audits and implement the effectiveness of operating subsidies.

### 4. Summary of Research Outcomes



計畫架構
Project Structure
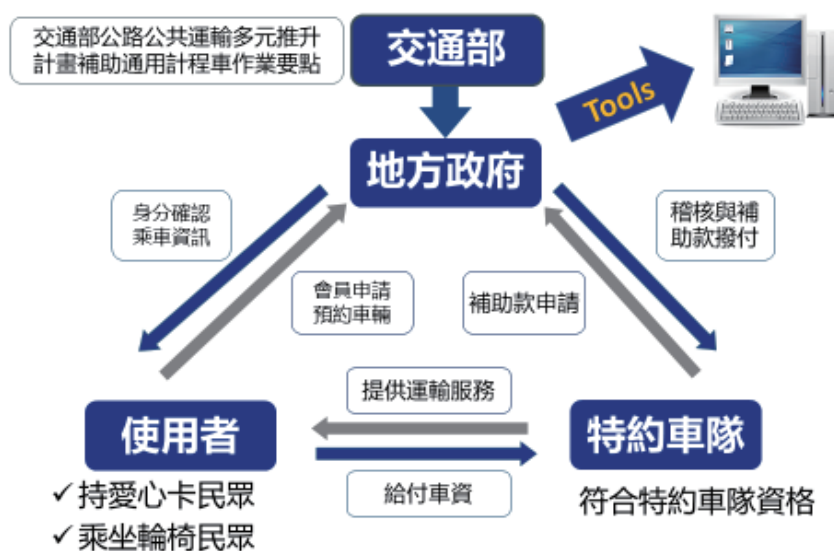
特約業者運作機制
Operating Mechanism for Special Taxi Carriers



109 年 9 月 2 日 4 都聯合正式啟用記者會
Press Conference for the Official Joint Opening of Four Municipalities on September 2, 2020

109 年 12 月 2 日辦理「愛接送 - 預約式通用計程車」服務品質提升工作坊（北部場）
Organized the Service Quality Improvement Workshop for the "i-Taxi – Reservation Accessible Taxi (Northern Region Session) on December 2, 2020



## 5.研究成果報告

· 預約式通用小客車運輸服務之試辦與推廣應用 （110年7月出版）

## 5. Report of Research Outcomes

· Trial Operation and Promotion Application of Pre-arranged General-purpose Passenger Car Transportation Service (Published in July 2021)

## （五）交通部補助學界成立區域運輸發展研究中心計畫（104-109）

### 1.計畫概述

為鼓勵大學院校運用豐沛之基礎研發設施及研究資源，與已累積之基礎研發能量及既有之設施，協助交通部相關政策之推動，交通部於104年起配合匡列經費，責請本所辦理「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。

### 2.研究成果

**（1）辦理交通運輸專業人才培訓課程：** 105.12-109.12共開設702門實體課程，參與學員達15,372人次。另線上課程部分，共開設12門，觀看人次約達4,500人次。

**（2）協助地方政府進行公共運輸案例研析：** 105.12-109.12共協助地方政府進行公共運輸案例研析計66案。105.12-107.12計畫執行期間，案例以提昇公共運輸使用，抑制私人運具使用為目標進行規劃與實作，了解公共運輸供需及私人運具使用現況，以探討可運用之推拉策略，並提出局部地區之實際試辦計畫；107.12-109.10計畫執行期間，分別就「偏遠地區公共運輸環境健全發展策略」與「都市地區公共運輸載客量提升策略」兩項課題進行規劃與實作，著重探討各地方政府公共運輸策略作為與成效，針對各區域縣市提出因地適宜之觀點及未來建議策略。

**（3）提供地方政、交通部公路總局所屬監理所、站與汽車客運業者府諮詢服務及輔導地方政府提案：** 105.12-109.12已提供1,036次之諮詢服務，其中370次有地方政府局處長層級人員參與。另輔導地方政府向交通部公路總局公共運輸計畫提案並獲核定計183案。

### 1. Project Overview

In order to encourage universities and colleges to use abundant basic R&D facilities and research resources, together with the accumulated basic R&D energy and existing facilities, to assist in the promotion of relevant policies of the Ministry of Transportation and Communications, the Ministry has cooperated with the allocation of funds starting from 2015, and requested the IOT to conduct the "Ministry of Transportation and Communications Subsidizes the Academia to Establish Regional Transportation Development Research Center" Project, through the Regional Transportation Development Research Center (hereinafter referred to as the Regional Center) to strengthen the construction of local government capability, promote the cooperative development of academia, industry, and government departments, and implement the sustainable development of Local Public Transportation.

### 2. Research Outcomes

**(1) Organize Training Courses for the Transportation Professionals:** Organized a total of 702 physical courses from December 2016 to December 2020 with 15,372 participants. In addition, there were 12 online courses with viewers of approximately 4,500 people/time.

**(2) Assist Local Governments in Conducting public Transportation Case Studies:** Assisted a total of 66 Local Governments in Conducting public Transportation Case Studies from December 2016 to December 2020. During the implementation of the project from December 2016 to December 2018, the case was planned and practiced with the goal of increasing the use of public transportation and restraining the use of private transportation vehicles, to understand the supply and demand of public transportation and the current status of the use of private transportation vehicles, to explore applicable push-pull strategies, and to propose the actual pilot project in the local region; during the implementation of the project from December 2018 to October 2020, two topics of "Sound Development Strategy of Public Transportation Environment in Remote Areas" and "Public Transportation Passenger Capacity Increase Strategy in Urban Areas" were planned and implemented respectively, focused on discussing the actions and effects of public transportation strategies of all Local Governments, and put forward appropriate views and future recommended strategies for the Counties and Cities of all Regions.

**(3) Provide Consulting Services for the Motor Vehicles Offices, Stations subordinated to the Local Government, Directorate General of Highways of the Ministry of Transportation and Communications and the Bus Passenger Transportation Carriers and Counsel Local Government Proposals:** Provided 1,036 consulting services from December 2016 to December 2020, of which 370 services were participated by the personnel of Director-General and Director level of the Local Government. In addition, the Counseled Local Government to submit proposals of Public Transportation Projects to the Directorate General of Highways of the Ministry of Transportation, and 183 projects were approved.

## 3.成果推廣與效益

（1）協助地方政府及業者構建運輸規劃能力，尤其是協助非六都縣市所獲公共運輸發展計畫平均補助金額比率從99-105年平均24%提升至106-108年平均26%，顯示在區域中心協助下，業促使非六都縣市地方政府透過公共運輸發展計畫發揮實質效益。

（2）在提升偏鄉人本公共運輸服務部分，105.12-109.12區域中心共計輔導30鄉鎮推動幸福巴士（DRTS），並獲公路總局核定70案相關提案，由提升偏鄉地區公路公共運輸空間服務涵蓋率顯示，已從104年68.8%提升至108年81.63%，對於偏鄉基本民行的改善與落實，有相當助益。

（3）109年4月9日完成立法委員高金素梅關心55個原鄉公共運輸服務課題報告書，本所與六大區域中心合作辦理「盤點原住民族地區55個鄉鎮市區之交通需求」案，並函送報告書予立法委員高金素梅國會辦公室、原住民族委員會、衛生福利部及教育部等相關單位，俾供做為研議改善偏鄉公共運輸服務之重要參據。

（4）109年4月30日完成交通部交辦「探討臺北至宜蘭地區觀光旅運之公共運輸衔接供需缺口」案，本所與北區區域中心合作提出「宜蘭縣五環觀光公車路網」之概念，並已與宜蘭縣政府、宜蘭觀光旅宿協會等單位代表凝聚共識，逐步落實推動。

（5）109年6月5日本所與中華及開南大學桃竹苗區域中心舉辦「公共運輸載客量提升策略跨區論壇」，進行經驗分享及意見交流，彙集各相關單位對如何提升公共運輸載客量之意見，後續納入各區域中心共同策劃提升公共運輸運量之可行策略方案，以協助地方政府推出讓民眾有感的優質公共運輸服務。

（6）109年6月9日本所與國立中山大學高屏澎區域中心共同辦理「偏鄉公共運輸環境健全跨區論壇」，進行經驗分享及意見交流，彙集各相關單位對如何改善偏

## 3. Promotion of Outcomes and Benefits

(1) Assist Local Governments and Carriers in building transportation planning capabilities; especially assist the Counties and Cities outside of six Municipalities to increase the average received subsidy of public transportation development projects from an average of 24% in 2011–2016 to an average of 26% in 2017–2019, showing that under the assistance of the Regional Center, it has encouraged the Local Governments of Counties and Cities outside of six Municipalities to achieve substantial benefits through public transportation development projects.

(2) On the part of improving people-oriented public transportation services in rural areas, the Regional Center counseled a total of 30 townships to promote the Demand Responsive Transit Service (DRTS) from December 2016 to December 2020, and received approval for 70 cases of related proposals from the Directorate General of Highways; the improvement of the service coverage rate of highway public transportation space in rural areas shows that it has increased from 68.8% in 2015 to 81.63% in 2019, which is of great help to the improvement and implementation of basic people transportation in rural areas.

(3) On April 9, 2020, a Report on 55 rural public transportation services issues concerned by the Member of the Legislative Yuan, Kao Chin Su-mei was completed. The IOT cooperated with six Regional Centers to manage the "Inventory of Transportation Demands in 55 Townships and Cities in Indigenous Areas," and mailed the Report to the Office of Member of the Legislative Yuan, Kao Chin Su-mei, and the relevant Units of the Council of Indigenous Peoples, the Ministry of Health and Welfare, and the Ministry of Education to serve as an important reference for the research and improvement of rural public transportation services.

(4) On April 30, 2020, the "Explore the Gap between Supply and Demand of Public Transportation in Tourism and Trip from Taipei to Yilan Area" assigned by the Ministry of Transportation and Communication was completed. The IOT cooperated with the North Regional Center to propose the concept of "Yilan County Five Circular Tourist Bus Road Network," and reached consensus with Representatives of the Yilan County Government, Yilan Tourism and Accommodation Association to implement and promote gradually.

(5) On June 5, 2020, the IOT held the "Cross-Region Forum of Public Transportation Passenger Capacity Improvement Strategies" with the Taoyuan-Hsinchu-Miaoli Regional Center of Chung Hua University and Kainan University to share experience and exchange opinions, collect the opinions of how to improve public transportation passenger capacity from all relevant Units, and subsequently incorporate into the Regional Centers to jointly plan for feasible strategic programs to increase the capacity of public transportation, so as to assist Local Governments in launching high-quality public transportation services that make the public appreciative.

(6) On June 9, 2020, the IOT and the Kaohsiung-Pingtung-Penghu Regional Center of National Sun Yat-sen University jointly organized the "Cross-Region Forum on Improving

鄉公共運輸服務之意見。本所將陸續與各區域中心共同策劃健全偏鄉公共運輸環境之可行策略方案，以協助地方政府儘速推出讓民眾幸福的優質公共運輸服務。

（7）109年10月13日本所與六大區域中心共同辦理「公共運輸跨域發展策略論壇」，就中央及地方政府作為、發展課題、研析成果及推動策略，與外界分享與交流，並藉由凝聚產官學研各界意見，構思未來公共運輸服務發展方向，來滿足民眾交通行動需求，並藉由「創新整合、服務升級」，推動各方資源進入偏鄉，以跨部會合作及公私協力方式，結合觀光旅遊與地方創生，回歸「人本」交通健全偏鄉生活環境。

the Rural Public Transportation Environment" to share experience and exchange opinions, collect the opinions of how to improve the rural public transportation services from all relevant Units. The IOT will continue to conduct planning with all Regional Centers on feasible strategies for improving the rural public transportation environment, to assist Local Governments in launching high-quality public transportation services that will make people happy.

(7) On October 13, 2020, the IOT and the six Regional Centers jointly organized the "Public Transportation Cross-domain Development Strategy Forum" to share and exchange with the outside world the actions of the central and local governments, development issues, research and analysis results, and promotion strategies, and conceive the future development direction of public transportation services by gathering opinions from all sectors of industry, government, academia, and institute, to meet the needs of people's transportation actions, and promote all resources to enter the remote villages through "Innovative Integration, Service Upgrade," by the means of cross-ministries and agencies cooperation and collaboration of public and private sectors, and combine the tourism with local livelihood creation, return to "people-oriented" transportation and improve the rural living environment.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
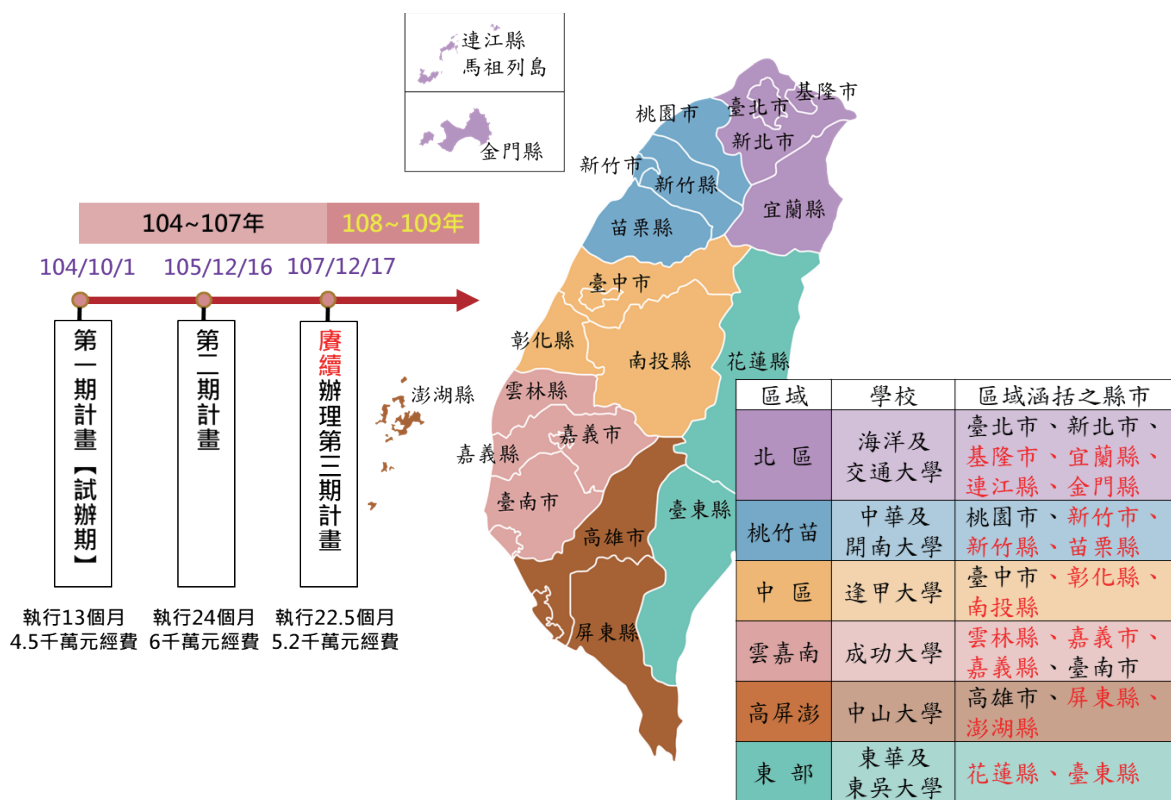


六大區域中心輔導範圍
Scope of Counseling for Six Regional Centers

## （六）研提第四期公路公共運輸計畫

### 1.計畫概述

　　自98年起交通部指示本所研擬計畫向行政院申請公共建設計畫經費以推動公路公共運輸發展，截至目前已有三期計畫經行政院審議核定進行推動，包括「公路公共運輸發展計畫（99-101年）」（經費150億元）、「公路公共運輸提昇計畫（102-105年）」（經費200億元）、「公路公共運輸多元推升計畫（106-109年）」（經費150億元），大幅擴增交通部及縣市政府推動公路公共運輸發展之財源，堪稱我國史上規模最大的公路公共運輸重建運動（Public Transportation Rebuild Campaign）。在中央與地方政府及公車業者之努力合作下，三期公路公共運輸計畫已顯著提升公路公共運輸服務之品質與運量。由於第三期計畫將於民國109年屆滿，為延續其執行成效，本所奉交通部指示研提新一期計畫向行政院爭取經費，以賡續推動公共運輸發展並落實2020年版運輸政策白皮書行動方案。

### 2.研究成果

　　本所依交通部指示蒐集國際及國內公共運輸發展情勢，洽徵相關單位意見及評估合適預算規模，撰擬「公路公共運輸服務升級計畫」草案，除歷經多次工作會議與交通部相關單位詳加討論確認計畫內容外，並召開2次座談會洽徵專家學者、行政院相關單位、各縣市政府、各區域運輸發展研究中心及客運業者之意見，做為增修計畫（草案）之參據，達到凝聚各界共識之效果。計畫草案於108年12月31日經交通部陳報行政院進行審議，已於109年6月12獲行政院核定，成功爭取了4年245億元之計畫經費，後續將交由公路總局編列預算執行，以賡續協助各縣市政府及汽車客運業者推動公路公共運輸發展。

　　「公路公共運輸服務升級計畫（110-113年）」以無縫、安全、永續、精緻為公路公共運輸服務升級之目標，辦理重點包括強化跨運具服務整合、完善無障礙乘車及候車環境、改善偏鄉交通協助地方創生、推廣電動大客車以利空污防制、導入先進設備預防事故發生等。

### 1. Project Overview

Since 2009, the Ministry of Transportation and Communications has instructed the IOT to apply for public construction project funding from the Executive Yuan to promote the development of highway public transportation for the project researched and planned by the IOT, and there are three phases of the project which have been reviewed and approved by the Executive Yuan for promotion up to now, including "Development Project of Highway Public Transportation (2010–2012)" (NTD 15 billion in funding), "Highway Public Transportation Improvement Project (2013–2016)" (NTD 20 billion in funding), and the "Highway Public Transportation Multiple Promotion Project (2017–2020)" (NTD 15 billion in funding), which significantly expanded the financial resources of the Ministry of Transportation and Communications and the county and city governments to promote the development of highway public transportation, and can be called the largest scale of Public Transportation Rebuild Campaign in the history of our country. With the efforts of the central and local governments and bus carriers, the third phase of the Highway Public Transportation Project has significantly improved the quality and volume of Highway Public Transportation services. Since the third phase of the project will expire in 2020, in order to continue its implementation effectiveness, the IOT was instructed by the Ministry of Transportation and Communications to research and propose a new phase of the project to seek funding from the Executive Yuan to continue to promote the development of public transportation and implement the 2020 version of Transportation Policy White Paper Action Plan.

### 2. Research Outcomes

In accordance with the instructions of the Ministry of Transportation and Communications, the IOT collects international and domestic public transportation development, consults with relevant units for comments and evaluates the appropriate budget scale, and drafts the "Highway Public Transportation Service Upgrade Project," in addition to many working meetings with relevant units of the Ministry of Transportation and Communications to discuss and confirm the content of the project in detail, two symposiums were organized to consult the opinions with experts and scholars, relevant units of the Executive Yuan, various county and city governments, Regional Transportation Development Research Centers, and the Passenger Transportation Carriers as the basis for an Amendment Project (draft) to achieve the effect of consolidating consensus from all sectors. The draft project was submitted to the Executive Yuan by the Ministry of Transportation and Communications for review on December 31, 2019, and was approved by the Executive Yuan on June 12, 2020, successfully secured a four-year project funding of NTD 24.5 billion, which will be handed over to the Directorate General of Highways to prepare budgets for implementation, to continue to assist the county and city governments and bus passenger transportation carriers to promote the development of highway public transportation.

The "Highway Public Transportation Service Upgrade Project (2021–2024)" aims at seamlessness, safety, sustainability, and sophistication as the goal of highway public

## 3.成果推廣與效益

　　「公路公共運輸服務升級計畫（110-113年）」係做為交通部及公路總局辦理公路公共運輸相關補助計畫之依據，有助於協助地方及客運業者推動公路公共運輸發展，強化公車服務品質與競爭力，提高民眾搭乘意願，以利達成改善交通壅塞、拉近城鄉發展差距、促進節能減碳與空污防制等政策。
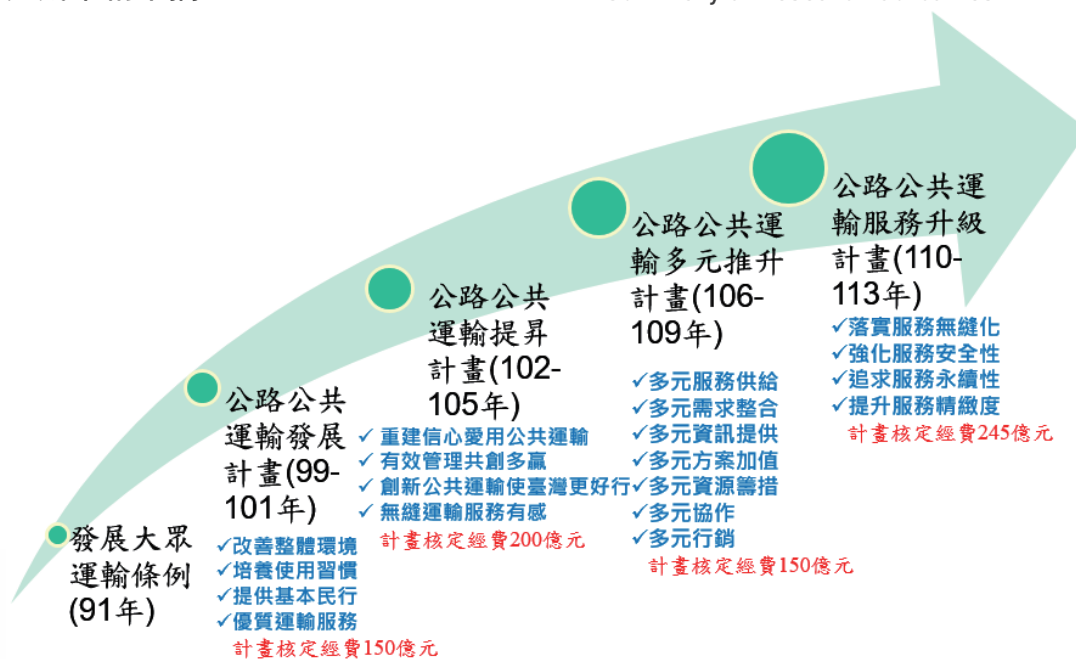
transportation service upgrades. The focus of management includes strengthening the integration of cross-transportation vehicle services, improving accessible riding and waiting environment, improving transportation in rural areas to assist local livelihood creation, promote electric buses to control air pollution, and introduce advanced equipment to prevent accidents.

## 3. Promotion of Outcomes and Benefits

　　The "Highway Public Transportation Service Upgrade Project (2021–2024)" is used as the basis for the Ministry of Transportation and Communications and the Directorate General of Highways to manage the highway public transportation related subsidy program, which is helpful to assist the local and passenger transportation carriers to promote the development of highway public transportation and strengthen bus service quality and competitiveness, and increase people's willingness to ride in order to achieve policies of improving traffic congestion, narrowing the gap between urban and rural development, promoting energy conservation and carbon reduction, and air pollution control.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes

發展大眾運輸條例(91年)

公路公共運輸發展計畫(99-101年)
✓改善整體環境
✓培養使用習慣
✓提供基本民行
✓優質運輸服務
計畫核定經費150億元

公路公共運輸提昇計畫(102-105年)
✓重建信心愛用公共運輸
✓有效管理共創多贏
✓創新公共運輸使臺灣更好行
✓無縫運輸服務有感
計畫核定經費200億元

公路公共運輸多元推升計畫(106-109年)
✓多元服務供給
✓多元需求整合
✓多元資訊提供
✓多元方案加值
✓多元資源籌措
✓多元協作
✓多元行銷
計畫核定經費150億元

公路公共運輸服務升級計畫(110-113年)
✓落實服務無縫化
✓強化服務安全性
✓追求服務永續性
✓提升服務精緻度
計畫核定經費245億元

各期公路公共運輸計畫之演進
The Progress of Public Highway Transportation Project in All Phases

## 5.研究成果報告

・研提第四期公路公共運輸計畫，運輸研究專輯第51期。

## 5. Report of Research Outcomes

・ Propose the Fourth Phase of Public Transportation of Highways Project (Transportation Research Special Report 51)

五、 智慧運輸科技發展與創新應用

## （一）應用人工智慧技術進行交通數據蒐集暨號誌控制之研究

### 1.計畫概述

　　為提升號誌化路口使用效率，路口控制策略從靜態之定時式發展至全動態之適應性號誌控制。近年來人工智慧（Artificial Intelligence, AI）技術快速發展，藉由AI深度學習（Deep Learning, DL）之類神經網路（Artificial Neural Network, ANN）模式解決交通問題為交通領域當前之重要課題。本計畫將AI影像偵測與辨識技術所蒐集交通參數（交通量），應用於以AI強化學習為基礎的動態號誌制所需交通數據，進而藉由以模仿學習（Imitation Learning, IL）與以週期為基礎的AI強化學習，來選擇最適號誌時制計畫，以及下載至路口執行，以即時反應車流變化與提高號誌化路口運作效率。

　　在AI影像偵測與辨識技術上，本計畫透過實測進行模式與路口偵測線設計精進，來提高所偵測各式交通參數（例如：分車道各車種交通流量、路口各車種轉向交通量、佔有率、延滯等）的準確度，同時進行不同運算晶片能力的量化效能分析。在AI號誌控制部分，本計畫先對實驗場域臺中市太平區「樂業路與十甲東路」至「樂業路與東英路」兩個路口進行車流分析與事前交通調查，並以太平匝道下匝道車流與經樂業路往臺中市區車流續進最佳為目標進行號誌控制策略設計。為掌握所設計號誌策略與時制計畫之實務可執行性，本計畫利用號誌時制計畫最佳化軟體產生符合實驗場域車流特性之最佳化基礎時制計畫，供人工智慧強化學習（Reinforcement Learning, RL）的仿真學習方式進行學習，並透過交通模擬軟體事先進行量化效益分析與評估。

## V. Development and Innovative Application of Intelligent Transportation Technology

### (1) Preliminary Study of Artificial Intelligence in Traffic Data Collection and Urban Traffic Signal Control

#### 1. Project Overview

　　In order to improve the efficiency of the use of signalized intersections, the intersection control strategy has been developed from a static timing to a fully dynamic adaptive signaling control. In recent years, Artificial Intelligence (AI) technology has developed rapidly, and solving traffic problems through Artificial Neural Network (ANN) models of AI Deep Learning (DL) has become an important topic currently in the transportation field. This project applies the traffic parameters (traffic volume) collected by AI image detection and recognition technology to the traffic data required by the dynamic signal system based on AI Reinforcement Learning, and then through the Imitation Learning (IL) and cycle-based AI Reinforcement Learning to select the most appropriate signal timing plan, and downloaded to the intersection for execution, so as to respond to traffic flow changes in real time and improve the operational efficiency of signalized intersections.

　　In terms of AI image detection and recognition technology, this project improves the accuracy of detection for various traffic parameters (for example, traffic flow of various vehicle types in divided lanes and turning traffic volume, occupancy rate and delay of various vehicle types at intersections), while performing quantitative performance analysis of different computing chip capabilities. In the part of AI signal control, this project first conducted traffic flow analysis and pre-traffic surveys at the experimental field of two intersections of "Leye Road and Shijia East Road" to "Leye Road and Dongying Road" in Taiping District of Taichung City, and with the traffic flow continuation optimization on the off-ramp of Taiping ramp toward Taichung city via Leye Road as the objectives to design the signal control strategy. In order to grasp the practical performability of the designed signal strategy and time system plan, this project uses the signal timing system plan optimization software to generate an optimized basic timing system plan that meets the characteristics of the traffic flow in the experimental field to conduct learning for the simulation learning method of Artificial Intelligence Reinforcement Learning (RL), and through the traffic simulation software to conduct quantitative benefit analysis and evaluation in advance.

## 2.研究成果

（1）本研究應用AI影像辨識技術於交通車流偵測與資料蒐集，透過於臺中市「樂業-十甲東」、「樂業-東英」兩路口進行實證分析，「分車道各車種交通流量」之小客車不分情境，均可達90%以上，機車則為72%以上；「路口轉向交通量」之小客車與機車準確率為83%~100%，左右轉轉準確率則在40%~89%；「佔有率」準確率多在80%以上；在等候車隊長度為4輛車時之「延滯」準確率為87%。

（2）AI應用於號誌控制時會因強化學習於尋找最適號誌控制過程，需耗費大量試誤的探索時間才會收斂，致使較無真實環境之應用案例。本研究利用時制最佳化分析軟體PaSO，先行針對實驗範圍產生考量幹道續進之最佳化時制計畫與時段參數，來進行AI仿真學習，最後將學習後之AI號誌控制模式，於現場進行實際運作。

（3）本研究事先透過微觀交通模擬軟體SUMO建構臺中市「樂業-十甲東」、「樂業-東英」兩路口之交通環境，進而產生AI號誌控制之模擬績效，最後在實測場域上進行實測。實測結果顯示，可改善實驗場域之幹道旅行時間，晨昏峰時段主要路徑旅行時間改善為7%~30%，離峰時段主要路徑旅行時間改善則為4%以上。

## 3.成果推廣與效益

（1）109年12月2日與109年12月10日分別於逢甲大學與本所辦理成果說明會，邀集產官學研參與討論，進行成果交流。

（2）製作宣傳影片，讓民眾更易了解運輸政策。

## 2. Research Outcomes

(1) This study uses AI image recognition technology in traffic flow detection and data collection. Through empirical analysis at the intersections of "Leye-Shijia East" and "Leye-Dongying" in Taichung City, the accuracy of "Traffic Flow Volume of All Vehicle Types in Divided Lanes" can reach better than 90% for small passenger cars regardless of the situation, and for motorcycles better than 72%; the accuracy of the small passenger car and the motorcycle of the "Turning Traffic Flow Volume at the Intersection" is 83%–100%, and the accuracy of turning left and right is between 40% and 89%; the accuracy of "Occupancy Rate" is mostly better than 80%; the accuracy rate of "Delay" is 87% when the number of vehicles waiting is 4.

(2) When AI is applied to signal control, it will take a lot of exploration time for error testing to converge due to the Reinforcement Learning to find the most appropriate signal control process, which resulted in fewer application cases in the real-world environment. This study uses the timing system optimization analysis software PaSO to first generate optimized timing system plans and time period parameters for the continuation of the main road in accordance with the scope of the experiment, to conduct AI simulation learning, and finally the AI signal control mode after the Learning is placed in the field to perform actual operations.

(3) This study used the micro-traffic simulation software SUMO to construct the traffic environment at the intersections of "Leye-Shijia East" and "Leye-Dongying" in Taichung City beforehand, then generated the simulated performance of AI signal control, and finally, performed actual detection in the experimental field. The actual detection results show that the main road travel time in the experimental field can be improved. The travel time of the main path during the morning and evening peak hours is improved by 7% to 30%, and the travel time of the main path during the off-peak hours is improved by more than 4%.

## 3. Promotion of Outcomes and Benefits

(1) On December 2, 2020 and December 10, 2020 organized the results presentation in Feng Chia University and IOT and invited the government, industry, university to participate in discussions and exchange results.

(2) Produced promotional videos to make it easier for the public to understand transportation policies.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
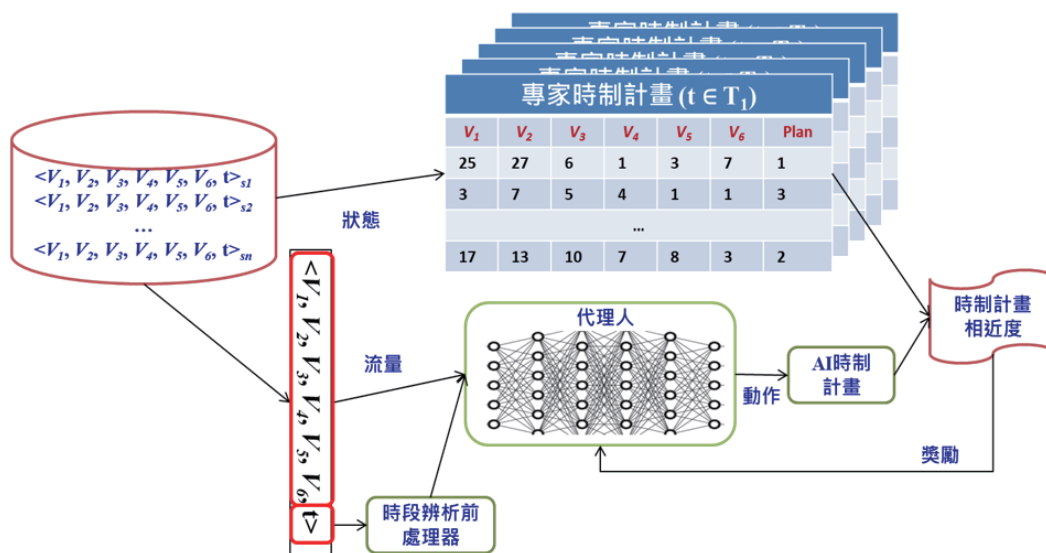


AI號誌控制學習模式示意圖
Schematic Diagram of AI Signal Control Learning Mode

## 5.研究成果報告

· 應用人工智慧技術進行交通數據蒐集暨號誌控制之研究 （110年7月出版）

## 5. Report of Research Outcomes

· Preliminary Study of Artificial Intelligence in Traffic Data Collection and Urban Traffic Signal Control (Published in July 2021)

## （二）電動公車示範計畫執行績效分析與推動策略支援應用（108-109）

### 1.計畫概述

近幾年，電動公車之技術發展逐漸成熟，且全球之銷售量亦持續成長，對於國內各客運業者來說，車輛關鍵系統穩定性與基礎設施配合、營運規劃隨經營環境之客製化等，皆有賴於營運績效數據之持續蒐集與分析，而透過各車廠妥善率、用電效率與續航力等性能之比較，可藉以提出國內電動公車之導入指南提供業者參考，並作為政策推動與資源配置之滾動檢討依據。爰此，交通部已規定自108年起所有電動公車補助（含示範計畫與一般型計畫），均須提供相關數據供本所與公路總局進行分析。本計畫主要目的在於協助蒐集電動公車之示範計畫與一般型計畫執行期間的系統資訊，並建置營運數據監控管理平台，進而透過平台分析電動公車各式營運及行車數據，提供示範計畫與一般型計畫分年檢核資料參據，並掌握營運關鍵指標及關鍵課題。此外，亦同步檢討電動公車經營環境與基礎設施缺口，期藉由本計畫執行累積本土電動公車實際營運數據，研擬電動公車導入指南，提供地方政府後續擴大推動執行參據。

109年度主要工作包括：電動公車營運數據監控管理平台功能精進與維運、滾動檢討本年度示範計畫分期檢核營運績效評估方式，配合示範計畫及公運計畫進度辦理傳輸測試檢核、蒐集資料進行營運關鍵指標分析、績效評核及提供營運補助申請參據、追蹤與檢討示範計畫及公運計畫電動公車執行情形、研擬電動公車導入指南（草案）、蒐集訪談掌握智慧充電發展趨勢、效益及推動方向，據以研提後續推動之建議，並針對計畫重要成果或執行過程製作影片與協助行銷。

### 2.研究成果

（1）公布「電動大客車營運數據監控管理平台資料傳輸作業規範」，並配合計畫推動調整平台蒐集機制與呈現方式。

（2）配合109年起申請示範計畫及一般型計畫業者，進行車載機資料及充電設施運行資料傳輸測試與檢核作業。

（3）蒐集電動大客車營運數據，追蹤示範計畫

## (2) The Analysis of Project Performance and Application of Promotion Strategy in the Pilot Project of Electric Bus (2019-2020)

### 1. Project Overview

In recent years, the technology development of electric buses has gradually matured, and global sales have continued to grow. For domestic passenger transportation carriers, the stability of the vehicle's key systems is coordinated with the infrastructure and the customization of operation planning according to the business environment, all which rely on the continuous collection and analysis of operating performance data. Through the comparison of the availability, power efficiency and endurance of each vehicle manufacturer, it can be used to propose the guide of introducing the domestic electric buses for reference by the carriers and serve as the basis of rolling review for the policy promotion and resource allocation. Therefore, the Ministry of Transportation and Communications has stipulated that all electric bus subsidies (including demonstration projects and general projects) from 2019 onwards must provide relevant data for analysis by the IOT and the Directorate General of Highways. The main purpose of this project is to assist in collecting system information during the execution period of the electric bus demonstration project and the general project, and to build the Operating Data Monitoring and Management Platform, and then analyze the various operating and driving data of electric buses through the platform, to provide the references for yearly inspection data of the demonstration project and the general project, and grasp the key operational indicators and key issues. In addition, it also simultaneously reviews the operating environment and infrastructure gaps of electric buses, expecting to accumulate actual operating data of local electric buses through the implementation of this project, develop the electric bus introduction guidelines, and provide local governments with reference for subsequent expansion and implementation.

The main tasks in 2020 include: functional improvement and maintenance of the Electric Bus Operating Data Monitoring and Management Platform; rolling review of this year's demonstration projects; staged review of the operation performance evaluation method; manage the transmission test inspection and collection of data in accordance with the demonstration project and the progress of the public transportation to perform the key operating indicators analysis, performance evaluation, and provide the reference for operating subsidy applications; track and review the implementation situation of the demonstration projects and public transportation plans of the electric bus; develop the electric bus introduction guidelines (draft); collect interviews to grasp the trend, benefits and promotion directions of smart charging development, as the basis to research and propose recommendations for follow-up promotion, and produce videos and assist in marketing for the important project results or the implementation process.

### 2. Research Outcomes

(1) Announce the "Regulations for Data Transmission Operations of the Electric Bus Operating Data Monitoring and Management Platform," and coordinate with the project to promote and adjust the platform collection mechanisms and presentation methods.

電動大客車營運績效，協助公路總局進行後續分期檢核與營運績效補助之資料統計與報表分析。

（4）配合示範計畫作業機制推動、營運績效分析與執行課題因應，綜整研提導入指南（草案），為客運業者提供必要的導入資訊，讓其在導入過程中減輕潛在風險。

（5）對應電動大客車基礎建設後續推展，初步蒐集國內外智慧充電發展趨勢與推動方向，並訪問研究單位與國內具備智慧充電產品的廠商，作為智慧充電推動方向之參考。

### 3.成果推廣與效益

（1）藉由長期性累積我國電動大客車營運數據資料，提供車廠提升產品性能、業者經營管理及滾動檢討電動公車推動政策依據，提升電動公車整體營運品質。

（2）依循本計畫建立電動公車營運數據監控管理平台資料傳輸作業規範，納入電動大客車補助計畫（一般型及示範型）申請補助條件。進行電動大客車營運數據資料蒐集，以達到資料蒐集便利及一致性。

（3）滾動更新電動大客車導入指南，建構電動大客車導入環境與提高使用意願，達到改善空污之目標。

（4）應用電動大客車營運數據監控管理平台進行示範計畫營運績效追蹤檢核，可協助管理單位進行業者營運狀況稽核。

（5）引進國際先進技術並整合國內研發資源，促進產官學研間之合作。

(2) Cooperate with carriers with applications of demonstration projects and general projects from 2020 to conduct on-board equipment data and charging facility operation data transmission testing and verification operations.

(3) Collect electric bus operation data, track the operation performance of electric buses in the demonstration project, and assist the Directorate General of Highways in the follow-up phased inspection and operation performance subsidy data statistics and report analysis.

(4) Cooperate with the promotion of the demonstration project operation mechanism, the analysis of operational performance and the response to the implementation topics, to the comprehensively organize, research and propose the Introduction Guide (draft), to provide the passenger transportation carriers with the necessary introduction information, so that the potential risks in the introduction process can be reduced.

(5) Correspond to the follow-up promotion of electric bus infrastructure, preliminarily collect the domestic and foreign smart charging development trends and promotion directions, and interview research institutes and domestic manufacturers of smart charging products as the reference for the promotion direction of smart charging.

### 3. Promotion of Outcomes and Benefits

(1) By accumulating data on the operation of electric buses in our country over a long period of time, to provide vehicle manufacturers with the basis for improving product performance, business management, and rolling review of electric bus promotion policies, so as to improve the overall operating quality of electric buses.

(2) According to this project, establish the "Regulations for Data Transmission Operations of the Electric Bus Operating Data Monitoring and Management Platform," to be incorporated into the application subsidy conditions of the electric bus subsidy program (general and demonstration type). Collect operating data of electric buses to achieve convenience and consistency in data collection.

(3) Rolling update of the Electric Bus Introduction Guide, construct the electric bus introduction environment and increase the willingness of use, to achieve the goal of improving air pollution.

(4) Apply the Electric Bus Operating Data Monitoring and Management Platform to track and check the operation performance of the demonstration project, which can assist the Management Unit in conducting the Carrier Operation Status Audit.

(5) Introduce international advanced technology and integrate domestic R&D resources to promote cooperation between the industry, government, universities, and institutions.
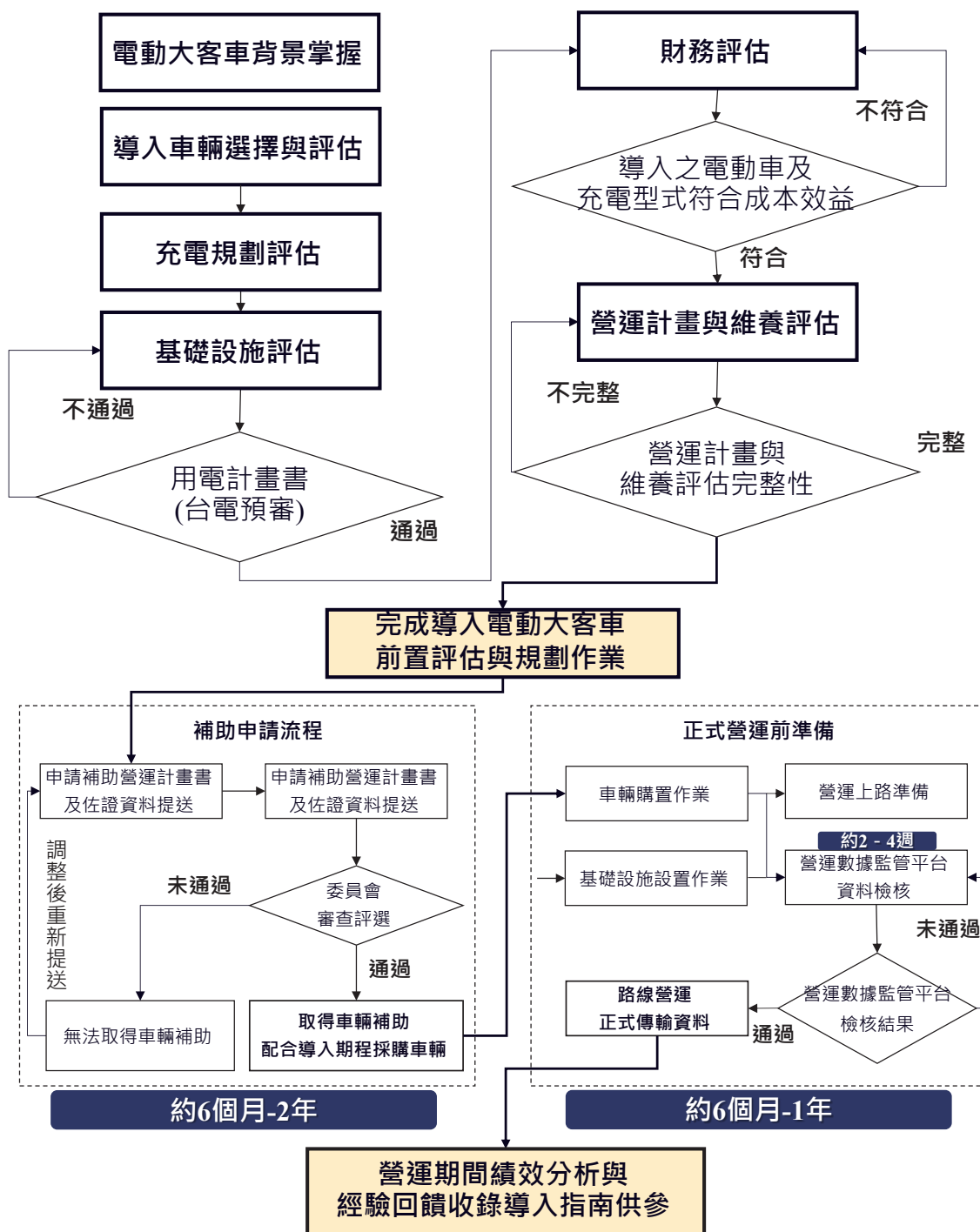
**4.研究成果精華摘整**
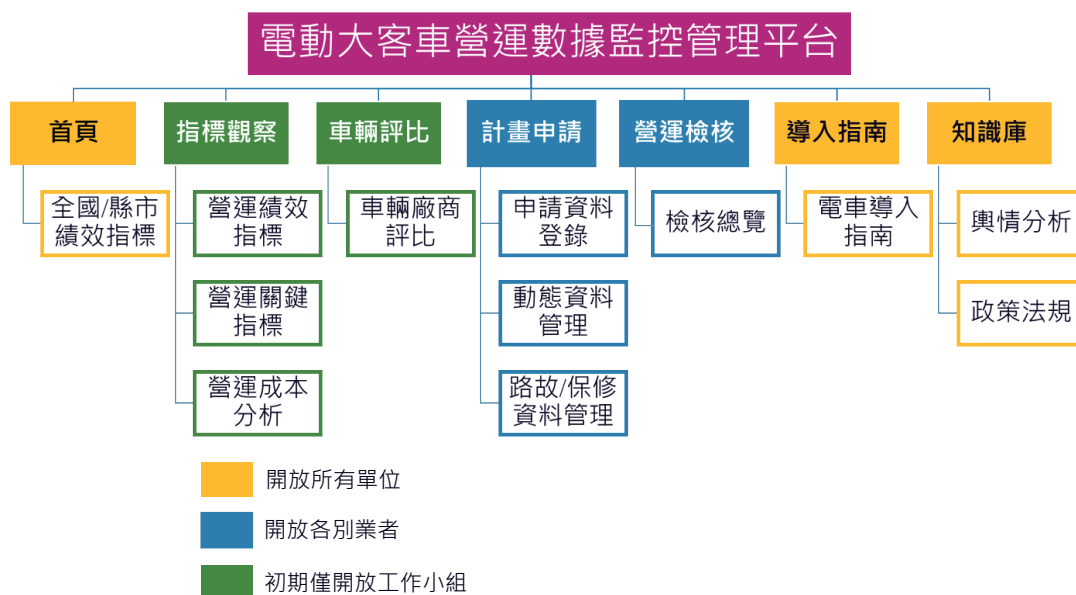
電動大客車營運數據監控管理平台權限設定
Electric Bus Operation Data Monitoring and Management Platform Permission Setting



電動大客車營運數據監控管理平台資料蒐集與串接架構
Data Collection and Connection Architecture of Electric Bus Operation Data Monitoring and Management Platform

電動大客車導入評估流程圖
Flowchart for the Electric Bus Introduction Evaluation

## 5.研究成果報告

- 電動公車示範計畫執行績效分析與推動策略支援應用（1/2）（109年12月出版）
- 電動公車示範計畫執行績效分析與推動策略支援應用（2/2）（預計110年11月出版）

## 5. Report of Research Outcomes

- The Analysis of Project Performance and Application of Promotion Strategy Support in the Pilot Project of Electric Bus (1/2) (Published in December 2020)
- The Analysis of Project Performance and Application of Promotion Strategy Support in the Pilot Project of Electric Bus (2/2) (To be published in November 2021)

## （三）交通行動服務（MaaS）示範建置計畫（107-109）

### 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。

高雄市MaaS以MeN Go為名，將民眾日常生活與通勤通學會用到的所有運輸工具整合成為單一運輸服務，包括高雄捷運、市區公車、公路客運、輕軌、渡輪、共享自行車、共享電動機車、停車場停車轉乘（P&R）以及專屬計程車（MeN Go TAXI）等，本計畫於107年9月28日正式啟用，使高雄市成為亞洲第一個MaaS服務都市，民眾只要透過電子票證MeN Go月票以及智慧型手機APP，即可在30天效期內無限次數使用所有的運輸服務並享有套票優惠價，更可利用手機APP進行最佳旅運規劃，並隨時查詢車輛即時動態資訊。此外，本計畫首創MeN Go point點數服務，可補助民眾搭乘計程車起跳費用，提供民眾在必要或急要時做彈性的運用，充分展現臺灣推動智慧交通的能量與成果。

### 2.研究成果

本計畫自107年9月28日上線至109年12月31日，目前已完成系統服務移轉高雄市政府交通局接續營運，主要成果概要說明如下：

（1）**辦理期程：**106年11月~109年12月。

（2）**示範推動場域：**高雄市，於107年9月28日正式啟用，並成為亞洲第一個MaaS服務都市。

（3）**服務名稱：**MeN Go交通行動服務。

（4）**參與業者：**捷運、市區公車、公路客運、輕軌、渡輪、公共自行車、計程車、共享電動機車、停車轉乘停車場（P&R）

## (3) Demonstration Plan of Mobility as a Service (MaaS)(2018-2020)

### 1. Project Overview

In recent years, as economic development has promoted the improvement of people's living standards, traditional urban public transportation service types (fixed routes and fixed schedules) have been unable to meet the people's "transportation" needs. Therefore, Helsinki, Finland proposed the concept of Mobility as a Service (MaaS) in 2014: integrating multiple transportation vehicles into a single transportation mobile service, and providing transportation services that meet the needs of the public through long-term ticket package discounts and mobile devices. The innovative concept of MaaS integrated transportation is not only highly valued in the transportation sector around the world, but also the advanced countries in Europe and America (such as the United Kingdom, Germany, Sweden, Belgium, and the United States) are racing to launch MaaS projects.

Kaohsiung City MaaS is in the name of MeN Go, integrates all the means of transportation used in people's daily life and commuting to work and school into a single transportation service, including Kaohsiung MRT, city buses, highway passenger transportation, light rail, ferries, shared bicycles, and shared electric motorcycles, parking lot park and ride (P&R), as well as the MeN Go TAXI. This project was officially launched on September 28, 2018, making Kaohsiung the first MaaS service city in Asia. People only need to use the electronic stored value card MeN Go Monthly Pass and smartphone APP; they can use all transportation services unlimited times within 30 days of validity and enjoy the ticket package discount prices, and can also use the smartphone APP to conduct the best travel planning and check the real-time dynamic information of the vehicle at any time. In addition, this project pioneered the MeN Go point service, which can subsidize the initial charge for the people riding taxis, provide people with flexible use when necessary or urgent, and fully demonstrate the energy and achievements of promoting smart transportation in Taiwan.

### 2. Research Outcomes

The project was online from September 28, 2018 to December 31, 2020 . The system service has been transferred to the Transportation Bureau of Kaohsiung City Government to continue its operation. The main achievements are summarized as follows:

(1) **Management Period:** November 2017 – December 2020.

(2) **Demonstration Promotion Field:** Kaohsiung City, officially opened on September 28, 2018, and became the first MaaS service city in Asia.

(3) **Service Name:** MeN Go Transportation Mobility Service.

(4) **Participating Businesses:** Nine means/services of transportation including MRT, City Buses, Highway Passenger Transportation, Light Rail, Ferries, Public Bicycles, Taxis, Shared Electric Motorcycles, Transfer Parking Lot Park and Ride (P&R) services, with more than 30 businesses participated.

(5) **Information Services:** System background, website, APP development and services.

服務等九種運輸工具/服務，超過30家業者參與。

（5）**資訊服務**：系統後臺、網站、APP建置與服務。

（6）**票證系統**：一卡通二代卡。

（7）**主要票種**：

- 無限暢遊月票：票價為1,499元（一般卡）/1,299元（學生卡），可於30天效期內無限次數搭乘捷運、公車、輕軌，YouBike每次前30分鐘免費，並含4次渡輪搭乘及 600 MeN Go points。

- 學生7日票：票價為333元，可於7天效期內無限次數搭乘捷運、公車、輕軌，YouBike每次前30分鐘免費。

### 3.成果推廣與效益

（1）**完成跨單位與系統協調，民眾只要透過電子票證MeN Go月票以及智慧型手機APP，即可在高雄地區方便使用所有的運輸服務**：

- 跨單位資源整合與協調：結合中央與地方資源，共同協調促成整體服務實現，參與合作的單位包含交通部路政司、科顧室、公路總局、運輸研究所以及高雄市政府（交通局、環保局、捷運局）。

- 提出輔助運輸系統概念（包括:公共自行車、計程車隊（倫永、中華大車隊）、共享電動機車（WeMo、UrDa）等運輸系統），結合傳統公共運輸（包括: 捷運、公車、公路客運、輕軌、渡輪），完成多元運具整合與資訊系統建置，藉由輔助運輸系統彌補公共運輸第一哩/最後一哩服務縫隙。

（2）**共創三贏的局面**：本計畫的推動，可使通學與通勤的民眾得以較低廉的價格搭乘公共運具、交通施政品質提昇、公共運輸使用量增加、民間運輸業者營收成長，預期也將減少都市空汙及交通事故的發生率。經初步統計，已獲致以下效益：

(6) **Electronic Stored Value Card System:** the second-generation card of i-Pass.

(7) **Main Ticket Types:**

a. Unlimited Travel Monthly Pass: The ticket price is NTD 1,499 (Standard Card)/NTD 1,299 (Student Card), can ride the MRT, Bus, Light Rail unlimited times with the validity period of 30 days, YouBike is free for the first 30 minutes every time, and includes four ferry rides and 600 MeN Go points.

b. Student 7-day Ticket: The ticket price is NTD 333, can ride the MRT, Bus, Light Rail unlimited times with the validity period of 30 days, YouBike is free for the first 30 minutes every time.

### 3. Promotion of Outcomes and Benefits

(1) **Complete the cross-unit and system coordination, the people can use all transportation services in Kaohsiung area easily by using the electronic stored value card MeN Go Monthly Pass and smartphone APP:**

a. Cross-unit resource integration and coordination: Combine the central and local resources to jointly coordinate and promote the realization of the overall service. The units which participated in the cooperation include the Department of Railways and Highways, Office of Science and Technology Advisors, Directorate General of Highways, Institute of Transportation of the Ministry of Transportation and Communications, and the Kaohsiung City Government (Transportation Bureau, Environmental Protection Bureau, Mass Rapid Transit Bureau).

b. Propose the concept of auxiliary transportation systems (including public bicycles, taxi fleets (Yes Taxi and Chunghwa Taxi Team), shared electric motorcycles (WeMo, UrDa) and other transportation systems), combined with the traditional public transportation (including MRT, Bus, Highway Passenger Transportation, Light Rail and Ferry), to complete the integration of multiple transportation vehicles and the establishment of information systems, and compensate the gap of first/last mile service of public transportation through the auxiliary transportation systems.

(2) **Create a Win-Win-Win Situation:** The promotion of this project will enable people who commute to school and commute to work to take public transportation vehicles at a lower price, improve the quality of transportation administration, increase the use of public transportation, and grow the revenue of private transportation businesses. It is also expected to reduce the occurrence of urban air pollution and traffic accidents. According to preliminary statistics, the following benefits have been achieved:

a. All the transportation vehicle businesses participated in the service have received growth in ticket revenue (bus revenue increased by NTD 153,222/month, and MRT revenue increased by NTD 1,227,248/month).

・各參與服務之運具業者均獲得票收成長
（公車收入增加153,222元/月、捷運收
入增加1,227,248 元/月）。

・減少民眾支出（一般民眾節省368元/月
/人、學生節省568元/月/人）。

・提升公共運輸使用量181,979人次/月。

**（3）推廣行銷：** 本計畫針對高雄旅運特性，初
期鎖定包括大專學校以及地區大型企業
做為特定目標族群，並加強計畫推廣行
銷作業。目前已有包括中山大學、樹德
科大、輔英科大以及正修科大等四所大
學做為高雄MaaS計畫標竿示範學校；標
竿示範企業包括中鋼與日月光，獲得高
雄市民眾的支持與肯定。

**（4）交通運輸：** 透過本計畫月票方案之推動，
民眾除在月票效期內主要運具（捷運、
公車及輕軌）可無限使用，能有效提昇
公共運輸使用率（如108年公共運輸使
用率較106年之公共運輸使用率，提升
1.76%，109年因受新冠疫情影響，公共
運輸使用率微幅下降），同時也搭配輔
助運具（計程車、渡輪、轉乘公共運輸
停車P＆R、共享自行車、共享電動機車
等）使用優惠方案，吸引更多輔助運具
業者投入服務。

**（5）社會經濟：** 本計畫之推動，可有效吸引
通勤通學者樂於使用公共運輸及共享運
具，除可減少自行開車所產生的負面經
濟效益（如車輛持有稅費、停車費用與
停車空間不足等）外，同時藉由蒐集分
析使用者之搭乘行為與需求，可以彈性
調整改善現有公共運輸路線班表等服務
內容，進而吸引原非公共運輸使用者加
入、增加公共運輸使用、降低交通意外
事故、降低空氣汙染與尖峰時間的道路
壅塞等。

**（6）大數據分析優化交通服務：** 透過本計畫所
蒐集之民眾旅次資訊大數據並進行交
通需求分析，可進一步調整改善現有
公共運輸路網、路線及班次時刻等，
進而有效改善公共運輸之服務品質，
促使民眾更加提昇MaaS服務之滿意度
及購買意願，促進整體公共運輸服務
之良性循環。

b. Reduce public expenditure (average citizens saved NTD 368/month/person, students saved NTD 568/month/person).

c. Increase the usage of public transportation by 181,979 person-times/month.

**(3) Promotion and Marketing:** This project is aimed at the travel characteristics of Kaohsiung with the preliminary target including colleges, universities and large regional enterprises as specific target groups, and strengthens the project promotion and marketing operations. At present, four universities, including Sun Yat-sen University, Shu-Te University, Fooyin University, and Cheng Shiu University serve as the benchmark demonstration schools for the Kaohsiung MaaS project; benchmark demonstration enterprises include China Steel Corporation and ASE group, which have received the support and affirmation of the people of Kaohsiung City.

**(4) Transportation:** Through the promotion of the Monthly Pass program of this project, the people can use unlimited use of the main transportation vehicles (MRT, bus and light rail) during the validity period of the Monthly Pass, which can effectively increase the utilization rate of public transportation (the utilization rate of public transportation in 2019 increased by 1.76% compared with the utilization rate of public transportation utilization rate in 2017. In 2020, due to the impact of the COVID-19 epidemic, the utilization rate of public transportation decreased slightly), while also paired with the discount program of using auxiliary transportation vehicles (taxis, ferries, public transportation transfer Park and Ride, shared bicycles, shared electric motorcycles, etc.), more auxiliary transportation vehicle businesses are attracted to invest in the services.

**(5) Socio-economic:** The promotion of this project can effectively attract commuters to work and school who are willing to use public transportation and shared transportation vehicles. In addition to reducing the negative economic benefits generated by driving by themselves (such as vehicle ownership taxes, parking fees, and insufficient parking spaces), the existing service contents of public transportation routes and schedules can be flexibly adjusted and improved at the same time through the collection and analysis of the users' riding behaviors and needs, and further attracting original non-public transportation users to join, increasing public transportation utilization, reducing traffic accidents, and lowering air pollution and road congestion during peak hours, etc.

**(6) Big data analysis and optimization of transportation services:** Through the big data of people's trip information collected by this project and analysis of transportation needs, the existing public transportation network, routes, and schedules can be further adjusted and improved, to effectively improve the service quality of public transportation to promote the people in increasing the satisfaction and purchase willingness of MaaS services, and advancing the virtuous circle of the overall public transportation services.

**（７）獲德國萊茵認證**

德國萊茵認證具有全世界公信力，但因該公司認證作業極為複雜嚴謹且價格昂貴，因此國內除了大型交通建設之外，智慧交通系統鮮少有系統獲得德國萊茵認證。為能使Men Go資訊系統與服務品質達到國際水準，本計畫資訊系統與服務功能已於108年9月取得德國萊茵認證。

（８）本計畫於俄羅斯莫斯科舉行之APEC第48次運輸工作小組會議時提出成果報告，獲得與會各會員體關注，嗣後我國於本（2021）年3月9日召開之APEC第50次運輸工作小組會議（TPT-WG50）之複合運輸與智慧型運輸系統專家小組（IIEG）會中以MeN Go計畫之成果做為核心主軸提出政策主題「以科技創新實現整合交通服務（Facilitating Mobility Integration through Technological Innovation）」，並獲得全體會員體支持，同意由我國擔任該政策主題主導/自願會員體，預計於7月底召開政策主題視訊會議，此為TPT-WG有史以來首次的政策主題會議，我國能成功爭取到此項議題主導權十分不易，積極向國際社會展現我國之施政成果。

（９）截至109年12月31日，高雄市MaaS服務累計會員數達34,563人，累計申辦卡片數（含數位學生證綁卡）23,530張、數位學生證綁卡6,531張，使用人次達800萬以上，並呈穩定趨勢成長。

（１０）2020年受新冠肺炎疫情（COVID-19）影響，整體公共運輸運量下跌20~30%以上，為提升民眾購買MeN Go各式月票意願，推升大高雄地區公共運輸使用率，自109年3月29日至109年9月30日期間，本計畫與高雄市交通局合作推動「MeN Go愛的迫降」優惠方案（補助MeN Go各月票方案200~249元），優惠推出後銷售量隨即升高，優惠期間共銷售42,315張套票，其中又以109年5月份銷售7,534張，較108年同期成長61%，顯見優惠方案足以吸引民眾加入MeN Go會員並購買月票使用。

**(7) Certified by the TÜV Rheinland**

TÜV Rheinland Certification has worldwide credibility, but because the company's certification operations are extremely complicated, rigorous and expensive, few domestic smart transportation systems have therefore obtained TÜV Rheinland certification except for large-scale transportation construction. In order to enable MeN Go's information system and service quality to reach international standards, the information system and service functions of this project were certified by TÜV Rheinland in September 2019.

(8) This project presented the report on the results of the 48th APEC Transportation Working Group Meeting held in Moscow, Russia, and attracted the attention of all participating members. Later, our country proposed the policy theme of "Facilitating Mobility Integration through Technological Innovation" with the results of MeN Go project as the core theme in the Integrated Transportation and Intelligent Transportation System Expert Group (IIEG) of the 50th APEC Transportation Working Group Meeting held on March 9, 2021, and received support from all members, agreeing for our country to serve as the leading/voluntary member of the policy theme. The policy-themed video conference is expected to be held at the end of July. This is the first policy theme meeting in TPT-WG history and it is not easy for our country to successfully win the leadership of this topic to actively present the administrative achievement of our country to the international community.

(9) As of December 31, 2020, Kaohsiung City's MaaS service has accumulated 34,563 members, with 23,530 cards (including cards linked to digital student ID cards) applied, 6,531 cards linked to digital student ID cards, used more than 8 million person/times, and showing a steady growth trend.

(10) Affected by the COVID-19 in 2020, the overall public transportation volume dropped by more than 20–30%. In order to increase the willingness of the people to buy all types of MeN Go Monthly Passes, and increase the utilization rate of public transportation in the Kaohsiung metropolitan area, this project cooperated with the Transportation Bureau of Kaohsiung City to promote the discount program (subsidies of NTD 200–249 for each MeN Go Monthly Pass Program) of "MeN Go Love Price Reduction" from March 29, 2020 to September 30, 2020. Sales volume increased immediately after the discount was introduced and a total of 42,315 package tickets were sold during the discount period, among which 7,534 tickets were sold in May 2020, an increase of 61% over the same period in 2019. It is obvious that the discount program is sufficient to attract people to join as the MeN. Go members and purchase monthly passes for use.

（11）吸引私人運具使用者加入MaaS服務，經問卷調查，MeN Go服務使用者中移轉私人運具者達21%（如圖5.3.3）。

(11) Attracted private transportation vehicle users to join the MaaS service. According to a questionnaire survey, 21% of MeN Go service users transfer to private transportation vehicles (as shown in Figure 5.3.3).



公車, [16%]

捷運, [63%]

私人運具, [21%]
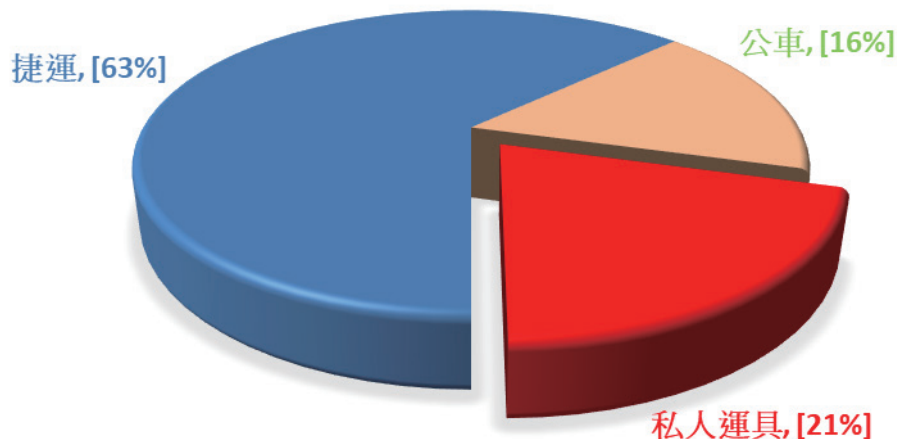
高雄市 MeN Go 使用者原使用運具分布概況
Distribution Overview of Original Transportation Modes Used by MeN Go Users in Kaohsiung City

## 4.研究成果精華摘整

（1）獲得獎項：本計畫榮獲獎項如下：

- 交通部107年「智慧運輸系統建設發展計畫」評鑑特優獎

- 中華民國運輸學會2019年「傑出交通運輸計畫獎」

- 交通部108年創新提案「甲等獎」

- 「2019智慧城市創新應用獎」優勝獎

- ITS協會2020年度「智慧運輸應用獎」。

（2）成為亞洲MaaS標竿學習對象，至今已有多個日本團體來訪（包含日本岡山縣知事率團、日本旅行（Nippon Travel Agency）、日本沖繩縣政府、日本國土交通省暨總研、勤業眾信日本等），進行實地參訪了解及推動經驗交流座談。另獲邀參展新加坡2019年ITS世界年會、國際會議進行專題報告（2019年ITS世界年會、2019莫斯科APEC運輸工作小組會議、2020 Transit Ticketing & MaaS in APAC視訊會議、2020 App-Based Mobility - APEC TPTWG Virtual Workshop），對全世界交通專家分享計畫執行經驗。

## 4. Summary of Research Outcomes

(1) Awards: The awards for this project are as follows:

a. High Distinction Award of "Smart Transportation System Construction and Development Project" Evaluation by the Ministry of Transportation and Communications in 2018

b. "Outstanding Transportation Project Award" by the Chinese Institute of Transportation in 2019

c. "Grade-A Award" of 2019 Innovative Proposals by the Ministry of Transportation and Communications

d. Winner Award of "2019 Smart City Innovation Application Award."

e. 2020 ITS Association "Smart Transportation Application Award."

(2) Become a benchmark learning object for MaaS in Asia. So far, many Japanese groups have visited (including the group led by the magistrate of Okayama-ken Japan, Nippon Travel Agency), the Government of Okinawa-ken, Japan Ministry of Land, Infrastructure, Transport and Tourism Ministry of Land, Infrastructure, Transport and Tourism and Nomura Research, Deloitte & Touche Japan, etc.), to conduct on-site visits to understand and promote experience exchange seminars. Also invited to participate in Singapore's 2019 ITS World Annual Conference and International Conferences to give reports on special topics (2019 ITS World Conference, 2019 Moscow APEC Transportation Working Group Meeting, 2020 Transit Ticketing & MaaS in APAC Video Conference, 2020 App-Based Mobility-APEC TPTWG Virtual Workshop), sharing project implementation experience with transportation experts from all over the world.

高雄 MeN Go 服務內容
Kaohsiung MeN Go Service Content



MaaS 服務以手機及月票卡整合多元運輸系統
MaaS Service integrates multiple Transportation Systems with Mobile Phones and Monthly Pass Cards

## 5.研究成果報告

- 交通行動服務（MaaS）示範建置計畫（108年10月出版）。

- 交通行動服務（ＭａaＳ）示範建置計畫（2/2）（109年8月出版）。

- 交通行動服務（MaaS）示範建置與服務擴充計畫（110年7月出版）。

## 5. Report of Research Outcomes

- Demonstration Plan of Mobility as a Service (MaaS) (Published in October 2019)

- Demonstration Plan of Mobility as a Service (MaaS) (2/2) (Published in August 2020)

- Demonstration and service expansion plan of Mobility-as-a-Service (MaaS) (Published in July 2021)

## （四）交通行動服務（MaaS）後續服務擴充與推廣策略規劃

### 1.計畫概述

　　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，本計畫將針對國內跨縣市及風景區之地理特性、用路人需求特性、現有運具組成特性等面向進行探討，研擬後續擴展國內MaaS服務之推動策略，使MaaS服務效益擴展至更多地區，全面提供使用者方便又經濟的行旅服務，藉以減少自行開（騎）車所產生的負面效益（如車輛持有稅費、停車費用、車輛閒置、空氣污染與尖峰時間的塞車等）。

### 2.研究成果

　　本計畫探討MaaS由單一縣市（如：MeN Go）擴展至跨縣市運輸服務以及其他應用場域（觀光風景區、偏鄉）服務之策略方向，透過服務對象、旅次及運具之特性探討，研擬運具整合及票價方案，並藉此建構各場域合適之MaaS服務模式。相關成果簡述如下：

（1）本計畫盤點未來可能加入服務之運具，並依照本計畫三個場域MaaS之類型歸納成四種，分別為「偏鄉內使用運具」、「城市內使用運具」、「城際間使用運具」及「風景區內使用運具」，其中，跨縣市場域主要偏重「城市內使用運具」及「城際間使用運具」之整合；風景區場域主要偏重「城市內使用運具」、「城際間使用運具」及「風景區內使用運具」；而偏鄉場域則主要偏重「偏鄉內使用運具」及「城市內使用運具」之整合。

（2）跨縣市場域中，使用者最大宗旅次目的為通勤、通學，屬於固定高頻率之旅次型態；運具整合偏向「城市內使用運具」及「城際間使用運具」之整合，如「市區公車」及「臺鐵」；票價方案以高頻率使用之單一運具月票或多元運具月套票為主。

（3）風景區場域中，其旅次目的屬非固定

### (4) Strategic Planning for the Expansion and Promotion of MaaS Subsequent Services

### 1. Project Overview

In view of the increasing attention and promotion of MaaS services by all countries, the Ministry of Transportation and Communications 2020 Transportation Policy White Paper also declares that MaaS is one of the important development strategies, in order to gradually expand domestic MaaS services, so that people in all regions of the Country can enjoy the convenience and sustainability of MaaS services. This project will explore the aspects of geographic characteristics of domestic cross-county, city, and scenic areas, the demand characteristics of road users, and the characteristics of existing transportation vehicle composition, to research and plan the promotion strategies of subsequent expansion of the domestic MaaS services, to expand the Maas service benefits to more areas, and comprehensively provide users with convenient and economical travel services, so as to reduce the negative benefits of driving (riding) by themselves (such as vehicle ownership taxes, parking fees, idle vehicles, air pollution, and traffic congestion during peak hours).

### 2. Research Outcomes

This project explores the strategic direction of expanding MaaS from a single county and city (such as MeN Go) to cross-county and city transportation services and other application fields (sightseeing scenic areas, rural areas) services, to research and plan the transportation vehicle integration and fare programs through discussing the characteristics of the service targets, trips and transportation vehicles, and use it to construct the MaaS service model suitable for each field. The relevant results are briefly described as follows:

(1) This project inventories the transportation vehicles that may be added to the service in the future, and summarizes them into four types according to the types of MaaS in three fields of this project, namely "Transportation Vehicles used in the Remote Rural Villages," "Transportation Vehicles used in the Cities," "Transportation Vehicles used between Cities" and "Transportation Vehicles used in the Scenic Areas," among which, the field of cross counties and cities mainly emphasizes the integration of "Transportation Vehicles used in the Cities" and "Transportation Vehicles used between Cities"; the field of scenic areas mainly emphasizes the "Transportation Vehicles used in the Cities," "Transportation Vehicles used between Cities" and "Transportation Vehicles used in the Scenic Areas"; and the field of remote rural villages mainly emphasizes the integration of "Transportation Vehicles used in the Remote Rural Villages" and "Transportation Vehicles used in the Cities."

(2) In the field of cross-counties and cities, the users' largest trip purpose is commuting to work/school, which belongs to the fixed high-frequency trip type; the integration of transportation vehicles is more towards the integration of "Transportation Vehicles used in the Cities" and "Transportation Vehicles used between Cities," such as "City Bus" and "Taiwan Railway"; the fare program is mainly with the "Monthly Pass of Single Transportation Vehicle" or "Monthly Package Ticket of Multiple Transportation Vehicles" of high-frequency use.

型態；運具整合偏向「城市內使用運具」、「城際間使用運具」及「風景區內使用運具」之整合，如「捷運」、「高鐵」及「觀光巴士」；票價方案以單一運具之單次票、日數票或多元運具之單次套票、日數套票為主。

（4）偏鄉場域中，使用者最主要旅次目的為65歲以上高齡者就醫及採買、18歲以下就學需求，分別屬於固定低頻率及固定高頻率之旅次型態；運具整合偏向「偏鄉內使用運具」及「城市內使用運具」之整合，如「幸福巴士」及「公路客運」；票價方案以低頻率使用之單一運具單次票或多元運具單次套票，及高頻率使用之單一運具月票或多元運具月套票為主。

另除研提跨縣市、偏鄉及風景區之通案性MaaS服務模式外，亦針對前述三種服務場域，各擇定一實際案例進行探討；透過通勤學旅次分析，劃分國內主要縣市生活圈，並研提區域選定原則，由五大生活圈中篩選出中彰投區域做為後續建置縣市之建議區域，且鑑於促進區域縫合發展、資源整合及落實深化之目標，遂由中彰投區域中選定風景區及偏鄉探討場域，分別為集集遊憩廊帶及集集鎮，最後利用前述研究內容與探討成果，針對中彰投跨縣市通勤學、集集遊憩廊帶、集集鎮三場域初擬MaaS服務內容。

## 3.成果推廣與效益

（1）研究成果發表於中華民國運輸學會109年學術論文研討會，讓與會人員知悉MaaS執行過程中的相關議題與重要策略。

（2）109年8月18日參與APEC TPTWG49 IIEG Meeting線上會議，掌握各會員體在ITS領域之發展及分享我國MaaS發展成效。

（3）109年10月27日參與APEC TPTWG Virtual Workshop on Uses of App-Based Transportation Mobility Technologies線上論壇，分享我國在手機APP與交通行動整合服務應用之成果。

(3) In the field of scenic areas, the trip purpose is non-fixed; the integration of transportation vehicles is more towards the integration of "Transportation Vehicles used in the Cities," "Transportation Vehicles used between Cities"and "Transportation Vehicles used in the Scenic Areas," such as "MRT," "High Speed Rail" and "Sightseeing Bus"; the fare program is mainly with the "Single Trip Ticket of Single Transportation Vehicle," "Multiple-day Ticket or "Single Trip Package Ticket of Multiple Transportation Vehicles," and "Multiple-day Package Ticket."

(4) In the field of remote rural villages, the users' main trip purpose for people over 65 years old is to seek medical treatment and shopping, and for those under 18 years old to go to school, which belong to fixed low-frequency and fixed high-frequency trip types respectively; integration of transportation vehicles is more towards the integration of "Transportation Vehicles used in the Remote Rural Villages" and "Transportation Vehicles used in the Cities," such as "Happy Bus" and "Highway Passenger Transportation"; the fare program is mainly with the "Single Trip Ticket of Single Transportation Vehicle" or "Single Trip Package Ticket of Multiple Transportation Vehicles" of low-frequency use, and "Monthly Pass of Single Transportation Vehicle" or "Monthly Package Ticket of Multiple Transportation Vehicles" of high-frequency use.

In addition to researching and proposing the general case MaaS service model across counties, cities, remote rural villages, and scenic areas, this project also selected a practical case for each of the aforementioned three service fields for discussion; through the analysis of commuting to work and school trips, to divide the life circles of main counties and cities in the country, and research and propose the principle of area selection, the Taichung, Changhua and Nantou area were selected from the five major life circles as the recommended area for subsequent counties and cities for construction. In view of the goal of promoting area-linked development, resource integration and deepened implementation, the selected fields of scenic areas and remote rural villages for discussion were in the Taichung, Changhua and Nantou area Jiji Recreation Corridor and Jiji Township respectively. Finally, the aforementioned research content and research results are used to target the three fields of cross-counties and cities commuting to work and school, Jiji Recreation Corridor and Jiji Township to preliminarily plan for the MaaS service content.

## 3. Promotion of Outcomes and Benefits

(1) The research results were published in the 2020 academic paper seminar of the Chinese Institute of Transportation, for the participants to be aware of relevant issues and important strategies in the implementation of MaaS.

(2) Participated in the APEC TPTWG49 IIEG Meeting online on August 18, 2020, to grasp the development of each member body in the ITS field and share the effectiveness of MaaS development in our country.

(3) Participated in the APEC TPTWG Virtual Workshop on Uses of App-Based Transportation Mobility Technologies online forum on October 27, 2020, to share the achievements of our country's mobile phone APP and transportation mobile integrated service application.

## 4.研究成果精華摘整
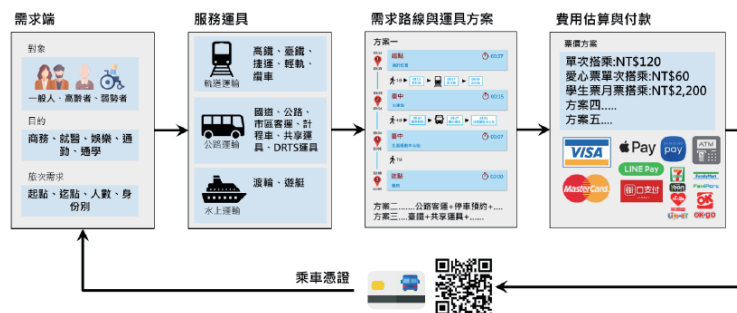
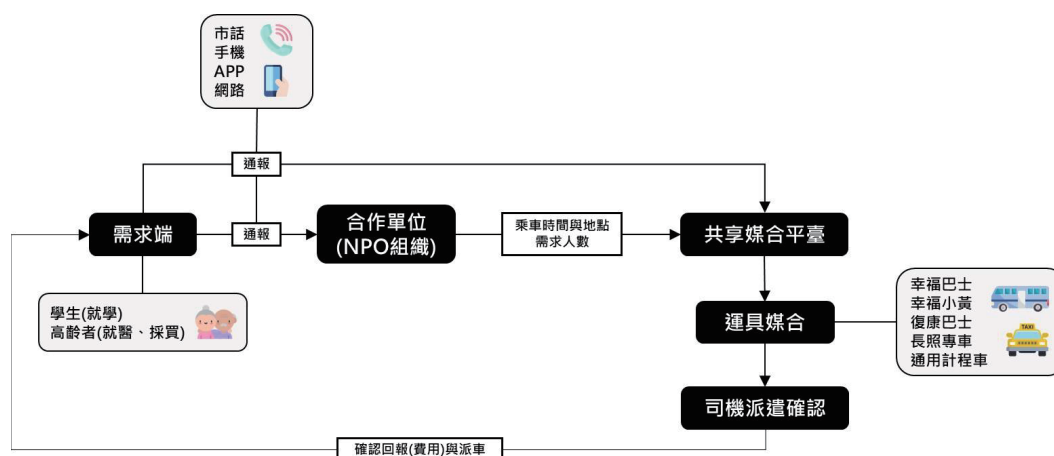跨縣市場域 MaaS 服務模式
MaaS Service Model for Field of Cross-Counties and Cities



觀光風景區場域 MaaS 服務模式
MaaS Service Model for Tourist Scenic Areas



偏鄉場域 MaaS 服務模式
MaaS Service Model for the Field of Remote Rural Villages

## 5.研究成果報告

‧交通行動服務（MaaS）後續服務擴充與推廣策略規劃（110年7月出版）

## 5. Report of Research Outcomes

‧ Planning for the Expansion and Promotion of MaaS Subsequent Services (Published in July 2021)

## （五）交通事件資訊整合服務擴充與事件偵測技術精進計畫

### 1.計畫概述

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

此外為能提昇交通事件初報、續報與結報之內容品質，本計畫嘗試運用影像辨識結合人工智慧（AI）等技術，針對交通事件發生前後的時空影響進行事件偵測與事件續報/解除之研究與實作，透過視覺化事件管理平台來呈現各單位事件資料，除可即時掌握事件資訊外，更能節省許多橫向溝通時間，進而提升交通管理效益。

本系列計畫相關成果簡要說明如下表。

## (5) Service and Enhancement Project for the Information Integration of Traffic Events

### 1. Project Overview

Implementation of Intelligent National Land, and cooperates with the 2016–2020 "National Spatio-temporal Information Cloud – Implementation of Intelligent National Land Project" promoted by the Ministry of Transportation and Communications, and has managed a series of projects for the Traffic Event Data Integration Data Service since 2016, with traffic event information as the target of the project to establish the relevant information standardization operations and to plan appropriate reporting mechanisms and tools, and selects Kaohsiung City (Transportation Bureau) and Tainan City (Bureau of Transportation) to cooperate in real-time traffic event information reporting, removal and release practices, expecting to strengthen the collection and diversified integration of real-time road information.

In addition, in order to improve the quality of the content of the original, renewed, and finalized reports of traffic events, this project attempts to use image recognition combined with artificial intelligence (AI) and other technologies to conduct the research and practice of event detection and event renewed report/removal aiming at the time and space effects before and after the traffic event, to present the event data of each unit through the Visual Event Management Platform. In addition to grasping event information in real time, it can also save a lot of time for horizontal communication, and further improve the efficiency of traffic management.

The related achievements of this series of projects are concisely described in the following table.

| 年度<br>Year | 計畫簡要成果<br>Concise Results of the Project |
|---|---|
| 105<br>(2016) | 1. 完成都市交通事件資訊定義與分類。<br>2. 訂定都市交通事件資料交換流通規範草案。<br>3. 完成高雄市交通事件資訊之通報、發布與解除流程機制規劃設計。<br>4. 完成高雄市 11 個事件資料來源介接。<br><br>1. Completed the definition and classification of urban traffic event data.<br>2. Formulated the draft of Urban Traffic Event Data Exchange and Circulation Specification.<br>3. Completed the planning and design of the process and mechanism for the report, release and removal of traffic event data in Kaohsiung City.<br>4. Completed the interfacing of 11 event data sources in Kaohsiung City. |
| 106<br>(2017) | 1. 修訂都市交通事件資料交換流通規範草案。<br>2. 擴充高雄市交通事件資料源，完成 18 個資料來源介接（含活動類事件），並建立資料源監控機制。<br>3. 開發都市交通事件資訊整合發布平台（雛型）。<br><br>1. Revised the draft of Urban Traffic Event Data Exchange and Circulation Specification.<br>2. Expanded the data sources of traffic events in Kaohsiung, completed the interfacing of 18 data sources (including activities type events), and established the data source monitoring mechanism.<br>3. Developed the Urban Traffic Event Data Integration and Publication Platform (Prototype). |
| 107<br>(2018) | 1. 持續擴充高雄市交通事件資料源，完成 19 個資料來源介接。<br>2. 整合交通服務 e 網通系統，建置全國交通事件整合資訊流通服務平台。<br><br>1. Continue to expand the data sources of traffic events in Kaohsiung City and completed the interfacing of 19 data sources.<br>2. Integrate the Traffic and Transportation Service Center and built the National Traffic Event Integration and Information Circulation Service Platform. |

| 年度<br>Year | 計畫簡要成果<br>Concise Results of the Project |
|---|---|
| 107<br>(2018) | 3. 與高雄市合作擇一易肇事路口與周邊路段設置 30 組 AI 偵測設備，採用單次多重目標檢測器（SSD）之 AI 影像辨識技術，進行交通車流參數偵測，在車流量方面大車、小車及機車之準確率平均為 89%、95% 及 90%。<br>4. 研擬各類型事件偵測辨識邏輯，事件偵測總計 436 件、誤判 7 件。<br><br>3. Cooperated with Kaohsiung City to set up 30 sets of AI Detection Device at the intersections and surrounding road sections prone to accidents, using the AI image recognition technology of Single Shot MultiBox Detector (SSD) to detect traffic flow parameters with the average accuracy rate of 89%, 95% and 90% for large vehicles, small vehicle and motorcycles respectively in terms of traffic flow.<br><br>4. Develop the detection and identification logic of various types of events, with a total of 436 cases of event detections and 7 cases of misjudgments. |
| 108<br>(2019) | 1. 協助高雄市與臺南市完成交通事件整合資訊流通服務建置。<br>2. 持續運用影像辨識與人工智慧技術精準交通事件偵測與通報內容，並增加特定車種與交通事件類型之辨識。<br>3. 調整高雄市實驗場域，並於臺南市一重要路口與周邊路段增設 12 組 AI 偵測設備。<br>4. 在交通參數偵測精進方面，車輛偵測之平均準確率，不論在白天、夜晚或是雨天均可達 96%；另增加路口轉向交通量偵測，大部分車種準確率可達 90%。<br>5. 在交通事件偵測邏輯精進方面，除增加車輛及事件標示樣本外，亦透過 AI 學習架構和偵測邏輯的調整，提升事件偵測之準確率。<br><br>1. Assisted Kaohsiung City and Tainan City to complete the establishment of Traffic Event Integration and Information Circulation Service.<br><br>2. Continue to use image recognition and artificial intelligence technology to improve the traffic event detection and report content, and increased the identification of specific vehicle types and types of traffic events.<br><br>3. Adjusted the experimental field in Kaohsiung City, and added 12 sets of AI Detection Devices at an important intersection and surrounding road sections in Tainan City.<br><br>4. In terms of the improvement of traffic parameter detection, the average accuracy rate of vehicle detection can reach 96% regardless day, night or rain; also added the detection of turning traffic volume at intersections, with the accuracy rate of most vehicle types reaching 90%.<br><br>5. In terms of the improvement of traffic event detection logic, in addition to increasing vehicle and event marking samples, the AI learning architecture and the adjustment of detection logic was added to improve the accuracy rate of event detection. |
| 109 | 1. 持續維運與強化中央與地方交通事件整合資訊流通服務平台。<br>2. 完成交通事件資料交換規範（草案）。<br>3. 持續檢討 AI 影像偵測邏輯精進調整及區域劃設邏輯更新。<br>4. 定義路口及路段可偵測項目區域劃設之邏輯，其中路口可偵測轉向交通量、異常停留與溢流；路段可偵測車流量、車速、佔有率、異常停留、逆向與壅塞。<br>5. 增加車輛及事件標示樣本，亦調整 AI 學習架構和偵測邏輯，提升物件與事件偵測準確率。<br><br>1. Continue to maintain and strengthen the Central and Local National Traffic Event Integration and Information Circulation Service Platform.<br><br>2. Completed the Traffic Event Data Exchange Specification (draft).<br><br>3. Continue to review AI image detection logic improvement, adjustments and area designation logic updates.<br><br>4. Define the logic for the area designation of detectable items at intersections and road sections, in which intersections can detect turning traffic volume, abnormal stays and overflows; road sections can detect traffic flow, vehicle speed, occupancy, abnormal stays, opposite direction and congestion.<br><br>5. Added vehicle and event marking samples; also adjusted the AI learning architecture and detection logic to improve the accuracy rate of object and event detection. |

## 2.研究成果

（1）本計畫已於108-109年度將高雄市交通事件整合服務成果複製移轉至臺南市，並完成中央與地方（高雄市與臺南市）之「交通事件整合資訊流通服務平台」開發建置，提供圖台查詢即時事件服務、資訊流通模組、活動通報模組與會員管理機制等功能。

## 2. Research Outcomes

(1) This project has copied and transferred the results of Kaohsiung's traffic event integration service to Tainan City in 2019–2020, and completed the development and construction of the "Traffic Event Integration and Information Circulation Service Platform" between the Central and Local Governments (Kaohsiung City and Tainan City), to provide functions of map real-time event service inquiry, information exchange module, activity report module and member management mechanism.

（2）此外為能提昇交通事件初報、續報與結報之資訊品質，本計畫自107至109年度嘗試運用影像辨識結合人工智慧等技術，針對交通事件發生前後的時空影響進行事件偵測與事件續報/解除之研究與實作，截至109年底已持續優化AI辨識技術，減少誤判機率，在車流量準確率方面，機車/小型車均可維持在90%以上，大型車部分則可達80%以上；車速準確率可達80%以上；車道佔有率準確率可達75%以上。此外透過AI學習架構和偵測邏輯調整，提升事件偵測準確率（異常停留偵測率為80%~98%不等）。

## 3.成果推廣與效益

（1）本計畫成果「交通需求導向之AI影像辨識技術研發與應用」榮獲「2020智慧城市創新應用獎」政府智慧治理組優勝獎項，並於109年9月參加智慧城市虛實整合線上展。

（2）109年11月舉辦年度計畫「研究成果經驗分享說明會」，使相關單位能夠瞭解本計畫重要研究成果，更進一步分享AI 影像偵測技術於交通事件辨識偵測之應用經驗。

（3）計畫成果已摘錄論文於「2020 台灣地理資訊學會年會暨學術研討會」及「中華民國運輸學會2020年會暨學術論文國際研討會」發表相關研究規劃成果，以提供各界瞭解及研討與應用。

(2) In addition, in order to improve the quality of the information of the original, renewed, and finalized reports of traffic events, this project attempted to use image recognition combined with artificial intelligence and other technologies to conduct the research and practice of event detection and event renewed report/removal aiming at the time and space effects before and after the traffic event from 2018 to 2020. As of the end of 2020, the AI recognition technology has been continuously optimized to reduce the probability of misjudgment. In terms of traffic flow accuracy rate, both motorcycles and vehicles cars can be maintained better than 90%, and on the part of large vehicles, it can reach better than 80%; vehicle speed accuracy rate can reach better than 80%; lane occupancy accuracy rate can reach better than 75%. Besides this, the accuracy rate of event detection has been improved (the abnormal stay detection rate ranges from 80% to 98%) through the AI learning architecture and detection logic adjustments.

## 3. Promotion of Outcomes and Benefits

(1) The results of this project, "Research and Application of Transportation Demand Oriented AI Image Recognition Technology" won the "2020 Smart City Innovation Application Award" of the Winning Award in the Government Smart Governance Group, and participated in the Smart City Virtual Reality Integration Online Exhibition in September 2020.

(2) In November 2020, the annual project "Research Results and Experience Sharing Seminar" was held to enable relevant units to understand the important research results of this project, and to further share the application experience of AI image detection technology in traffic event recognition and detection.

(3) The project results have been extracted into papers to publish the relevant research and planning results in the "2020 Taiwan Geographic Information Society Annual Conference and Academic Symposium" and the "Chinese Institute of Transportation 2020 Annual Conference and Academic Papers International Symposium" to provide understanding, discussion and application by all sectors.

**4.研究成果精華摘整**

依據使用需求於圖台套疊各事件類別

由新到舊表列即時事件資訊

依據圖台資訊分類統計即時交通事件數量
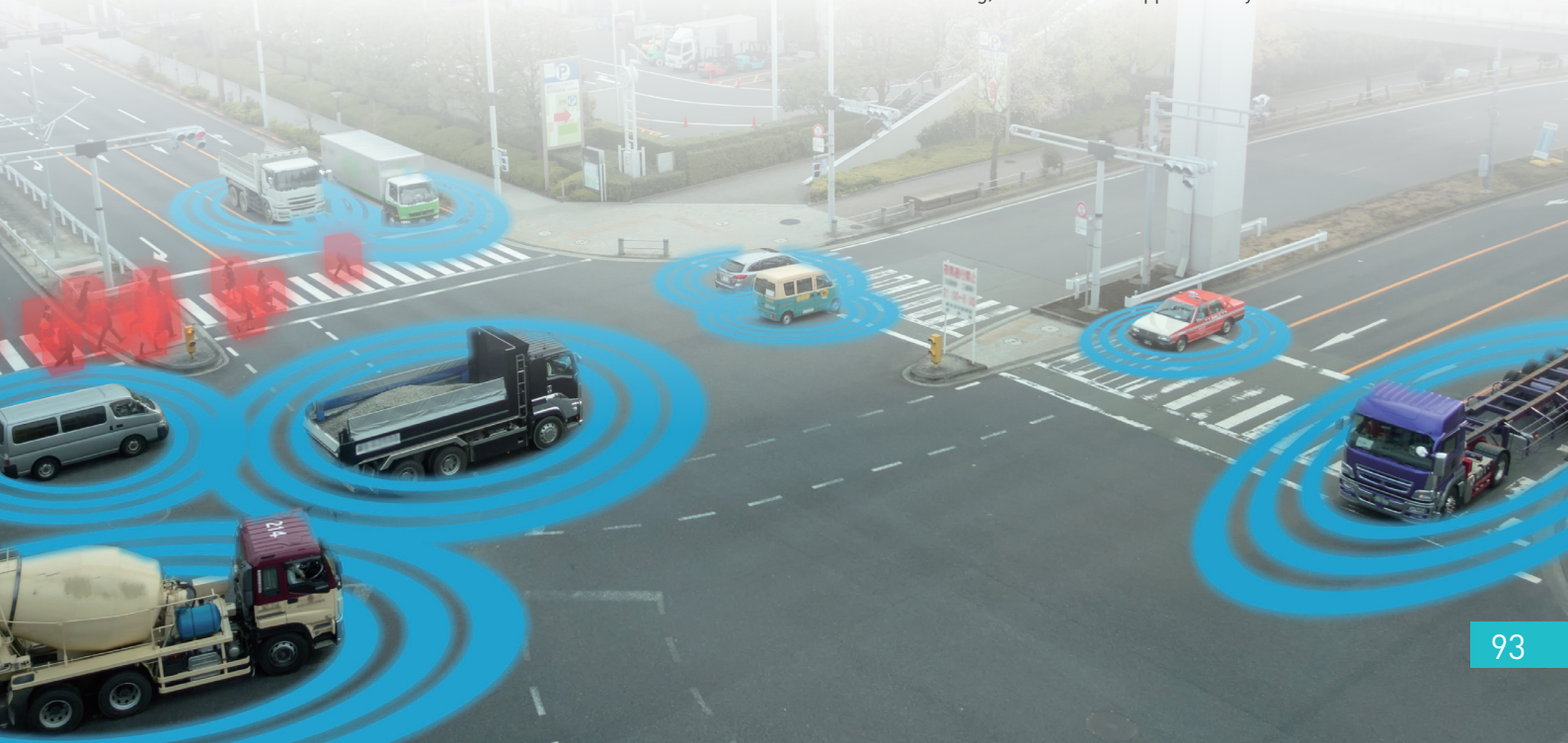
交通事件整合資訊流通服務平台
Traffic Event Integration and Information Circulation Service Platform



分車道分車種流量偵測

路口車輛溢流偵測

違規停車偵測

車輛、物體異常停留偵測

交通事故偵測

AI 影像辨識偵測車流與事件之成效示意圖
Schematic Diagram of the Effectiveness of AI Image Recognition in Detecting Traffic Flow and Events

**5.研究成果報告**

- 交通旅運資訊多元整合服務計畫-都市交通事件資訊整合發布實作（107年7月出版）

- 交通事件資訊整合服務與精進計畫（1/2）（108年10月出版）

- 交通事件資訊整合服務與精進計畫（2/2）（109年7月出版）

- 交通事件資訊整合服務擴充與事件偵測技術精進計畫（110年7月出版）

**5. Report of Research Outcomes**

- A Project of Integrating Multiple Travel Information Services – An Implementation of integrated Information Dissemination for Urban Traffic Event (Published in July 2018)

- The Service and Enhancement Project for The Information Integration of Traffic Events (1/2) (Published in October 2019)

- The Service and Enhancement Project for The Information Integration of Traffic Events (2/2) (Published in July 2020)

- Service and Enhancement Project for the Information Integration of Traffic Events (Published in July 2021)

## （六）多元公共運輸數據分析與行銷策略之研究

### 1.計畫概述

　　本計畫透過多元公共運輸數據進行分析，針對不同類型之MaaS會員，規劃不同之行銷策略，並協調高雄在地之計程車隊加入MaaS計程車服務，以增加MaaS計程車之車輛數及其服務品質。本研究選定高雄市內學校作為行銷重點學校，協助校方透過包含設攤、大型集會宣傳、製作宣傳品、懸掛看板等方式，以及服務性社團之學生協助宣傳MaaS服務，以同儕之角度增強宣傳之力度。兩所重點行銷學校輔英科大與正修科大之最終兩校會員數及購買月票數量皆有顯著成長。本計畫並從學生族群之行銷結果中，歸納出高雄MaaS於行銷層面之優勢與劣勢，並提出相對應之改善策略，俾利未來持續行銷高雄MaaS服務。

### 2.研究成果

（1）本計畫針對高雄市MaaS系統之會員資料，以及其多元公共運輸數據進行分析，藉以了解高雄MaaS使用者背景、旅運特性，並進行行銷策略之研擬與推動。

（2）本計畫為增加MeN Go計程車之車輛數，縮短MeN Go會員叫車之等候時間及提升MeN Go計程車之服務品質，協調中華大車隊加入MeN Go計程車之營運。在中華大車隊加入後，因其車隊數量較多，使會員叫車之成功率增加，故MeN Go計程車之使用量逐漸增加。

（3）本計畫在行銷方面採即時動態調整之策略，與MeN Go營運商、校方、MeN Go計程車隊及兩校學生保持密切之聯繫，隨時視情況調整行銷手法與策略，進而明顯增加兩校之會員數及購買月票數量。

## (6) Research of Diverse Public Transportation Data Analysis and Marketing Strategy

### 1. Project Overview

This project analyzes multiple public transportation data, plans different marketing strategies for different types of MaaS members, and coordinates the Kaohsiung local taxi fleet to join the MaaS taxi service to increase the number of MaaS taxis and their service quality. This study selects schools in Kaohsiung City as key schools for marketing, and assists the schools to promote the MaaS services through the methods including setting up booths, large-scale publicity gathering, production of promotional materials, and hanging of billboards, as well as students of service associations to help promote MaaS services, to enhance the intensity of promotion from the perspective of peers. The final number of registered members for two schools and the number of monthly tickets purchased by the two key marketing schools, Fooyin University and Cheng Shiu University, have increased significantly. This project also summarizes the advantages and disadvantages of Kaohsiung MaaS at the marketing level from the marketing results of the student population, and proposes corresponding improvement strategies to benefit the continued marketing of Kaohsiung MaaS services in the future.

### 2. Research Outcomes

(1) This project analyzes the membership information of the MaaS system in Kaohsiung City and its multiple public transportation data, so as to understand the background of Kaohsiung MaaS users, travel characteristics, and conduct the development and promotion of marketing strategies.

(2) This project is to increase the number of MeN Go taxis, shorten the waiting time for MeN Go members to book taxis, improve the service quality of MeN Go taxis, and coordinate the Chunghwa Taxi Team to join the operation of MeN Go taxis. After the joining of the Chunghwa Taxi Team, due to the large number of its taxis, the success rate of member booking for taxis has increased, so the use of MeN Go taxis has been gradually increased.

(3) This project adopts real-time and dynamic adjustment strategies in marketing, and maintains close contact with MeN Go operators, the school, the MeN Go taxi team and the students of the two schools, and adjusts the marketing methods and strategies according to the situation at any time, thereby significantly increasing the number of registered members of the two schools and the number of monthly tickets purchased.

### 3.成果推廣與效益

（1）為讓學生更認識與了解高雄MaaS服務，進而認同並加入會員，本計畫在重點學校規劃許多宣傳活動，協助校方透過包含大型集會宣傳、製作宣傳品等方式，推廣行銷與增加兩校會員人數。

（2）與上個學期相比，重點學校之會員數量明顯增加，購買月票數量亦有顯著成長。由購買月票數量可發現，正修科大之學生購買公車暢遊方案之數量明顯占多數，輔英科大則以無限暢遊方案為多數，此與兩校之交通條件、地理環境等因素相符合。

（3）本計畫歸納出高雄MaaS於行銷層面之經驗，109年11月於交通大學臺北校區邀請高雄市政府交通局、臺東縣政府交通及觀光發展處、正修科大、輔英科大、倫永大車隊及中華大車隊等代表，深入探討MaaS成果行銷與推廣議題。

### 3. Promotion of Outcomes and Benefits

(1) In order to let students know and understand more about the Kaohsiung MaaS services, and then recognize and join as members, this project plans many publicity activities in key schools, and assists the schools to promote marketing and increase the number of registered members for both schools by including large-scale publicity gathering and production of promotional materials.

(2) Compared with the previous semester, the number of registered members in key schools has increased significantly, and the number of monthly tickets purchased has also significantly increased. From the number of monthly tickets purchased, it can be found that the students of Cheng Shiu University who purchased the bus ride program are obviously the majority, while the students of Fooyin University purchased the unlimited ride program as the majority, and this is in line with the traffic conditions and geographical environment of the two schools.

(3) This project summarizes the experience of Kaohsiung MaaS at the marketing level. In November 2020, the representatives of the Transportation Bureau of Kaohsiung City Government, Tourism Department of Taitung County Government, Cheng Shiu University, Fooyin University, Yes Taxi and Chunghwa Taxi Team discussed in depth on the issues of marketing and promotion of MaaS results.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes



MaaS 重點學校客製化行銷海報
Customized Marketing Poster for MaaS Key School
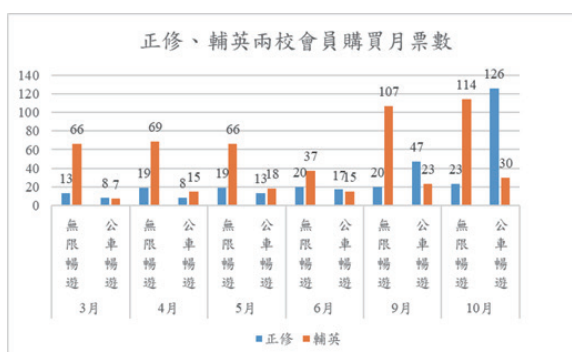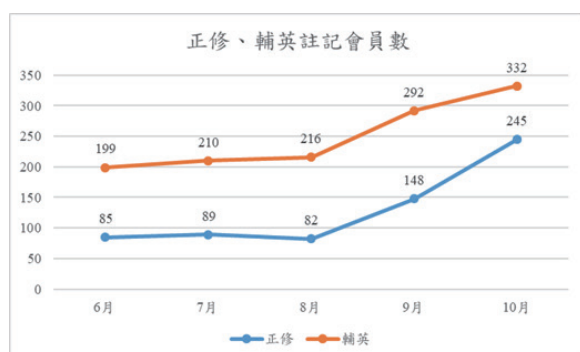


MaaS 重點學校註冊會員數及購買月票數
Number of Registered Members of MaaS Key Schools and Number of Monthly Tickets Purchased

## 5.研究成果報告

· 多元公共運輸數據分析與行銷策略研究
（110年7月出版）

## 5. Report of Research Outcomes

· Research of Diverse Public Transportation Data Analysis and Marketing Strategy (Published in July 2021)

## （七）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

　　隨著電子及通訊產業的進步，發展遙控無人機的應用服務已成為國際趨勢，遙控無人機在交通運輸領域的應用是層見疊出，其高機動性、高彈性部署特性，能夠有效提升運輸系統之　性、可及性及安全性。交通部為有效導入遙控無人機於我國交通運輸領域的應用以及促進相關產業的發展，成立「無人機科技產業小組」。

　　本所108年度辦理「我國遙控無人機在交通域發展之推動策略」計畫，邀請國內學者專家，就防救災、智慧運輸（含交通資料蒐集）、物流運送三大議題，探討如何從科技面、經濟面與交通面　整合，帶動相關產業之合作與發展，並於108年9月11日舉辦「無人機於交通運輸創新應用產業論壇」，，提出8項推動策略，並據以規劃我國無人機在交通領域發展之路徑圖。

　　109年7月至110年10月延續前述發展策略及路徑圖，與財團法人中華航空事業發展基金會合辦「推動我國無人機科技產業發展先期研究規劃」、「無人機在交通領域之創意應用競賽」、「無人機整合示範計畫推動及管理服務」等三項計畫，持續推動檢討精進相關發展策略，並推廣無人機於交通領域之創新應用與產業發展。

### 2.研究成果

（1）交通科技產業會報無人機科技產業小組：109年7月3日召開第3次諮詢委員會議，討論國家中山科學研究院及嘉義縣政府提報設置「無人機產業園區及國家級無人機研發測試驗證中心」案。

（2）推動我國無人機科技產業發展先期研究規劃：完成蒐集國際無人機發展趨勢及盤點我國無人機科技產業能量，並啟動修訂無人機在交通領域之發展策略及路徑圖。

（3）無人機在交通領域之創意應用競賽：競賽分為創意組及應用組，創意組鼓勵學生提出無人機創新設計；應用組由政府機關提出導入無人機於公務應用之成功案例。

（4）無人機整合示範計畫推動及管理服務：分別與公路總局合作，開放橋梁檢測場

## (7) Promoting innovative applications and industrial development of UAV in transportation sector

### 1. Project Overview

With the advancement of the electronics and communications industries, the development of application services for remote controlled Unmanned Aerial Vehicles has become an international trend, and the applications of remote controlled Unmanned Aerial Vehicles in the field of transportation keep appearing one after another. Their high mobility and flexible deployment characteristics can effectively improve the mobility, accessibility and safety of the transportation system. In order to effectively introduce the application of remote controlled Unmanned Aerial Vehicles in our country's transportation field and promote the development of related industries, the Ministry of Transportation and Communications established the "UAV Technology Industry Group."

In 2019, the IOT managed the "Promotion Strategies for the Development of our Country's Remote Controlled Unmanned Aerial Vehicles in the Transportation Sector" project, invited domestic scholars and experts to discuss how to connect and integrate them from the aspects of technology, economy and transportation with three major topics of disaster prevention and relief, smart transportation (including traffic data collection), and logistics transportation, to promote the cooperation and development of related industries, and organized the "Unmanned Aerial Vehicles in the Transportation Innovation Application Industry Forum" on September 11, 2019, with eight promotion strategies proposed as the basis for the road map of planning our country's Unmanned Aerial Vehicles in the Development of Transportation Sector.

Continuing the aforementioned development strategy and road map from July 2020 to October 2021, and co-organized three projects of the "Preliminary Research on the Development of our Country's Unmanned Aerial Vehicles Technology Industry," "Creative Application Competition of Unmanned Aerial Vehicles in the Transportation Sector" and "UAV Integration Pilot Program Promotion and Management Services" with the China Aviation Development Foundation. The three projects continue to promote the review and improvement of related development strategies, and promote the innovative applications and industrial development of Unmanned Aerial Vehicles in the transportation sector.

### 2. Research Outcomes

(1) The Unmanned Aerial Vehicle Technology Industry Group of the Transportation Technology Industry Committee: On July 3, 2020, the third advisory committee meeting was convened to discuss the project proposed by the National Chung-Shan Institute of Sciences and Technology and the Chiayi County Government to set up the "Unmanned Aerial Vehicle Industry Park and National Unmanned Aerial Vehicle Research and Development, Testing and Verification Center."

(2) Promote the preliminary research planning for the development of our Country's Unmanned Aerial Vehicle technology industry: Complete the collection of international Unmanned Aerial Vehicle development trends

域，以及與中華郵政合作物流運送等兩項議題，提供無人機業者場域實地測試驗證。

### 3.成果推廣與效益

109年11月17日辦理「卓越領航 乘風起飛」記者會。

### 4.研究成果精華摘整



109 年 11 月 17 日交通部「卓越領航 乘風起飛」記者會
Press Conference of "Excellence in Piloting, Taking Off with the Wind" by the
Ministry of Transportation and Communications on November 17, 2020

and inventory the energy of our Country's Unmanned Aerial Vehicle technology industry, and initiate the revision of Unmanned Aerial Vehicle development strategies and road maps in the transportation sector.

(3) The Creative Application Competition of Unmanned Aerial Vehicles in the Transportation Sector: The competition is divided into a creative group and an application group. The creative group encourages students to propose innovative designs for Unmanned Aerial Vehicles; the application group proposes successful cases of introducing Unmanned Aerial Vehicles for official business by government agencies.

(4) Promotion and management services for Unmanned Aerial Vehicle integration demonstration projects: Provide field testing and verification by the Unmanned Aerial Vehicle operators with two subjects of cooperating with the Directorate General of Highways to open up bridge inspection fields, as well as cooperating with Chunghwa Post for logistics transportation.

### 3. Promotion of Outcomes and Benefits

Held the Press Conference of "Excellence in Piloting, Taking Off with the Wind" on November 17, 2020.

### 4. Summary of Research Outcomes



我國無人機在交通領域發展的施政主軸（RoadMap）
The Development Road Map of Our Country's Unmanned Aerial Vehicle
in Transportation Sector

### 5.研究成果報告

- 推動我國無人機科技產業發展先期研究規劃（預定111年3月出版）
- 無人機在交通領域之創意應用競賽（預定111年3月出版）
- 無人機整合示範計畫推動及管理服務（預定111年3月出版）

### 5. Report of Research Outcomes

- The Preliminary Research on the Development of our Country's Unmanned Aerial Vehicles Technology Industry (To be published in March 2022)
- A Competition for Creative Applications of UAV in the Transportation Sector (To be published in March 2022)
- Promoting and Management Service on UAV Integrated Pilot Program (To be published in March 2022)

## （八）Taiwan Pass 數位旅遊服務整合平台規劃

### 1.計畫概述

「Taiwan Pass 數位旅遊服務整合平台」因其涉及層面廣大且相關介面整併複雜，須多方工作協調且具有錯綜複雜之關係，爰交通部指示本所協助觀光局先行辦理規劃案。

本計畫規劃提供國際旅客及國內旅客一站式觀光旅運服務，整合觀光旅遊需要的服務包括餐飲（食）、飯店旅館（宿）、觀光景點（遊）、特色商品（購）、交通（行）等面向，將其服務數位化並於服務平台上進行整合與包裝，使用者可於平台上進行旅運規劃、服務預訂、完成付費及服務評價等項目；當觀光旅運需求鏈集中在平台中進行，各類服務可有效整合時，相關產業之經營者將可創造更大的市場獲益，使用者也因此得到更高的運輸服務及觀光旅遊價值。

此外，亦將透過旅客行為大數據之蒐集與分析，找出可能隱藏其中之珍貴訊息與趨勢，進一步轉換為營運管理、服務創新與政策決策支援之有效資訊，以做為後續公共政策、交通管理、加值服務、服務品質提升等之墊腳石。

### 2.研究成果

（1）就Taiwan Pass 數位旅遊服務整合平台之架構、功能需求、建置規劃、營運模式及策略、後續營運移轉、相關法規等議題進行規劃探討並研提相關建議，以做為後續平台實際建置、營運、移轉等之應用。

（2）分別研提「Taiwan Pass 數位旅遊服務整合平台建置計畫」之第一期招標規範及「Taiwan Pass 數位旅遊服務整合平台營運暨建置計畫」之招標規範，協助Taiwan Pass 數位旅遊服務整合平台之建置與推動。

## (8) Taiwan Pass Digital Travel Service Integration Platform Planning

### 1. Project Overview

Because the "Taiwan Pass Digital Tourism Service Integration Platform" involved in a wide range of aspects and the related interface integration is complex, which requires coordination of multiple parties and has a complicated relationship, the Ministry of Transportation and Communications therefore instructed the IOT to assist the Tourism Bureau to first manage the planning project.

This project is planned to provide one-stop tourism transportation services for international and domestic tourists, and integrates the required services of tourism including catering (food), hotels (accommodation), tourist attractions (tours), specialty products (purchasing) and transportation aspects, to digitize the tourism services and integrate and package the services on the service platform for the users to carry out travel planning, service booking, payment and service evaluation on the platform; when the tourism travel demand chain is concentrated for implementation and all types of services can be effectively integrated on the platform, operators of related industries will be able to create greater market benefits, and users will therefore get higher transportation service and tourism value.

In addition, through the collection and analysis of tourists' behavior big data, precious information and trends can be found, and further transform it into effective information for operation management, service innovation and policy decision support as the stepping stones for the improvement of subsequent public policies and traffic management, value-added services and service quality, etc.

### 2. Research Outcomes

(1) Conduct planning and discussion, researching and proposing relevant recommendations on the topics of architecture, functional requirements, construction planning, operation model and strategy, follow-up operation transfer, and related laws and regulations of the "Taiwan Pass Digital Tourism Service Integration Platform," to be used as the actual implementation, operations and transfer of the follow-up platform.

(2) Research and propose the first phase tendering specifications of the "Taiwan Pass Digital Tourism Service Integration Platform Construction Project" and the tendering specifications of the "Taiwan Pass Digital Tourism Service Integration Platform Operation and Construction Project" to assist the construction and promotion of the Taiwan Pass Digital Tourism Service Integration Platform.

## 3.成果推廣與效益

（1）協助Tourism 2030臺灣觀光政策白皮書之策略推動，計畫成果研提之相關招標規範，將提供交通部觀光局做為後續Taiwan Pass 數位旅遊服務整合平台之營運暨建置參據。

（2）辦理Taiwan Pass 數位旅遊服務整合平台服務功能意見蒐集或推廣活動。

## 4.研究成果精華摘整

## 3. Promotion of Outcomes and Benefits

(1) Assist in the strategic promotion of the Tourism 2030 Taiwan Tourism Policy White Paper, and the relevant tendering specifications for the project results research and proposal, and provide the Tourism Bureau of the Ministry of Transportation and Communications as a reference of operation and construction for the follow-up Taiwan Pass Digital Tourism Service Integration Platform.

(2) Organize the Taiwan Pass Digital Tourism Service Integration Platform service function comments collection or promotion activities.

## 4. Summary of Research Outcomes



Taiwan Pass 數位旅遊服務整合平台示意圖
Schematic Diagram of Taiwan Pass Digital Travel Service Integration Platform

## 六、 氣候變遷環境下運輸部門之因應作為

### （一）運輸部門第1期溫室氣體減量作為及第2期精進建議

#### 1.計畫概述

為配合國家推動溫室氣體減量政策，交通部依溫管法暨施行細則規定，以5年為一階段，擬定運輸部門溫室氣體排放管制行動方案，作為我國運輸部門推動溫室氣體減量之依循，並作為直轄市、縣（市）依溫管法訂定溫室氣體管制執行方案之依據。

運輸部門為我國溫室氣體排放第四大部門，以公路運輸排放為最大宗，108年占比達96.8%；公路運輸排放又以小客車50.5% 最高、其次是大貨車18.3%。為推動溫室氣體減量工作，第1期（105-109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11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。

#### 2.研究成果

（1）完成並陳報「運輸部門溫室氣體排放管制行動方案執行成果」（109年9月版），於110年1月6日奉行政院核定。

（2）配合行政院協商第2期（110-114年）部門減量分配目標，協助推估運輸部門排放基線及減量效益。

（3）研議第2期（110-114年）運輸部門溫室氣體排放管制行動方案（草案）推動措施精進建議，蒐集民眾及專家意見，研提行動方案草案初稿。

#### 3.成果推廣與效益

（1）於109年10月15日、16日及20日環保署假臺北、臺中、高雄召開之「第2期階段管制目標」公聽會中，向與會民眾說明運輸部門第1期減量成果，以及第2期減量策略及措施規劃內容。

（2）透過交通部、環保署、經濟部等部會執

## VI. Response of Transportation Sectors in Climate Change Environment

### (1) Phase 1 Actions of Greenhouse Gas Reduction and Phase 2 Improvement Suggestions of Greenhouse Gas Reduction in the Transportation Sector

#### 1. Project Overview

In order to cooperate with the country's promotion of greenhouse gas reduction policies, the Ministry of Transportation and Communications draws up the Greenhouse Gas Emission Control Action Plan for the transportation sector with five years as a phase in accordance with the provisions specified in the "Enforcement Rules of Greenhouse Gas Reduction and Management Act" as the compliance for our country's transportation sector in promoting the greenhouse gas reduction, and as the basis for the municipalities, counties (cities) to establish the greenhouse gas control implementation plans in accordance with the Greenhouse Gas Reduction and Management Act.

The transportation sector is the fourth largest sector of greenhouse gas emissions in our country, with highway transportation emission as the largest amount, accounting for 96.8% in 2019; the small passenger car is the highest in highway transportation emission at 50.5%, followed by large trucks at 18.3%. In order to promote greenhouse gas reduction work, in the first phase (2016–2020), the transportation sector adopted three major strategies of "Developing Public Transportation Systems, Strengthening Transportation Demand Management," "Building Green Transportation Network, Promoting the Use of Low-carbon Transportation Vehicles, Establishing Green Transportation Vehicle Oriented Transportation Environment" and "Improving the Transportation System and Energy Use Efficiency of Transportation Vehicles," with eleven measures. Rolling review the action plan implementation effectiveness as well as research and submit the implementation results report every year.

#### 2. Research Outcomes

(1) Completed and reported the "Implementation Results of the Greenhouse Gas Emission Control Action Plan for the Transportation Sector" (September 2020 Edition), which was approved by the Executive Yuan on January 6, 2021.

(2) Cooperate with the Executive Yuan to negotiate the Phase-2 (2021–2025) departmental reduction allocation target, and assist in estimating the emission baseline and reduction benefits of the transportation sector.

(3) Develop the Phase-2 (2021–2025) Transportation Sector Greenhouse Gas Emission Control Action Plan (Draft) to promote measure improvement recommendations, collect opinions from the public and experts, research and submit the first draft of the Action Plan.
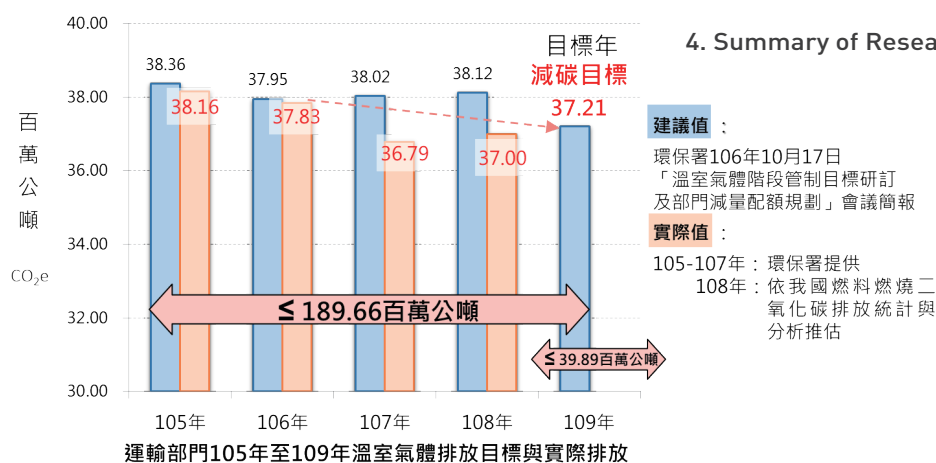
#### 3. Promotion of Outcomes and Benefits

(1) In the "The 2nd Phase GHG Control Targets" public hearing held by the Environmental Protection Administration in Taipei, Taichung, and Kaohsiung on October 15, 16 and

行相關措施,運輸部門溫室氣體排放量已下降,107年、108年運輸部門溫室氣體排放量分別為3,679萬公噸及3,700萬公噸,均低於第一期(105-109年)109年溫室氣體排放管制目標(3,721.1萬噸),顯示運輸部門推動溫室氣體減量工作已見成效。

20, 2020, to explain the Phase-1 reduction results of the transportation sector to the people participating in the hearing, and the content of the Phase-2 reduction strategies and measure planning.
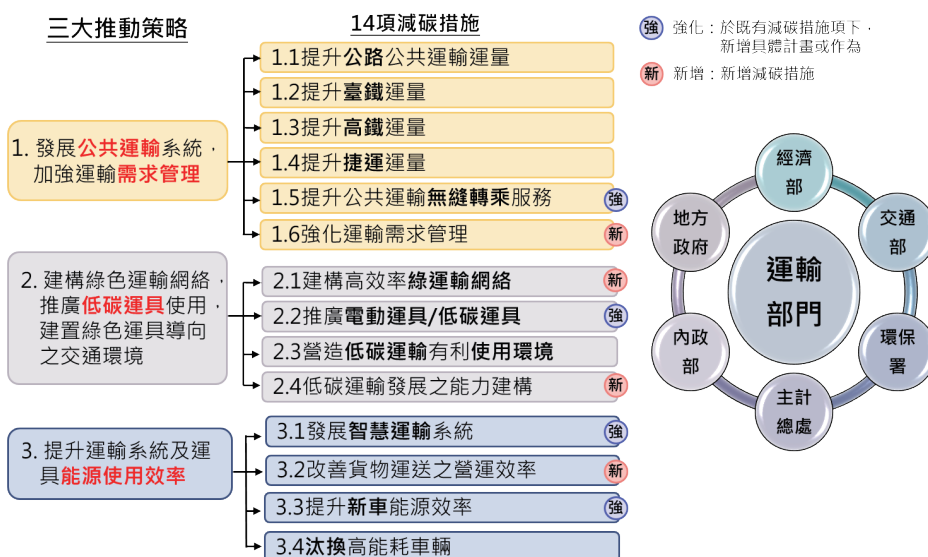
(2) Through the implementation of relevant measures by the Ministry of Transportation and Communications, the Environmental Protection Administration, and the Ministry of Economic Affairs, the greenhouse gas emissions of the transportation sector have been reduced. The greenhouse gas emissions of the transportation sector in 2018 and 2019 were 36.79 million metric tons and 37 million metric tons, respectively, both are lower than the Phase-1 (2016–2020) 2020 greenhouse gas emission control target (37.211 million tons), indicating that the transportation sector has achieved the effectiveness in promoting greenhouse gas reduction.

## 4.研究成果精華摘整



百萬公噸 $CO_2e$

- 38.36 / 38.16 (105年)
- 37.95 / 37.83 (106年)
- 38.02 / 36.79 (107年)
- 38.12 / 37.00 (108年)
- 目標年 減碳目標 37.21 (109年)

≤ 189.66百萬公噸
≤ 39.89百萬公噸

**運輸部門105年至109年溫室氣體排放目標與實際排放**

運輸部門減碳執行成果
Implementation Results of Carbon Reduction in the Transportation Sector

## 4. Summary of Research Outcomes

**建議值**:
環保署106年10月17日「溫室氣體階段管制目標研訂及部門減量配額規劃」會議簡報

**實際值**:
105-107年:環保署提供
108年:依我國燃料燃燒二氧化碳排放統計與分析推估



### 三大推動策略

**14項減碳措施**

1. 發展**公共運輸**系統,加強運輸**需求管理**
   - 1.1提升**公路**公共運輸運量
   - 1.2提升**臺鐵**運量
   - 1.3提升**高鐵**運量
   - 1.4提升**捷運**運量
   - 1.5提升公共運輸**無縫轉乘**服務 (強)
   - 1.6強化運輸需求管理 (新)

2. 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
   - 2.1建構高效率**綠運輸網絡** (新)
   - 2.2推廣電動運具/低碳運具 (強)
   - 2.3營造**低碳運輸**有利**使用環境**
   - 2.4低碳運輸發展之能力建構 (新)

3. 提升運輸系統及運具**能源使用效率**
   - 3.1發展**智慧運輸**系統 (強)
   - 3.2改善貨物運送之營運效率 (新)
   - 3.3提升**新車**能源效率 (強)
   - 3.4**汰換**高能耗車輛

(強) 強化:於既有減碳措施項下,新增具體計畫或作為
(新) 新增:新增減碳措施

運輸部門:經濟部、交通部、環保署、主計總處、內政部、地方政府

第2期運輸部門溫室氣體排放管制行動方案(草案)
Phase 2 Transportation Sector Greenhouse Gas Emission Control Action Plan (Draft)

## 5.研究成果報告

- 運輸部門溫室氣體減量第二階段策略精進研究(110年8月出版)

## 5. Report of Research Outcomes

- Research on the Phase 2 Strategy Improvement of Greenhouse Gas Reduction in the Transportation Sector(Published in August 2021)

## （二）汽車運輸業參與溫室氣體抵換專案之研究

### 1.計畫概述

為鼓勵溫室氣體排放源自願減量，我國《溫室氣體減量及管理法》及《溫室氣體抵換專案管理辦法》已訂有相關規範，各類事業可透過執行抵換專案，向環保署申請取得排放額度。

本計畫主要工作係評析國內汽車運輸業可應用之減量措施與適用於申請抵換專案之減量方法，並考量我國汽車運輸業營運特性及參與抵換專案可能面臨問題，提出優先輔導對象及減量方法本土化之建議，做為後續交通部及公路總局輔導汽車運輸業溫室氣體減量之應用。

### 2.研究成果

（1）彙析聯合國清潔發展機制（Clean Development Mechanism，CDM）之減量方法，較適用於我國汽車運輸業參與抵換專案者為引入低碳車輛或提升車輛能源效率之減量方法。

（2）市區及公路汽車客運業可配合大客車電動化措施，逐年將柴油大客車汰換為電動大客車，目前已有「港都客運電動公車抵換專案」案例，可供業者參考依循。

（3）汽車客貨運業已有採行之車輛節能措施，如空氣動力套件、數位行車紀錄及駕駛行為分析系統等，業者可依實務應用狀況，以CDM為基礎，建立本土化減量方法，降低參與抵換專案之門檻。

### 3.成果推廣與效益

（1）辦理3場教育訓練，邀集交通部路政司、公路總局、監理所站及直轄市交通局人員，說明抵換專案法規制度與作業程序，以及汽車運輸業參與抵換專案輔導經驗分享。

## (2) A Study on the Participation of Automobile Transportation Industry in the GHG Offset Project

### 1. Project Overview

In order to encourage voluntary reduction of greenhouse gas emission sources, our country's "Greenhouse Gas Reduction and Management Ac" and "Regulations for Greenhouse Gas Offset Project Management" have established relevant regulations; all businesses can apply for reduction credits from the Environmental Protection Administration through the implementation of the Offset Project.

The main work of this project is to evaluate the reduction measures that can be applied by the domestic automobile transportation carriers and the reduction methods applicable to the application for the offset project, consider the operational characteristics of our country's automobile transportation carriers and the problems that may be faced by participating in the offset project, and propose the recommendations of priority guidance targets and reductions method localization, as a follow-up application of the Ministry of Transportation and Communications and the Directorate General of Highways to guide the automobile transportation carriers to reduce greenhouse gas emissions.

### 2. Research Outcomes

(1) Categorize and analyze the reduction method of the United Nations Clean Development Mechanism (CDM), for the reduction method which is more suitable for our country's automobile transportation carriers to participate in the offset project as the reduction method to introduce the low-carbon vehicles or to improve the vehicle energy efficiency.

(2) The city and highway automobile passenger transportation carriers can cooperate with the electric bus electrification measures, and replace diesel buses with electric buses year by year. At present, there is a case of the "Great City Life Bus Electric Bus Replacement Project," which can be used as a reference for the carrier operators.

(3) The automobile passenger and freight carriers have adopted vehicle energy-saving measures, such as aerodynamic kits, digital driving records and driving behavior analysis systems. The carrier operators can establish localized reduction methods based on the actual use conditions and CDM to reduce the threshold of participating in the replacement project.

### 3. Promotion of Outcomes and Benefits

(1) Organized three education training sessions and invited personnel from the Department of Railways and Highways, Directorate General of Highways, Motor Vehicles Offices and Stations of the Ministry of Transportation and Communications, and the Transportation Bureau of Municipalities to explain the laws and regulations system and the operating procedures of the Offset Project, as well as the guidance experience sharing of the automobile transportation carriers participated in the Offset Project.

（2）辦理2場專家諮詢會，透過產官學界專家進行意見交流，討論汽車運輸業應用減量措施、參數取得、論述減量方法規範項目時之實務狀況，以及減量方法本土化之建議。

(2) Managed two Expert Consultation Meetings to exchange opinions through industry, government, and academic experts, and discuss the application of reduction measures in the automobile transportation carriers, the acquisition of parameters, the practical situation of the reduction method regulation items, as well as the recommendations for localization of reduction methods.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes



汽車運輸業輔導建議
Counseling Advice for the Automotive Transportation Carriers

## 5.研究成果報告

· 汽車運輸業參與溫室氣體抵換專案之研究（110年9月出版）

## 5. Report of Research Outcomes

· A Study on the Participation of Automobile Transportation Industry in the GHG Offset Project (Published in September 2021)

## （三）應用交通管理策略減少都會區交通空氣污染之研析（1/3）

### 1.計畫概述

108年10月行政院核定之空氣污染防制行動方案計畫書，其策略十二交通管理新作為中，明確揭示除透過運具之動力形式轉移外，亦要透過相關管制措施，導引汽機車使用者減少使用量。

本計畫探討有效影響用路人運具選擇之作為，並考量不同需求之用路人對於各項交通減污措施的行為反應，進而提出交通部門因地制宜之交通管理策略建議，使交通空污減量。

本計畫為3年期計畫，第一年已依六都之公共運輸發展、空污狀況進行調查地區分類，依據其各地區特性規劃問卷設計，並於擇定之區域進行問卷調查，探討私人運具使用族群對於交通減污策略之可能行為反應。

### 2.研究成果

（1）以各都會區之公共運輸服務能量及私人運具空氣污染影響程度為指標，完成調查研究地區分類，並依據年度目標規劃分年調查區域及調查計畫。

（2）針對優先調查地區（臺北市內湖區及大安區、新北市汐止區及板橋區）辦理問卷調查，顯示限制私有運具方便性、增加私有運具成本及降低公共運輸整體乘車時間，較能使私有運具使用者轉移至公共運輸。另提升低污染運具穩定度、普及充／換電站，以及提供車輛汰舊換新補助為主要影響低污染運具使用之措施。

（3）辦理焦點團體座談會，聚焦並提出減少都會區私人運具使用及空污減量之交通管理策略的通案性建議。

## (3) Research and Analysis on Applying Traffic Management Strategies to Reduce Traffic Air Pollution in Metropolitan Areas (1/3)

### 1. Project Overview

In the 12 new traffic management actions of the "Air Pollution Control Action Plans" approved by the Executive Yuan in October 2019, it is clearly stated that in addition to transferring the form of power for the transportation vehicles, it is also necessary to guide the automobile and motorcycle users to reduce usage through relevant control measures.

This project explores the actions that can effectively influence the choice of road users, and considers the behavioral responses of road users with different needs to various traffic pollution reduction measures, and further proposes traffic management strategies to suit the implementation of policy measures to the local conditions for the transportation departments to reduce traffic air pollution.

This project is a three-year project. In the first year, the survey area has been classified according to the public transportation development and air pollution condition in six municipalities, with the questionnaire design planned according to the characteristics of each area, and the questionnaire survey conducted in the selected area to explore the possible behavioral responses of the group using private transportation vehicles on the traffic pollution reduction strategies.
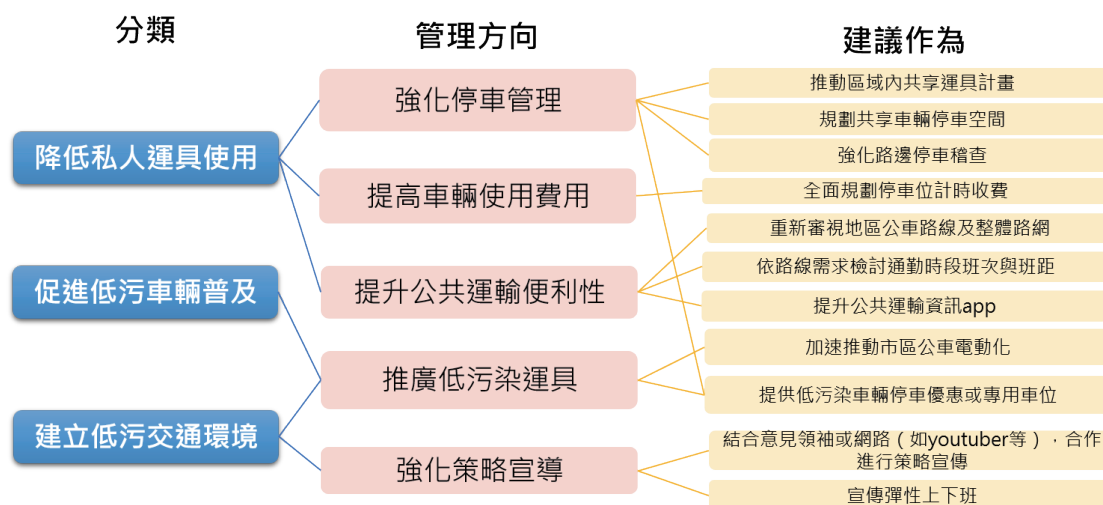
### 2. Research Outcomes

(1) Based on the public transportation service energy of each metropolitan area and the air pollution impact of private transportation vehicles as indicators, completed the classification for the survey and research areas, and planned for the annual survey area and survey plan according to the annual target.

(2) Conducted questionnaire surveys aiming at the priority areas (Neihu District and Da'an District of Taipei City, Xizhi District and Banqiao District of New Taipei City), showing that limiting the convenience of private transportation, increasing the cost of private transportation vehicles, and lowering the overall travel time of public transportation, the users of private transportation vehicles are more willing to transfer to public transportation. Furthermore, improving the stability of low-pollution transportation vehicles, popularizing charging/replacement stations, and providing vehicle replacement subsidies are measures that mainly affect the use of low-pollution transportation vehicles.

(3) Conduct Focus Group Round Discussion: focused on and put forward general proposals for traffic management strategies to reduce the use of private transportation vehicles and air pollution reduction in metropolitan areas.

## 3.成果推廣與效益

（1）連結「空氣污染防制行動方案計畫書」及「運輸政策白皮書-綠運輸分冊」之相關交通空污減量管理策略，做為支持中央及地方環保與交通管理機關（如交通部、環保署、地方交通局與環保局）推動前述政策之研究論述。另可提供中央/地方交通主管機關因地制宜提出提升空氣品質之交通管理措施，用以改善地區交通環境空氣品質與民眾健康。

（2）透過推廣工作坊，促使交通管理單位將交通空污減量思維納入交通管理措施之規劃。

## 4.研究成果精華摘整

## 3. Promotion of Outcomes and Benefits

(1) Link the relevant air pollution reduction management strategies of the "Air Pollution Control Action Plans" and the "Transportation Policy White Paper-Green Transportation Volume" as the research discussion to support the Central and Local Environmental Protection and Traffic Management Agencies (such as the Ministry of Transportation and Communications, the Environmental Protection Administration, Local Transportation Bureau and Environmental Protection Bureau) in promoting the research and discussion of the aforementioned policies. In addition, it can provide the Central/Local Transportation Competent Authorities to propose traffic management measures of improving air quality to suit the implementation of policy measures to the local conditions, and to improve the air quality of the local traffic environment and the health of the people.

(2) Through promotion workshops, encourage the traffic management units to incorporate traffic air pollution reduction thinking into the planning of traffic management measures.

## 4. Summary of Research Outcomes

| 分類 | 管理方向 | 建議作為 |
|---|---|---|
| 降低私人運具使用 | 強化停車管理 | 推動區域內共享運具計畫 |
| | | 規劃共享車輛停車空間 |
| | | 強化路邊停車稽查 |
| | 提高車輛使用費用 | 全面規劃停車位計時收費 |
| 促進低污車輛普及 | 提升公共運輸便利性 | 重新審視地區公車路線及整體路網 |
| | | 依路線需求檢討通勤時段班次與班距 |
| | | 提升公共運輸資訊app |
| 建立低污交通環境 | 推廣低污染運具 | 加速推動市區公車電動化 |
| | | 提供低污染車輛停車優惠或專用車位 |
| | 強化策略宣導 | 結合意見領袖或網路（如youtuber等），合作進行策略宣傳 |
| | | 宣傳彈性上下班 |

降低交通空污管理方向及建議作為
Management Directions and Recommended Actions to Reduce Traffic Air Pollution

## 5.研究成果報告

· 應用交通管理策略減少都會區交通空氣污染之研析（1/3）－研究地區分類及初期調查（110年8月出版）

## 5. Report of Research Outcomes

· Research and Analysis on Applying Traffic Management Strategies to Reduce Traffic Air Pollution in Metropolitan Areas (1/3) - Research Area Classification and Preliminary Investigation (Published in August 2021)

## （四）運輸系統因應氣候變遷調適之研究

### 1.計畫概述

　　為提升並健全我國面對氣候變遷的調適能力，我國於104年 7月公布施行《溫室氣體減量及管理法》，其中第13條明定中央目的事業主管機關應進行調適策略之研議，係屬部層級之施政策略方向，爰需對於整體運輸設施有上位政策之探討 。

　　本所已於107年辦理完成「運輸部門氣候變遷調適策略研議計畫」，提出四大構面及15項調適策略建議。為掌握國際最新調適趨勢，本計畫滾動檢討運輸系統調適策略，並借鏡於國外調適之新趨勢與應用新科技於調適之作為，完成新版調適策略，並提出應用新科技輔助提升運輸系統調適能力的建議，提供設施管理機關參考。

### 2.研究成果

**（1）完成運輸系統調適策略滾動檢討：**

　　以本所「運輸部門氣候變遷調適策略研議計畫」所研提之調適策略為基礎，依據國外最新調適趨勢、國外新科技應用案例及部屬機關建議，研訂新版策略與措施並補充相關説明。

**（2）完成鐵公路系統因應極端氣候事件之新科技運用趨勢探討及建議：**

　　蒐集國外與我國類似氣候狀態，如強降雨、高溫的國家運用新科技於調適的案例，依鐵公路系統於不同生命週期應用GIS、數位分身、大數據與物聯網等數位新科技，分析優缺點及國內新科技運用之注意事項。

**（3）完成「鐵公路氣候變遷調適資訊平台」之維護及風險資訊之應用移轉作業：**

　　與鐵公路主管機關溝通與訪談，針對平台之氣候變遷風險資訊納入各機關既有系統或其他使用方式，研擬最佳應用移轉方式，並完成移轉輔導作業。

## (4) Research on the Climate Change Adaption for Transport Systems

### 1. Project Overview

　　In order to enhance and improve our country's ability to adapt to climate change, our country promulgated and implemented the "Greenhouse Gas Reduction and Management Act" in July 2015. Article 13 stipulates that the central industry competent authorities shall develop climate change adaptation strategies as the administrative strategic directions for the levels subordinated to the Ministry, and therefore the discussion is required for the overall transportation facilities with upper-level policy.

　　In 2018, the IOT completed the "Climate Change Adaptation Strategy Development Project for the Transportation Sector," and put forward four major aspects and 15 adaptation strategy suggestions. In order to grasp the latest international adaptation trends, this project reviews the transportation system adaptation strategies on a rolling basis, and learns from the new trends in foreign adaptation and the application of new technologies in adaptation to complete the new version of the adaptation strategy, and proposes the application of new technologies to assist in improving the adaptation ability of the transportation system, to provide the reference to the Facility Management Agencies.

### 2. Research Outcomes

**(1) Complete the rolling review of the transportation system adaptation strategy:**

Based on the adaptation strategies researched and proposed by IOT's "Climate Change Adaptation Strategy Development Project for the Transportation Sector," new strategies and measures are established and supplemented with related instructions, based on the latest foreign adaptation trends, foreign new technology application cases, and recommendations from agencies subordinated to the Ministry.

**(2) Complete the discussion and recommendations on the new technology application trend of the railway and highway system in response to extreme weather events:**

Collect cases of foreign countries with climate conditions similar to our country, such as heavy rainfall and high temperature, using new technology for adaptation, and apply new digital technologies of GIS, Digital Twin, Big Data, and the Internet of Things in different life cycles according to the railway and highway system, and analyze the advantages and disadvantages and precautions for the use of new domestic technology.

**(3) Complete the maintenance of the "Railway and Highway Climate Change Adaptation Information Platform" and the application and transfer of risk information:**

Communicate and interview with the Railway and Highway Competent Authorities, integrate the climate change risk information of the platform into the existing systems or other use methods of each agency, develop the best application transfer method, and complete the transfer guidance work.

## 3.成果推廣與效益

（1）完成「應用科技輔助鐵公路系統管理氣候變遷風險之探討」論文，發表於「中華民國運輸學會2020年會暨學術論文國際研討會」。

（2）邀集部屬機關辦理氣候變遷調適專業知識教育訓練，並召開專家學者座談會，推廣氣候變遷調適概念，分享氣候變遷的衝擊影響與可採取之對策與新科技應用建議，以深化部屬機關人員對調適的認識，俾利推展運用於運輸系統新建規劃及管理維護業務。

（3）本計畫透過「鐵公路氣候變遷調適資訊平台」移轉輔導作業，在鐵公路設施管理機關人力及資源有限下，提供其快速掌握全臺路網大尺度之風險資訊，並推廣提供公路總局、高速公路局、鐵道局、臺鐵局及高鐵公司等單位，強化氣候變遷風險評估工作，以有效提升鐵公路系統調適能力。

## 4.研究成果精華摘整

## 3. Promotion of Outcomes and Benefits

(1) Completed the paper on "Application of Technology to Assist Railway and Highway Systems to Manage Climate Change Risks and published it in the "Chinese Institute of Transportation 2020 Annual Conference and Academic Papers International Seminar."

(2) Invite the Agencies subordinated to the Ministry to organize professional knowledge education and training on climate change adaptation, hold a symposium of experts and scholars to promote the concept of climate change adaptation, and share the impact of climate change and the countermeasures that can be taken and suggestions for new technology applications, so as to deepen the understanding of adaptation for personnel of the Agencies subordinated to the Ministry, to facilitate the promotion and application in the new construction planning and management maintenance businesses of the transportation system.

(3) This project transfers the guidance operation through the "Railway and Highway Climate Change Adaptation Information Platform," with the limited manpower and resources of the railway and highway facility management agencies, it provides a quick grasp of the large-scale risk information of Taiwan's entire road network, and promotes and provides the units of the Directorate General of Highways, Freeway Bureau, Railway Bureau, Taiwan Railways Administration, and Taiwan High Speed Rail Corporation in strengthening their climate change risk assessment work to effectively improve the adaptation ability of the railway and highway systems.

## 4. Summary of Research Outcomes
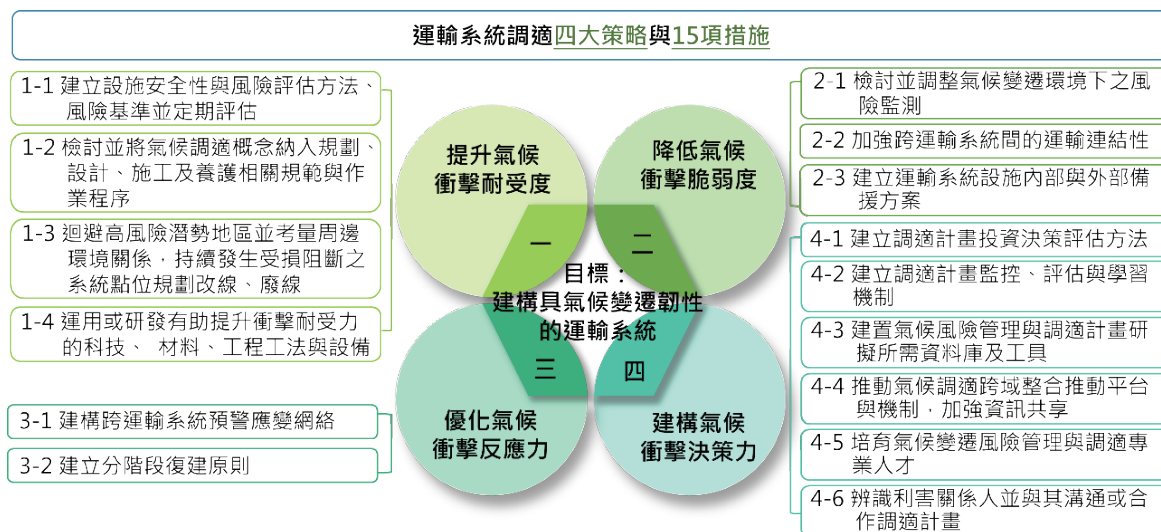


運輸系統調適四大策略與 15 項措施
Four Major Strategies and 15 Measures for Transportation System Adaptation

## 5.研究成果報告

· 運輸系統因應氣候變遷調適之研究（110年7月出版）

## 5. Report of Research Outcomes

· Research on the Climate Change Adaption for Transport Systems (Published in July 2021)

## 七、 港灣環境與船舶航行安全研究發展

### （一）港灣構造物維護策略研析與管理資訊系統應用推廣

#### 1.計畫概述

近年來因氣候變遷影響，極端天氣事件如強風、強降雨、暴潮及海平面持續上升等發生機率增加，皆對我國商港致生不小災損，而若商港針對災害之應變及調適能力不佳，就容易造成商港系統的運輸服務中斷，增加旅客及物流之不便性。爰此，碼頭與防波堤等港灣構造物應加強風險監管並研擬因應對策，通盤檢視設施之安全性，以及建立完善維護管理機制，應用科技強化巡檢與監測，俾以快速掌握災害高風險區狀況，縮短災害資訊傳達時間，提高防救災效率。本研究前期已初步建立港灣構造物維護管理制度及維護管理系統，以滿足臺灣港務公司落實港灣構造物之維護管理工作及維管資訊化的需求。

本計畫109年主要工作為協助臺灣港務股份有限公司及連江縣港務處研訂港灣構造物維護管理手冊，並評估現有巡檢標準作業程序與操作方法，輔以滾動式及系統化方式，蒐集相關使用者意見，擴充並健全前期計畫建置完成之維護管理資訊系統及行動應用程式APP，完善其內容，藉由辦理教育訓練、提供操作手冊下載等方式推廣應用，俾邁向構造物檢測及管理系統化作業。

#### 2.研究成果

##### （1）協助訂定各港港灣構造物維護管理手冊

研訂碼頭、防波堤、海堤、護岸等「港灣構造物維護管理手冊」，提供臺灣港務公司及其分公司據以辦理設施維護管理作業，做為未來巡查及檢測作業之依循。

##### （2）舉辦教育訓練及應用推廣

舉辦教育訓練，分別至臺灣港務公司各分公司及連江縣港務處推廣港灣構造物維護管理制度、手冊及資訊系統，參訓人數共138人，會後蒐整學員回饋意見，納為系統擴充精進之參考。

## VII. Research and Development of Harbor and Maritime Environment and Ship Navigation Safety

### (1) Research on Maintenance Strategy of Harbor Structures and Promotion of Management Information System

#### 1. Project Overview

In recent years, due to the impact of climate change, increasing probabilities of occurrence for extreme weather events such as strong winds, heavy rainfall, storm surges, and continuous rise of sea level, have caused considerable damage to our country's commercial ports. If the commercial port's response and adaptability to disasters is not good, it is easy to cause interruption to transportation services in the commercial port system and increase the inconvenience of passengers and logistics. Therefore, harbor structures of wharfs and breakwaters shall strengthen risk control and develop countermeasures, comprehensively inspect the safety of facilities and establish a sound maintenance management mechanism, and apply technology to strengthen inspections and monitoring, so as to quickly grasp the high-risk areas of disasters, reduce disaster information transmission time and improve the efficiency of disaster prevention and relief. In the early stage of this research, the maintenance management systems for harbor structures have been initially established to meet the needs of Taiwan International Ports Corporation in implementing the maintenance and management works of harbor structures and information-based maintenance management.

The main work of this project in 2020 was to assist Taiwan International Ports Corporation, Ltd. and the Harbor Bureau of Lienchiang County to research and develop the Harbor Structure Maintenance Management Manual, and to evaluate existing inspection standard operating procedures and operating methods, supplemented by rolling and systematic methods to collect the opinions of relevant users, expand and improve the maintenance management information system and mobile application APP completed in the previous project phase, improve its content, and promote the application by organizing education and training, providing operation manual downloading, etc., in order to move toward the systematic operation of structure testing and management.

#### 2. Research Outcomes

##### (1) Assist in the establishment of Harbor Structure Maintenance Management Manuals for harbor structures of all ports

Research and develop the "Harbor Structure Maintenance Management Manual" for wharfs, breakwaters, seawalls, and revetments, and provide the Manual to the Taiwan International Ports Corporation and its branch companies as the basis to manage the facility maintenance and management operations, and the compliance of future inspections and testing operations.

##### (2) Organize the education training and application promotion

Organize the education and training, and promote the Harbor Structure Maintenance Management System, Manuals and Information System at the branch companies

**（3）擴充既有港灣構造物維護管理資訊系統及APP並優化功能**

完成建置港灣構造物維護管理資訊系統及APP，提供國內各國際商港與主要港口使用，後續將依使用者回饋意見，持續精進。

## 3.成果推廣與效益

（1）109年6月19日函送臺灣港務公司各港港灣構造物維護管理手冊（共9冊）。

（2）109年6月30日、7月3日、7月6日、7月10日前往高雄、基隆、臺中、花蓮港務分公司，舉辦教育訓練，推廣港灣構造物維護管理制度、手冊及資訊系統。

## 4.研究成果精華摘整

of Taiwan International Ports Corporation and the Harbor Bureau of Lienchiang County, with a total of 138 people participating in the training, and collect the feedback opinions of the trainees after the training to be included as the reference for the system expansion and improvement.

〔3〕Expand the existing Harbor Structure Maintenance Management System and APP and optimize functions

Complete the establishment of the Harbor Structure Maintenance Management Information System and APP, for the use by the domestic and international commercial ports and major ports, and continue to improve based on the user feedback opinions in the future.

## 3. Promotion of Outcomes and Benefits

〔1〕Sent the "Harbor Structure Maintenance Management Manual" of all the ports to Taiwan International Ports Corporation (a total of nine volumes) on June 19, 2020.

〔2〕Went to Port of Kaohsiung, Keelung, Taichung, and Hualien on June 30, July 3, July 6, and July 10, 2020, respectively, to organize education and training, and promote the Harbor Structure Maintenance Management System, Manual and Information System.
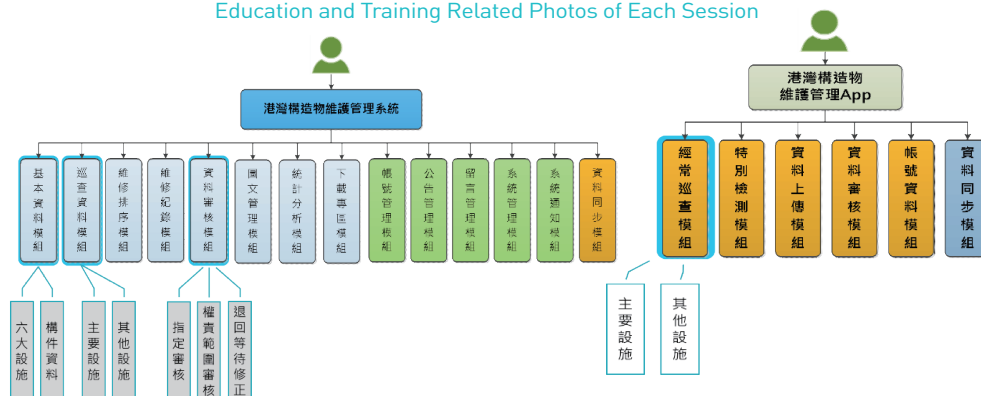
## 4. Summary of Research Outcomes



各場次教育訓練相關相片
Education and Training Related Photos of Each Session



港灣構造物維護管理資訊系統及 APP 模組架構圖
The Structure Diagram of Harbor Structure Maintenance Management Information System and APP Module

## 5.研究成果報告

・各港港灣構造物維護管理手冊（共9冊）（109年9月出版）

・港灣構造物維護策略研析與管理資訊系統應用推廣（110年2月出版）

## 5. Report of Research Outcomes

・Harbor Structure Maintenance Management Manuals (Published in September 2020)

・Research on Maintenance Strategy of Harbor Structures and Promotion of Management Information System(Published in February 2021)

## （二）軌道扣件缺失辨識系統建置研究

### 1.計畫概述

　　交通部臺灣鐵路管理局（以下簡稱臺鐵局）之軌道扣件巡檢作業，目前係採用夜間人工目視方式進行，而人工目視巡檢受限於巡檢車車速及視察角度等問題，無法有效快速進行。因此，本計畫於108~109年與臺鐵局合作，開發軌道扣件缺失辨識系統。108年初步建立一套系統，先以攝影機進行軌道扣件影像拍攝，再利用人工智慧辨識扣件缺失，檢測鐵路軌道扣件是否脫落；109年進行系統精進及驗證，增加人工智慧辨識缺失種類，並提高辨識準確性及定位精度。

### 2.研究成果

　　（1）建立軌道扣件影像的收集設備，於夜間時速30公里下，獲取足供AI辨識之清晰影像。

　　（2）建立軌道扣件缺失辨識系統，錄製70公里軌道扣件影像，利用人工智慧辨識扣件缺失，扣件影像辨識準確率為86.7%，並於Google Map上定位有缺失之扣件。

　　（3）開發雲端儲存、辨識與查詢等功能，提供軌道管理單位巡檢實務應用。

### 3.成果推廣與效益

　　（1）109年3月3日於交通部例行記者會，發表「軌道扣件缺失辨識系統之建置與應用」新聞稿。

　　（2）109年6月於港灣季刊發表「軌道扣件缺失辨識系統之建置研究」。

　　（3）109年10月16日辦理「軌道扣件巡檢系統建置（2/2）-扣件缺失辨識系統精進驗證」教育訓練。

　　（4）研究成果可協助軌道扣件巡檢判釋，提供鐵路養護巡檢單位使用，可提昇軌道巡檢效能，減少現場人工勘查及增進管理效能。

## (2) Railway Track Fastener Inspection System Establishment

### 1. Project Overview

The inspection of track fasteners by the Taiwan Railways Administration of the Ministry of Transportation and Communications (hereinafter referred to as Taiwan Railway Administration) is currently conducted by manual visual inspection at night; however, the manual visual inspection is limited by the speed of the inspection vehicle and the inspection angle, which cannot be conducted effectively and quickly. Therefore, this project cooperated with the Taiwan Railways Administration from 2019 to 2020 to develop a defective identification system for track fasteners. In 2019, a set of systems was initially established, with cameras to capture images of track fasteners, and artificial intelligence to identify defective fasteners and detect whether the railway track fasteners had fallen off. In 2020, the system was improved and verified, and artificial intelligence added to identify defective types, and improve identification accuracy and positioning accuracy.

### 2. Research Outcomes

(1) Established a collection device for track fastener images to obtain clear images sufficient for AI identification at a speed of 30 kilometers per hour at night.

(2) Established a track fastener defective identification system, recorded 70 km of track fastener images, and used artificial intelligence to identify defective fasteners; the recall rate of fastener image identification was 86.7%, and the defective fasteners were positioned on Google Maps.

(3) Developed functions of cloud storage, identification and query, and provided practical applications for inspection by the track management unit.

### 3. Promotion of Outcomes and Benefits

(1) On March 3, 2020, published the news release of "Construction and Application of the Track Fastener Defective Identification System" at the regular press conference of the Ministry of Transportation and Communications.

(2) In June 2020, published the "Research for Construction of the Track Fastener Defective Identification System" in the Harbor Quarterly.

(3) On October 16, 2020, organized the education and training of "Construction of Track Fastener Inspection System (2/2) – Improvement and Verification of Fastener Defective Identification System."

(4) The research results can assist track fastener inspection, judgment and interpretation, and provide railway maintenance inspection units for use, which can improve track inspection efficiency, reduce on-site manual inspections and improve management efficiency.

## 4.研究成果精華摘整

（a）系統網頁



（b）上傳影像自動辨識扣件缺失

**軌道扣件缺失辨識系統**
**Track Fastener Defective Identification System**
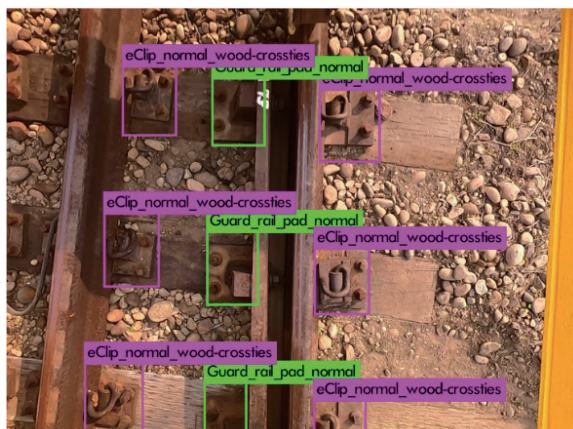


（a）軌道扣件影像自動辨識
(a) Track Fastener Images Automatic Identification
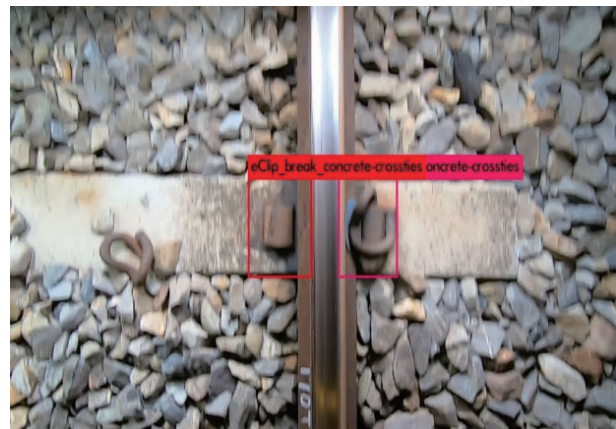


（b）左為有缺失之扣件，右為正常扣件
(b) The Left is a Defective Fastener, the Right is a Normal Fastener

**軌道扣件影像自動缺失辨識**
**Track Fastener Images Automatic Defective Identification**

## 5.研究成果報告

- ・軌道扣件巡檢系統建置（1/2）-扣件缺失辨識系統建置研究（109年2月出版）
- ・軌道扣件巡檢系統建置（2/2）-扣件缺失辨識系統精進驗證（110年2月出版）

## 5. Report of Research Outcomes

- ・ Railway Track Fastener Inspection System Establishment (1/2)-A Research on the Establishment of a Defective Fasteners Detection System (Published in February 2020)
- ・ A Rail Track Fastener Inspection System(2/2)-Progressive and Verification of Defective Fastener Identification(Published in February 2021)

## （三）整合風浪模式建立船舶航行監控預警系統

### 1.計畫概述

　　為有效提升船舶於海上航行與港灣碇靠的安全，本所建置臺灣周邊海域即時的航行安全自動化預警介面，針對颱風時期，結合船舶航行安全風險評估模型，使其在船舶AIS資訊外，亦能包含海上海象資訊，從而建立更完善的船舶航行安全風險評估模型與監測系統，以減災避災為主要目的，可提供警示資訊讓船隻、航港單位據以評估不同海域及港口航行風險，做為早期防災應變使用，並結合人工智慧與大數據分析技術，建立船舶航跡預測模型，再透過統計分析界定船舶行為異常、位置異常等情況的告警原則，以布袋港為示範港建立智慧化船舶航行安全風險評估系統，期能降低海上災難發生機率。

### 2.研究成果

（1）完成建立自動化颱風二維風浪模式模擬模組。

（2）建立自動化颱風波浪警示與預測介面，提供6小時以上之預測結果，並劃設警示範圍，透過連結現有船舶自動識別系統（AIS），列出應提出警示的船舶資訊，供管理人員應用。

（3）以AI技術配合AIS大數據資料庫，建立船舶軌跡預測模型，判斷船舶誤入禁航區與擱淺的風險。並利用統計分析，界定船速異常、船艏異常等的告警門檻，研發智慧化船舶航行安全風險評估系統。

### 3.成果推廣與效益

（1）提供交通部航港局於颱風期間加強船舶航行安全管理，並提供海洋委員會海巡署執行海上救難之參考，亦提供港務公司船舶航行安全資訊以及船舶航行規劃與離港疏散之應用依據。

（2）109年11月於第42屆海洋工程研討會發表「結合風浪預測與AIS的船舶航安預警系統」。

（3）依交通部指示，與航港局研議優先將相

## (3) Development of the Monitoring and Warning Systems for Ship Navigation Considering Wind and Wave Simulation

### 1. Project Overview

In order to effectively improve the safety of ships' navigation and harbor anchorage, the IOT has built an automated early warning interface for real-time navigation safety in the sea areas surrounding Taiwan, targeting the typhoon season, combined with the ship's navigation safety risk assessment model, so that the oceanographic information can be included in addition to the ship's AIS information. Furthermore to establish a more complete ship navigation safety risk assessment model and monitoring system with the main purpose of disaster mitigation and avoidance, which can provide warning information for ships and Maritime and Port units to evaluate navigation risks in different sea areas and ports for the use of early disaster prevention and response, combined with artificial intelligence and big data analysis technology to establish a ship's trajectory prediction model, and combined with the artificial intelligence and big data analysis technology to establish the ship's course prediction model, and then through statistical analysis to define the warning principles for abnormal ship behavior and location. Use the Budai Harbor as the demonstration port to establish an intelligent ship navigation safety risk assessment system, expecting to reduce the probability of marine disasters.

### 2. Research Outcomes

(1) Complete the establishment of Automated Typhoon Two-Dimensional Wind and Wave Model Simulation Module.

(2) Establish an Automated Typhoon Wave Warning and Forecast Interface to provide forecast results for more than 6 hours, and set the range of warning and list the information of ships to be warned through linking to the existing ship Automatic Identification System (AIS), for the use by the management personnel.

(3) AI technology is used in conjunction with the AIS big data database to establish the course of the ship prediction model, to determine the risk of ships entering the prohibited zone by mistake and stranding. And use statistical analysis to define the warning threshold for abnormal ship speed and bow abnormality, and develop a smart ship navigation safety risk assessment system.

### 3. Promotion of Outcomes and Benefits

(1) Provide the Maritime and Port Bureau of Ministry of Transportation and Communications with the information on strengthening the ship navigation safety management during typhoon period, and provide a reference for maritime rescue operations executed by the Coast Guard Administration of the Ocean Affairs Council; also provide the application basis of Ship Navigation Safety Information and Ship Navigation Planning and Port Departure Dispersal for the Taiwan International Ports Corporation.

(2) Published the "A Safe Ship Navigation Warning System Combining Wind Wave Model and AIS" at the 42nd Ocean Engineering Seminar in November 2020.

關應用導入彰化離岸風場海域，本所於110年4月23日於該局辦理推廣會議。

(3) In accordance with the instructions of the Ministry of Transportation and Communications, the IOT discussed with the Maritime and Port Bureau to give priority to the introduction of relevant applications into the Changhua offshore wind farm sea area. The IOT held a promotion meeting at the Bureau on April 23, 2021.

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
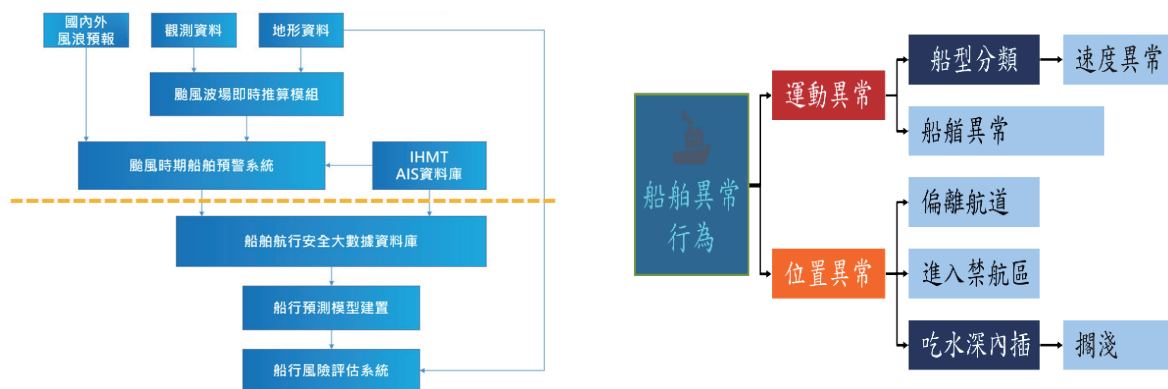


船舶航行監控預警系統架構
Architecture of Ship Navigation Monitoring and Warning System
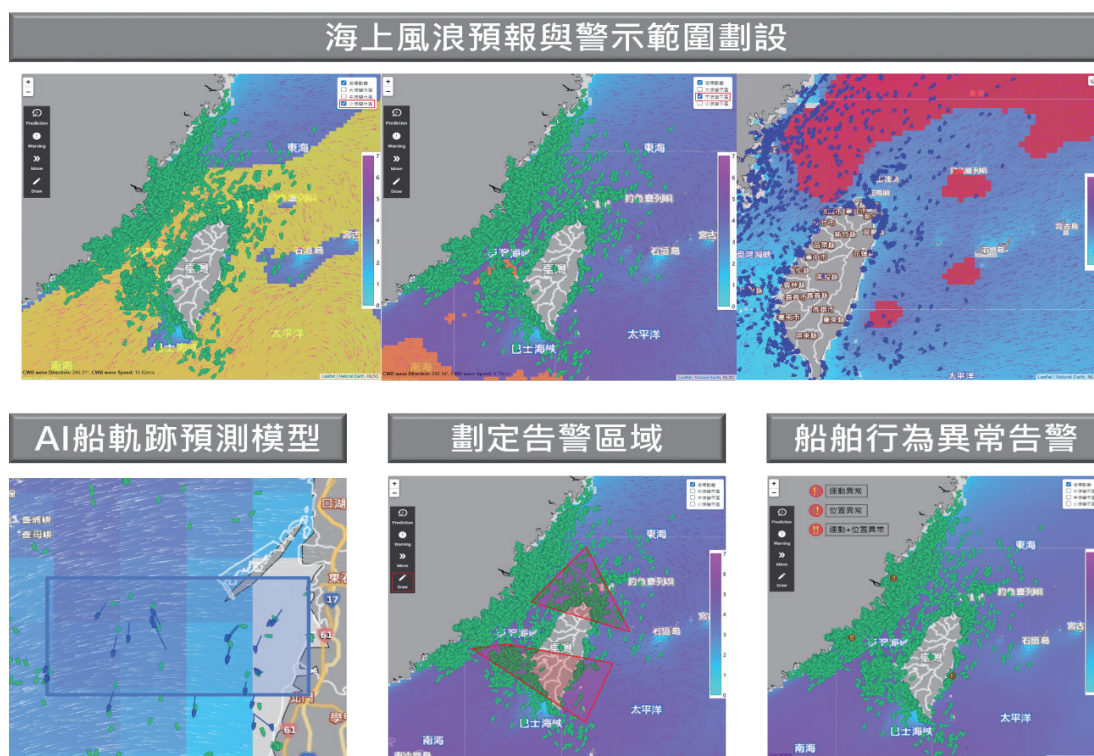


船舶航行監控預警系統告警示意圖
Schematic Diagram of Ship Navigation Monitoring and Warning System Alarm

## 5.研究成果報告

· 整合風浪模式建立船舶航行監控預警系統（110年2月出版）

## 5. Report of Research Outcomes

· Development of the Monitoring and Warning Systems for Ship Navigation Considering Wind and Wave Simulation (Published in February 2021)

## （四）花蓮海岸公路浪襲預警及防災應用技術之研究

### 1.計畫概述

花蓮台11線浪襲路段在颱風季節因受大浪直接襲擊，公路發生溢淹機會大增，碎波波浪更可能直接淘刷路基，影響公路通行安全。為提升浪襲防災應變時間，本計畫研發推算海岸公路波浪溯上技術，俾以提供颱風期間浪襲路段通行安全所需之防災預警資訊。

本計畫整合本所發展之臺灣海象即時觀測作業系統、臺灣近岸海象模擬作業系統、花蓮海岸公路波浪溯上資料庫，完成建置「花蓮海岸公路浪襲預警系統」，以單一畫面網頁方式，提供台11線浪襲易致災路段（人定勝天段）於颱風期間之預警資訊，提供公路總局做為浪襲封路之決策輔助應用。

### 2.研究成果

整合花蓮海域觀測、模擬資料及波浪溯上系統，建置「花蓮海岸公路浪襲預警系統」，以單一畫面網頁方式提供人定勝天段的24小時浪襲預警資訊，做為浪襲封路之輔助決策參考，可改善僅仰賴即時觀測之封路作業，讓人員有充分時間做應變及調度。

### 3.成果推廣與效益

（1）研究成果提供交通部公路總局第四區養護工程處，做為防災應變應用，降低颱風期間現場人員監測之安全風險，並有充分時間做應變及調度，109年11月並於第四區養護工程花蓮工務段處辦理教育訓練。

（2）本系統後續可持續配合颱風期間使用狀況，進行滾動式檢討，以精進預警系統之準確性，研究成果亦可提供後續研擬花蓮海岸公路（台11線）溯上及長浪作用力與路基易流失因應對策之基礎。

## (4) Wave Attack Early Warning and Disaster Prevention of Hualien Coastal Highway

### 1. Project Overview

Due to the direct hit by large waves on the wave-attack section of the Hualien Taiwan Provincial Highway 11 in the typhoon season, the chance of flooding on the highway is greatly increased. Breaking waves are more likely to directly scour the roadbed and affect highway traffic safety. In order to improve the response time of wave attacks and disasters, this project develops the technology of calculating the wave run-up of the coastal highway, so as to provide disaster prevention and alarm information necessary for the traffic safety of road sections under wave attacks during typhoons.

This project integrates the Taiwan Oceanographic Phenomena Real-time Observation Operating System, the Taiwan Coastal Oceanographic Phenomena Simulation Operating System, and the Hualien Coastal Highway Wave Run-up Database developed by the IOT, to complete the construction of the "Wave Attack Warning system for Hualien Coastal Highway" with a single-screen web page to provide the early warning information of the highway section of Taiwan Provincial Highway 11 prone to disaster due to wave attacks ("Man Can Conquer Nature" Section) during typhoons, and provides the decision-making auxiliary application by the Directorate General of Highways for wave attacks and road closure.

### 2. Research Outcomes

Integrate Hualien sea area observation, simulation data and wave run-up system to build the "Wave Attack Warning System for Hualien Coastal Highway," and to provide 24-hour wave attack warning information for the "Man Can Conquer Nature" Section, as the auxiliary decision-making reference for wave attacks and road; it can improve road closure operations that only rely on real-time observations, so that personnel can have sufficient time to respond and for scheduling.

### 3. Promotion of Outcomes and Benefits

(1) The research results were provided to the Fourth Maintenance Office, Directorate General of Highways, Ministry of Transportation and Communications, as a disaster prevention and response application, to reduce the safety risks of on-site personnel monitoring during typhoons, and to have sufficient time for response and scheduling, and organized education and training at the Fourth Maintenance Office of Hualien Branch in November 2020.

(2) The system will continue to cooperate with the use conditions during the typhoon season in the future, conduct rolling reviews to improve the accuracy of the warning system, and the research results can also provide the basis for follow-up research and planning of countermeasures for the active force of wave run-up and long wave and easy loss of roadbeds for the Hualien Coastal Highway (Taiwan Provincial Highway 11).

## 4.研究成果精華摘整

## 4. Summary of Research Outcomes
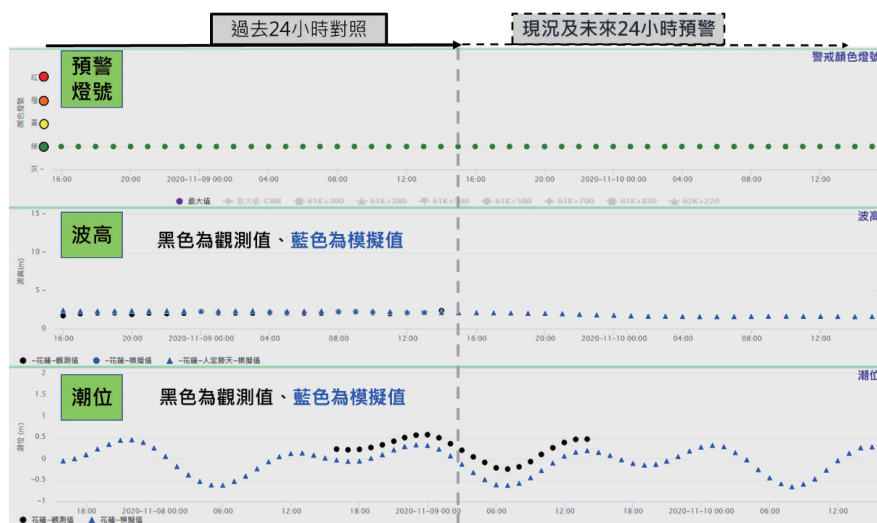


「花蓮海岸公路浪襲預警系統」畫面圖
Picture of "Wave Attack Warning system for Hualien Coastal Highway"
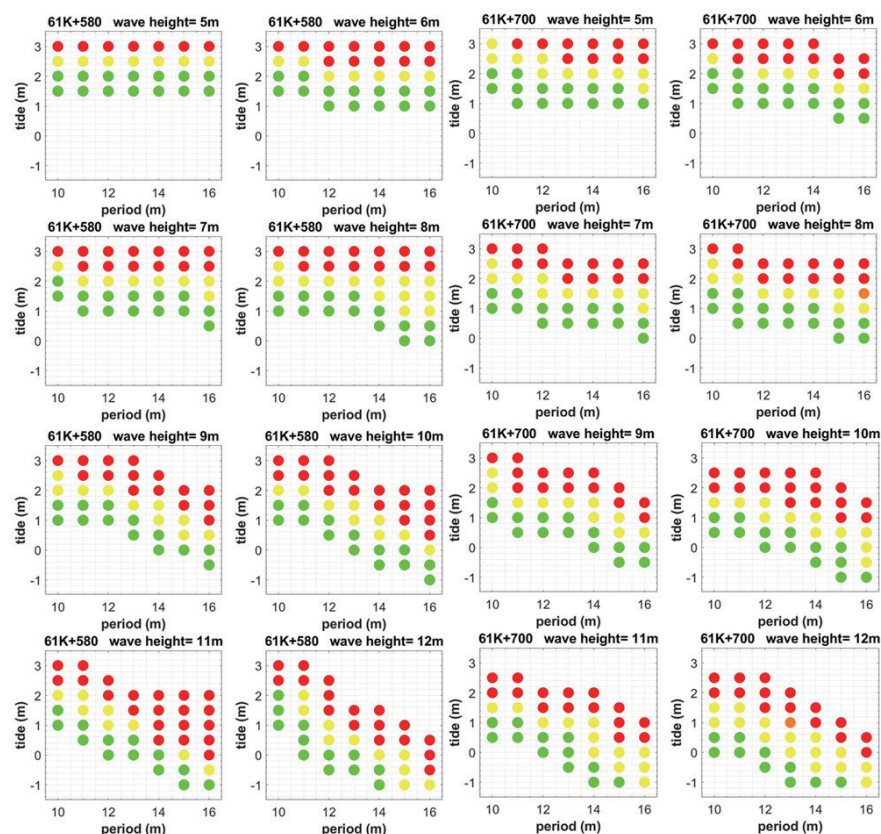


台 11 線海岸公路波浪溯上情境模擬結果示意圖
Schematic Diagram of the Simulation Results of the Wave Run-up Scenario of the Taiwan Provincial Highway 11 Coastal Highway

## 5.研究成果報告

· 花蓮海岸公路浪襲預警及防災應用技術之研究（1/2）-浪襲預警系統建置（110年2月出版）

## 5. Report of Research Outcomes

· Wave Attack Early Warning and Disaster Prevention of Hualien Coastal Highway (1/2)–Establishing Wave Attack Early Warning System (Published in February 2021)

## （五）港灣環境及防災資訊服務應用研究

### 1.計畫概述

本計畫於107年完成港灣環境資訊網電腦版改版，重新規劃整體架構，讓網頁的編排方式更符合使用者簡易、直觀的使用需求；108年建立主動示警機制，結合資通訊與數位展示技術開發海氣象示警與海象模擬等即時訊息推播 ；109年採用地理環境資訊技術，整合港灣海氣象圖層資料，構建港灣海象地理環境（GIS）資訊服務系統，實現數據圖層視覺化展示，進而建置颱風專區，於颱風來襲期間提供港區之整合性示警資訊。另配合行政院「向海致敬」政策，提供9 商港區海氣象資訊於政府資料開放平臺（https://data.gov.tw），並展示在海洋委員會「海域遊憩活動一站式資訊平臺」網站。

本所港灣環境資訊網包括港區海象、全國海象、港區地震、港區海嘯及港區腐蝕資訊等5項查詢功能，提供整體性、即時性海象資訊供政府單位及一般民眾參考。基於海象資料之立即性應用並轉化為可靠之資訊需求越趨強烈，落實整合各單位的觀測資料、資料品管、資料即時展示及資料檢核、統計分析工作，有其必要性。

### 2.研究成果

（1）彙整國內包括中央氣象局、經濟部水利署等之即時觀測海象資料，整合成港灣環境大數據資料庫，透過全臺12海域分區資訊專區，提供全國各商港外船舶航行海域即時觀測及模擬預報海氣象資訊。

（2）運用開放性圖台技術，並整合本所、中央氣象局及颱風2000網站資料庫之海氣象資訊與颱風資訊，提供商港區「颱風示警」功能，依不同颱風路徑的觸發機制，示警各商港區，提升應變資訊的即時性，可縮短管理單位因應災害預防之處置時間與提升資料即時性，進一步完善港埠災防資訊服務目的。

（3）配合行政院推行數位國家雲端化，將系統移轉至中華電信機房（IDC）租用服務，實現網站服務維持不中斷及正常運作。

### 1. Project Overview

This project completed the revision of the computer version of the Harbor Environment Information Network in 2018, and re-planned the overall structure to make the layout of the web page more in line with the use's needs of simplicity and intuitiveness; the active warning mechanism was established in 2019, combining information communication and digital display technology to develop real-time information broadcast of marine meteorological warning and oceanographic phenomena simulation; adopted the geographic environment information technology in 2020, to integrate harbor marine meteorological layer data, construct the harbor oceanographic geographic information environment information service system (GIS), realize the visual display of data layers, and then build the typhoon zone to provide integrated warning information of the harbor area during typhoon. In addition, cooperate with the Executive Yuan's "Ocean Taiwan" policy, to provide marine meteorological information for nine commercial port areas on the government data open platform (https://data.gov.tw), and demonstrate the Ocean Affairs Council's "One-stop Information Platform for Sea Area Recreation Activities" website.

The IOT's Harbor Environment Information Network includes five query functions of harbor area oceanographic phenomena, national oceanographic phenomena, harbor area earthquakes, harbor area tsunami, and harbor area corrosion information to provide integrated and real-time oceanographic information as the reference for government agencies and the general public. Based on the demand for the immediate application of oceanographic data and the conversion to reliable information getting stronger, it is necessary to implement the integration of observational data, data quality control, real-time data display, data verification, and statistical analysis works of each units.

### 2. Research Outcomes

(1) Consolidate the real-time observational oceanographic data from the Central Weather Bureau, the Water Resources Agency of the Ministry of Economic Affairs, and integrate the data into a big data database of the harbor environment, to provide real-time observations of ships navigating the sea area outside commercial ports across the country through 12 sea area information zones in Taiwan, and simulate the forecast of marine meteorological information.

(2) Use open map technology, and integrate with marine meteorological information and typhoon data from the database of the IOT, the Central Weather Bureau and the Typhoon 2000 website data to provide the harbor area "typhoon warning" function, and alert all commercial port areas according to the trigger mechanism of different typhoon paths, to improve the timeliness of response information, which can shorten the handling time for management units to respond with disaster prevention and improve the timeliness of data, and further improve the purpose of disaster prevention information services for the ports.

## 3.成果推廣與效益

109年10月21日召開「109年港灣環境資訊服務系統使用者會議」，簡介系統項下海象觀測、海象模擬、海嘯模擬、港區地震、港區腐蝕及系統操作，透過綜合討論與滿意度問卷調查，綜整各單位對系統功能需求之開發建議，優化系統資訊服務。

## 4.研究成果精華摘整



港灣環境資訊系統之五項子系統
Five Subsystems of Harbor Environmental Information System

## 5.研究成果報告

- 港灣環境資訊系統--加值應用暨功能擴充及維護（107年3月出版）

- 107年港灣環境資訊系統維護--功能提升（108年2月出版）

- 108年港灣環境資訊系統維護-功能提升（109年2月出版）

- 109年港灣環境資訊系統維護-功能提升（110年2月出版）

(3) Cooperate with the Executive Yuan to implement the digital national cloud, and transfer the system to the Chunghwa Telecom Internet Data Center (IDC) rental service, to realize uninterrupted and normal operation of website services.

## 3. Promotion of Outcomes and Benefits

Convened the "2020 Annual Harbor Environmental Information Service System User Conference" on October 21, 2020 to introduce the oceanographic observation, oceanographic simulation, tsunami simulation, harbor area earthquake, harbor area corrosion and system operation under the system, to comprehensively organize the development recommendations of all units on the system function requirement through comprehensive discussion and satisfaction questionnaire survey, to optimize the system information services.

## 4. Summary of Research Outcomes
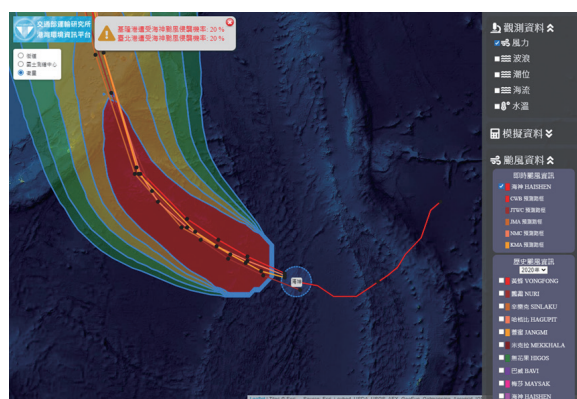


港灣環境資訊平台 - 即時颱風資訊（各國颱風路徑預測）
Harbor Environment Information Platform – Real-time Typhoon Information (Typhoon Track Forecast in Various Countries)

## 5. Report of Research Outcomes

- Maintenance and Expansisson of the Functions and Applications of the Harbor Environmental Information Website (Published in March 2018)

- 2018 Maintenance and Expansisson of the Functions and Applications of the Harbor Environmental Information Website (Published in February 2019)

- 2019 Maintenance and Expansisson of the Functions and Applications of the Harbor Environmental Information Website (Published in February 2020)

- 2020 Maintenance and Expansisson of the Functions and Applications of the Harbor Environmental Information Website (Published in February 2021)

# 研討與成果推廣活動

05. Seminars and Results Promotion Activities

| 伍 | 研討與成果推廣活動 | V | Seminars and Results Promotion Activities |

| 項次 | 日期 | 主　題 | Topic |
|---|---|---|---|
| 1 | 3 月 10 日 | 109 年 3 月海運期刊研討會 | Seminar: March 2020 Maritime Journal |
| 2 | 3 月 11 日 | 109 年 3 月空運期刊研討會 | Seminar: March 2020 Air Transport Journal |
| 3 | 4 月 10 日 | 「商港整體發展規劃（111~115 年）」第 2 次專家學者座談會 | Experts Meeting: The Integrated Overall Development Plan of Commercial Ports (2022-2026) (2nd Session) |
| 4 | 4 月 14 日 | 109 年 4 月海運期刊研討會 | Seminar: April 2020 Maritime Journal |
| 5 | 4 月 15 日 | 109 年 4 月空運期刊研討會 | Seminar: April 2020 Air Transport Journal |
| 6 | 5 月 12 日 | 109 年 5 月海運期刊研討會 | Seminar: May 2020 Maritime Journal |
| 7 | 5 月 13 日 | 109 年 5 月空運期刊研討會 | Seminar: May 2020 Air Transport Journal |
| 8 | 5 月 27 日 | 「遙控無人飛機專業操作證學科及術科」教育訓練 | Training Workshop: Professional Operation Courses for Remote Control Unmanned Aerial Vechicle |
| 9 | 5 月 28 日 | 「運輸規劃支援系統維運技術服務（109 年）」第 1 場次工作坊 | The 1st workshop of Maintenance Service of the Transportation Planning Support System (2020) |
| 10 | 6 月 2 日 | 數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究 第一場專家學者座談會 | Experts Meeting: A Study on Application of Digitization and Blockchain Technology for the Container Transportation Operation Chain. (1st Session) |
| 11 | 6 月 4 日 | 電動車輛技術發展專家諮詢會 | Expert Consultation Meeting on Electric Vehicle Technology Development |
| 12 | 6 月 5 日 | 公共運輸載客量提升策略之跨區論壇 | The Regional Forum on Strategy to Increase Passengers in Public Transport |
| 13 | 6 月 9 日 | 109 年 6 月海運期刊研討會 | Seminar: June 2020 Maritime Journal |
| 14 | 6 月 9 日 | 偏鄉公共運輸環境之健全跨區論壇 | The Regional Forum to Improve Rural Towns in Public Transport |
| 15 | 6 月 10 日 | 109 年 6 月空運期刊研討會 | Seminar: June 2020 Air Transport Journal |
| 16 | 6 月 13 日 | 「混合車流路口道路與交通工程 設計範例（3/4）-非號誌化路口」教育訓練臺中場 | Training(Taichung): Design Model on Road Traffic Engineering at Intersection under Mixed Traffic(3/3)-Unsignalized Intersections |
| 17 | 6 月 14 日 | 「混合車流路口道路與交通工程 設計範例（3/4）-非號誌化路口」教育訓練臺南場 | Training(Tainan): Design Model on `Road Traffic Engineering at Intersection under Mixed Traffic(3/4)-Unsignalized Intersections |
| 18 | 6 月 18 日 | 「混合車流路口道路與交通工程 設計範例（3/4）-非號誌化路口」教育訓練臺北場 | Training(Taipei): Design Model on Road Traffic Engineering at Intersection under Mixed Traffic(3/4)-Unsignalized Intersections |
| 19 | 6 月 18 日 | 「氣候變遷的衝擊與科學研究現況」教育訓練 | Education and Training: The Impact and Science Research of Climate Change |
| 20 | 6 月 20 日 | 離岸風電海下工程技術研發計畫技術討論與交流座談會 | Experts Meeting: Discussion and Exchange of Offshore Wind Power Subsea Engineering Technology |

| 項次 | 日 期 | 主 題 | Topic |
|---|---|---|---|
| 21 | 6 月 23 日 | 「汽車運輸業溫室氣體管理與減量」知識推廣教育訓練 | Training Workshop: Promoting Awareness of the GHG Management and Reduction for Automobile Transportation Industry |
| 22 | 6 月 30 日 | 「港灣構造物維護管理系統」教育訓練 - 高雄場 | Training Workshop: Harbor Structure Maintenance Management System. (Kaohsiung Session) |
| 23 | 7 月 3 日 | 「港灣構造物維護管理系統」教育訓練 - 基隆場 | Training Workshop: Harbor Structure Maintenance Management System. (Keelung Session) |
| 24 | 7 月 6 日 | 數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究 第二場專家學者座談會 | Experts Meeting: A Study on Application of Digitization and Blockchain Technology for the Container Transportation Operation Chain. (2nd Session) |
| 25 | 7 月 6 日 | 「港灣構造物維護管理系統」教育訓練 - 臺中場 | Training Workshop: Harbor Structure Maintenance Management System. (Taichung Session) |
| 26 | 7 月 8 日 | 109 年 7 月空運期刊研討會 | Seminar: July 2020 Air Transport Journal |
| 27 | 7 月 10 日 | 「港灣構造物維護管理系統」教育訓練 - 花蓮場 | Training Workshop: Harbor Structure Maintenance Management System. (Hualien Session) |
| 28 | 7 月 14 日 | 109 年 7 月海運期刊研討會 | Seminar: July 2020 Maritime Journal |
| 29 | 8 月 7 日 | 「商港整體發展規劃（111~115 年）」第 3 次專家學者座談會 | Experts Meeting: The Integrated Overall Development Plan of Commercial Ports (2022-2026) (3rd Session) |
| 30 | 8 月 10 日 | 109 年 8 月空運期刊研討會 | Seminar: August 2020 Air Transport Journal |
| 31 | 8 月 10 日 | 運輸部門排放量影響因素專家意見諮詢會 | Expert Consultation Meeting on Affecting Factors in the Transportation Sector GHG Emissions |
| 32 | 8 月 11 日 | 109 年 8 月海運期刊研討會 | Seminar: August 2020 Maritime Journal |
| 33 | 8 月 13 日 | 「鐵公路氣候變遷調適與科技輔助應用」教育訓練 | Education and Training: Climate Change Adaptation and Technology Application on the Railway and Highway Transport |
| 34 | 8 月 18 日 | APEC 第 49 次複合運輸及智慧型運輸系統專家小組線上會議 | Intermodal and ITS Expert Group (IIEG) Virtual APEC TPT-WG49 Meeting |
| 35 | 8 月 21 日 | 「運輸規劃支援系統維運技術服務（109 年）」教育訓練 | Training Workshop: Maintenance Service of the Transportation Planning Support System (2020) |
| 36 | 8 月 26 日 | 無人機公務應用大未來交流座談會 | Experts Meeting: Big Future for UAS Official Business Application |
| 37 | 8 月 26 日 | 「109 年國際及國內商港即時潮位系統優化暨布袋港區航道即時水深資訊系統建置」教育訓練 | Training Workshop: Improvement of Real-time Tidal Level System for International and Domestic Harbors in Taiwan (2020) |
| 38 | 9 月 1 日 | 「汽車運輸業溫室氣體管理與減量」知識推廣教育訓練 | Training Workshop: Promoting Awareness of the GHG Management and Reduction for Automobile Transportation Industry |
| 39 | 9 月 8 日 | 109 年 9 月海運期刊研討會 | Seminar: September 2020 Maritime Journal |
| 40 | 9 月 9 日 | 109 年 9 月空運期刊研討會 | Seminar: September 2020 Air Transport Journal |
| 41 | 9 月 24 日 | 「輕軌運輸系統容量分析概論暨分析軟體應用」教育訓練 | Training Workshop of Light Rail Transit Capacity Analysis Software |
| 42 | 9 月 28 日 | 「運輸規劃支援系統維運技術服務（109 年）」第 2 場次工作坊 | The 2nd workshop of Maintenance Service of the Transportation Planning Support System (2020) |
| 43 | 9 月 29 日 | 「運輸系統調適策略」專家學者座談會 | Expert Symposium: Adaptation Strategies of Transportation Systems |

| 項次 | 日 期 | 主　題 | Topic |
|---|---|---|---|
| 44 | 10 月 12 日 | 「109 年臺灣公路容量分析軟體教育訓練 - 臺北場」 | Training Workshop of Taiwan Highway Capacity Analysis Software (THCS) (Taipei) 2020 |
| 45 | 10 月 13 日 | 公共運輸跨域發展策略論壇 | The Forum on Strategy of Public Transport Interdisciplinary Development |
| 46 | 10 月 15 日 | 「鐵、公路轉乘無縫運輸檢核系統」教育訓練 | Training Workshop: System for Detecting Public Transit Transfer Time Gap |
| 47 | 10 月 15 日 | 北區「第 2 期階段管制目標」公聽會（臺北） | "The 2nd Phase GHG Control Targets" Public Hearing in Taipei |
| 48 | 10 月 16 日 | 「109 年臺灣公路容量分析軟體教育訓練 - 臺中場」 | Training Workshop of Taiwan Highway Capacity Analysis Software (THCS) (Taichung) 2020 |
| 49 | 10 月 16 日 | 中區「第 2 期階段管制目標」公聽會（臺中） | "The 2nd Phase GHG Control Targets" Public Hearing in Taichung |
| 50 | 10 月 16 日 | 「軌道扣件巡檢系統建置（2/2）- 扣件缺失辨識系統精進驗證」教育訓練 | Training Workshop: Rail Track Fastener Inspection System(2/2)- Progressive and Verification of Defective Fastener Identification |
| 51 | 10 月 17 日 | 「第一屆交通盃辯論賽」專家學者講座 | "The 1st Transportation Cup Debate Contest" Expert Lecture |
| 52 | 10 月 20 日 | 109 年 10 月空運期刊研討會 | Seminar: October 2020 Air Transport Journal |
| 53 | 10 月 20 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第一梯次（客運業者） | Training Workshop(1): The Routed-based Costing System of Motor Carrier Industry Application Software(Motor Carrier Industry Companies) |
| 54 | 10 月 20 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第二梯次（客運業者） | Training Workshop(2): The Routed-based Costing System for Motor Carrier Industry Application Software (Motor Carrier Industry Companies) |
| 55 | 10 月 20 日 | 南區「第 2 期階段　室氣體管制目標」公聽會（高雄） | "The 2nd Phase GHG Control Targets" Public Hearing in Kaohsiung |
| 56 | 10 月 21 日 | 109 年 10 月海運期刊研討會 | Seminar: October 2020 Maritime Journal |
| 57 | 10 月 21 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第三梯次（客運業者） | Training Workshop(3): The Routed-based Costing System for Motor Carrier Industry Application Software (Motor Carrier Industry Companies) |
| 58 | 10 月 21 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第四梯次（客運業者） | Training Workshop(4): The Routed-based Costing System for Motor Carrier Industry Application Software (Motor Carrier Industry Companies) |
| 59 | 10 月 21 日 | 109 年度港灣環境資訊服務系統使用者會議 | User Conference :2020 User Conference of Harbor Environmental Information System |
| 60 | 10 月 22 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第五梯次（客運業者） | Training Workshop(5): The Routed-based Costing System for Motor Carrier Industry Application Software (Motor Carrier Industry Companies) |
| 61 | 10 月 23 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第六梯次（主管機關） | Training Workshop(6): The Routed-based Costing System for Motor Carrier Industry Application Software(Competent Authorities) |
| 62 | 10 月 23 日 | 「汽車客運業路線別成本計算制度應用軟體」教育訓練第七梯次（主管機關） | Training Workshop(7): The Routed-based Costing System for Motor Carrier Industry Application Software (Competent Authorities) |
| 63 | 10 月 27 日 | APEC 手機應用程式於包容性智慧城市之應用工作坊 | APEC The Virtual Workshop on Uses of App-Based Transportation Mobility Technologies for Inclusive Smart Cities |
| 64 | 10 月 27 日 | 辦理「極端氣候下公路系統強化調適能力新科技運用」專家學者座談會 | Expert Symposium: New Technological Applications for Enhancing Adaptation of Highway Transport Under Extreme Climate |

| 項次 | 日 期 | 主 題 | Topic |
|---|---|---|---|
| 65 | 11 月 3 日 | 「汽車運輸業參與溫室氣體抵換專案」知識推廣教育訓練 | Training Workshop: Promoting Awareness of the Participation in GHG Offset Projects for Automobile Transportation Industry |
| 66 | 11 月 3 日 | 辦理「極端氣候下鐵路系統強化調適能力新科技運用」專家學者座談會 | Expert Symposium: New Technological Applications for Enhancing Adaptation of Railway Transport Under Extreme Climate |
| 67 | 11 月 6 日 | 貨櫃運輸作業鏈應用數位化區塊鏈技術國際研討會 | International Seminar: Application of Digital Digitization and Blockchain Technology for the Container Transportation Operation Chain. |
| 68 | 11 月 6 日 | 「公共運輸供需契合與轉乘縫隙之研究─以鐵、公路轉乘為例」案座談會 | Symposium: Transfer Time Gap Evaluation and Enhancement Mechanism for Taiwan Railways, Taiwan High Speed Rail, and Their Shuttle Buses |
| 69 | 11 月 9 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：新竹場 | Training Workshop (Hsinchu): Decision Support System for Scanning Public Transit Service Gaps |
| 70 | 11 月 10 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：臺南場 | Training Workshop (Tainan): Decision Support System for Scanning Public Transit Service Gaps |
| 71 | 11 月 11 日 | 數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究 第三場專家學者座談會 | Experts Meeting: A Study on Application of Digitization and Blockchain Technology for the Container Transportation Operation Chain. (3rd Session) |
| 72 | 11 月 11 日 | 「海空運系統面對氣候變遷之風險管理與資訊應用」教育訓練 | Education and Training: The Risk Management and Information Application of Sea and Air Transport Under Climate Change |
| 73 | 11 月 12 日 | 「路口無人機交通攝影及衝突分析技術開發」成果發表會暨教育訓練 | Results Presentation and Training: "Development of Traffic Conflict Analysis Using UAV Aerial Videography for Intersections" |
| 74 | 11 月 12 日 | 「南臺區域運輸需求模式教育訓練」 | Training Workshop: Transportation Demand Model of Southern Taiwan Region |
| 75 | 11 月 13 日 | 109 年 11 月空運期刊研討會 | Seminar: November 2020 Air Transport Journal |
| 76 | 11 月 13 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：臺中場 | Training Workshop (Taichung): Decision Support System for Scanning Public Transit Service Gap |
| 77 | 11 月 16 日 | 109 年度「國際海運資料庫」座談會 | Experts Meeting: International Maritime Database of 2020 |
| 78 | 11 月 16 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：臺北場 | Training Workshop (Taipei): Decision Support System for Scanning Public Transit Service Gaps |
| 79 | 11 月 16 日 | 「花蓮海岸公路浪襲預警系統」教育訓練 | Training Workshop: Wave Attack Warning System for Hualien Coastal Road. |
| 80 | 11 月 17 日 | 「卓越領航 乘風起飛」記者會 | Drone News Conference |
| 81 | 11 月 17 日 | 109 年 11 月海運期刊研討會 | Seminar: November 2020 Maritime Journal |
| 82 | 11 月 17 日 | 「轉移汽、機車使用族群至公共運輸或低污運具之交通管理策略探討」第一場焦點團體座談會 | Focus Group 1st Round: Discussion of Traffic Management Strategies Transferring Vehicle Users to Public Transportation or Low-emission Modal |
| 83 | 11 月 18 日 | 「109 年度馬祖港維護管理系統」教育訓練 | Training Workshop: Matsu Port Maintenance Management System in 2020 |
| 84 | 11 月 18 日 | 「臺灣附近海域及港區船舶排放量對空氣品質影響預測系統」教育訓練 | Training Workshop: Prediction System for the Impact of Ship Emissions on Air Quality in the Waters and Port Areas Near Taiwan |

| 項次 | 日 期 | 主　題 | Topic |
|---|---|---|---|
| 85 | 11 月 19 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：花蓮場 | Training Workshop (Hualien): Decision Support System for Scanning Public Transit Service Gaps |
| 86 | 11 月 23 日 | 「公共運輸縫隙掃描決策支援系統」教育訓練：高雄場 | Training Workshop (Kaohsiung): Decision Support System for Scanning Public Transit Service Gaps |
| 87 | 11 月 23 日 | 「愛接送 - 預約式通用計程車」服務品質提升工作坊（南部場） | Training Workshop: iTaxi Service Quality Improvement (South Taiwan Session) |
| 88 | 11 月 24 日 | 「愛接送 - 預約式通用計程車」服務品質提升工作坊（中部場） | Training Workshop: iTaxi Service Quality Improvement (Middle Taiwan Session) |
| 89 | 11 月 25 日 | 「交通事件資訊整合服務擴充與事件偵測技術精進計畫」研究成果經驗分享說明會 | The Project for The Information Integration Service Expansion of Traffic Events and Incident Detection Technology Improvement |
| 90 | 11 月 25 日 | 臺灣腐蝕環境分類資訊系統與橋梁防蝕工法應用研習會 | Training Workshop: Taiwan Corrosion Environment Classification Information System and Application of Bridge Anti-corrosion Construction Method |
| 91 | 11 月 27 日 | 109 年度「國際空運資料庫」更新擴充及資料分析服務座談會 | Experts Meeting: Expanding, Updating and Data Analyzing of International Air Transport Database of 2020 |
| 92 | 12 月 2 日 | 應用人工智慧技術進行交通數據蒐集暨號誌控制之研究成果說明會 - 臺中場 | Seminar: A Preliminary Study of Artificial Intelligence in Traffic Data Collection and Urban Traffic Signal Control (Taichung) |
| 93 | 12 月 2 日 | 「愛接送 - 預約式通用計程車」服務品質提升工作坊（北部場） | Training Workshop: iTaxi Service Quality Improvement (North Taiwan Session) |
| 94 | 12 月 8 日 | Taiwan Pass 數位旅遊服務整合平台規劃案專家座談會 | Expert Symposium: Taiwan Pass Digital Travel Services Integration Platform Planning |
| 95 | 12 月 8 日 | 「轉移汽、機車使用族群至公共運輸或低污運具之交通管理策略探討」第二場焦點團體座談會 | Focus Group 2nd Round: Discussion of Traffic Management Strategies on Transferring Vehicle Users to Public Transportation or Low-emission Modal |
| 96 | 12 月 9 日 | 「捷運路網規劃參考手冊」南區說明會 | Training Workshop: Rapid Transit Network Planning (in Kaohsiung) |
| 97 | 12 月 10 日 | 應用人工智慧技術進行交通數據蒐集暨號誌控制之研究成果說明會 - 臺北場 | Seminar: A Preliminary Study of Artificial Intelligence in Traffic Data Collection and Urban Traffic Signal Control (Taipei) |
| 98 | 12 月 10 日 | Taiwan Pass 數位旅遊服務整合平台規劃案專家座談會 | Expert Symposium: Taiwan Pass Digital Travel Services Integration Platform Planning |
| 99 | 12 月 16 日 | Taiwan Pass 數位旅遊服務整合平台規劃案專家座談會 | Expert Symposium: Taiwan Pass Digital Travel Services Integration Platform Planning |
| 100 | 12 月 16 日 | 「捷運路網規劃參考手冊」中區說明會 | Training Workshop: Rapid Transit Network Planning for Central Area |
| 101 | 12 月 17 日 | 「捷運路網規劃參考手冊」北區說明會 | Training Workshop: Rapid Transit Network Planning for Northern Area |
| 102 | 12 月 23 日 | 「減少交通空污暴露之管理思維」推廣工作坊 | Training Workshop: Traffic Management of Reducing the Exposure of the Air Pollution Emitted by Vehicles |

# 大事紀要

## 06. Major Events

## 109 年度大事紀要
## 2020 Calendar of Major Events

| 日期 Date | 重要記事 Major Event |
|---|---|
| **04** April | |

**6**

行政院能源及減碳辦公室召開「運輸部門溫室氣體減量策略討論會議」，由本所代表交通部簡報説明運輸部門溫室氣體減量策略。

The Office of Energy and Carbon Reduction, Executive Yuan called a "Conference Greenhouse Gas Reduction Strategies for the Transportation Sector," and the IOT represented the Ministry of Transportation and Communications to give a briefing on the greenhouse gas reduction strategies for the transportation sector.

**15**

交通部核備本所陳報「橋梁維護管理策進作為（交通部及所屬機關部分）列管追蹤執行機制」及備查本所辦理「交通部及所屬機關橋梁維護管理策進作為-具體作為分辦追蹤辦理情形表（第1次）」。

The Ministry of Transportation and Communications verified the "Bridge Maintenance Management Promotion Actions (the Part of the Ministry of Transportation and Communications and Subordinated Agencies) Control and Tracking Implementation Mechanism" reported by the IOT and referenced the "Bridge Maintenance Management Promotion Actions of the Ministry of Transportation and Communications and Subordinated Agencies – Management Status List for Differentiated Managing and Tracking of Specific Actions (First Time)."

撰擬部長箋函以部長名義贈送2020運輸政策白皮書套書及專書予行政院院長室、副院長室、秘書長室、政務副秘書長室及張政委辦公室。並針對2020運輸政策白皮書之願景、目標、策略、相關作業程序及後續作為向 政院提出説明。

Composed a letter of the Minister in the name of the Minister to present the 2020 Transportation Policy White Paper Set of Books and Monograph to the Executive Yuan, Premier Office, Vice Premier Office, Secretary-General Office, Minister of State Deputy Secretary-General Office and the Office of Minister Provided explanations to the Executive Yuan regarding the vision, goals, strategies, relevant operating procedures and follow-up actions of the 2020 Transportation Policy White Paper.

**30**

本所督請國立交通大學北區區域運輸發展研究中心，完成交通部交辦「探討臺北至宜蘭地區觀光旅運之公共運輸銜接供需缺口」案，藉由訪談宜蘭縣政府、宜蘭市公所及宜蘭觀光旅宿協會代表等瞭解公共運輸服務缺口，於109年4月17日召開座談會，邀集相關單位凝聚共識，使研究成果能符合在地需要，並於109年4月30日完成結案報告書，俾利宜蘭縣政府提案申請公運計畫經費。

The IOT asked the North Center Transportation Research Development of National Chiao Tung University to complete the "Discussion on the Connecting Supply and Demand Gap between Taipei and Yilan Tourism and Transportation in Public Transportation" assigned by the Ministry of Transportation and Communications. Through interviews with Yilan County Government, Yilan City Office and representatives of Yilan Tourism and Accommodation Association to understand the gaps in public transportation services, held a symposium on April 17, 2020, invited relevant units to gather consensus so that the research results can meet local needs, and completed the case closure report on April 30, 2020 to facilitate the Yilan County Government submitting a proposal to apply for the funds of the Public Transportation Project.

| 日期 Date | 重要記事 Major Event |
|---|---|

## 05 May

### 18

2020年版運輸政策白皮書動畫影片上線，進行包含YouTube天下雜誌Video、本所官網與YouTube之推播，並同步啟動社群推文，如天下雜誌、未來城市FB及部長臉書等。另請相關部屬機關官方網站及臉書進行推播。

The 2020 Transportation Policy White Paper animation video was online for push broadcasting, including YouTube CommonWealth Magazine Video, and the official website and YouTube of the IOT, and tweeted simultaneously in social media such as Facebook of CommonWealth Magazine, FutureCity, and the Minister of MOTC etc. Also Subordinated Agencies assisted broadcasting the video via their official websites and Facebook..



## 06 June

### 5

本所與中華及開南大學桃竹苗區域運輸發展研究中心共同舉辦「公共運輸載客量提升策略跨區論壇」，進行經驗分享及意見交流，彙集各相關單位對如何提升公共運輸載客量之意見，後續納入各區域中心共同策劃提升公共運輸運量之可行策略方案，以協助地方政府推出讓民眾有感的優質公共運輸服務。

The IOT held the "Cross-Region Forum of Public Transportation Passenger Capacity Improvement Strategies" with the Taoyuan-Hsinchu-Miaoli Regional Center of Chung Hua University and Kainan University to share experience and exchange opinions, and collect the opinions of how to improve public transportation passenger capacity from all relevant Units, and subsequently incorporated into the Regional Centers to jointly plan for feasible strategic programs to increase the capacity of public transportation, so as to assist Local Governments in launching high-quality public transportation services that the public appreciate.

| 日期 Date | 重要記事 Major Event |
|---|---|

## 06
### June

**9**

　　本所與國立中山大學高屏澎區域運輸發展研究中心共同辦理「偏鄉公共運輸環境健全跨區論壇」，進行經驗分享及意見交流，彙集各相關單位對如何改善偏鄉公共運輸服務之意見。本所將陸續與各區域中心共同策劃健全偏鄉公共運輸環境之可行策略方案，以協助地方政府儘速推出讓民眾幸福的優質公共運輸服務。

　　The IOT and the Kaohsiung-Pingtung-Penghu Regional Center of National Sun Yat-sen University jointly organized the "The Regional Forum to Improve Rural Towns in Public Transport" to share experience and exchange opinions, and collect the opinions of how to improve the rural public transportation services from all relevant Units. The IOT will continue to conduct planning with all Regional Centers on feasible strategies to improve the rural public transportation environment, and to assist Local Governments in launching high-quality public transportation services that will make people happy.



**12**

　　行政院核定交通部提報「公路公共運輸服務升級計畫（110-113年）」，計畫編列245億元經費用於協助地方政府及客運業者推動公共運輸發展。本計畫係本所研擬，以無縫、安全、永續、精緻為公路公共運輸服務升級之目標，辦理重點包括強化跨運具服務整合、完善無障礙乘車及候車環境、改善偏鄉交通協助地方創生、推廣電動大客車以利空污防制、導入先進設備預防事故發生等。

　　The Executive Yuan approved the "Service Upgrade Project of Bus Transit System(2021–2024)" submitted by the Ministry of Transportation and Communications, with NTD 24.5 billion allocated for the project to assist local governments and bus companies to promote the development of public transportation. This project, proposed by the Institute of Transportation, aims at seamlessness, safety, sustainability, and sophistication as the goal of service upgrade of bus transit system. The main tasks of this project include strengthening the service integration of multimodal transportation, improving accessible riding and waiting environments, improving transportation in rural areas to assist the creation of local livelihood, promoting electric buses to control air pollution, and introducing advanced equipment to prevent accidents.

| 日期 Date | 重要記事 Major Event |
|---|---|

**06 June**

**13**

辦理「預約式通用小客車運輸服務之試辦與推廣應用」案雙北市第二階段試營運經驗分享與意見回饋座談會，除90位參與試營運之身心障礙者外，另邀請路政司、教育部學生事務及特殊教育司、中華民國罕見疾病基金會、參與試辦之主管機關與車隊等共襄盛舉，並由林繼國所長頒發感謝狀給經票選前5名積極協助其他身心障礙者參與試營運之小老師，感謝其為推動臺灣通用化友善交通服務之貢獻。

Conduct the forum of experience sharing and opinion feedback for the Taipei City and New Taipei City Phase-2 Trial Operation of the "Trial and Promotion of Reservation-type Accessible Taxi Transportation Services" Project. In addition to 90 persons with disability who participated in the trial operation, the Department of Railways and Highways, Department of Student Affairs of Special Education of the Ministry of Education, Taiwan Foundation for Rare Disorders, Competent Authorities and Taxi Fleet also participated in the trial operation and were invited to cooperate on a grand undertaking, and the Director General Lin, Chi-Kuo issued the Certificate of Appreciation to the top five Teachers by voting for those who actively assist other people with disabilities to participate in the trial operation, appreciating their contribution to the promotion of Taiwan accessible and friendly transportation services.



**07 July**

**3**

召開交通部交通科技產業會報無人機科技產業小組第3次諮詢委員會議。

Convened the 3rd Consultation Committee Meeting of the UAV Technology Industry Group of the Transportation Technology Industry Conference by the Ministry of Transportation and Communications.

**7**

行政院災防辦公室吳主任武泰率員參訪本所，瞭解橋梁管理資訊系統及橋梁維護管理作業要點內容。

Director Wu, Wu-Tai of the Office of Disaster Management of the Executive Yuan visited the IOT to learn about the "Bridge Management Information System" and the content of the "Directions for Bridge Maintenance and Management Operation."

**21**

本所研擬「橋梁維護管理作業要點」經行政院109年7月21日院臺交字第1090094108號函頒訂分行各單位。

The "Directions for Bridge Maintenance and Management Operation" developed by the IOT was issued and distributed to all Units by Letter Yuan-Tai-Chiao-Tzu No. 1090094108 of the Executive Yuan.

| 日期 Date | 重要記事 Major Event |
|---|---|

**07**
June

**27**

本所「運輸計劃季刊」獲得國家圖書館109年「期刊長期傳播獎」。

"Transportation Planning Journal" won the 2020 "Journal Long-term Communication Award"of the National Central Library.



**30**

於交通部第1770次部務會報報告「愛接送-預約式通用計程車試營運成果暨正式啟用活動規劃」。

Reported at the "i-Taxi – Reservation Accessible Taxi Trial Operation Results and Official Launching Activity Planning" at the 1770th Ministry Affair Meeting of the Ministry of Transportation and Communications.

**31**

啟動2020年版運輸政策白皮書動畫影片英文完整版及精華版上線推播，包含YouTube天下雜誌Video、本所官網與YouTube推播。

Started online broadcasting the English Full Version and the Essence Version of the 2020 Transportation Policy White Paper, including YouTube Commonwealth Magazine Video, and Official Website and YouTube of IOT.

| 日期 Date | 重要記事 Major Event |
|---|---|

## 08
### August

**4**
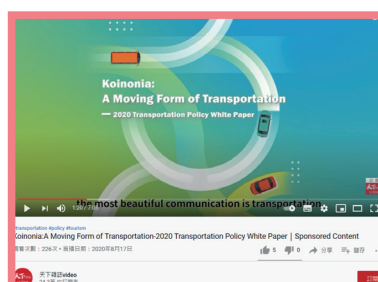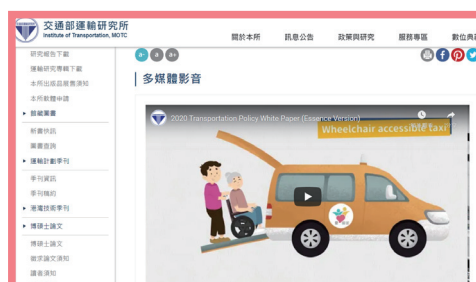
　　林繼國所長陪同林佳龍部長出席行政院蘇院長主持之中央災害防救會報第42次會議，會中並由林所長簡報「強化全國橋梁維護管理制度」。

Director General Lin, Chi-Kuo accompanied Minister Lin, Chia-Lung to attend the 42nd meeting of the Central Disaster Prevention and Response Council hosted by Premier Su of the Executive Yuan, and Director General Lin presented the briefing on "Strengthening the National Bridge Maintenance and Management System."



**18**
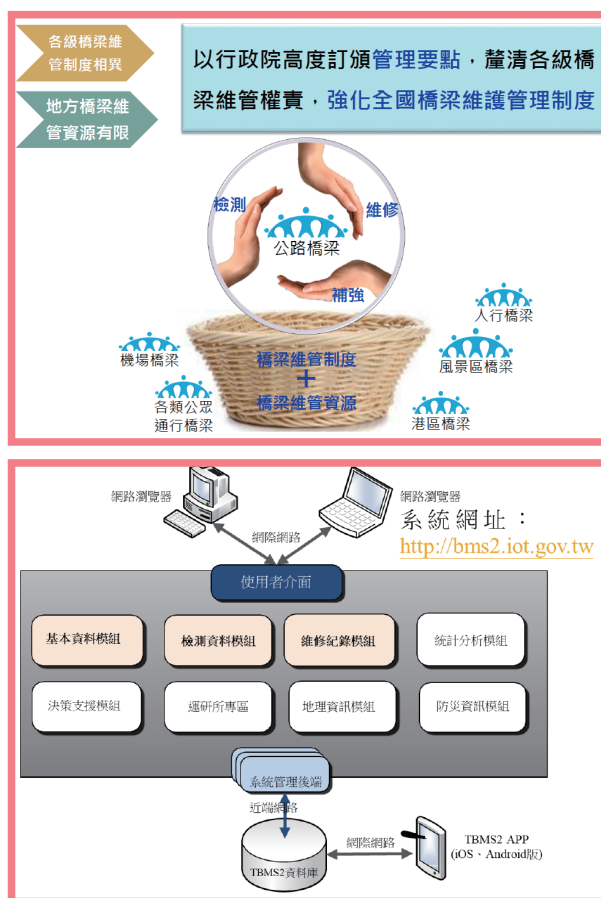
　　本所於8月18日參與APEC第49次複合運具及智慧型運輸系統專家小組線上會議，參與過程除分享我國申請之MaaS推廣論壇專案內容外，更掌握其他國家對於複合運具整合及ITS領域之專案執行成效，作為本所後續策略研擬之參考。

On August 18th, IOT designate several delegates to participate in the APEC TPT-WG49 IIEG Virtual Meeting. One of IOT's delegate gave presentation on the MaaS promotion forum project applied by our country, and kept up with the implementation experiences of the intermodal vehicles integration and ITS projects in other countries. These experiences and lesson learned from the meeting does provide IOT with solid reference.

| 日期 Date | 重要記事 Major Event |
|---|---|

**08 August**

**20**

　　配合交通部於行政院第3715次院會報告「全臺自行車道路網建置成果」案，本所協助彙整各部會建置成果，並完成簡報、懶人包、新聞稿等資料。後續將配合交通部自行車小組作業需要，適時給予協助。

In cooperation with the Ministry of Transportation and Communications to report the "Achievements of Taiwan Cycling Route Network Construction" at the 3715th Meeting of the Executive Yuan Council, the IOT assisted in collecting and organizing the achievements of the construction of various Ministries, and completed the materials of the briefing, quick reference package and press releases, and will cooperate with the needs of the Cycling Team of the Ministry of Transportation and Communications in follow-ups to provide timely assistance.

**25**

　　本所奉交通部指示配合行政院農業委員會漁業署推動「前鎮漁港建設專案」計畫，協助辦理該計畫之聯外交通改善規劃。行政院蘇院長於109年8月25日視察前鎮漁港時，由本所林所長繼國代表交通部簡報說明前鎮漁港聯外交通改善規劃情形。

The IOT was instructed by the Ministry of Transportation and Communications to cooperate with the Fisheries Agency, the Council of Agriculture of the Executive Yuan to promote the "Cianjhen Fishing Port Construction Project," and assisted in the planning of the access traffic improvement plan for the project. When Premier Su of the Executive Yuan inspected the Cianjhen Fishing Port on August 25, 2020, Director General Lin, Chi-Kuo of the IOT, on behalf of the Ministry of Transportation and Communications, presented the briefing of traffic planning for Cianjhen Fishing Port.



　　行政院龔政務委員明鑫召開「第二期溫室氣體階段管制目標研商會議（住商、運輸、環境與農業部門）」，交通部祁常務次長文中率路政司及本所出席，由本所代表交通部簡報，成功爭取運輸部門較合理之減量目標，由114年較94年（基準年）減量8.5%降低為6.79%。

The Minister without Portfolio Kung, Ming-Hsin of the Executive Yuan held the "Research and Discussion Conference for the 2nd Phase GHG Control Targets (Residential and Commercial, Transportation, Environment and Agriculture Sectors)"; Deputy Minister Chi, Wen-Jong of the Ministry of Transportation and Communications led the Department of Railways and Highways and the IOT to attend, on behalf of the Ministry of Transportation and Communications; the IOT presented the briefing, successfully endeavored after the more reasonable reduction target for the transportation sector, which was reduced from 8.5% in 2025 to 6.79% compared to 2015 (base year).

| 日期 Date | 重要記事 Major Event |
|---|---|

**09**
September

辦理「愛接送-預約式通用計程車」正式啟用典禮記者會，由林繼國所長進行愛接送四都試營運成果簡報，交通部林佳龍部長、教育部蔡清華次長、衛生福利部社會及家庭署簡慧娟署長亦出席致詞，並由林佳龍部長正式宣布對外提供服務，且指示後續透過工作坊進行意見蒐集研析與交換、數位行銷設計等規劃，以利推廣至其他縣市。

Held the press conference for the official opening ceremony of "i-Taxi – Reservation Accessible Taxi" and the Director General Lin, Chi-Kuo presented briefing on the results of the trial operation of i-Taxi in four Municipalities. Minister Lin, Chia-Lung of the Ministry of Transportation and Communications, Deputy Minister Tsai, Ching-Hwa of the Ministry of Education, and Director General Chien, Hui-Jiuan of the Social and Family Affairs Administration of the Ministry of Health and Welfare also attended and provided speeches; Minister Lin, Chia-Lung officially announced the provision of services to the outside world, and instructed the follow-up plans to collect, analyze and exchange opinions, and design digital marketing through workshops to facilitate promotion to other Counties and Cities.



本所「提升都市交通智慧管理效能新契機-交通需求導向之AI影像辨識技術研發與應用」獲得2020智慧城市創新應用獎，由賴副總統清德親自頒獎予本所黃新薰副所長。

"New Opportunities for Enhancing Smart Urban Traffic Management Effectiveness– Traffic Demand-oriented AI Image Recognition Technology R&D and Application" won the 2020 Smart City Innovation Application Award and Vice President Lai, Ching-Te personally presented the Award to IOT Deputy Director General Huang, Hsin-Hsun.

| 日期 Date | 重要記事 Major Event |
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**09**
September

**24**

本所「我國臺、高鐵車站與公車轉乘接駁時間縫隙檢核及改善機制之研究」計畫研發成果「無縫銜接檢核系統」，正式授權中華民國公共汽車客運商業同業公會全國聯合會使用。

The research and development results "Seamless Connection Evaluation System" of the "Study on the Transfer Time Gap Evaluation and Enhancement Mechanism for Taiwan Railways, Taiwan High Speed Rail, and Their Shuttle Buses" was officially authorized for the use by the Federation of Highway and Intercity Bus Companies in Taiwan, Republic of China.

**10**
October

**13**

本所與六大區域運輸發展研究中心共同辦理「公共運輸跨域發展策略論壇」，交通部林佳龍部長蒞臨致詞，於會中揭示未來偏遠地區公共運輸政策之三大重點方向「因地制宜、以人為本」、「導入『E』化智慧交通服務與治理」及「資源整合，永續經營」，以及未來都市地區公共運輸政策之重點方向為「開發站體，整合交通行動服務」、「運用數據，強化運輸供給效率」及「放寬限制，鼓勵創意服務管理」，因後續相關工作的推動需要中央各部會資源進行協調整合，交通部將持續關注與協助加以落實，以達成人本交通服務之施政理念。

The IOT and the six Regional Transportation Development Research Centers jointly organized the "The Forum on Strategy of Public Transport Interdisciplinary Development." Minister Lin, Chia-Lung of the Ministry of Transportation and Communications attended to give a speech and revealed the three key directions of future public transportation policies in remote rural areas: "Adapt to Local Conditions, People-Oriented," "Introduction of 'E' Smart Transportation Services and Governance" and "Resource Integration, Sustainable Operation," and the key directions of future public transportation policies in urban areas: "Development of Stations, Integration of Transportation Mobility Services," "Use Data, Strengthen Transportation Supply Efficiency" and "Relax Restrictions, Encourage Creative Service Management." Since the related follow-up work requires coordination and integration of resources from various Central Ministries and Agencies, the Ministry of Transportation and Communications will continue to pay attention and assist in implementation to achieve the administrative concept of people-oriented transportation services.

| 日期 Date | 重要記事 Major Event |
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**10**
October

**15**
**16**

環保署假臺北、臺中、高雄召開「第2期階段管制目標」公聽會，由本所代表交通部向與會民眾説明運輸部門第1期減量成果，以及第2期減量策略及措施規劃內容。

The Environmental Protection Administration held "The 2nd Phase GHG Control Targets"Public Hearings in Taipei, Taichung, and Kaohsiung. On behalf of the Ministry of Transportation and Communications, the IOT explained the results of the 1st phase reduction of the transportation sector, as well as the content of the 2nd phase reduction strategy and measure planning.

**20**

**24**

舉辦「第一屆交通盃辯論賽」，由交通部主辦、本所承辦、中華辯論推廣協進會執行。比賽以「我國汽燃費徵收方式應採隨油徵收」為題，吸引全臺18所大專院校共23支辯論隊伍、超過百人青年辯士參與激辯，最終由東吳大學正言社B隊拿下冠軍。林佳龍部長於閉幕及頒獎典禮親臨現場致詞及頒獎，活動圓滿落幕。

**26**

The "First Transportation Cup Debate Tournament" was sponsored by the Ministry of Transportation and Communications, organized by the IOT, and implemented by the Chinese Debate Promotion Association. With the topic of "Our Country's Automobile Fuel Tax shall be Collected with the Fuel," the competition attracted 23 debate teams from 18 colleges and universities in Taiwan, and more than 100 young debaters participated in the debate, with Debating Club B Soochow University winning the championship in the end. Minister Lin, Chia-Lung delivered the speech and awarded the prizes in person at the closing and awards ceremony, and the event ended successfully.

**27**

於10月27日參與APEC手機應用程式於包容性智慧城市之專題會議，除於會議中分享我國在手機APP於MaaS功能應用之執行成效外，亦掌握美國、加拿大等其他國家在手機APP於智慧城市應用之案例，作為後續執行方向借鏡。

IOT designate several delegates to participate in the APEC "Uses of App-Based Transportation Mobility Technologies for Inclusive Smart Cities" thematic session on October 27th. One of IOT's delegate gave presentation on the implementation results of our Country's mobile APP uses of app based technologies for MaaS, and kept up with the cases of app-based technologies for inclusive smart cities of the United States, Canada and other countries. These experiences and lesson learned from the meeting does provide IOT with solid reference in policy making.

| 日期 Date | 重要記事 Major Event |
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## 11
### November

**6**

　　祁文中次長出席本所舉辦「貨櫃運輸作業鏈應用數位化區塊鏈技術國際研討會」，會中肯定本所啟動航運數位化區塊鏈技術研究，充分發揮交通部智庫之角色功能，並期許產官學研共同努力，透過AI、5G、區塊鏈等資通訊科技應用，將商流、物流、資訊流、金流、人才流等五流緊密串聯與發展。研討會共180餘位相關領域人員參加，透過共同交流互動，為後疫情時代我國的海運數位化與區塊鏈技術應用可能的發展帶來貢獻。

　　Deputy Minister Chi, Wen-Jong attended the "International Seminar: Application of Digital Digitization and Blockchain Technology for the Container Transportation Operation Chain" organized by the IOT, and affirmed the start of research on the digital blockchain technology in shipping by the IOT in the Seminar, which gave full play to the role and function of the think tank of the Ministry of Transportation and Communications, expected to closely connect and develop the five streams of business flow, logistics, information flow, cash flow, and talent flow with the joint efforts of the industry, government, academia and institutions through AI, 5G, blockchain and other information and communication technology applications. A total of more than 180 personnel from related fields participated in the seminar, and contributed to the possible development of our Country's marine transportation digitization and blockchain technology applications in the post-epidemic era through mutual exchanges and interactions.

**9**

　　辦理「公共運輸縫隙掃描決策支援系統教育訓練」（新竹場，臺南場，臺中場，臺北場，花蓮場，高雄場），培訓各區域運輸發展研究中心及地方政府人員熟悉本系統相關功能操作，以利應用於公車路網規劃。本次訓練係透過客觀評量方式快速篩出搭乘公車不便之運輸節點做為改善重點，並可評估改善方案之成效，克服過去因相關資訊不足只能仰賴經驗法則所導致的管理盲點，使公共運輸服務供給更符合民眾所需。

　　Organized the "Education Training of the Decision Support System for the Scanning of Public Transit Service Gaps" (Hsinchu Session, Tainan Session, Taichung Session, Taipei Session, Hualien Session and Kaohsiung Session) to train the personnel of the Regional Transportation Development Research Centers and Local Governments to be familiar with how to use the functions of this system in order to apply it for the planning or bus network. This training was to quickly screen out the transportation nodes which are inconvenient to take the bus as the focus of improvement through objective evaluation, and evaluate the effectiveness of the improvement plan, which can overcome the management blind spots caused by the lack of relevant information and can only rely on the rules of experience in the past, so that the supply of bus services can be more in line with the needs of people.

**23**

| 日期 Date | 重要記事 Major Event |
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**11**
November

**17**

舉辦交通部「卓越領航 乘風起飛」記者會,由林佳龍部長出席致辭,宣告本所三大無人機計畫(「推動我國無人機科技產業發展先期研究規劃」、「無人機在交通領域之創意應用競賽」及「無人機整合示範計畫推動及管理服務」)開跑,持續推動檢討精進相關發展策略,並推廣無人機於交通領域之創新應用與產業發展。

Held the "Excellence in Piloting, Taking Off with the Wind" News Conference of the Ministry of Transportation and Communications; Minister Lin, Chia-Lung attended the press conference and delivered a speech, announcing the start of IOT's three major UAV projects ("The Advance Research and Planning of Promoting the Development of Taiwan's UAV Science and Technology Industry," "A Competition for Creative Applications of UAV in the Field of Transportation" and "Promoting and Management Service on UAV Integrated Pilot Program"), continued to promote the review and improvement of related development strategies, and promoted the innovative applications and industrial development of UAV in the transportation sector.



**23**

**24**

於中山大學及逢甲大學辦理「愛接送-預約式通用計程車」服務品質提升工作坊(南部場,中部場),透過「愛接送」品牌之服務介紹以及經驗分享、問卷調查,以蒐集各項服務改善和使用者推廣的建議。

Organized the Training Workshop: iTaxi Service Quality Improvement (South Taiwan Session and Middle Taiwan Session) at the National Sun Yat-sen University and Feng Chia University, through the service introduction and experience sharing, questionnaire survey of the "i-Taxi" brand to collect the suggestions of various items of service improvement and user promotion.

| 日期 Date | 重要記事 Major Event |
|---|---|

**12**
December

**1**

本所邀集各中央部會召開「『臺灣地區橋梁管理資訊系統』內縣市政府橋梁之中央主管機關歸屬認定原則研商會議」，針對縣市政府轄管各類橋梁，後續依據行政院109年7月21日頒訂「橋梁維護管理作業要點」規定之中央主管機關歸屬進行討論並獲得初步共識。

The IOT invited various Central Ministries to convene the "Research and Discussion Conference on the "Principles of Ownership Recognition by the Central Competent Authority on the Bridges of County and City Government in the 'Taiwan Bridge Management System'" targeting all types of bridges under the jurisdiction of County and City Government, and subsequently, conducted discussion based on the ownership of the Central Competent Authority stipulated in the "Directions for Bridge Maintenance and Management Operation" promulgated by the Executive Yuan on July 21, 2020, and reached preliminary consensus.

**2**

於本所國際會議廳辦理「愛接送-預約式通用計程車」服務品質提升工作坊（北部場），共計113人共同參與，透過服務介紹、經驗分享、問卷調查、分組討論與報告及專家與談等活動，蒐集服務改善和使用者推廣的建議。

Organized the Training Workshop: iTaxi Service Quality Improvement (North Taiwan Session) in the Conference Hall of the Institute of Transportation Building with a total of 113 people participating; through the activities of service introduction, experience sharing, questionnaire survey, group discussions and reports, experts joined in conversation to collect suggestions for service improvement and user promotion.

| 日期 Date | 重要記事 Major Event |
|---|---|

**12**
December

交通部指示本所以中立的立場搭建對話平台，召開「淡水河北側沿河平面道路相關事宜」座談會，邀請歷任臺北市交通局長、專家學者，與新北市、臺北市、公路總局、路政司就交通議題進行意見交流與對話，相關建議供後續辦理參考。

The Ministry of Transportation and Communications instructed the IOT to establish a dialogue platform with a neutral standpoint, held a symposium on "Business Matters Related to Surface Road along the North Side of Tamsui River," and invited successive Commissioners of Department of Transportation, Taipei City, Experts and Scholars to discuss with New Taipei City, Taipei City, Directorate General of Highways, and Department of Railways and Highways of MOTC to exchange opinions and dialogue on transportation issues, and relevant suggestions for the reference of subsequent processing.

**24**



**29**

行政院能源及減碳辦公室召開「運輸部門第二期溫室氣體減量行動方案討論工作坊」，由本所代表交通部簡報「運輸部門溫室氣體排放管制行動方案（草案）」

The Office of Energy and Carbon Reduction of the Executive Yuan held the "Phase-2 of Greenhouse Gas Reduction Action Plan Discussion Workshop for the Transport Sector," and the IOT represented the Ministry of Transportation and Communications to present the briefing of the "Greenhouse Gas Emission Control Action Plan for the Transportation Sector (Draft)."

| 日期 Date | 重要記事 Major Event |
|---|---|

**12**
December

30

　　針對本所擬訂「『臺灣地區橋梁管理資訊系統』內縣市政府橋梁之中央主管機關歸屬認定原則」之內容與後續系統調整及操作事宜，邀集各縣市政府辦理說明會。

　　Organized the seminar inviting all County and City Governments to attend targeting the contents of the "Principles of Ownership Recognition by the Central Competent Authority on the Bridges of County and City Government in the 'Taiwan Bridge Management Information System'" established by the IOT and the subsequent system adjustments and operation matters.

# 附錄：年度研究計畫

07. Appendix: Annual Research Projects

# 附錄：年度研究計畫
## Appendix: Annual Research Projects

| 項次 | 計畫名稱 | Project Title |
|---|---|---|
| 1 | 高雄港洲際貨櫃中心聯外改善策略 | The Study on Access Road Improvement for Kaohsiung Intercontinental Container Terminal |
| 2 | 南臺區域整體運輸規劃系列研究（2/2）－供需預測及發展策略分析 | A Series of Studies on the Overall Transportation Planning of Southern Taiwan Region (2/2) - Transportation Demand and Supply Analysis |
| 3 | 輕軌系統容量分析暨應用研究（2/2）－ A、B 型路權容量及可靠度分析 | Light Rail Transit Capacity Analysis and Applications Study (2/2) - Capacity and Reliability Analysis for A-Type and B-Type Right-of-Way |
| 4 | 捷運路網規劃設計參考手冊之研究（2/2） | The Research of Rapid Transit Network Planning and Design Manual (2/2) |
| 5 | 中臺區域整體運輸規劃系列研究（1/3）－旅次特性調查及初步分析與（2/3）－旅次特性分析及補充調查 | A Series of Studies on the Overall Transportation Planning of Central Taiwan Region (1/3) – Investigation and *Preliminary* Analysis of Trip Characteristics and(2/3)- Analysis of Trip Characteristics and Supplementary Investigation. |
| 6 | 國內行車成本調查蒐集（2/2） | Vehicle Operating Cost Survey and Analysis of Taiwan(2/2) |
| 7 | 運輸規劃支援系統維運技術服務（109 年度） | Maintenance Service of the Transportation Planning Support System (2020) |
| 8 | 高快速公路匝道分匯流區容量及服務水準分析之研究（2/3）－非獨立進出口分匯流區 | Capacity and Level of Service Analysis of Freeway and Expressway Merging and Diverging Area (1/3) – Non-Isolated Merging Area for On-ramp and Non-Isolated Diverging Area for Off-ramp |
| 9 | 臺灣公路容量分析軟體（THCS）與專區網站更新維運服務 | 2020 Updating and Maintenance Service of Taiwan Highway Capacity Analysis Software and website |
| 10 | 環島自行車道升級暨多元路線整合規劃與評估（I） | An Integrated Technical Planning and Evaluation of Upgrading and Diversifying Island Round Cycling Routes (I) |
| 11 | 多元自行車路網資訊系統之建置與行銷（I） | Development of System and Marketing Services of Diversified Network of Cycling Routes (I) |
| 12 | 北部縣市交通運輸課題與發展策略 | Transportation Issues and Development Strategies in Northern Taiwan |
| 13 | 大淡水北海岸地區交通系統改善策略 | A Traffic System Improvement Strategy of the Tamsui-Taipei Transport Corridor |

| 項次 | 計畫名稱 | Project Title |
|---|---|---|
| 14 | C 型路權輕軌系統之規劃設計暨交通安全課題分析 | Reviews on the Planning and Traffic Safety Analysis for Light Rail Transit of C-Type Right-of-Way |
| 15 | 外籍旅客來臺運輸需求初探 | A Study on Transport Demand of International Tourists in Taiwan |
| 16 | 109 年度「國際空運資料庫」更新擴充及資料分析服務 | Expanding, Updating and Data Analyzing of International Air Transport Database of 2020 |
| 17 | 109 年度「國際空運資料庫」更新擴充及資料分析服務 | Expanding, Updating and Data Analyzing of International Maritime Database of 2020 |
| 18 | 無人機整合示範計畫推動及管理服務 | Promoting and Management Service on UAV Integrated Pilot Program(IPP) |
| 19 | 商港整體發展規劃（111-115 年） | The Integrated Overall Development Plan of Commercial Ports (2022-2026) |
| 20 | 數位化與區塊鏈技術應用於我國貨櫃運輸作業鏈之研究 | Research on the Application of Digitization and Blockchain Technology in the Operation Chain of Container Transportation |
| 21 | 大數據分析技術進行鐵路供需診斷與策略分析（2/2） | Railway Supply and Demand Diagnosis and Strategy Analysis with Big Data Technology (2/2) |
| 22 | 資通訊科技在航港領域之應用發展 | Application and Development of Information and Communication Technology in the Port and Shipping Field |
| 23 | 數位科技與海事生態系統發展趨勢之研究 | A Study on the Development Trend of Digital Technology and Maritime Ecosystem |
| 24 | 國際綠色航運激勵機制初探 | Preliminary Study on Incentive Schemes for Promoting Green Shipping |
| 25 | 港口優惠費率吸引綠色船舶靠泊臺灣初析 | Preliminary Study on Price Incentives to Promote Green Shipping in Taiwan |
| 26 | 高雄港貨櫃碼頭營運績效評析 | A Study on operation Performance of Container Terminals at Kaohsiung Port |
| 27 | 兩岸海運直航航線營運變化分析 | Analysis on the Operation Variations for the Cross Strait Direct Shipping |
| 28 | 應用 5G 技術加強國際機場智慧化發展之研究 | Preliminary Study on 5G Technology Applications to Enhance the Development of International Smart Airports |

| 項次 | 計畫名稱 | Project Title |
|---|---|---|
| 29 | 以航網角度研析兩岸主要機場轉運競爭關係 - 以東南亞中轉北美為例 | Analysis of the Transfer Competitive Relations Between China and Taiwan Airports-Southeast Asia Transfer to North America for an Example |
| 30 | 以旅客量及旅運路徑探討桃園機場與鄰近競爭機場之發展 | Preliminary Study on Taoyuan and Neighboring Airport Rivals Based on Passenger Traffic and Routes |
| 31 | 臺鐵增站建設對旅客需求及列車供給服務影響之初探 | Preliminary Study on the Influences of Construction of New Stations of Taiwan Railway on Passenger Demand and Train Supply Service |
| 32 | 公路橋梁維護管理制度之策進研究—交通部所轄車行橋梁維管制度之探討 | Research on the Policy of Highway Bridge Maintenance and Management - Discussion on the Vehicle Bridge Maintenance and Management System under the Jurisdiction of Ministry of Transportation and Communications |
| 33 | 高齡者與重要醫療疾病者適性駕駛評估之探討 | Fitness to Drive Evaluation for Old Drivers and Drivers with Major Mmedical Conditions |
| 34 | 路口俯視攝影技術於交通衝突分析之案例應用與比較 | Case Application and Comparison of Intersection Overlook Videography Technology in Traffic Conflict Analysis |
| 35 | 我國交通事故傷害嚴重度分類方案之研析與實作 | Classification of Injury Severity of Traffic Crash on Data Linkage |
| 36 | 事故型態導向之路口交通工程設計範例之研究 | Study on Traffic Engineering Safety Design Based on the Accident Types at Intersections |
| 37 | 第 38 期臺灣地區易肇事路段改善計畫 | The 38th Project for Improving Accident-Prone Locations in the Taiwan Area. |
| 38 | 國內外海事安全資料內涵及應用初探 | A Preliminary Study of Domestic and Foreign Maritime Safety Data Application. |
| 39 | 高齡友善交通對策精進方向之初探 | Exploratory Study on Areas of Improvement for Elderly-Friendly Transportation Policies |
| 40 | 公共運輸縫隙掃描決策支援系統之維運、功能強化及教育訓練（2/2） | Maintenance, Functional Enhancement and Education Training of the Decision Support System for the Scanning of Public Transit Service Gaps (2/2) |
| 41 | 公共運輸供需契合與轉乘縫隙之研究—以鐵、公路轉乘為例 | Transfer Time Gap Evaluation and Enhancement Mechanism for Train and Bus Transfers |
| 42 | 汽車客運業路線別成本計算制度應用軟體更新及維護運作計畫 | Routed-based Costing System for Motor Carrier Industry Application Software Upgrade and Maintenance Operation Project |

| 項次 | 計畫名稱 | Project Title |
|---|---|---|
| 43 | 預約式通用小客車運輸服務之試辦暨推廣應用 | Trial operation and promotion application of pre-arranged general-purpose passenger car transportation service |
| 44 | 小客車租賃業數位轉型發展計畫 - 專案管理及監督審驗 | Project Management and Supervision for the Studies on Digital Transformation of Car-rental Industry |
| 45 | 國際物流專業人員證照或認證制度之研究 | A Study of Certification on International Logistics Professionals |
| 46 | 國際鐵道運輸發展議題與政策之探討一以數位轉型發展為例 | A Study on Issues and Policies for Railway Transport-Topic about Digital Transformation |
| 47 | 區域運輸發展研究中心服務升級 2.0 計畫之初探 | A Preliminary Project of the Regional Transportation Development Research Center Service Upgrade 2.0 |
| 48 | 汽車客運業路線別成本計算制度及應用需求初探 | Preliminary Research on The Routed-based Costing System of Motor Carrier Industry and Application Preliminary Research |
| 49 | 亞洲鄰近國家物流發展現況蒐集分析 | The Collection and Analysis of Current Logistics Development in Neighboring Asian Countries |
| 50 | 高齡化社會下之計程車市場最佳化研究 | Optimization of a Taxi Market in Aging Society |
| 51 | 應用人工智慧技術進行交通數據蒐集暨號誌控制之研究 | Preliminary Study on Artificial Intelligence in Traffic Data Collection and Urban Traffic Signal Control |
| 52 | 交通事件資訊整合服務擴充與事件偵測技術精進計畫 | Service and Enhancement Project for the Information Integration of Traffic Events |
| 53 | 推動我國無人機科技產業發展先期研究規劃 | Preliminary Research on the Development of our Country's Unmanned Aerial Vechicles Technology Industry |
| 54 | 無人機在交通領域之創意應用競賽 | Creative Applications Competition of Unmanned Aerial Vechicles in the Transportation Sector |
| 55 | 運輸部門溫室氣體減量第二階段策略精進研究 | Research on the Phase 2 Strategy Improvement of Greenhouse Gas Reduction in the Transportation Sector |
| 56 | 汽車運輸業參與溫室氣體抵換專案之研究 | A Study on the Participation of Automobile Transportation Industry in the GHG Offset Project |

| 項次 | 計畫名稱 | Project Title |
|------|----------|---------------|
| 57 | 應用交通管理策略減少都會區交通空氣污染之研析（1/3）- 研究地區分類及初期調查 | Research and Analysis on Applying Traffic Management Strategies to Reduce Traffic Air Pollution in Metropolitan Areas (1/3) - Research Area Classification and Preliminary Investigation |
| 58 | 運輸系統因應氣候變遷調適之研究 | Research on the Climate Change Adaption for Transport Systems |
| 59 | 都會區私人汽機車使用者對空氣污染減量交通管理措施之行為反應分析架構初探 | The Framework of Exploring Behavioral Reaction of Private Car and Motorcycle Users to the Traffic Management Measures which Reduce Air Pollution in Urban Area |
| 60 | 海空運場站因應氣候變遷調適分析資訊之初探 | A Preliminary Discussion on the Adaptation Information of Climate Change for Taiwan Airports and Seaports |
| 61 | 國際氣候變遷情境發展對鐵公路氣候變遷風險評估影響研析 | A Study on the Impacts of Climate Change Risk Assessment with Considering the Development of Climate Change Scenarios on the Railway and Highway Transport |
| 62 | 推動共享交通工具對用路人行為改變及其排碳影響初探 | A Preliminary Study on the Influence of Promoting Shared Mobility on Travel Behavior Change and Carbon Emission Reduction |
| 63 | 地工織物應用於橋墩基礎保護之可行性研究 | Study on Feasible Application of Geotextiles to the Protection of Bridge Piers Foundation |
| 64 | 108 年臺灣沿岸地區金屬材料腐蝕環境調查研究 | Investigation on Corrosive Environment of Metal Materials in Coastal Areas of Taiwan in 2019 |
| 65 | 108 年港區震災速報系統維護及地層下陷調查分析研究 | Analysis and Research on the Maintenance of the Earthquake Disaster Rapid Reporting System in the Harbor Area and Strata Subsidence Survey in 2019 |
| 66 | 高雄港港區工程基本資料網頁查詢模組建置 | Establishment of Web-based Inquiry System of Kaohsiung Harbor's Basic Engineering Data |
| 67 | 臺中港港灣構造物維護策略探討與管理系統擴建 | Study on the Maintenance strategy and Management system of Taichung harbor structures |
| 68 | 地層下陷與地下水位之關聯性研析 | Correlation Analysis of Land Subsidence and Groundwater Level |
| 69 | 港灣構造物設計基準條文增補研議與編修擬訂 | A Discussion on the Amendments to and Revision of the Harbor Structure Design Criteria |

| 項次 | 計畫名稱 | Project Title |
|---|---|---|
| 70 | 軌道扣件巡檢系統建置 (1/2)- 扣件缺失辨識系統建置研究 | Railway Track Fastener Inspection System Establishment (1/2) - A Research on the Establishment of a Defective Fasteners Detection System |
| 71 | 公路土壤邊坡崩塌監測系統維護及模組功能提升 | Maintenance of highway soil slope landslide wireless monitoring system and upgrading of module |
| 72 | 108 年國際商港風波潮流觀測與特性分析 | Analysis of meteo-oceanographic observations near international harbors in Taiwan, 2019 |
| 73 | 108 年國內商港風波潮流觀測與特性分析 | Analysis of meteo-oceanographic observations in Taiwan domestic sea commercial ports, 2019 |
| 74 | 臺灣周圍海域及港口之船舶 AIS 應用分析 | E-Navigation with Ship Monitoring and Warning Systems |
| 75 | 船舶斷纜預警系統建置及繫纜方式研擬 | Study on ship broken cable early warning system establishment and cable tethering method investigation |
| 76 | 建立即時氣象模組及船舶排放之三維空氣品質模擬系統 | Establishment of Real-Time Three-dimensional Meteorological and Air Quality Forecasting System for Ship Emission |
| 77 | 船舶航行安全大數據資料庫應用與分析 | An analysis of ship navigation safety big data database |
| 78 | 水波時尺或時頻分析法之比較與應用 | The Best Wavelet for Water Waves and Its Optimization –Wavelet Coherences versus Fourier Coherences |
| 79 | 港灣風波潮流模擬及長浪預警之研究 (2/4)- 模擬評估及長浪預報研究 | Sea Simulation and Long Wave Early Warning Research of Harbor(2/4)- Simulation Evaluation and Long Wave Forecasting Research |
| 80 | 臺灣東部近岸港口外廓配置對毗鄰海灘沖淤之影響評估 | The assessments of harbor entrance siltation and adjacent beach erosion induced by the inshore harbor configurations in the eastern coasts of Taiwan. |
| 81 | 臺東海岸公路沿岸地形變遷因應對策研究 | Study of the hazard countermeasures in response to the morphological changes near the coastal highway in Taitung |
| 82 | 108 年海氣象自動化預報模擬系統作業化校修與維運 | Operational calibration and maintenance of the marine meteorology automatic forecast simulation system, 2019 |
| 83 | 108 年港灣環境資訊系統維護 - 功能提升 | Maintenance and Enhancement of Harbor Environmental Information Website, 2019 |

# 2020

## 交通部運輸研究所年報

INSTITUTE OF TRANSPORTATION, MOTC
ANNUAL REPORT 2020

## 專業領航╳追求卓越

Professional Navigation X Pursuit of Excellence

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