

2016

交通部運輸研究所 105年年報

2016 Annual Report of
The Institute of Transportation, MOTC



交通部運輸研究所105年年報

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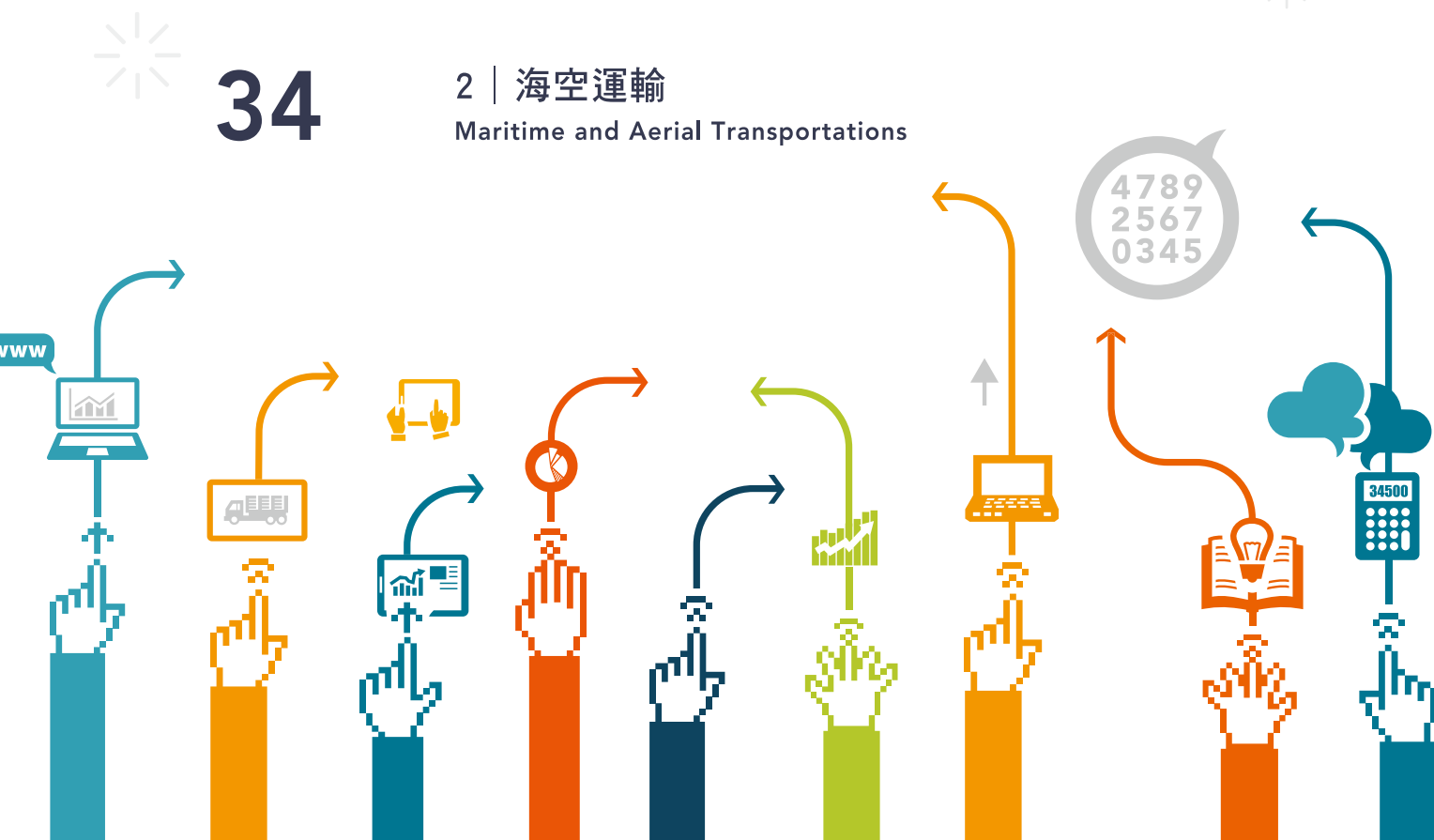
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所長的話

近年來，在社會經濟、環境保育以及資通訊科技等外在條件的快速變遷下，國人對於運輸的需求，除了有形「運量」的增加外，對於「服務品質」的提升也有更高的期待。因此交通部業務推動必須以更創新、前瞻的思維進行規劃與提供服務，以因應各項嚴峻挑戰。

本所是交通部重要智庫，肩負協助交通部政策擬訂、統合協調運輸決策與執行計畫、支援各級運輸行政技術與研發創新，以及承擔運輸產官學跨域溝通等工作。本所主管與同仁皆自我期勉，以「專業領航、追求卓越」做為團隊共識，以「政策、前瞻、基礎」三個層次研究，做為創新思維與深化專業的技能。

運輸建設與發展必須兼顧延續性與開創性。回顧過去一年，本所推動全國第一條自行車道-環島一號線的規劃與建置、完成我國商港整體規劃、道路交通秩序與交通安全改進方案、推動全國區域運輸發展研究中心設置、日

月潭低碳觀光旅遊成果獲得 APEC 智慧能源社區 ESCI 金質獎、協助交通部規劃運輸部門減碳路徑及減碳策略、推動臺灣綠色港埠並獲得歐盟認證等重大成果。顯示本所不僅盡責擔任交通部的智庫，更在我國交通基礎研究、前瞻技術研發、支援運輸政策規劃等重要任務上，達成具體的目標。

展望未來，配合即將推動的政府組織再造，本所的組織與功能將配合交通及建設部而調整，除了持續提升重大政策研擬與支援決策實力之外，更將順應國際趨勢，應用資通訊科技發展智慧運輸服務，強化運輸安全研究以及海、空運輸規劃能力，以引領運輸施政與技術創新並促進產業發展，奠立我國運輸服務優質化之堅實基礎。

交通部運輸研究所 所長

吳玉珍

Message from the Director General

In recent years, with the rapid changes of the external factors of social economy, environmental protection as well as information technology, People's transportation needs express not only the increased "transportation ridership" but also higher expectation in the improvement of "the quality of service". Therefore, the Ministry of Transportation and Communications (MOTC) needs to promote its mandates in a more innovative and perspective manner for planning and providing services in order to overcome various obstacles and challenges.

We acts as an important think-tank for the MOTC and are responsible for assisting the MOTC in policy making, collaborating and coordinating transportation decisions and execution plans, supporting all levels of transportation administrations in innovative techniques and research, as well as being in charge of tasks of integrating among various transportation industries, authorities and academic institutions across various fields. The supervisor of our Institute and the staff have all encouraged themselves to share the vision of "Professional Leadership, Pursuit of Excellence" as a consensus, along with the three level research of "Policy, Prospect and Foundation" as the guideline for innovative thinking and strengthening of professional skills.

Transportation construction and development need to incorporate the factors of continuity and innovativeness therein. Reviewing the achievements in the previous year, we have successfully achieved in the promotion of the planning and construction of the first national bicycle track - Cycling Route No. 1, completion

of overall planning for commercial ports, improvement projects of traffic safety and traffic flow, promotion of regional transportation development and research center, being rewarded the ESCI gold medal from APEC smart energy society for the Sun Moon Lake low-carbon tourism achievement, assisting the MOTC in the planning of carbon reduction path and strategy for transportation department, promoting Taiwan green harbor and receiving EU certification etc. All of the above demonstrates that we are more than playing the role of a think-tank of the MOTC but also achieving specific goals for important missions including the fundamental transportation research , innovative technology applications as well as support on transportation policy planning etc.

Looking ahead to the future, along with the restructuring of the government organization, the organization and functions of our institute will be adjusted in corporation with the ministry of transportation and construction. In addition to continuously enhancing the abilities in major policy and decision making support, we will also follow the international trend, applying information and communication technology in developing the intelligent transportation services, strengthening the transportation safety researches and the planning ability in marine and aeronautical transportations, in order to lead the transportation administrative implementations and technology innovation as well as stimulate industrial developments; thereby, establishing a solid foundation for the service of transportation with excellent quality.

Director General

Wu, Jennifer Yuh-Jen

Institute of Transportation, MOTC

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02

Organization And Human Resources

Government authorities have to prepare medium-range and longrange plans to satisfy future transportation demand.



ORGANIZATION AND HUMAN RESOURCES



一、沿革 ●●●

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

1. HISTORY ●●●

Since its relocation to Taiwan, the Central Government of the Republic of Mainland 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

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由於運輸方面所需要的投資甚為龐大，且在整體經濟的考量下，其可供應用的資金究屬有限，因此對於投資決策的研提及優先順序的釐定，便須由一個統一的運輸規劃機構來承擔；其次，由於運輸事業係屬公用事業，政府對其費率、加入、退出、能量等等，均有必要加以參與管理，而參與的方法是否適當、是否需加修正，亦須由一個統籌的運輸規劃機構來研究；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。交通部基於上述三項考慮，乃於民國 59 年 8 月 1 日成立運輸計劃委員會專司其事。14 年中已完成諸多的運輸研究規劃工作，其瑣瑣大者計有：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。



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.

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 Mainland China. Being a formal branch of the

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。

government, the Institute of Transportation is funded through a normal budgeting process.

Because of the increased demand for its services, the organizational structure of the Institute was expanded, on January 30, 1991, by adding a Deputy Director-General, an Interdisciplinary Research Division, and intermediate-level planners. And since July 1, 1999, due to the adjustment of government functions, the Institute of Harbor and Maritime Technology has become affiliated to the Institute of Transportation and renamed as Center of Harbor and Maritime Technology. It was originally affiliated to the Department of Transportation of the Taiwan Provincial Government. As part of the entire government agency reorganization, the Institute of Transportation's organization adjustment has been approved by the Executive Yuan, and since August 1, 2001 the organization level of the Center of Harbor and Maritime Technology has again been adjusted. According to the new arrangement, the Center is incorporated with the Institute of Transportation and becomes.



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二、組織及人力 ●●●

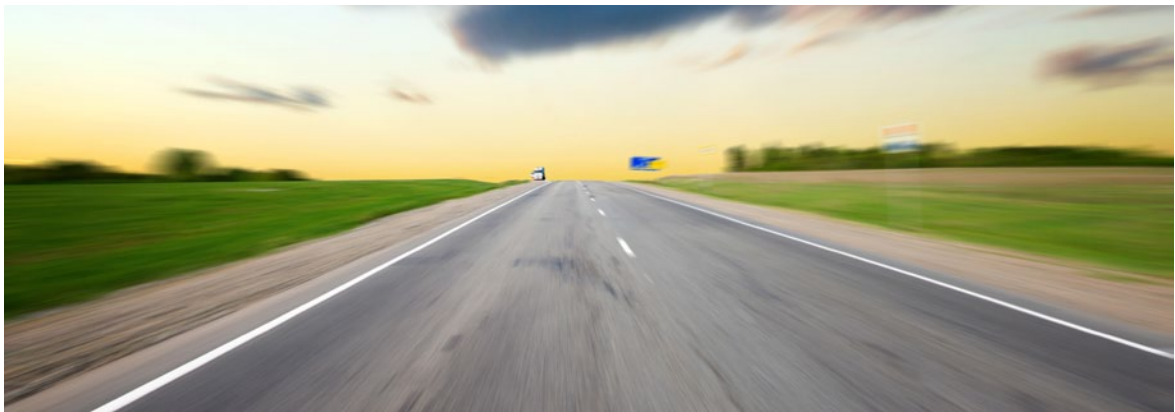
本所設運輸計畫、運輸工程、運輸經營管理、運輸安全、運輸資訊、綜合技術 6 個組與港灣技術研究中心等計 7 個業務單位，及秘書室、人事室、主計室等部門。

依照本所組織條例，編制員額計 177 人，預算員額 164 人。另約聘人員 4 人，技工及工友 25 人。

2.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 IOT, the total authorized staff is 177 and the budgetary staff is 164. In addition, there are 4 contracted research employees and 25 technicians and office workers.



三、本所執掌 ●●●

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。

3.FUNCTIONS ●●●

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

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

四、組織架構 ●●●

本所組織架構如下：

4. ORGANIZATION FRAMEWORK

Organization of the Institute is shown below:



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年度施政概況介紹

Overview of Annual
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The implementation status of the administrative plans for 2016 of this Institute is generally introduced in 7 major business fields



OVERVIEW OF ANNUAL ADMINISTRATIVE IMPLEMENTATION

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年度施政概況介紹 ●●●

以下分別從運輸系統研究規劃、運輸工程研究發展、運輸安全研究發展、運輸經營管理研究發展、運輸資料蒐集與資訊應用之研發推動、綜合技術研究發展以及港灣技術研究發展等 7 大項重要業務，概略說明本所 105 年施政計畫之實施狀況。

一、運輸系統研究規劃

反映實際交通情境之大貨車動態能耗與碳排放特性研究

- 北臺區域整體運輸規劃—社經與起迄旅次整合分析
- 交通建設計畫經濟效益評估指導手冊 (105 年版) 暨應用軟體更新
- 海量資料分析於交通建設計畫審議決策之應用服務 (105 年)
- 應用大數據技術推廣交通預警模式於重要瓶頸路段及運輸走廊
- 公路交通系統模擬模式調校與新版容量手冊研訂 (1/3)

Overview of Annual Administrative Implementation ●●●

The implementation status of the administrative plans for 2016 of this Institute is generally introduced in 7 major business fields of the transportation system research and planning, transportation construction research and development, transportation safety research and development, transportation operation management research and development, research promotion for transportation data collection and information application, comprehensive technology research and development and harbor technology research and development.

1. Transportation system research planning

- A Study on the Characteristics of Real-life Energy Consumption and Carbon Emissions of Large Trucks
- Northern Taiwan area integrated transportation plan -- socioeconomics and trip origin and destination integrated analysis
- The Handbook of Economic Analysis for Transportation Construction Projects (2016)
- Big Data Analysis on Application Service for



- 104-105 年度臺灣公路容量分析軟體 (THCS) 優化與推廣 (2/2)
- 郊區雙車道公路自由速率及號誌化路口車流特性調查
- 自行車友善環境路網整體規劃與檢視評估 (1/3)
- 自行車路網示範系統之圖資建置與行銷 (1/3)
- 105 年度「臺灣地區橋梁管理資訊系統」維護管理服務
- 105 年度臺灣地區橋梁管理教育訓練
- 104 年西部城際陸路公共運輸消長觀察
- 交通建設計畫民眾參與程序改善推動計畫 (2/3)- 外部推廣



Transportation Infrastructure Decision Support Systems

- Big Data Technology Application on Major congestion Roads and Corridors for Warning Mechanisms of Traffic Management
- Calibration of HTSS (Highway Traffic Systems Simulation) Model and Revise of Taiwan Highway Capacity Manual (HCM) (2016)
- Optimization and Promotion of Taiwan Highway Capacity Analysis Software (2016)
- Survey of Free Flow Speed and Intersection Traffic Characteristics on Rural Two-Lane Highway
- An Integrated Technical Planning and Evaluation of Friendly Bike Lane Network (1/3)
- The First Year Plan of the development of Image Data for the Demonstration System and Marketing of Cycle Route
- Taiwan Bridge Management System (2016)
- Training Workshop of Bridge Maintenance and Management(2016)
- The Market Share Changes of Intercity Public Transportation after HSR in Operation (2015)
- Improving the Public Participation Procedure for Transportation Construction Projects (2/3) - External Promotion

二、運輸工程研究發展

- 辦理「臺灣國際機場引進機場協調整合決策 (A-CDM) 系統之研究」研究計畫
- 辦理「由國際航運網路模型探討臺灣港群之營運策略與未來發展」研究計畫
- 2016 年我國海運發展回顧
- 2016 年我國空運發展回顧
- 兩岸海運直航相關航政法令之研析
- 船舶大型化未來可能發展之探討
- 海運連結度及其對總體經濟影響之研究
- big data 應用於國際空運領域之初探
- 兩岸客運定期航班執行現況分析
- 國際機場商業特許經營模式及提升收益措施之研究
- 無人飛行載具監理制度蒐集分析之研究
- 中國大陸推動「一帶一路」對我國海空運影響及因應策略初探



2. Transportation construction research and development

- Conducting research and development for "Research on Introduction of Airport Collaborative Decision Making(Airport CDM) system in Taiwan"
- 「The strategies and development of ports in Taiwan based on a network model of international liner shipping network」
- Air Transportation Annual Review 2016
- Maritime Transportation Annual Review 2016 (2016)
- Analysis on navigation and aviation administrative regulations related to cross-strait direct Maritime transportation
- Study on the future trend of mega container ships
- Study on maritime transportation connectivity and its impact on Macroeconomic
- A Study of Big Data Analytics in Air Transportation
- Study on Cross-Strait Scheduled Passenger Flights
- Study on Business Models for International airport Concessions and Measures to Enhance Non-Aeronautical Revenues
- Preliminary analysis on impacts of low-cost aviation development on Taiwan aviation market
- Study on Management and Control System of Unmanned Aerial Vehicle
- Preliminary study on impacts of "One Belt and One Road" Initiative on Taiwan's aerial and maritime transportations and its countermeasures

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三、運輸安全研究發展

- 辦理「我國汽車駕駛執照分類管理制度之研析」研究計畫
- 辦理「交通事故傷害資料蒐集體系建構及應用 (1/2)」研究計畫
- 辦理「行人及自行車騎士之道路通行環境調查與輔助工具研發 (2/3)—以道路安全檢核調查為例」研究計畫
- 辦理「機車危險感知學習工具開發與應用 (2/2)」研究計畫
- 辦理「混合車流情境路口交通工程設計範例」研究計畫
- 辦理「道路交通安全管理 (ISO 39001) 規範之評估及推廣」研究計畫
- 辦理「道路安全大數據案例分析與應用」研究計畫
- 辦理「國際船舶安全管理章程風險管理規範之推行策略」研究計畫

3. Transportation safety research and development

- Conduct the "Research of Classification Management Mechanism for Driver's License in Taiwan" Project
- Conduct the "Establishment of Collection System of Traffic Accident Injury Data (1/2) " Project
- Conduct the "Development Instruments of Road Environment Checking and Mobility Assistant for Pedestrians and Cyclists (2/3) - A Case Study of Road Safety Survey" Project
- Conduct the "Development and Application of Hazard Perception Learning Tool for Motorcycle Riders(2/2)" Project
- Conduct the "Typical Examples for Traffic Engineering Design under Mixed Traffic Situation" Project
- Conduct the "Evaluation and Promotion of ISO 39001 RTSMS Standard" Project
- Conduct the "Big Data Case Analysis and Application on Road Safety" Project
- Conduct the "Tactic Implementation of Risk management Assessment related to ISM Code" Project

四、運輸經營管理研究發展

- 辦理「臺北都會區至宜蘭地區多點國道客運路線需求調查分析暨假日景點公車路線之檢討規劃」研究計畫
- 辦理「電子票證資料加值應用分析之研究及示範計畫」研究計畫
- 辦理「計程車產業發展分析模式之研究暨資訊平台建置」研究計畫
- 辦理「以責任保險角度探討汽車運輸業經營管理之研究」研究計畫

五、運輸資料蒐集與資訊應用之研發推動

- 我國智慧型運輸系統車路整合應用模式探討與先期模擬測試
科技計畫創新研發成果之智財權研究與知識分享
- 104 年度參與 APEC 運輸部門相關國際事務與資訊管理
- 公車動態資訊系統巨量資料（big data）蒐集與視覺化分析研究
- 日月潭低碳觀光智慧旅遊示範計畫執行成效評估
- 104 年度 APEC 運輸領域重點議題發展趨勢分析
- 本所資訊資源盤點及資訊服務提昇方向評估計畫
- 資訊科技發展趨勢分析與交通領域應用架構探討



4. Transportation operation management research and development

- Conduct the "Identification of Potential stop Locations of Taipei-Yilan freeway bus route and review of sightseeing bus routes in Yilan" Project
- Conduct the "Study and Demonstration Project on the Value-added Application and Analytics of Data from Smart Cards" Project
- Conduct the "Study and Development of a Information Platform for Taxi Industry Analysis" Project
- Conduct the "study on the Motor Carrier Operation and Management from the Liability Insurance Aspect" Project

5. Research promotion for transportation collection and information application

- Study on national smart transportation system road integration application model and preliminary simulation test
- Intellectual property research and knowledge sharing for technology project innovative research achievement
- Participation on international affairs and information management related to APEC transportation department in 2015
- Bus dynamic information system big data collection and visualization analysis and research
- Performance evaluation on Sun Moon Lake low-carbon smart tourism demonstration plan execution
- Analysis of 2015 APEC transportation field key issues and development trends
- Evaluation plan on information resource auditing and information service improvement direction of this Institute
- Analysis of information technology development trend and study on transportation field application infrastructure

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六、綜合技術研究發展

- 城際運輸節能減碳策略評估模組開發及應用 (2/2)
- 公路貨運服務碳足跡公用係數建置計畫 (2/2)
快速公路 LED 路燈量測計畫與成本效益分析 (1/2)
- 氣候變遷運輸設施風險評估暨風險資訊進階服務計畫
- 氣候變遷運輸系統風險評估案例分析之研究
運輸部門能源消耗與溫室氣體評估模型參變數更新與估算」
- 運輸部門因應溫室氣體減量及管理法之階段管制目標及減碳途徑探討
- 交通主管機關對於運輸事業溫室氣體排放管理初探
- 地方政府運輸部門 CO₂ 排放估算暨中央與地方政府節能減碳合作方向研析



6. Comprehensive technology research and development

- Develop and Apply the Evaluation Model of Intercity Transport Energy Saving and Carbon Reduction Strategies (2/2)
- Establishment of General Emission Factor for Carbon Footprint for Road Transport Services of Freight (2/2)
- Expressway LED Lamp Test Program and Cost-benefit Analysis(1/2)
- Climate Change Risk Assessment on Transport Infrastructure and Advanced Risk Information Service Project
- Case study on the Climate Change Risk Assessment for Transportation System
- Revised Version of Energy Consumption and Greenhouse Gas Emission Evaluation Model of Transport Sector
- Discussion on Greenhouse Gas (GHG) Regulatory Goals and Roadmap of Transportation Sector
- A Preliminary Discussion on the Management for Greenhouse Gas Emission of Transportation Business
- Study on the Emission for CO₂ of Local Governments in the Transportation Sector and the Cooperation of Central and Local Governments



七、港灣技術研究發展

- 道路及橋梁災害防治技術整合之研究 (1/2)
腐蝕環境分類及港灣構造物腐蝕劣化調查研究 (1/2)
- 港灣碼頭耐震性能評估之研究 - 以高雄港為例 (1/2)
- 西南沿海地區地層下陷調查及基本資料建置研究 (1/2)
- 我國貨櫃港口營運環境改善之研究 (1/2)
臺灣港灣長期性海氣象調查及資訊應用系統建置之研究 (3/4)
- 水波時頻分析之優化 (3/4)
- 港灣構造物與波流互制研究 (3/4)
- 創造綠色港埠之新技術研發 (3/4)
- 港灣海象模擬暨溢淹資訊建置之研究 (1/2)
- 港灣海氣象環境資訊整合及統計分析研究 (3/4)
- 全球暖化引致臺灣海域海面水位昇降變動率之評估研究 (3/4)

7. Harbor technology research and development

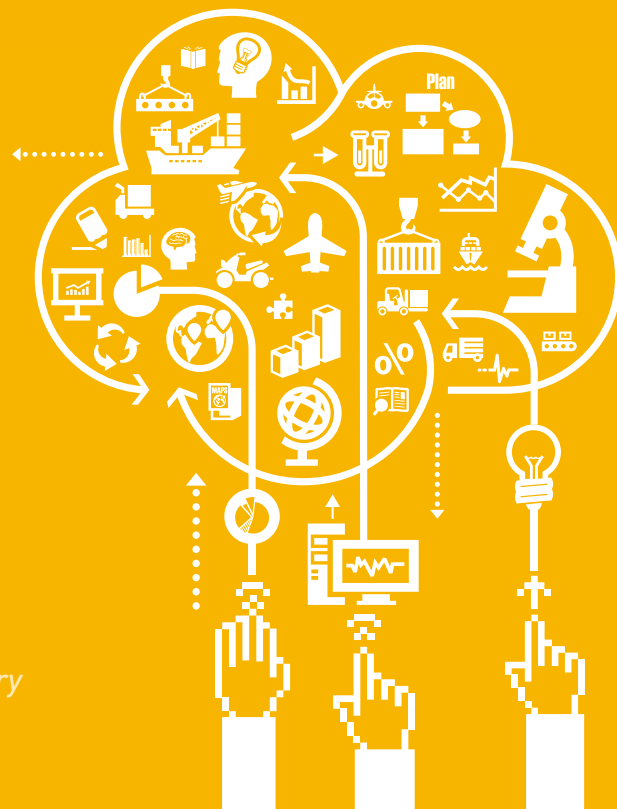
- Research on road and bridge disaster prevention technology integration (1/2)
- Investigation and research on corrosive environment classification and harbor construction corrosive deterioration (1/2)
- Research on harbor and dock shock resistance performance evaluation – a case study on Port of Kaohsiung (1/2)
- Investigation on Southwest coastal area land subsidence and research on basic data construction (1/2)
- Research on national container port operation environment improvement (1/2)
- Investigation on Taiwan harbor long-term ocean weather and research on information application system construction (3/4)
- Optimization of water wave time-frequency analysis (3/4)
- Research on harbor construction and wave-current interaction (3/4)
- Research on new technology for creating green harbor (3/4)
- Research on harbor ocean weather simulation and tsunami information (1/2)
- Research on harbor ocean weather environment information integration and statistics analysis (3/4)
- Evaluation and analysis on sea level rise variation rate in Taiwan water caused by global warming (3/4)

04

重點研究介紹

Introduction
of
Key Research

The institute cooperates with the current key policies and domestic traffic issues of the Ministry of Transportation and Communications (MOTC).



INTRODUCTION OF KEY RESEARCH

本所配合交通部當前重點政策及國內交通問題，研擬及執行相關研究計畫，以協助完成國內交通政策之推動，並提供研究成果作為中央及地方政府交通單位施政之參考，這些當前交通政策重點包含：(一) 整體運輸規劃；(二) 海空運輸；(三) 永續運輸；(四) 運輸安全；(五) 交通大數據應用；(六) 災害防救。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、整體運輸規劃 ●●●

(一) 交通部門綱要計畫

交通建設不僅是國家建設之基礎，更是引領國家整體經濟脈動的火車頭，以及扮演民眾生活連結的關鍵角色，實為我國公共建設中影響範圍最廣的部門。為能有效發揮上位引領功能，協助中長程交通個案計畫穩健布局，並與年度預算叩合，俾使政府預算分配能達成最佳化，茲以 4 年為一期 (本期計畫期程為民國 106 至 109 年) 研提「交通建設部門綱要計畫」(以下簡稱本計畫)。

The institute cooperates with the current key policies and domestic traffic issues of the Ministry of Transportation and Communications (MOTC) in stipulating and executing relevant research plans in order to assist the completion of the promotion of the domestic traffic policies and to provide the research outcomes as reference for the administrative implementations of the traffic units of the central and local governments. The main topics of these current traffic policies include: (1) Overall transportation planning; (2) Maritime and aerial transportation; (3) sustainable transportation; (3) transportation safety; (5) traffic big data application; (6) disaster prevention and protection. The following provides an introduction on the subjects of the key researches executed cooperatively by the institute.

I. Overall Transportation Planning ●●●

(I) Traffic Department Master Plan

Traffic infrastructure is not only the foundation of the national infrastructure but also the lead for guiding the overall economic development of the country as well as the key role in connecting lives of the public, which is indeed the most influential department in the civil infrastructure of our nation. To effectively implement the superior leading function, to assist the firm planning of individual traffic projects for mid- and long-terms and to meet the annual budget in order to optimize the government budget allocation, the "Traffic Infrastructure Department Master Plan" (hereafter referred to as "the present plan") is proposed in sessions of which one session consists of 4 years (the plan schedule of this session is from 2017 to 2020).

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圖 4-1-1 交通建設部門綱要計畫 (106~109 年)

FIG. 4-1-1 Traffic Infrastructure Department Master Plan (2017~2020)

為因應當前兩岸關係、人口高齡少子化、全球氣候變遷、節能減碳、金融海嘯危機，以及亞洲逐漸成為世界經濟的成長引擎等政策課題，並達成便捷舒適之運輸環境並提升觀光服務品質，我國交通建設之中長期發展將持續朝以下 4 個重點方向努力：

1. 開創海空運輸新動能，提升國際運籌實力。
2. 打造完善交通網絡，確保優質生活環境。
3. 推動綠色運輸，提高公共運輸效能。
4. 優化旅遊品質，邁向國際觀光大國。

現階段交通建設以「跨域整合新智慧，打造幸福心交通」作為未來發展願景，亦即以「跨域多元整合，擴大交通綜效」、「善用智慧科技，優化交通服務」、及「轉換施政思維，貼近民意需求」等三大理念，結合具前瞻思維的「想像力」及與時俱進的「執行力」，達成安全、永續、優質、公義與無縫的「臺灣幸福心交通」。



To cope with the subjects of the policies related to the current cross-strait relationship, aging and low fertility population, global climate changes, energy saving and low carbon reduction, financial tidal wave crisis and Asia gradually becoming the development engine for the world economics, along with the objectives of achieving convenient and comfortable transportation environment as well as the tourism service quality, the mid- and long-term developments of the traffic infrastructure of our nation continues to focus on the following 4 key directions:

1. Develop new energy for Maritime and aerial transportations, increase international logistics ability.
2. Create complete traffic network, ensure qualified life environment.
3. Promote green transportation, increase public transportation efficiency.
4. Optimize travel quality, march toward international tourism country.

The current stage of traffic infrastructure is based on the notion of "Integrate new intelligent cross fields, create fortunate traffic" as the future development vision and is also based on the three major concepts of "integrate diversity cross fields, expand traffic collaborative performance", "maximize intelligent technology, optimize traffic service" and "transform administrative thinking, act close to public demands" along with the "creativity" of forward thinking and the "execution" advancing with times in order to achieve the "Taiwan fortunate traffic" that is of the qualities of safety, sustainability, excellent quality, righteousness and seamlessness.

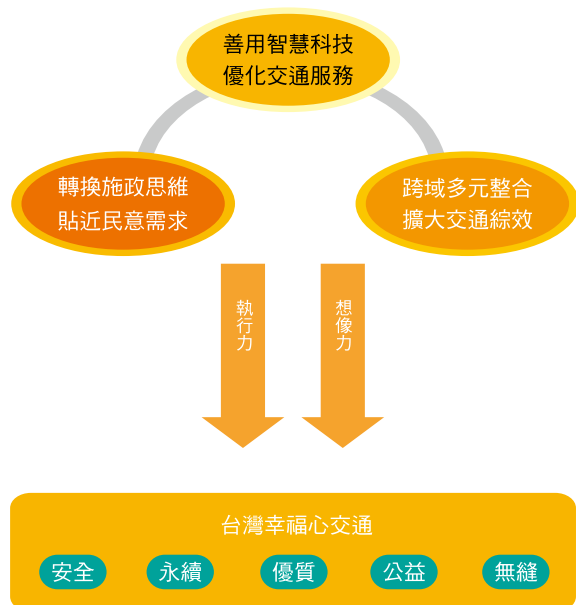


圖 4-1-2 交通建設發展願景

FIG. 4-1-2 Traffic infrastructure development vision

然而要達成上述願景，我國交通建設仍面臨以下重要課題：

1. 為拓展經貿戰略優勢，國際運輸格局宜宏觀。
2. 為提升系統服務效率，城際運輸競爭應避免。
3. 為增進國土利用效率，運輸土地使用需整合。
4. 為發揮路網整體效益，公路運輸瓶頸應消除。
5. 為健全軌道運輸服務，各類軌道系統應強化。
6. 為確保軌道運輸安全，鐵路風險管理應明確。
7. 為創造軌道永續經營，軌道營運體質應提升。
8. 為推廣臺灣觀光市場，整體環境配套須加強。
9. 為因應氣候變遷影響，設施服務調適應積極。
10. 為改善物流經營環境，發展藍圖應重新檢討。
11. 為型塑人本交通環境，運輸安全管理待強化。
12. 為落實資源分配公義，運輸投資模式宜調整。
13. 為提供無縫公共運輸，四向維度縫隙應消弭。
14. 為創造優質運輸服務，智慧運輸應用需精進。

However, to achieve the aforementioned visions, the traffic infrastructure of our nation still needs to deal with the following important subjects:

1. To expand the economic and trading strategic advantages, the scale of the international transportation shall be based on macroscopic view.
2. To increase the system service efficiency, intercity transportation competition shall be avoided.
3. To increase the utilization rate of the national land, the use of transportation lands shall be integrated.
4. To achieve the overall benefit of the road network, the bottleneck of the highway transportation shall be eliminated.
5. To obtain a complete railway transportation service, all types of railway systems shall be enhanced.
6. To ensure the railway transportation safety, railway risk management shall be definite.
7. To create railway sustainable operation management, railway operation system shall be improved.
8. To promote the market for tourism in Taiwan, overall environmental complementary measures shall be enhanced.
9. To cope with the impacts of climate changes, adjustments of facilities and services shall be active.
10. To improve the logistics operational environment, review on development blueprint shall be conducted.
11. To shape the human-based traffic environment, transportation safety management requires further enhancement.
12. To implement the righteousness of source allocation, the transportation investment model shall be properly adjusted.
13. To provide seamless public transportation, gaps in four-directional dimension shall be eliminated.
14. To create transportation services of excellent quality, intelligent transportation applications shall be further improved.

交通建設部門(以下簡稱本部門)涉及軌道、公路、航空、港埠及觀光等 5 個次類別之建設計畫，分別由交通部鐵道局、公路總局、航港局、民航局及觀光局擔任各次類別計畫之主辦機關，並由本所擔任部門綱要計畫之彙整機關，組織分工示意圖如圖 4-1-3 所示。至於本部門綱要計畫之位階則主要是作為國家發展計畫、國土空間發展策略計畫、運輸政策白皮書(由上而下)及次類別綱要計畫與個別計畫(由下而上)之相互指導與支援(如圖 4-1-4 所示)。

The Traffic Infrastructure Department (the "Department") is in relation to the infrastructure plans of 5 subclasses of railway, highway, aviation, harbor and tourism, which are under the hosting agencies of the Taiwan Railways Administration, Directorate General of Highways, Maritime and Port Bureau, Civil Aeronautics Administration and Tourism Bureau of MOTC in charge of each subclass respectively, and the Department acts as an coordinating agency for the Department master plan; the illustration for organization and work allocation is as shown in FIG. 4-1-3. As for the levels of the master plan of the Department, they mainly include the national development plan, national land spatial development strategic plan, transportation policy proposal (top-down manner) and subclass master plans and individual plans (bottom-up manner) mutual guidance and support (as shown in FIG. 4-1-4)

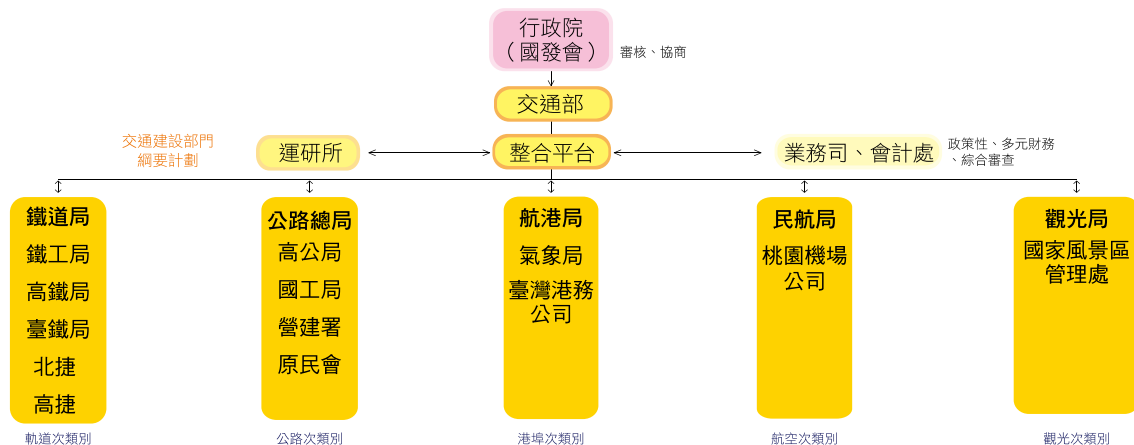


圖 4-1-3 本部門組織分工示意圖

FIG. 4-1-3 Illustration for organization and work allocation of the Department

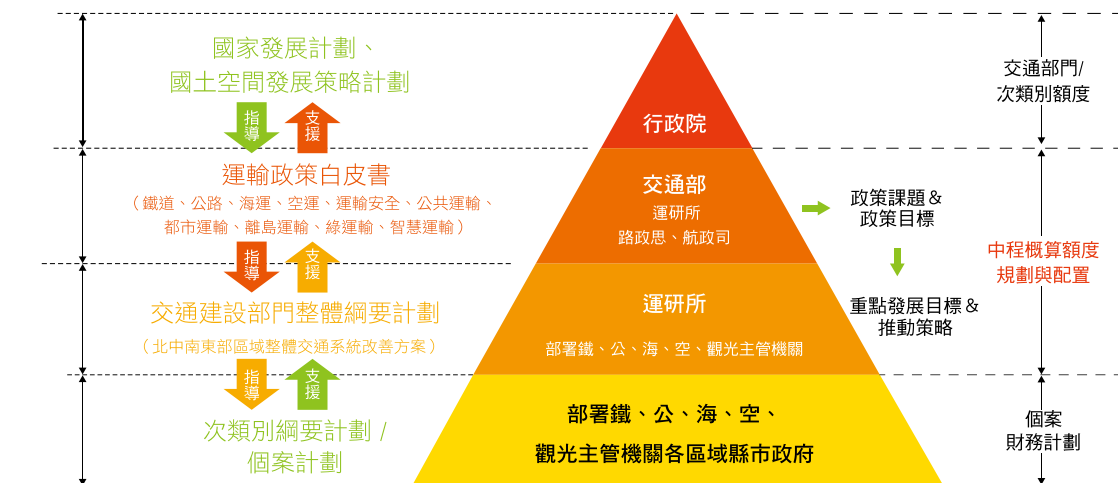


圖 4-1-4 本部門綱要計畫位階關係圖

FIG. 4-1-4 Level relationship diagram for the master plan of the Department

面對前述課題，在軌道與公路運輸建設方面，應從國土空間階層網絡觀點檢視現行城際鐵路運輸建設計畫，考量臺灣各區域運輸特性與需求之差異，擘劃以公共綠色運輸為主軸的城際運輸發展政策，包括：(一)線性主幹服務以鐵道為主，並以公路公共運輸提供面性網狀服務，同時串聯公路系統與重點運輸場站及各主要觀光區之自行車道路網，打造無縫運輸環境；(二)西部地區以高鐵為主，臺鐵與公路為輔，三大都會區則有捷運，建置都會及都市地區公共運輸的交通環境；(三)東部地區以臺鐵快速化為骨幹，輔以公路公共運輸之面性網狀服務。

在航空運輸建設方面：(一)精進飛航安全監理，鞏固民航發展基石；(二)推動桃園航空城建設，擴增桃園國際機場園區範圍，提供桃園國際機場未來建設發展所需用地；(三)拓展國際及兩岸航網，提升國籍航空公司競爭力；(四)完善飛航服務及場站設施，優化機場服務效能；(五)強化偏遠離島地區基本空運服務，提供適當運能。



Facing the aforementioned subjects, in terms of the aspect of the railway and highway transportation infrastructure, the current intercity railway and highway transportation infrastructure plan should be examined from the viewpoint of the national land spatial level network, and the differences in the characteristics and demands among regions in Taiwan should be considered in order to stipulate the intercity transportation development policy based on the core of the public and green transportation; such policy includes: (1) The linear main service is mainly based on train railways in principle with the highway public transportations providing surface type of network service while connecting the highway system and key transportation stations as well as bicycle road network of all major tourist areas at the same time in order to create a seamless transportation environment; (2) the western region is primarily based on the high speed rail with the Taiwan railways and highways as the secondary transportation, and three municipal areas are built with MRT in order to construct a traffic environment with municipal and urban area public transportations; (3) the eastern region uses the express Taiwan railways as the primary transportation means with the highway public transportation providing surface type network service as the secondary transportation means.

In terms of the aerial transportation construction: (1) Improving aviation safety monitoring, establishing solid foundation for civil aviation development; (2) promoting the construction of Taoyuan Aerotropolis, expanding the Taoyuan International Airport Park range, providing required lands necessary for the future infrastructure development of the Taoyuan International Airport; (3) expanding international and cross-strait aviation network, improving national airline company competitiveness; (4) completing aviation service and airport facilities, optimizing airport service efficiency; (5) enhancing basic aerial transportation service for distant and offshore island areas, providing adequate transportation capacity.

In terms of harbor transportation infrastructure:

- (1) Establishing solid international logistics ability, increasing international competitiveness.
- (2) improving intercity urban transportation, completing fundamental infrastructure.
- (3) maximizing advanced management technology, increasing logistics efficiency.
- (4) strengthening safety management mechanism, reducing disaster risks.
- (5) reviewing existing legal systems, improving operation management environment.

In terms of tourism infrastructure:

在港埠運輸建設方面：

- (一) 厚植國際運籌能力，強化國際競爭。
- (二) 健全城際都市運輸，完備基礎建設。
- (三) 善用先進管理技術，提升物流效率。
- (四) 強化安全管理機制，降低災害風險。
- (五) 檢討既有法規制度，健全經管環境。

在觀光建設方面：

- (一) 集中資源投資對臺灣觀光整體發展具指標性意義之重要觀光景點，並擴大觀光服務層面為旅遊線與面之串連，營造優質、多元且友善的觀光遊憩空間。
- (二) 重視「永續觀光」，落實「總量管制、引導分流」觀念，針對熱門景點建立合宜的總量管制措施；並積極拓展周邊副核心景點，引導遊客分流。
- (三) 促進跨域整合，強化跨部會、跨中央與地方之資源整合、分工營運及跨域合作平臺，提升建設財務自償性。

而為能綜合呈現本部門計畫之執行績效，本計畫考量與各次類別政策目標與推動策略之關聯性，擬訂 14 項關鍵績效指標 (Key Performance Index, KPI) 包括：軌道客運運量、軌道 / 公路旅行時間節省、捷運路線長度、臺鐵行車事故死亡人數、節能減碳效益、道路完工通車累計長度、提供服務道路密度、國籍航空公司近 10 年 15,000 公斤以上渦輪噴射飛機百萬飛時失事率、國際及兩岸 (含過境) 航空旅客人數、國際商港貨櫃總運量、國際 (內) 商港客運量成長情形、國家風景區遊客人次及國家風景區觀光產值等，並且務實訂出 106-109 年預計達成之分年目標值。

- (1) Focusing resource investments on important tourist attraction spots with indicative meanings to the overall development of tourism in Taiwan, and expanding tourism service level to connect the traveling lines and surfaces in order to create a high-quality, diverse and friendly tourist recreation space.
- (2) Emphasizing the concept of "sustainable tourism" and implementing the concept of "total volume control, guidance to branch flows" in order to establish appropriate total volume control measures for popular attraction spots; and actively expand surrounding secondary attraction spots in order to guide the branch flows of the tourists to such surrounding spots.
- (3) Promoting cross-field integration, enhancing resource integration cross ministries, central and local governments, establishing work distribution operation and cross-field cooperation platform in order to increase the infrastructure financial self-liquidation.

To collaboratively present the performance of the execution of the plan of the Department, the present plan considers the co-relation with all subclass policy objectives and promoted strategies in order to stipulate 14 Key Performance Index (KPI) including: railway passenger transportation capacity, railway/highway traveling time saved, MRT line length, number of deaths in Taiwan railway traffic accident, energy saving and carbon reduction benefits, accumulated length of roads completed for access, density of road available in service, accident rate per million hours flown of turbo jet aircrafts above 15,000kg of national airline companies in recent decade, number of airline passengers of international and cross-strait (including transfers), international commercial port cargo total transportation volume, international (domestic) commercial port passenger transportation volume growth status, national scenic area tourist population and national scenic area tourism economic value etc. In addition, the annual target value expectations for 2017-2020 are then stipulated in a practical manner.



表 4-1-1 各次類別 106-109 年績效目標表

次類別	主要策略	衡量指標	單位	105 年目標值	106 年目標值	107 年目標值	108 年目標值	109 年目標值
軌道	健全城際都市運輸，完備基礎建設	軌道（鐵路＋捷運）客運運量	每月平均運量（百萬人／次）	87.5	87.7	87.8	88.1	88.2
		旅行時間節省（與現況比較）	百萬元	34,106	68,212	102,318	136,424	170,531
		捷運路線長度	公里	224.83	240.23	251.79	282.89	299.6
	強化安全管理機制，降低災害風險	臺鐵行車事故死亡人數	人數	60	58	56	55	54
	推展低碳節能運輸，營造環境融合	節能減碳效益（與現況比較）	每年減少百萬元	119.6	239.2	358.7	478.3	597.9
公路	健全城際都市運輸，完備基礎建設	道路完工通車累計長度	公里	43,114	43,761	44,417	45,083	45,760
		提供服務道路密度	公尺／平方公里	1,235	1,253	1,272	1,291	1,311
		旅行時間節省（與現況比較）	pcu-hr／日	5,650	6,497	7,472	8,593	9,882
航空	落實飛航安全	國籍航空公司近 10 年 15,000 公斤以上渦輪噴射飛機百萬飛時失事率	次／百萬飛時	0.17 次／百萬飛時	0.17 次／百萬飛時	0.17 次／百萬飛時	0.17 次／百萬飛時	0.17 次／百萬飛時
	提升空運服務水準	國際及兩岸（含過境）航空旅客人數	萬人次	4,640	4,720 萬人次	4,810 萬人次	4,890 萬人次	4,980 萬人次
港埠	整合港區土地及倉棧設施，連結物流作業，提高作業效能，及建立深水碼頭	國際商港貨櫃總運量	萬人次	4,720 萬人次	4,810 萬人次	4,890 萬人次	4,980 萬人次	1,694 萬 TEU
	提升海運服務水準	國際（內）商港客運量成長情形	萬人次	493.4	501.6	510.0	518.5	527.2
觀光	提升觀光景點服務質量	國家風景區遊客人次	萬人次	4,348	4,451	4,549	4,665	4,758
		國家風景區觀光產值	新臺幣億元	988	1,023	1,053	1,090	1,120

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Table 4-1-1 2017-2020 performance target table for each subclass

Subclass	Main strategy	Evaluation index	Unit	Target value for 2016	Target value for 2017	Target value for 2018	Target value for 2019	Target value for 2020
Railway	Improving intercity urban transportation, completing fundamental infrastructure	Railway (train railway+MRT) passenger transportation volume	Monthly average transportation volume (million of passengers)	87.5	87.7	87.8	88.1	88.2
		Traveling time saved (compare to current status)	Million dollars	34,106	68,212	102,318	136,424	170,531
		MRT line length	Km	224.83	240.23	251.79	282.89	299.6
	Strengthening safety management mechanism, reducing disaster risks	Number of death in Taiwan railway traffic accident	Number of people	60	58	56	55	54
	Promoting low carbon and energy saving transportations, creating environmental integration	Energy saving and carbon reduction benefits (compare to current status)	Million dollar reduced per year	119.6	239.2	358.7	478.3	597.9
Highway	Improving intercity urban transportation, completing fundamental infrastructure	Accumulated length of roads completed for access	Km	43,114	43,761	44,417	45,083	45,760
		Density of road available in service	m/square km	1,235	1,253	1,272	1,291	1,311
		Traveling time saved (compare to current status)	pcu-hr/day	5,650	6,497	7,472	8,593	9,882
Aviation	Implementing aviation safety	Accident rate per million hours flown of turbo jet aircrafts above 15,000kg of national airline companies in recent decade	Number of accident/ million hours flown	0.17 number of accidents/ million hours flown	0.17 number of accidents/ million hours flown	0.17 number of accidents/ million hours flown	0.17 number of accidents/ million hours flown	0.17 number of accidents/ million hours flown
	Increasing aerial transportation service	Number of airline passengers of international and cross-strait (including transfers)	Ten thousand passengers	4,640 ten thousand passengers	4,720 ten thousand passengers	4,810 ten thousand passengers	4,890 ten thousand passengers	4,980 ten thousand passengers
Harbor	Integrating port area land and warehouse facility, connecting logistics operation, increasing operation efficiency and constructing deep water dock	International commercial port cargo total transportation volume	Ten thousand TEU	1,567 ten thousand TEU	1,599 ten thousand TEU	1,630 ten thousand TEU	1,662 ten thousand TEU	1,694 ten thousand TEU
	Increasing Maritime transportation service level	International (domestic) commercial port passenger transportation volume growth status	Ten thousand passengers	493.4	501.6	510.0	518.5	527.2
Tourism	Increasing tourist attraction spot service quality	National scenic area tourist population	ten thousand passengers	4,348	4,451	4,549	4,665	4,758
		National scenic area tourism economic value	NTD\$ hundred million dollars	988	1,023	1,053	1,090	1,120

共擬辦 125 項計畫，總經費需求達新臺幣 11,542 億元。各次類別經費需求高低依次為軌道次類別 6,053 億元 (52.44%)、公路次類別 2,921 億元 (25.31%)、航空次類別 1,431 億元 (12.40%)、港埠次類別 956 億元 (8.28%) 及觀光次類別 181 億元 (1.57%)。其中，在各項預算來源中，計有 5,416 億元 (46.93%) 係由中央公務預算所支應，其次為基金 3,435 億元 (29.77%)，再其次為地方配合款 1,633 億元 (14.15%)，其餘預算來源合計共 1,057 億元 (9.16%)。

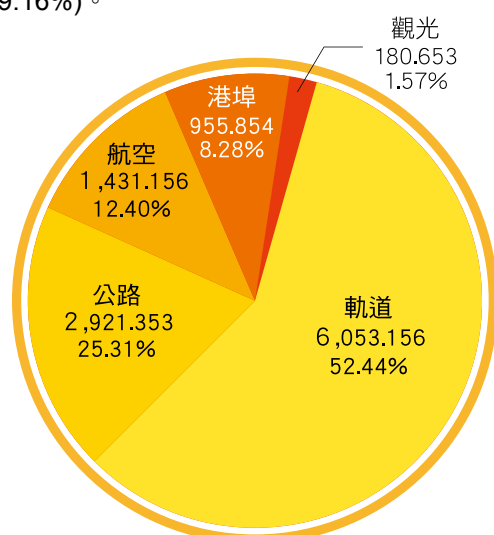


圖 4-1-5 各次類別 106-109 年總經費需求占比

FIG. 4-1-5 2017-2020 total budget requirement percentage weight for each subclass

國家整體資源有限，為能有效分配公共建設預算，必須強化個案計畫與上位政策之關聯並透過關鍵績效指標之衡量與中程概算叩合。雖然本部門涵蓋公路、軌道、港埠、航空及觀光等 5 個次類別，而且除交通部暨所屬機關外，尚涉及營建署 (市區道路)、原民會 (山區道路)、海巡署 (港埠)、6 都 (捷運) 等機關之計畫，不僅所涉範圍廣，需整合協調的機關亦多，惟藉由各主管機關之盤點，重新檢視確有必要推動之個案計畫，並且明確論述其與上位政策、推動策略之關聯，實可作為本部門未來規劃推動個案設計畫之上位指導，俾便政府有限資源投入能達成最佳化。



In terms of the budget requirement, collaboratively summarizing the 125 projects of the 5 subclasses to be executed during 2017-2020, the total budget requirement reaches NTD\$ 1,154.2 billion dollars. The budgets required by each of the subclasses ranked from high to low are 605.3 billion dollars (55.44%) for the railway subclass, 292.1 billion dollars (25.31%) for the highway subclass, 143.1 billion dollars (12.40%) for the aviation subclass, 95.6 billion dollars (8.28%) for the harbor subclass and 18.1 billion dollars (1.57%) for the tourism subclass. Among the sources of budgets for each item, an amount of 541.6 billion dollars (46.93%) is to be covered by the central public affairs budget, next amount of 343.5 billion dollars (29.77%) comes from the fund, further amount of 163.3 billion dollars (14.15%) comes from the local matching grants, and the remaining budget sources account for the subtotal of 105.7 billion dollars (9.16%).

The national overall resource is limited; therefore, to effectively allocate the public infrastructure budget, there is a need to enhance the correlation between each individual project and the superordinate policy along with the evaluation based on the key performance index matching with the mid-range general estimation. Despite that the Department covers the 5 subclasses of the highway, railway, harbor, aviation and tourism etc. and in addition to the agencies under the MOTC, projects also involve the agencies of Construction and Planning Agency (urban roads), Council of Indigenous People (mountain roads), Coast Guard Administration (harbor), 6 cities (MRT) etc. such that projects not only wide in scope but also require extensive integration and coordination among a great number of agencies. Accordingly, with the audits conducted by each authority, reviewing the necessity of each individual project for promotion and explicitly discussing the correlation with the superordinate policy and promotion strategy in order to be served as the superordinate guidance for the Department in promoting each individual infrastructure plan in the future such that the investment of the limited resource of the government can be optimized.

(二) 自行車環島 1 號線啟用

有人說，臺灣人一生必做的三件事，第一是泳渡明(日月)潭；第二是玉山登頂；第三就是自行車環島，也因此造就自行車環島人數逐年上升。然而想要自行車環島，必須面臨騎乘路線的選擇，由於大部分民眾不熟悉路線，大多選擇參加環島套裝行程，但從現在起，只要照著「自行車環島 1 號線」標誌標線騎乘，一個人也能順利完成自行車環島壯舉。

行政院於 103 年 5 月 15 日第 3398 次會議中指示交通部、內政部及教育部等能整合相關資源，於 104 年底串連自行車道斷點完成第 1 條自行車環島路線。「自行車環島 1 號線」主線全長 968 公里，另有南投與大鵬灣等環支線約 235 公里，以上 1,203 公里由交通部所屬公路總局、觀光局及 18 個縣市政府通力合作完成。「自行車環島 1 號線」圖如圖 4-1-6。

「自行車環島 1 號線」之選線及規劃原則主要考量目前多數環島騎士選擇路線、道路線型、距離長短，以及後續管養等因素，因此全線 8 成以上於省道公路以共用車道方式設置，在車流量較大且較危險路段，則以地方自行車道進行串接。



(II) Start of use of Cycling Route No. 1

Many people used to say that there are a few things to be done during the lifetime of every Taiwanese; the first is to swim across Sun Moon Lake, the second is to climb to the top of Jade Mountain and the third is to cycle across the Sun Moon Lake, the second is to climb to the top of the Yushan and the third is to cycling around the island, which is also the reason for the increase of the population cycling around the island every year. However, to cycle around the island, riders must select the route for cycling. Since most of the public are not familiar with the routes, most people would choose to join the around-the-island travel package. Now, any individual can follow the signs and marked lines for the "Cycling Route No. 1" to ride bicycle even alone to complete the outstanding trip of cycling around the island successfully.

In the No. 3398 meeting of the Executive Yuan dated May 15, 2014, the Executive Yuan instructed the MOTC and the Ministry of Interiors (MOI) and the Ministry of Education (MOE) etc. to integral relevant resources in order to connect the cycling route discontinued points since the end of 2015 for completing the first cycling route around the island. The length of the main route of the "Cycling Route No. 1" is 968km in addition to the ring branches at Nantou and Dapeng Bay etc. of the length of approximately 235km such that the total of 1,203 km has been completed by the Directorate General of Highways and the Tourism Bureau of the MOTC as well as the 18 county/city governments in cooperation. FIG. 4-1-6 is a map for the "Cycling Route No. 1".

The route selection and planning for the "Cycling Route No. 1" are mainly based on the consideration of the factors of the current routes selected by cycling riders, road line type, length of distance and subsequent management and maintenance of the route etc. Accordingly, more than 80 percent of the entire route is constructed in a manner of common roads with the provisional freeways and highways; in addition, for road sections of large traffic volume and relatively hazardous, these sections are to be connected to the local cycling path.

In addition, considering the safety, friendliness and continuity of the route, the MOTC approved the "2015 cycling round island connecting road signs, marked lines trail plan" in April 2015. Currently, dedicated signs and marked lines have been installed along the route, and there are approximately 3,200 sign plates, 70 guidance plates and 3,000 sets of marked line formations in total. Furthermore, with the consideration on the rider supply demands, in addition to that one



圖 4-1-6 「自行車環島 1 號線」. FIG. 4-1-6 Cycling Route No. 1

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此外，為考量該路線之安全性、友善性及連續性，交通部於 104 年 4 月核定「104 年自行車環島串連路線標誌、標線試辦計畫」，目前沿線已設置專屬標誌、標線，約計 3,200 座標示牌面、70 座導覽牌、及 3,000 組成型標線。另考量騎士補給需求，除於沿線每 15~20 公里規劃 1 處認證補給站外，沿線補給站提供之服務項目亦清楚於明列於標示牌。一般而言，每個補給站至少提供飲水及廁所服務，便利商店補給站更可提供餐飲服務，以上資訊皆可於「環騎圓夢」-「自行車環島 1 號線」專屬網站查詢。相關標誌標線圖如圖 4-1-7 ~ 圖 4-1-10。

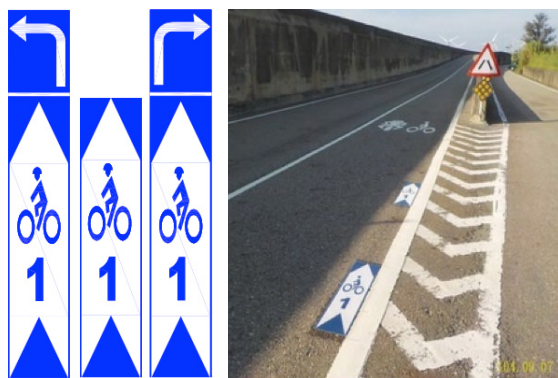


圖 4-1-7 路線指示標線

FIG. 4-1-7 Indicator marked line for the route



圖 4-1-8 路線指示標誌, FIG. 4-1-8 Indicator signs for the route



圖 4-1-9 轉運站、補給站指示標誌、標線, FIG. 4-1-9 Indicator signs and marked lines for transfer station and supply station

certified supply station is planned for every 15~20km along the route, service items available at each supply station along the route are also clearly indicated on the sign plates. In general, each supply station is able to at least provide the services of drinking water and toilet, and those supply stations with convenience stores can further provide catering service. All of the above information is available for lookup on the dedicated website of "Cycling Around Island Dream Come True" – "Cycling Route No. 1". Relevant signs and marked lines are as shown in FIG. 4-1-7~FIG. 4-1-10.

The website for the "Cycling Around Island Dream Come True" is <http://itaiwanbike.iot.gov.tw> (as shown in FIG. 6). The website mainly provides the introduction on the road sections for 9-day around-the-island trip, including not only descriptions on routes but also information related to the tourist attraction spots, accommodation, catering, hospital and clinic, bicycle rental station, convenient stores etc., along the route, and the supply stations certified officially are also provided for lookup. In addition, the website also provides videos or panoramic images of each road section along the route in order to allow riders to understand the actual conditions of the road sections during the planning of the trip and to prepare in advance. The website is also provided with a forum area for riders to share comments and thoughts as well as exchange experience. The aforementioned information will be uploaded further subsequently and continuous rolling reviews and updates.

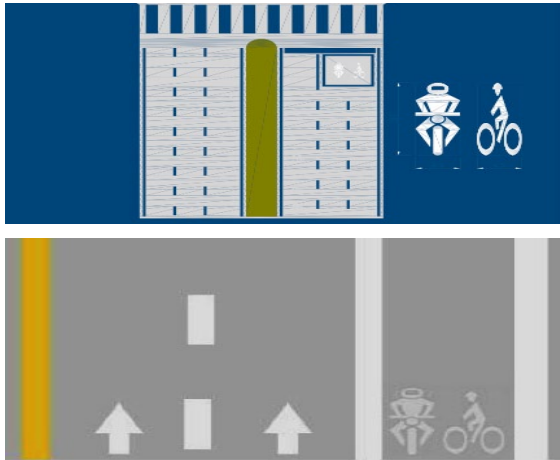


圖 4-1-10 機車與自行車停等區合併配置及慢車道路段
FIG. 4-1-10 Motorcycle and bicycle waiting zone combinational arrangement and slow-speed car lane road section

「環騎圓夢」網址為 <http://taiwanbike.iot.gov.tw> (如圖 4-1-11)，該網站主要以 9 天環島行程進行路段介紹，除路線說明外，另提供沿線經過的景點、住宿、餐飲、醫療院所、自行車租賃站、便利商店等資訊，而經官方認證之補給站亦提供查詢。此外，網站亦提供各路段沿線錄影或環景影像，方便騎士於規劃行程時，了解該路段之實際狀況，預作準備。該網站同時設有論壇專區，方便車友們交換心得，分享經驗。以上資訊後續將陸續上傳，並持續滾動檢討更新。

雖然自行車環島是臺灣人一生必做的事，但多數人卻無法一次挪出 9 天時間完成，因此，交通部特別規劃多條自行車道支線串接至臺鐵車站，讓無法一次完成環島的騎士們，得以利用臺鐵的兩鐵運輸列車進行分次環島。臺鐵局為服務車友，增開了兩鐵運送班次，目前共計 242 班次（包括指定區間車 234 班次、及花東莒光號附掛兩鐵車班 8 班次），已較改點前增加 100 餘班次；另為縮短車友上車時間，兩鐵區間車自 104 年 10 月 15 日起，改為只要開車前 20 分鐘至車站申請後即可乘車。

展望未來以「自行車環島 1 號線」為核心主軸，連結周邊縣市之自行車路線，帶動國人自行車旅遊風氣，行銷各地鄉土產業，並配合車友之旅遊需求，提升服務品質，開啟觀光旅遊新模式，共同打造自行車環島新紀元。



圖 4-1-11 環騎圓夢網站
FIG. 4-1-11 Cycling around island dream come true website

Despite that cycling around the island is said to be one of the things to be done during the lifetime of every Taiwanese, nevertheless, most people cannot schedule for 9 free days to complete such trip. Therefore, the MOTC specially plans numerous cycling branch routes connecting to the Taiwan railway stations in order to allow riders whom cannot complete the cycling around the island at once to use the two railway transportation trains of the Taiwan railways for cycling the island in sessions. To service the riders, Taiwan Railways Administration additionally schedules two transportation trains, and currently, there are a total of 242 scheduled trains (including 234 scheduled local trains and 8 schedule trains attached to two railways of Chu-Kuang Express for Hualien and Taitung), an increase of more than 100 schedule trains in comparison to the schedules prior to the modification. Furthermore, to reduce the processing time required for onboard of the riders, since October 15, 2015, the local trains of the two railways have been modified to accept applications at stations 20 minutes in advance of the take-off time of the train at each station for onboard of the trains.

Looking forward to the future, the "Cycling Route No. 1" will serve as the primary core for connecting the cycling routes of the surrounding counties and cities in order to promote the trend of traveling by bicycle of the public in our nation, to market the local industry of each region and to cope with the traveling demands of the riders in light of increasing the service quality, opening a new model for tourism and traveling and creating a new era for cycling around the island together.

二、海空運輸 ●●●

(一) 普通航空業經營環境改善

我國普通航空業概分為空中工作 (包括空中遊覽、勘察、照測、消防、搜尋、救護、拖吊、噴灑、拖靶勤務及其他經核准飛航業務) 及商務專機兩大類業務。

空中工作業務部分，現況面臨課題包含：

1. 業務需求大幅萎縮，照測、消防、搜尋、救護、噴灑、拖靶等業務需求逐年減少，勘察及拖吊幾無業務 (如圖 4-2-1)。
2. 經營未達規模經濟，為維持基本飛航安全標準，仍須投入維護成本，業者財務多為虧損。
3. 無人機分食業務。
4. 空勤總隊任務與業者業務重疊。
5. 委商合約要求高，影響業者承接標案意願。
6. 新型業務尚待開發。業者表示已嚴重影響生存空間，希望政府正視，以利空中工作永續發展。

II. Maritime and Aerial Transportations ●●●

(I) Conventional aviation industry operation environment improvement

Our conventional aviation industry is generally divided into two major services of aerial works (including aerial tourism, survey, photographing, fire-fighting, searching, paramedic, hauling and lifting, spraying and dusting, drone-hauling service and other authorized aviation service) and business charters.

With regard to the aerial work service part, currently, subjects that need to be dealt with include:

- (1) Due to the significant decrease in service demands, the service demands for photographing, fire-fighting, searching, paramedic, spraying and dusting and drone-hauling gradually decreases year after year, and there are nearly no demands for survey and hauling/lifting (as shown in FIG. 4-2-1).
- (2) Business operation fails to reach the economic scale but maintenance expenses still need to be invested in order to maintain the basic aviation safety standard such that most of the operators are operating at a loss.
- (3) Unmanned flying vehicles take up portions of the service.
- (4) Missions of the National Airborne Service Corps overlap with the services of the operators.
- (5) High requirements specified in the contractor agreement affect the will of operators in contracting the tender project.

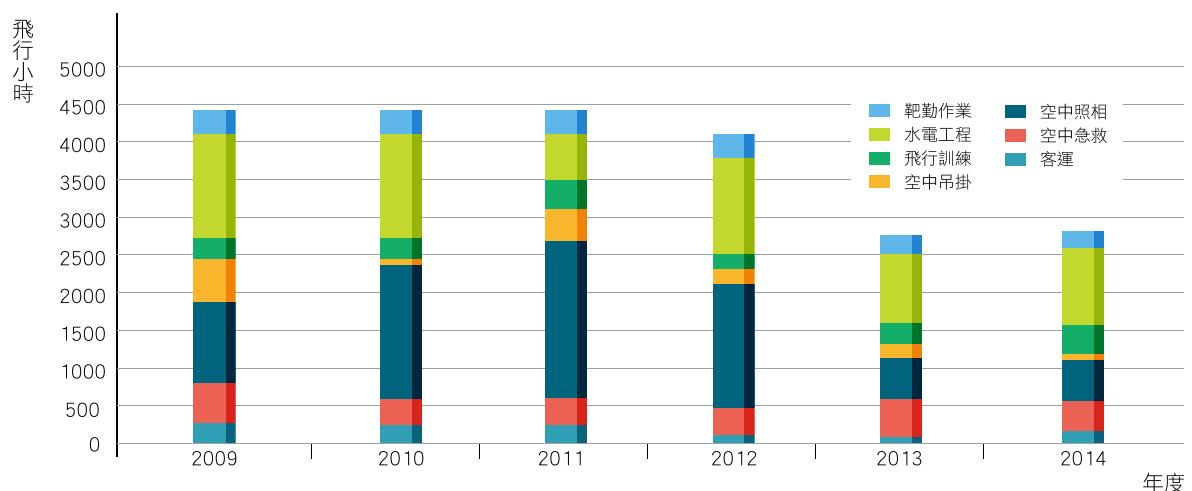


圖 4-2-1 我國空中工作各項業務歷年飛行時數圖

FIG. 4-2-1 Chart for historical flying hours of each service of aerial work in our nation

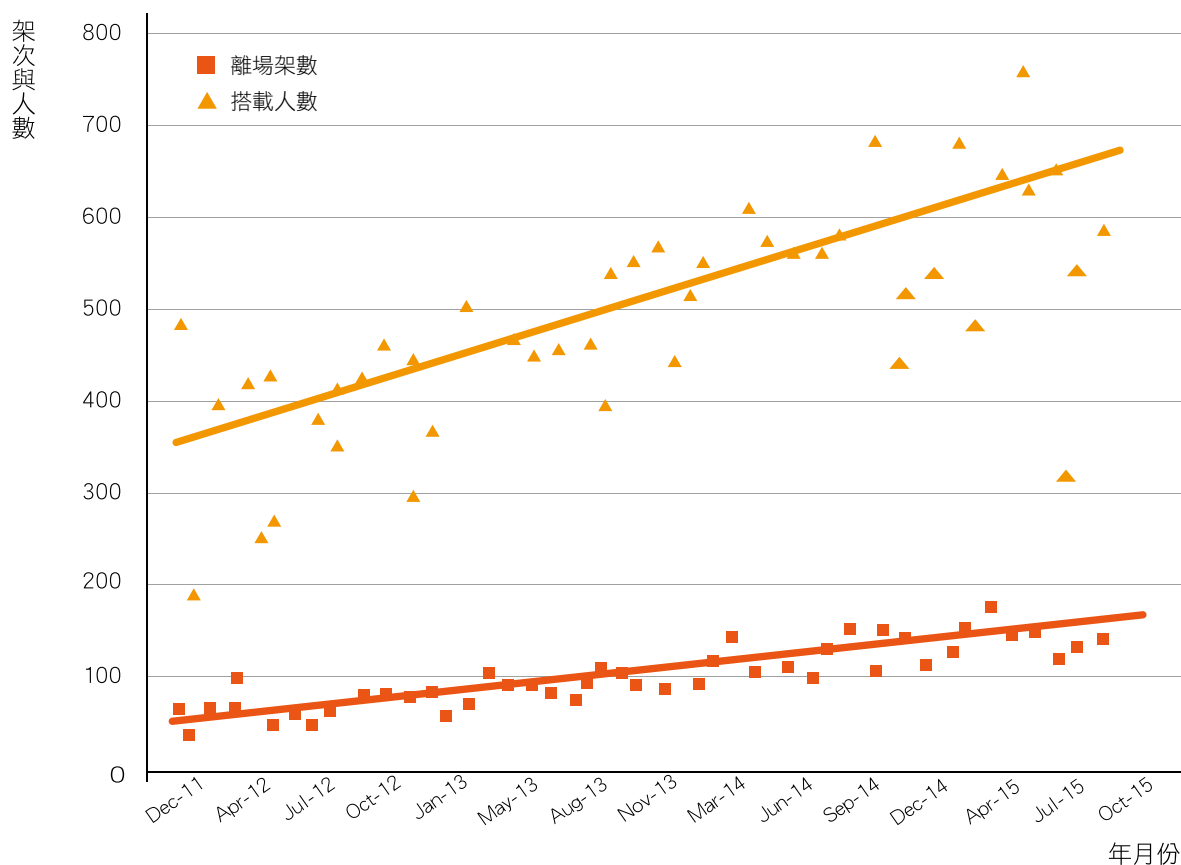


圖 4-2-2 我國商務航空近年起降架數與搭載人數趨勢圖

FIG. 4-2-2 Graph showing tendencies of number of departure and arrival aircrafts and passengers of business aviation in recent years in our nation

商務專機業務部分，現況面臨課題包含：

1. 各家業者經營規模尚小（如圖 4-2-2），且以代管飛機為主，尚須積極強化經營體質。
2. 國內商務航空機場腹地空間受限，影響長期發展。
3. 缺乏上下游產業鏈發展與整合。如何健全產業發展環境、強化經營實力，並提升國際競爭力，是未來發展重要課題。

本研究參考國外普通航空業經營概況、政策及可參考案例，檢討國內法規定義及業別劃分，進行十五家業者與相關單位訪談，並召開兩次座談會（由普通航空業者及相關機關共同參與）檢討相關課題後，分就以下三大面向研提未來經營環境改善策略及發展方向，以利提升我國普通航空業未來發展水準及國際競爭力：

- (6) New model of service is still under development. Operators express that their spaces for survival have been significantly affected and hope the government could deal such issue properly in order to facilitate the aerial works to develop sustainably.

With regard to the business charter aspect, currently, subjects that need to be dealt with include:

- (1) The operation scale of each operator is still small (as shown in FIG. 4-2-2), and the services of most of the operators are mainly for airplane management and maintenance agencies, which still require active improvements in the operational structures.
- (2) The domestic business aviation airport land and space are still limited such that the long-term development thereof is affected.
- (3) It lacks development and integration among upstream and downstream industrial chains. It is an important subject for the future development to improve the industrial development environment, strengthen the operation ability and increase international competitiveness.



「改善現有經營環境」：

1. 空中工作部分，交通部應與內政部、衛福部、海巡署及農委會跨部會協商，將空勤總隊重疊業務釋商。短期先將救護業務釋商；中期將偵巡業務釋商；長期將照測業務釋商。
2. 商務專機部分，宜檢討增加現有機場商務航空軟硬體設施。

「鞏固永續經營體質」：

1. 空中工作部分，委商機制建議改採多年期合約辦理。
2. 商務專機部分，應長遠規劃商務機場整體發展與產業鏈整合，中期提升商務航空機務維修之能量及其規模，長期則整體規劃商務航空機場發展，並落實商務航空產業鏈一條鞭，以整體帶動發展。

The present research makes reference to general status, policies and available cases of the foreign general aviation business operations for conducting the reviews on domestic legal regulation definition and service type classification, performing interviews with 15 operators and relevant units and hosting 2 seminars (participated by the general aviation operators and relevant agencies together) in order to review on relevant subjects. Based on three main aspects, the following provides proposals for future operation environment improvement strategies and development directions in order to increase the future development standard and international competitiveness of the general aviation industry in our nation.

First, "improve existing operation environment":

- (1) With regard to the aerial work part, the MOTC shall consolidate cross ministries and agencies with the MOI, Ministry of Health and Welfare (MOHW), Coast Guard Administration and Council of Agriculture in order to commercially transfer the overlapping service of the National Airborne Service Corps. For the short term, the service of paramedic can be commercially transferred first; for the intermediate term, the service of patrol can be commercially transferred; for the long term, the service of photographing can be commercially transferred.
- (2) With regard to the business charter part, appropriate discussion shall be given to the addition of the currently existing airport business aviation software and hardware facilities.

Second, "strengthening sustainable operation structure":

- (1) With regard to the aerial work part, the contracting mechanism is suggested to use the method of multiple year and session contracts.
- (2) With regard to the business charter part, the business airport overall development and industrial chain integration shall be planned for the long term, and during the intermediate term, the ability and scale of the business aviation flight affair and maintenance shall be increased; for the long term, overall planning for business aviation airport development shall be performed and the single stream of business aviation industrial chain shall be implemented in order to drive the overall development.

Third, "expanding new type of service scope":

- (1) With regard to the aerial work part, appropriate discussion shall be given to the open-type of new services (including: open to allow flight training business operators to also provide the flight

「拓展新型業務範疇」：

1. 空中工作部分，宜檢討開放新型業務（如：開放飛行訓練業者取得普通航空業資格後，可兼營體驗飛行業務）。
2. 商務專機部分，應拓展新型業務範疇並提升競爭力，短期可增修法規開放「比例所有分時使用」與「航空器共同持有」業務，中期推動「商務專機兩岸航線協商」，長期可考量開放「外籍業者來臺經營」，以利引進更多經營策略及業務，帶動產業發展，活絡我國商務專機業務。

另外，本研究也提出相關配套建議，如：應長遠規劃無人機安全管理法制作業，審慎研擬相關管理法規，以及建議業者可結合飛行訓練、體驗飛行及空中遊覽等業務，從多角化經營角度切入，除了可活化部分閒置機場，並可增進普通航空業多元發展。

experiencing service after obtaining the general aviation business qualification).

- (2) With regard to the business charter part, new type of service scope shall be expanded to increase the competitiveness; for the short term, regulations can be added or revised to open up the services of "usage under proportional ownership" and "aircraft common ownership"; for the intermediate term, the "business charter cross-strait flight route consolidation" can be promoted; for the long term, considerations on opening for "foreign business operators to operate in Taiwan" can be made in order to facilitate the attraction of more business operation strategies and services in light of driving the development of the industry and to stimulating the business charter service in our nation.

Furthermore, the present research also proposes suggestions on relevant complementary measures; for example: Unmanned flying vehicle safety management regulation operation shall be planned in a long term, relevant management regulations shall be stipulated carefully, and it is recommended that the operators can collaborate the services of flight training, flight experiencing and aerial tourism etc. in order to operate the business in a diverse manner such that it would not only actively utilize the idle portions of the airport but also stimulate the diverse development of the general aviation industry.



(二) 我國整體運輸系統分析研究

我國自民國 90 年代以來，工業生產製造業大量外移至中國大陸及海外，使得提供國際貿易貨載服務海運服務業的業務量（營業收入）無法大幅成長。由圖 4-2-3 可知，「船舶運送業」家數持續增加，為我國航運事業中，產值最高之行業。「船務代理業」及「海運承攬運送業」家數持續增加，多數為中小型企業，競爭相對激烈，其營業收入 2004 年下跌後，均無明顯復甦。我國「貨櫃集散站經營業」（資料來源內僅有家數統計，無從業人員、營業收入等統計資料）共有 40 家（含 2 家暫行停業）。

為了探討我國航運產業面臨之問題，針對航業法所規範的「船舶運送業」、「船務代理業」、「海運承攬運送業」及「貨櫃集散站經營業」等 4 個業別，本計畫以航運企業經營投入及產出角度，對於我國航運產業「人力」、「船

(II) An Analysis of Overall Shipping Transportation System in Taiwan

Since 2001, the industrial production and manufacturing businesses in our nation have relocated to Mainland China and overseas, causing the business quantity (operation revenue) of the Maritime transportation service industry providing international trading cargo transportation services fail to grow significantly. From FIG. 4-2-3, it can be learned that number of operators of "shipping carrier business" continues to increase, which has become the business of the highest production value among the Maritime shipping businesses in our nation. The numbers of operators of "shipping agency business" and "shipping forwarder business" continue to increase, and most of the operators are medium to small enterprises with great competition among the operators; however, since the decline of the operation revenue in 2004, it shows no significant improvement. For the "container terminal operator business" in our nation (in the content of the data source, only the statistics of the number of operators is available without the statistical data on the employees, operation revenue

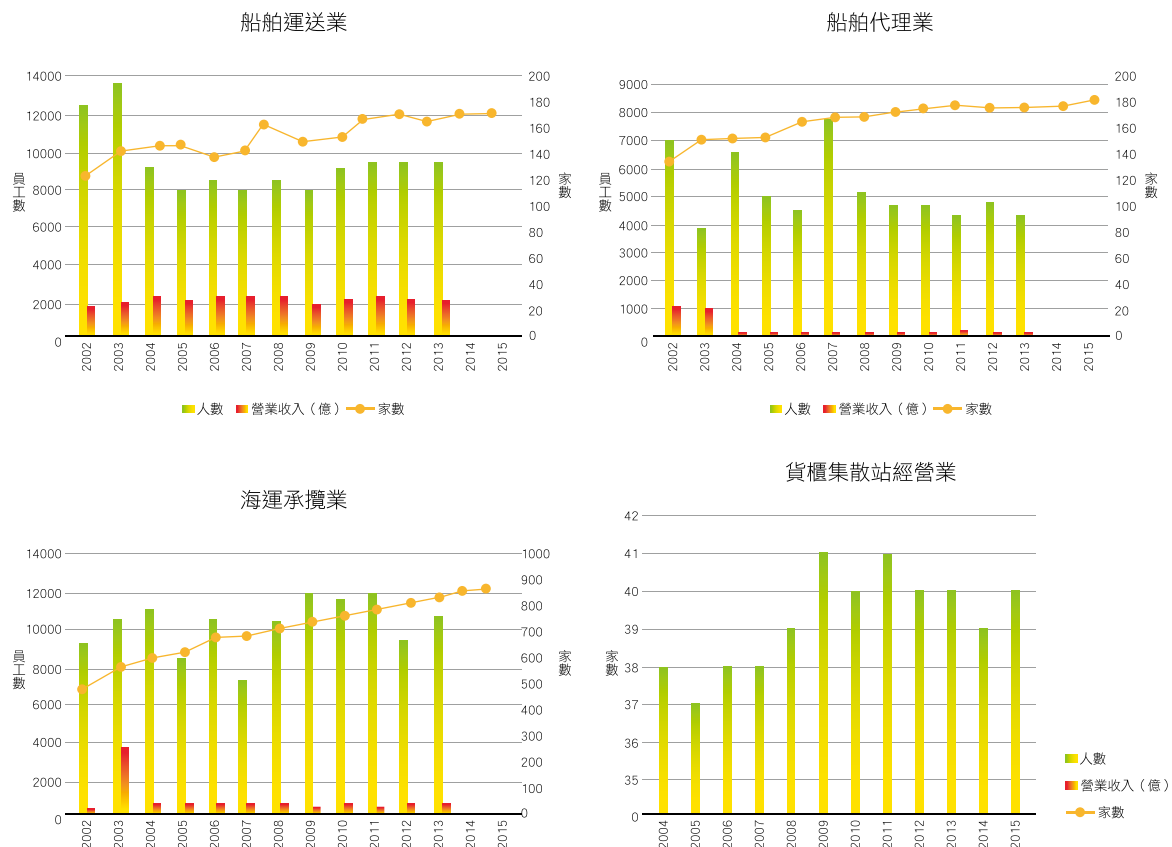


圖 4-2-3 臺灣海運產業各業別經營統計

FIG. 4-2-3 Operation statistics of each business type for marine shipping industry in Taiwan



圖 4-2-4 業者座談會實照，FIG. 4-2-4 Shipping business symposium

船」、「貨運」與「客運」等 4 大課題為核心進行深入分析，以瞭解我國整體航運產業所面臨到質與量的問題，並透過舉辦業者座談會強化政策研擬的完整性（如圖 4-2-4），以求在國家經濟發展的目標下，研擬政府可透過法規調整或其他政策手段，型塑臺灣成為航運產業的發展據點。

根據研究，在人力資源部分，我國每年培育所培育之人才上船工作比例偏低，各校實際上船人數約 20%~40% 間，一等船副達 35%，一等管輪約 25%。依此推算，每年提供船舶運送業船員人才，一等船副約 130 人，一等管輪約 125 人，並無法滿足國籍航商需求之人數如表 4-2-1~4-2-2。又因學生上船意願不高，造成航商營運上之困擾，因此為配合航運公司的船員需求，提供足夠適格船員是航政主管機關必須努力的重要課題。對於非船員能力提升，應致力於縮短學用落差及提升航運產業人才國際競爭力，並補助業者或公會協助舉辦各種專業實務課程，滿足業界的人才需求。

在法規調整部分，經參考比較我國與其他亞洲海運國家的航運稅捐制度差異後（如表 4-2-3），提出檢討我國現行船舶噸位稅制度建議，包括降低稅率、解除條件限制與簡化計費方式

etc.), there are a total of 40 operators (including 2 operators temporarily terminate their operations).

To discuss the problems encountered by the Maritime transportation industry in our nation, regarding the 4 business types of "shipping carrier business", "shipping agency business", "shipping forwarder business" and "container terminal operator business", this project performs an in depth analysis on the 4 main subjects of "human resource", "vessel", "freight transportation" and "passenger transportation" of the Maritime transportation industry in our nation based on the aspects of Maritime transportation enterprise operation investment and production output in order to understand issues related to the quality and quantity encountered by the overall Maritime transportation industry in our nation. In addition, by hosting operator seminars, emphasis on the completeness of the policy stipulation can be drawn (as shown in FIG. 4-2-4) such that in light of achieving the goal of the national economic development, the methods of legal regulation adjustments or other political measures utilized by the government can be stipulated in such a way that Taiwan can be structured into a development foundation for Maritime transportation industry.

According to research, with regard to the human resource part, the onboard work ratio of talents cultivated annually by our nation is still low, and the actual ratio of number of people onboard from each school is approximately 20%~40%, of which the first class deck officer reaches 35% and the first class engineer officer is approximately 25%. Based on such statistics, it is estimated that the talents of crews for shipping carrier business provided

表 4-2-1 海事校院航海科系畢業生人數統計

校 名	系 名	2011 年	2012 年	2013 年	2014 年
臺灣海洋大學	商船學系	104	105	94	106
	運輸科學系 (航海組)	40	58	40	-
	小 計	144	163	134	106
高雄海洋科技大學	航運技術系	144	139	133	152
臺北海洋技術學院	航海系	129	123	114	106
合 計		417	425	381	364

Table 4-2-1 Statistics on number of graduates from marine science department of maritime schools and colleges

School name	Department name	Year of 2011	Year of 2012	Year of 2013	Year of 2014
National Taiwan Ocean University	Department of Merchant Maritime	104	105	94	106
	Department of transportation science (Navigation team)	40	58	40	-
	Subtotal	144	163	134	106
National Kaohsiung Maritime University	Department of shipping technology	144	139	133	152
Taipei College of Maritime Technology	Department of navigation	129	123	114	106
Total		417	425	381	364

表 4-2-2 海事校院輪機科系畢業生人數統計

校 名	系 名	2011 年	2012 年	2013 年	2014 年
臺灣海洋大學	輪機工程學系	85	85	84	104
高雄海洋科技大學	輪機工程系	176	221	207	196
臺北海洋技術學院	輪機工程系	161	188	193	195
合 計		422	494	484	495

Table 4-2-2 Statistics on the number of graduates from marine engineering department of maritime schools and colleges

School name	Department name	Year of 2011	Year of 2012	Year of 2013	Year of 2014
National Taiwan Ocean University	Department of Maritime engineering	85	85	84	104
National Kaohsiung Maritime University	Department of Maritime engineering	176	221	207	196
Taipei College of Maritime Technology	Department of Maritime engineering	161	188	193	195
Total		422	494	484	495

表 4-2-3 我國與亞洲海運國家航運稅捐制度比較

Table 4-2-3 Comparison on marine shipping taxation system among our nation and Asian marine shipping countries

比較項目		日本	中國	南韓	新加坡	香港	臺灣
傳統 船籍	所有權人限制	✓	✓	✓	✓	✓	✓
	船員國籍限制	✓	✓	✓	X	X	✓
	船齡限制	X	X	X	17 年	X	X
	船舶最小總噸位限制	X	X	20	1,600	X	X
第二 船籍	所有權人限制	✓	未實施	✓	未實施	未實施	
	船舶最小總噸位限制	2000		500			未實施
	船齡限制	X		20 年			
	船員國籍限制	X		✓			
航運 稅捐 制度	公司稅或噸位稅	二選一	公司稅	擇一	皆否	皆否	擇一
	自有船與租船比率限制		X	✓	X	X	X
	營所稅（%）	33.06%	25	11-24	X	X	17
	噸位稅形式	荷蘭式		荷蘭式	未實施	未實施	未實施
	實施年限（年）	5 年		5	X	X	10
	噸位單位	淨噸		淨噸	淨噸	淨噸	淨噸
	噸位級距	4		4	1	3	4
	船齡級距		未實施	X	X	X	X
	年費收費底限	X		X	100 新幣	1,500 港幣	X
	年費收費上限	X		X	10,000 新幣	77,500 港幣	X
	附加條件	船員培訓與 國輪數量		X	X	X	船員國輪



annually are approximately 130 people as the first class deck officers and 125 people as the first class engineer officers, which cannot satisfy the number of people demanded by the national shipping operators, as shown in Table 4-2-1~4-2-2. In addition, the lack of interests in working onboard of students has caused obstacles to the shipping operators in the business operation. Therefore, it is an important task for the maritime administrative authority to satisfy the demand for crews by the Maritime shipping company while providing sufficient and adequate crews. For the improvement of the non-crew ability, the emphasis shall be focused on shortening the gap between the academic studies and the practical application and increasing international competitiveness of the talents for the Maritime shipping industry, along with subsidy to operators or assistance of the union in hosting various professional and practical courses in order to satisfy the demands for talents in the industry.

表 4-2-4 臺灣與亞洲區郵輪發展機制

Table 4-2-4 Cruise development mechanism in Taiwan and Asian area

	新加坡 Singapore	中國大陸 China	南韓 South Korea	日本 Japan	臺灣 Taiwan
1. 強化擴充郵輪港埠設施 1. Strengthening the expansion of cruise harbor facilities	◎	◎	◎		◎
2. 搭建國際郵輪供應鏈體系 2. Establishing international cruise supply chain system	◎	◎	◎		
3. 人才培育 3. Talent cultivation		◎	◎		
4. 區域港口合作 4. Regional harbor cooperation	◎	◎	◎	◎	◎
5. 簡化旅客通關程序、過境免簽 5. Simply passenger custom procedure, transit without visa		◎	◎	◎	
6. 實施獎勵政策 6. Implement award policy	◎	◎		◎	◎

等。在貨運部分，應著力於培養我國的全球航運物流企業，建議可循三大策略方向積極規劃：

(1) 由交通部設立專責單位協助海運業者拓展國際貨運業務。(2) 重新考慮提供獎助措施，以協助海運業者前往海外市場拓展業務。(3) 輔導業者垂直整合或併購，以圖擴大營業規模降低營運成本，並充實內部在職訓練機制等。

在客運部分，蒐集比較亞洲國家的郵輪港口發展策略（如表 4-2-4），為提高郵輪產業對我國經濟貢獻度，可思考由專責單位構建資訊資源整合平台，提供郵輪補給品採購交易平台與倉儲功能，建立順暢的郵輪物資補給作業流程與系統。

長期而言，臺灣航運產業發展應以走向航運產業群聚為目標，仿效新加坡規劃「航運產業鏈群聚方案」，發展船舶管理、船舶融資、傭船經紀、船舶維修、海事法律服務等，發揮航運產業群聚效應。

（三）我國貨櫃港口營運環境改善之研究

隨著中國大陸的經濟發展與港口崛起，東亞地區的貨櫃航線愈來愈以大陸東南沿海為重

With regard to the legal regulation adjustment, after referencing and comparing the differences in the Maritime shipping taxations among our nation and other Asian Maritime shipping countries (as shown in Table 4-2-3), recommendations on review of the current tonnage tax system of our nation are proposed, which includes the reduction of tax, removal of conditional restrictions and simplifying fee calculation method etc. For the container carrier part, emphasis shall be focused on cultivating the global Maritime shipping and logistics enterprises in our nation, and it is suggested that active planning can be made based on three main strategic directions: (1) The MOTC shall set up a dedicated agency in assisting the Maritime shipping operators to expand the international container carrier business. (2) Reconsidering the measure of offering awards and subsidies in order to assist the Maritime shipping operators to expand business at the overseas market. (3) Guiding operators to integrate or merge vertically in order to expand the operation scale and reduce the operation cost as well as implementing internal on-job training mechanism and so on.

For the passenger carrier part, cruise terminal development strategies of Asian countries can be collected and compared (as shown in Table 4-2-4). To increase the economic contribution of cruise industry in our nation, a dedicated agency can be assigned to establish the information resource integration platform in order to provide cruise



心，有減弱我國港口貨櫃轉運功能之隱憂。而兩岸直航排除了外籍航商的參與，使得外籍航商對我國港口的貨櫃航線配置的依賴程度漸減。面對這些內、外部營運環境的劇烈變化，努力鞏固我國港口之航運樞紐地位，提振我國海運的競爭能力，實為目前海運發展刻不容緩的工作。本計畫主要針對我國貨櫃港口營運環境改善之相關課題作深入分析，據以研提發展方向與因應策略。

本計畫 104 年度的研究重點在探討如何強化我國貨櫃港口對營運環境改變的調適能力，蒐集分析主要貨櫃航商在貨櫃裝卸量的演變情勢與航線變化、瞭解主要貨櫃航商之聯盟行為與港口選擇偏好，佐以文獻回顧、專家實務訪談以及研討會之舉辦，據以掌握歸納出我國國際貨櫃港埠在經營上所面臨之脆弱度，研擬出我國貨櫃港口應有的調適策略與能力。

supply procurement transaction platform and warehouse functions and to establish a smooth cruise material supply operation flow and system.

For the long term, the development of the Maritime shipping industry in Taiwan shall head toward the goal of Maritime shipping industry cluster and follow the example of Singapore in the planning of "Maritime shipping industry chain cluster solution" in the development of the vessel management, vessel finance, vessel rental agency, vessel repair and maintenance, maritime legal service etc. in order to exert the effect of Maritime shipping industry cluster.

(III) Research on improvement of container harbor operation environment in our nation

With the rise of the economic development and ports in Mainland China, the container shipping routes in East Asian region tends to center around the south east coast of Mainland China, and there is a concern on the weakening of the port container transfer function in our nation. The direct cross-strait transportation excludes the participation of foreign carrier operators such that the reliance of the foreign carrier operators on the container shipping route planning for our nation is reduced. Facing such rapid changes in the these internal and external operation environments, our nation shall strive to secure the shipping hub status of our ports and to increase the competitiveness of the Maritime shipping of our nation as key tasks to be executed immediately for the current Maritime shipping development. This project mainly provides an in-depth analysis on subjects related to the container port operational environment improvement in our nation in order to propose the direction for development and counter strategies.

The 2015 research of this project mainly focuses on how to strengthen the adaptability of the container ports of our nation to handle the operational environment changes, to collect and analyze the development trends and shipping routes of the major container shipping operators in terms of the container loading capacity and to understand the alliance behavior and port selection preference of major container shipping operators along with review of past documentations, expert practice interviews and hosting of seminars in order to understand and classify the weakness encountered by the international carrier harbors of our nation in terms of the business operation and to further propose adaptive strategies and abilities necessary for the container ports in our nation.

CH1
所長的話

CH2
組織與人力

CH3
施政概況

CH4
重點研究介紹

CH5
落實應用實績

CH6
大事紀要



圖 4-2-5 高雄港貨櫃碼頭使用移轉示意圖，

FIG. 4-2-5 Illustration of container dock usage transfer at the Port of Kaohsiung

研究成果主要有以下 4 項：

1. 營運現況分析結果顯示：臺灣各港貨櫃碼頭能量供給充分，但深水碼頭與設施仍需局部強化；基隆、臺北、臺中三港非常依賴兩岸所屬之貨櫃航商；高雄港存在部分碼頭壅塞、部分碼頭使用率低的不均衡現象。
2. 影響航商在臺泊靠之因素甚多，以「貨源因素」為主要考量因素，另外，「在港口有承租碼頭」與船舶大型化之下之「策略聯盟行為」亦是重要因素。
3. 我國貨櫃港口在營運脆弱度的來源，按問卷分析結果顯示：主要包括「東協國家之興起」、「貨櫃船舶持續大型化」及「貨櫃航商策略聯盟力量趨強」等 3 個層面。
4. 在高雄港，部分航商承租貨櫃碼頭的碼頭使用率很高，部分航商擁有萬 TEU 級貨櫃船，但其碼頭水深不足以泊靠，建議未來在高雄港新增深水貨櫃碼頭後，透過碼頭遞移方式，吸引這些航商改租空間較大的深水碼頭，以減緩碼頭壅塞現象 (如圖 4-2-5 所示)。

由航商成本面之研究結果顯示：未來美東航線之航程愈長、船型愈大，則愈可能有利於以高雄港做為主航線之樞紐港或最終樞紐港口。

The research outcome mainly includes the following 4 issues:

1. The result of the analysis on the current status of the operation shows: All ports and container docks have sufficient supply energy in Taiwan; however, deep-water docks and facilities still require strengthening in some parts. The three ports of Keelung, Taipei and Taichung rely heavily on the container shipping operators belong to both Taiwan and Mainland China. The Port of Kaohsiung shows unbalanced occurrence where a portion of the docks has high volume and backlogs, whereas a portion of the docks has low usage rate.
2. Factors affecting shipping operators to dock in Taiwan are many, and the "factor of source of goods" is the main factor for consideration. In addition, the "strategic alliance behavior" due to "port with dock rental" and the trend of large vessel are also key factors to be considered.
3. For the source of the operation weakness of the container ports in our nation, the result of the survey analysis shows: it mainly includes three aspects of the "rising of the Southeast Asian nations", "continuous trend of large container vessels" and "increasing power of strategic alliance of container shipping operators" etc.
4. For the Port of Kaohsiung, the dock usage rates of a portion of the container docks rented by the shipping operators are high, and some shipping

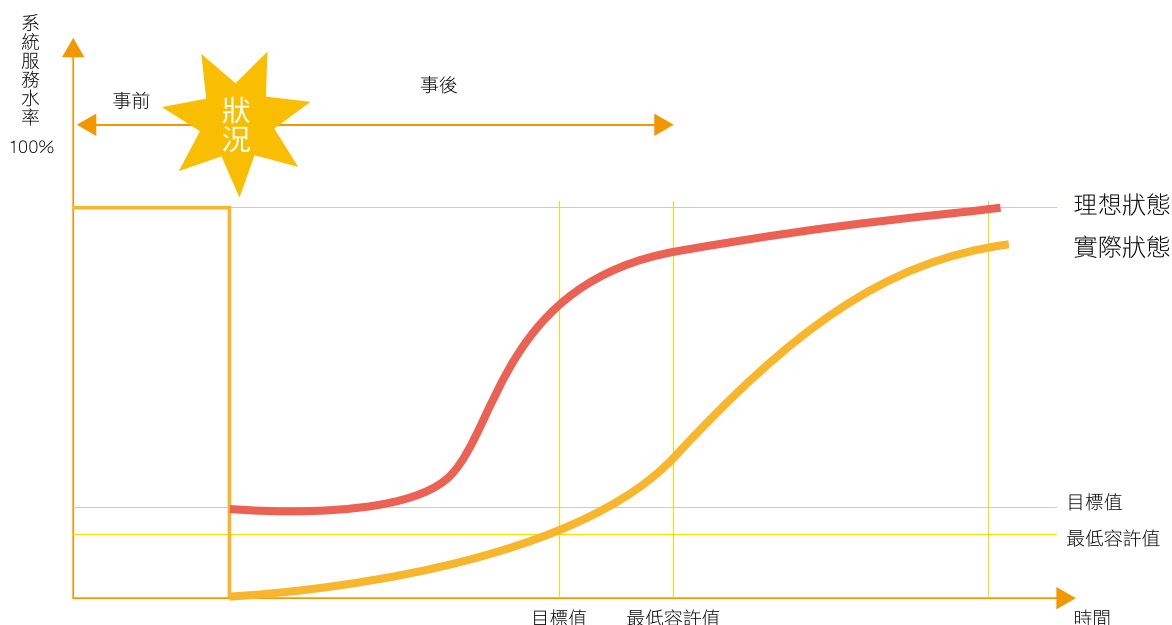


圖 4-2-6 供應鏈遭遇外力衝擊時之恢復力, FIG. 4-2-6 Resilience of supply chain under external impacts

(四) 強化供應鏈恢復力 提昇國際運輸 物流競爭力

本計畫係配合行政院「國際物流服務業發展行動計畫」與 APEC「供應鏈連結行動計畫」之物流發展政策目標，以及落實交通部「提昇國際海空門戶競爭力，帶動臺灣產業加值轉型」施政願景，達成「強化國際運輸效能與提昇國際物流服務品質」施政目標而辦理。

近年來運輸物流供應鏈跨境運作的環境，受到全球極端氣候與經貿全球化的影響，屢顯顯露不同程度的脆弱性，亟需特別予以關注並加強供應鏈遭遇外力衝擊時之恢復力，以因應外部自然、人為環境的變化與衝擊，使運輸物流系統能於衝擊發生後儘速恢復系統服務水準。其中，交通部門特別關心國際運輸與物流服務面對各種風險所造成供應鏈斷鏈之危機，考量之範圍包括國際運輸與物流基礎設施（如：機場、港口、港埠聯外運輸系統、航線與空域等）以及國際運輸物流服務業者。

operators own 10000 TEU class container vessels; however, the water depth of the dock is not sufficient part the docking of such large vessels. It is suggested that new deep-water container docks are to be built at the port of Kaohsiung in the future such that by relocating the docks, it would attract those shipping operators to change to rent the deep-water docks of larger space in order to reduce the occurrence of dock jamming (as shown in FIG. 4-2-5)

The result of the shipping operator cost research shows: In the future, the longer the shipping journey of the U.S. east coast navigation route, the larger the type of the vessels and the greater likelihood for the Port of Kaohsiung to be advantageously used as the hub port or the destination hub port of the main navigation route.

(IV) Strengthen Supply Chain Resilience & Increase International Transportation Logistics Competitiveness

This project is conducted in cooperation with the logistics development policy objectives of the "International Logistics Service Business Development Action Plan" of the Executive Yuan and the "Supply Chain Connection Action Plan" of APEC along with the execution of the administrative implementation of "Increasing international Maritime and aerial gateway competitiveness,



我國於 89 年完成災害防救法之立法，迄今已相當完備建立災害預防、應變及復原重建機制，本計畫檢視我國各交通運輸機關、機構、國營事業對於運輸物流供應鏈遭遇外力衝擊時之現況作法，發現各單位在緊急應變計畫以及緊急應變工作上，已經相當周延，惟對於所謂「恢復力」與「脆弱度」，則相對較沒有涉入。本計畫深入了解我國國際運輸物流系統因應天災之即時反應機制並建立強化運輸部門供應鏈恢復力之發展藍圖，以健全我國運輸物流供應鏈風險處理體質，確保我國企業之永續發展。

為辨識我國國際運輸物流風險因子，本計畫以「失效模式與效應分析法」(Failure Mode and Effects Analysis, FMEA) 如圖 4-2-7，針對我國五大出口國(中國大陸、新加坡、美國、日本、韓國)的國際運輸物流風險進行分析評估，並對各項國際海、空運風險因子提出因應對策，如表 4-2-4、表 4-2-5。

評估結果顯示，我國至前五大出口國的航空貨運物流作業的風險等級大部分都屬於低度風險，較高風險的作業項目僅有「機場設施受災損壞關場」、「機場受天災影響關場」、「跑道事故無法使用」、「航機間或航機與地勤車輛地面碰撞」、「颱風影響飛行」等。海運貨運物流作業的風險等級大部分也都屬於低度風

Driving industry value-added transformation in Taiwan” of the MOTC in order to achieve the administrative implementation objective of “strengthening international transportation performance and increasing international logistics service quality”.

In recent years, the environment of the transportation logistics supply chain cross-region operation has been affected by the global extreme climates and the economic trade globalization, weaknesses of different levels are exposed, which requires special attention and strengthening of the resilience of supply chain under the impact of external forces in order to cope with the natural and man-made changes and impacts from the external such that the transportation logistics system is able to recovery to the system service standard immediately after the occurrence of the impact. Among the impacts, the Department of Transportation particularly cares about the crisis of supply chain disconnection caused by various risks encountered by the international transportation and logistics service, and the scope to be considered includes the international transportation and logistics foundation facilities (such as: airport, port, harbor external connection transportation system, navigation route and air space etc.) and the international transportation logistics service business operators.

Our nation has completed legislation on the Disaster Prevention and Protection Act in 2000, and mechanisms for the disaster prevention, countermeasure and recover reconstruction have been established completely until the present day. This project reviews the current methods adopted by the traffic transportation agencies, institutes, government owned businesses during the time when the supply chain encounters external impacts. It has been discovered that the emergency counter

表 4-2-4 我國國際出口航空運輸物流風險因應對策建議 (部分內容)

風險因子	因應對策
航班停飛	建立更縣密的航網，每條航線均開放兩家以上的航空公司以客運航線裝載貨物
航空公司停航	建立更縣密的航網，每條航線均開放兩家以上的航空公司以客運航線裝載貨物
資訊平台當機	建立異地備援、即時切換。建立雙主機運作、即時切換
駭客入侵資訊平台	強化防火牆、加密、資安作業
資訊平台機房損壞	建立異地備援
無艙位	與航空公司預簽合約

表 4-2-5 我國國際出口海運運輸物流風險因應對策建議 (部分內容)

風險因子	因應對策
船公司停航	吸引多家船公司靠港營運
船期調整	吸引多家船公司靠港營運，提供更多的船班
船公司倒閉或移轉經營權	規劃有替代往來的船公司提供服務
資訊平台當機	建立異地備援、即時切換。建立雙主機運作、即時切換
駭客入侵資訊平台	強化防火牆、加密、資安作業
資訊平台機房損壞	建立異地備援

Table 4-2-4 Counter strategy suggestions on international export aerial transportation logistics risk in our nation (partial content)

Risk factor	Counter strategy
Flight cancellation	Establish aviation network of greater density, each flight route shall be opened to more than two airline companies Use passenger flight route to carry cargo
Airline not in operation	Establish aviation network of greater density, each flight route shall be opened to more than two airline companies Use passenger flight route to carry cargo
Information platform breakdown	Establish remote location backup for immediate switch Establish dual mainframe operation for immediate switch
Hacker hacking into information platform	Strengthen firewall, encryption and information security operations
Information platform utility room damaged	Establish remote location background
No flight vacancy	Sign contracts with airline in advance.

Table 4-2-5 Counter strategy suggestions on international export Maritime transportation logistics risk in our nation (partial content)

Risk factor	Counter strategy
Shipping company not in operation	Attract more shipping companies to dock at the ports for operation
Adjustment of shipping schedule	Attract more shipping companies to dock at the ports for operation, provide more shipping schedules
Shipping company bankrupt or transfer of ownership	Plan for alternative shipping companies to provide services
Information platform breakdown	Establish remote location backup for immediate switch Establish dual mainframe operation for immediate switch
Hacker hacking into information platform	Strengthen firewall, encryption and information security operations
Information platform utility room damaged	Establish remote location background

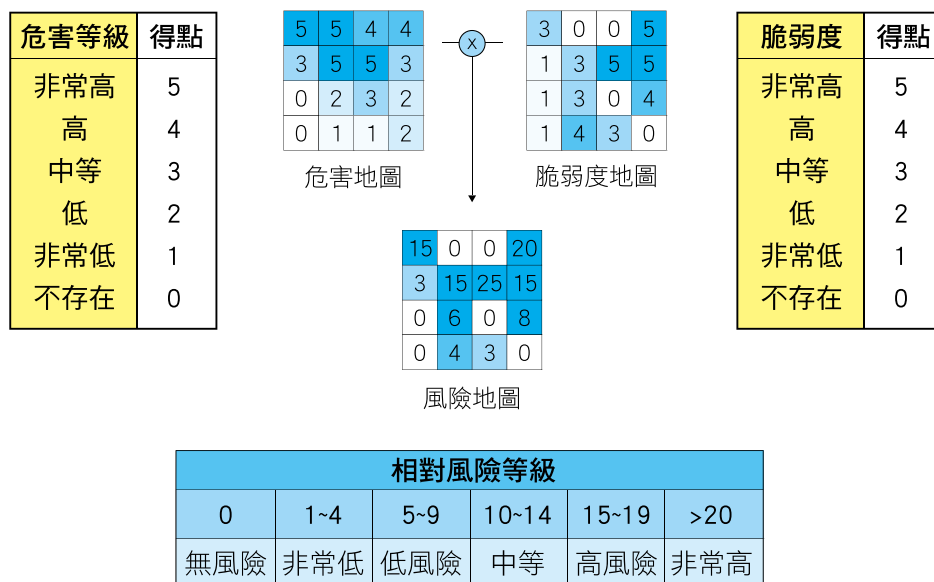


圖 4-2-7 失效模式與效應分析法, FIG. 4-2-7 Failure Mode and Effects Analysis Method



plans and emergency counter works of all units are relatively complete; however, in terms of the "resilience" and "vulnerability", there shows no relevant performances. This project is to understand the immediate response mechanism of the international transportation logistics system of our nation in depth and to establish a development blueprint for strengthening the supply chain resilience of the transportation department in order to improve the supply chain risk handling structure of the transportation logistics in our nation and to ensure the sustainability development of the enterprises of our nation.

To identify the risk factors of the international transportation logistics in our nation, this project uses the "Failure Mode and Effect Analysis (FMEA)" method as shown in FIG. 4-2-7 in order to perform analysis and assessment of the international transportation logistics risks on the five major export countries (Mainland China, Singapore, the U.S.A, Japan, Korea) of our nation and to propose counter strategies for each risk factor of the international Maritime and aerial shipping. As shown in Table 4-2-4 & 4-2-5.

The assessment result shows that the risk levels of the aerial shipping logistics operation of the five major export countries in our nation are mostly at the low risk level, and the operation items of higher risk only include the "airport facility damaged and shutdown",

險，較高風險的作業項目僅有「碼頭受災停止作業」、「港埠受天災影響關閉」、「颱風影響航行」等，另前往新加坡行經麻六甲海峽可能遭遇「船舶遭海盜劫持/恐怖活動」風險，前往美國可能遇到「人員罷工」的碼頭工人罷工風險，則分別屬於不同出口國家的特殊風險項目。若以我國至前五大出口國的海、空運輸物流作業相較，海運的風險相對較低，其可能原因是我國國際商港較多，一旦某一港口發生干擾事件，港口與港口間彼此仍具有相互替代支援的效果。

本計畫另依實務之推動進程，分為近程、中程及遠程之推動構想，分別針對不同進程階段規劃參與單位/合作夥伴、政策推動、發展策略、科技支援等構面的重點內容，初步研擬我國推動國際運輸物流供應鏈復原協作發展藍圖，以協調各政府部門以強化我國國際運輸物流供應鏈之復原協作能力；並建議建立一跨部會的「國際運輸物流持續營運工作會報」以及成立「國際運輸物流持續營運中心」做為運作單位，其組織架構(草案)如圖4-2-8。

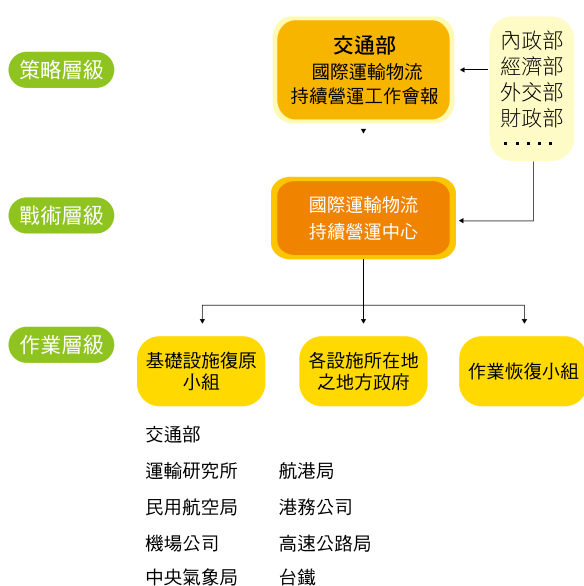
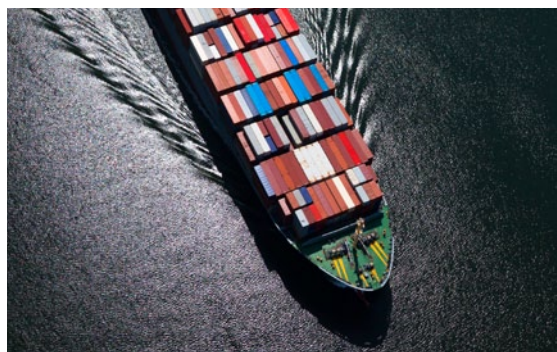


圖4-2-8 國際運輸物流供應鏈持續運作中心之組織架構(草案)
FIG. 4-2-8 Organization structure (draft) of international transportation logistics supply chain continuous operation center

"airport shutdown due to natural calamity", "runway unavailable due to accidents", "collision between aircrafts or between aircraft and ground service vehicle", "flights affected by typhoon" etc. The risk levels of the Maritime shipping logistics operation also belong to the low risk level mostly, and the operation items of higher risk only include the "dock shutdown due to disaster", "harbor shutdown due to natural calamity", "navigation affected by typhoon" etc., in addition to the risk of "ship encountering pirate hijack/terrorist activities" possibly encountered in the trip to Singapore via the Strait of Malacca and the risk of dock worker strike of "personnel strike" possibly encountered in the U.S., which belong to special risk items of export countries respectively. The comparison on the Maritime and aerial logistics operations of our nation to the current five major export countries shows that the risk of Maritime shipping is relatively lower, and it could be a result of the larger number of international commercial ports in our nation such that once a certain port is under certain interference events, there are still alternative supports from other ports.

In addition, this project further promotes the progress according to the actual practice, divided into the promotion concepts of short timer, intermediate term and long term, in order to plan the key contents of the structural aspects of the participated units/cooperative partners, policy promotion, development strategy, and technology support for different progress stages. Initially, the development blueprint for promoting the international transportation logistics supply chain recovery cooperation in our nation is proposed in order to coordinate each government department in strengthening the resilience of the international transportation logistics supply chain of our nation. Furthermore, it is suggested that a cross ministry and department of "international transportation logistic continuous operation working meeting" is to be established and an "international transportation logistics continuous operation center" is to be established as the operation unit, and its organization structure (draft) is as shown in FIG.4-2-8.



三、永續運輸 ●●●

(一) 永續發展綠運輸

自 1997 年京都議定書通過以來，國際上推動節能減碳以因應氣候變遷的行動即如火如荼的展開。身為國際村的一員，因應國際節能減碳發展趨勢，自民國 87 年迄今行政院已召開 4 次「全國能源會議」，並配合大會決議，廣續推動相關節能減碳行動方案。另外，行政院於 97 年 6 月 5 日第 3095 次院會中通過「永續能源政策綱領」，並於 98 年 12 月成立「節能減碳推動會」(於 103 年 5 月 20 日更名為「綠能低碳推動會」)，督導落實「國家綠能低碳總行動方案」。

III. Sustainable Transportation ●●●

(I) Sustainable development for green transportation

Since the pass of the Kyoto Protocol in 1997, the actions of promotions on the energy saving and carbon reduction to cope with the climate changes have been carried out extensively on a global scale. As a member of the international village, to cope with the international energy saving and carbon reduction development trend, the Executive Yuan has hosted 4 "National Energy Meeting" since 1988 and has consecutively promoted action solutions related to the energy saving and carbon reduction in line with the decisions of the meetings. In addition, in the No. 3095 meeting dated June 5, 2008, the Executive Yuan passed the "Sustainable Energy Policy Guideline" and established the "Energy Saving Carbon Reduction Promotion Committee" (renamed to the "Green Energy Low Carbon Promotion Committee") on May 20, 2014 in order to supervise the implementation of the "National Green Energy Low Carbon Total Action Solution".

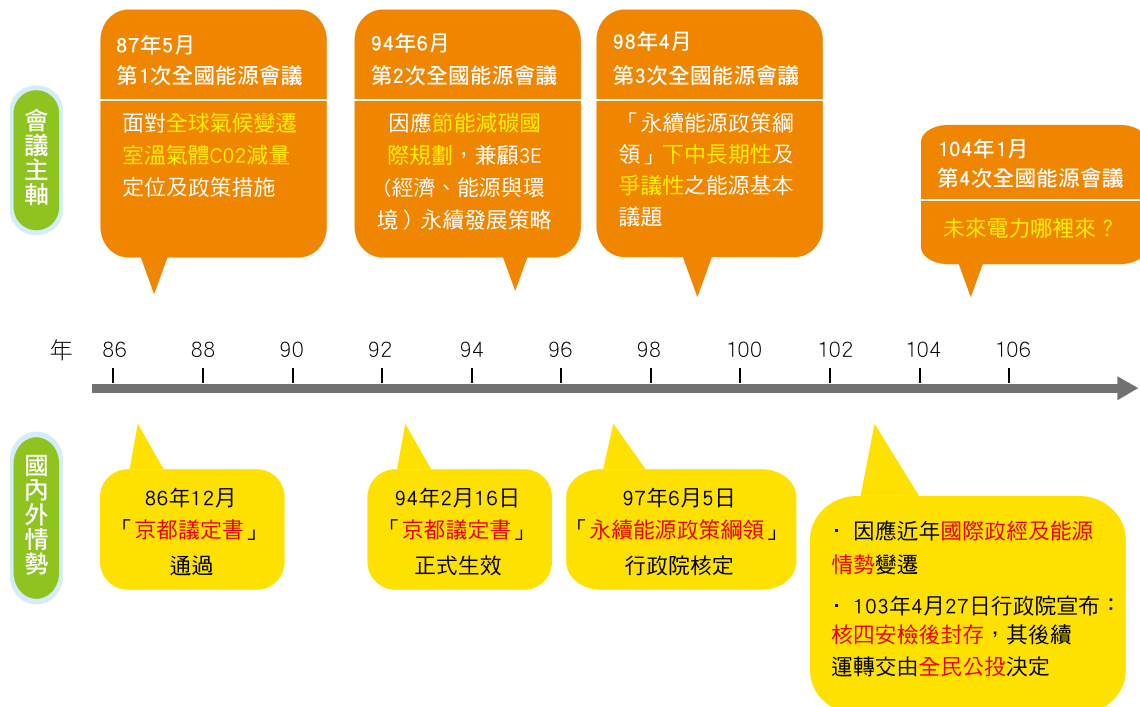


圖 4-3-1 我國全國能源會議召開歷程

FIG. 4-3-1 History of the national energy meeting hosted in our nation

資料來源：104 年全國能源會議會務簡報

Data source: 2016 National Energy Conference meeting presentation



圖 4-3-2 國家綠能低碳總行動方案

FIG. 4-3-2 National green energy low carbon total action solution

資料來源：行政院綠能低碳推動會

Data source: Green Energy Low Carbon Promotion Committee of Executive Yuan

我國於 104 年 7 月 1 日公布施行「溫室氣體減量及管理法」，揭櫫 2050 年的溫室氣體排放量要降至 2005 年排放量的 50% 以下，同時對外宣示「國家自定預期貢獻」(Intended Nationally Determined Contribution, INDC) 溫室氣體減量目標更是推動節能減碳的重要里程碑。為務實達成我國綠能低碳目標，行政院已於 105 年 1 月 5 日「行政院綠能低碳推動會 105 年度第 1 次委員會議」訂定部門年度減碳目標。

因應前述趨勢與國家政策，交通部將「推動永續綠色運輸，落實節能減碳政策」訂定為交通政策施政方針，並訂有相關綠運輸發展策略。而為實踐交通部施政目標，本所自 96 年起，已著手進行運輸部門各項節能減碳策略之評估模組開發，能同時考量經濟行為、能源消耗與

Our nation announced and implemented the "Greenhouse Gas Reduction and Management Act" on July 1, 2015 with the goal of reducing the amount of greenhouse gas exhaust in 2050 by more than 50% of the amount of exhaust of 2005. In addition, our nation has also announced to the public that the "Intended Nationally Determined Contribution (INDC) greenhouse gas reduction target is a key milestone for promoting energy saving and carbon reduction. To practically achieve the green energy low carbon goal of our nation, the Executive Yuan has stipulated the ministry annual carbon reduction target in the "2016 1st Committee Meeting of Green Energy Low Carbon Promotion Committee of Executive Yuan".

To cope with the aforementioned trend and the national policy, the MOTC has set the "Promoting sustainable green transportation, Implementing energy saving carbon reduction strategy as the transportation policy administrative implementation guideline" and has also stipulated relevant green transportation development strategies. To achieve the administrative implementation goal of the

運輸需求之關聯性，俾綜合評估運輸部門節能減碳策略與措施之成效，以作為我國運輸部門溫室氣體減量目標與因應策略之政策評估工具。以歷年之「運輸部門因應氣候變遷政策決策支援系統」研究成果為基礎，本系列研究執行迄今已能以總體國家資源投入角度分析運輸部門減碳效果，104 年度本所「城際運輸節能減碳策略評估模組開發及應用 (1/2)」已完成城際運輸需求模式導入，並開發城際運輸節能減碳策略評估模組，經由此模組完成高鐵增站與票價調降，以及蘇花公路貨運由公路運輸移轉為鐵路運輸等 2 項城際運輸節能減碳政策案例評估，計畫研究成果已支援「行政院綠能低碳推動會」與環保署「國家自定預期貢獻」(Intended Nationally Determined Contribution, INDC) 專案，研提運輸部門減量目標、研擬減量策略，以及估算成長基線。

此系列研究所建置之「運輸部門能源消耗與溫室氣體排放整合資訊平台」，提供近期運輸、能源與環保法規、運輸能源與溫室氣體評估方法、運輸部門相關節能減碳策略措施、運輸節能管理技術、以及我國歷年相關社會經濟資料庫、能源價格資料庫、溫室氣體參數與各運輸系統之能源消耗與排放估算資料，另已建



MOTC, the Institute has started the assessment module development of each energy saving strategy for the transportation department since 2007 along with the consideration on the correlation along the economic behavior, energy consumption and transportation demands in order to collaborative evaluate the performance of the energy saving carbon reduction strategies and measures of the transportation department such that it can be used as a policy assessment tool for the greenhouse gas reduction target and counter strategy of the transportation department of our nation. Based on the research outcomes on the “counter climate change policy and decision supportive system of transportation department” in the past years, this series of researches that have been executed to the present day are able to analyze the carbon reduction performance of the transportation department from the angle of the overall national resource investment. In 2015, the “intercity transportation energy saving carbon reduction strategy assessment module development and application (1/2)” by the institute has completed the introduction of the intercity transportation demand modes, and the intercity transportation energy saving carbon reduction strategy assessment module is has been developed. With such module, 2 assessments on the intercity transportation energy saving carbon reduction policy cases including the addition of stations for High Speed Rail and the reduction of ticket price as well as the cargo transportation at SuHua Highway transferred to road transportation. The project research outcome has supported the “Green Energy Low Carbon Promotion Committee of Executive Yuan” and the “Intended Nationally Determined Contribution (INDC) of the Environmental Protection Administration in the proposal of transportation department reduction target, stipulation of reduction strategy and evaluation of growth baseline.

The “transportation department energy consumption and greenhouse gas exhaust integrated information platform” established in this series of researches provides the estimated data for the short-term transportation, energy and environmental protection regulations, transportation energy and greenhouse gas assessment method, transportation energy saving management techniques as well as relevant social economic database, energy price database, greenhouse gas parameters and energy consumption and exhaust of each transportation system. In addition, the energy saving carbon reduction management module has also been established for easy estimation on carbon reduction performance of relevant transportation energy saving low carbon policies.

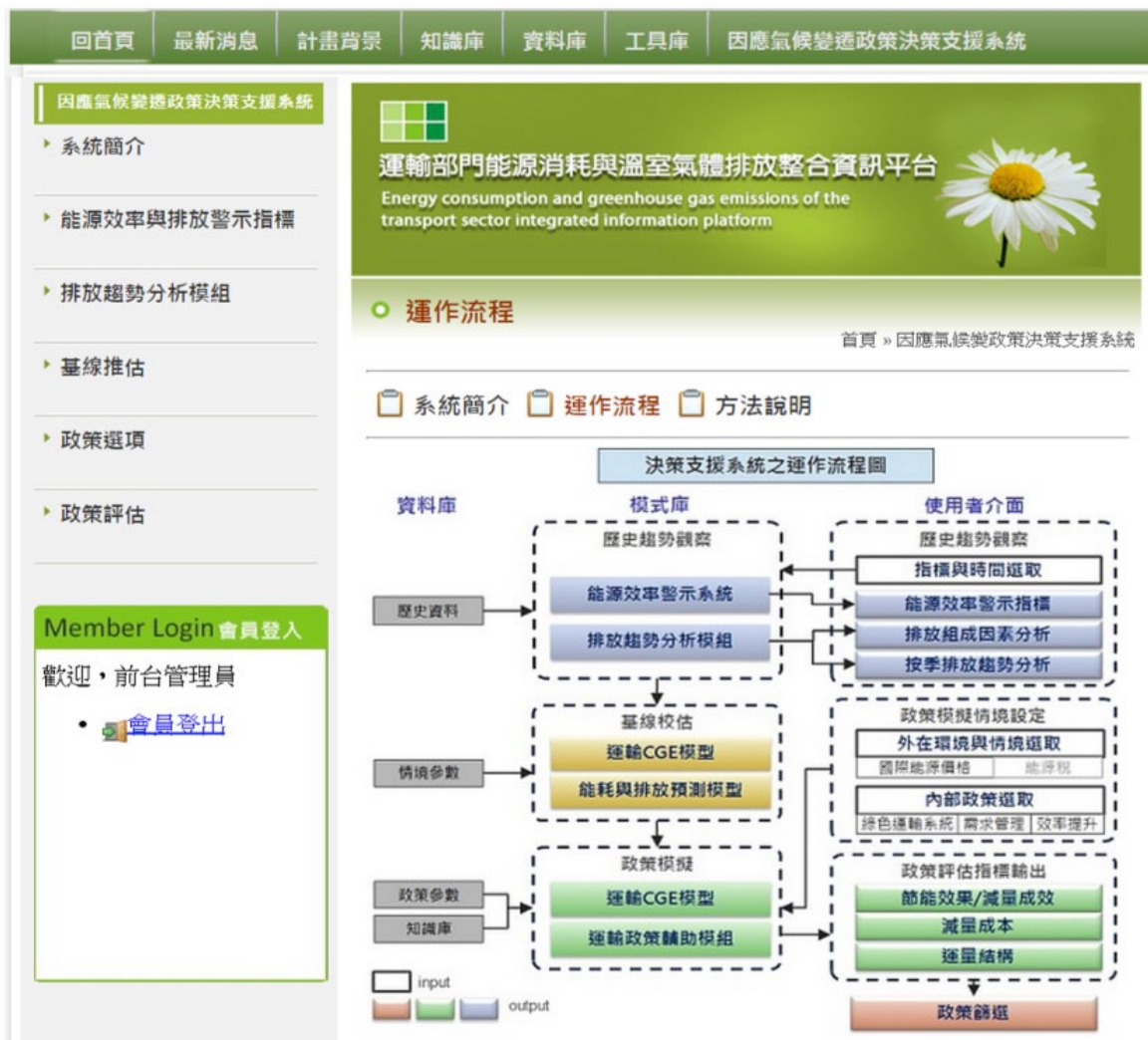


圖 4-3-3 運輸部門能源消耗與溫室氣體排放整合資訊平台介面

FIG. 4-3-3 Transportation department energy consumption and greenhouse gas exhaust integrated information platform interface

置節能減碳管考模組，可簡易估算相關運輸節能減碳政策之減碳效益，前述相關資料除可供相關專家學者掌握最新的運輸節能減碳相關統計及研究資訊外，同時也是運輸節能減碳政策研究之重要參考依據，亦肩負作為各界專家學者之資訊分享與交流平台之責任。相關實績證實本所在綠運輸推動持續投入研究，對協助交通部落實運輸部門永續發展與節能減碳政策之重要性。

The aforementioned relevant data is able to not only allow relevant experts and scholars to understand the latest transportation energy saving and carbon reduction related statistics and research information but also serve as an important basis of reference for the transportation energy saving low carbon policy researches, which also carries the responsibility of acting as a platform for information sharing and exchange among experts and scholars in all fields. Relevant achievements proof the continuous investments and researches in promoting the green transportation such that it is of great importance to assisting the MOTC in the implementation of the sustainable development and energy saving carbon reduction policy.

(二) 綠色能源 · LED 路燈照明

行政院為使我國得於 10 年內發展成為能源產業大國，並引領臺灣社會邁入低碳化與產業高值化目標，已於 98 年 4 月 23 日宣布啟動「綠色能源產業旭升方案」，其中在 LED 照明方面，已設定在 2015 年成為全球最大 LED 光源及模組供應國，產值達到新台幣 5,400 億元之國家目標。為達此目標，行政院於民國 98 年開始推動「LED 道路照明示範計畫」，在各縣市計 47 個示範地點，以 LED 路燈汰換耗能之水銀路燈，100 年再投入新臺幣 1.2 億經費推動「高效率道路照明節能示範計畫」，更於 101 年推出「LED 路燈節能專案示範計畫」及 103 年推動「水銀路燈落日計畫」，期望在 2018 年底，將全國總計達 81.5 萬盞（占全部路燈 51.9%）之水銀燈全數汰換，屆時預計將可節電達 5.18 億度，減少 CO₂ 排放 31.7 萬公噸。

(II) Green Energy · LED Road Lighting

For our nation to become a top energy industry nation within 10 years, the Executive Yuan has led Taiwan to head toward low carbon and high value industry targets and has announced the start of the Green Energy Industry Development Solution" on April 23, 2009, wherein for the LED lighting, the national goals of becoming the largest LED light source and module supply nation in the world by 2015 and the industry value reaching 540 billion dollars have been set. To achieve such goals, the Executive Yuan started the promotion on "LED Road Lighting Demonstration Plan" since 2009, and at 47 demonstrative locations of counties and cities have been installed with LED street lamps in replacement of mercury street lamps. In 2011, a further budget of NTD\$ 120 million dollars was invested to promote the "High Power Street Lighting Energy Saving Demonstration Plan". Moreover, the "LED Street Lamp Energy Saving Project Demonstration Plan" was launched in 2012 and the "Mercury Street Lamp Retirement Plan" was promoted in 2014. It is expected that by the end of 2018, the total number of 815 thousand units (51.9% of the overall street lamps) of mercury lamps in the nation are to be replaced, and by that time, it is expected that the energy saving would reach 518 million degrees with the reduction of CO₂ emission by 317 thousand tons.

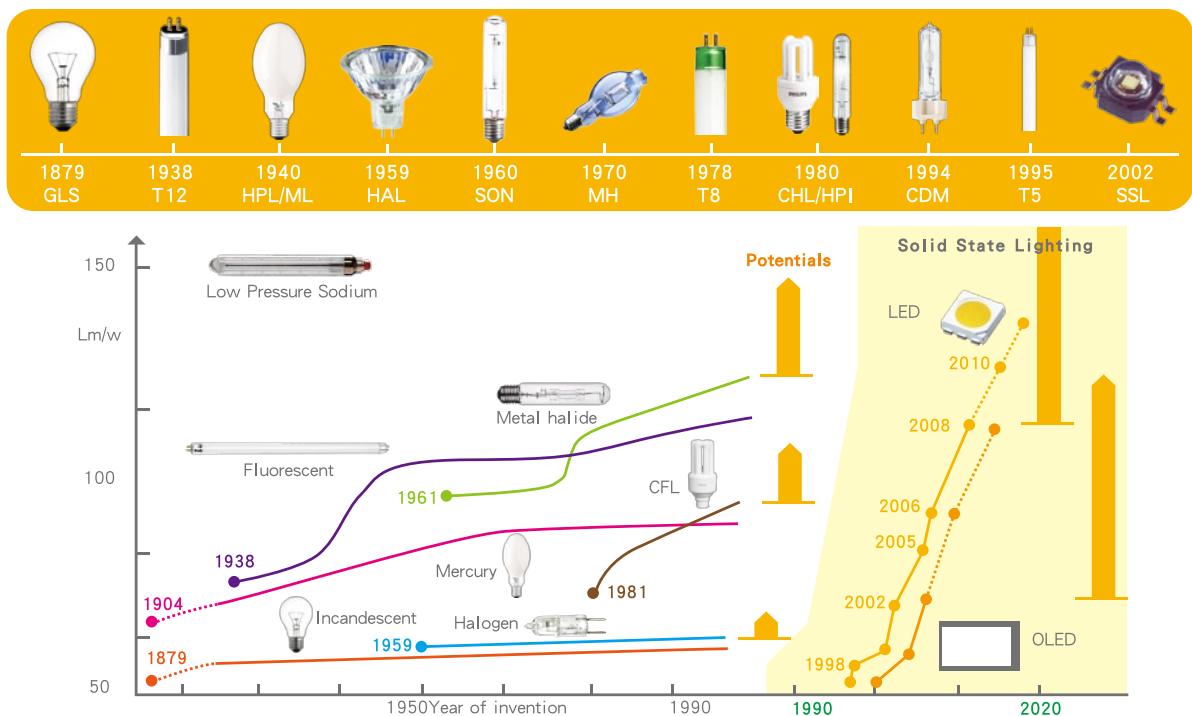


圖 4-3-4 照明技術演進

FIG. 4-3-4 Evolution of lighting technology

資料來源：<http://www.pida.org.tw>Data source: <http://www.pida.org.tw>



我國路燈多數仍為水銀路燈，數量約 94 萬盞，每年總耗電量超過 9 億度，其發光效率僅 35 lm/W，且有汞污染之問題，不符合目前環保、節能之訴求。目前經濟部能源局透過擴大公共建設應用 LED 照明產品方式，推動 LED 路燈應用示範計畫，97 至 102 年累計推動 28.4 萬盞以上之水銀路燈汰換為 LED 路燈，節能效果可達 60%，每年可節省道路照明用電約 1.8 億度，減少 11 萬噸 CO₂ 排放量。道路照明主要係提供交通安全、方向識別、減少事故及行人安全等 4 項服務，就交通部所主管之國道與省道而言，可各自區分為平原區、丘陵區、山嶺區及都市計畫區之路線，上開各種道路類型所需之照明需求各有差異。由於 LED 路燈與傳統路燈在光源特性、方向性、演色性、色溫、二次光學、燈桿高度、燈頭重量、維護方式及成本等部分，均有一定程度之差異，因此將對道路照明設計產生極大衝擊。世界各先進國家如美國、日本等，目前均仍以示範建置方式，累積相關經驗，以作為未來全面建置之參考。為配合暨因應經濟部未來 LED 路燈汰換計畫，

Most of the street lamps in our nation still are mercury street lamps, and the total number is approximately 940 thousand units with the annual total electricity consumption exceeding 900 million degrees. Due to the low luminous efficiency of 35 lm/W and the problem of mercury pollution, the mercury street lamps do not satisfy the current demands for environmental protection and energy saving. Presently, the Bureau of Energy of MOEA adopts the method of expanding the public infrastructure with the application of LED lighting product to promote the LED street lamp application demonstration plan. During 2008 to 2013, more than 284 thousand units of mercury street lamps were replaced by LED street lamps and the energy saving effect reached 60% with the annual street lighting electricity consumption reduced by approximated 180 million degrees, and 110 thousand tons of CO₂ emission was reduced. The street lighting is mainly for providing 4 services of traffic safety, direction identification, accident reduction and pedestrian safety etc. For the national highways and provisional highways managed by the MOTC, the roads can be divided into plain areas, hilly areas, mountain areas and urban plan areas, and the lighting requirements for each one of the aforementioned areas are different from each other. Since there are certain difference between the LED street lamps and traditional street lamps in terms of light source characteristic, directionality,



圖 4-3-5 測試計畫空拍

FIG. 4-3-5 Testing project aerial view

交通部門如何在兼顧交通安全、節能減碳及照明設備維運管養成本等目標下，預為研擬交通部門相關配合推動作法與配套措施，係刻不容緩之課題。

本研究於 103 年起於台 3 乙線 (龍原路) 進行 LED 路燈測試計畫，並以美國能源之星之規範，實際點燈測試 6,000 小時，記錄分析其實際使用成本效益，做為交通部及經濟部推動 LED 路燈政策之參據。另於經濟部技術處第 11 次標準調合會議公告測試規格及需求，選用基本規格應符合：發光效率 $\geq 100 \text{ lm/W}$ 、輸出功率 (100~150) W、色溫 $\leq 4000 \text{ K}$ 、演色指數 ≥ 70 模擬平均照度 $\geq 7.5 \text{ lx}$ 模擬照度均勻度 ≥ 0.25 。照明條件依據「交通工程手冊」照明標準平均照度 7 lx 以上，照度均勻度 (最低照度與平均照度比值) 須大於 0.25 平均輝度須 0.5 cd/m^2 以上同時參考，CNS 10779 M5 標準規定全般均勻度 (最低輝度與平均輝度比值) 須大於 0.35 門檻增量值 (T.I.) $\leq 15 \%$ 。

CRI, color temperature, secondary optics, height of lamp pole, weight of lamp head, maintenance and costs etc., currently, they are installed in a way of demonstrative construction in order to accumulate relevant experience as reference for future overall construction in full. Currently, all advanced countries, such as U.S.A. and Japan etc., still adopt the demonstrative installation method to accumulate relevant experience in order to be used as references for future overall comprehensive installations. To cooperate and cope with the future LED street lamp replacement plan of the MOEA, it is an urgent issue for the department of transportation to research and propose relevant cooperative promotion methods and complementary measures in advance for the department of transportation while satisfying the objectives of traffic safety, energy saving carbon reduction and lighting equipment maintenance and development costs at the same time.

In this research, the LED street lamp test project has been conducted for the National Highway No. 3B (Longyuan road) since 2014, and the specification of U.S. Energy Star has been implemented in order to perform actual street lamp illumination test for 6,000 hours, and the actual usage cost and effect are recorded and analyzed to be used as a reference for the MOTC and MOEA in promoting the LED street lamp policy. In addition, the 11th standard consolidation meeting of the Department of Industrial Technology of the DOIT has announced the testing specification requirement such that the basic specification selected for use shall satisfy: luminous efficiency $\geq 100 \text{ lm/W}$, output power (100~150) W, color temperature $\leq 4000 \text{ K}$, CRI ≥ 70 , simulation of average illuminance $\geq 7.5 \text{ lx}$, simulation of illuminance uniformity ≥ 0.25 . The lighting criteria according to the "Traffic Engineering Manual" indicates that the lighting standard average illuminous is above 7 lx, and the illuminance uniformity (lowest illuminance and average illuminance ratio) shall be greater than 0.25 and the average luminance shall be above 0.5 cd/m^2 ; in addition, with reference to the CNS 10779 M5 standard, it specifies that the full uniformity (lowest luminance and the average luminance ratio) shall be greater than 0.35, and the threshold increment (T.I.) $\leq 15 \%$.

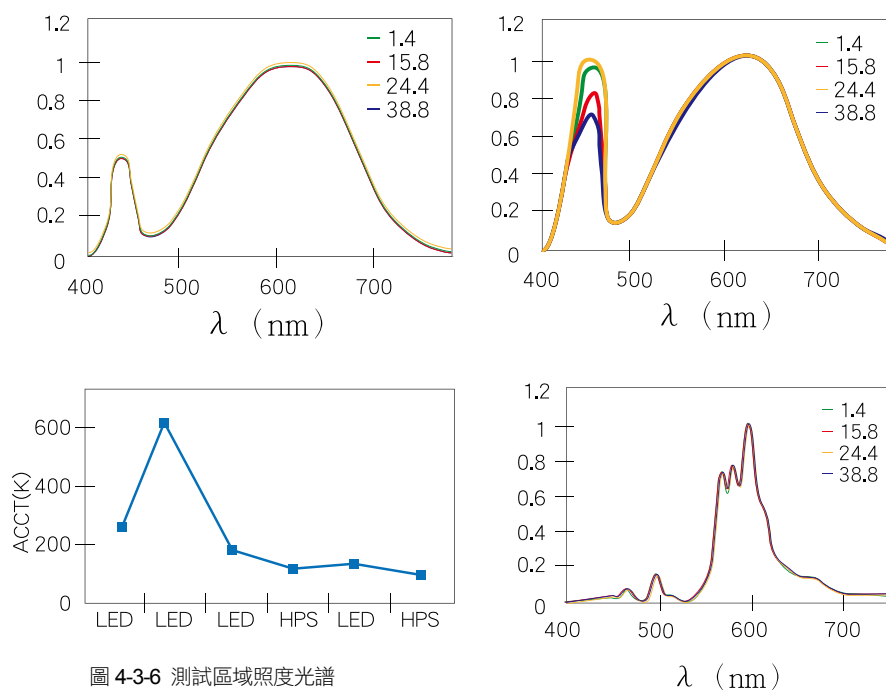


圖 4-3-6 測試區域照度光譜

FIG. 4-3-6 Illuminance spectra at test areas

資料來源：本計畫研究成果

Data source: Research outcomes of this project



圖 4-3-7 台 3 乙線 LED 路燈測試圖

FIG. 4-3-7 Photograph of LED street lamp test on National Highway No. 3B

本計畫主要進行 LED 路燈道路照明品質量測分析，以這些數據分析在現場環境下 LED 路燈之物理效能隨時間、天候、機電等因素之變動，可做為未來高快速公路或省道置換與新設路燈之參據。本計畫已於 104 年度完成 6,000 小時測試，包括節能性、光衰與光均勻性測試，結果已提供經濟部納入研訂「快速公路 LED 路燈標準（草案）」之參據。

This project is mainly to conduct the street lighting quality measurement analysis for LED street lamp in order to use such data to analyze the changes of the physical performance of LED street lamp under the actual environment due to the factors of time, weather, electromechanical parts etc. in order to be used as references for street lamp installation and addition on express highways or provisional highways in the future. This project has completed the 6,000-hour operation test in 2015, including the energy saving performance, light decay and light uniformity tests. The results have been provided to the MOEA for incorporation into the research and stipulation of "Express Highway LED Street Lamp Standard (Draft)".

(三) 日月潭低碳觀光智慧旅遊計畫執行成效推廣

日月潭國家風景區是台灣最著名的旅遊景點，每年吸引大量國內外觀光客到訪，但隨著遊客與小汽車的增加，不僅造成風景區內嚴重的交通擁塞，導致空氣品質逐漸惡化。為能解決上述問題，交通部運輸研究所與日月潭國家風景區管理處共同展開跨部會合作，以創新（innovative）、智慧化（intelligent）與樂趣（interesting）的 i3 Travel 理念，導入 ITS、ICT 以及低碳環保策略，推動「Park & Travel」的新型態旅遊方式，結合「公共運輸」、「低碳運具」、「交通管理」以及「智慧旅遊」等四大面向，經過 4 年計畫完成多項低碳觀光、智慧運輸之相關策略規劃與落實。藉由提供即時的適地性 (Location-Based Service, LBS) 交通及旅遊資訊服務以及低碳優質的無縫公共運輸，鼓勵遊客直接搭乘公共運輸進入潭區，或將私人運具停在日月潭區周邊後改使用低碳運具，以根本減少私人運具於日月潭地區之流入總量，進而改善日月潭國家風景區交通與空汙問題。

(III) Sun Moon Lake Low Carbon Tourism Intelligent Travel Plan Execution Achievement Promotion

The Sun Moon Lake National Scenic Area is one of the most well-known tourist spot, and it attracts a great number of domestic and foreign tourists to visit the area. However, with the increase of the tourists and cars in the area, it has not caused serious traffic jams in the scenic area but also cause degradation of air quality. To overcome the aforementioned problems, the Institute of Transportation of the MOTC has cooperated with the Sun Moon Lake National Scenic Area Administration to engage in a cross ministry and department cooperation based on the i3 Travel Concept of innovative, intelligent and interesting in order to introduce the ITS, ICT and low carbon environmental protection strategy and to promote the new way of travel of "Park & Travel" in combination with the four aspects of the "public transportation", "low carbon transportation vehicles", "traffic management" and "intelligent travel". After the 4-year project, various strategic planning and implementation related to low carbon tourism and intelligent transportation have been completed. By providing the Location-Based Service (LBS) traffic and travel information service in real time and seamless public transportation of low carbon and high quality, tourists are encouraged to take public transportation to enter the lake

STRATEGY-Public Transportation



圖 4-3-8 公共運輸策略, FIG. 4-3-8 Public transportation strategy

在公共運輸策略方面，本計畫由時間、空間、資訊、服務等四個面向，針對日月潭區內(環湖地區)與聯外交通兩部分，進行公共運輸縫隙的檢核，並提出日月潭地區公共運輸發展策略建議，勾勒一整體旅遊情境(如圖 4-3-8)。

在低碳運具策略方面，導入全新電動公車以及電動車共享(EV-Sharing)服務，並將柴油環湖船汰換為電動環湖船，除了可滿足各種遊客不同需求外，並透過旅運系統整合提升整體旅運服務品質。其中低碳環湖電動公車服務是與環保署共同合作推動，車上並配置多媒體語音導覽及公車動態資訊顯示系統，使日月潭國家風景區成為臺灣第一個全面使用電動公車的國家風景區(如圖 4-3-9)。另一項電動車共享(EV-Sharing)服務是與經濟部共同合作推動，透過高品質的電動車(iQ-EV)在環湖區域旅遊，此一共享方式可有效降低車輛閒置時間，提升車輛使用周轉率，以更節能環保方式體驗日月潭的美。而在每一台電動車上所配備的先進導航服務(Advanced Navi Services, ANS)，更是針對日月潭旅遊特性所開發的專屬旅遊導航系統，可透過適地性服務(Location Based Services, LBS)以及多媒體資訊帶領遊客進行日月潭深度旅遊服務(如圖 4-3-10)。



圖 4-3-9 日月潭低碳環湖電動公車

FIG. 4-3-9 Sun Moon Lake low carbon lakeside electric buses



圖 4-3-10 日月潭電動車共享服務

FIG. 4-3-10 Sun Moon Lake electric vehicle sharing service

area directly or to park private vehicles at the surrounding of the Sun Moon Lake and followed by taking low carbon transportation means in order to fundamentally reduce the total volume of private transportation vehicles entering the Sun Moon Lake area such that the traffic and air pollution problems of the Sun Moon Lake National Scenic Area can be improved.

With regard to the public transportation strategy aspect, based on the four aspects of time, space, information and service, for the two parts of the internal (lakeside area) and the external connection traffic of the Sun Moon Lake, this project conducts reviews on the seamlessness of the public transportation and proposes strategic suggestion on the public transportation development of the Sun Moon Lake area in order to depict an overall travel scene (as shown in FIG. 4-3-8).

With regards to the low carbon transportation vehicle strategy, brand new electric bus and electric car sharing (EV-sharing) service are introduced, and the diesel lake boats are replaced with electric lake boats such that it is able to not only satisfy different demands of various passengers but also use the passenger transportation system integration to increase the overall passenger transportation service quality. Wherein, the low carbon lakeside electric bus service is promoted together with the Environmental Protection Administration and the buses are equipped with multimedia voice tour guidance and bus dynamic information display system such that the Sun Moon Lake area becomes the first national scenic area to use electric buses completely (as shown in FIG. 4-3-9). In addition, the EV-Sharing service is promoted together with the MOEA. By traveling in electric vehicle (iQ-EV) of high quality at the lakeside area, such sharing method is able to effectively reduce the vehicle idle time and to increase the vehicle turn over usage rate in order to enjoy the beauty of Sun Moon Lake with a more energy saving and environment friendly way. Moreover, each electric vehicle is equipped with the Advanced Navi Services (ANS) and it is a specialized traveling navigation system developed specifically based on the traveling characteristics of Sun Moon Lake, which allows the use of Location Based Services (LBS) and multimedia information to guide the tourists with in depth travel service at Sun Moon Lake (as shown in FIG. 4-3-10).



圖 4-3-11 日月潭低碳觀光電子旅遊套票

FIG. 4-3-11 Sun Moon Lake low carbon electronic traveling ticket package



在交通管理策略方面，為能有效解決過多小汽車湧入日月潭地區所衍生的交通問題，我們提出「多階層交通管制與車輛分流導引」策略，透過跨部門資訊整合作業，提供區域交通協調管理整合運作，並且有效協助日月潭風景區管理處進行大型活動的交通管制措施與疏散作業。

在智慧觀光策略方面，推動「日月潭低碳觀光電子旅遊套票創新服務」，共同發展低碳運輸與商業之 PPP (Public-Private Partnership) 整合模式，進一步提供旅客體驗完整的低碳旅遊及智慧運輸的環境。此項創新服務透過電子票證串聯在地低碳旅遊之交通與商業店家，並提供日月潭電子旅遊套票專屬 APP 服務，推動完整的智慧運輸與低碳觀光服務平台，以提供智慧便利的區域旅遊整合服務 (如圖 4-3-11)

正值 2015 年聯合國巴黎氣候高峰會議落幕，推動減碳與潔淨再生能源再度成為全球關心的重要議題，日月潭低碳觀光智慧旅遊計畫之成果正因充分實踐此趨勢，贏得亞太經濟合作會議 (APEC) 能源智慧社區倡議 (Energy Smart Community Initiatives, ESCI)」最佳案例評選之智慧運輸類金獎 (如圖 4-3-12、圖 4-3-13)，在近 150 件參賽作品中脫穎而出，獲評審團一致肯定並以高分超越南韓首爾無車日案例！透過此計畫能夠有效地降低私人運具使用量，並使日月潭碳排放量大幅減少，是個值得驕傲的成功案例，如今更是讓臺灣能在國際中展露頭角，成為國際上低碳旅遊與智慧運輸的標竿計畫。



左圖 4-3-12 榮獲 APEC 金獎殊榮

FIG. 4-3-12 Golden award honorably received from APEC

圖 4-3-13 頒獎典禮合影

FIG. 4-3-13 Ceremony group photograph

With regard to the traffic management strategy aspect, to effectively overcome the traffic problem caused by excess amount of cars in the Sun Moon Lake area, we have proposed the strategy of "Multi-Level Traffic Control and Vehicle Branching Guidance". Through integration operation cross ministries and departments, regional traffic coordination management integrated operation is provided, and it is able to effectively assist the Sun Moon Lake Scenic Area Administration to perform traffic control measures and evacuation operations for large events.

With regard to the intelligent tourism strategy aspect, the "New Service of Sun Moon Lake Low Carbon Tourism Electronic Ticket Package" is promoted along with the development of low carbon transportation and commercial PPP (Public-Private Partnership) integration model in order to allow tourists to experience a complete environment of low carbon travelling and intelligent transportation. Such innovative service utilizes electronic tickets to connect the local traffic and commercial stores for low carbon traveling and provides the specialized APP service for the Sun Moon Lake electronic travelling ticket package in order to promote a complete platform for intelligent transportation and low carbon tourism service such that an intelligent and convenient integrated regional traveling service is provided (as shown in FIG. 4-3-11).

With the 2015 United Nations Climate Change Conference (in Paris), the promotions of carbon

reduction and clean reusable energy have become important subjects globally. The achievement of the Sun Moon Lake low carbon tourism intelligent travel project sufficiently reflects such trend and has won the golden award in the intelligent transportation category outstandingly selected and evaluated by the Energy Smart Community Initiatives (ESCI) of APEC (as shown in FIG. 4-3-12 and FIG. 4-3-13). Among nearly 150 projects submitted for competition, this project stood out and received consistent recognition from the judges and with high scores surpassing the no-vehicle date project launched in the Seoul, South Korea! With such project, the usage amount of private transportation vehicles can be effectively reduced and the carbon emission at Sun Moon Lake can be significantly reduced, which is a successful case to be proud of. Now, it is also a case allowing Taiwan to lead and shine internationally and to become a landmark project for low carbon traveling and intelligent transportation around the world.

四、運輸安全 ●●

(一) 制訂機車交通政策白皮書

機車因具有機動性強、可及性高、成本低廉、停車方便等特性，是國內主要使用的交通工具之一。依據臺灣地區機動車輛統計，103年登記機動車輛總數約2,129萬輛，其中機車數量達1,373餘萬輛；同年道路交通事故資料亦顯示，機車乘員涉入之交通事故，占總死亡人數超過6成，占總受傷人數超過8成以上，詳圖4-4-1。機車安全與使用問題，已是交通問題中，最需要關心的議題。機車事故傷亡嚴重，主要原因在於：工程環境設計是以汽車為對象、行駛速度過高或不當、駕駛能力不足、以及習慣於機車之經濟方便而忽略其風險等，而速度又是造成事故嚴重度的重要關鍵因素之一，詳圖4-4-2。

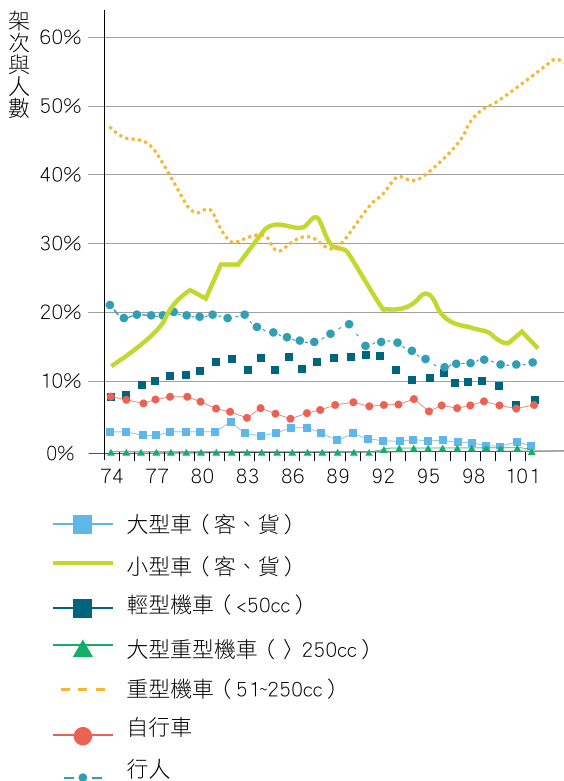


圖 4-4-1 歷年各車種死亡人數占總死亡數百分比

FIG. 4-4-1 Percentage of number of deaths of each type of vehicles over total number of death in the past years

IV. Transportation Safety ●●

(I) Stipulation of motorcycle traffic policy proposal

Due to the characteristics of high mobility, high accessibility, low cost, convenience to park, the motorcycle has become one of the main transportation tool in our nation. According to the automobile statistics in the region of Taiwan, the total number of registered automobiles in 2014 was approximately 21.29 million units, in which the number of motorcycles reaches more than 13.73 million units. The road traffic accident data of the same year also indicated that the traffic accidents involving motorcycle passengers accounted for more than 60% of the number of deaths in total, which was approximately more than 80% of the number of injuries in total, as shown in FIG. 4-4-1. Motorcycle safety and usage problems have become one of the most concerned issues to be dealt with among the traffic problems. The reason that motorcycle accidents lead to serious deaths and injuries is mainly due to: the engineering environment design based on cars, driving at speeds too high or improper, inadequate driving skills and the custom to the economic convenience of motorcycle such that its risks are overlooked; in addition, speed is also one of the crucial factor leading to the severity of accidents. As shown in FIG. 4-4-2.

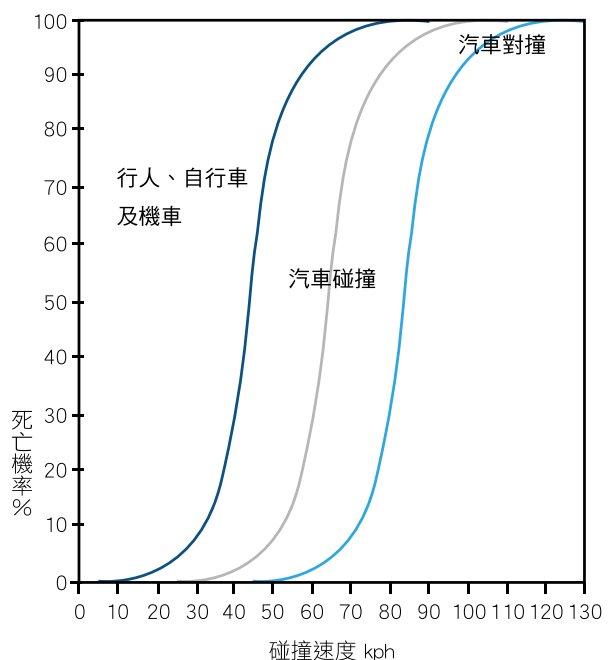


圖 4-4-2 不同運具發生事故之碰撞速度與死亡機率圖

FIG. 4-4-2 Collision speed and death probability chart for different transportation vehicle with accidents



圖 4-4-3 改善機車安全之對策與目的
FIG. 4-4-3 Strategy and objective of improving motorcycle safety

由人、車、路及社會文化所衍生影響機車安全的關鍵課題，本白皮書研提 4 項改善對策，即「安全道路」、「安全文化」、「安全駕駛」、「安全車輛」等，4 項改善對策及其推動目的如圖 4-4-3 所示。「安全道路」的目的為達到共享道路空間、減少轉向衝突；「安全文化」涉及與交通安全有關的社會系統脈絡，包括風險態度、駕駛習慣、運具使用習慣等，其目的在於培養禮讓習慣、降低行車速度；「安全駕駛」的目的在於提升年輕族群駕駛經驗技能、增進高齡者適應環境能力；最後，「安全車輛」的目的則希望鼓勵機車使用者轉用安全運具，以及轉乘公共運輸工具。

為聚焦於問題之改善，藉由建構 4 項治理方案，即「友善行駛環境」、「控制速度風險」、「提昇駕駛能力」與「選擇多元運具」等，做為系統性推動機車交通政策的核心架構：

1. 「友善行駛環境」方案在於透過法規與執法、

With respect to the key subjects on the motorcycle safety derived from people, cars, roads and society culture, this proposal outlines 4 improvement strategies, including the "road safety", "culture safety", "driving safety" and "vehicle safety" etc. The 4 improvement strategies and promotion objectives are as shown in FIG. 4-4-3. The objective of the "road safety" is to achieve road space sharing and reduction of conflicts at turning. The "culture of safety" is related to the society system network associated with the traffic safety, including the risk attitude, driving habit, transportation tool usage habit etc., and its objective is to develop the habit of yielding and to reduce the driving speed. The objective of "driving safety" is to increase the driving experience and skills of the young drivers and to improve the environment adaptive skills of elders. Finally, the objective of "vehicle safety" is to encourage motorcycle users to change to use safety transportation tools and to change to take public transportation tools.

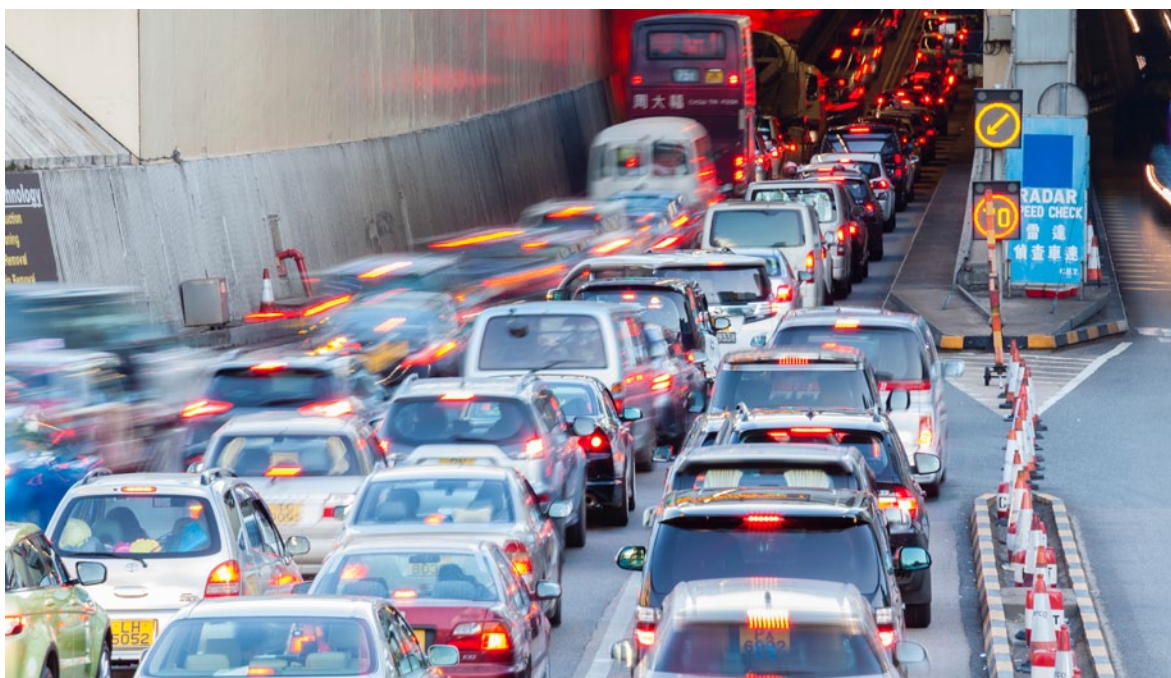
To focus on the improvement of the problem, 4 improvement solutions are established, including "friendly driving environment", "control speed risk", "increase driving ability" and "choose diverse transportation tools" etc. in order to be used as the core structure for systematically promoting the motorcycle traffic policy:



空間重分配、工程手段等方式，正視機車行駛的合理空間，即平等對待汽、機車的使用需求，以減少環境設置不當所引發的危險。

2. 「控制速度風險」方案則透過建立高速行駛具高危害性的社會共識與安全文化，從行為面、執法面、工程面改變駕駛人態度與習慣，對於容易發生事故的路口及路段，讓所有車輛均能適時適所地降低速度，增加駕駛人反應時間，避免事故之衝突。
3. 「提昇駕駛能力」方案區分年輕駕駛人與高齡駕駛人兩類高風險族群，藉由教育訓練、能力辨識的監理機制，輔導新手駕駛人提昇經驗、危險察覺與技術能力，並建立高齡駕駛者繼續或放棄使用機車的適當安全機制。
4. 「選擇多元運具」方案強調選擇適當情境，鼓勵機車族改變使用習慣，極短途以步行、自行車等綠運輸方式，長途通勤以公共運輸為主要交通工具，可減少長途、頻繁使用機車所帶來的風險；並導入 3 輪機車等較穩定之車型，提供國人多元選擇，可間接提昇交通安全。

期望藉由本白皮書的頒布，將傳統「管理」的觀念轉為「治理」的觀點，建立政府與民眾的合作夥伴關係，而非對立的兩邊。政策的推動牽涉對民眾行為的規範，初期難免需要適應，成就美好需要代價，需要政府與民眾的共同合作。在大家同心協力之下，我國的交通安全水準得以邁入世界先進國家之林，儘快達到「型塑禮讓、安全的機車環境」的願景，預期未來 10 年（2016 年為開始年，2025 年為目標年）可達成「機車死亡人數降低 30%、受傷人數降低 20%」之政策目標，為國民帶來更多幸福。



- 1.The solution of “friendly driving environment” is to utilize the methods of regulations and law enforcement, space weight distribution, engineering techniques etc. in order to evaluate the reasonable space for motorcycle driving, meaning that the usage requirements of cars and motorcycles are to be dealt equally such that hazards due to improper environmental installations can be reduced.
- 2.The solution of “control speed risk” is to establish the social consensus and safety culture on high danger of driving at high speed such that from the behavior aspect, the law enforcement aspect, engineering aspect to change the attitude and habit of drivers. For road intersection and road sections prone to accidents, allow all vehicles to have appropriate time and space to reduce speed properly and to increase the response time of drivers in order to prevent conflicts of accidents.
- 3.The solution of “increasing driving ability” is to classify the high risk groups into two types of young drivers and senior drivers. Through educational training and monitoring mechanism of ability identification, guiding new drivers to increase experience, hazard discovery and technical skills in addition to the establishment of appropriate safety mechanism for senior drivers to continue or abandon the use of motorcycles.
- 4.The solution of “chose diverse transportation tools” emphasizes the selection of appropriate scenarios

and encourage motorcyclists to change their use habit in such a way of using green transportation means of walking and bicycles etc., for short journey and taking public transportation for a long journey and commute as the main transportation tools; therefore, the risks associated with the long journey, frequent use of motorcycles can be reduced. In addition, the vehicle types of 3-wheel motorcycles that are more stable can be introduced in order to provide diverse selection for the public and to indirectly increase the traffic safety.

With the publication of this proposal, it is expected that the traditional concept of management” can be changed to viewpoint of “governance” in order to establish a cooperative partner relationship between the government and the public rather than as two opposing sides. The promotion of the policy requires regulation on the actions of the public, and it would require adaption at the initial stage; there is a cost for achieve the great future, which requires common cooperation between the government and the public. Under the common cooperation of all groups, traffic safety standard in our nation would be able to head toward the top advanced countries and to reach the vision of “shaping a yielding and safety motorcycle environment”. It is expected that the policy objective of “reducing the number of death of motorcyclists by 30%, number of injuries thereof by 20%” in the next 10 years (starting from 2016, and 2025 as the target year) such that greater fortune is provided to the public.

五、交通大數據應用 ●●●

(一) 導入科技 提昇公車路網規劃品質

「公共運輸縫隙掃描決策支援系統」係就本所先前研發之「先進公共運輸系統整合資料庫加值應用系統」與「公共運輸系統區域發展指標評估系統」整合在共通平臺中；前者主要提供路線評估指標衡量公車服務缺口，後者主要提供區域評估指標衡量當地公共運輸發展程度，二者功能未重覆但應用時具有相互輔助之效，且因系統所需軟硬體設備及資料庫內容相近，爰本計畫將兩個系統整合在共通平臺中，以增進系統使用之便利性、節省設備購置與系統維運經費。本系統另依使用者需求擴增功能，例如納入電子票證資料分析功能。

「公共運輸縫隙掃描決策支援系統」導入交通部公路總局及各縣市政府所建立之「公車動態資訊系統」資料庫結合內政部「國土資訊系統」社會經濟資料庫之戶籍人口空間資料進行加值應用，透過大數據分析技術產出評估指標值，篩出搭乘公車不便之運輸節點作為改善重點對象，其形態包括公車站牌距離太遠、公車班次稀疏、沒有公車到達重要地標、搭乘公車時間遠較自行開車長等；本系統可就交通主管機關研擬之改善方案分析方案實施後之評估指標值變化，以研判該方案是否具顯著改善成效。

為提昇地方政府以系統化分析方法，規劃符合民眾搭乘需求之公車路網服務，本所與中華大學組成輔導團隊，協助地方政府運用「公共運輸縫隙掃描決策支援系統」，找出公車服務縫隙與需求潛力熱區，以利交通主管機關對症下藥規劃具改善成效之路線方案，輔導應用案例包括掃描 30 個原住民鄉之公共運輸無縫服務環境以及掃描高鐵新闢車站、觀光景點及大專院校聯外運輸無縫服務環境等。以輔導新竹市政府為例，為增進中華大學學生搭乘公車便利性，減少學生依賴機車外出所帶來之安全隱

V. Traffic Big Data Application ●●●

(I) Introduction of Technology & Increase Bus Road Network Planning Quality

"Public Transportation Gap scan Decision Support System" refers to a common platform in which the "Advanced Public Transportation System Integration Database Value-Added Application System" and the "Public Transportation System Regional Development Index Assessment System" developed by the institute earlier. The former is mainly provided for the route assessment index evaluating gaps in the bus services, and the latter is mainly provided for regional assessment index for evaluating the level of development of the local public transportation. The functions of the two are not overlapped but are of complementary effect with each other during the application. In addition, since the software and hardware equipment and database content required by the systems are similar, this project integrates the two system into one common platform in order to increase the convenience of the use of the system and to save the equipment procurement and system maintenance costs. This system further includes additional functions based on the user needs, such as the incorporation of the electronic ticket data analysis function.

The "Bus Dynamic Information System" database established by the Directorate General of Highways of the MOTC and governments of counties and cities is introduced into the "Public Transportation Gap scan Decision Support System" along with the household population space database of the social economic database of the "National Geographic Information System" by the MOI in combination in order to perform the value-added application. Through Big Data analysis, an assessment index value is generated in order to screen out the transportation nodes inconvenient to buses as the key targets for improvement, and the types of nodes include those with distance too far from bus stops, few scheduled buses, bus not reaching important landmark, the time for taking bus being longer than the time for bicycles etc. This system is able to determine whether the solution is of obvious effects of improvements based on the improvement solution proposed by the authority and the analysis on the changes of the assessment index value after the implementation of the solution.

To enhance the local government using systematic analysis method for planning the bus road network service meeting the public demand in taking buses,

憂，在經過學生問卷調查及使用本系統針對中華大學所研擬之方案進行評估後，新竹市政府根據本系統評估數據快速地確認有效方案，將原屬公路客運之苗栗客運 5809 路線納為新竹市區公車綠線，並於中華大學校園內設站，縮短學生至校園外搭車之步行時間，此外該路線亦從新竹車站延駛至經國路口，以滿足學生及香山區民眾至巨城購物中心及臺大醫院新竹分院之需求。因為公車進校園符合交通部施政鼓勵方向，且計畫書附有本系統產製之評估指標數據作為佐證，有助公路總局快速判斷計畫預期成效，該局已同意給予新竹市政府補助經費執行本改善計畫，因此該路線已於 104 年 12 月 25 日正式通車。預計 105 年中該路線將再增開每日往返各 16 班次提供中華大學直達新竹車站服務，由於行駛直捷路徑，行車時間可縮短達 15 分鐘。根據桃竹苗區域運輸發展研究中心所進行之問卷調查，因為改善方案之路線規劃符合學生需求，學生搭乘公車意願可由 44% 提升至 70%。



the institute together with the Chung Hua University to form a guidance team for assisting the local government in utilizing the "Public Transportation Gap scan Decision Support System" in order to find out the bus service gaps and potential hot spots of demands and to facilitate the traffic authority in the planning of route solutions with improved effects. Examples of the guiding application include the scanning of the public transportation seamless service environments of 30 indigenous villages and the scanning of High Speed Rail new stations, tourist spots and college and university external connection transportation seamless service environments etc. In the example of the guidance for the Hsinchu Government, to increase the convenience of the students of the Chung Hua University in taking buses and to reduce the safety concern on students relying on motorcycles, after student surveys and the use of this system to conduct assessment on the solution proposed for the Chung Hua University, the Hsinchu Government was able to determine an effective solution based on the assessment data of this system by incorporating the No. 5089 Bus of the Miaoli Motor Transportation originally belonging to the highway bus transportation into the Hsinchu City bus green line and to set up a stop inside the campus of the Chung Hua University in order to reduce the walking time of the students to the bus stop outside the campus, and this route also passes the Hsinchu Station to the Jingguo Road intersection in order to satisfy the needs of the students and the people at the Xiangshan District traveling to the Big City shopping center and the National Taiwan University Hospital Hsinchu Branch. Since the bus drives into the university campus, complying with the encouragement purpose of the administration of the MOTC, and the proposal is enclosed with the assessment index data generated by this system as evidence, it is able to facilitate the Directorate General of Highways in determining the project expected achievement in a swift manner such that the agency has agreed to provide subsidy to the Hsinchu Government for executing this improvement project. As a result, the route has been officially opened on December 25, 2015. It is expected that in 2016, the route would further provide the service of 16 shifts daily between the Chuang Hua University and the Hsinchu station directly. Since the driving passes through direct paths, the traveling time can be reduced by 15 minutes. According to the survey conducted by the Tao-Zhu-Miao Regional Transport Development Research Center, since the route planned in the improvement solution satisfies the needs of the students, the will of the students in taking the buses increases from 44% to 70%.

CH1
所長的話

CH2
組織與人力

CH3
施政概況

CH4
重點研究介紹

CH5
落實應用實績

CH6
大事紀要



本所與中華大學組成之輔導團隊已輔導 14 個有意願之縣市政府使用本系統，包括桃園市、臺南市、基隆市、新竹市、嘉義市、新竹縣、彰化縣、南投縣、雲林縣、嘉義縣、屏東縣、宜蘭縣、花蓮縣及金門縣政府。此外，本計畫並完成 30 人次之教育訓練活動，根據輔導對象滿意度問卷調查（計回收 22 份問卷），其對於本系統滿意度平均為 4.4 分（滿意等級最高為 5 分），顯示受訪者認為本系統確有助於未來進行公車路線規劃評估。

考量地方政府人力有限，部分縣市政府甚至沒有交通局處單位，交通部補助學界成立 6 個「區域運輸發展研究中心」，除協助地方政府與產業界進行人才培育外，亦可就近協助區域內地方政府構思在地公共運輸發展相關議題，因此本所未來將與 6 個「區域運輸發展研究中心」合作廣續協助地方政府使用本系統，以提昇公車路線規劃品質。

The guidance team formed by the institute and the Chung Hua University has guided 14 governments of counties and cities with the will to use this system, which includes the city governments of Taoyuan, Tainan, Keelung, Hsinchu, Chiayi, Hsinchu, and the county governments of Hsinchu, Changhua, Nantou, Yunlin, Chiayi, Pingtung, Yilan, Hualien and Kinmen. In addition, this project also completes the educational training activities for 30 people, and based on the guidance target satisfaction survey (22 surveys collected in return), it shows that the average satisfaction on this system is of the score of 4.4 (the maximum score of satisfaction is 5), showing that the respondents believe that this system can indeed facilitate the bus route planning and assessment in the future.

With the consideration of the limited manpower of the local governments, some governments of counties and cities are even devoid of the installation of traffic bureau or department units; the MOTC has assisted the academic institutes to set up 6 "Regional Transportation Research Centers" such that they would not only assist the local government and the industrial fields to perform talent cultivation but also assist the local government in the region to formulate relevant subjects of local public transportation development. Therefore, the institute will continue to cooperate with the 6 "Regional Transportation Research Centers" in the future to assist the local governments in using this system in order to increase the bus route network planning quality.



圖 4-5-1 公共運輸縫隙掃描決策支援系統功能架構圖

FIG. 4-5-1 Public transportation gap scan decision support system functional infrastructure diagram



圖 4-5-2 發現空間服務縫隙情境之決策流程

FIG. 4-5-2 Decision flow for discovering space service gap scenario



圖 4-5-3 發現時段性服務縫隙情境之決策流程

FIG. 4-5-3 Decision flow in discovering time-interval service gap scenario



圖 4-5-4 節點連結可及性不佳情境之決策流程

FIG. 4-5-4 Decision flow for poor node connection accessibility



圖 4-5-5 節點連結移動性不佳情境之決策流程

FIG. 4-5-5 Decision flow for poor node connection mobility

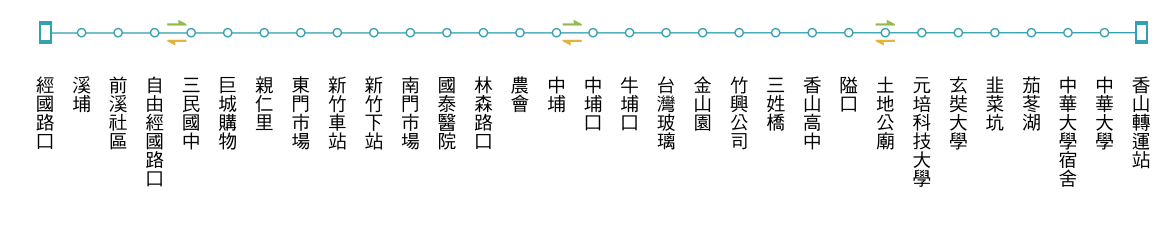


圖 4-5-6 新竹市公車綠線「經國路→香山轉運站」設站地點及行駛班次

FIG. 4-5-6 Hsinchu bus green line “Jingguo Road → Xiangshan transfer station” stop setup location and bus schedule



圖 4-5-7 輔導縣市政府之教育訓練活動

FIG. 4-5-7 Educational training event for guiding governments of counties and cities

(二) 永續維運，強化大數據加值應用與支援決策

為利使用者了解平台資料可利用之方向，本研究提出數個數據應用之建議方向，包括不同分區基礎之起迄統計、捷運轉乘型態推估與品質成效評估、車站人潮時間分布統計、系統擾動分析、系統運轉資源運用效率以及統計報表自動產生與發送等，後續仍需由軌道機構視需要加以應用分析。

展望本平台未來發展，因以原始資料為基礎，加上受限鐵路機構對資料保護之考量，所面臨的重大課題在於無法以自動界接方式取得平台資料，該問題就長期而言，應由軌道機構自身資料庫整合並建立良好的資料分享方式。此外，如何強化本平台資料與其他社經資料之融合，以創造資料更高之加值應用價值，甚至進一步透過創造指標達到支援決策之功能，為後續努力之方向。



(II) Sustaining Maintenance and Operation, Strengthening Big Data Value-Added Application and Support Decision Making

To facilitate users in understanding the data utilizability of the platform, this research proposes several suggestions on the data application, including the start and end stops statistics, MRT transfer type estimation and quality performance evaluation, station crowd time distribution statistics, system disturbance analysis, system operation resource utilization efficiency and statistics report automatic generation and transmission etc. for different districts. Subsequently, in the future, there is still a need to perform further application analysis based on the needs of the railway agency.

Looking forward to the future development of this platform, since it is based on the original data, along with the concern on the limitation of the data protection required by the railway agency, the major issue faced is about the obtaining of the platform data via an automatic connection method. For such problem in a long term, the railway agency shall conduct the database integration and establish excellent data sharing method to overcome the problem. Furthermore, as to question on how to strengthen the fusion of this platform data with other social and economic data, the future direction relies in the creation of higher value-added application values of the data and the further utilization of the creation index to achieve the function of supporting decision making.

計劃成效與未來應用展望



軌道資訊平台收錄資料內容

表 4-5-1. 本平台收錄有關臺鐵之資料項目

項目	說 明
車次統計	分年、月、日統計各種車種之開行車次數、列車公里數、運行時數、行經站數、停靠站數
旅次統計	分年、月、日，分 IC 卡、非 IC 卡、及總計，統計車站間、行政區間、及生活圈間旅次在空間及時間之分布
基本統計	民國 90 年 1 月至 104 年 9 月之營運收入、旅客人數、自強號乘客數、自強號客座利用率、自強號準點率、莒光號乘客數、莒光號客座利用率、莒光號準點率、區間車乘客數、區間車客座利用率、區間車準點率、普通車乘客數、普通車客座利用率、普通車準點率、貨物噸數

表 4-5-2. 本平台收錄有關高鐵之資料項目

項目	說 明
車次統計	分年、月、日統計各種車種之開行車次數、列車公里數、運行時數、行經站數、停靠站數
旅次統計	分年、月、日，分 IC 卡、非 IC 卡、及總計，統計車站間、行政區間、及生活圈間旅次在空間及時間之分布
基本統計	民國 90 年 1 月至 104 年 9 月之營運收入、旅客人數、自強號乘客數、自強號客座利用率、自強號準點率、莒光號乘客數、莒光號客座利用率、莒光號準點率、區間車乘客數、區間車客座利用率、區間車準點率、普通車乘客數、普通車客座利用率、普通車準點率、貨物噸數

Railway information platform recorded data content

Table 4-5-1 Data items related to Taiwan Railways recorded in this platform

Item	Description
Number of train statistics	Number of trains, mileage of trains, operation hours, number of stations passing by, number stations stopped of each type of trains according to year, month and date.
Number of trips statistics	Distribution of between stations, between administrative districts and living circle trips in space and time according to year, month and date as well as according to IC card, non-IC card and total.
Basic statistics	Operation revenue, number of passengers, number of passengers of Tze-Chiang Express, passenger seat utilization rate of Tze-Chiang Express, on-time percentage of Tze-Chiang Express, number of passengers of Chu-Kuang Express, passenger seat utilization rate of Chu-Kuang Express, on-time percentage of Chu-Kuang Express, number of passengers of local train, passenger seat utilization rate of local train, on-time percentage of local train, number of passengers of ordinary train, passenger seat utilization rate of ordinary train, on-time percentage of ordinary train, tonnage of cargo between the period of January 2001 to September 2015

Table 4-5-2 Data content related to Taiwan Highspeed Rail recorded in this platform

Item	Description
Number of train statistics	Number of trains, mileage of trains, operation hours, number of stations passing by, number stations stopped of each type of trains according to year, month and date.
Number of trips statistics	Distribution of between stations, between administrative districts and living circle trips in space and time according to year, month and date as well as according to IC card, non-IC card and total.



表 4-5-3. 本平台收錄有關臺北捷運之資料項目

項目	說明
運輸本業相關統計	營運里程、運量、準點率
悠遊卡進出站資料	103 年 1 月至 104 年 7 月資料
附屬事業相關統計	商店數量、廣告數量、停車位數量
財務統計	收入、稅前純益
績效統計	滿意度、MKBF*
基本統計	民國 90 年 1 月至 94 年 9 月間之旅客人數以及客運收入

Basic statistics	Operation revenue, number of passengers, number of passengers of Tze-Chiang Express, passenger seat utilization rate of Tze-Chiang Express, on-time percentage of Tze-Chiang Express, number of passengers of Chu-Kuang Express, passenger seat utilization rate of Chu-Kuang Express, on-time percentage of Chu-Kuang Express, number of passengers of local train, passenger seat utilization rate of local train, on-time percentage of local train, number of passengers of ordinary train, passenger seat utilization rate of ordinary train, on-time percentage of ordinary train, tonnage of cargo between the period of January 2001 to September 2015
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Table 4-5-3 Data content related to Taipei MRT recorded in this platform

項目	說明
Relevant statistics of transportation original business	Operation mileage, transportation capacity, on-time percentage
Data for in/out station with easy card	Data from January 2014 to July 2015
Relevant statistics of subsidiary business	Number of commercial stores, number of advertisements, number of parking lots
Financial statistics	Revenue, income before tax
Performance statistics	Satisfaction, MKBF*
Basic statistics	Number of passenger and passenger transportation revenue between January 2001 to September 2005

(三) 國際海運資料庫更新擴充與資料分析

為有效掌握國際與國內海運產業之變遷與發展趨勢，以利海運政策之分析，本所自 102 年起持續進行有關「國際海運資料庫」之開發工作。本 (104) 年度本計畫旨在進行資料與資料庫之更新擴充，並進行資料之運用分析，強化資料庫應用與發展。

本計畫所蒐集資料包括航線類、航商類、港口類與船舶類等，涵蓋 2011~2015 年之歷年資料。藉由資料庫之整理，分別運用於亞太區域航線佈署趨勢分析 (如圖 4-5-8~4-5-11)、我國及亞太主要港口航線佈署趨勢分析 (如圖 4-5-12~4-5-13)、我國與各國主要貨櫃航商營運趨勢分析 (如圖 4-5-14)、航商聯營對我國樞紐高雄港之影響分析 (如圖 4-5-15) 等議題，重點如下：

1. 在亞太區域航線佈署趨勢上，近 4 年來，受到船舶大型化現象影響，全球 7 大貿易路線營運航線數並未增加，但是各航線的總船舶艘數與船舶總運能數，增加速度甚快。由各貿易路線船型與艘數分佈統計發現，各大航線的船舶大型化現象，均很顯著。而各貿易路線在不同時期船寬與吃水深度之分布統計上，大型船舶的艘數有顯著增長。
2. 在我國及亞太主要港口航線佈署趨勢分析上，各主要貨櫃港口內之貿易路線航線數中，臺灣港口除了越太平洋航線數量較顯著外，高雄港已經逐漸朝向以近洋航線兼具區域樞紐為主的港群定位發展中，而亞太各國重要樞紐港口的航線數，受到船舶大型化影響，並未顯著增加。各貿易路線船型、船舶寬度與吃水的統計上，普遍皆有增長。由船型寬度與吃水深度等數據，可以了解目前各大航商佈署船舶，對各港口內部之碼頭與港灣的均造成建設壓力，包括深水碼頭建設與大型裝卸機具的更新等課題。
3. 在我國與各國主要貨櫃航商之營運趨勢分析

(III) International Maritime shipping database update expansion and data analysis

To effectively understand the change and development trend of international and domestic Maritime shipping industries in order to facilitate the analysis on Maritime shipping policy, the institute has continuously engaged in the development works related to the "international Maritime shipping database" since 2013. The project of this year (2015) is to perform the update expansion of the data and the database as well as to perform the utilization analysis on the data and to strengthen the database application and development.

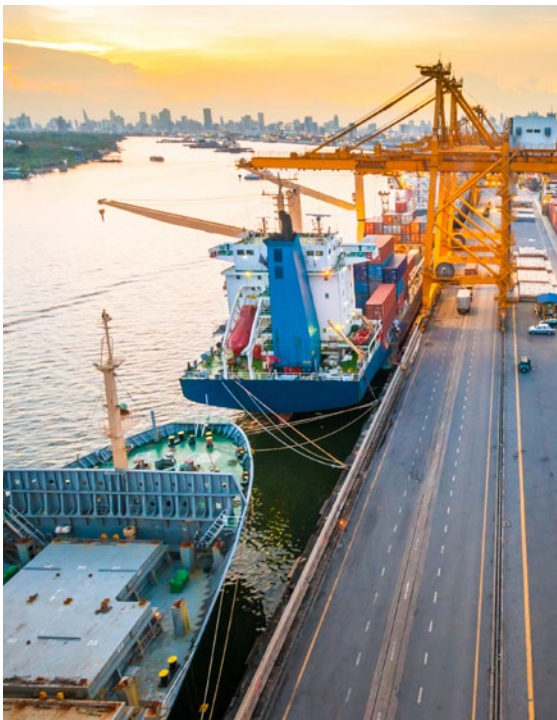
The data collected in this project includes the navigation route type, shipping operator type, port type and vessel type etc., which covers the historical data for years 2011~2015. The organization of the database can be respectively used in the issues related to the analysis on the Asia Pacific region navigation route deployment trend (as shown in FIGs 4-5-8~4-5-11), analysis on major port navigation route deployment trends of our nation and Asia Pacific (as shown in FIGs 4-5-12~4-5-13), analysis on major container shipping operator business trends of our nation and each country (as shown in FIG. 4-5-14), analysis on the impacts of the shipping operator alliance on the hub of the port of Kaohsiung of our nation (as shown in FIG. 4-5-15) etc., and the key points are summarized as follows:

1. With regard to the Asia Pacific region navigation route deployment trend, in recent 4 years, under the influence of the trend of large vessels, the 7 major trading lines for operation navigation routes in the world have not been increased; however, the total number of vessels and total vessel shipping capacities are increased relatively fast. From the statistics of the distributions of each trading line vessel types and the number of vessels, it can be found that the trend of large vessels at each major navigation route is quite obvious. In addition, from the statistics of the distribution of vessel widths and the draughts at different period of times on each trading route, it clearly shows that the number of large vessels significantly increases.
2. With regard to the analysis on the major port navigation route deployment trend of our nation and Asia Pacific, among the number of navigation routes of trading lines of all major container ports, in addition to that the ports in Taiwan show significant numbers for the cross-Pacific navigation routes, the port of Kaohsiung has gradually developed into a port cluster status mainly for near-sea navigation routes and

上，近年來全球前 25 大航商在主要貿易航線之派船艘數，並未顯著增加，但在航線總運能 (TEU)，則有顯著成長。投入船型部分，亦有顯著增長，特別是遠歐航線上的超大型船舶 (13,000TEU 以上)，增加速度甚快，並導致其他次大的貨櫃船型，逐漸往越太平洋佈署與移動，或至近洋區域航線進行佈署，造成全球大型航商在各大主要航線上之船型使用，產生遞移現象。

4. 有關航商聯營趨勢與對我國樞紐港之影響上，由於策略聯盟已經是大型貨櫃航商最重要的經營策略，目前已造成了遠歐主航線上的母船集貨分散化、共同派船母港化、轉運港雙靠現象以及主航線集中靠泊大型樞紐港的現象，而我國高雄港於遠歐航線的洲際樞紐優勢也漸遭弱化。

本計畫所蒐集之海運資料與建置之資料庫，對於海運政策分析已可提供助益，包括各類數據應用於政策分析之用，及採議題導向之分析，均可彰顯國際海運資料庫之效益。後續將持續進行資料更新與資料庫查詢功能之擴充，並增加在海運政策分析之應用。



regional hub. As for the number of navigation routes of major hub ports of Asia Pacific countries, under the impact of the trend of large vessels, it shows no significant increase. For the statistics of the vessel widths and draughts, they all show an increasing trend. From the data of the vessel widths and draughts etc., it can be understood that the deployment of vessels by all major shipping operators have created infrastructure pressures on the docks and harbors at the internal of each port, including the issues on the deep-water docks construction and the upgrades of large loading and unloading machinery.

3. With respect to the analysis on the operation trend of major container shipping operators of our nation and each country, in recent years, the 25 major shipping operators in the world show no significant increase in the number of nominated vessels at the major trading navigation routes; however, the navigation route total shipping capacity (TEU) shows a significant increase. For the part of the nominated vessel type, it also shows an increasing trend; in particular, for the long-distance European navigation routes, the number of extra-large vessels (above 13,000TEU) increases rather rapidly, which also causes the subsequent large container vessel types to gradually shift to the cross-pacific deployment and movement or even to be deployed at the near-sea regional navigation routes, causing the shifting phenomena on the type of vessels being used by the international large shipping operators at each major navigation routes.
4. With regard to the impacts of the trend of shipping operator alliance on the hub ports of our nation, since the strategic alliances have been treated as the most important business strategy for large container shipping operators, currently, it has caused the phenomena of the decentralization of mothership cargo collection on the long-distance European main navigation routes, homeport for common nominated ships, double-side docking at transfer ports and the phenomena of main navigation routes centralized to dock at large hub ports. In addition, the advantages of intercontinental hub for long-distance European navigation routes of the Port of Kaohsiung in our nation have also been degraded.

The Maritime shipping data collected and the database established in this project can provide assistance and benefits to the Maritime shipping policy analysis, including the uses for policy analysis on the types of data applications and the topic-oriented analysis such that they are able to demonstrate the benefits of the international Maritime shipping database. Subsequently, data update and expansion of database search function would continue to be executed in the future in addition to the application of Maritime shipping policy analysis.

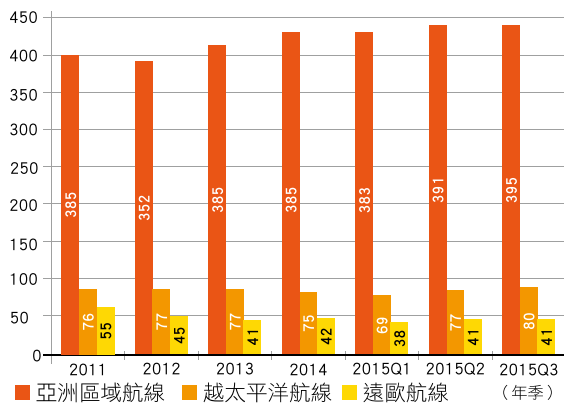


圖 4-5-8 亞太區域三大貿易路線航線數 (條)
FIG. 4-5-8 Number of navigation routes of three major trading lines in Asia Pacific Region (unit in lines)

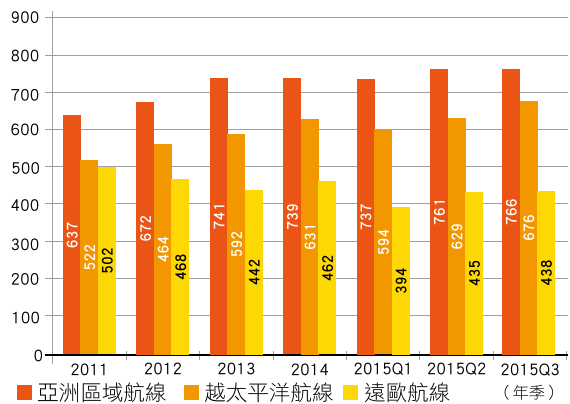


圖 4-5-9 亞太區域三大貿易路線船舶艘數 (艘)
FIG. 4-5-9 Number of vessels of three major trading lines in Asia Pacific Region (unit in ships)

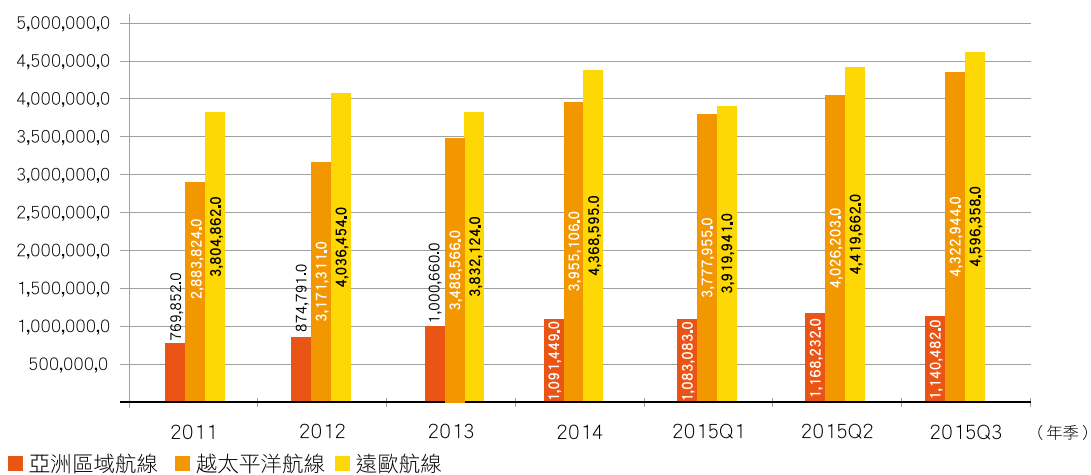


圖 4-5-10 亞太區域三大貿易路線船舶總運能 (TEU)
FIG. 4-5-10 Total shipping capacity of vessels at three major trading lines in Asia Pacific Region (unit in TEU)

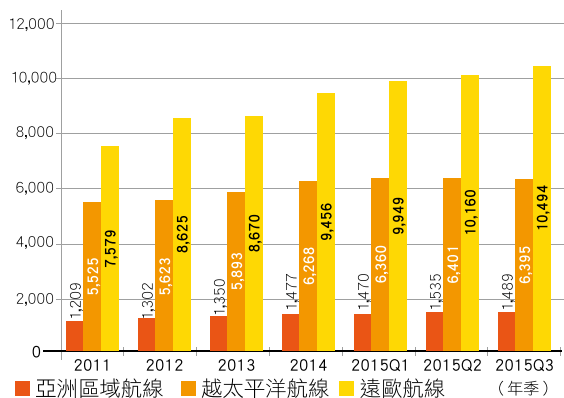


圖 4-5-11 亞太區域三大貿易路線平均船型 (TEU)
FIG. 4-5-11 Average vessel type at three major trading lines in Asia Pacific Region (unit in TEU)



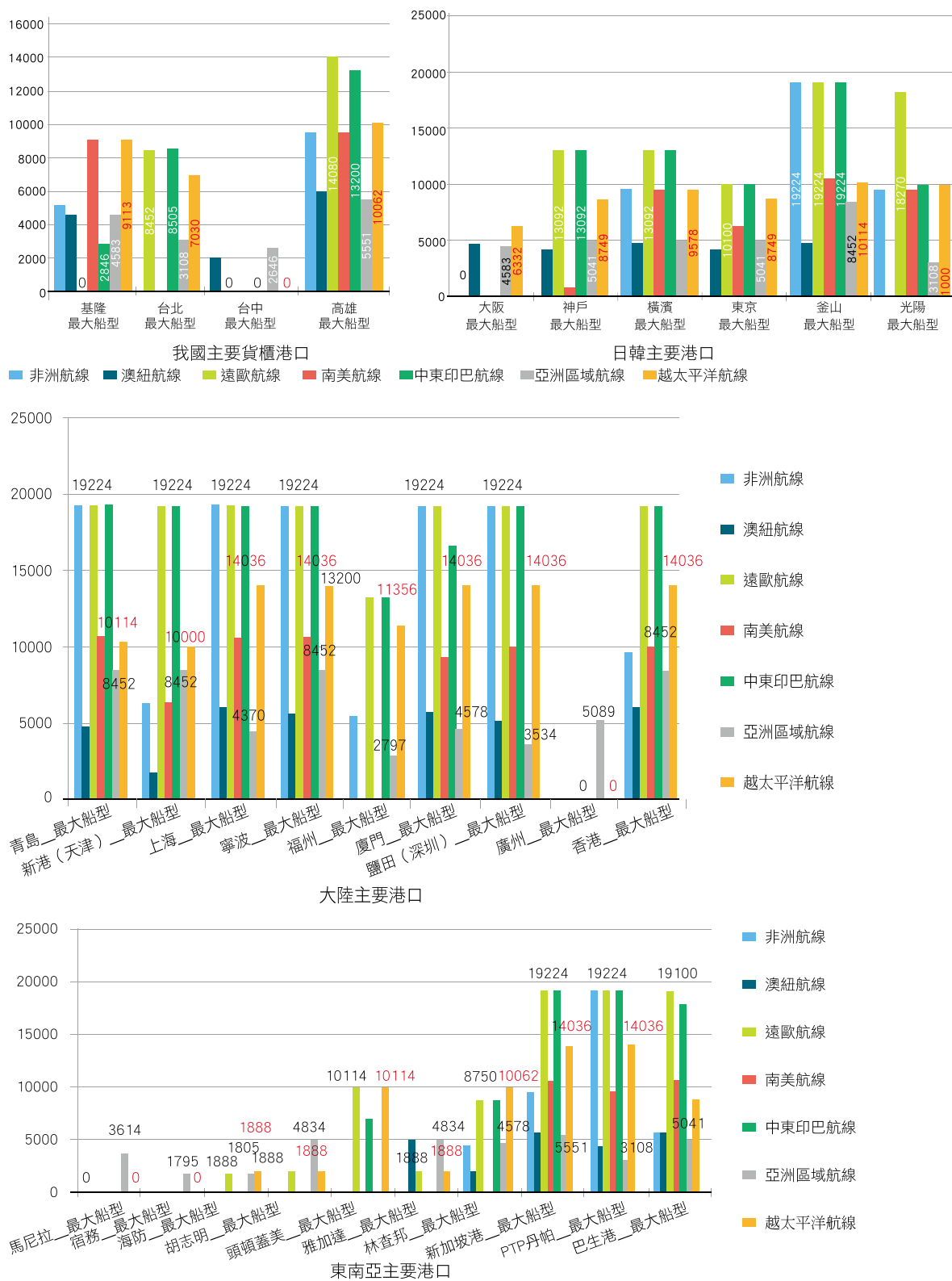


圖 4-5-12 亞太區域主要貨櫃港口各貿易路線最大船型 (TEU)

FIG. 4-5-12 Maximum vessel type at each trading line of major container ports in Asia Pacific Region (unit in TEU)

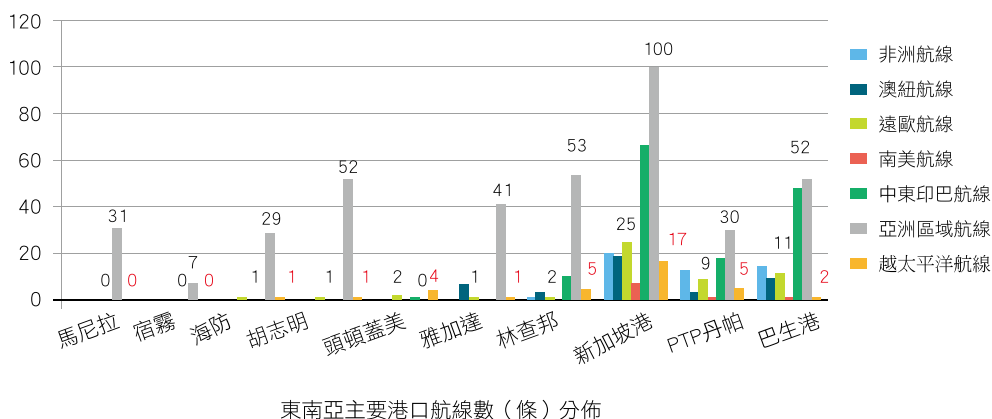
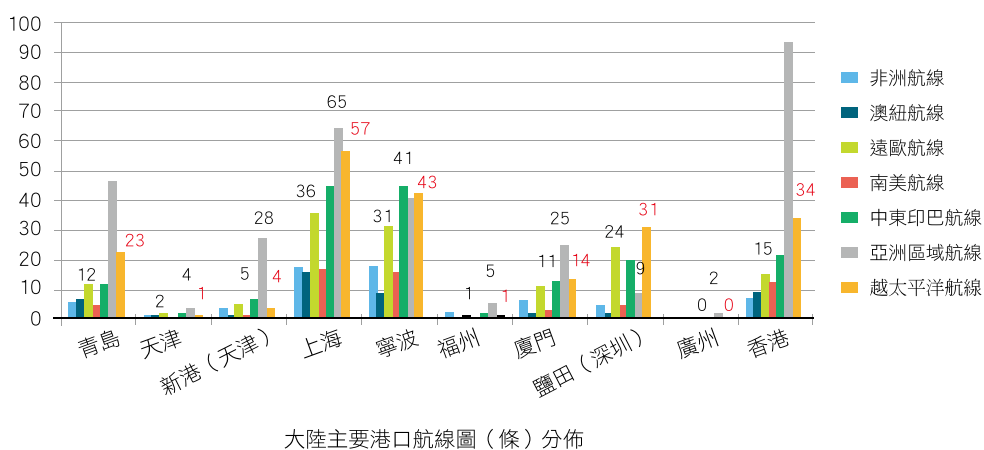
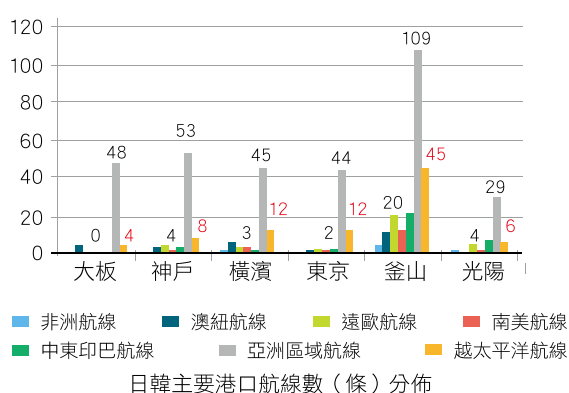
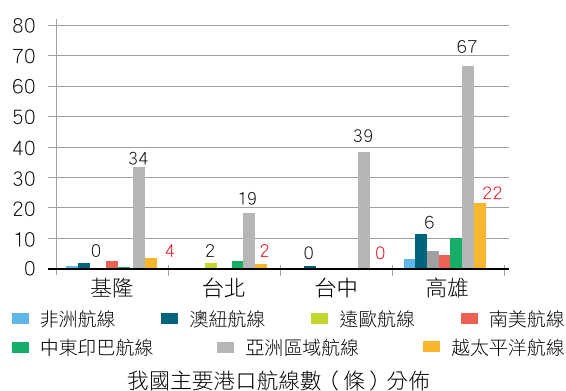


圖 4-5-13 亞太區域主要港口各貿易路線航線數統計 (2015 年 Q3)

FIG.4-5-13 Statics of number of navigation routes at each trading line of major container ports in Asia Pacific Region (unit in TEU)

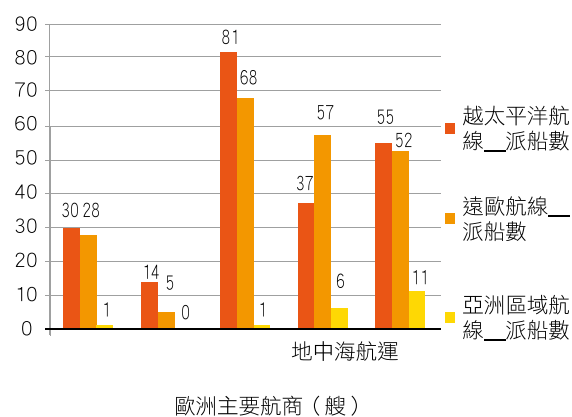
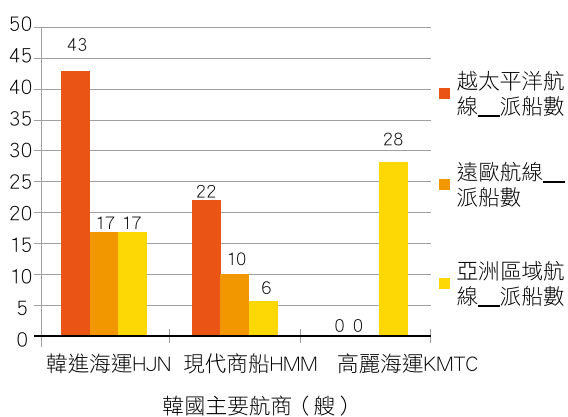
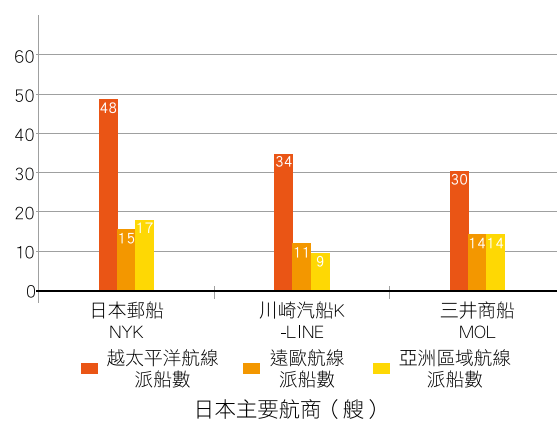
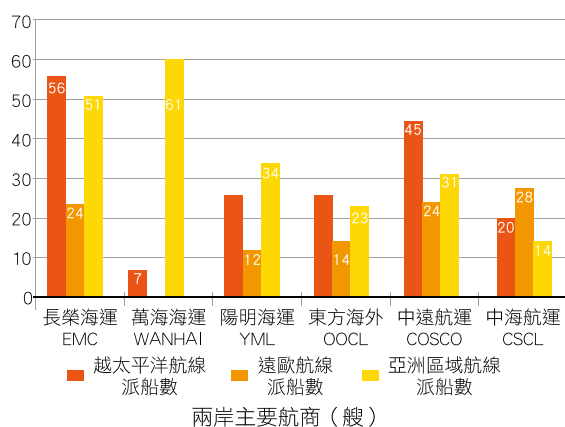


圖 4-5-14 主要航商在各貿易路線派船艘數統計 (2015 年 Q3)

FIG. 4-5-14 tactics of number of nominated vessels at each trading line by major shipping operators (2015 Q3)

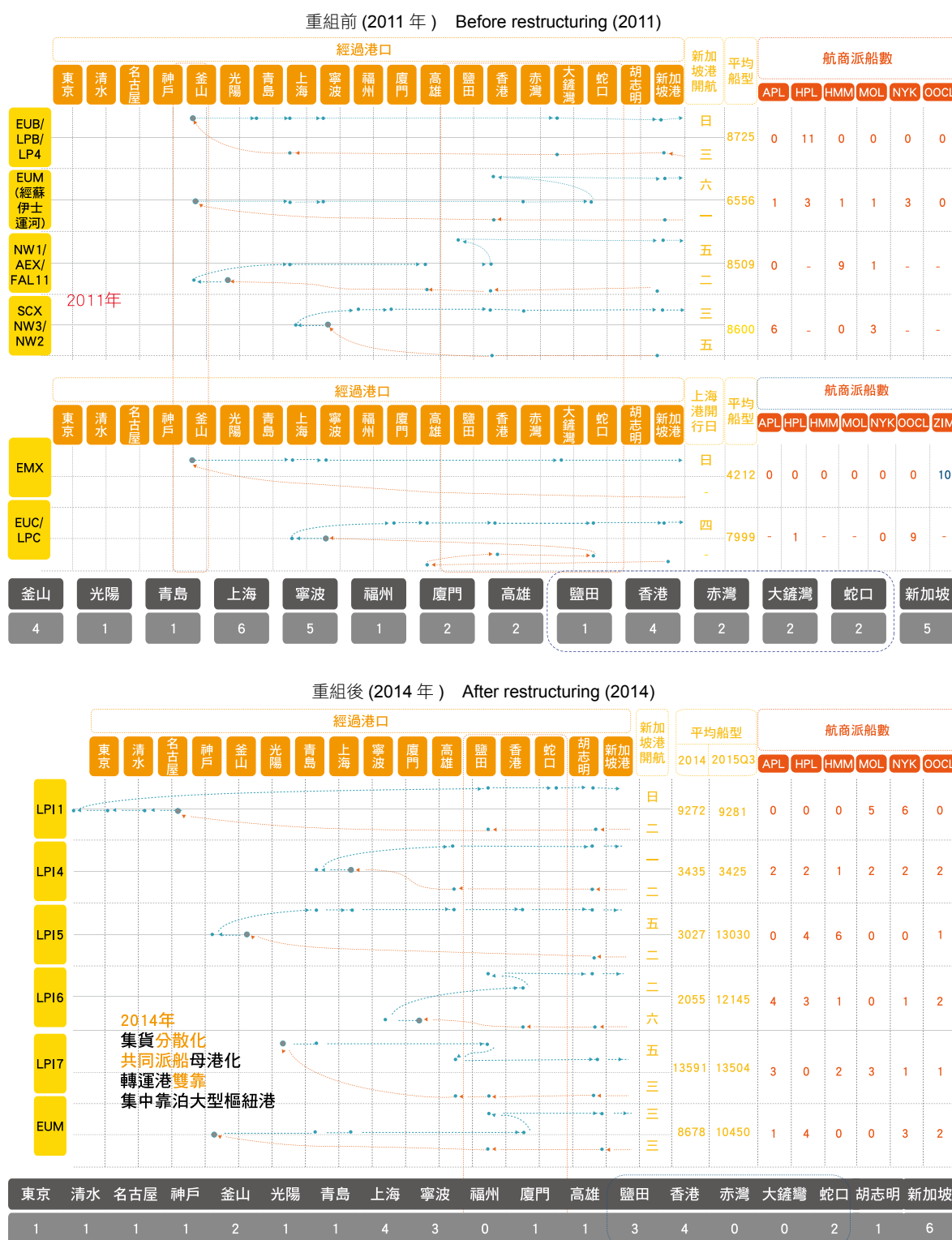


圖 4-5-15 聯盟重組前後各大樞紐港靠泊情況 (以 G6 為例)

FIG. 4-5-15 Docking status of each major hub port before and after restructuring of alliance (using G6 as an example)



(四) 國際空運資料庫更新擴充與資料分析

為掌握國際空運發展趨勢，以利空運政策之分析，本所於 103 年起持續進行「國際空運資料庫」之開發與持續擴充工作。本 (104) 年度計畫旨在將資料庫中「機場設施與營運資料庫」和「旅客起迄資料庫」二項子資料庫，重新以 Web-based 系統進行使用者介面更新，強化資料庫功能，並進行資料之更新、擴充及分析。

本計畫所更新與擴充資料機場部分主要包括 146 個國際機場及我國 17 座民航機場的基本設施、運量和航網資料，系統介面更新部分重新以世界地圖為背景，讓系統更具易讀性，協助使用者在資料內容與地理印象的結合 (如圖 4-5-16、4-5-17)。旅客起迄資料部分，則購買 IATA MarketIS 包含桃園機場 (TPE)、仁川機場 (ICN)、洛杉磯機場 (LAX)、紐約甘迺迪機場 (JFK)、紐華克機場 (EWR)、休士頓機場 (IAH)、華盛頓機場 (IAD)、波士頓機場 (BOS)、拉斯維

(IV) International air shipping database update expansion and data analysis

To understand the international air shipping development trend in order to facilitate the analysis on the air shipping policy, the institute has continuously conducted the development of "international air shipping database" since 2014 and has continued the expansion work. The project of this year (2015) is to perform user interface update and strengthen the database function with a Web-based system for the "airport facility and operation database" and "passenger departure and arrival database" in the database as well as performing the update, expansion and analysis of the data.

The airport part of the data updated and expanded in this project mainly includes the basic facilities, transportation capacity and flight network data of 146 international airports and 17 civil aviation airports in our nation; the system interface update part is to use the world map for the background in order to allow the system to be of greater readability and to assist users in associating the data content and the geographic images (as shown in FIGs 4-5-16 and 4-5-17). For the passenger departure and arrival data part, the IATA MarketIS is purchased, which includes all of the arrival and departure passenger departure and arrival data for 10 airports of Taoyuan Airport (TPE), Incheon Airport (ICN), Los



加斯機場 (LAS)、溫哥華機場 (YVR) 等 10 座機場所有入、出境旅客起迄資料，分析擇要如下：

1. 中國大陸 2014 年赴北美八大主要機場之總人數約有 187.6 萬人次，由該八大機場至中國大陸之旅客則有 190.2 萬人次 (如圖 4-5-18)。其中中國大陸往返北美八大主要機場間，旅客主要經轉運機場分別為香港機場、仁川機場及成田機場 (如圖 4-5-19)。
2. 香港、澳門、東南亞國協 10 國 2014 年赴北美八大主要機場之總人數約有 178 萬人次，由該八大機場西返之旅客則有 185.1 萬餘人次 (如圖 4-5-20)。其中香港、澳門、東南亞國協 10 國往返北美八大主要機場間，旅客主要經轉運機場如圖 4-5-21，其中桃園機場是中轉最多旅客的機場，服務中轉人次合計將近 40 萬人次，其次為仁川機場，雙向人次合計達 35.4 萬人次，日本東京成田和香港機場則分居 3、4 名，雙向總和均超過 28 萬人次。
3. 桃園機場入、出境旅客前 3 大國家地區分別為中國大陸、日本及香港 (如圖 4-5-22、4-5-23)；桃園與仁川機場起迄旅客基本比較如表 4-5-4 所示，以國家地區別之市場來看，仁川機場往來可達 20 萬以上旅客的國家地區約有 15 個，旅客人數之總和占全體約八成五以上；桃園機場雖僅有 12 個國家地區可達 20 萬人，但占其全體旅客之 93% 左右。

Angeles Airport (LAX), New York Kennedy Airport (JFK), Newark Airport (EWR), Huston Airport (IAH), Washington Airport (IAD), Boston Airport (BOS), Las Vegas Airport (LAS), Vancouver Airport (YVR) etc., and the analysis is summarized as follows:

1. The total number of people in Mainland China arriving at 8 major airports in North America in 2014 was approximately 1.876 million passengers, and the number of passengers flying from the 8 major airports to Mainland China was 1.902 million passengers (as shown in FIG. 4-5-18). Wherein, the passengers traveling between Mainland China and the 8 major airports in North America mainly transferred via the airports of Hong Kong Airport, Incheon Airport and Narita Airport (as shown in FIG. 4-5-19).
2. The number of people traveling from Hong Kong, Macau and the 10 countries of the Association of Southeast Asian Nations to the 8 major airports in North America in 2014 was approximately 1.78 million passengers, and the passengers returning westward from the 8 major airports was 1.851 million passengers (as shown in 4-5-20). Wherein, the passengers traveling between Hong Kong, Macau, the 10 countries of the Association of Southeast Asian Nations and the 8 major airports in North America mainly transferred via the airport (as shown in FIG. 4-5-21) of Taoyuan Airport with the greatest number of passengers, serving the number of transfer passengers of nearly 400 thousand passengers in total; the next most popular airport for transfer was the Incheon Airport with the number of two-way passengers reaching 354 thousand passengers in total, and the Tokyo Narita Airport in Japan and the Hong Kong Airport were ranked 3rd and 4th with the two-way total number of passengers both exceeding 280 thousand passengers.
3. The top three main countries and regions of passengers departing from and arriving at the Taoyuan Airport are Mainland China, Japan and Hong Kong (as shown in FIGs 4-5-22 and 4-5-23). A basic comparison on the departure and arrival passengers at the Taoyuan Airport and the Incheon Airport is as shown in Table 4-5-4; from the distinction of the markets between the countries and regions, the Incheon Airport has flights to and from approximately 15 countries and regions with the number of passengers exceeding 200 thousand, and the subtotal of passengers of such flights accounts for approximately more than 85% of the overall total number of passengers; whereas although the Taoyuan Airport has flights to and from only 12 countries and regions with number of passengers reaching 200 thousand passengers, the subtotal of passengers accounts for approximately 93% of the overall total number of passengers.



圖 4-5-16 空運資料庫之機場基本資料及運量資料查詢畫面

FIG. 4-5-16 Airport basic data and transportation capacity data search screen of aerial shipping database



圖 4-5-17 空運資料庫之機場營運資料查詢畫面

FIG. 4-5-17 Airport operation data search screen of aerial shipping database

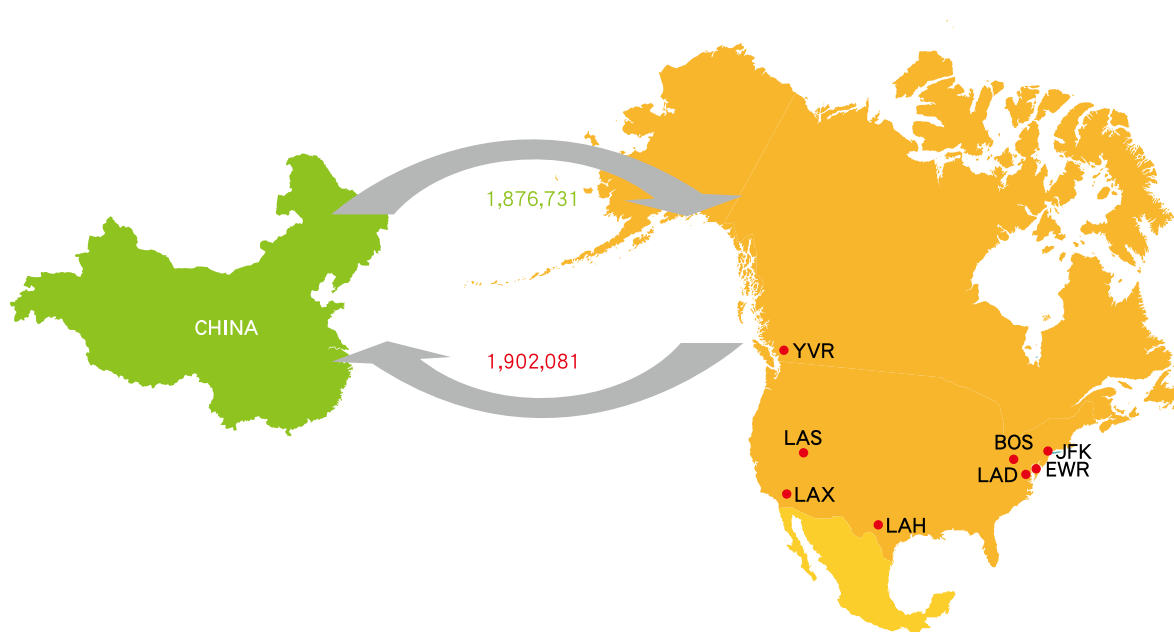


圖 4-5-18 中國大陸與北美八大國際機場之總往來旅客人數

FIG. 4-5-18 Total number of passengers traveling between China and eight major international airports in North America

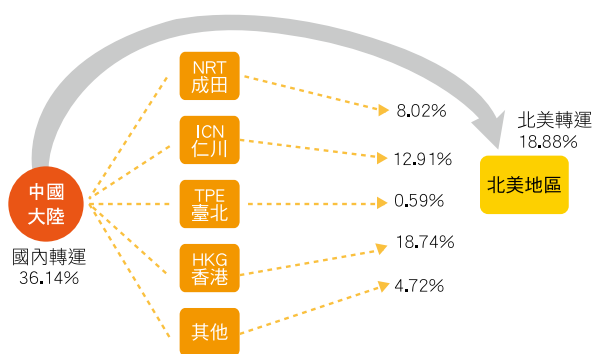


圖 4-5-19 中國大陸赴北美八大國際機場之主要轉運機場

FIG. 4-5-19 Main airports for transfer for Chinese people traveling to eight major international airports in North America

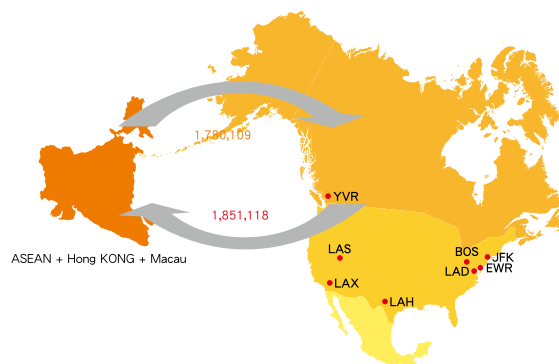


圖 4-5-20 中國大陸與北美八大國際機場之總往來旅客人數

FIG. 4-5-20 Total number of passengers traveling between China and eight major international airports in North America

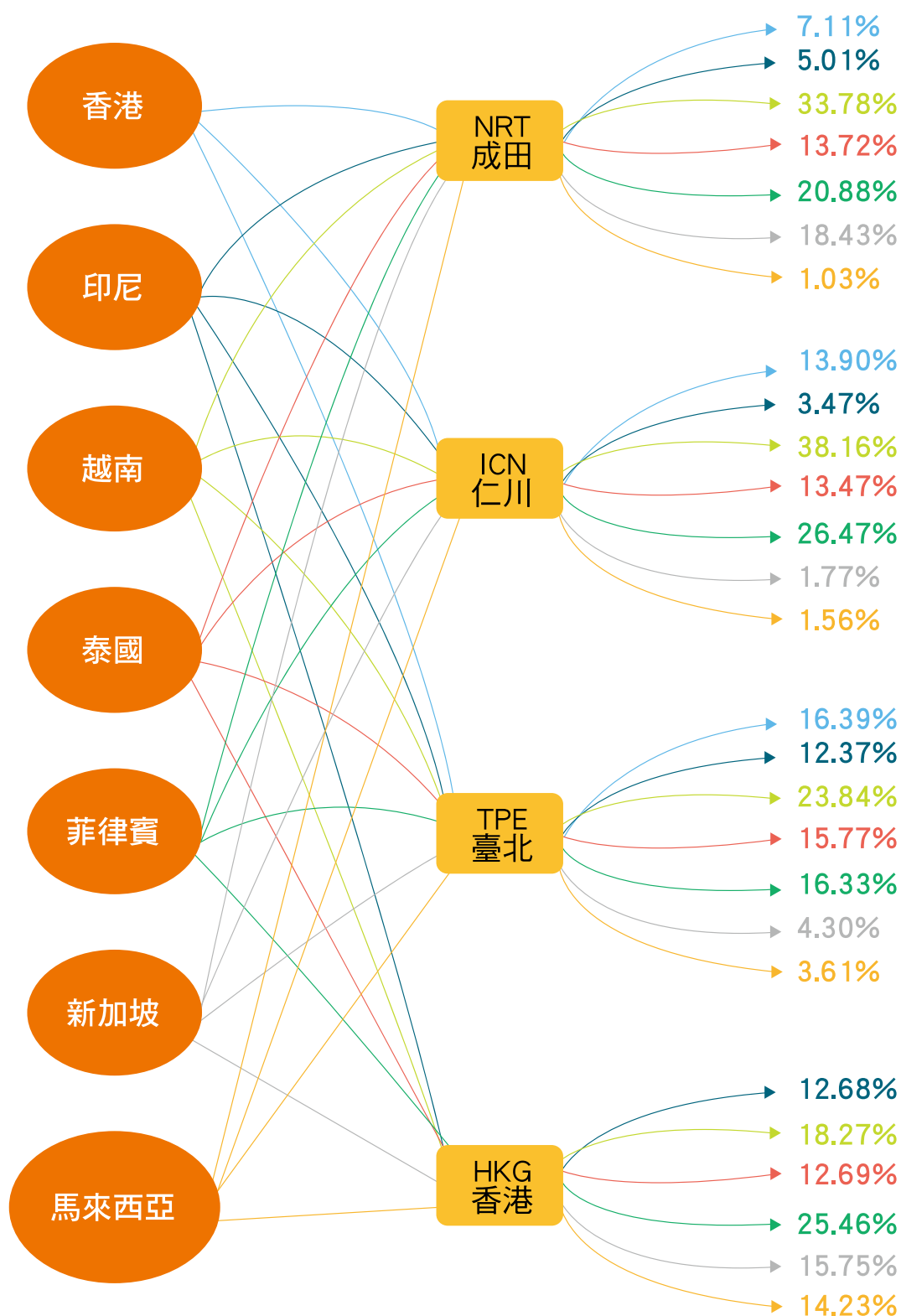


圖 4-5-21 中國大陸赴北美八大國際機場之主要轉運機場

FIG. 4-5-21 Main airports for transfer for Chinese people traveling to eight major international airports in North America

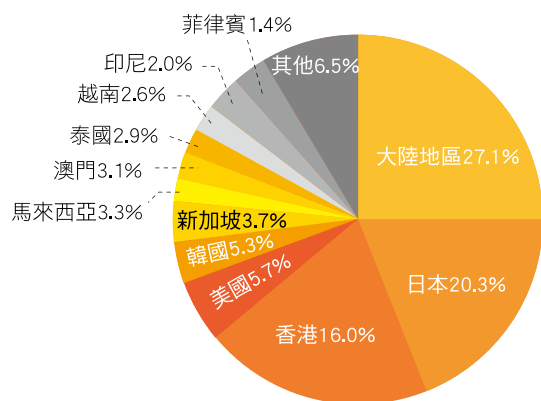


圖 4-5-22 桃園機場入境旅客主要國家分布

FIG. 4-5-22 Distribution of the main countries of passengers arriving at Taoyuan Airport

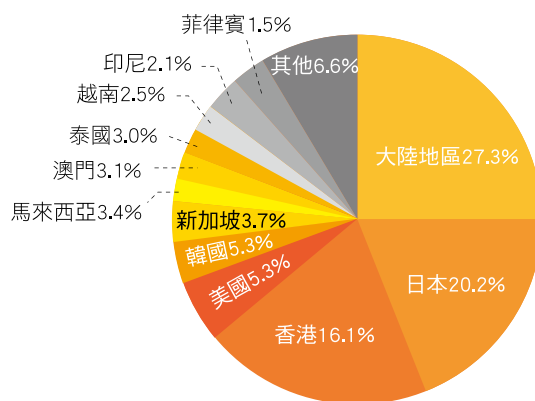


圖 4-5-23 桃園機場出境旅客主要國家分布

FIG. 4-5-23 Distribution of the main countries of passengers departing from Taoyuan Airport

表 4-5-4 桃園與仁川機場起迄旅客基本比較

Table 4-5-4 Basic comparison between departure and arrival passengers of Taoyuan and Incheon Airport

	桃園機場 Taoyuan Airport		仁川機場 Incheon Airport	
	出境 Departure	入境 Arrival	出境 Departure	入境 Arrival
抵達或出發之國家數 Number of arrival or departure countries	168	166	192	192
抵達或出發之機場數 Number of arrival or departure airports	1141	1126	1440	1459
旅客人數 Number of passengers	15,828,571	15,781,216	19,189,067	19,170,840
旅客達 20 萬之國家數 (總和佔全體百分比) Number of countries with passengers reaching 200 thousands (percentage of subtotal over overall total passengers)	12 (93.4%)	12 (93.5%)	16 (87.4%)	15 (85.8%)
旅客達 10 萬之機場數 (總和佔全體百分比) Number of airports with passengers reaching 100 thousands (percentage of subtotal over overall total passengers)	32 (76.4%)	32 (76.8%)	51 (76.4%)	52 (76.5%)
採直達旅客之比例 Ratio of passengers using direct flights	90.8%	91.0%	88.4%	88.3%
採轉運旅客之人數 (比例) Number of passengers using transfer flights (ratio)	1,451,446 (9.2%)	1,415,663 (9.0%)	2,219,597 (11.6%)	2,242,450 (11.7%)

資料來源：MarketIS，本研究整理。

Data source: MarketIS, organized by the institute.

(五) 公車動態資訊系統巨量資料蒐集與視覺化分析

交通部應用智慧型運輸系統 (ITS) 技術積極推動先進公共運輸系統 (APTS)，其功能除了提供乘客公車動態資訊、預估車輛到站時間之外，客運業者亦可透過追蹤車輛動態訊息以調整營運調度績效。然在上述 APTS 中心所蒐集的龐大公車行車資料除了上述應用外，卻鮮少進行更進一步的資料探勘 (Data mining) 與分析。近年來，由於巨量資料分析技術日趨成熟，因此本研究透過 APTS 中心資料庫所記錄之各項巨量資料，結合客運業者營運路線、班表、天氣等資料進行視覺化分析，我們透過巨量資料分析工具發展了一套公車動態資訊系統資料視覺化分析程序，未來可協助公路主管機關與客運業者更有效進行公共運輸監督管理。

本研究主要針對臺中市全年度 (2014-05-01~2015-04-30) 公車動態資訊系統資料庫，包含公車動態定點資料、客運業者班表，並結合業者自主管理資料、氣象歷史相關資料。應用巨量資料技術，視覺化分析下列內容：

- (1) 行車時間分析：以營運路線為單位，針對各路線行車時間等相關指標，與各影響因素交叉分析。
- (2) 班表分析：班表分析著重於車輛與車輛之間的關係，通常會關心以下課題：從路線、時段、空間（站牌）等維度分析班次總數（含平均班距）、班距變異（尖離峰差異）、連班（含多輛追越、兩兩相互追越）。
- (3) 駕駛員風險分析：視覺化呈現高速與高轉速駕駛之地理空間。

(V) Bus Dynamic Information System Big Data Collection and Visualization Analysis

The MOTC applies the Intelligent Transportation System (ITS) technology to actively promoting the Advanced Public Transportation System (APTS), and its functions not only include passenger bus dynamic information, estimate vehicle stop arrival time but also allow the passenger bus operators to adjust the operation adjustment performance by tracking the vehicle dynamic information. However, the massive bus traveling data collected by the aforementioned APTS center is mostly used in the aforementioned applications only, and further data mining and analysis on data are rarely performed. In recent years, as the Big Data analysis technique becomes more mature, this research is able to use big data of each items recorded in the APTS center database to combine with the data of the operation routes, timetables, weather etc. of the passenger bus operators in order to perform visualization analysis. With the Big Data analysis tool, we have developed a bus dynamic information system data visualization analysis program, which is able to assist the highway authority and passenger bus operators to perform public transportation supervision management more effectively in the future.

This research is mainly directed to the annual (2014-05-01~2015-04-30) bus dynamic information system database of Taichung city, including the bus dynamic fixed point data, passenger bus operator timetables along with the operator self-management data and weather history relevant data. With The application of the Big Data technology, visualization analysis is conducted on the following contents:

- (1) Traveling time analysis: Using the operation routes as the unit, cross analysis is conducted on relevant index of the traveling time etc. of each route and each influence factors.
- (2) Timetable analysis: The timetable analysis emphasizes the relationship between vehicles, and typically, the following subjects are considered: conducting dimensional analysis on the total number of buses (including average bus gap), bus gap variation (difference between peak and off-time time), consecutive buses (involving multiple buses passing by, passing by in pairs) based on the route, time period, space (bus stop) etc.
- (3) Driver risk analysis: Visually presenting the geographic space of high speed and high turning speed driving.

透過班表則可洞悉車輛與車輛之間的關係，透過本研究之班表連班 / 班車追越樣態儀錶板可協助公共運輸主管機關探討以下課題：班次總數（含平均班距）、班距變異（尖離峰差異）、連班（含多輛追越、兩兩相互追越）等、從路線、時段、空間（站牌）等維度分析連班樣態

From the timetable, the relationship between vehicles can be understood; through the timetable consecutive bus/bus passing type control panel in this research, it is able to provide assistance to the public transportation authority in studying the following subjects: total number of buses (including average bus gap), bus gap variation (difference between peak and off-peak periods), consecutive buses (including multiple buses passing by, passing by in pairs) etc. in order to analyze the consecutive bus type based on the dimensions of route, time period, space (bus stop) etc.



圖 4-5-25 客運班表連班 / 班車追越樣態視覺化呈現圖

FIG.4-5-25 Visual presentation graph of passenger bus timetable consecutive bus/bus passing type.

安全是大眾運輸系統最重要的基本條件，公車運輸系統的安全性雖遠比私人運具高，但基於「精益求精」的原則，本研究亦利用巨量資料對已發現或潛在駕駛風險進行分析，期能增進公車運輸系統之安全。考慮的危險駕駛包括：(1) 超速駕駛 (2) 超轉駕駛 (3) 急加速駕駛 (4) 急減速駕駛。本研究將原始巨量資料去蕪存菁、格式轉換、索引壓縮為適合視覺化呈現之格式後，可運用儀表板針對公車動態資訊系統與數位行車記錄器資料異常比對、不同車輛駕駛行為差異比較。

Safety is the most important basic criteria for public transportation system, and the safety of bus transportation system is far higher than private transportation tools. However, based on the principle of "excel for perfection", this research also utilizes the Big Data to perform analysis on already known or potential driving risks in light of increasing the safety of bus transportation system. The dangerous driving concerned includes: (1) Road rage, (2) frequent passing (3) sudden acceleration (4) sudden speed reduction. After filtering, format converting and directory compressing the original Big Data in this research, the file is presented in an appropriate visualization such that further control panel can be utilized to perform abnormality comparison between the bus dynamic information system and the digital driving recorder and comparison between different vehicle driving behavior difference.

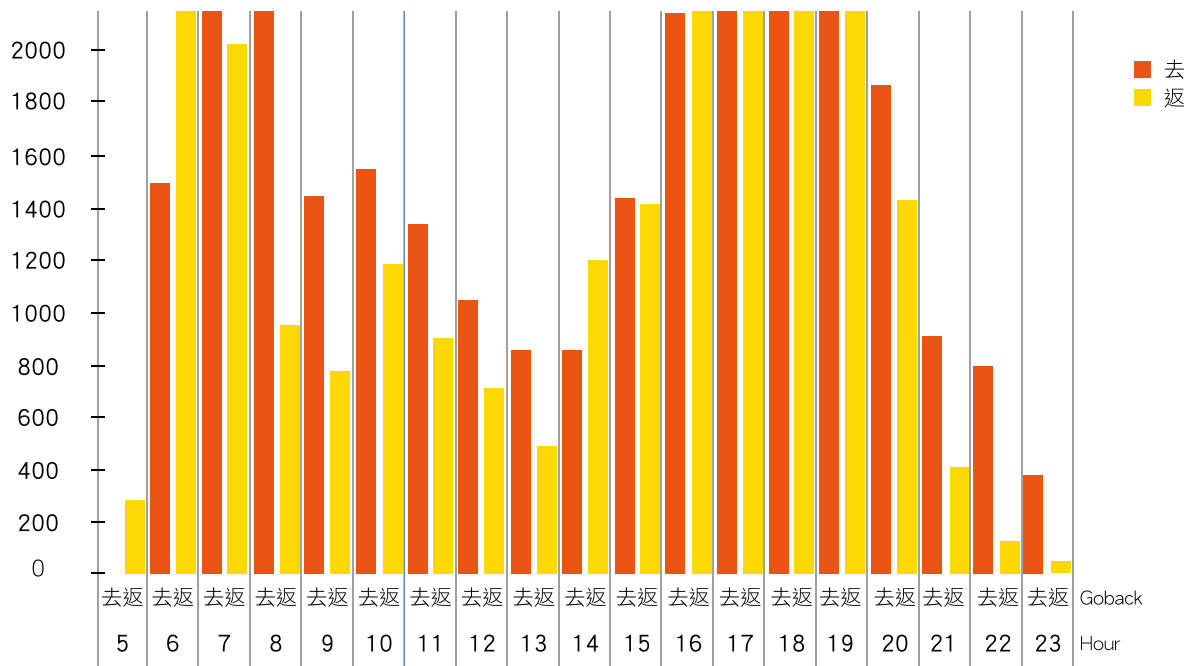


圖 4-5-26 客運連班分佈分析（時間角度）

FIG. 4-5-26 Passenger bus consecutive bus distribution analysis (based on time)

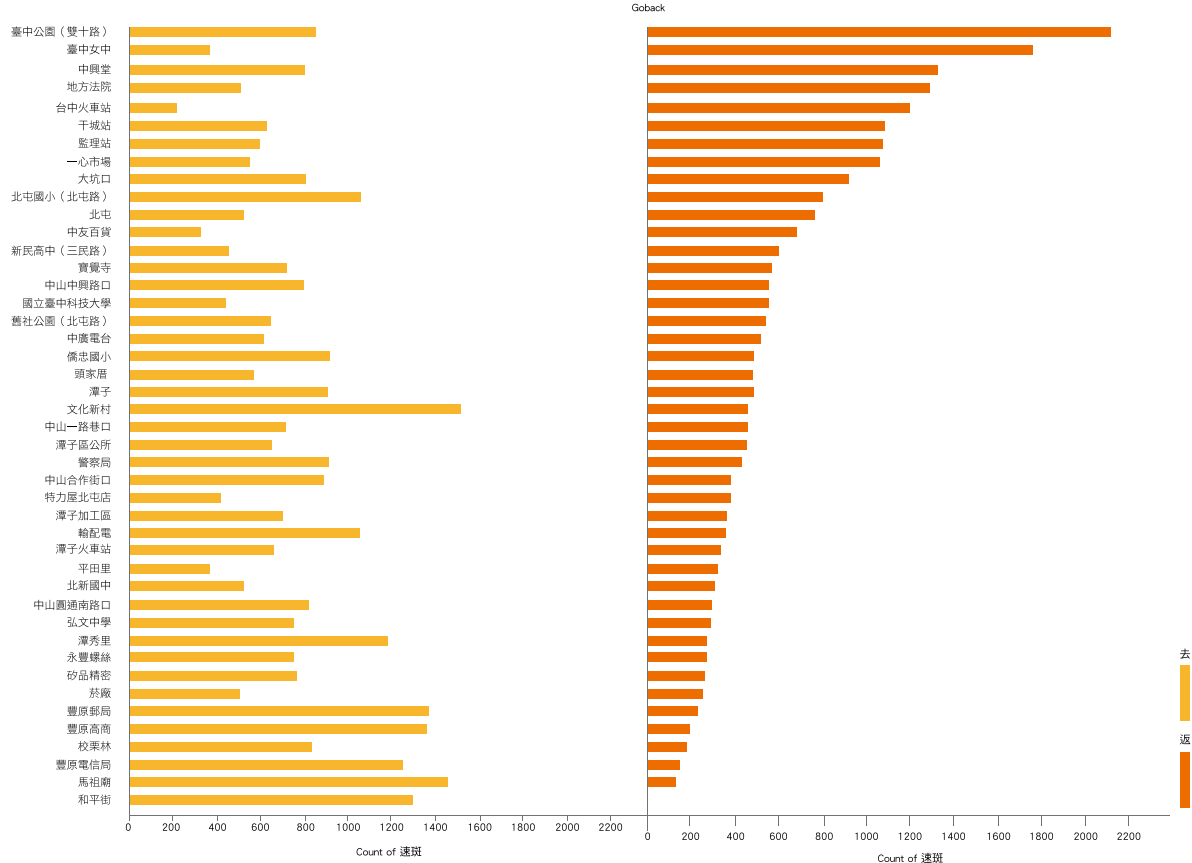


圖 4-5-27 客運連班分佈分析（空間角度）

FIG. 4-5-27 Passenger bus consecutive bus distribution analysis (based on space)

CH1
所長的話

CH2
組織與人力

CH3
施政概況

CH4
重點研究介紹

CH5
落實應用實績

CH6
大事紀要

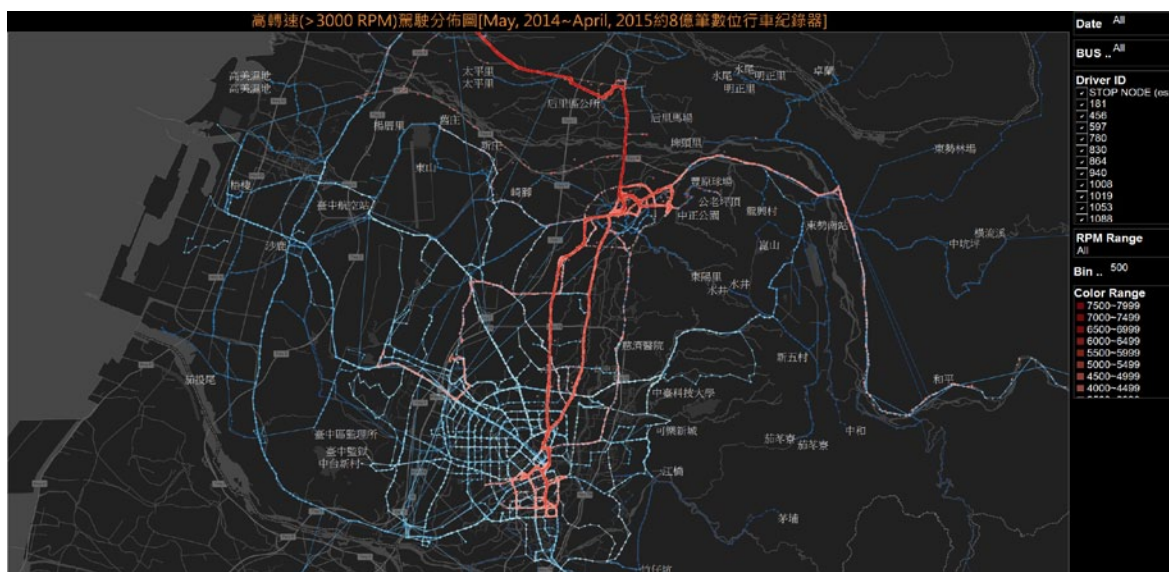
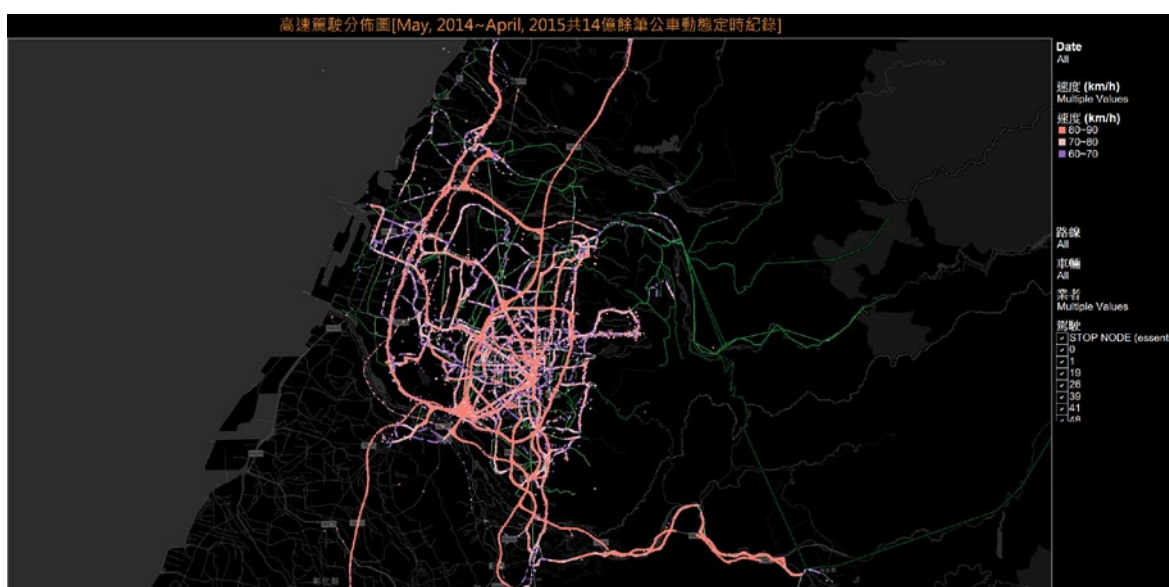


圖 4-5-28 超轉危險駕駛空間分佈視覺化呈現示意圖

FIG. 4-5-28 Illustration of dangerous frequent passing space distribution visualization presentation





CH1
所長的話

CH2
組織與人力

CH3
施政概況

CH4
重點研究介紹

CH5
落實應用實績

CH6
大事紀要



未來交通主管機關從各單位所收集到的相關動態與靜態之巨量資料 (**Big Data**) 具有各自的格式與特性，為了能夠透過資料的探勘、比對與分析，建置資料視覺化分析之程序，建議可透過三層架構來加以進行：資料層 (**Data Layer**)、應用層 (**Application Layer**)、與巨量資料視覺化分析層 (**Big Data Visualization Analytics**)。經由本計畫之執行經驗，收集包含公車動態資訊系統在內的各項相關資料，建立大數據資料庫，並透過適合的資料探勘分析方法，針對所收集到的資料進行分析，探討如何可以協助業者進行有效的營運管理，更進一步提昇公共運輸的服務水準。對於政府單位而言，也可探討如何利用這些資料，分析目前公共運輸的供需情形，作為整體公共運輸規劃的依據。

Relevant dynamic and static Big Data collected by the traffic authority from all units in the future has its own format and characteristics. In order to establish the program for data visualization analysis via the mining, comparison and analysis of the data, it is suggested that it can be performed based the three-layer structure: Data Layer, Application Layer and Big Data Visualization Analytics. With the experience gained from the execution of this project, collection of all relevant data including the bus dynamic information system, establishment of Big Data database and the with the use of appropriate data mining analysis method, analysis can be performed on the data collected in order to discuss on how to assist the operators to perform effective operation management and to further increase the service standard of public transportation. For the government officials, it can also be used for discussion on how to utilize such data in order to analysis the supply and demand status of the current public transportation such that it can be used as a basis for the overall public transportation planning.

六、災害防救 ●●

(一) 橋梁耐震能力與檢測評估分析模式之建立研究

橋梁為台灣地區用來連絡河流兩岸之重要交通工程設施，然而台灣屬為多地震的國家，且每年颱風、豪雨頻繁，使得河水劇烈淘刷橋墩及橋台之基礎處河床，一旦發生大規模天然災害時，橋梁倒塌或斷裂的機率高，且易造成人員傷亡。對現有橋梁進行全面檢測勢在必行。有鑑於此，過去研究中已發展「橋梁通阻檢測分析模式」，應用地表震動分析，進行地震模擬，求得台灣各區域地表加速度分布情形，再依橋梁現況診斷推估在不同地震強度下之損壞機率。本計畫進一步擴充「橋梁耐震側推分析模式」側推分析案例數量，並擴充「人工智慧耐震能力推論模式」案例資料庫，更新推論模式，以提高預測之準確性。另外，為提升「移動式振動檢測模式」實用性，將針對災後開放通行判斷之災害前後橋墩頻率變化率做進一步研究及驗證。最後擴充防災應變實務應用之橋梁地震防災決策支援網頁、橋梁資料自動更新機制、防災地圖及橋梁災情回報系統，以符合橋梁管理單位防災應變實務應用需要。



VI . Disaster prevention and protection ●●

(I) Research on Establishment of Bridge Seismic Capacity and Inspection Evaluation Analysis Model

Bridges are important traffic construction facilities for communicating two shores of rivers in the region of Taiwan. However, Taiwan is a nation with a great number of earthquakes, and frequent typhoons and heavy rainfall every year tend to cause violent disturbance of the river water to scour the foundation river beds at the bridge piers and abutments such that once there is large scale of natural calamity, there is a great chance of bridge collapsing or breakage and is likely to cause injuries. There is an immediate need to conduct full inspections on the currently existing bridges. Accordingly, in the past researches, the “Bridge Access Inspection Analysis Model” has been developed, which utilizes the ground vibration analysis and performs earthquake simulation to obtain the ground surface acceleration distribution conditions of all areas of Taiwan, followed by diagnosing and estimating the damage probability under the current status of the bridge. This project further expands the “Bridge Seismic Pushover Analysis Model” to analyze the quantity of the pushover cases and also expands the “Artificial Intelligent Seismic Capacity Inference Model” to update the inference model in order to incase the accuracy of prediction. Furthermore, to increase the applicability of the “Movable Vibration Inspection Model”, further research and verification are conducted for the bridge pier frequency variation rate before and after disaster determined based on the open for access after disaster. Finally, the bridge earthquake disaster prevention decision supportive webpages, bridge data automatic update mechanism, disaster prevention map and bridge disaster status report system of the expanded disaster prevention countermeasure are utilized in order to satisfy the application needs of the bridge management unit in disaster prevention countermeasure practice.

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本研究之年度工作成果完成 (1) 建議適用於台灣地區之「移動式振動檢測模式」，將儀器裝置於具有行動能力的車輛中，針對洪水前後之橋墩頻率變化率進行研究 (如圖 4-6-1，決定橋梁受損臨界頻率示意圖)，作為判斷橋梁健康之依據。實測橋梁對象 2 座，分別到蘭陽大橋與舊東澳大橋進行共計 6 次量測試驗，試驗結果建議將儀器置於橋面可獲得較理想的結果。(2) 擴展側推分析橋梁案例，進行 3 座橋梁側推分析。分析過程中考量不同鋼筋斷面腐蝕程度對橋梁安全之影響。並將所新增 15 筆之側推分析橋梁案例 (如圖 4-6-2，不同鋼筋斷面劣化程度下橋梁耐震能力)，擴充人工智慧推論案例資料庫，提升預測準確度。(3) 研發橋梁災情回報系統，便於直升機勘災時將災情點選回傳 (如圖 4-6-3，橋梁現地災情系統)。

本研究成果可提供橋梁管理單位於災前評估橋梁地震損壞潛勢，並依此進行維修補強。在實務上，可在災後應用移動式振動檢測，評估橋梁是否可開放通行。

The work outcomes of the research in this year have completed (1) suggestion on using the “moveable vibration inspection model” applicable to the region of Taiwan, installing the instrument device onto a vehicle with mobility to conduct researches on the bridge pier frequency variation rates before and after floods (as shown in FIG. 4-6-1 showing an illustration of determining the bridge damage threshold frequency) in order to be used as a basis for determining the bridge health. The actual measurements was conducted on 2 bridge targets, and a total of 6 measurement tests were performed on the Lanyang Bridge and the Jiudongao Bridge, and the test result suggested that the placing the instrument at the bridge surface would yield a more optimal result. (2) For the expansion pushover analysis bridge case, pushover analysis were conducted on 3 bridges, during the process of analysis, the influence of different reinforced bar cross section corrosion levels on the bridge safety was considered, and 15 new bridge cases on the pushover analysis were added (as shown in FIG. 4-6-2, the bridge seismic ability under different levels of reinforced bar degradation), and the artificial intelligent inference case database is expanded in order to increase the predication accuracy. (3) Bridge disaster status report system as developed in order to facilitate the feedback of the disaster status during the helicopter reconnaissance (as shown in FIG. 4-6-3, the bridge onsite disaster status system).

The outcomes of this research can be provided to the bridge management units to evaluate the bridge seismic damage potentials prior to disasters and to perform repair and reinforcement accordingly. In practice, the moveable vibration inspection can be utilized after disasters in order to evaluate whether the bridge can be opened for access.

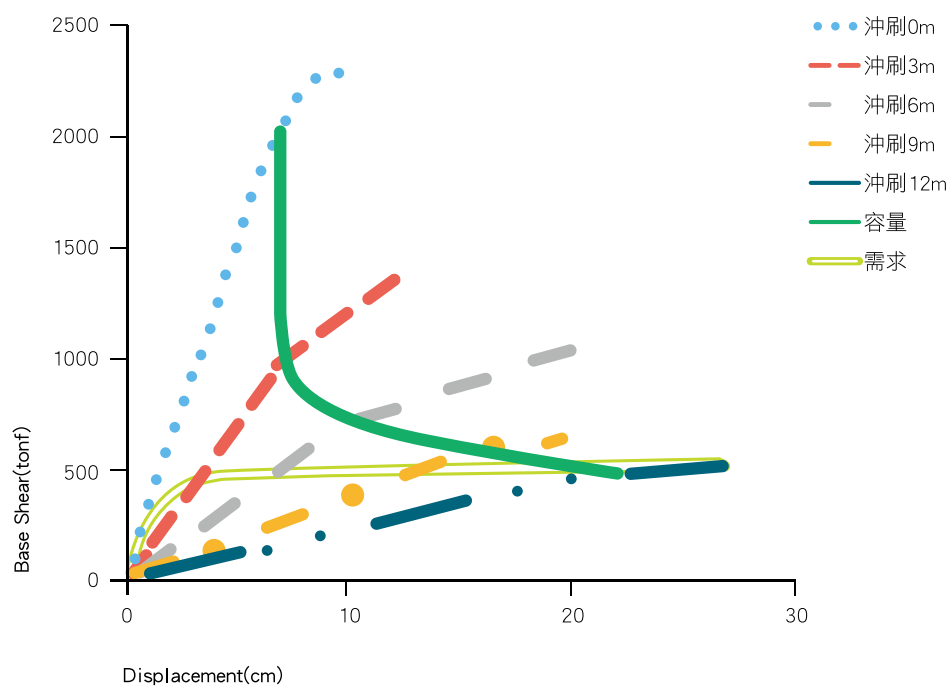


圖 4-6-1 決定橋梁受損臨界頻率示意圖

FIG. 4-6-1 Illustration of determining bridge damage threshold frequency



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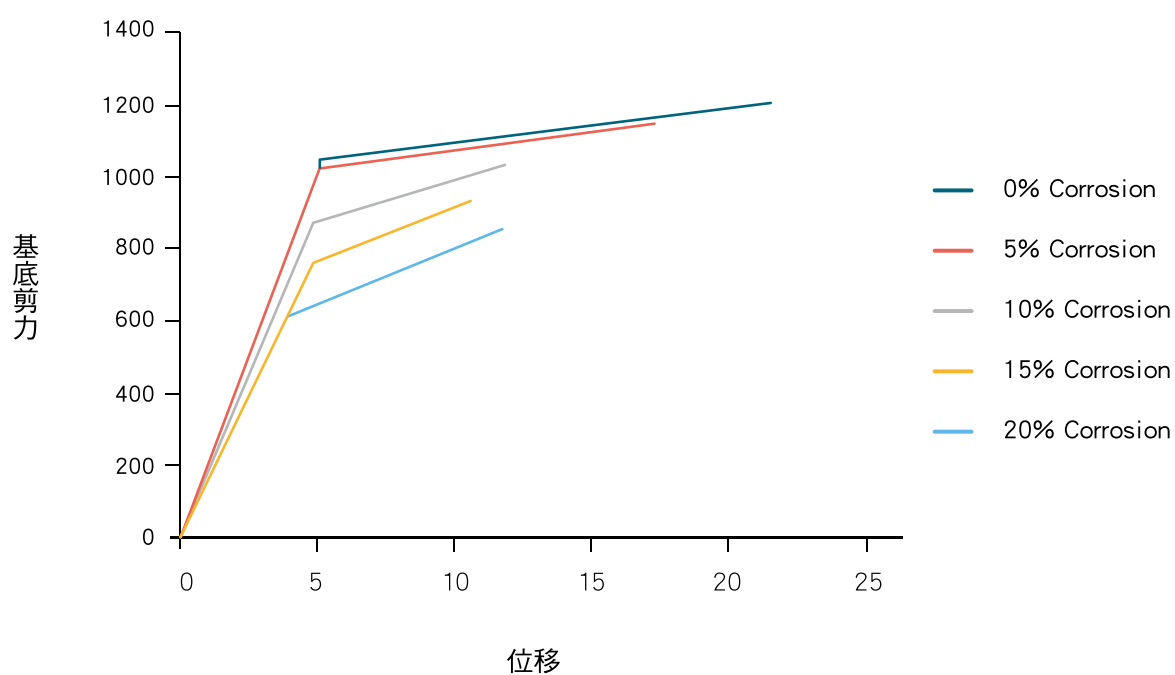
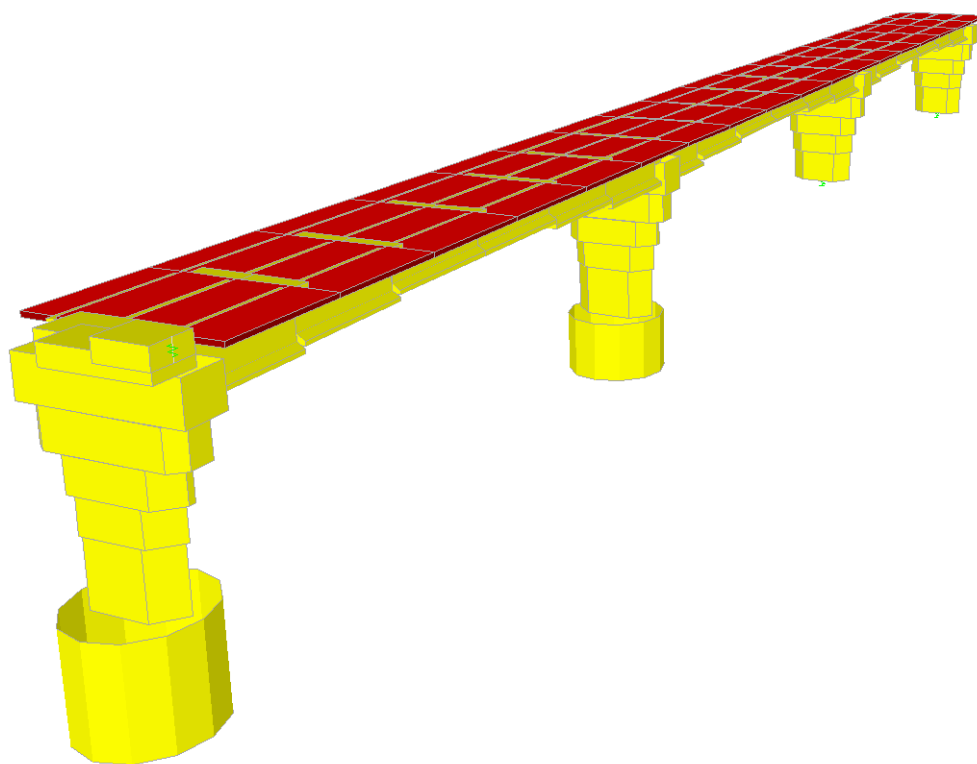


圖 4-6-2 不同鋼筋斷面腐蝕程度下橋梁耐震能力

FIG. 4-6-2 Bridge seismic ability under different level of reinforced bar cross section corrosion



圖 4-6-3 橋梁現地災情系統
FIG. 4-6-3 Bridge onsite disaster status system

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(二) 臺灣主要商港海嘯速報系統之應用—建置溢淹災害潛勢圖

海嘯所造成之災害不同於其他天然災害，由於海嘯是整個水體被帶動且波長甚長，故能攜帶之水體通常會造成大範圍之溢淹，以2004年南亞海嘯東斯里蘭卡為例，可造成長度約2.5km之溢淹；薩摩亞海嘯也有此一現象產生。後續衍生之衛生、心理及重建問題亦是甚為棘手之問題。其次是海嘯波之速度，2011年3月11日東日本海嘯事件中，由現場實況及事後調查報告均顯示即使海嘯波已經造成溢淹，其殘餘速度仍足夠衝垮目前現有之結構物。本研究結合視覺化之防災溢淹潛勢圖(Inundation Map)並整合地理資訊系統之圖資一起展現，以

建立 Google Earth 地理資訊系統圖資之視窗化操作介面，使主管機關都能快速掌握港內受災狀況，大幅降低災害之威脅，在地震規模較大時主動針對港務公司特定人員發送相關預警資訊。

本系統由於透過數值技巧與事先完成資料庫運算及建置，故輸入地震參數即可進行運算及圖形輸出，以個人電腦等級設備僅需20秒內即可完成單一港口計算作業；其中海域地形主要是採用海科中心網格間距為500公尺之水深資料(TaiDBMV6)；除了TaiDBMV6外，港區之水深亦採用港研中心所提供之船測資料加以校正。陸域地形資料是由內政部地政司所提供之5m×5m之DSM數值地形資料，考量DSM



(II) Application of Taiwan Major Commercial Port Tsunami Instant Report System – Establishment of Inundation Map

The disaster caused by a tsunami is different from other natural disasters due to the reason that a tsunami is driven by entire water mass and the wavelength is exceptionally long; as a result, it is able to carry the water mass to cause flooding in a great range. With the example of the South Asia tsunami at Sri Lanka in 2004, it caused the flooding of the length of approximately 2.5km. The Samoa tsunami also had such occurrence. The subsequent health, psychological and reconstruction problems associated to the disasters are also challenging issues to be overcome. The next is the speed of the tsunami wave. In the tsunami event occurred in the east coast of Japan on March 11, 2011, as the actual onsite status and the subsequent investigation report both indicated that despite the tsunami wave had caused flooding, the remaining speed of the wave was still sufficient to destroy currently existing buildings at that time. In this research, presentation is made in combination with the visualized Inundation Map and integration with map of the geographic information system in order to establish a visualization operational interface of Google Earth geographic information system map for assisting the authorities to instantly understand the disaster status inside the harbor and to significantly reduce the threats of the disaster. During the time when the earthquake scale is larger, it is able to actively send out relevant early-warning information to particular personnel in the Taiwan Ports Corporation.

Since this system utilizes the numerical schemes and database computation and establishment completed in advance, it is able to perform computations and graph outputs with the input of the earthquake parameters such that the equipment level of a personal computer is sufficient to complete the computation operation for one single port within 20 seconds. Wherein, the hydrographic features mainly uses the water depth data (TaiDBMV6) with the grid gap of 500m of the Maritime Science Center, and the water depth of the port area also uses the boat measurement data provided by the Harbor and Maritime Technology Center for correction. The land topography data uses the DSM numerical geographic data of

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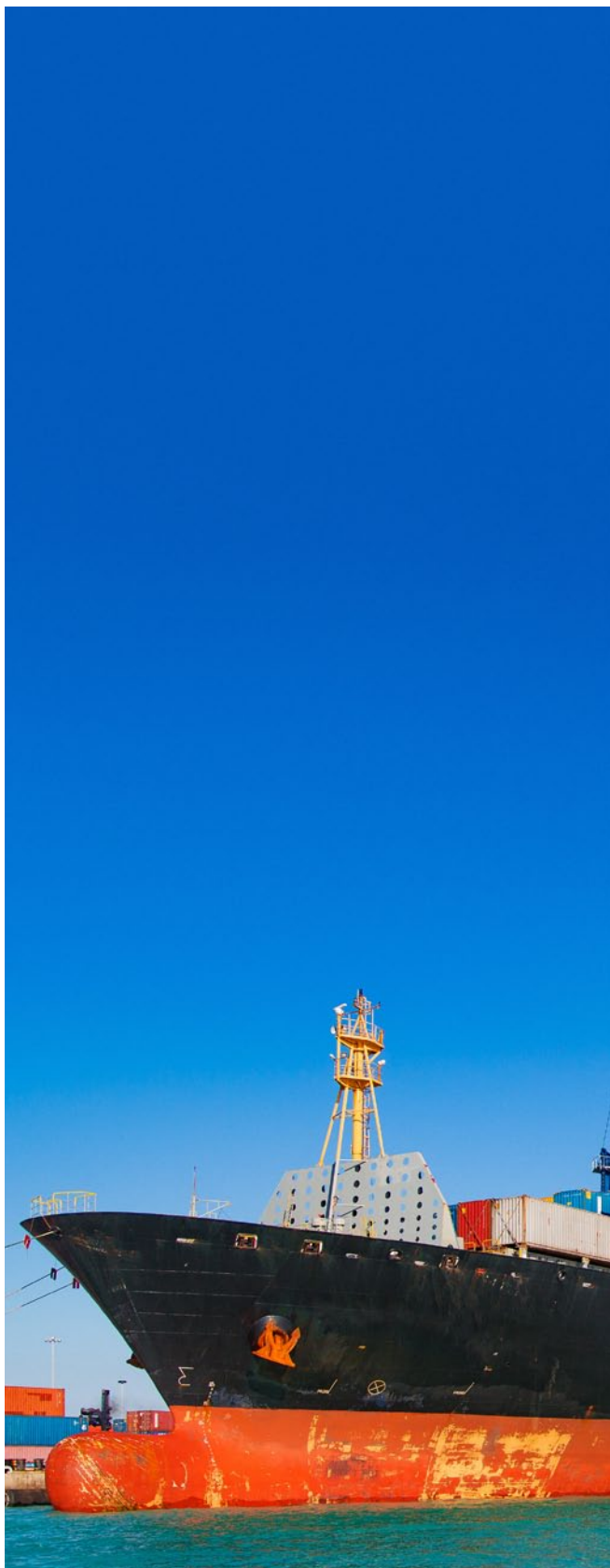
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數值地形資料，於港區的貨櫃容易被誤判成建築，另以陸域地形資料是由內政部地政司所提供之 $5\text{m} \times 5\text{m}$ 之 DEM 數值地形資料，無建物之地形資料來模擬，以代表所有建築物被一掃而空之最糟情況。其中 DSM (Digital Surface Model) 則指的是地表上所有地物，包含人工構造物或自然森林或人工作物覆蓋地面的高程，DEM(Digital Elevation Model) 經由大量自動與人工的植生濾除過程以得到原始地表高程。

將模擬後之每一網格水位的高度已製做成溢淹的範圍並顯示水位高度，藉此將所計算出來的水位資料疊加原始的地形資料 (如圖 4-6-4)，並轉將其經緯度座標轉換成地理資訊系統座標，與地理資訊系統 (GIS) 相結合 (如圖 4-6-5)，配合各種圖層，依照每個溢淹潛勢圖的功能，以最一目了然的方式呈現 (如圖 4-6-6)。各地理資訊系統中尤其以 Google Earth 最方便經濟，系統使用者可直接於網路上下載使用應用軟體，同時可以免除建立基本圖層及數位資料之困擾，其強大之多圖層功能可應用於防災圖資之建立，做為溢淹潛勢圖的展示平臺，因此海嘯速報系統將可輸出 Google Earth 圖資地形用之 kmz 檔。



5mx5m provided by with the concerns on the DSM numerical geographic data that the containers in port area are prone to be erroneously identified as buildings, the DEM numerical geographic data of 5mx5m provided by the Department of Land Administration of MOI is further used as the land topography geographic data in order to conduct simulation based on the geographic data without buildings and to represent the worst case scenario where all buildings have been wiped out completely. Wherein, the DSM (Digital Surface Model) refers to all of the surface objects on the surface, including artificial structure or natural forest or artificial plants covering the ground elevation. The DEM (Digital Elevation Model) uses the massive automatic and artificial plant growing leaching process in order to obtain the original surface elevation.

The height of the water level of each grid after the simulation has been created for the range of the flood and for displaying the height of the water level. By stacking such water level data calculated onto the original geographic data (as shown in FIG.

4-6-4), and converting the longitude and latitude coordinates into the geographic information system coordinates, it can cooperate with all layers of the geographic information system (GIS) in combination (as shown in FIG. 4-6-5) in order to create a clear presentation (as shown in FIG. 4-6-6 based on the function of each inundation map. In each geographic information system, it is most convenient and economic to use Google Earth, and the system user can directly download the application program form the website directly for use; in addition, it can also eliminate the hassle of establishing the basic layers and digital data. Its powerful multi-layer function can be applied to the establishment of disaster prevention map in order to be used as a demonstration platform for the inundation map; therefore, the tsunami instant report system is able to output the kmz file for Google Earth map terrain.

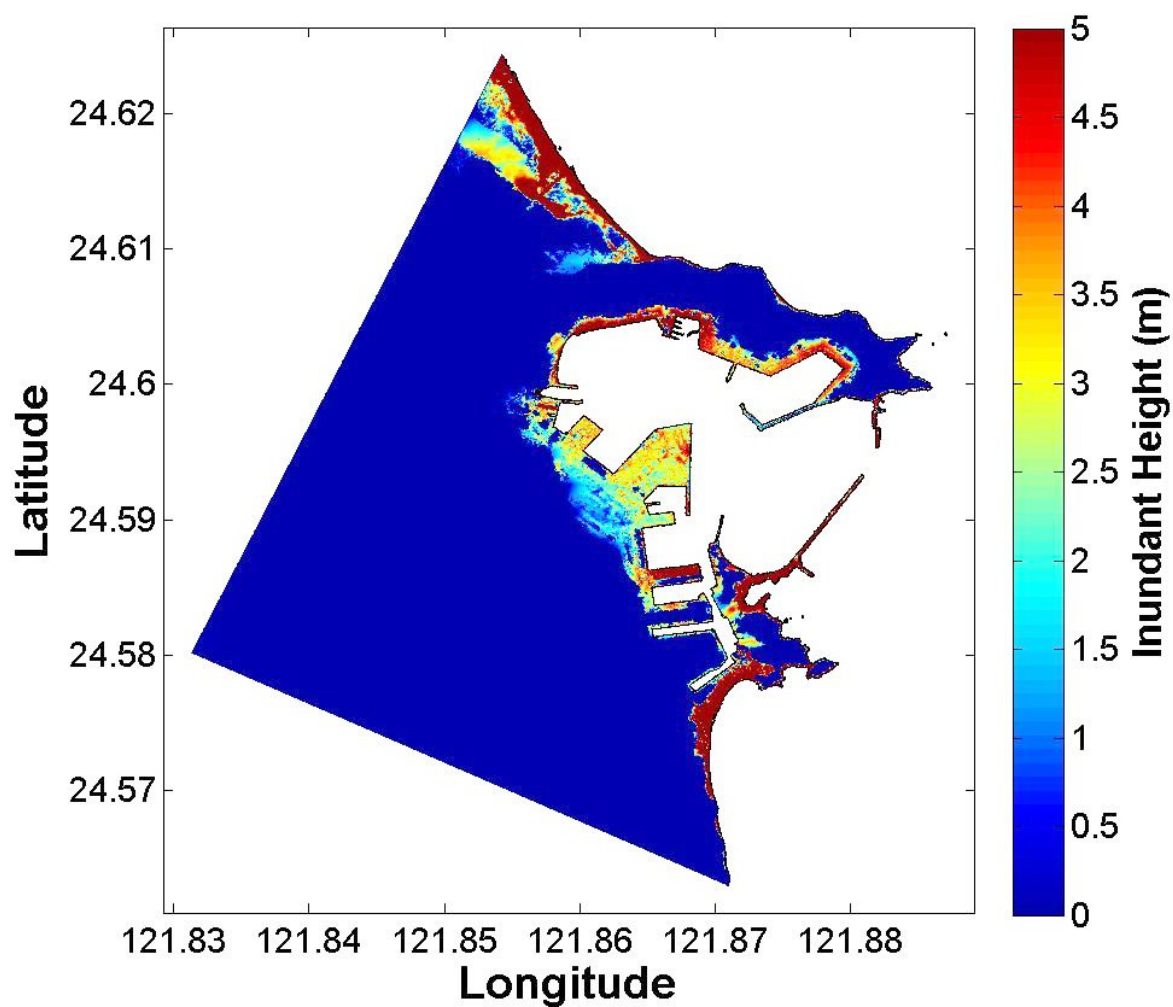
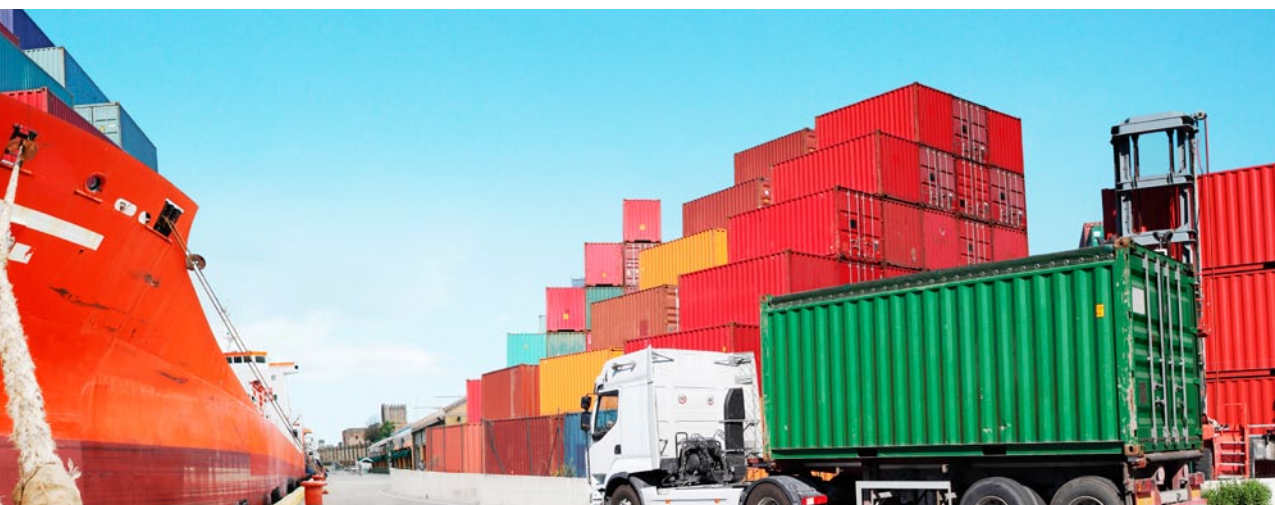


圖 4-6-4 溢淹潛勢圖 (實體圖)

FIG. 4-6-4 Inundation map (physical map)



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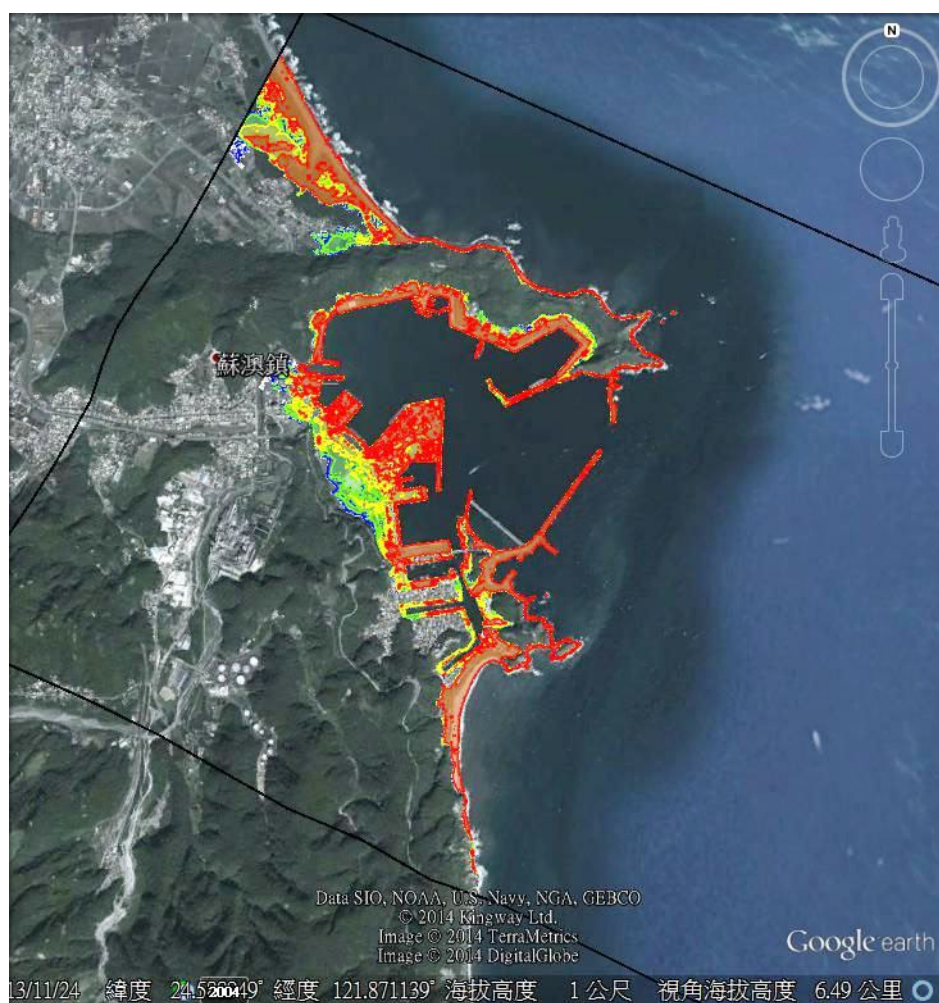


圖 4-6-5 溢淹潛勢圖 (電子圖)
FIG. 4-6-5 Inundation map (electronic map)

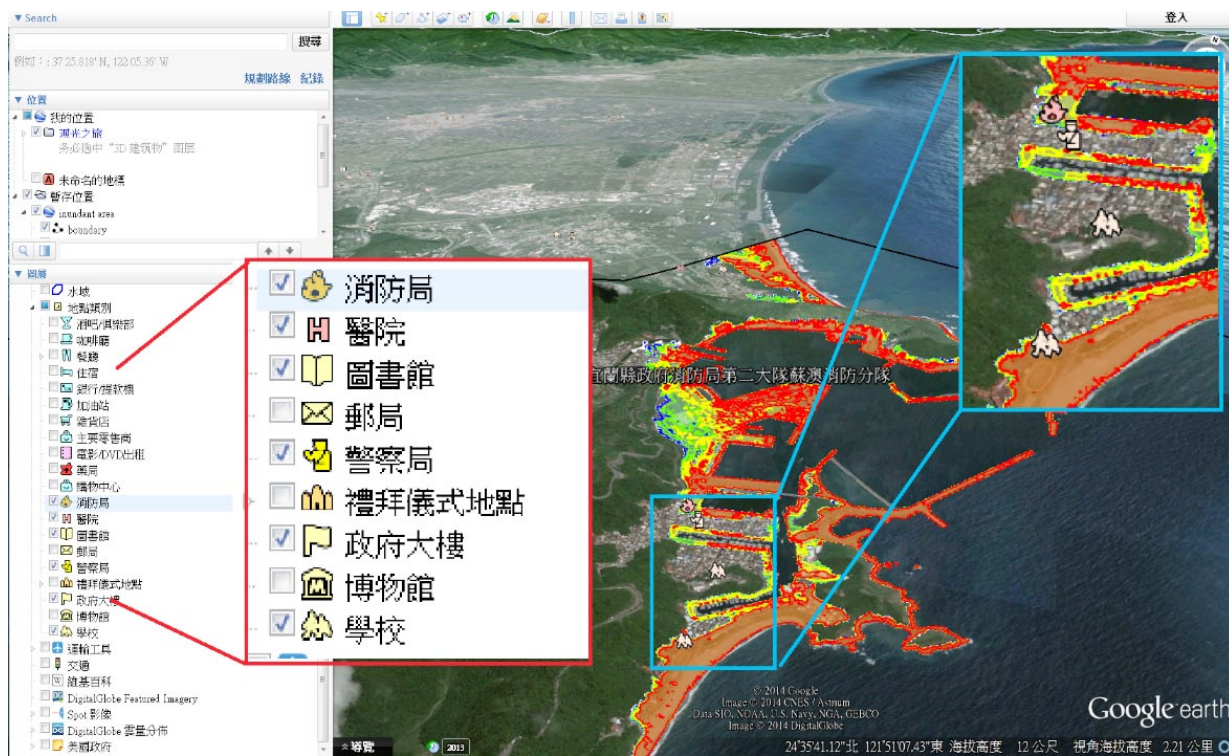


圖 4-6-6 溢淹圖結合 Google Earth 圖層

FIG. 4-6-6 Inundation map combining with Google Earth layer

當太平洋區域發生地震時，可透過海嘯預報系統 (圖 4-6-7) 快速計算港口外海的海嘯波高，再搭配相對應的 Google Earth 溢淹圖資作應變參考。本例為假設馬尼拉海溝北段東經 120.75 度，北緯 20.96 度的位置發生地震矩規模 8.0 的地震時情境模擬，於高雄港外海造成約 1.5 公尺的海嘯波高。由美國地質調查所 1973 至 2010 年期間的地震資料求得的 G-R 關係式 (Gutenberg and Richter 1944) 可知每個地震規模所對應的再現頻率。當地規模 8.0 的地震在 100 年間的期望次數約 0.04，即每 2500 年發生 1 次規模 8.0 以上的地震。圖 4-6-8 為 1.5 公尺海嘯波高在 DSM 和 DEM 地形下所造成的溢淹範圍 (由海嘯模式分別模擬 1 和 2 公尺高斯波形入射，再利用兩者的結果作溢淹水位的空間線性內插)





When an earthquake occurs in the Pacific rim it is able to utilize the tsunami early-warning system (FIG. 4-6-7) to quickly calculate the tsunami wave height of the sea outside the port along with the corresponding Google Earth inundation map as countermeasure reference. In this example, it is assumed that the scenario where an earthquake of the seismic scale of 8.0 occurs at the location of 120.75 degrees of east longitude and 20.96 degrees of north latitude at the north section of the Manila Trench, and tsunami waves of the height of approximately 1.5m is caused to occur at the sea outside the Port of Kaohsiung. From the G-R relationship (Gutenberg and Richter 1944) obtained based on the earthquake data during 1973 and 2010 by the U.S. Geological Survey, the re-occurrence frequency corresponds to each earthquake scale can be obtained. The expectation number for the local earthquakes of 8.0 scale is approximately 0.04, which means that an earthquake of the scale above 8.0 occurs once every 2500 years. FIG. 4-6-8 shows the flooding range caused by tsunami waves of the height of 1.5m under the terrain of DSM and DEM (simulating the Gaussian waveform incidents of 1m and 2m respectively based on the tsunami mode, followed by using the results of the two to perform the spatial linear interpolation of the flood water level)

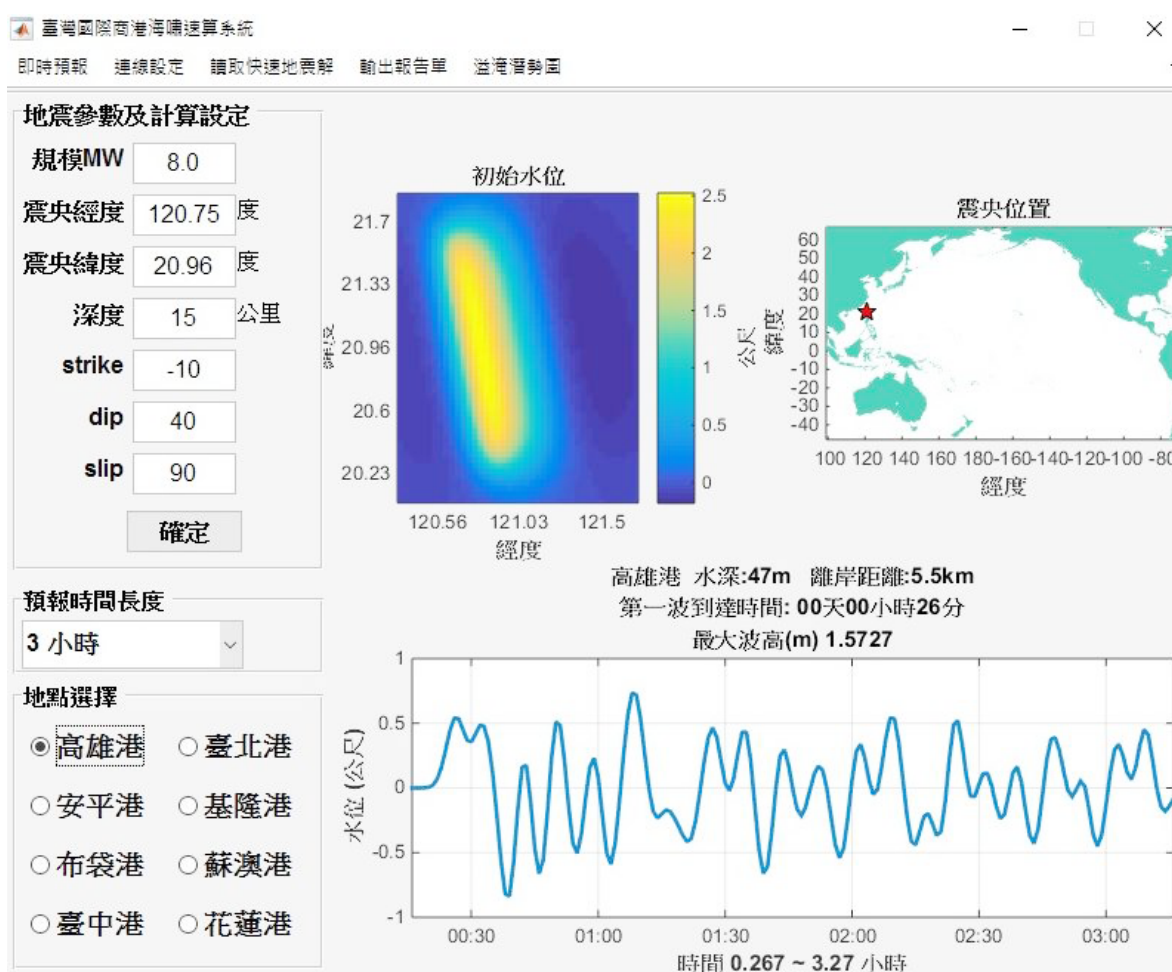


圖 4-6-7 海嘯預報系統介面

FIG. 4-6-7 Tsunami early-warning system interface



圖 4-6-8 高雄港 DSM 地形 (上圖) DEM 地形 (下圖) 的局部溢淹範圍

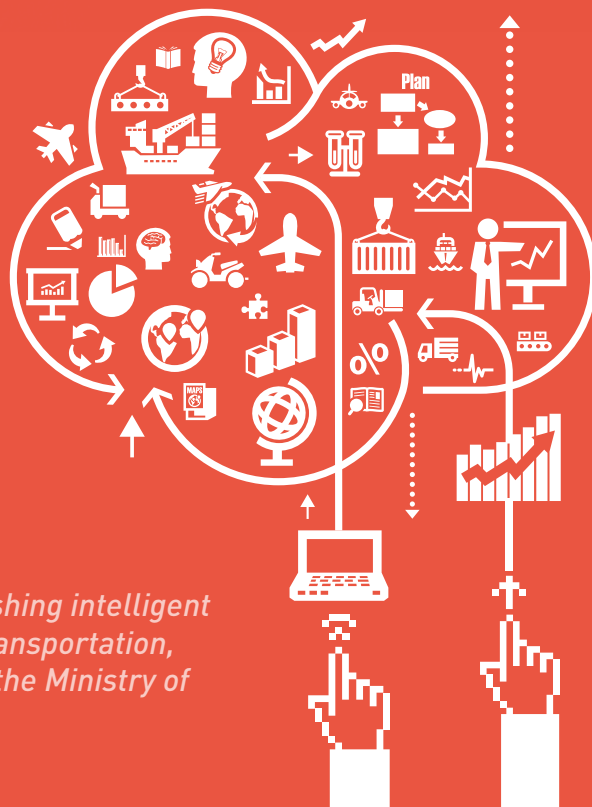
FIG. 4-6-8 Partial flooding ranges of DSM terrain (drawing on the above) and DEM terrain (drawing on the below) of the port of Kaohsiung

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落實應用實績

Implementation and Application Achievements

To achieve the administrative objective of “establishing intelligent transportation system, promoting lasting green transportation, satisfying energy saving and carbon reduction” of the Ministry of Transportation and Communications (MOTC)



IMPLEMENTATION AND APPLICATION ACHIEVEMENTS



為達成交通部「建置智慧型運輸系統，推動永續綠運輸，符合節能減碳」之施政目標，本所致力於落實科技計畫研究成果於交通部政策推動，並配合我國交通環境，研發相關交通科技軟、硬體系統後，移轉至各交通管理機關或地方政府實施應用，以提升各交通管理機關與地方政府之交通管理效能。以下即簡要介紹相關實績：

To achieve the administrative objective of “establishing intelligent transportation system, promoting lasting green transportation, satisfying energy saving and carbon reduction” of the Ministry of Transportation and Communications (MOTC), this institute is dedicated to implementing technology project research outcomes in the promotion of the MOTC policies and cooperates with the traffic environment of our nation in order to research and develop relevant traffic technology software and hardware systems, followed by transferring to all traffic management agencies or local governments for further implementation and application in light of enhancing the traffic management performance of all traffic management agencies and local governments. The following provides a brief introduction on relevant achievements.

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辦理「交通部門中長程各次類別計畫」年度預算之審議及個案計畫審查 ●●●

辦理「運輸部門中長程公共建設發展作業評估」相關研究，並配合交通部辦理 105 年度公共建設運輸部門先期作業審查；協助編擬中長程發展計畫報院核定。104 年除協助交通部審議與評估相關建設計畫案件，出席縣市政府及各機關交通建設與改善計畫審查會與諮商會議外，且協助交通部審核各機關提報 103 年度屆期重大公共建設計畫執行成效檢討評估。此外，配合國家發展委員會針對中長程個案計畫編審作業之調整，協助交通部盤點公路、軌道、航空、港埠及觀光等 5 個次類別 106-109 年度個案建設計畫需求，並與上位交通建設政策目標及推動策略等進行連結，104 年 10 月撰擬完成「交通建設部門綱要計畫 (106- 109 年)」，期有效發揮上位引領功能，協助中長程交通個案計畫穩健布局，並與年度預算叩合。

Conducting review of annual budget for “Each mid- and long-term subclass project in MOTC” and review of individual project ●●●

Conducting relevant researches on “Mid- and long-term public infrastructure development operation evaluation in transportation department” and cooperating with the MOTC in conducting the 2016 early stage operation review with the public infrastructure transportation department; assisting in the stipulation of mid- and long-term development plan and reporting to the Yuan for approval. In 2015, this institute not only assisted the MOTC in reviews and evaluations of relevant infrastructure project cases, attended the county/city government and agency traffic construction and improvement plan review meeting and counseling meetings but also assisted the MOTC in examining the 2014 major public infrastructure plan execution outcome reviews and evaluations submitted by all agencies. In addition, to cooperate with the adjustment of the auditing operation on the mid and long term individual plan by the National Development Council, to assist the MOTC in auditing 5 subclasses of highways, rails, airlines and ports etc. for the 2017-2020 individual infrastructure project requirements and to connect with the superordinate traffic infrastructure policy objective and promotion strategies etc., the “Traffic Infrastructure Department Schema Plan (2017-2020)” was drafted completely in October 2015, in light of effectively implementing the super-ordinate guiding functions, assisting the stable deployments of mid and long term traffic individual projects and to match with the annual budget requirement.

進行「整體運輸規劃」與運輸策略系列研究 ●●●

整體運輸規劃是政府用以擬訂未來各項交通運輸建設或政策之主要依據及藍圖，本所自民國65年以來，以10年為一期，陸續完成4期的整體運輸規劃，考量近期隨著氣候變遷、全球產業趨勢、國家發展、國土空間結構等大環境的快速變化，民眾對於運輸服務的要求也隨之改變，連帶的旅運特性亦不同於以往。上述社經發展趨勢與運輸需求之改變，將影響社經及模式中各參數、各模組間之關係及模式整體解釋能力。第5期整體運輸規劃於103年正式展開，為掌握旅次特性，本所於103及104年進行全國性（含臺、澎、金、馬）大規模之城際旅次特性調查，以瞭解我國城際運輸系統平假日旅運特性，作為建構符合實際發展之城際運輸需求模式之基礎，期能更準確的預測未來運輸系統之供需情形，並進行相關運輸系統藍圖與策略分析，以利近期提出第5期整體運輸規劃成果，俾供作為未來整體運輸發展規劃與政策制定之參考。



Performing series of researches on “Overall transportation planning” and transportation strategy ●●●

Overall transportation planning serves as a primary basis and blueprint for the government in stipulating all traffic and transportation infrastructures or policies for the future. Since 1976, this institute has consecutively completed the overall transportation planning for 4 sessions, in which every 10 years are counted as 1 session. With the consideration of the recent rapid changes of the greater environment related to climate changes, global industrial trend, national development, national land space structure etc., the demands of the public on transportation service also changes such that the traveling and transportation characteristics associated thereto are too different from the past. The aforementioned changes of the development trend and transportation demands would affect parameters in the social and economic models, relationship among modules and overall interpretation ability of the model. The fifth session of the overall transportation planning has officially started in 2014. To fully grasp the traveling characteristics, this institute has conducted a large scale of intercity traveling characteristic survey nationwide (including Taiwan, Penghu, Kinmen and Matsu) in order to understand the intercity transportation system regular and holiday traveling transportation characteristics in our nation such that it can be used as a foundation for establishing an intercity transportation demand model satisfying the actual development in light of predicting the demand and supply conditions of the future transportation system more accurately. In addition, relevant transportation system blueprint and strategy analysis are conducted in order to facilitate the recently proposed 5th overall transportation planning outcome to be served as a reference for future overall transportation development planning and strategy stipulation.

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研訂我國「運輸系統容量分析」 手冊及分析軟體並推廣其應用 ●●●

在軌道容量方面，本所於 102 年提出我國第 1 版軌道容量手冊 -- 「2013 年臺灣鐵道容量手冊」，並完成「傳統區域鐵路系統容量分析模式暨視窗軟體」(CRCS) 供各界應用。在公路容量方面，本所於民國 79 年首次出版「臺灣公路容量手冊」，陸續於 90 年、100 年編修部分內容，目前最新版本為「2011 年臺灣公路容量手冊」，同時開發「臺灣公路容量分析軟體 THCS」，期使運輸系統容量分析過程標準化並提高評估效率；為推廣公路容量研究成果，每年辦理中央及地方政府交通運輸人員培訓，並擴及顧問公司專業人員與大學交通系所學生，以提升運輸專業從業人員之運輸系統分析評估能力。104 年度公路容量分析軟體教育訓練於北區及南區各辦理 1 場次，共計 47 人參訓。

Stipulating "Transportation System Capacity Analysis" manual and analysis software as well as promoting their applications in our nation ●●●

For the aspect of the rail capacity, this institute proposed the 1st edition of the rail capacity manual – "2013 Taiwan Railway Capacity Manual" of our nation in 2013 and also completed the "Analysis of Conventional and Regional Railway Capacity and Software Development" (CRCS) for applications in various fields. For the aspect of the highway capacity, this institute issued the first edition of "Taiwan Highway Capacity Manual" in 1990 and consecutively released the edited and revised contents in 2001 and 2011, with the latest edition of the "2011 Taiwan Highway Capacity Manual"; in addition, the "Taiwan Highway Capacity Analysis Software" (THCS) was developed at the same time in light of standardizing the transportation system capacity analysis process and increasing the evaluation efficiency. To promote the highway capacity research outcome, trainings for central and local government traffic and transportation personnel have been held annually, which further includes professionals of consulting firms and university undergrads and graduates of the department or institute of traffic science in order to enhance the transportation system analysis evaluation ability of transportation professionals and workers. In 2015, highway capacity analysis software educational trainings were held once for the northern region and the southern region respectively, and a total of 47 people participated in the training.



自行車環島一號線

主幹線 **968** 公里 + 環支線 **235** 公里 = **1,203** 公里

104 年底



11 處兩鐵轉運站



122 處補給站

辦理自行車環島串連路網規劃 ●●●

為響應節能減碳政策，引領綠色運具騎乘風潮，本所協助交通部「自行車路網建設計畫督導小組」針對跨部會、地方政府與道路主管機關之介面問題進行協調配合，並負責全國自行車路網整體規劃、施工中的檢視與調整、完工後的路網資訊查詢與行銷文宣等事宜。於 104 年底串連全臺第 1 條 1,203 公里環島自行車道 -- 「自行車環島 1 號線」，該線主幹線長 968 公里，環支線約 235 公里。騎士只要沿著自行車專屬標誌標線就可環臺一圈，中途並規劃 122 處補給站供騎士休息；另設置 11 處兩鐵轉運站方便騎士依假期長短進行分段環島，自啟用後獲得國內外騎士稱許。

Conducting cycling around island road connection network plan ●●●

In response to the energy saving and carbon reduction policies, to lead the trend of green transportation, this institute assists the "Cycling Path Network Infrastructure Plan Supervision Team" of the MOTC to conduct coordination and cooperation among ministries, local governments and the road authority agencies on interface issues, and this institute is also responsible for matters related to the nationwide cycling path network overall planning, reviews and adjustments during construction, information searches for road network after completion and the marketing propaganda etc. At the end of 2015, the 1st cycling path around the island connecting the entire Taiwan - "Cycling Route No.1" was established, and the main route is 968km and the ring branch route is approximately 235km. Riders can simply follow the particular signs for cycling in order to circle the island once. Along the cycling route, 122 spots have been planned as supply stations for resting; in addition, 11 spots have been set up as dual railway transfer stations to facilitate riders in planning the cycling around the island in sections according to the length of holidays, which have received warm appraisals from the domestic and foreign riders since the official start of use of these facilities.

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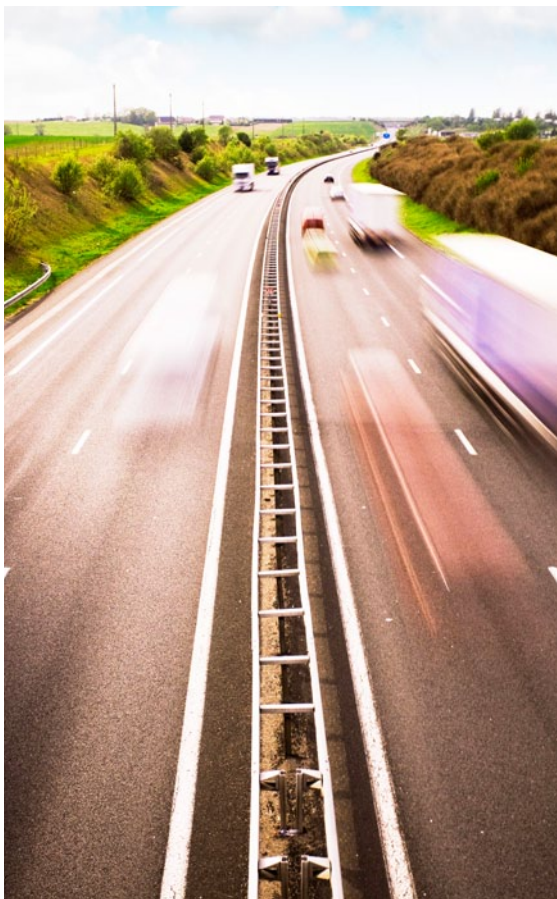
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應用公路容量研究，針對國 5 壅塞研提具體管理措施 ●●●

本所致力於公路容量之基礎研究，長期觀察國 5 車流特性，104 年 9 月提出“國道 5 號設置大客車專用道搭配主線儀控”做法，獲得部次長同意交由高公局落實辦理，104 年 12 月 20 日與 27 日試辦成功後，旋即於 105 年元旦開始實施「假期尖峰開放國 5 北上大客車行駛路肩並結合主線儀控」交管措施。元旦假期交通量雙向約 7 萬輛，大於平日週休假期，但車陣回堵長度卻較平常假日為短（從 8 公里縮短為 7.5 公里），小客車的行車時間無明顯變化，大客車行車時間卻大幅縮短（假期實施路肩開放大客車）與未實施期間相比，保守估計單日可節省大客車乘客總旅行時間超過 25 萬・人分鐘，大大提高公共運輸優勢與吸引力。



Researching and proposing specific management measures for traffic congestion on National Highway No. 5 with the application of highway capacity research ●●●

This institute is dedicated in the fundamental researches of highway capacity, and after observing the traffic flow characteristic of the National Highway No. 5, this institute proposed the method of “Installation of Bus Exclusive Lane Along with Main Line Instrumental Control for National Highway No. 5” in September 2015, which was approved by the Deputy Minister for implementation by the National Freeway Bureau; in addition, after the successful trial runs on December 20 and 27, 2015, the traffic control measure of “Northward Bus Traveling Road Shoulder Along with Main Line Instrumental Control on National Highway No. 5 During Holiday Peak Periods” was started and implemented on the first day of 2016. During the New Year holidays, the traffic volume both ways was approximately 70 thousand vehicles, greater than the regular weekend holidays; however, the traffic jam length was shorter than the regular holidays (reduced from 8km to 7.5km), and there was no obvious changes in the traveling time of the small passenger vehicles; however, the traveling time of the buses was significantly reduced (road shoulder opened for buses for holiday was implemented), and in comparison to the period without such implementation, it was conservatively estimated that the bus passenger total traveling time saved on a daily basis exceeded the rate of 250 thousand person minutes, which significantly increased the advantages and attraction for public transit.



統合協調高公局及地方政府，持續辦理林口交流道改善 ●●●

林口地區發展迅速，交流道兩側分屬新北市與桃園市各有疏導重點，不易整合，致使交流道周邊道路壅塞。自 101 年起本所即針對林口 A 及 B 交流道壅塞問題進行區域性路網旅運特性分析，研提整體改善方案，依最新調查結果顯示，新北市及桃園市政府辦理短期改善措施後，整體道路運轉效率明顯提升，全年節省路口延滯換算旅行時間成本逾 5,000 萬元，約 1 座迴轉道工程費。104 年並協助新北與桃園二市府辦理增設 2 處迴轉道及 20 處主次要路口區域性號誌協控，整合該地區各道路交通控制系統，均衡區域性路網車流，有效提升林口交流道整體運轉效能。

Collaborating and consolidating National Freeway Bureau and local government in continuously performing Linkou interchange improvement ●●●

The Linkou area is under rapid development, and the two sides of the interchanges belong to the New Taipei City and Taoyuan City respectively such that both have their own dredging methods and cannot be integrated with ease, which causes the traffic congestion at the nearby roads of the interchanges. Since 2012, this institute has conducted the regional road network traveling characteristic analysis on the traffic congestion issue at the Linkou interchanges A and B in order to propose an overall improvement solution. According to the latest investigation result, it shows that after both the New Taipei City Government and Taoyuan City Government implements the short-term improvement measures, the overall road transportation efficiency is significantly increased, and the intersection delay converting to traveling time cost saved annually exceeds 50 million dollars, approximately equivalent to the construction cost of 1 U-turn lane. In 2015, this institute also assisted the two governments of the New Taipei City and Taoyuan City to additionally install 2 areas of U-turn lanes and 20 areas of main and secondary intersection regional signs to assist the control thereof; therefore, by integrating the road traffic control system of the region and balancing the regional road network traffic flow, the overall operation performances of the Linkou interchanges are effectively increased.

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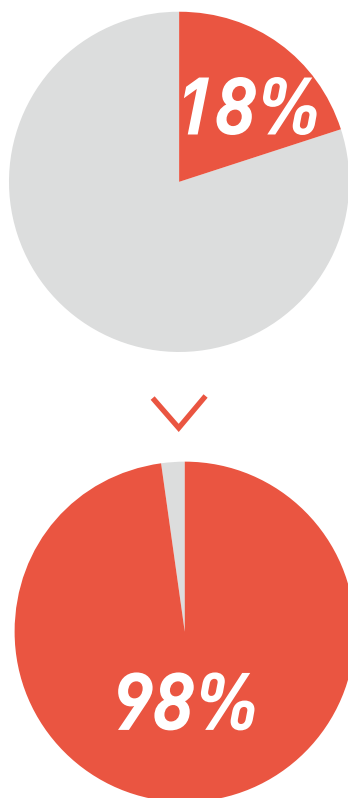
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協助落實橋梁安全維護管理 ●●●

為落實橋梁安全管理與維護，提升臺灣橋梁使用安全與改善交通環境安全，本所於 89 年建置第一代橋梁管理系統 (TBMS) 供全國橋梁管理單位使用，而後每年辦理橋梁維護管理教育訓練 (每年約 1,000 人次參訓)，以提升人員素質；並自 94 年開始實施橋梁維護管理作業評鑑，以縣市政府為例，整體橋梁檢測比率由 18% 逐漸提升為 98%，透過評鑑結果的公布，督促管理單位重視橋梁安全，從而積極管理。104 年本所已開發完成第二代橋梁管理資訊系統，藉由構件化、行動化等創新作法，達到「逐構件、全紀錄」目標，提升橋梁維護管理品質及效率，後續年度將正式啟用第二代橋梁管理系統。

94 年起
整體橋梁檢測比率



Assisting implementation of bridge safety maintenance management ●●●

To implement the bridge safety management and maintenance in order to increase the Taiwan bridge usage safety and improve the traffic environment safety, this institute established the first generation of Taiwan bridge management system (TBMS) in 2000 and provided for the use of the national bridge management units, following which bridge maintenance management educational training was held annually (approximately 1,000 people participated in the training annually) in order to increase the personnel quality. Furthermore, the bridge maintenance management operation evaluation has been implemented since 2005. By using the county/city government as an example, the overall bridge inspection percentage increases from 18% to 98%; through the publication of the evaluation results, the management units are urged to consider the bridge safety seriously in order to perform active management. Since 2015, this institute has already completed the development of the second generation of bridge management information system such that through innovative methods of component-based and mobility-based techniques, the goal of "by component, full record" can be achieved in order to increase the bridge maintenance management quality and efficiency. For the subsequent years, the second generation of bridge management system would be officially put to use in practice.



開發「地震後橋梁快篩提醒模組」， 節省檢測工作量 ●●●

我國每年發生近 3.8 萬次有感地震，平均每 2.13 天發生一次震度 4 級 (含) 以上地震，相應之橋梁特別檢測工作量繁重。本所跨領域整合橋管機關地震後特別檢測作業需求、氣象局網格震度資料，開發「地震後橋梁快篩提醒模組」，透過資通技術篩選發布，讓橋管機關能將地震後特別檢測作業之判別尺度，由 98 平方公里縮小為 1 平方公里，於 104 年 6 月提供跨機關服務 (供高公局、公路總局、臺鐵局及全國 22 縣市政府使用)，本模組可協助橋管機關快速篩選出震度 4 級 (含) 以上橋梁外，並大幅節省檢測人員之工作量，每年節省檢測費用約 4,000 萬元。

Developing “Bridge Quick-Screening After Earthquake Notification Module” in order to save inspection workload ●●●

Approximately 38 thousand earthquakes occur in our nation annually, and on average, a felt earthquake of the intensity above 4 (inclusive) occurs once every 2.13 days, which causes the workload for special corresponding bridge inspection to be great. This institute integrates the special inspection operation requirements after earthquake of the bridge management agencies cross fields along with the grid earthquake scale information from the Weather Bureau in order to develop the “Bridge Quick-Screening After Earthquake Notification Module”. By broadcasting via the information technology and screening, the bridge management agencies are able to reduce the determination range for the special inspection operation after earthquake from 98 square kilometer to 1 square kilometer. This module was provided to service various agencies (provided for the uses by the National Freeway Bureau, Directorate General of Highways, Taiwan Railways Administration and 22 county/city governments nationwide) in June 2015. This module is able to assist bridge management agencies to promptly screen out bridges with an earthquake of the intensity above 4 (inclusive) such that it is able to significantly reduce the workload of the inspection personnel, and the annual inspection cost saved is approximately 40 million dollars.'

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協助交通部完成院頒「道路交通秩序與交通安全改進方案」之檢討修訂 ●●●

行政院頒「道路交通秩序與交通安全改進方案」執行多年至今，執行面呈現諸多問題，例如：工作項目繁雜、重點工作失焦、執行效果不彰等，本所協助交通部重新檢討修訂，提出第 12 期 (105-107 年) 院頒「道路交通秩序與交通安全改進方案」草案，將「速度管理、路口停讓、機車安全」列為亮點工作，該方案業經行政院 104 年 12 月 1 日院臺交字第 1040064115 號核定執行在案。

辦理「臺灣地區易肇事路段改善計畫」 ●●●

配合行政院「道路交通秩序與交通安全改進方案」執行臺灣地區易肇事路段改善工作，提供各縣市道安聯席（督導）會報於研提易肇事地點改善計畫之相關技術分析協助，以提昇道路交通安全。104 年底已完成第 33 期「臺灣地區易肇事路段改善計畫」，以 101 年（第 30 期）計畫改善地點 115 處之執行成效為例，改善前（100 年）與改善後（103 年）肇事件數減少 36%、死亡人數減少 71%、受傷人數減少 41%，成效良好。



Assisting the MOTC in completing the review and revision of "Road Traffic Order and Traffic Safety Improvement Solution" announced by the Yuan ●●●

After the execution of the "Road Traffic Order and Traffic Safety Improvement Solution" announced by the Executive Yuan for years until now, a lot of issues on the execution aspect have been found, such as: complicated work items, loss of focus on the key works, inadequate outcome of the execution performance etc. This institute has assisted the MOTC in overall review and revision such that the 12th edition (2016-2018) of the draft of "Road Traffic Order and Traffic Safety Improvement Solution" announced by the Yuan is proposed, in which the "speed management, intersection stopping and yielding, motorcycle safety" are listed as the key tasks, and this solution has been approved for execution under the Yuan-Tai-Jiao-Tze No. 1040064115 of the Execution Yuan on December 1, 2015. For the subsequent years, the second generation of bridge management system would be officially put to use in practice.

Conducting "Taiwan Region Accident-Prone Road Section Improvement Plan" ●●●

Cooperating with the "Road Traffic Order and Traffic Safety Improvement Solution" of the Executive Yuan in executing the Taiwan region accident-prone road section improvement plan, providing relevant technical assistance on research and proposal of accident-prone location improvement plan in the meeting with all county/city road safety union (supervision) in order to increase the road traffic safety. At the end of 2015, the 33rd edition of "Taiwan Region Accident-Prone Road Section Improvement Plan" has been completed. With the example of the execution outcome of 115 areas of the 2012 (30rd edition) planned improvement location, the number of accidents reduced from before the improvement (2011) to after the improvement (2014) by 36%, number of deaths reduced by 71%, number of injuries reduced by 41%, which demonstrates excellent results.



協助交通部辦理「機車交通政策白皮書」政策研究 ●●

交通部配合聯合國推動 2011-2020 年為道路安全行動十年，並改善國內道路交通安全，辦理「機車交通政策白皮書」政策研究，配合「全國道安扎根強化行動」計畫，所研擬治理方案之實施要領，納入第 12 期院頒「道路交通安全與交通秩序改進方案」中執行，並藉由安全監測指標之建立，可持續監督與評估各項課題的安全績效，督促各部門重視及持續執行。

Assisting MOTC in conducting policy research on "Motorcycle Traffic Policy Proposal" ●●●

The MOTC promotes the years of 2011-2020 as the road safety in action for 10 years according to the United Nation to improve the domestic road traffic safety, conducting the policy researches of "Motorcycle Traffic Policy Proposal", cooperating with the project of "National Road Safety Rooting and Strengthening Action", in order to incorporate the researched and stipulated implementation essentials of the treatment solution into the 12th session of "Road Traffic Safety and Traffic Order Improvement Solution" announced by the Yuan for execution. In addition, with the establishment of the safety monitoring index, the safety performance of all subjects can be monitored and evaluated continuously along with supervising each department to emphasize and continue the execution thereof.

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辦理「鐵路安全之風險管理推動研究 - 發展鐵路系統之安全管理實務與報告」研究 ●●●

配合交通部提昇我國鐵路安全管理制度之目標，本所辦理鐵路安全之風險管理推動等系列研究，提出年度安全管理報告精進範本，擬定適用於鐵路系統之年度安全管理報告書操作指引，並以阿里山森林鐵路列車出軌案例，推廣防止出軌事故防護作業之標準化、文件化與程序化探討，提出防止列車出軌危害之建議，以及建議鐵路安全之相關法規條文修正方向。交通部鐵路營運監理小組參考本所報告建議事項，規劃函請鐵路營運單位精進年度安全管理報告之完整性與充實性。

Conducting research on “Railway Safety Risk management Promotion Research – Safety Management Practice and Report for Developing Railway Safety” ●●●

In cooperation with the MOTC in improving the objective of the railway safety management system of our nation, this institute conducts a series of researches on railway safety risk management promotion etc., proposing annual safety management report improvement template, stipulating annual safety management report operation guideline for railway system along with the use of the Alishan Forest Railway Derailment Case as an example in order to promote the standardization of the protection operation preventing derailment accidents, to review documentation and procedures, to propose suggestions on preventing the hazard of train derailment and to suggest the revision direction of legal regulations related to railway

協助交通部推動「公路公共運輸 提昇計畫(102～105年)」●●●

為延續「公路公共運輸發展計畫(99-101年)」推動成果，交通部奉行政院核定續推動「公路公共運輸提昇計畫(102～105年)」，為期4年。本(104)年度預算數為47億2,208萬3,000元，實際核定金額為46億673萬117元。本計畫由公路總局負責編列預算及執行，本所配合交通部續督導及協助各縣市推動本計畫，以強化全國各地區公共運輸服務品質與能量。

交通部自99年開始辦理兩期公路公共運輸計畫(99-101年，102-105年)，平均每年投入約40億元，成效顯著(例如公車載客量成長20%，公共運輸碳排減量等同653座大安森林公園年吸附碳量)。為續推動公共運輸發展，本所已依交通部指示研擬第3期計畫(「公路公共運輸多元推升計畫(106-109年)」)，以提案方式、單位及內容更加多元、經費運用更具彈性之概念進行規劃，以解決過去執行面所遭遇之問題，以及因應產業未來發展之需求。



safety. The MOTC railway operation monitoring team plans to request the railway operation unit to improve the integrity and enrichment of the annual safety management report based on referencing to the suggestion matters reported by this institute.

Assisting the MOTC in promoting “Highway Public Transportation Improvement Plan (2013~2016)” ●●●

To continue the promotion outcome of the “Highway Public Transportation Development Plan 2000~2012”, the MOTC acts according to the approval of the Executive Yuan to continue the promotion on the “Highway Public Transportation Development Plan 2013~2016” for a period of 4 years. For this year (2015), the annual budget amount is 4,722,083,000 dollars, and the actual approved amount is 4,606,730,117 dollars. The Directorate General of Highways is responsible for the budget stipulation and execution of this project, and this institute cooperates with the MOTC in continuously supervising and assisting all counties and cities in the promotion of this project in order to enhance the service quality and energy of public transportation in all areas nationwide.

Since the start of the two sessions of the highway public transportation project in 2000 (2000-2012, 2013-2016), the average annual investment spent is approximately 4 billion dollars annually, and the its results are profound (such as the increase of the bus carrying capacity by 20%, the reduction of the carbon exhaust amount by the public transportation is equivalent to the carbon absorption amount 653 times greater than Da-An Forest Park). To continue the promotion of the public transportation development, this institute has already stipulated the 3rd session of project (“Highway Public Transportation Diversity Improvement Project (2017~2020)”) according to the MOTC instruction such that with the planning is conducted according to the method of proposals, more diverse units and content, the concept of more flexibility in the budget utilization in order to overcome the issues encountered during the past execution and, therefore, it is able to cope with the requirements for future development of the industries.

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辦理「運輸物流管理系統整體研究發展」●●●

以運輸物流為主要研究對象，針對交通部之運輸物流發展政策重新檢視，以因應我國物流產業發展政策之動態性調整及國際全球運籌發展趨勢。104 年度配合行政院「國際物流服務業發展行動計畫」之推動，辦理「運輸物流供應鏈恢復力之研究」，本研究主要目的在盤點我國國際運輸物流海空港基礎設施之脆弱度，針對我國與五大出口國（中國大陸、新加坡、美國、日本、韓國）間國際運輸物流供應鏈風險進行分析評估，並對各項國際海、空運風險因子提出因應對策，俾提供交通部航政司、航港局、民航局、臺灣港務股份有限公司、桃園國際機場股份有限公司與相關運輸物流公協會等運用，做為強化我國輸物流發展施政之參據。

5 大出口國

中國大陸

新加坡

美國

日本

韓國

辦理「先進公共運輸系統整體研究發展」●●●

節能減碳及發展公共運輸系統深受全球重視，為提升我國公共運輸市占率，紓緩私人運具之使用，有必要引進低汙染、省能源之綠色運輸工具及運用系統分析方法提昇軌道運輸系統服務效能，以完善公共運輸服務。本 (104) 年

Conducting "Transportation Logistics Management System Overall Research and Development" ●●●

With the transportation logistics as the main research target, the transportation logistics development policy of the MOTC is re-examined in order to cope with the dynamic adjustment of the logistics industry development policy in our nation and the trend of the global logistics development. In 2015, to cooperate with the promotion of the "International Logistics Service Business Development Action Project" of the Executive Yuan, this institute conducted the "Research on Transportation Logistic Supply Chain Recovery Ability", and the primary objective of this research was to auditing the weakness of the aerial and Maritime port fundamental facilities for the international transportation logistics in our nation such that the international transportation logistics supply chain risk between our nation and the five major export countries (Mainland China, Singapore, the U.S. Japan and Korea) are analyzed and evaluated along with the proposal on countermeasure strategies for each international Maritime and aerial transportation risk factor in order to provide such analysis and evaluation to Department of Aviation and Navigation, Maritime and Port Bureau, Civil Aeronautics Administration of the MOTC, Taiwan International Ports Corporation Ltd., Taoyuan International Airport Corporation and relevant transportation logistics association etc., for their utilizations such that they can be served as a basis for strengthening the transportation logistics development and administration of our nation.

Conducting "Advanced Public Transportation System Overall Research and Development" ●●●

The energy saving and carbon reduction as well as the development of public transportation system have gained significant attention globally. To increase the public transportation market share in our nation and to sooth the use of personal transportation means, it is essential to introduce

度辦理「公共運輸縫隙掃描決策支援系統之整合及推廣運用」與「軌道運輸系統營運資訊整合平台建置與應用計畫」2項研究，其中，「公共運輸縫隙掃描決策支援系統之整合及推廣運用」係將本所先前研發之「先進公共運輸系統整合資料庫加值應用系統」與「公共運輸系統區域發展指標評估系統」整合在共通平臺中，以增進系統使用之便利性及功能性。本系統可針對各區域公共運輸發展現況產出評估指標值，以篩選出搭乘公車不便之運輸節點，做為改善重點對象，本系統亦可分析交通主管機關規劃之方案，研判該方案是否有顯著改善成效。本所 104 年度已輔導 14 個縣市政府使用本系統，調查顯示受訪者均認為本系統對於未來規劃公車路網服務甚有助益。另外，「軌道運輸系統營運資訊整合平台建置與應用計畫」係延續 103 年「軌道運輸系統營運統計資料與績效評量指標整合規劃」計畫研究成果，實際建置具有資料融合能力之關聯式軌道運輸資訊平台。本平台已建立約 30 項以上資料之關聯、並提供 63 種資料查詢。現階段本平台以開放鐵路機構及政府機關使用為主，未來將強化資料自動化接，以及與其他社經資料之融合，創造更高資料加值應用價值，進一步達到支援決策之功能。



green transportation tools of low pollution and energy saving and to utilize systematic analysis method to increase the service performance of the rail transportation system in order to complete the public transportation system. In 2015, 2 researches of "Integration and Promotional Utilization of Public Transportation Gap Scanning Decision Supportive System" and "Railway Transportation System Operation Integration Platform Establishment and Application Project" were conducted, wherein the "Integration and Promotional Utilization of Public Transportation Gap Scanning Decision Supportive System" is to integrate the previous "Advanced Public Transportation System Integration Database Value-Added Application System" and the "Public Transportation System Regional Development Index Evaluation System" developed by this instituted into the common platform in order to increase the convenience and functionality of the use of the system. This system is able to generate an evaluation index value based on the public transportation development status in each region in order to screen out the transportation nodes inconvenient to taking buses as the key targets for improvement; in addition, this system can also analyze the solution planned by the traffic authority agency in order determine whether the solution is of significant improvement outcome. In 2015, this institute assisted and guided 14 counties and cities in using this system, and the survey shows that all of the interviewees are of the opinion that this system is of great assistance to the future planning of bus route network service. Furthermore, the "Railway Transportation System Operation Integration Platform Establishment and Application Project" is a continuation of the research outcome of the project of "Railway Transportation System Operation Statistics Data and Performance Evaluation Index Integration Plan" in order to physically establish an association type of railway transportation information platform with data fusion ability. This platform has been established with more than 30 data associations and is able to provide 63 types of data searches. At the current stage, this platform is opened mainly for the use by the railway agencies and the government agencies; in the future, it would be interfaced with the strengthened data automation and fusion with other social and economic data in order to create greater data value-added application values and to further achieve the function of supporting decisions.

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「交通服務 e 網通」整合網站系統維運與擴充服務 ●●●

本案持續整合國省縣道、市區路況資訊及陸海空公共運輸搭乘資訊並提供開放資料 (OPEN DATA) 供外界進行加值應用，已有約 300 多家加值應用單位 (其中政府機關約佔 25%，學術應用約佔 10%，民間企業約佔 65%) 提供各種交通資訊服務如車輛導航及公共運輸行程規劃查詢服務等。後續工作重點除了持續提供即時交通資訊外，並進行路況事件之標準格式與通報解除機制之訂定，並協助交通部規劃國內下一階段的交通資訊服務策略。另為因應交通旅運多元資訊服務需求，將進一步針對都市交通事件之蒐集、整理、發布與開放加值，結合地方政府行政流程，建立完整的資訊整合平台及運作機制。

“E-Traffic Service” Integrated Website System Operation and Expansion Service ●●●

This project continues to integrate the national and county freeways, city area road conditions and land/ Maritime/aerial public transportation passenger information and also provides open data for the external users to perform value-added applications. Currently, there have been approximately 300 value-added application units (wherein the government agency accounts for approximately 25%, academic application accounts for approximately 10% and civil enterprise accounts for approximately 65% of these units) provide various traffic information services, such as vehicle navigation and public transportation schedule planning search services etc. The keys to the subsequent tasks would not only continuously provide the real-time traffic information but also perform the stipulation of the standard formats for road incidents and the notification relief mechanism as well as assisting the MOTC in planning the next stage of domestic traffic information service strategy. Moreover, to cope with the diverse information service demands by the traffic transportation and passengers, further collection, organization, publication and value-added opening of municipal traffic incidence would be combine with the local government administrative process in order to establish a complete information integration platform and operation mechanism.

推動「觀光遊憩區導入智慧型運輸系統計畫－i3 Travel 愛上旅遊」●●●

本計畫以「低碳觀光」與「智慧運輸」概念，結合創新 (innovative) 的思維，提供智慧化 (intelligent) 的資訊服務，以服務整合 (integrating) 的 i3Travel 理念，打造日月潭國家風景區為「全國首座低碳旅遊智慧觀光國家風景區」。本計畫在 103 年已整合環湖區域的低碳運輸系統 (電動環湖公車、電動汽車、自行車、纜車與電動船) 以及當地優質商家，規劃推動日月潭低碳觀光電子旅遊套票創新服務，結合日月潭國家風景區管理處、悠遊卡公司、工業技術研究院及清境旅行社等公部門與民間力量，在區內建立便利的遊購環境，讓遊客只需一卡在手即可在日月潭享受量身打造、細膩的客製化旅遊服務，共同建立低碳旅遊及智慧消費的觀光服務環境，預期帶動 2 億元之套票消費，估計將能夠有效地將私人運具使用量降低到 18%，並使碳排放量大幅減少 50% 以上，可為國內觀光產業提供全新的旅遊服務模式。獲得「2015 年 APEC 能源智慧社區 (ESCI) 最佳案例評選活動－智慧運輸主軸」之金獎殊榮。由於此案件提供的資訊量及構想完整，可提供 APEC 會員體借鑑，並派員至夏威夷頒獎典禮受獎，並進行案例分享。

Promoting "Introduction of Intelligent Transportation System to Tourism Recreation Area Project - i3 Travel in love of traveling" ●●●

This project is based on the concepts of "low carbon tourism" and "intelligent transportation" along with innovative ideas in order to provide intelligent information service such that based on the service integration concept of i3Travel, the Sun Moon Lake National Landscape Area is transformed into the "first low-carbon traveling intelligent tourism national landscape area in our nation". In 2014, this project has integrated the low-carbon transportation system (electric round-the-lake bus, electric cars, bicycles, cable carts and electric boats) and the local promising business operators in promoting the Sun Moon Lake low-carbon tourism electronic traveling package innovative service. By combining the powers of the public departments of the Sun Moon Lake national landscape area administrative office, Easy Card Corporation, Industrial Technology Research Institute and Cinjing Travel Agency and the civil organizations, convenient tourism and shopping environment is established in the area in order to allow the tourists to simply use one card to enjoy the delicate and customized traveling services created for Sun Moon Lake. Such low-carbon traveling and intelligent consumption tourism service environment commonly established is expected to drive the sales of the packages for 200 million dollars; in addition, it is estimated that it is able to effectively reduce the private transportation means to 18% and a significant reduction of carbon emission by more than 50%, which is able to provide a completely new traveling service model for the domestic tourism industry. It also received the golden award for the "2015 APEC Energy Smart Community Initiatives (ESCI) Best Case Evaluation Event - Intelligent Main Transportation". Since the information amount and the concepts provided by this case are complete, it can be provided to the APEC members as a reference; in addition, personnel have been assigned to travel to Hawaii to attend the award ceremony for receiving the award and to share case experience.

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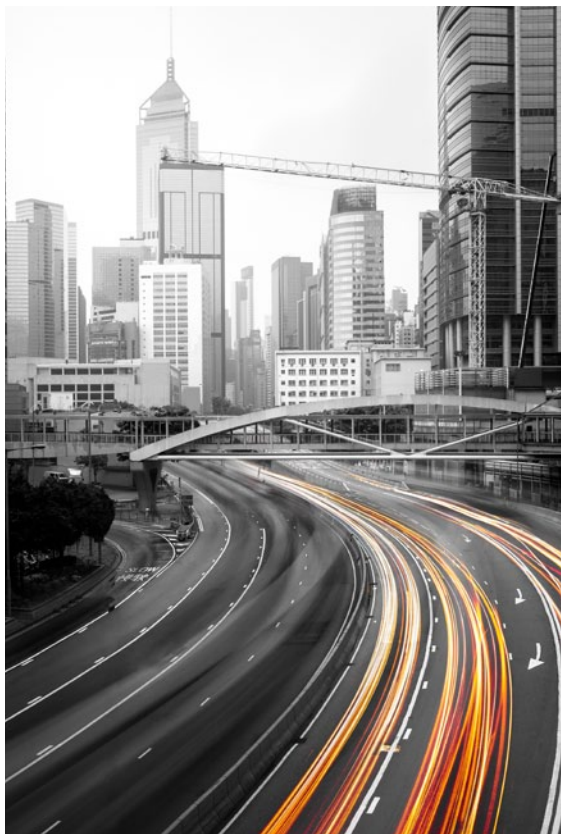
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辦理「創新交通科技研發成果之智財權研究與知識分享」●●●

本案針對本所科技計畫創新研發成果，進行可專利性分析與授權應用推廣，共計完成「一種連續影像之處理方法」中華民國發明專利申請及「區域公共運輸服務環境評估系統與方法」中華民國新型專利取得，並完成本所「先進公共運輸系統整合資料庫加值應用系統」無償授權國內 7 縣市政府交通單位使用。此外，本案亦設置完成「交通科技知識分享服務」網站，提供本所研發成果、期刊論文及當前重要交通科技國際參考專利文獻知識分享服務，藉以促進我國交通運輸科技研究之技術交流，並可避免相關研究資源與能量重複投入於已取得智財權保護之技術，造成研究經費與研究人力之浪費。



Conducting "Intellectual Property Research and Knowledge Sharing for Innovative Traffic Technology Research Outcome" ●●●

This case is to perform patentability analysis and licensing application promotion on the innovative research outcomes of the technology projects of this institute, in which the R.O.C. Invention patent application for "a processing method for continuous images" has been completed and the R.O.C. Utility Model Patent for "Regional Public Transportation Service Environment Evaluation System and Method" has been obtained, and the free licensing of "Advanced Public Transportation System Integration Database Value-Added Application System" of this institute to 7 domestic traffic units of county and city governments for their uses. Furthermore, this case also completes the setup of the "Traffic Technology and Knowledge Sharing Service" website in order to provide the knowledge sharing services on the research outcomes, journals and theses and the current important traffic technology international references and patent documentation in light of promoting the technical exchange on traffic transportation technology researches in our nation; moreover, it can also prevent repetitive investments of relevant research and development resources and energies into technologies already protected by the intellectual property right and to prevent wastes of research costs and research manpower. publication and value-added opening of municipal traffic incidence would be combine with the local government administrative process in order to establish a complete information integration platform and operation mechanism.



先進交通管理與車路整合技術創新應用 ●●●

鑒於國際上智慧型運輸系統在車聯網與車路整合的發展趨勢，以及在運輸安全、效率與永續的效益，本所自 104 年起結合經濟部在 DSRC 智慧車載研發成果，進行導入於交通安全與資訊服務應用實作。前期 (104 年) 完成我國智慧型運輸系統車路整合應用模式探討與先期評估，以及導入 5.9 GHz 專用短距通訊 (DSRC) 技術於基隆市台 62 線銜接基金二路的連續 4 個路口構建實驗場域，經由架設於道路上的路側設備以及安裝在測試車上的車載設備來進行測試。測試內容包括：提供危險路段、減速 / 施工區、彎道、天候、路口行人通行等警示，以及道路標誌等警示指示，以及利用所蒐集到更即時與細膩的車流資訊來發展更可靠的交通資訊服務。後續將延續前期研究成果，納入高快速道路車路整合運作測試、車路整合節能駕駛等探討，以及建立車路整合應用實驗室等主題。期望應用我國在 DSRC 車載與路側設備研發成果，探究先進交通管理與車載資通訊創新整合模式在「交通安全」、「交通管理」、「交通資訊服務」、「節能減碳面」等之應用需求模式，以及進而規劃驗證場域，來探究技術與市場可行性；藉由國際參與來調和我國與國際的智慧型運輸系統相關標準，以利我國車載產業鏈之建構與發展，同時運用我國資通訊優勢，驅動智慧交通風潮，發展多元車載設備價值服務。

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Advanced Traffic Management and Road Integration Technology Innovative Application ●●●

In view of the international development of the intelligent transportation system on the internet of vehicles and road integration as well as the benefits of transportation safety, efficiency and sustainability, since the year of 2015, this institute combines the DSRC intelligent onboard vehicle research outcome of the Ministry of Economic Affairs in order to perform actual implementation on introduction into the traffic safety and information service application. At the early stage (2015), the intelligent transportation system road integration application model review and the early stage evaluation were completed, and the technology of 5.9 GHz dedicated short range communication (DSRC) was introduced into the Provisional Highway No. 62 of Keelung City connecting to the 4 consecutive intersections of Jijin 2nd Road in order to construct an experimental field such that the roadside equipment installed in erecting on the road and the vehicle onboard equipment installed on the testing car can be used for testing. The test content includes: providing warnings for dangerous road sections, speed reduction/

construction zones, curves, weather, intersection pedestrian crossing etc., as well as warning indications of road signs etc. along with the use of the updated and delicate traffic flow information collected in order to develop a more reliable traffic information service. At the later stage, the early stage research outcomes would be continued and incorporated into the high-speed expressway and road integration operation test, reviews on road integration with energy saving driving etc. as well as establishing the themes on road integration application laboratories etc. It is expected that the DSRC vehicle onboard and roadside equipment research outcomes of our nation can be applied in studying of the advanced traffic management and vehicle onboard information innovative integration model on the application demand models of "traffic safety", "traffic management", "traffic information service" and "energy saving and carbon reduction aspects" etc.; furthermore, fields for verification can be further planned in order to study the technology and market feasibility. With the international participation and the relevant standards of the international intelligent transportation system in our nation, it would facilitate the construction and development of the vehicle onboard industry chain in our nation while at the same time, the information communication advantages of our nation can be utilized, to drive the trend of the intelligent traffic

辦理「環境影響評估－交通影響評估案」審議與追蹤 ●●●

本所持續配合交通部辦理部屬機關開發案環境影響評估審議、追蹤事宜，以及配合行政院環境保護署審議各類開發案之交通影響評估，104 年度截至 12 月底出席會議及審查案件達 228 件。

配合內政部辦理「都市計畫與區域計畫案」審議 ●●●

本所持續配合內政部辦理部屬機關與各縣市都市計畫與區域計畫案審議事宜，104 年度參與內政部都市計畫委員會審查桃園機場捷運沿線站區周邊土地開發等重大變更案，截至 12 月底計出席會議 140 次、審查案件達 278 案【前段文字要請運計組更新】；另配合內政部區域計畫委員會修訂「全國區域計畫」中「區域性部門計畫」，研提「區域性運輸系統計畫」，並參與審查相關開發案，截至 12 月底計出席會議 45 次、審查案件達 19 案。



and to develop diverse vehicle onboard equipment value-added services.

Conducting Reviews and Tracking on “Environmental Impact Evaluation – Traffic Impact Evaluation Project” ●●●

This institute continues to cooperate with the MOTC in conducting agencies of the ministry in the reviews and tracking matters related to the environmental impacts evaluation associated with the development projects and to cooperate with the traffic impact evaluations of various development projects reviewed by the Environmental Protection Administration of the Executive Yuan. Until the end of December, 2015, number of the meetings attended and the cases reviewed has reached 228 cases.

Cooperating with the Ministry of the Interior in conducting review on “Municipal Project and Regional Project” ●●●

This institute continues to cooperate with the matters related to the reviews on the municipal projects and regional projects conducted by the Ministry of the Interior for its agencies and all counties/cities. In 2015, this institute participated in the municipal project committee of the Ministry of the Interior in reviewing the major transformation cases of the land development at the surrounding along route of the station area of the Taoyuan Airport MRT, and until the end of December, this institute had participated 140 meetings and reviewed 278 cases [the front paragraph content shall request the transportation planning team to update]. In addition, this institute cooperates with the regional planning committee of the Ministry of the Interior in the revision of the “Regional Department Plan” in the “National Regional Plan”, proposing the “Regional Transportation System plan” and participating in the review of the relevant development projects. Until the end of December, the number of meetings participated is 45 and the number of cases reviewed has reached 19 cases.

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辦理「運輸部門節能減碳政策與推動策略」之擬定暨有關政策評估決策支援系統研究 ●●●

配合行政院成立「綠能低碳推動會」及依據交通部指示，由本所擔任「綠色運輸推廣」工作組之幕僚作業，已完成「國家綠能低碳總行動方案」交通部負責部分之綜整，並配合行政院國家發展委員會與交通部管考業務，辦理各行動計畫各季與年度辦理情形的彙整提報。另 104 年配合我國「國家自定預期貢獻」對外宣示，本所協助交通部規劃運輸部門減碳路徑，包括預測運輸部門 2015~2030 年排放量及擬定減碳策略。此外，完成「城際運輸節能減碳策略評估模組」開發，對於運輸部門後續推動城際各項節能減碳政策之效益可提供初步評估分析結果，以作為交通部節能減碳政策施政之參據。



Conducting stipulation of "Transportation Department Energy Saving and Carbon Reduction Policy and Promotion Strategy" and research related to policy evaluation decision supportive system ●●●

In cooperation with the "Green Energy Low Carbon Promotion Committee" established by the Executive Yuan and according to the instruction of the MOTC, this institute is responsible for the internal operation of the work team of "Green Transportation Promotion" and has completed the collaboration of the parts on "National Green Low Carbon Overall Action Solution" responsible by the MOTC along with the cooperation in the management and examination affairs of the National Development Council of the Executive Yuan and the MOTC for conducting the organization and report of all seasonal action projects and annual performance status. Furthermore, in cooperation with the external declaration of "National Self-Expected Contribution" of our nation in 2015, this institute has assisted the Transportation Planning Department of the MOTC in the path of carbon reduction, including the estimation on the exhaust amount for the years of 2015~2030 and the stipulation on the carbon reduction strategy. Moreover, this institute has completed the development of the "Intercity Transportation Node Carbon Reduction Strategy Evaluation Module" in order to provide preliminary evaluation and analysis result on the benefits of all intercity energy saving and carbon reduction policies subsequently promoted by the Transportation Department such that they could be served as a basis for the carbon reduction policy administrative implementation by the MOTC.

Assisting the MOTC in stipulation of traffic infrastructure climate change adjustment strategy and action solution ●●●

In corporation with the project of "Planning for Promotion on Climate Change Adjustment Policy

協助交通部擬定交通建設氣候變遷調適策略與行動方案 ●●●

配合行政院國家發展委員會「規劃推動氣候變遷調適政策綱領及行動計畫」專案，協助交通部擔任「維生基礎設施」調適領域主辦機關之行政幕僚作業，彙整及檢視各部屬機關所提氣候變遷調適行動計畫之內容並提供具體建議。同時辦理運輸系統氣候變遷調適相關研究，104 年完成鐵公路系統氣候變遷風險評估及建構風險地圖、研擬鐵公路系統因應氣候變遷風險管理機制，以及建置「鐵公路氣候變遷調適資訊平台」，研究成果可提供鐵公路主管機關長期規劃研提調適措施之參據。

辦理「運輸部門永續發展政策與推動策略」之擬定 ●●●

本所依據行政院「國家永續發展委員會」與交通部指示，已完成「中華民國永續發展政策綱領—交通發展」撰擬及行動計畫之研擬，並配合永續會指示，持續進行行動計畫之滾動修訂，由部屬相關機關據以推動中。104 年配合行政院國家永續發展委員會指示，研訂中期(2020 年)及長期(2030 年)永續發展量化目標、檢討修訂「永續發展政策綱領」中「交通發展」章節，並配合編撰「104 年度國家永續發展年報」。

Guideline and Action Project” by the National Development Council of the Executive Yuan, assisting the MOTC in handling the administrative internal operation related to the “Life Supporting Fundamental System” adjustment field of the hosted agency, collecting and reviewing contents related to the climate change adjustment project proposed by all ministry agencies and provide specific suggestions. In addition, this institute also conducted research related to the transportation system climate change adjustment, completed the railway and highway system climate change risk evaluation and construction of risk map in 2015, stipulated railway and highway system risk management mechanism coping with the climate change and established “Railway and Highway Climate Change Adjustment Information Platform”. The research outcome can be provided for the railway and highway authority agency as a basis for long-term planning and stipulation on adjustment and measures.

Conducting situation of “Transportation Department Sustainable Development Policy and Promotion Strategy” ●●●

According to the instructions of the “National Council for Sustainable Development Network” of the Executive Yuan and the MOTC, this institute has completed preparation of the “R.O.C. Sustainable Development Policy Guideline - Traffic Development” and the stipulation of the action plan along with the instruction of the Sustainable Council in order to continuously perform the rolling revision of the action plan and to be promoted by relevant agencies of the ministry. In 2015, in cooperation with the instruction of the National Council for Sustainable Development Network of the Executive Yuan, the sustainable development quantification target for intermediate term (2020) and for long term (2030) were stipulated, the chapter of “Traffic Development” in the “Sustainable Development Policy Guideline” was reviewed and revised along with the cooperation in the drafting of the “2015 National Sustainable Development Annual Report”.

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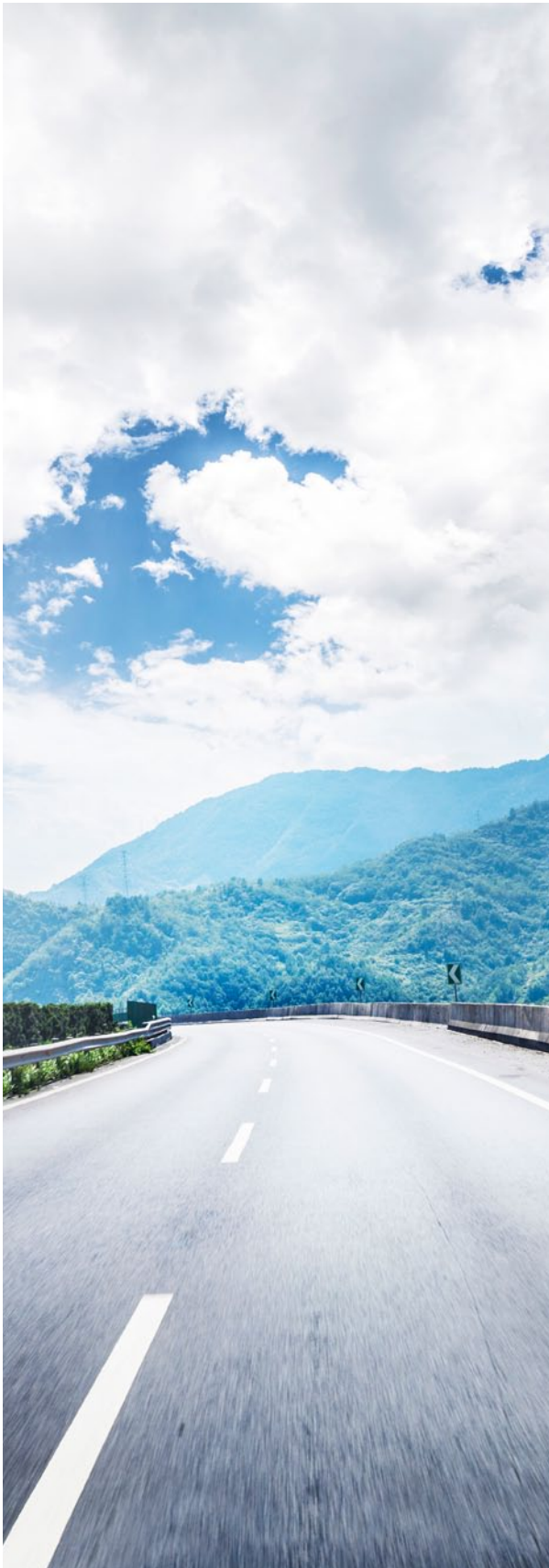
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辦理「省道丘陵區 LED 路燈 測試計畫與成本效益分析」 計畫 ●●●

行政院於 100 年 12 月核定「擴大設置 LED 路燈節能專案計畫」。為配合暨因應經濟部未來 LED 路燈汰換計畫，交通部門必須在兼顧交通安全、節能減碳及照明設備維運管養成本等目標下，預為研擬配合推動作法與配套措施。基此，本所自 102 年起辦理交通部門配合推動 LED 路燈照明成本效益系列研究，已於 104 年於台 3 乙線完成 6,000 小時之 LED 路燈實測計畫，研究成果除提供經濟部納入研訂「快速公路 LED 路燈標準 (草案)」之參據外，並協助國內廠商改善產品缺失。

辦理「公路貨運碳足跡公用 係數建置」計畫 ●●●

配合環保署推動產品碳足跡標籤，亟需建立各類運具之碳足 公用係數供廠商核算產品的碳足跡。本所於 104 年針對我國公路貨運業者之營運模式，完成 2 家業者之組織碳盤查及碳足跡調查，調查車隊規模達 3,300 輛以上。研究成果除協助台灣宅配通於 105 年通過英國標準協會 (BSI) 碳足跡查證，獲得國際碳足跡標準「PAS 2050 認證」之外，亦研擬「公路貨運服務碳足跡產品類別規則 (草案)」，可提供公路貨運業者申請碳標籤之依循。



Conducting “Provisional Highway Hilly Region LED Road Lamp Testing Project and Cost and Effect Analysis” Project ●●●

The Executive Yuan approved the “Expanded Installation of LED Road Lamp Energy Saving Project Plan” in December, 2011. To cooperate and cope with the future LED road lamp replacement project of the Ministry of Economic Affairs, the MOTC departments must stipulate the cooperative promotion methods and supplementary measures in advance based on the objectives associated with the traffic safety, energy saving and carbon reduction as well as the maintenance costs of lighting equipment. Accordingly, this institute has conducted a series of cost and effect researches on the promotion of the LED road lamp lighting in cooperation with the MOTC departments since 2013, and this institute has completed the 6,000-hours LED road lamp actual test project for the Provisional Highway 3B in 2015. The research outcome is not only provided to the Ministry of Economic Affairs as a reference for incorporation into the stipulation of “Highway LED Road Lamp Standard (Draft)” but also used to assist the domestic manufacturers in improving the product drawbacks.

Conducting the project of “Highway Cargo Transport Carbon Footprint Public Coefficient Establishment” ●●●

To cooperate with the Environmental Protection Administration in promoting the product carbon footprint label, there is a need to establish carbon footprint public coefficients for various transportation means to allow manufacturers in calculating the carbon footprint of products. In 2015, for the highway cargo transportation business operators, this institute completed the organization carbon auditing and carbon footprint investigation for 2 business operators, and the investigation vehicle team reaches more than 3,300 units. The research outcome has assisted not only the Taiwan Pelican Express Co., LTD to pass the carbon footprint verification by the British Standard Institution (BSI) in 2016 and to obtain the “PAS 2050 Certificate” of the international carbon footprint standard but also the stipulation of the “Highway Cargo Transportation Service Footprint Product Classification Rules (Draft)”, which can be provided as a reference for the highway cargo transportation business operators in the application of carbon label.

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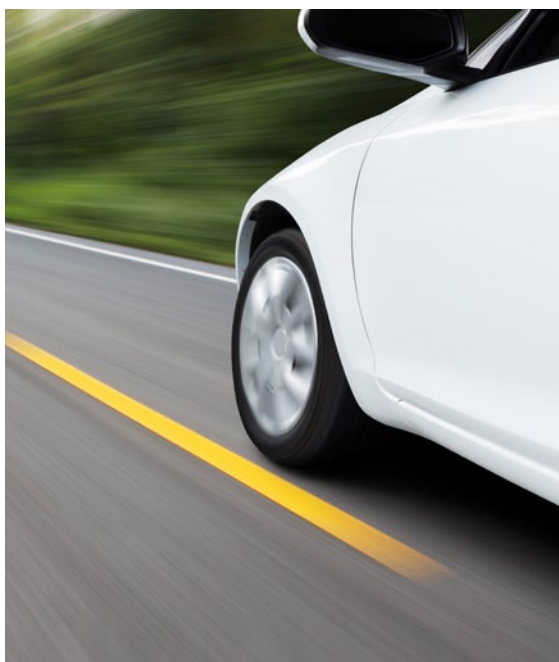
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辦理「山地原住民鄉（區）交通改善計畫」●●●

102 年度針對 30 個山地原住民鄉（區），蒐集人口、產業與道路交通等相關資料，檢討分析其通學、通勤、觀光與地方產業等運輸需要，據以研擬包括道路交通安全改善、道路行駛車輛種類管制，與非典型公共運輸之發展等各項改善措施。目前已針對各原住民鄉（區）提報之待改善道路，完成第一階段現勘審查及第二階段經費協商作業，共篩選納入 111 條道路改善計畫。除已經原住民族委員會審查通過納入「103 年度原住民族部落特色道路改善計畫」之項目改由該計畫併案辦理外，本計畫總經費約 3.36 億元，已於 103 年底彙編完成「山地原住民鄉（區）交通改善計畫」報告，陳報交通部轉送相關單位作為後續各年執行原住民鄉（區）交通改善之參考依據。另為推廣本計畫研發之需求調查程式，本所並於 104 年 9 月 7 日舉辦「山地原住民鄉（區）道路交通改善需求調查程式」研發成果推廣講習會，參加人員包括內政部營建署、交通部路政司、各縣市政府與鄉鎮區公所等單位代表。



Conducting “Mountain Indigenous Village (District) Traffic Improvement Project” ●●●

In 2013, for 30 mountain indigenous villages (districts), relevant data of the population, industry and road traffic etc., were collected in order to review and analyze the transportation demands for their school commute, work commute, tourism and local industry etc. such that the data could be used for stipulating various improvement measures including road traffic safety improvement, road driving vehicle type control and non-classic public transportation development. Currently, for the roads pending for improvement reported by all indigenous villages (districts), the first stage of investigation review and the second stage of budget negotiation process have been completed, which have been selected to be incorporated into the improvement projects for 111 roads. In addition to the subject of “2014 Indigenous Cultural Tribe Characteristic Road Improvement Project” has been amended to be handled in conjunction with the project, the total budget of this project is approximately 336 million dollars and has been completed in the report of “Mountain Indigenous Village (District) Traffic Improvement Project” at the end of 2014, which is reported to the MOTC for transferring to relevant units as a reference for subsequent execution of indigenous village (district) traffic improvement in later years. Furthermore, for the required survey program developed to promote this project, this institute also hosted the “Mountain Indigenous Village (District) Road Traffic Improvement Demand Survey Program” research outcome promotion seminar on September 7, 2015, and the participated parties included the unit representatives from the Construction and Planning Agency of Ministry of the Interior, Department of Railways and Highways of MOTC, all county/city governments and village/township/district offices.



辦理「桃園航空城聯外交通規劃」 ●●●

為推動航空城相關建設計畫，101 年 10 月 17 日交通部成立「桃園航空城核心計畫專案小組 -『開發建設』分組」，在該分組下設「聯外運輸系統」工作小組，由本所召集相關單位共同成立。本工作小組列管國 2 大園支線西延、國 1 甲線、台 15 線改線、台 4 線路段改善等 4 項機場園區聯外道路建設計畫、5 項機場園區與航空城聯繫道路建設計畫及「桃園航空城捷運線」。迄 104 年底已召開 15 次會議，共協商、追蹤 108 項重要議題與交辦事項，並參與交通部「開發建設」分組 12 次會議及行政院專案小組 12 次會議。未來將持續召開會議檢視聯外運輸系統供需並協調相關事宜，以利計畫之推動。

Conducting "Taoyuan Aerotropolis External Connection Traffic Planning" ●●●

To promote the relevant construction plans of the Aerotropolis, the MOTC established the "Taoyuan Aerotropolis, Core Plan Project Team – 'Development Construction' Division" on October 17, 2012, and under the division, the workforce team of "External Transportation System" was formed, which was formed by this institute summoning relevant units together. This workforce team is in charge of the management of 4 airport park external connection road construction projects of the National Highway No. 2 Dayuan branch westward route, National Highway No. 1A, Provisional Highway No. 15 route modification, Provisional Highway No. 4 section improvement etc., 5 construction projects of the connecting roads between the airport park and the Aerotropolis as well as the "Taoyuan Aerotropolis MRT Line". Since the end of 2015, there have been 15 meetings for consolidation and tracking of 108 items of important subjects and assigned matters. In addition, this institute also participated in 12 meetings for the division of "development and construction" of the MOTC and 12 meetings in the project team of the Executive Yuan. In the future, further meetings will be continuously summoned in order to review the external transportation system demand and supply as well as matters related to consolidation in order to facilitate the promotion of the project.

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辦理「國際空運資料庫更新擴充與資料分析」 ●●●

為掌握國際空運發展趨勢，以利空運政策之分析，本計畫蒐集 146 座國際機場及我國 17 座民航機場主要機場的基本設施資料、運量資料和航網資料，並購置國際空運資料庫 -IATA MarketIS 旅客起迄資料，另以 Web-based 系統進行使用者介面更新，強化資料庫功能，進行資料之更新、擴充及分析，以解析國際空運市場重要趨勢，支援本所空運政策相關研究。

辦理「商港整體發展規劃(106~110 年)」 ●●●

本所依據行政院及交通部指示自民國 84 年起每 5 年辦理工商港整體規劃，俾作為我國商港未來整體發展方向，研擬整體商港發展策略及各港發展定位，作為各港進行未來發展及建設計畫之上位計畫，使港埠資源能作最有效利用，以提昇我國港口國際競爭力並作為各商港進行未來發展及建設計畫研擬之依據。本期(106~110 年)研究重點包括：航港組織調整後商港內外部環境分析、客貨運量預測、面臨課題與發展策略，相關整體規劃內容已提報交通部並完成審查，後續將配合交通部進行報院核定作業。

Update, Exchange and Analysis of International Air Transportation Database" ●●●

To understand the trend of the international air transportation development in order to facilitate the analysis on the aerial transportation policy, this project collects the basic facility data, traffic and network of 146 international airports and 17 civil airports; in addition, the international air transportation database-IATA MarketIS passenger departure and arrival data has been purchased and installed; furthermore, the Web-based system is used for performing the user interface update, improving the database functions and performing the update, expansion and analysis of the data in order to analyze the international air transportation market important trends and to support relevant researches of this institute on aerial transportation policies.

Conducting "Commercial Port Overall Development Planning (2017~2021)" ●●●

Since 1995, according to the instructions of the Executive Yuan and the MOTC, this institute has conducted the commercial port overall planning every 5 years in order to use such planning for future overall development direction of the commercial ports in our nation, stipulation of overall commercial port development strategy and development and

辦理「國際海運資料庫更新擴充與資料分析」●●●

為掌握國際海運發展趨勢，以利海運政策之分析，本計畫蒐集 100~104 年航線、航商、港口與船舶等海運相關資料，並藉由資料庫建置與分析，對於亞太區域航線佈署趨勢、我國及亞太主要港口航線佈署趨勢、我國與各國主要貨櫃航商營運趨勢、航商聯營對我國樞紐高雄港之影響等議題進行分析，提供海運施政參考。



positioning of each port such that these plans can be used as the super-ordinate plans for the future development and construction projects of each port; consequently, the port resources can be utilized in a most effective way for increasing the port international competitiveness of our nation and serving as a basis for the stipulation of the future development construction project of each port. The research key points in this session (2017~2021) include: commercial port internal and external environments analysis after adjustment of navigation port organizations, passenger can cargo transportation capacity estimation, issue encountering and developing strategies; relevant overall planned contents have been submitted to the MOTC and the review has been completed, and subsequently, this institute will cooperate with the MOTC to perform the report and approval operation by the Yuan.

Conducting "International Maritime Transportation Database Update Expansion and Data Analysis" ●●●

To understand the trend of the international Maritime transportation development in order to facilitate the analysis on the Maritime transportation policy, this project collects the relevant Maritime transportation data of the navigation route, navigation operator, port and vessel for the years of 2011~2015. In addition, with the establishment and analysis of the database, analysis are conducted for the Asian Pacific Region navigation route deployment trend, navigation route deployment trends of our nation and Asian Pacific main ports, operational trends of our nation and main container Maritime transportation operators of our nation, impact of Maritime transportation operator union on the main hub of the port of Kaohsiung in our nation etc., in order to provide such analysis as reference for the Maritime transportation administrative implementation.

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辦理「臺灣主要港口海域長期性 海氣象觀測及資料特性應用」研 究 ●●●

本研究以建置維護臺灣各國際港與國內港附近海域之長期性海氣象觀測網站為首要工作，將收集之海氣象資料做統計與特性分析。各港口之觀測資料提供即時性資訊於港灣環境資訊網系統及船席水深系統，作為船隻航行與停泊安全維護之依據，並進行波浪推算模式建置與應用，以及受氣候變遷影響之分析探討，共同建立港池安全動態資訊管理系統。本研究除出版各港口每年之海氣象觀測資料年報與專刊外，並應國內產官學研各界需求，每年提供觀測資料與研究成果將近 40 件作為在港灣、海岸工程規劃設計與環境評估的重要參據。

Conducting research of “Taiwan Main Port Sea Water Long Term Ocean Weather Monitoring and Data Characteristic Application” ●●●

This research is to establish and maintain the long-term ocean weather monitoring website at the sea water adjacent to all international ports and domestic ports of Taiwan as the key task in order to perform statistic and characteristic analysis on the ocean weather data obtained. The monitored data of each port is provided as real-time information on the harbor environment information network system and berth depth system in order to be used as a reference for vessel navigation and parking safety. In addition, the wave estimation model establishment and application are conducted, and the climate change impacts are analyzed and reviewed in order to commonly establish a basin safety dynamic information management system. This research not only issues the ocean weather monitored data annual report and journal for each port annually but also cooperating with the demands of the various fields of the domestic industrial/official/academic organizations in order to provide monitored data and research outcome for nearly 40 cases as important reference for port and harbor, coastal construction planning design and environment evaluation.

推動及執行「智慧型航行與監測系統」 ●●●

本研究結合了臺灣現有航運技術與電子資訊通訊技術，針對臺灣海運設計建置了一套整合綠色航路規劃分析與監測之作業化應用系統，可提供給交通部、航港局、海巡署、各港務分公司與民間航運界等作為參考及運用。使用者可透過網頁介面操作，整合應用包括 AIS 船舶即時動態、海氣象資訊、電子海圖、網路地圖、海事安全資訊（航行警告）等資訊，並以環境資訊及航跡探勘所得參數為基礎，提供擱淺、碰撞、漂流、偏航等自動化偵測警示功能。另以最新國際規範與技術發展訊息之轉譯發佈平台為輔，發展沿岸航路與進出港領航的綠色概念智慧化應用服務技術。



Promoting and Executing "Intelligent Navigation and Monitoring System" ●●●

This research combines the currently existing navigation technology and electronic information communication technology in Taiwan. For the Maritime transportation in Taiwan, a set of integrated green navigation route planning analysis and monitoring operational application system is established, which can be provided as a reference and use by the MOTC, Maritime and Port Bureau, Coast Guard Administration, Port Administrative Affairs branch office and civil Maritime transportation industry etc. The user can sue the webpage as an interface for operations, which integrates the applications including the information of AIS vessel real-time dynamic status, ocean weather information, electronic sea chart, network map, maritime safety information (navigation warning) etc., and it also uses the parameters obtained from the environmental information and navigation track exploration as the basis in order to provide the automatic detection warning functions for strand, collision, drifting, deviation etc. Moreover, it further uses the latest international standards and technically developed message translation announcement platform as an assistance in order to develop the coastal navigation route and the green concept of intelligent application service technology for navigation guidance on entering and existing ports.

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推動「臺灣海象環境資訊服務系統」 ●●●

整合國內各主要港區現場海氣象即時觀測系統、數值模擬預報系統、海上藍色公路、港區地震地資訊、海嘯模擬資訊、港區大氣腐蝕系統及即時影像系統，近年來與交通部中央氣象局、經濟部水利署及各港務分公司等簽定合作備忘錄或互助合作協議，建立完整海情資料庫及資訊平台。並將臺灣各港區之海氣地象與相關環境資訊，以動態網頁與手持裝置 App 相互搭配顯示方式，透過「臺灣環境資訊網」即時提供給一般民眾、港灣管理機關、國內外船舶業者及有關人員查詢，以提昇船舶航行安全、增進港埠營運效能及救災緊急措施之擬定。本(104)年度另整合金門地區氣象及交通資訊開發「金廈 e 條龍 show 三通」App 提供金門港務處及進出金門旅客更完整便利資訊服務。

Promoting "Harbor Ocean Weather Environment Information Service System" ●●●

Integrating the area on-spot weather real-time monitoring systems, value simulation forecast system, ocean blue highway, port area earthquake geographic information, tsunami simulation information, port area atmospheric corrosion system and real-time image system for all major port areas along with the cooperation memorandum or mutual cooperation agreement executed with the Central Weather Bureau of MOTC, Water Resource Agency of Ministry of Economic Affairs and all port administrative affairs branch offices etc., in order to create a complete ocean condition database and information platform. In addition, the ocean weather and land climate as well as relevant environmental information of all port areas in Taiwan are provided to the general public, harbor management agency, domestic and foreign vessel operators as well as relevant personnel for searches via the "Harbor Environment Information Network" based on the cooperative display method of dynamic webpages and the handheld device APP in order to increase the vessel navigation safety, enhance the port operation performance and stipulation of emergency rescue measures. In this year (2015), this institute further integrates the Kinmen area weather and the traffic information to develop the "Kinxia e-show triple Links" App in order to provide more thorough and convenient information services to Harbor Bureau of Kinmen and passengers traveling in/out of Kinmen.

辦理「公路邊坡崩塌監測之無線感測網路模組研發」 ●●●

本研究針對公路邊坡可能遭遇之淺層崩塌破壞進行解析法分析，並研發與解析法搭配之無線感測土層反應模組，發展客製化淺層公路邊坡降雨崩塌預警系統。簡易土層監測模組採用廣為應用於消費性電子產品及醫療器材之微機電系統感測器，客製化具無線網路通訊功能且可監測地表傾角、加速度及土壤含水量之監測模組。104 年度主要成果為：（1）選定淺層破壞研究測試場址一處，進行場址地層材料力學試驗並進行傳統極限平衡及水力力學耦合數值分析。（2）研製簡易土層監測模組原型，進行模組整合測試。（3）規劃簡易土層監測模組佈設及發展資料處理程序。相關研究成果將可提供公路養護單位作為防災決策支援使用。



Conducting "Research and Development of Wireless Detection Network Module for Monitoring Highway Slope Landslide" ●●●

In this research, an analytical method for analyzing the shallow layer landslide destruction possibly occurring at the highway slope is performed, and a wireless detection soil layer reaction module cooperating with the analytical method is developed in order to develop a customized shallow layer highway slope rainfall landslide warning system. The simple soil layer monitoring module uses the micro-electromechanical system sensor widely applied to consumer electronic products and medical devices in order to customize a monitoring module equipped with the wireless network communication function and capable of monitoring the surface angle of inclination, acceleration and soil water content. In 2015, the main achievements include: (1) Select one area as the shallow layer destructive research testing site in order to perform the site stratum material mechanics experiment and to conduct traditional limit balance and hydro-mechanical coupled value analysis. (2) Develop simple soil layer monitoring module prototype in order to perform module integration tests. (3) Planning simple soil layer monitoring module layout installation and develop data processing procedure. The relevant research outcome can be provided to the highway maintenance unit for use in disaster prevention decision support.

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辦理「橋梁耐震能力與檢測評估分析模式之建立研究」 ●●●

橋梁倒塌或斷裂易造成人員傷亡，因此對於現有橋梁進行全面檢測勢在必行。本所在過去研究中已發展出「橋梁通阻檢測分析模式」，推估在不同地震強度下橋梁之損壞機率。104年度進一步擴充「橋梁耐震側推分析模式」側推分析案例數量，擴充「人工智慧耐震能力推論模式」案例資料庫，更新推論模式。更針對災後開放通行判斷之災害前後橋墩頻率變化率做研究及驗證。最後擴充防災應變實務應用之橋梁地震防災決策支援網頁、橋梁資料自動更新機制、防災地圖及橋梁災情回報系統，以符合橋梁管理單位防災應變實務應用需要。

辦理「腐蝕環境分類及港灣構造物腐蝕劣化調查研究」 ●●●

臺灣屬於亞熱帶氣候，常有颱風侵襲，所引起的暴潮及波浪對於港灣設施常會造成損壞。且因環境高溫、高溼與高鹽份，大氣中亦充滿著各類氣體諸如 SO_x 、 NO_x 、PM(細懸浮顆粒)……等污染的因子，隨時間增加逐漸造成材料劣化銹蝕。本研究 104 年度完成 (1) 臺灣全島金屬材料大氣腐蝕劣化因子調查及大氣腐蝕環境分類，建置大氣腐蝕環境分類系統並開放供各界查詢；(2) 金門、基隆…等港區之現況調查與檢測評估以及維修工法、維護機制、管理系統之建置。研究成果有利於工程設施之防蝕設計、港灣構造物檢測及管理自動化應用。

Conducting “Research on Establishment of Bridge Shock Resistance Ability and Inspection Evaluation Analysis Model” ●●●

Bridge collapse or breakage can easily cause bodily injuries; therefore, it is essential to conduct full inspections on all existing bridges. Based on the past researches, this institute has already developed “Bridge Accessibility Detection Analysis Model” in order to estimate the damage probability of the bridge under different earthquake scales. In 2015, this institute further expanded the quantities of the seismic analysis case of the “Bridge Shock Resistance Seismic Analysis Model” and expands the case database of “Artificial Intelligent Shock Resistance Ability Inference Model” to update the inference model. This institute further conducts researches and verifications on the determination of the rate of frequency change of bridge piers before and after disasters after the opening for access after disaster. Finally, the disaster prevention practical application is expanded to include the bridge earthquake prevention decision support webpage, bridge data automatic update mechanism, disaster prevention map and bridge disaster feedback system, in order to satisfy the application needs of the bridge management unit in disaster prevention countermeasure practice.

Conducting “Corrosive Environment Classification and Harbor Construction Corrosive deterioration Investigation and Research” ●●●

Taiwan is in a subtropical climate region and is often struck by typhoons; in addition, the storm surges and waves created thereby often cause damages on the harbor facilities. Furthermore, due to the high temperature of the environment, high humidity and high salt content, the atmosphere is also filled with various gases, including such as SO_x, NO_x, PM (suspended particles), etc., as factors causing pollution, which in turn would cause material deterioration and rust corrosion gradually overtime. In 2015, this research completed (1) Taiwan entire island metal material atmosphere corrosive deterioration factor investigation and atmosphere corrosive environment classification in order to establish the atmosphere corrosive environment classification system, which is also opened to the public for searching; (2) for the port areas of Kinmen, Keelung, etc., the current status investigation and inspection evaluation as well as repair method are established along with establishment of the maintenance mechanism and the management system. The research outcome is advantageous to the anti-corrosion design of the construction facilities, harbor construction inspection and management automation application.



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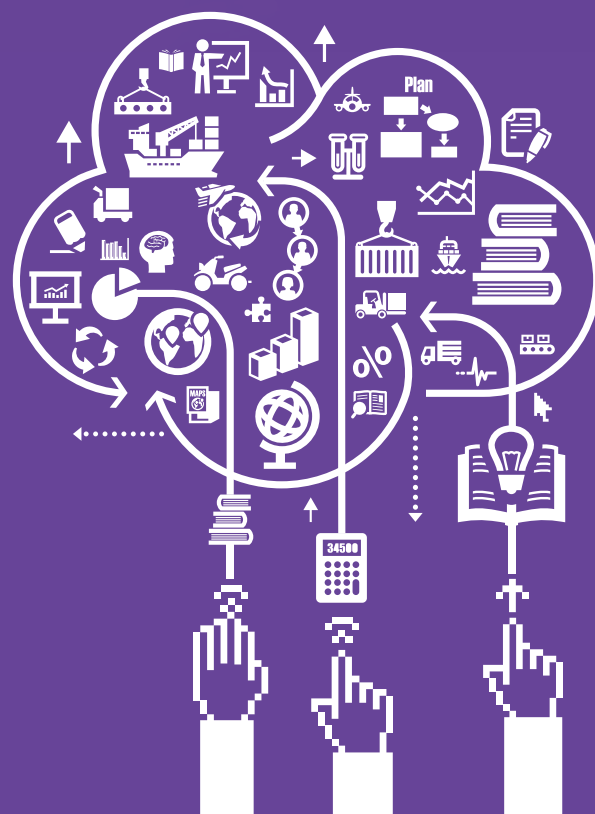
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Major Events



The following briefly describes all major events performed and completed by this Institute in 2015.

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以下簡述本所 104 年度辦理完成之各項大事紀要：

The following briefly describes all major events performed and completed by this Institute in 2015.

1 January

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美國猶他州運輸部鄭總工程司永欽專題演講「美國鐵路安全管理計畫 (Rail Safety Management Programs in the United States)」。

Keynote speech of “Rail Safety Management Programs in the United States” by Yong-Shing Cheng, Chief Engineer at Department of Transportation, Utah, U.S.A.

23

國立臺灣大學地理與環境資源學系孫志鴻教授專題演講「智慧城市與智慧決策雲」。

Keynote speech of “Smart City and Smart Decision Cloud” by professor Zhi-Hong Sun, Department of Geography, National Taiwan University.

3 March

5

辦理「公共運輸推動經驗與紀錄」專題演講。

Speech of experience and record of promoting public transportation

30

辦理院頒「道路交通秩序與交通安全改進方案」之檢討與修正研究計畫專家學者座談會

Hosting review and correction research plan expert and scholar seminar on “Road Traffic Order and Traffic Safety Improvement Solution” announced by the ministry.

4 April

21

公路貨運服務碳足跡輔導資訊座談會。

Coaching information forum of the “Carbon Footprint for Road Transport Services of Freight”

24

– 5/8

辦理「補助學界成立區域運輸發展研究中心計畫」作業須知[草案]3場說明會。

The Explanation Session of Regional Transportation Research Center.

5 May

7

辦理「智慧城市發展與商機」專題演講。

Speech of Smart city Development and Business Opportunities.

12

辦理「104年度公路坡度路段模擬(TGS)模式之應用」技術講習。

Seminar of 2015 Traffic-on-Grade Simulation (TGS) Model.

15

辦理「交通控制對雪山隧道交通作業效率之影響」技術講習。

Seminar of Traffic Control and It's Impact on the Operation of the Shea-San Tunnel.

18

辦理「著作權講堂」專題演講。

Speech of Copyright Law.

26

– 29

籌辦代表團出席在韓國濟州島召開之 APEC 第 41 次運輸工作小組會議。

Organizing representative team for attending APEC 41st transportation work group meeting.

7 July

2

辦理「機、慢車車道線畫設實務與法規探討」第 1 次研究會。

Hosting 1st research conference of “Motorcycle and Slow Lanes Layout Practice and Regulation Study”

3

辦理「鐵路安全之風險管理推動研究－發展鐵路系統之安全管理實務與報告」第 1 次教育訓練

Hosting 1st educational training of “Promotion and Research on Risk Management of Railway Safety - Safety Management Practice and Report for Development of Railway System”

8

10

辦理「104 年度橋梁維護管理訓練講習」- 臺中場

2015 Training Workshop of Bridge Maintenance and Management-Taichung Site

10

海運培訓課程 (1)- 壓艙水管理公約與處置設備簡介

Marine transportation training lesson (1) - ballast water management convention and treatment equipment introduction.

17

辦理「車流理論簡介與巨觀水流模式」第 2 次研究會

Hosting 2nd research conference on “Traffic Flow Theory and Macroscopic Water Flow Model”

22

辦理「車流理論微觀跟車模式」第 3 次研究會

Hosting 3rd research conference on “Traffic Flow Theory Microscopic Tracking Model”

22

24

辦理「104 年度橋梁維護管理訓練講習」- 臺南場

2015 Training Workshop of Bridge Maintenance and Management-Tainan Site

24

大數據 (Big Data) 分析在交通管理與服務應用研討會

Seminar for Big Data analysis on traffic management and service applications

28

海運培訓課程 (2)- 智慧化航行 (e-navigation) 之推動與執行：我國 AIS 系統建置現況、國際間智慧化航線發展趨勢

Marine transportation training lesson (2) - Promotion and execution of e-navigation: current status of the AIS system construction in our nation, international e-navigation development trend

辦理「春節疏運計畫回顧與精進」讀書會

Hosting reading group of “Chinese New Year Dispatch Plan Retrospect and Improvement”

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8 August

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辦理「鐵路安全之風險管理推動研究－發展鐵路系統之安全管理實務與報告」第2次教育訓練

Hosing 2nd educational training of “Promotion and Research on Risk Management of Railway Safety - Safety Management Practice and Report for Development of Railway System”

6

辦理「運輸統計學」第4次研究會

The 4th Workshop on Transport Statistics

12

14

辦理「104年度橋梁維護管理訓練講習」-臺北場

2015 Training Workshop of Bridge Maintenance and Management-Taipei Site

17

辦理「事故碰撞構圖繪製討論」第5次研究會

Hosting 5th research conference on “Collision Accident Structure Drawing Discussion”

26

空運培訓課程(1)-我國民航性能導航(PBN)計畫介紹及未來發展

Aerial transportation training lesson (1) - Performance Based Navigation (PBN) plan introduction and future development in our nation

28

空運培訓課程(2)-談如何從不完美的人機介面、軟體與運行環境養成接近至善的飛行團隊

Aerial training lesson (2) -Discussion on how to develop from imperfect human-machine interface, software and operation environment to a flying team close to perfection.

9 September

2

104年度交通部及各縣市交通首長會議

2015 MOTC and Counties/Cities Transportation Executive Meeting

7

舉辦「山地原住民鄉(區)交通改善需求調查程式」研發成果推廣講習

Hosting promotion seminar on research result of “Mountain Indigenous County (District) Transportation Improvement Demand Investigation Program”

9

2015 臺歐低碳智慧運輸論壇

2015 EU-Taiwan Smart Mobility Conference

15

辦理「開始在日本自助旅行」讀書會

Study session of beginning backpacking in Japan

21

空運培訓課程 (3)- 臺北飛航情報區空域優化規劃

Aerial transportation training lesson (3) - Taipei Flight Information Region Airspace Optimization Plan

23

海運培訓課程 (3)- 貨櫃航商之航線規劃決策

Marine transportation training lesson (3) - Planning and decision on navigation route of container carrier

10 October

8

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10

籌辦代表團出席在菲律賓宿霧召開之「APEC 第 9 次運輸部長會議 (TMM9)」

Organizing representative team to attend the “APEC 9th Transportation Minister Meeting (TMM9)” in Cebu, the Philippines

13

辦理美國運輸部聯邦公路總署陳玄仁博士「美國公路研究及道路資訊資料庫之發展」專題演講。

Hosting keynote speech of “U.S. Highway Research and Development of Road Information Database” by Dr. Xuan-Ren Chen from the U.S. Department of Transportation Federal Highway Administration.

臺北榮民總醫院江秉穎醫師專題演講「睡眠障礙與駕駛安全」

Keynote speech of “Sleeping Disorder and Driving Safety” by Dr. Bing-Ying Chiang from Taipei Veterans General Hospital

14

辦理「國際船舶安全管理章程之風險管理規範與實務研析」座談會

Hosting seminar of “Study on Risk Management Regulation of Practice of International Safety Management Code”

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辦理「鐵路安全之風險管理推動研究－發展鐵路系統之安全管理實務與報告」森鐵列車出軌案例專家學者座談會

Hosting expert and scholar meeting of forestry train derailment case for “Risk Management Promotion Research on Railway Safety - Safety Management Practice and Report for Developing Railway System”

20

辦理「機車危險感知學習工具開發與應用」專家座談會

Hosting expert seminar of “Motorcycle Hazard Perception Learning Tool Development and Application”

21

辦理「道路交通安全管理規範之初探」研究成果發表會

Hosting research outcome presentation on “Preliminary Study on Road Traffic Safety Management Regulation”

23

辦理「臺灣公路容量分析軟體 THCS(2015 年版) 實機教育訓練」- 臺北場

Workshop of Taiwan Highway Capacity Analysis Software, THCS, for Northern Area.

26

辦理「交通建設計畫經濟效益之節能減碳評估應用」教育訓練

Education and training of energy conservation and carbon reduction evaluation during economic analysis for transportation construction projects.

28

籌辦「工程產業全球化會議」之第 2 分組「交通建設一條龍」

Hosting second division “Transportation Construction All-In-One” of “Engineering Industry Globalization Conference”

30

辦理「臺灣公路容量分析軟體 THCS(2015 年版) 實機教育訓練」- 高雄場

Workshop of Taiwan Highway Capacity Analysis Software, THCS, for Southern Area

辦理「混合車流情境之機車交通安全工程設計方法」教育訓練講習會

Hosting educational training seminar on “Motorcycle Traffic Safety Engineering Design Method for Mixed Traffic Flow Scenario”

辦理「區域運輸發展研究中心」教育訓練

The Training course of Regional Transportation Research Center

11 November

3

辦理「鐵路安全之風險管理推動研究－發展鐵路系統之安全管理實務與報告」第3次教育訓練

Hosting 3rd educational training on “Promotion and Research on Risk Management of Railway Safety - Safety Management Practice and Report for Development of Railway System

6

辦理「輕軌、Tram-Train 與都市發展」專題演講

Speech of Light Rail, Tram-Train and Urban Development

辦理「區域運輸發展研究中心與產官學交流暨媒合會」

Hosting “Regional Transportation Development Research Center with Industry, Official and Scholar Exchange and Collaboration Conference”

9

辦理「交通建設計畫的民眾參與(一)-民刁?還是官僚?」研習會

Seminar of the Public Participation Procedure for Transportation Construction Plans (1) - Irrational Citizen? or Bureaucrat?

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辦理「交通建設計畫的民眾參與(二)-聽證會」

Seminar of the Public Participation Procedure for Transportation Construction Plans (2) - Hearing

辦理「知識管理系統」應用講習課程

Course of the knowledge management system

12 December

辦理「區域運輸發展研究中心」教育訓練

The Training course of Regional Transportation Research Center

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日月潭低碳旅遊服務贏得國際 APEC ESCI 金獎榮耀，出席 APEC 能源智慧社區倡議最佳案例評選頒獎典禮暨案例分享會

Sun Moon Lake low-carbon tourism service received the honor of APEC ESCI gold medal; attending APEC energy smart community proposing best case evaluation award ceremony and case study sharing conference

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辦理「日月潭低碳旅遊服務贏得國際 APEC ESCI 金獎榮耀」記者會

Hosting press conference for “Sun Moon Lake Low-Carbon Tourism Service Receiving Honor of International APEC ESCI Gold Medal Award”

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地址：105 臺北市松山區敦化北路240號
電話：(02) 2349-6789
網址：www.iot.gov.tw

