2015 ANNUAL REPORT

2015 ANNUAL REPORT OF
THE INSTITUTE OF
TRANSPORTATION, MOTC

交通部運輸研究所
104年年報

2015 ANNUAL REPORT OF THE INSTITUTE OF TRANSPORTATION, MOTC

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所長的話

面對人口高齡少子化改變運輸族群結構、資通訊科技躍升引領大數據加值應用、產業全球化分工衝擊海、空運輸市場，以及氣候變遷與碳排放催化綠色運輸發展，顯見交通業務推動必須以更創新、前瞻的思維進行規劃與提供服務，以因應環境快速變遷對運輸部門的嚴峻挑戰。

本所長期扮演交通部智庫的角色，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研跨域溝通等工作。本人上任以來，不時期勉同仁，以「專業領航、追求卓越」做為團隊共識，以「政策、前瞻、基礎」三類研究能力，做為創新思維與深化專業的技能。

檢視近期本所支援行政院、交通部暨所屬機關、地方政府陸續完成重大施政規劃並協助推動相關計畫，包括「運輸政策白皮書」、「山地原住民鄉（區）交通改善計畫」、「花東地區整體交通改善方案」、「南部、中部與北部區域整體交通系統改善方案」、「臺灣地區易肇事路段改善計畫」、「東部地區自行車道示範計畫」、「桃園航空城聯外交通規劃」、「橋梁維護管理作業評鑑」、「公路公共運輸提昇計畫（102-105 年）」、「觀光遊憩區導入智慧型運輸系統計畫－ i^3 Travel 愛上旅遊」，以及「臺灣綠色港埠建置之研究計畫案」等。著眼國家政策需要，本所將賡續擘劃與推動「全島自行車路網之建置」、「交通建設綱要計畫體系」、「大數據在交通領域之運用」、「運輸部門節能減碳政策」、「智慧型運輸系統車路整合應用」、「我國整體航運制度」、「機車交通政策白皮書」、「汽車運輸業管理相關規定法制化研究」、「補助學界成立區域運輸發展研究中心計畫」、「精進港灣及陸路、橋梁安全與防災技術」等重大計畫。

展望未來，因應運輸建設、科技、服務等面向已產生質變，期許本所不懼挑戰，朝引領政策規劃、發展前瞻研究、提昇技術能力、統合跨域協調來定位本身之功能角色，以充分發揮智庫的價值，繼而奠立我國運輸服務優質化發展之基礎。

交通部運輸研究所　所長

林信得

Words from the Director-general

Our progressively aging society and low birth rate has changed the transportation structure of Taiwan. Advancements in technology have brought about the value-added application of big data. Industrial globalization and division has affected sea and air shipping markets. Climate change and increasing carbon emissions have expedited the development of green transportation. These factors highlight the importance of adopting more innovate and bold ways of thinking in the planning and provision of services related to transportation, so as to cope with the rapidly changing environment and the stringent challenges facing the transportation department.

Our institute aims to serve as the think tank for the Ministry of Transportation and Communications (MOTC), providing assistance for the formulation of policies, integrating and coordinating transport decisions and implementation plans, supporting various transportation-related administration technologies and innovative R&D, and bridging the interdisciplinary communication between transportation-related industry, government, academic, and research units. Since I assumed office, I often encourage our colleagues to adopt "Professional Leadership; Pursue Excellence" as the maxim of our institute, and deem the three research qualities of "Policy, Prospect, and Foundation" as the skills for innovative thinking and extensive professionalism.

We have recently collaborated with the Executive Yuan, the MOTC and its affiliates, and local government units in planning numerous key policies and promoting relevant plans. These projects include the *White Paper on Transport Policy, Improvement Plan for the Transport in Aboriginal Villages (Mountain Areas), Improvement Plan for the Overall Transport in the Huadong Region, Improvement Plan for the Overall Transport Systems in Southern, Central and Northern Taiwan, Improvement Plan for Accident-Prone Road Sections in Taiwan, Demonstration Plan for the Bicycle Paths in Eastern Taiwan, Plan to Connect Taoyuan Airport with External Transport Infrastructure, Evaluation Criteria for the Maintenance and Management Operations of Bridges, Improvement Plan for Highway Public Transport (2013-2016), Intelligent Transportation System for Tourism and Recreational Areas – i^3 Travel, and Study on the Establishment of Green Ports in Taiwan.* Based on national policy requirements, we shall continue our efforts in the planning and promotion of several key projects, namely, *Establishment of a Nationwide Bicycle Network in Taiwan, Transportation Construction Outline, Application of Big Data in the transportation Sector, Energy Saving and Carbon Reduction Policies for Transportation Units, Intelligent Transport System Carriageway Integration and Application, Shipping System Integration in Taiwan, White Paper on Motorcycle Transport Policies, Legal Research on the Regulations of Automotive Transportation Management, Subsidization Project for the Establishment of Regional Transportation Research and Development Centers, and Enhancing Harbor, Land, and Bridge Safety and Hazard-Prevention Techniques.*

In response to changing transportation infrastructures, technologies, and services, I urge our Institute to boldly face challenges, focus on policy planning, conduct forward-thinking research, improve technological capabilities, and integrate interdisciplinary coordination to define our functional role, thereby exerting the full potential of knowledge databases and solidifying the foundation on which to develop quality transportation services in Taiwan.

Lin, Shinn-Der

Director-general of the Institute of Transportation

01

組織及人力

Organization and Human Resources

INSTITUTE OF
TRANSPORTATION, MOTC

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。

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，其犖犖大者計有：臺灣地區整體運輸規劃、高速公路交流道連絡道路系統整體規劃、臺北地區大眾運輸系統初步規劃、臺北市區鐵路改善計畫、臺北都會區大眾捷運系統計畫及高雄都會區大眾運輸系統長期發展計畫等等，皆已次第竣事。此外，該委員會並隨時配合政策需要，進行各項專案研究規劃，逐一付諸實施。

1. HISTORY

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

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

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。

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 135 人。另約聘人員 5 人，技工及工友 33 人。

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 China. Being a formal branch of the government, the Institute of Transportation is funded through a normal budgeting process.

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

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 Marine Technology Center.

According to the organization act of IOT, the total authorized staff is 177 and the budgetary staff is 137. In addition, there are 5 contracted research employees and 34 technicians and office workers.

三、本所職掌

依據本所組織條例第二條規定，本所掌理下列事項：

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

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 marine technologies and providing suggestions;
11. Other matters related to transportation research.

四、組織架構
4. ORGANIZATION FRAMEWORK

副所長 Deputy Director-general

陳茂南
Chen, Mao-Nan

所長 Director-general

林信得
Lin, Shinn-Der

主任秘書 Chief Secretary

黃新薰
Huang, Hsin-Hsun

副所長 Deputy Director-general

陳天賜
Chen, Tien-Tsyh

人事室 主任
陳權榮
Chen, Chuan-Jung

人事室
Personnel Office

主計室 主任
董欣靜
Tung, Hsin-Ching

主計室
Accounting Office

秘書室 主任
張添福
Chang, Tien-Fu

秘書室
Secretariat

運輸計畫組 組長
蘇振維
Su, Cheng-Wei

運輸計畫組
Transportation Planning Division

運輸工程組 組長
許書耕
Hsu, Shu-Keng

運輸工程組
Transportation Engineering Division

運輸安全組 組長
張開國
Chang, Kai-Kuo

運輸安全組
Transportation Safety Division

運輸經營與管理組 組長
張朝能
Chang, Chao-Neng

運輸經營管理組
Transportation Operations & Management Division

運輸資訊組 組長
陳其華
Chen, Chi-Hwa

運輸資訊組
Transportation Information Systems Division

綜合技術組 組長
張瓊文
Chang, Chiung-Wen

綜合技術組
Interdisciplinary Research Division

港灣技術研究中心 主任
邱永芳
Chiu, Yung-Fang

港灣技術研究中心
Interdisciplinary Research Division, Harbor & Marine Technology Center

02

年度施政概況介紹

Annual Policy Implementation Presentation

INSTITUTE OF TRANSPORTATION, MOTC

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 104 年施政計畫之實施狀況。

一、運輸系統研究規劃

- 車輛動態能源消耗與碳排放特性研究 - 以大貨車為例 (1/2)
- 交通建設計畫經濟效益評估工具之應用與效能提升
- 第 5 期整體運輸規劃研究系列 - 城際旅次特性分析及補充調查
- 單線連續區段軌道容量模式分析暨整體容量軟體改版研究 (2/2)
- 104 年度中長程計畫審議決策支援系統與整合資料庫維護
- 應用大數據分析於宜蘭地區交通管理預警機制之研究
- 公路坡度路段模擬模式之發展及應用 (3/3)
- 104-105 年度臺灣公路容量分析軟體（THCS）優化與推廣 (1/2)
- 高速公路分匯流區交通特性調查
- 交通部自行車友善環境路網整體規劃技術服務 (一)

The implementation of various policies and plans by the Institute of Transportation in 2015 with a focus on the seven major operations carried out is briefly presented. The operations are transport systems research and planning; transport engineering R&D; transport safety R&D; transport operations and management R&D; transport information collection and application research, development, and promotion; general technology R&D; and harbor technology R&D.

1. Transportation Systems Planning

- A Study on the On-board Measurements of Fuel Consumption and Carbon Emissions of Heavy Trucks (1/2)
- A Study on the Deployment and Improvement of Economic Appraisal Tools for Transport Projects
- The 5th Overall Transportation Planning Research - Intercity Trip Characteristics Analysis and Supplementary Survey
- The Development of a Capacity Model for Continuous Single-Track Sections and the Update of Rail Capacity Software (2/2)
- Plans to Enhance the Decision Support System and Integrated Database for Transportation Infrastructure Deliberations (2015)
- Big Data Application for Traffic Warning in the Yilan Area
- The Development and Application of a Traffic Simulation Model for Highway Grade Segments (3/3)
- THCS Optimization and Promotion in 2014 and 2015 (1/2)
- A Survey on the Traffic Characteristics of Freeway On/Off-ramp Junctions
- An Overall Plan for the Techniques and Service of the Friendly Bicycle Network of the Ministry of Transportation and Communications (I)
- The Development and Marketing of the Bicycle Lane Demonstration System of the Ministry of Transportation and Communications (I)
- The Bridge Management Information System of Taiwan (2015)
- Workshops for the Bridge Management Information System of Taiwan (2015)

- 交通部自行車路網示範系統開發及其行銷服務（一）
- 104 年度臺灣地區橋梁管理資訊系統
- 104 年度臺灣地區橋梁管理教育訓練
- 第二代臺灣地區橋梁管理資訊系統建置規劃（二）
- 高鐵營運對西部城際運輸市場消長之觀察（103 年）
- 交通建設計畫民眾參與程序改善推動計畫（1/3）- 內部推廣

二、運輸工程研究發展

- 持續辦理桃園航空城「聯外運輸系統」整體檢視及協商相關事宜
- 辦理「商港整體發展規劃（106~110 年）」合辦研究計畫
- 辦理「我國整體航運制度之分析研究」合辦研究計畫
- 辦理「我國普通航空業發展及經營環境改善之研究」合辦研究計畫
- 辦理「臺灣國內航空運輸整體規劃」合辦研究計畫
- 辦理「兩岸海運直航遭遇之問題與策略研析」自辦研究計畫
- 辦理「港埠發展郵輪產業效益初探」自辦研究計畫
- 辦理「LPG/LNG 發展對船舶與港口影響初探」自辦研究計畫
- 辦理「臺灣港群在亞太區域海運網絡定位初析」自辦研究計畫
- 辦理「國際間機場協調整合決策（A-CDM) 發展現況初探」自辦研究計畫
- 辦理「以 DEA 分析亞太地區主要傳統航空公司機隊營運績效」自辦研究計畫
- 辦理「拓展國際航空客運市場相關政策及策略之研究」自辦研究計畫
- 辦理「2015 年我國海運發展回顧」自辦研究計畫
- 辦理「2015 年我國空運發展回顧」自辦研究計畫

- Planning and Implementation of the Second-Generation Bridge Management Information System of Taiwan (II)
- A Survey on the Market Changes of Intercity (West) Public Transportation Caused by the HSR (2014)
- Promotion Plan for Improving the Public Participation and Procedures of Transportation Construction Projects (1/3) – Internal Implementation

2. Research and Development in Transportation Engineering

- Continued Inspection and Negotiations for Matters Concerning the Implementation of the "Taoyuan Aerotropolis Integrated Transportation System"
- Overall Development Plan for Commercial Ports (2017-2021) (joint research project)
- An Analysis of the Overall Shipping System of Taiwan (joint research project)
- A Study on the Development of the Aviation Industry in Taiwan and Improvements in the Operational Environment (joint research project)
- An Overall Plan for Domestic Air Shipping in Taiwan (joint research project)
- An Analysis of the Problems of and Strategies for the Direct Marine Shipping Between China and Taiwan (independent research project)
- A Preliminary Investigation into the Benefit of Developing Cruise Industry in Ports (independent research project)
- A Preliminary Investigation of the Influences of LPG/LNG Development on Ships and Ports (independent research project)
- A Preliminary Analysis of the Position of Taiwan's Ports in the Asian Pacific Marine Network (independent research project)
- A Preliminary Investigation of the Current Development Status of A-CDM (independent research project)
- Using DEA Analysis to Determine the Operational Performance of the Main Conventional Aviation Organizations in the Asian Pacific Region (independent research project)
- A Study on the Policies and Strategies for Expanding The International Air Passenger Transportation Market (independent research project)
- A Review of Marine Shipping in Taiwan (2015) (independent research project)
- A Review of Air Shipping in Taiwan (2015) (independent research project)

三、運輸安全研究發展

- 辦理「國際船舶安全管理章程之風險管理規範與實務研析」研究計畫。
- 辦理「道路交通事故調查報告表檢討修訂及統計運用」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（1/3）—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（1/2）」研究計畫。
- 辦理「混合車流情境之機車交通安全工程設計方法研究驗證與推廣」研究計畫。
- 辦理「道路交通安全管理（ISO 39001）規範之初探」研究計畫。
- 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」研究計畫。
- 辦理「第 33 期臺灣地區易肇事路段改善計畫」。

四、運輸經營管理研究發展

- 辦理「公共運輸縫隙掃瞄決策支援系統之整合及推廣運用計畫」研究計畫
- 辦理「軌道運輸系統營運資訊整合平台建置與應用計畫」研究計畫
- 辦理「運輸物流供應鏈恢復力之研究」研究計畫
- 辦理「汽車運輸業管理相關規定法制化作業之研究－法律位階檢討」研究計畫
- 辦理「汽車運輸業管理相關規定法制作作業之研究 - 客運類」研究計畫
- 辦理「汽車運輸業管理相關規定法制化作業之研究－計程車及小客車租賃業」研究計畫
- 辦理「汽車運輸業管理相關規定法制化作業之研究－貨運及小貨車租賃業」研究計畫

3. Research and Development in Transportation Security

- A Study on the Risk Management Specifications and Practices for The International Marine Safety Management Code
- A Revision and Statistical Application of the Roadway Accident Investigation Report
- The Development Instruments for Road Environment Checking and the Provision of Mobility Assistance for Pedestrians and Cyclists (1/3) - A Case Study of the Road Safety Survey
- The Development and Application of Hazard Perception Learning Tools for Motorcycle Riders (1/2)
- A Study on the Verification and Promotion of the Motorcycle Traffic Safety Design in Mixed Traffic
- A Preliminary Investigation of Road Traffic Safety Management Systems (ISO39001)
- A Study of Promoting Railway Safety Risk Management
- A Study on the Development of Railway Safety Management Practices and Reports for Railway Systems
- The 33rd Project for Improving Accident-Prone Locations in the Taiwan Area

4. Research and Development in Transportation Operations and Management

- The Integration and Application of a Decision-making Support System for the Scanning of Service Gaps in Public Transportation
- The Establishment and Application of an Integrated Management Information Platform for Railway Systems
- A Study on the Resilience of Transportation, Logistics, and Supply Chain
- A Study on the Renewal of the Motor Carrier-Related Regulations and Administration Systems – Legal Hierarchy
- A Study on the Renewal of the Motor Carrier-Related Regulations and Administration Systems – Passenger Transportation
- A Study on the Renewal of the Motor Carrier-Related Regulations and Administration Systems – Taxi Transportation and Passenger Car Rentals
- A Study on the Renewal of the Motor Carrier-Related Regulations and Administration Systems – Cargo Transportation and Pickup Truck Rentals

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
- 美好生活連結者 good life 交通輕雜誌跨載具服務平台規劃建置計畫
- 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

六、綜合技術研究發展

- 辦理「公車停等紅燈怠速熄火之可行性分析」
- 辦理「精進公路運輸能源消耗及排放推估方式之研析」
- 辦理「運輸部門能源消費趨勢及未來需求分析」
- 辦理「因應氣候變遷交通運輸調適行動計畫規劃方向」之研究
- 辦理「氫燃料電池車輛生命週期分析」
- 辦理「城際運輸節能減碳策略評估模組開發及應用（1/2）」
- 辦理「公路貨運服務碳足跡公用係數建置計畫（1/2）」
- 辦理「省道丘陵區 LED 路燈測試計畫與成本效益分析」
- 辦理「重大鐵公路建設氣候變遷風險評估機制與調適資訊平台之研究（2/2）」之研究

5. Research, Development, and Promotion in Transportation Data Collection and Information Application

- An Investigation of the Carriageway Integrated Application of the Intelligent Transport System and Pilot Simulations
- A Research and Knowledge Exchange Concerning the Intellectual Property for the Innovative R&D Achievements of Technology Projects
- Participated in the International Affairs and Information Management of APEC Transport Departments in 2015
- The Establishment of a Cross-Device Service Platform for Good Life Transportation Magazine
- A Study on the Collection and Visual Analysis of the Big Data of Bus Information Systems
- An Evaluation of the Performance of the Sun Moon Lake Low Carbon Intelligent Tourism Demonstration Plan
- An Analysis of the Development Trends Concerning the Key Transportation Issues Presented in APEC 2015
- Institute of Transportation Information and Resource Inventory and Information Service Improvement Evaluation Plan
- An Analysis of Information Technology Development Trends and Transport Application Frameworks

6. Research and Development in Integrated Technology

- A Feasibility Analysis for the Idling Stop of Buses At Red Lights
- Improving Energy Consumption and GHG Emission Estimations for Road Transportation
- An Analysis on the Future Energy Consumption Trends and Demands in the Transportation Sector
- An Action Plan and Directions for the Adaptation of Transportation to Climate Change
- An Analysis of the Lifecycle for Hydrogen Fuel Cells
- The Development and Application of Energy Saving and Carbon Reduction Strategic Evaluation Models for Intercity Transport (1/2)
- The Establishment of a General Emission Factor for the Carbon Footprints of Road Freight Services (1/2)
- A Test Plan and Cost-Benefit Analysis for LED Lighting in the Hill Areas of Provincial Roads
- A Study on the Risk Assessment Mechanism and Information Platform for Climate Change Adaptation for Major Railway and Road Constructions (2/2)

七、港灣技術研究發展

- 編印出版：港灣季刊第 100、101、102 期
- 辦理「道路及橋梁災害防治技術整合之研究」研究計畫
- 辦理「腐蝕環境分類及港灣構造物腐蝕劣化調查研究」研究計畫
- 辦理「港灣碼頭耐震性能評估之研究 - 以高雄港為例」研究計畫
- 辦理「西南沿海地區地層下陷調查及基本資料建置研究」研究計畫
- 辦理「我國貨櫃港口營運環境改善之研究」
- 持續辦理「臺灣港灣長期性海氣象調查及資訊應用系統建置之研究」
- 持續辦理「水波時頻分析之優化」
- 持續辦理「港灣構造物與波流互制研究」
- 持續辦理「創造綠色港埠之新技術研發」
- 辦理「港灣海象模擬暨溢淹資訊建置之研究」
- 港灣海氣象環境資訊整合及統計分析研究（3/4）
- 持續辦理「全球暖化引致臺灣海域海面水位昇降變動率之評估研究」

7. Research and Development in Harbor Technology

- Publications: Harbors Quarterly Vol. 100, 101, and 102
- A Study on the Integration of Disaster Prevention Technologies for Roads and Bridges
- A Study on Corrosive Environmental Classifications and Corrosive Deterioration of Harbor Structures
- Seismic Performance-Based Assessment on Port Terminals--A Case Study in Kaohsiung Harbor
- The Investigation of Ground Subsidence and the Establishment of a Demographic Database for the Southwestern Coastline of Taiwan
- A Study on the Environmental Improvement on Cargo Port Operations
- Continued Observation of Sea Meteorology and the Establishment of an Information Application System
- The Optimization of Water Wave Time-Frequency Analysis
- Interactions Between Port Structures and Waves and Currents
- New Technology R&D for Green Port Promotion
- Modeling Harbor Oceanographic Information and Establishing Overflow Information
- Harbor Environment Information and Statistical Analyses (3/4)
- An Assessment of Rising Sea Levels Around Taiwan Caused by Global Warming

03

專題報導 - 交通數據紀元

Feature Story - The Era of Traffic Data

INSTITUTE OF TRANSPORTATION, MOTC

一、大數據概念興起

大數據（Big Data）在維基百科中，一般廣泛地解釋為大量資訊，當其資料量龐大到資料庫系統難以在短時間內進行儲存、運算、處理，分析成能解讀的資訊時，即稱為大數據。

由於大數據中可能隱藏珍貴訊息，埋藏著未知或未發現的重要資訊，例如各種資料或行為的相關性（Unknown Correlation）、未顯露的模式（Hidden Patterns）、市場趨勢（Market Trend）等；因此近年來不僅各研究領域逐漸重視大數據的探勘與分析，歐美國家更將大數據的分析結果應用於政府的決策支援。

運算技術和結構化數據向來是數據分析的重要門檻，但在 2007 年 IBM 開始推展大數據概念後，顯示在技術面及資料面的成熟度已經開始具備處理大量資料的能力。而近年來雲端技術、運算架構等革新技術的不斷推出，各種 MEMS 微機電系統的逐漸普及，各自解決在技術面與資料面的重大障礙，而 Google、Apple 等科技大廠在近年來的行銷、生產、研發與設計各方面上，均為應用大數據概念的良好範例。

二、交通運輸領域的數據基礎

交通運輸的數據資料大量累積應該始於公共運輸領域，如同臺鐵在 1979 年 3 月 12 日開辦電話訂票及網路訂票於 1997 年 4 月 15 日開辦；臺北捷運在 2002 年 6 月開始營運；

1. The Prevalence of Big Data

According to Wikipedia, big data is a broad term for data sets that are so large that databases cannot store, compute, and/or process the data in a short amount of time and convert the data into interpretable information.

Valuable information may be hidden within big data. Such information includes key concealed or undiscovered information, such as unknown correlations, hidden patterns, and market trends. Therefore, not only have various fields placed greater focus on probing and analyzing big data in recent years, but in Europe and America they have applied their big data analysis results into governmental policies.

Computing technologies and structured data have also been the key thresholds of data analysis. However, following IBM's introduction of the concept of big data in 2007, technology and information have developed to a point where big data can now be processed. Moreover, the progressive launch of innovative technologies, such as cloud computing and computing architecture, and the gradual prevalence of MEMS have resolved major obstructions in technology and information. The recent marketing, production, R&D, and design of technology giants, such as Google and Apple, are perfect examples of the application of big data.

2. The Data Basis of the Transportation Sector

The mass accumulation of transportation data most likely originated in the public transportation sector, such as Taiwan Railways Administration's launch of telephone bookings on 12 March 1979 and Internet bookings on 15 April 1997; the activation of the MRT system in Taipei in June 2002; and the activation of the THSR on 15 January 2007. These three railway systems employ the automated procedures based on information and communication technologies (ICTs) for ticket sales and verification, which simultaneously began accumulating valuable data.

Moreover, electronic transportation tickets (formerly known as Taiwan Electronic tickets Payment; now known as electronic tickets; regulated by the FSC) have been able to be used to pay for MRT fares since 2002. The subsequent addition of Taipei City bus fares, highway passenger bus fares, parking fees, and micro-payments to the list of compatibilities have made the data collection and market prospects of electronic tickets limitless. Moreover, the interdisciplinary payment capability of electronic tickets has also enhanced the value of the data collected, which have made electronic tickets more consistent with the concept of big data, by which various data are meta-analyzed.

臺灣高鐵也在 2007 年 1 月 15 日營運，以上三種軌道運輸均採用資通訊（簡稱 ICT）技術進行購票、驗票等自動化流程，也同時開始累積寶貴的數據資料。

此外，交通電子票證（亦是臺灣電子票證支付的前身；現稱電子票證，由金管會為主管機關）自 2002 年起配合臺北捷運搭配使用，再經過統合臺北市區公車、公路客運、停車收費及小額支付後，其資料量及市場前景亦已無可限量。而其跨主管機關領域的支付行為，也為其數據資料增加不少含金量，亦更符合大數據概念在統合分析各種不同數據之精神。

小汽車之資料蒐集，主要來自 VD、AVI 等路側設施，不過由於維護成本高及不穩定等因素，資料品質難以確保且維護成本高，而 eTag 於 2006 年 2 月 10 日啟用後，在高速公路上的資料蒐集，往前邁進一大步，其可記錄之數據更多元詳細，亦立刻成為各界索取及分析之熱門目標。

行動裝置在 2003 年首次整合 GPS 晶片模式，掌握使用者位置的可能性大增下，立即成為熱門話題，而 Google map 及各種路況報導服務的推出，利用行動裝置推估路況的推測，成為各界毫不懷疑的臆測。後續在 Android 及 iOS 開發者大會公佈之規格細節，各種非經使用者同意回傳資料的新聞及許多通訊實驗室證明下，顯示利用行動裝置蒐集資料，進而推出相關服務並不是一種推測，而是一套運作模式。

以上除了行動裝置外，大多都建立在執行明確目標的架構下，建立及累積數據基礎，例如高鐵、捷運、臺鐵是為了訂票、購票、驗票，電子票證為了便利支付，公路主管機關為了道路監理及收費。但行動裝置系統業者（無論是設備製造商或電信系統業者）並非是毫無目標，而是清楚瞭解到數據的重要及價值，與其等待釐清目標之後再來蒐集相關數據，在其過程中即可先行蒐集所有資料，並且在單位儲存成本及運算成本下降的同時，反而凸顯數據的價值。

交通數據開始大量有系統蒐集應該始於 90 年代末期，但當時仍然存在許多技術及成本限制，留存下來的數據內容並非完整，即便至今，我們仍然會忽略掉我們不認為重要的數據，隨著技術進步，我們應該即刻改變觀念及習慣作為，能夠儘可能保留完整資訊將是未來發展的重要基石。

Small vehicle data mostly collected from vehicle detectors (VD) and Automatic Vehicle Identification Systems (AVI). However, the information quality could not be ensured due to the excessive maintenance costs and instability of these facilities. The activation of the eTag system on 10 February 2006 exponentially improved the data collection on highways, enabling the collection of more detailed data. The eTag database immediately became a popular target for the collection and analysis of data.

GPS chip modules were incorporated into mobile devices for the first time in 2003, increasing the possibility for users to pinpoint their locations. This became an instant popular topic of discussion. The launch of Google Maps and various traffic-reporting services, which use mobile phones to estimate traffic conditions, became conjecture that was taken as gospel by various sectors. Later, relevant specifications and details announced in developers' conferences for Android and iOS, news concerning the transmission of data without the approval of the user, and various communications verified through laboratory testing suggested that collecting data using mobile devices to launch relevant services is not a prediction; rather, it is an operational model.

With the exception of mobile devices, most data collection and databases are typically based on frameworks that have specific functions when establishing and accumulating a foundation for data. For example, the THSR, MRT, and TRA systems are aimed at ticket booking, sales, and verification; electronic passes are aimed at convenient payments; and the collection of data by highway authorities is aimed at monitoring traffic and charging for the use of roads. However, this does not denote that system operators for mobile devices (regardless of device manufacturers or telecommunication vendors) are without goals. They clearly understand the importance and value of data. Instead of only collecting relevant data once goals are identified, they start to collect data during this process. The value of the data is highlighted with the decline in unit storage costs and computing costs.

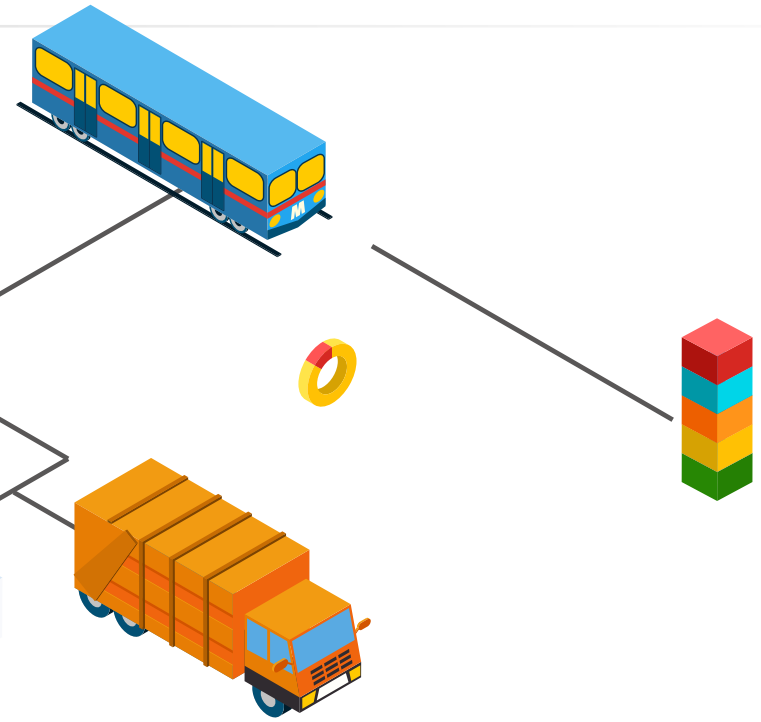
The expansive and systematic collection of traffic data is considered to have begun in the late 90s. However, numerous technological and cost restrictions existed during that time, causing the data retained during that time to be incomplete. Even today, we often neglect data we consider to be irrelevant. Apace with the advancements in technology, we should immediately change our perspectives and past habits. The retention of complete data will be a key factor for future development.

三、臺灣近來交通大數據的發展現況

目前大數據研究主要在於擁有大量數據的機構或單位，在科技發展的背景下，應用相關技術進行研究，以交通運輸領域而言，交通相關部門會應用其蒐集之資料分析其主管業務並進而輔助決策，即如同現在利用高速公路 eTag 收費系統之資料，分析國道車流狀況、輔助釐清問題、對策模擬及支援決策；在公共運輸方面，則主要為利用民眾上下車刷卡之資料，分析路網效率及旅客起訖，進而找出適當公車路網及擬定交通管理策略。

大數據另一個價值在於跨領域的分析和研究，因此許多民間企業及學術單位，甚至獨立研究團隊都對擁有龐大數據資料的政府部門深具期待，而因應這股開放風潮，我國於 2005 年即訂定「政府資訊公開法」明訂資訊公開的規則要項，但隨著技術深入和更客製化、細緻的數據要求，衍生對個人資料保護的議題，我國亦於 2010 年訂定「個人資料保護法」，加速個人資料保護制度的建立。

未來大數據在交通運輸領域的應用，在「個人資料保護」的各種細項逐步釐清後，預期將成為大數據的重要基礎之一，無論在運輸規劃、管理、安全及研究發展上，均將改變既有的運作模式，我們不需要再猜測母體的狀態、可以建立各種細緻的行為模式、大範圍模擬因應對策及即時監控成效和結果。這將是重要的改變力量。



3. The Recent Development of Traffic Big Data in Taiwan

Current big data research is based on institutes or units that possess large amounts of data. Due to technological developments, relevant technologies are applied for research. In the transportation sector, transportation departments use their collected data to analyze supervisory operations and facilitate decision-making. For example, data collected from the eTag system on highways are currently used to analyze the traffic conditions on highways, highlight problems, simulate measures, and facilitate decision-making. In the public transportation sector, data collected from swiping electronic passes are used to analyze network efficiency and passenger departure and destinations, thereby identifying appropriate bus route networks and formulating traffic control strategies.

Another value of big data is interdisciplinary analysis and research. Therefore, numerous private organizations, academic units, or even independent research teams are expectant on government units that possess big data. In response to the trend of data sharing, The Freedom of Government Information Law was passed in 2005, regulating the disclosure of information. However, to address the issue of personal information disclosure due to the growing requirements for in-depth and customized technological data, the Personal Information Protection Act was passed in 2010 to accelerate the establishment of a personal information protection system.

For the future application of big data in the transportation sector, we anticipate that "personal information protection" shall become a core foundation once relevant issues are clarified. We believe that big data will change extant operating models in transportation planning, management, safety, and R&D. We will no longer need to predict population conditions to create detailed behavioral models. We will be able to simulate strategies on a large scale and monitor performance and outcomes in real-time. Big data will be the primary driving force for change.

四、未來趨勢及發展

現在躍上各領域版面的熱門話題，例如無人車、物聯網（Internet of Things）等，其實無一不和數據有所關聯，科技業正提供及研究無數深入家庭生活的解決方案，藉由半導體晶片給合既有家電或各種器具，使其智慧化，能夠根據使用者的習慣，自動或半自動地給予回應。其背後所依靠的基礎，即是所謂的數據資源庫，依據過去的數據，使用適當的運算或模式，對使用者給予回應，同時透過機械學習（Machine Learning），不斷地再從使用者的反應，修正及調整模式並同時再持續蒐集資料，以達到更智慧化的效果。未來各行業的商業模式亦可能產生變化，過去工業化流程的生產、行銷、顧客管理可能都必須再搭配數據的研究和融入整體流程，例如德國政府已開始投入工業 4.0（Industry 4.0），美國 Brett King 也提出銀行 3.0（Bank 3.0），未來無人車技術、路側基礎設施、ICT 技術等整合，交通運輸也將會跨入下一個世代。

五、開啟數據時代的契機 – 大數據分析在交通管理與服務應用研討會

跨時代的變革也必須有堅實的基礎方能一蹴可及，交通部為因應科技趨勢及資訊數據應用方式變革，特別在 104 年 2 月 3 日「善用智慧科技、優化交通管理」研商會議指示交通部運輸研究所及交通部統計處共同策劃辦理「大數據（Big Data）分析在交通管理與服務應用」研討會。主要針對大數據發展趨勢，以及在交通運輸上成功應用案例分享等內容進行研討，邀請部屬機關、各縣市政府、學術單位、顧問公司等單位參與。

本次研討會於 104 年 7 月 24 日舉辦，特別邀請六都交通首長共同參與交通大數據高峰論壇，以實務執行角度，針對大數據的概念落實、應用等面向，檢視及討論國內未來發展大數據的重要性、課題、合作機會及政策方向。會中達成「六大核心共識」將可做為交通部暨部屬機關及六都未來發展大數據之重要基礎。會中部長也特別指示本所、交通部統計處及交通部管理資訊中心參與未來成立之大數據顧問團隊，配合六都及各重大交通議題應用大數據輔助解決交通問題。

4. Future Trends and Development

Recent popular topics in various sectors, such as Self-Driving Car and the Internet of Things, are all associated with data. The technology industry is currently endeavoring to research and provide countless solutions for the household, creating intelligent products by combining semiconductors with extant household appliances and devices. These products are able to automatically or semi-automatically provide feedback based on user habits. This is achieved through a back-end database. Past data are processed using an appropriate algorithm or model to provide users with feedback. Simultaneously, the "intelligence" of products can be elevated through machine learning, whereby they constantly revise and adjust their processing ability based on user responses. In the future, the business models of various industries may be altered, and data research would have to be incorporated into extant industrialized processes of production, marketing, and customer management, and eventually the overall industrial process. For example, the German government has invested in Industry 4.0 and the US citizen Brett King has proposed Bank 3.0. The integration of Self-Driving Car technology, roadside infrastructure, and ICT technologies in future will inevitably guide transportation into the next era.

5. Opening the Data Era – Application of Big Data Analysis in Transportation Management and Services Seminar

A sound foundation must be established in order for new-era reform to be effortless. In response to technological trends and the reform of data application, the Ministry of Transportation and Communication (MOTC) commissioned the Institute of Transportation and the Census and Statistics Department (C&SD) to jointly arrange the "Application of Big Data Analysis in Transportation Management and Services Seminar" (hereafter referred to as "the Seminar") in the Intelligent Technology Utilization and Transportation Management Optimization Seminar on 3 February 2015. The Seminar aimed to discuss the development trends of big data and share the successful implementation of big data analysis in transportation. Numerous affiliates, city and county governments, academic units, and consultation firms were invited to participate.

The Seminar was held on 24 July 2015. The heads of the transportation departments in the six municipalities of Taiwan were invited to attend. Viewing the concept implementation and application of big data from a practical perspective, the Seminar explored and discussed the importance, potential problems, cooperation opportunities, and policies concerning the future development of big data in Taiwan. Six core items were conceived in the Seminar, which will serve as a basis for the future development of big data in the MOTC, its affiliates, and the six municipalities. The Director of the MOTC further appointed the Institute, C&SD, and the Information Management Center, MOTC to participate in the future establishment of a big data consultation group, which will collaborate with the six cities to address and resolve major transportation issues through big data.

本次六都交通首長論壇達成六大核心共識如下：

（一）運輸好行，創造數據思維前瞻施政

公共運輸大數據資料為主，整合實務監理管理需求，視覺化車機資料分析研究成果，俾利應用於政府公共運輸之資源配置與監督，改善客運業者經營管理模式。交通旅運監測資料為輔，掌握運輸廊道交通流走勢，提升公共運輸運能與替代路徑資訊服務，以數據思維研擬中央地方路網瓶頸套案。

（二）安全提升，健全交通事故防治分析

利用大數據資料視覺化與地理資訊分析技術，以巨觀與微觀之交通科學角度，多元整合交通安全資料庫，以有效降低交通事故傷亡人數為目標，健全交通安全資訊系統與研擬防治策略。

圖 2-1　六都交通首長論壇

Figure 2-1　The Heads of the Transportation Departments in the Six Municipalities

The six core items conceived in the Seminar are as follows:

(1) Favorable Transportation – Creative Data-Based Thinking and Prospective Policies

The big data of public transportation should be the primary focus. Practical traffic management requirements should be integrated and car/motorcycle information analysis results should be visualized to facilitate their application in resource allocation and monitoring activities for public transportation by the government, thereby improving the management models of passenger transportation operators. Travel monitoring data should be the secondary focus. The traffic trends in transportation corridors should be analyzed to enhance public transportation capacity and alternative route information services. In addition, data-based thinking should be adopted to develop a solution for bottlenecks in central and local road networks.

(2) Safety Enhancement – Improving Traffic Accident Prevention Analysis

Big data visualization and geographical information analysis technologies should be used to diversely integrate transportation safety databases based on micro- and macro-transportation scientific perspectives, thereby effectively reducing accident mortality, reinforcing transportation safety information systems, and formulating preventive strategies.

（三）數據共享，累積政府決策基礎資源

累積及共享數據是快速形成交通大數據的基石，同時完整而詳細的大數據資料亦將是應用與研究發展的根本，我們希望達成政府對政府間大數據資料的開放交流，讓交通部統一了解問題，訂定資料規範與交換標準，並建立資料交換平台，透過該平台反映地方政府對於中央部會資料之需求。

（四）跨域整合，推動交通數據交流平台

大數據之資料數量、結構、交叉應用等資訊技術和各專業領域，相互交流可以啟發更多創新應用的可能，透過交通、防災與內政跨領域資料庫之整合並推動數據交流平台，是智慧城市推動的基石。

（五）人才培育，建立資料科學合作機制

建立大數據應用分析環境，以及培訓資料科學分析專才，是台灣能否跟進大數據分析潮流的關鍵所在。由中央與地方建立資料科學團隊合作機制，透過中央與地方交通大數據擁有者，資料科學家與交通專家三方之共同合作，探勘大數據應用價值，累積技術能量與經驗，共同創造智慧交通新臺灣。

圖 2-2　簽署交通大數據六大核心共識記者會

Figure 2-2　Press Conference for the Signing of the Six Core Items for Transportation Big Data

(3) Data Sharing – Accumulating the Fundamental Resources for Government Decisions

Accumulating and sharing data is a rapid means to form big data for transportation. Complete and detailed big data are a basis for application and research development. We anticipate actuating the inter-governmental sharing of big data, enabling the MOTC to uniformly view problems, formulate information regulations and exchange standards, and establish an information exchange platform. Through this platform, local governments can propose their requirements for information from the central authority.

(4) Interdisciplinary Integration – Promoting a Transportation Data Sharing Platform

Big data volumes, structures, cross-applications, and other information techniques as well as various professional fields should be inter-exchanged to inspire more innovative application possibilities. Integrating transportation, disaster prevention, and internal affairs databases, and promoting a data exchange platform are essential for developing a smart city.

（六）中央領航，群力六都數據顧問服務

透過中央與地方政府團隊合作，共同成立交通數據科學顧問服務組織，針對未來重要交通大數據資料推動方向，配合六都發展特色，由交通部創立前瞻計畫，由中央和地方政府組成的團隊共同定期討論與交流，讓業務單位無縫推廣，使大數據資料分析成果有效幫助中央與六都首長進行交通管理決策。

本次研討會共計 74 個機關或公司行號與會，303 人參加，除了中央部會、交通部暨部屬機關、各縣市政府及交通領域的顧問公司和研究單位外，其中更有近 50% 的電腦科技相關業者報名參考，更再次證實科技業跨入交通運輸領域應用的高詢問度，也代表未來兩者結合的潛力。

圖 2-3　研討會成果總結

Figure 2-3　Summary of the Seminar Outcomes

(5) Talent Cultivation – Establishing an Information Science Cooperation Mechanism

Establishing analysis environments for big data applications and cultivating analysts for information science are essential for Taiwan to keep up with the trend of big data analysis. Central and local authorities should establish a cooperation mechanism for information science teams, enabling the cooperation of big data holders, information scientists, and transportation experts, so that they may explore the application value of big data, accumulate technological practice and experience, and jointly create intelligent transportation for Taiwan.

(6) Centralized Management – Aggregating the Consultation Services of the Six Municipalities

Central and local governments should collaborate in establishing a transportation information science consultation services organization. This organization shall be responsible for the orientation of future transportation big data. The MOTC should formulate prospective plans based on the individual development features of the six municipalities. These plans should then be regularly discussed by teams established by the central and local governments, enabling business units to seamlessly operate, and big data analysis to effectively aid the leaders of the central and local authorities in their transportation management decisions.

The Seminar accommodated 303 participants from 74 institutes and businesses. Besides the central authority, MOTC and affiliates, city and county governments, and consultation firms and research units in the transportation sector, almost 50% of the participants were computer technology-related operators. This re-emphasizes the increasing application of technology in the transportation sector, highlighting the potential for future collaboration.

03

專題報導 - 15km/h 東部微感旅行

Feature Story - 15km/h East Coast Tour

INSTITUTE OF TRANSPORTATION, MOTC

慢活是現代生活一股新潮流，騎單車則成為全民運動新寵兒，結合兩者的單車慢遊更成為一種探索臺灣之美的新型態旅遊，開車太快，走路太慢，以時速 15 公里的自行車騎乘速度剛剛好重新認識臺灣的青山碧水與人文景緻。

「15km/h 東部微感旅行」是部透過一對分手男女以不同心境、思維及視角各自騎乘單車踏上療癒的旅程，將東部四個縣市六大經典自行車路線的風光融入兩人探索自我旅途中的沿線景緻，推廣臺灣東部自行車路線的 micro film ，接下來就讓我們跟著 micro film 的腳步，暢遊東部每條經典路線的風光景緻。

Slow living is a new trend in contemporary living and bicycling has become a new favorite activity of the public. Bicycle touring that combines both aspects has become a new form of traveling for exploring the beauty of Taiwan. Driving is too fast, and walking is too slow, but the 15km/h bicycling speed is perfect for getting to know the mountains, oceans, and people of Taiwan all over again.

15km/h East Coast Tour is a micro film about the self-healing and self-exploration journey of a couple who have recently broken up. The film shows their different state of mind, thinking, and perspective during their individual bicycle journey as they travel through four counties and cities and six classic bicycle routes in the eastern region. The objective of this micro film is to promote bicycle routes in Eastern Taiwan. So now, let us follow the footsteps of the film, and see the scenery along each of the classic routes in Eastern Taiwan.

迎風 Northeast Coast

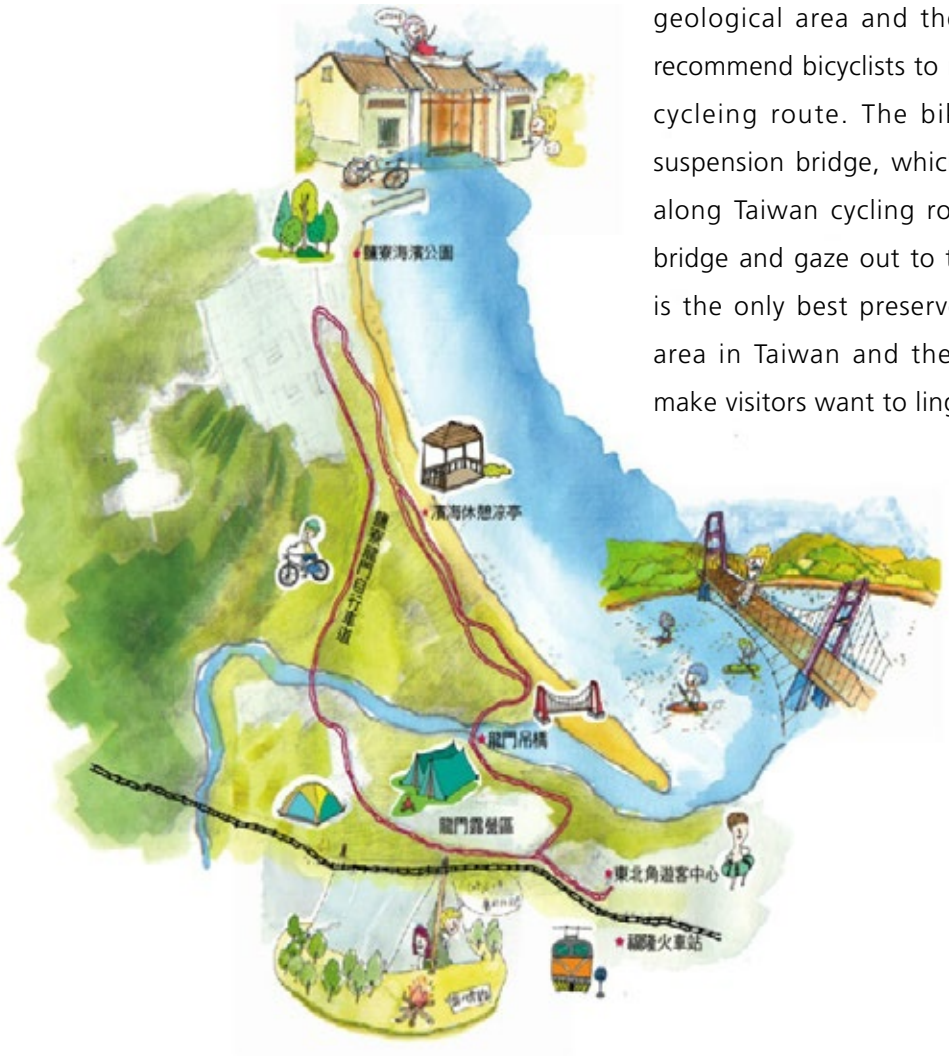
Northeast Coast 自行車路網包括 Provincial Highway 2 公路、舊 Caoling 環線、龍門 - 鹽寮自行車道，其中春、夏、秋季都是適合騎乘的季節。Northeast Coast 的 Fulong 車站是東部經典自行車道的起點，為北迴鐵路最具特色的車站；舊 Caoling 隧道全長 2,167 公尺，臺灣民謠「丟丟銅」描寫的就是這條穿越 Caoling 山脈的鐵馬隧道，隧道北端及南端洞口分別題有「制天險」及「白雲飛處」門額，一出隧道南口即可看見著名景點 Guishan Island 。其中，Fulong 車站是 micro film 男女主角單車旅程的最終站，影片中 male lead 騎在有著斑駁的紅磚牆及復古油燈的隧道內，隧道口透入的光線隱寓著迎向豁然開朗的未來。

之後再沿著 Provincial Highway 2 線一路探訪萊萊地質區、馬崗漁村等海岸公路特有的藍天綠水美景，建議可順道一訪龍門鹽寮自行車道，車道行經龍門吊橋是國內自行車道少見的景觀橋，在橋上可眺望出海口，鹽寮濱海公園是全國唯一保留最完整的沙丘植物生態區，豐富多樣的植物生態令人流連忘返。

Facing the wind in the Northeast Coast

Bicycle route network on the Northeast Coast include Provincial Highway 2, the old Caoling link, and the Lungmen-Yanliao bicycle route. Spring, summer, and fall are the best seasons for bicycle riding. The Fulong station on the Northeast Coast is the starting point of these classic bicycle routes, and the station is one of the most characteristic train stations along the North-Link Line. The old Caoling tunnel is 2,167 meters long in total, and the Taiwanese folk song "dio dio tong" describes the train tunnel that passes through the Caoling Mountain. The northern and southern ends of this tunnel have been called "zhitianxian" (natural barrier) and "baiyunfaitsu" (place where white cloud flies), respectively. Travelers can see the famous Guishan Island when they exit the tunnel at the southern end. Fulong station is the final destination of the male and female leads' bicycle journey in the micro film. In the film, the male lead rides in the nostalgic red brick and oil lamp lit tunnel. The distant tunnel light hints at the lightened up future.

Along the Provincial Highway 2, travelers can see the blue skies and green waters unique to the Lailai geological area and the Magang fishing village. We recommend bicyclists to ride along the Lungmen-Yanliao cycleing route. The bike path passes the Lungmen suspension bridge, which is a scenic bridge rarely seen along Taiwan cycling routes. Visitors can stop on the bridge and gaze out to the seaport. Yanliao Beach Park is the only best preserved sand dune plant ecological area in Taiwan and the abundant plants in the park make visitors want to linger on.



流連 Yilan 水岸

Yilan 自行車路網結合冬山河左岸與右岸的自行車道、蘭陽溪南岸自行車道、雙園自行車道、羅東溪南岸自行車道及梅花湖自行車道，環繞蘭陽平原，盡覽熱情山海與婉約水岸。帶著愛車或到冬山車站租車，開始 Yilan 水岸悠遊之旅，冬山站是台灣第一個以休閒觀光為目的所開發改建的鐵路車站，融合現代設計與台灣味的車站廣場，遠眺月台上方穹窿造型的棚架，彷若一張交織的網緊緊收攏蘭陽平原的美；沿途上有冬山橋的懷古、飛虹橋的仿古、蘭陽溪口獨特的生態環境或冬山河森林公園與梅花湖的自然景色，都等著您親臨探訪。

建議可順道造訪宜蘭濱海自行車道，沿著壯圍海濱一路慢行，蔚藍海岸為友海風輕拂為歌，欣賞龜山島長伴蘭陽平原的美景，經過永鎮濱海遊憩區時請記得跟微電影的男主角一樣停下腳步，細細品嚐海天一色的美景並讓海浪聲滌淨你一身的疲憊。

Lingering along Yilan shores

Yilan's bicycle network combines the left and right bank of the Dongshan River, the Lanyang River south shore bike path, Shuang Yuan bike path, Luodong River south shore bike path, and the Meihua Lake bike path. These bike paths circle the Langyan plain along beautiful mountains, rivers, and the sea. Bring your bicycle, or rent one at the Dongshan station and start your leisure Yilan river shore tour. Dongshan station is the first rail station in Taiwan built specifically for tourism, and the train plaza integrates contemporary design with Taiwan flavor. From afar, the platform has dome shaped scaffolding that looks like a tightly woven net that holds the beauty of the Lanyang plain. This route offers the nostalgic look of the Dongshan Bridge, the antique look of the Faihong Bridge, the unique ecological environment of the Langyang Estuary, and the beautiful scenery of the Dongshan River Forest Park and Meihua Lake. All these are awaiting your visit.

We recommend you to drop by the Yilan coastal cycling route. Ride along this magnificent bike path and you can have the blue seashore as your companion and listen to songs of sea breeze. Enjoy the view of Guishan Island and the beauty of the Langyang plain. As you pass the Yong Zhen Coastal Recreational Area, remember to stop and savor the sight of the distant horizon as the male lead in the micro film did, and let the sounds of waves cleanse your body of weariness.

忘情 Hualien 山水

Hualien-Taitung 列車向來一位難求，開車到 Hualien-Taitung 又難免路途遙遠，不妨換個方式體驗 Hualien-Taitung 之美，從冬山站或蘇澳新站搭上 Hualien-Taitung 線區間列車一路南行到太魯閣站，Hualien-Taitung 縱谷近在眼前，綿延東部海岸線近在咫尺，Hualien 山水行就此啟程。

Hualien 每處推薦的經對行程距離較長，適合安排一～三日的騎乘行程，遊客可斟酌體力負荷完成整個行程或隨時折返，亦可於行程中安排住宿，拉長騎乘天數。

Hualien 吉安一日自由行

魯閣站舊稱新城站是 Hualien 山水行的起點，也是進入 Chihsingtan 或中橫公路的門戶，沿著省道台 9 線轉往縣道 193 騎往兩潭自行車道，兩潭自行車道串連著 Chihsingtan 與 Liyu Lake ，沿途經過四八高地、奇萊鼻燈塔、南濱、北濱公園等，沿途處處是美景，等著你來發掘，到了 Liyu Lake 建議順便繞行約 4.5 公里的環潭自行車道，爾後沿著省道台 9 線往北，於吉城二街轉回兩潭自行車道至北濱公園，銜接兩鐵自行車道返回往 Hualien 車站。

Immerse in the mountains and rivers of Hualien

Seats for the Hualien-Taitung train have always been hard to get and the ride to Hualien/Taitung is long and difficult. Why not try another way of experiencing the magnificence of Hualien and Taitung? Get on the local train from Dongshan station or the new Su'ao station and go south to the Taroko station. The entire Hualien/Taitung rift valley will open up in front of your eyes. In close proximity to and extending along the east coast, the journey through Hualien starts here.

The distance between recommended scenic points in Hualien is longer and suitable for a one- to three-day trip. Travelers can complete the entire trip or turn back at any time depending on their physical strength. Or, accommodations can be arranged along the way to extend the duration of the bicycle ride.

Hualien Ji-an one day trip

The new Taroko station (formerly the Xincheng station) is the starting point of the Hualien trip, and the doorway for entering Chihsingtan or the Central Cross-Island Highway. Go along Provincial Highway 9 and turn to County Highway 193 toward the Twin Lake bike path. This cycling route will take travelers to Chihsingtan and Liyu Lake through Shiba Heights, Chilaibi lighthouse, Nanbin, and Baibin Park, all of which are destinations waiting for you to explore. When you arrive at Liyu Lake, we recommend that you take the 4.5 km lake detour bike path, then take Provincial Highway 9 northward. When you arrive at Jicheng 2nd St., turn back to the Twin Lake bike path and go toward Baibin Park. This will connect you to the railroad cycling route and take you back to Hualien station.



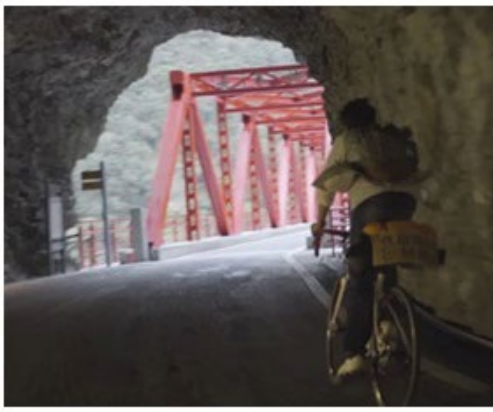



除了騎乘上述路線探訪沿途風光之外，建議額外再安排半天到一天的行程來到 Hualien 市區，探訪 male lead 遇見小狗的巷弄、停留的咖啡廳以及女主角沉澱心情的小書店等 micro film 私房場景。

或是從太魯閣車站出發踏上中橫公路省道台 8 線，挑戰一趟艱難險峻的單車峽谷之旅，欣賞太魯閣至天祥路段大自然的鬼斧神工。

In addition to the scenic spots described above, we recommend travelers arrange a half-day or one-day trip to tour around the downtown of Hualien City. Visit the alley where the male lead met his little dog, the coffee shop where he stopped by, and the small bookstore that the female lead visited, and see other secret spots from the micro film.

Or, start from the Taroko station, go on the Central Cross-Island Highway and Provincial Highway 8, and challenge the difficult rift valley bicycle tour. This is where you can revel in the natural wonders from Taroko to Tianxiang Road.



Hualien Rueisuei 縱谷山海二日遊

此行程屬於長程自行車旅程，以每日騎乘不超 100 公里為原則，第一天行程建議從 Hualien 車站出發，沿著美崙溪畔兩鐵自行車道至北濱公園，銜接兩潭自行車道往南轉入縣道 193 線自行車道，在海岸山脈與 Hualien 溪間蜿蜒南行至 Rueisuei 車站，夜宿 Rueisuei 溫泉區，結束第一天行程。

193 縣道沿途經過米棧大橋、米棧社區、光復鄉太巴塱等深具在地特色景點，值得一訪。

行經箭瑛大橋時，若體力與時間許可，建議順道轉往鳳林鄉，欣賞客家文化與煙樓後銜接林田山順道自行車路線。

Two day Hualien Rueisuei rift valley tour

This is a long-distance bicycle journey at a speed less than 100 km per day. We recommend starting from Hualien station on Day 1 and taking the Meilun riverbank railway bike path to Baibin Park. Connect to the Twin Lake bike path and go south to County Highway 193 bike path. This will take you on a winding coastal mountain route along Hualien River to Rueisuei station. You may end your first day journey and spend the night at the Rueisuei hot spring area.

County Highway 193 passes Mizhan Bridge, Mizhan community, and Guangfu Tafalong, all of which are full of local characteristics and worth a see.

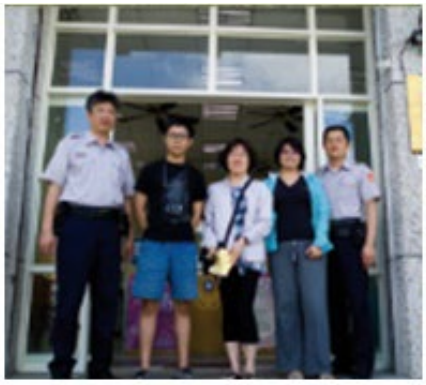
If your physical strength and time allows, we recommend you go toward Fenglin Township when passing through Jianying Bridge and enjoy the Hakka culture and Tobacco Building. Afterwards, connect to the Lintianshan bicycle route.

第二天行程從 Rueisuei 車站出發，挑戰瑞港公路（花 64 線），全長約 22 公里，坡度起伏變化大，屬於挑戰級的路線，抵達長虹橋後可稍做休息，利用橋上八座觀景橋遠眺秀姑巒溪綿延出海或俯瞰橋下舟艇；之後接入省道 Provincial Highway 11 ，由 Provincial Highway 11 北上回到 Hualien 車站，沿途經過 Shitiping、磯海、芭崎遊憩區不僅可稍做休息， 更可欣賞不同風貌的壯闊景觀與特色餐飲，以自行車挑戰體驗 Hualien 至 Rueisuei 的山、海、縱谷的洄瀾風光。

Hualien 車站是 Hualien 一日遊及二日遊的出發點，也是片中男女主角拍攝攜帶單車搭乘火車再度相遇的場景，193 縣道旁光復鄉大富大農平地森林園區就是 micro film 片尾 male lead 迎風騎乘在筆直通往綿蜓山脈的場景，建議繞道至這個在縱谷中面積約 40 個大安森林公園的平地森林，享受趟生態芬多精之旅。

Start the second day from Rueisuei station and challenge the Rueigang Highway (Hualien Highway 64). The entire distance is 22 km of fluctuating elevation, and is one of the more challenging routes. Travelers can rest after arriving at Changhong Bridge and use the eight lookout bridges on the bridge to view the Xiuguluan River as it meanders out to sea, as well as the boats and rafts below the bridge. Afterwards, connect to Provincial Highway 11 and return northward to Hualien station. Cyclists will pass by Shitiping, Jiqi Beach Recreational Area, and Baqi Gazebo, where they can rest and enjoy different magnificent landscapes and specialty foods. Come and challenge the mountain, coastal, and rift valley trip from Hualien to Rueisuei!

Hualien station is the starting point for the Hualien one-day and two-day trips. It is also where the hero and heroine in the film met once again when they traveled with their bicycles on the train. The Guangfu Dafudanong Forest Park next to County Highway 193 is where the male lead rode upwind on a straight path along the mountain chain at the end of the micro film. We recommend taking a detour to this forest park in the rift valley (equivalent to 40 Daan Forest Park) to enjoy the ecology and phytoncid.



Rueisuei Yuli 縱谷山海二日遊

此行程屬於長程自行車旅程，以每日騎乘不超 100 公里為原則，建議前一晚先入住 Rueisuei 溫泉，第一天行程從 Rueisuei 車站出發，沿著縣道 193 於海岸山脈與中央山脈之問的 Hualien-Taitung 縱谷一路南下，無論是小葉欖化吐芽的初春、阿勃勒金黃綻放的酷夏、入秋後層層疊疊的迷人稻浪或是冬天一畦畦的油菜花田值得讓人重複造訪此地，行經春日時請務必造訪春日鐵馬驛站這個全國第一處設置驛站的派出所，感受一下所長與同仁熱情款待，隨後轉入 Yuchang Highway 再沿著 Provincial Highway 11 繼續北上至 Shitiping 後即完成第一天行程，途中別忘了在長濱休息站稍做停留領略自縱谷跨越至東海岸乍見海天一色太平洋的驚豔，也務必到北緯 23.5 度的北迴歸線體驗同時跨越亞熱帶及熱帶的樂趣。

Two-day Rueisuei-Yuli rift valley trip

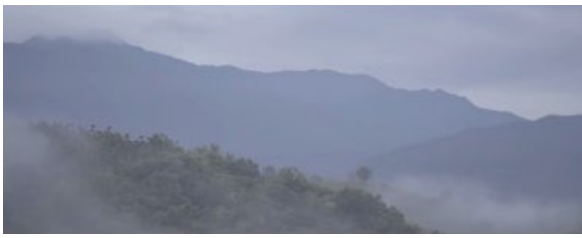
This is a long-distance bicycle journey at a speed less than 100 km per day. We recommend travelers to stay at the Rueisuei hot spring the night before and start from the Rueisuei station on the first day. Take County Highway 193 southward along the Hualien-Taitung rift valley (between the coastal mountain range and the central mountain range). Travelers can see verdant sprouts in spring, golden cassia fistula flowers in summer, mesmerizing rice fields in fall, and Brassica blossoms in winter. This is a place worth visiting over and over again in all seasons. When passing by Chunrih, don't forget to visit the Chunrih Bicycle Inn, the first police station to set up in an inn in Taiwan. Enjoy the welcome from the station chief and his comrades before heading toward Yuchang Highway. Go north along Provincial Highway 11 to Shitiping to finish the first day of journey. Don't forget to rest at the Changbin rest stop and see the amazing blend of the sea and the sky over the Pacific Ocean from the rift valley. Also remember to visit the Tropic of Cancer (23.5 degrees north latitude) that crossed between the tropic and the subtropics.

縣道 193 道上還有許多令人流連忘返的私密景點都在這次 micro film 中一一曝光，如金黃稻穗夾道而行的玉富自行車道、位於 Yuli 鎮與 Fuli Township 交界處的安通溪北岸，隱身幽谷山林的安通溫泉區，或是影片中讓女主角印象深刻可以劈霆腿歐亞大陸板塊與菲律賓板塊的秀姑巒溪大橋。

第二天的行程從 Shitiping 出發，沿著省道 Provincial Highway 11 回到 Hualien 車站，完整體驗 Rueisuei 、Yuli 至 Hualien 之問的山、海、縱谷旅遊風光，可參考 Hualien Rueisuei 縱谷山海二日遊行程。

There are many memorable secret spots on County Highway 193 exposed in the micro film such as the Yufu cycling route that cuts across golden rice fields, the north shore of Antung Creek between the boarders of Yuli and Fuli Township, the Antung hot spring area hidden in the forest, and the Xiuguluan Bridge that crosses between the Eurasian and the Philippine tectonic plates that impressed the female lead so much.

Set out from Shitiping on the second day and go along Provincial Highway 11 back to Hualien station. This will give travelers a complete experience of the mountains, ocean, and valley between Rueisuei, Yuli, and Hualien. Travelers can also consider the two-day rift valley trip between Hualien and Rueisuei.



翱遊 Taitung 山海

Taitung 擁有全台最長海岸線及最湛藍的海天一色美景，臨山面海的 Taitung 是臺灣的後花園與最後一塊淨土，就此跨上單車，踩動踏板，恣意翱遊在這片由高山、縱谷、平原與海洋交織出的 Taitung 山海。

來到 Taitung 建議行程安排三日以上才能深入縱谷線的 Chihshang、Guanshan、Long-tian 等經典自行車路線，第一天從 Taitung 車站出發，沿著 Ma Heng Heng Road 北行，沿途經過「小野柳」之稱的小野柳遊憩區、東河橋等一連串應接不瑕珍貴景點，接到省道 Provincial Highway 11 繼續往北，在湛藍天空與海岸山脈伴隨下，至長濱時轉往 Yuchang Highway，夜宿安通溫泉區。

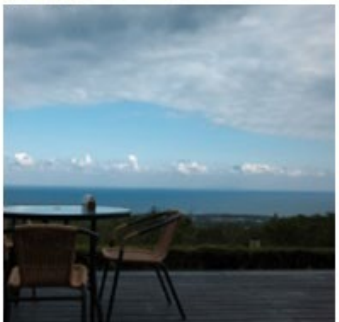
Taitung 進出 Green Island 和 Lanyu 的港口 - 富岡漁港、號稱臺灣本島最美麗的海灣與沙灘的金樽遊憩區、Yuchang Highway、八嗡嗡自行車道、半月形湖泊、綠意盎然的 Taitung Forest Park 都被收錄成為 micro film 珍貴場景，一起來發掘這些佔據你所有目光的美景吧。











Taitung excursion

Taitung possesses the longest shoreline and the bluest sky in Taiwan. Nearing both mountains and the Pacific, it is the last pristine paradise in Taiwan. Get your bicycle, step on the pedals, and trek through high mountains, rift valleys, plains, and the coast.

When visiting Taitung, we recommend at least a three-day trip for experiencing the classic bike path that goes through Chihshang, Guanshan, and Longtian. Set out from Taitung station on the first day and go north on Ma Heng Heng Road. Pass scenic places like the Xiaoyehliu Recreational Area and the Dongheh Bridge and connect to Provincial Highway 11. Continue going north with the company of blue skies and coastal mountain ranges and turn to the Yuchang Highway at Changbin. Stay overnight at the Antung hot spring area.

Fugang Harbor (the portal to and from Green Island and Lanyu in Taitung), Jinzun Recreational Area (known as Taiwan's most beautiful bay and beach), Yuchang Highway, Baonon cycling route, Half-Moon Lake, and the verdant Taitung Forest Park have all been recorded as cherished scenes in this micro film. Come and let these landscapes fill your eyes!

第二天行程從安通溫區出發，經由安通鐵馬驛站銜接玉富自行車道往南，至東里車站後銜接回省道台 9 線繼續南下，悠遊 Chihshang 環鄉自行車道，再經由 Chihshang Guanshan 聯絡道至 Guanshan，悠遊 Guanshan 環鄉自行車道並夜宿 Guanshan。

第三天行程從 Guanshan 車站出發，沿著省道台 9 線往南，至武陵綠色隧道轉入銜接鄉道東 33 線，經由永安社區、Luye Hill 至 Longtian，可悠遊 Longtian 自行車道，最後經由 Luye Taitung 聯絡道（縣道 197 線銜接鄉道東 45 線）回到 Taitung 車站。

暢遊東北與整個東部波瀾壯闊的青山綠水與縱谷平原後，延續東部單車漫遊行程即將在西部展開，即將於 104 年完工的環島路線，規劃了九天及兩天順道行程的一次環島路線與分段環島（全臺分為北中四日、中彰投雲林三日、嘉南三日、高屏 Taitung 四日、Taitung Yuli 四日、Hualien Yuli 三日、Yilan Northeast Coast 二日）的行程路線，你可以選擇適合自己的速度與行程，用你的方式穿梭首都臺北、風城新竹、穀倉 Changhua 等各具特色的西部城市，慢活悠遊收藏臺灣之美。

Start the second day from Antung hot springs and connect to the Yufu cycling route through the Antung Bicycle Inn. Go south to Tungli station and continue south on Provincial Highway 9. Travel with leisure through the Chihshang detour cycling route and go to Guanshan through the Chihshang-Guanshan linking road. Take the Guanshan detour cycling route and stay overnight at Guanshan.

Start from the Guanshan station on the third day and go south on Provincial Highway 9. Take the Wuling green tunnel and connect to Taitung Highway 33. Go pass Yongan community and Luye Hill to Longtian. Visit the Longtian bike trail and return to Taitung station via the Luye-Taitung linking road (County Highway 197 to Taitung Highway 45).

After seeing the magnificent mountains, coast, rift valleys, and plains of the Northeast coast and the East coast, try the West coast tour! The circum-island route is scheduled to complete in 2015, which can be used to plan a one-off nine-day circum-Taiwan trip or staged two-day trips (the entire Taiwan is divided into the North-Central four-day trip, Taichung-Changhua-Nantou-Yunlin three-day trip, Chiayi-Tainan three-day trip, Kaohsiung-Pingtung-Taitung four-day trip, Taitung-Yuli four-day trip, Hualien-Yuli three-day trip, and Yilan Northeast Coast two-day trip). You can choose the route and speed suitable for yourself, and use your own way to shuttle between the windy city of Hsinchu, the granary of Changhua, and other west coast cities. Enjoy the beauty of Taiwan at a leisurely pace.

04

重點研究介紹

Introduction to Key Research

INSTITUTE OF TRANSPORTATION, MOTC

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) 智慧科技應用。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) 第 5 期整體運輸規劃研究重點

臺灣地區整體運輸規劃為交通部運輸研究所多年來賡續致力辦理之研究，透過定期的資料蒐集與滾動式之模式更新檢核，長期進行驗證及檢視不確定因素之影響，及時作必要之檢討修正，使臺灣城際運輸需求模式的功能與預測能力更臻完善。

本所於民國 65、75、88 及 98 年分別完成第 1~ 4 期整體運輸規劃，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。因此自 98 年開始展開第 5 期整體運輸規劃的先期研究－第 4 期修正模式研究，包含 2 年期之「運輸系統與

1. Overall Transportation Planning

(1) The 5th Stage Overall Transportation Planning Research Focus

Overall Taiwan transportation planning has been the Institute of Transportation, MOTC's ongoing endeavor for many years. Through periodical data collection and the rolling model of updated reviews, along with the validation over a long period of time while examining the influences caused by uncertain factors, the research has been reviewed and necessary modifications have been made to perfect its function and prediction for the blueprint of Taiwan's intercity transportation demand.

The Institute has completed the first to 4th stages of the overall transportation planning in 1976, 1986, 1999 and 2009 respectively. Due to recent climate changes, global industry trends, national development, land structure and other rapid social, political and economic environmental changes, the general public's demand for transportation service has also changed. Consequently, the characteristics of travel and transportation are also different from the past. The above mentioned social and economic development trends, in addition to the changes in the transportation demand, will have an impact on each parameter in socioeconomics and the blueprint, the relationship between each module and the overall interpretation of the blueprint. Therefore, since 2009, the Institute has already embarked on the early part of the 5th stage of the overall transportation planning-the 4th stage of the research on modifications and revisions of the blueprint. This includes the 2 year "Research on the Transportation System and the Social and Economic Development Trends" (2009-2010) and the 3 year "Research on the Reviews and Updated Parameters of the Intercity Transportation Demand Blueprint (2011-2013).

The 4th stage blueprint revisions uses the analysis and updates to 2009-2010's socioeconomic development data to be the groundwork for reconstructing the blueprint. In 2011, the updates and adjustments to the parameters of the 4th stage's blueprint and the reviews on its prediction ability were completed. The reviews and analyses on the past and future socioeconomic development trends were conducted to understand how to revise the blueprint to meet transportation demand. The revision

社經發展趨勢研究」(98~99 年)與 3 年期之「城際運輸需求模式檢討及參數更新研究」(100~102 年)。

第 4 期修正模式係以 98~99 年社經發展資料之更新及分析，作為模式重新構建之預備，並於 100 年完成檢討第 4 期模式預測能力及參數更新調校，利用過去及未來之社經趨勢進行檢討與分析，確定運輸需求模式修正方向；再於 101~102 年完成模式構建與修正工作，包含第 4 期模式之客貨運城際運輸供需預測分析與評估。

第 5 期整體運輸規劃正式於 103 年展開，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。並規劃於 105 年進行城際運輸需求模式檢核，納入大數據之分析應用技術進行驗證，以建構符合實際發展之城際運輸需求模式，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 106 年提出第 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。

圖 4-1　整體運輸規劃發展歷程

Figure 4-1　The Development Process of Overall Transportation Planning

and reconstruction of the blueprint were concluded in 2012-2013, including the prediction analyses and assessment of the supply and demand for passenger and freight intercity transportation for the 4th stage blueprint.

The 5th stage of the overall transportation planning officially started in 2014. To comprehend travel characteristics, the Institute has conducted a large scale, nationwide (including Taiwan, Penghu, Kinmen, Matsu) investigation of intercity travel characteristics in 2014 and 2015 to learn about the general public's travel patterns in Taiwan's intercity transportation system during the holidays and regular days. The examinations and reviews on the intercity transportation demand blueprint is scheduled to be carried out in 2016. An applied analysis technology will be incorporated to verify the extensive data to construct the intercity transportation demand blueprint that corresponds to actual transportation development in the hope that it will be even more accurate in predicting the supply and demand of the future transportation system. The related transportation system blueprint and the strategy analysis will also be performed in order to provide the outcome of the 5th stage overall transportation planning in 2017 and to be the reference for the future overall transportation development planning and policy making.

本所 103 年已完成之城際旅次特性調查與初步分析，不同於以往前 4 期調查方式採面訪方式，本（第 5）期採用電話訪問調查，針對有效樣本分配不足問題，規劃於 104 年度再進行補充調查，僅就 103 年具體研究成果摘要如下：

1. 本研究完成城際運輸旅次特性電訪調查共 28,000 份，以掌握城際運輸旅次平假日特性。共計撥打 54.9 萬通電話，接觸 32,620 個受訪者。整體電訪調查受訪率約 5.9%，其中中途拒訪比例約 1.1%。

表 4-1　城際運輸旅次特性調查受訪率

Table 4-1 The Survey Response Percentage for the Intercity Transportation Travel Characteristics

項目 Item	完成進度 Progress	占比 Percentage
撥打通數 (通) The number of calls got through (call)	548,500	100%
受訪人數 (人) The number of respondents (person)	32,620	5.9%
中途拒訪 (人) The number of people who refused to continue midway through the interview (person)	369	1.1%

2. 旅次目的的分類共計分為「休閒娛樂」、「旅遊出差」、「商務洽公」、「探親訪友」、「通勤上班」、「通勤上學」以及「其他活動」共計 7 大旅次目的類別，平均每趟跨生活圈旅程約產生 1.9 段跨生活圈旅次。

3. 跨生活圈旅次特性調查分析上，不分日型跨生活圈起迄旅次以「臺北 - 桃園」旅次最高；主要之旅次目的為「探親訪友」；旅次長度週一、五及週二～週四主要集中在 20-50 公里，週六、日則集中在 50-100 公里；旅次頻率特性主要集中於「少於 1 週 1 次」；運具使用特性主要運具為小客車。

The Institute has completed the preliminary investigation and analysis of the 2014 intercity transportation travel characteristics. Different from the previous 4 stages when the face to face interview method was used, this stage (the 5th) utilized the telephone survey approach to target the problem of imbalanced allocation of the valid samples. Supplementary surveys are scheduled to be carried out in 2015. The following is the summary of the 2014 research findings:

A. 28,000 telephone interviews for the intercity transportation travel characteristics were conducted in this research to learn about the intercity transportation travel characteristics on holidays and regular days. A total of 549,000 telephone calls were made, and 32,620 people were interviewed. The overall telephone survey response percentage was about 5.9%, among which about 1.1% percent of interviewees refused to continue the survey part way through.

B. The purposes of the travel are divided into 7 categories. They are: leisure and recreation, travel and business trips, business engagements, visiting relatives and friends, commuting to work, commuting to school, and other activities. On average, a trip that goes beyond the living circle generates 1.9 trips of travel.

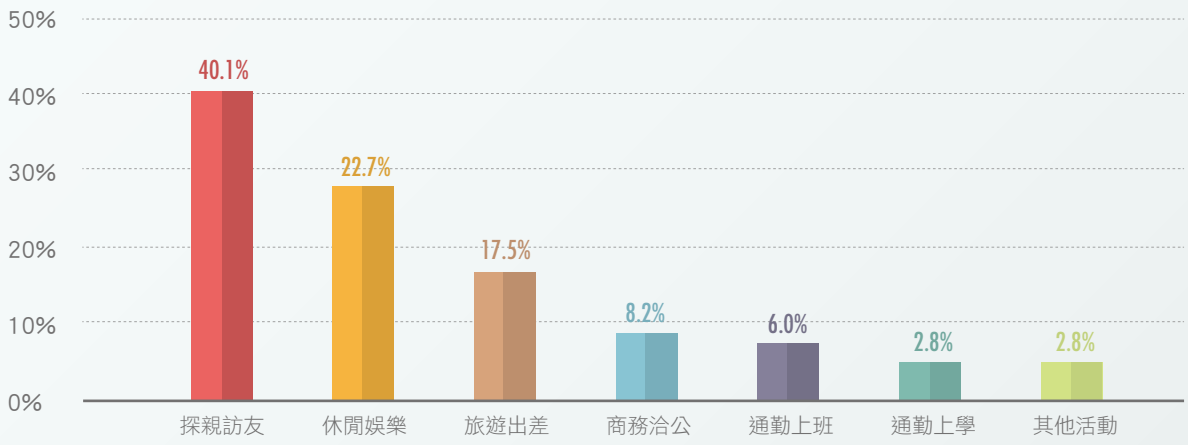
C. According to the investigations and analyses on beyond the living circle travel characteristics, regardless of the types of the days, the most travelled origins and destinations of the beyond living circle travel was "Taipei-Taoyuan". The main purpose of the trip was "visiting relatives and friends". The primary trip distance for Monday, Friday and Tuesday to Thursday was about 20-50 km, while Saturday and Sunday was about 50-100 km. The foremost trip frequency was "less than once a week". The leading travel transportation means was by small vehicle.

4. 性別統計分析方面：平常日不論男性（60%）與女性（45%）皆集中於小客車；一般假日男性與女性約占 60%~65%。平常日男性主要集中於商務洽公（30%）；女性則偏向休閒旅遊與探親訪友（30%）；一般假日則不論男性或女性皆集中休閒旅遊與探親訪友（40%~45%）。不論平常日或一般假日，男性與女性旅程天數皆以 1~3 天為主。

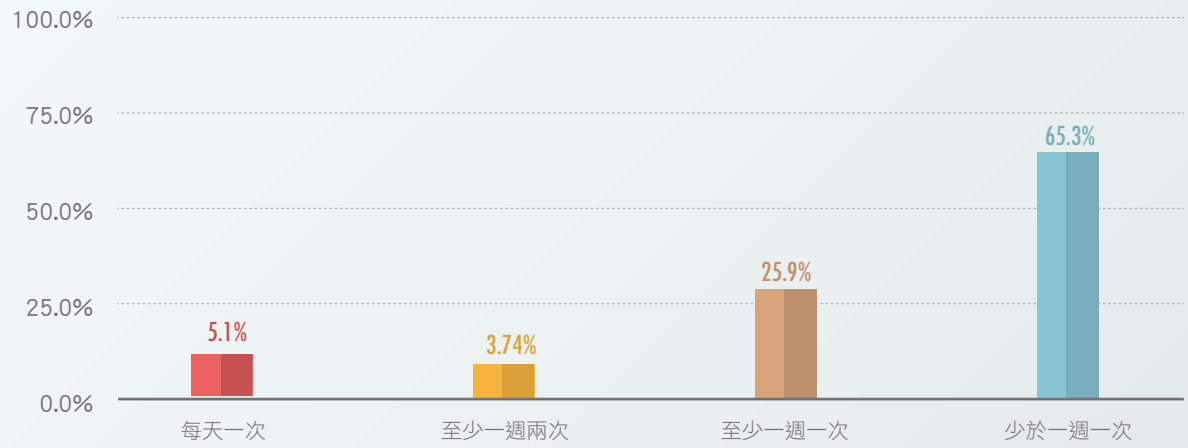
圖 4-2　旅次特性調查分布圖

Figure4-2　The Distribution Map of Travel Characteristics

旅次目的分布

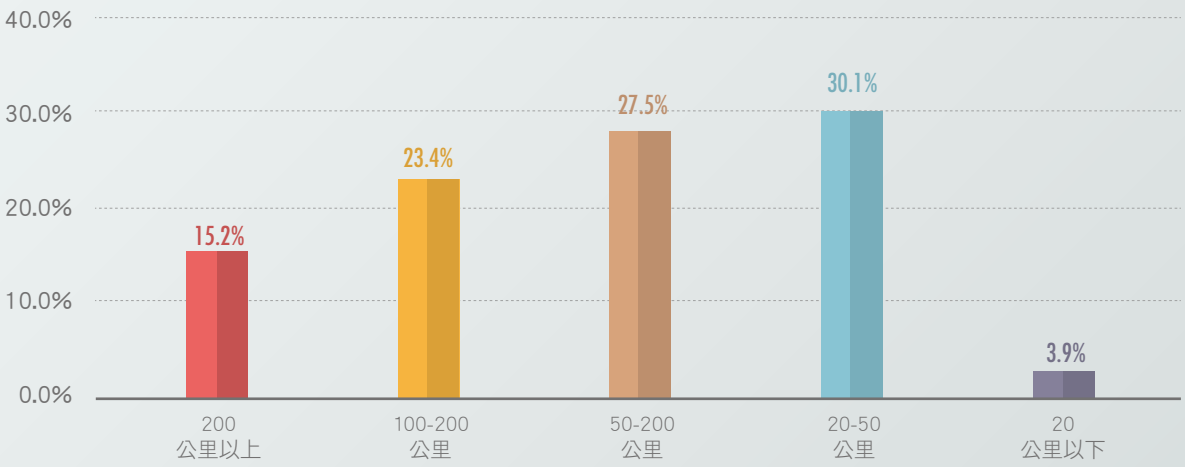


旅次頻率特性

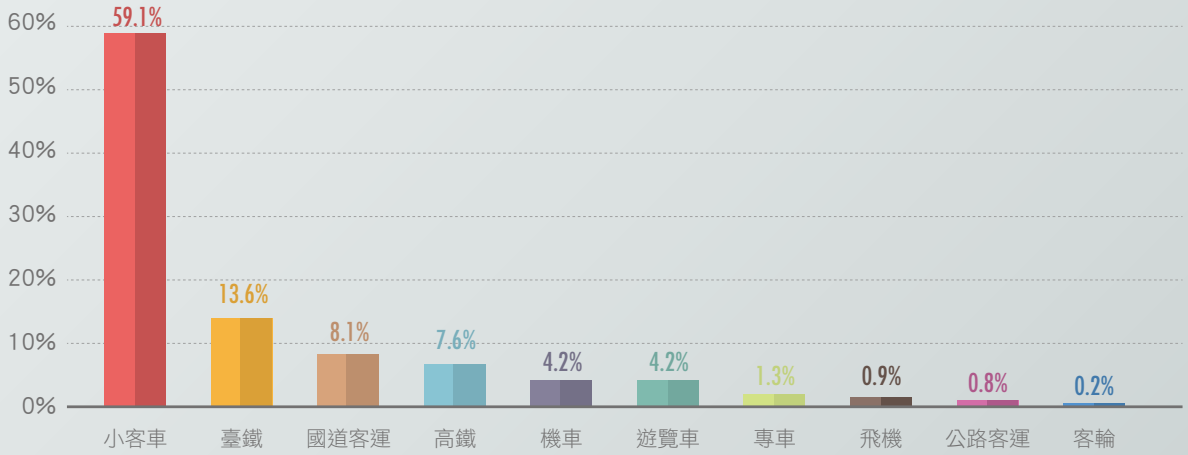


D. In the gender statistical analysis aspect: (A) On regular days, both male (60%) and female (45%) use small vehicles as their primary transportation, while 60%-65% of males and females use small vehicles as their primary transportation on the general holidays. (B) on regular days, the main trip purpose for males was business engagement (30%) while it was leisure and recreation and visiting relatives and friends for females (30%); on the general holidays, the main purpose of the trip was leisure and recreation and visiting relatives and friends for both males and females (40%~45%). (C) Irrespective of regular days or general holidays, the length of the trip for both males and females was primarily in the range of 1-3 days.

旅次長度分布



運具使用比例



5. 依據第 5 期模式建構需要，進行國際機場旅客到離站運輸行為調查、國際港埠聯外道路交通量調查分析，以及配合模式驗證檢討確認屏柵線交通量資料。

6. 研究成果可作為國家未來整體運輸發展規劃與政策制定之參考，並供作國家發展委員會、交通部及交通部運輸研究所進行後續審議交通部公路總局、交通部臺灣區國道高速公路局、交通部臺灣鐵路管理局及各縣市政府所提相關建設計畫之依據。

圖 4-3　性別統計分析圖

Figure 4-3　Gender Statistical Analysis Chart

運具

- 小客車為主，台鐵為輔
- 平常日女性使用公共運具占比高

旅次長度

- 男女特性相同
- 平常日 20~50 公里
- 一般假日 50~100 公里

E. To accommodate the needs of constructing the 5th stage blueprint, investigations on how passengers at international airports left the airports and analyses of the traffic volume on connecting roads to international seaports were conducted while pattern verification was incorporated to review and verify the data on screen line traffic volume.

F. The outcome of the research can serve as a reference for Taiwan's future overall transportation development planning and policy making. It can also be the basis with which the National Development Council, the Ministry of Transportation and Communication and the Institute of Transportation, MOTC conducts follow-up reviews on related construction plans proposed by the Directorate General of Highways, MOTC; the National Freeway Bureau, MOTC; Taiwan Railways Administration MOTC, and the city and county governments.

旅次目的

- 男女皆探親訪友為主
- 商務洽公 / 通勤上班男女分布符合傳統社會概念

平常日	男性	女性
探親訪友	27.7%	38.9%
商務洽公	23.7%	10.2%
通勤上班	12.4%	6.6%

旅次頻次

- 頻次集中 1 週一次 ~1 月一次
- 女性發生頻次較男性低

旅程天數

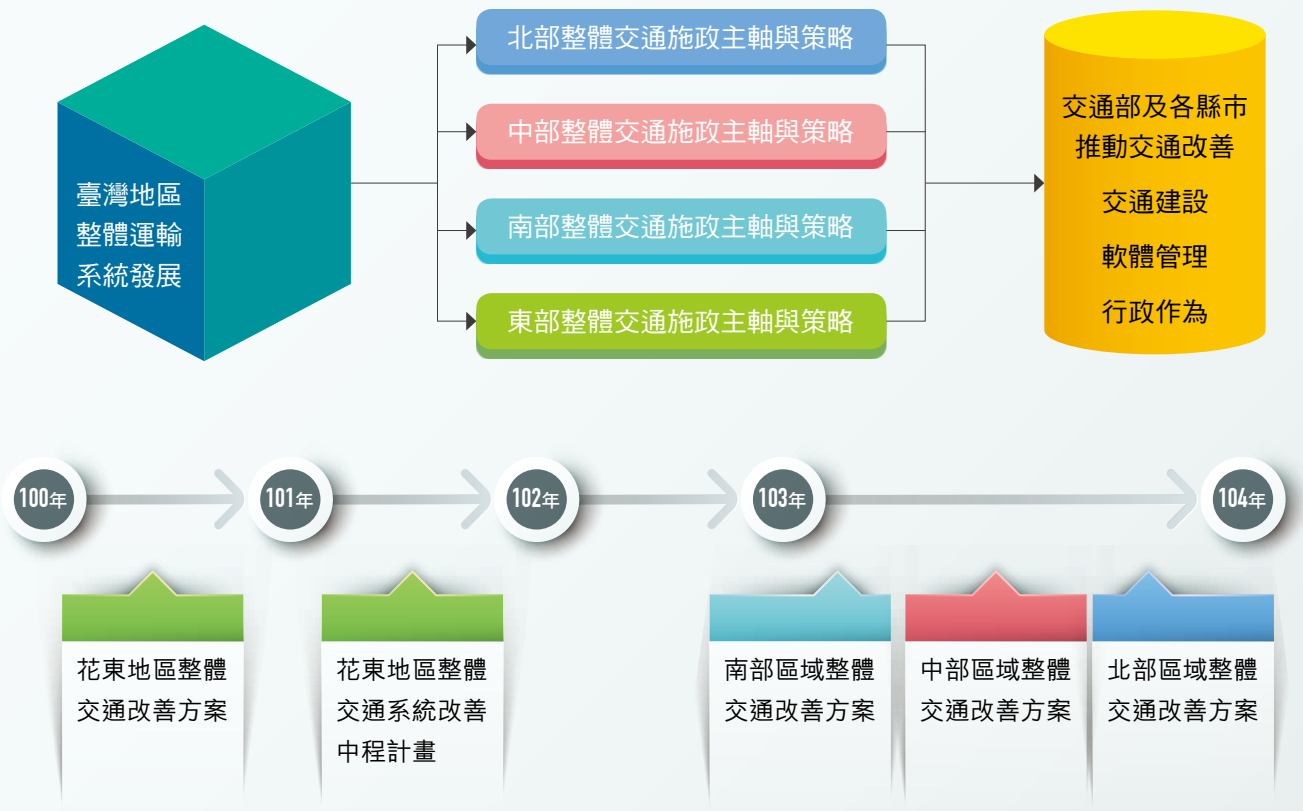
- 男女特性相同
- 8 成以上比例集中 1~3 天，因週末特性影響

(二)北、中、南、東部區域整體交通系統改善方案

為因應全球性產業經濟競爭模式的改變、海空運輸技術的新發展、日趨嚴峻的能源危機與氣候變遷、兩岸直航與開放陸客來臺、國際觀光客快速成長、國內高速鐵路通車對於城際運輸系統的衝擊，乃至交通安全與區域公平性議題的重要性日增等國內外環境的快速變化，本所長期以來一直扮演「臺灣地區整體運輸系統規劃者」的角色，並在交通部的指導下完成多項指標性的研究報告。為能做為交通部與各縣市推動交通改善之依據，在規劃臺灣地區整體運輸系統發展同時，亦同時擘劃北、中、南、東四大區域之交通施政主軸與策略，除先後於 100 年及 101 年完成「花東地區整體交通系統改善方案」、「花東地區交通部門整體施政中程計畫」外，續於 103 年完成「南部區域整體交通系統改善方案」、「中部區域整體交通系統改善方案」及「北部區域整體交通系統改善方案」，期能作為交通部與地方政府推動交通改善之參據，並藉由整合中央與地方之交通建設、軟體管理及行政作為，讓區域交通服務發揮更大成效。

圖 4-4　臺灣地區各區域整體交通系統改善方案發展進程

Figure 4-4　The Progress of the Overall Transportation Improvement Plan in Taiwan’ s Various Regions



(2) Overall Transportation System Improvement Plans in Northern, Central, Southern and Eastern Taiwan

To deal with the changes in global industry economic competition patterns, the new developments in sea and air transportation technology, the increasing severity of energy and climate change crises, cross straits direct transportation links and allowing Chinese tourists to visit Taiwan, the rapid growth of international tourism, the impact that the Taiwan High Speed Rail has had on intercity transportation systems , and the growing importance of traffic safety and regional equality issues and rapid changes in domestic and international environments, the Institute has been playing the role of planner for Taiwan's overall transportation system. Under the guidance of the Ministry of Transportation and Communication, the Institute has also completed many exemplary research reports. These reports can serve as a reference for promoting traffic improvements for the Ministry of Transportation and Communication and the governments of cities and counties in Taiwan.

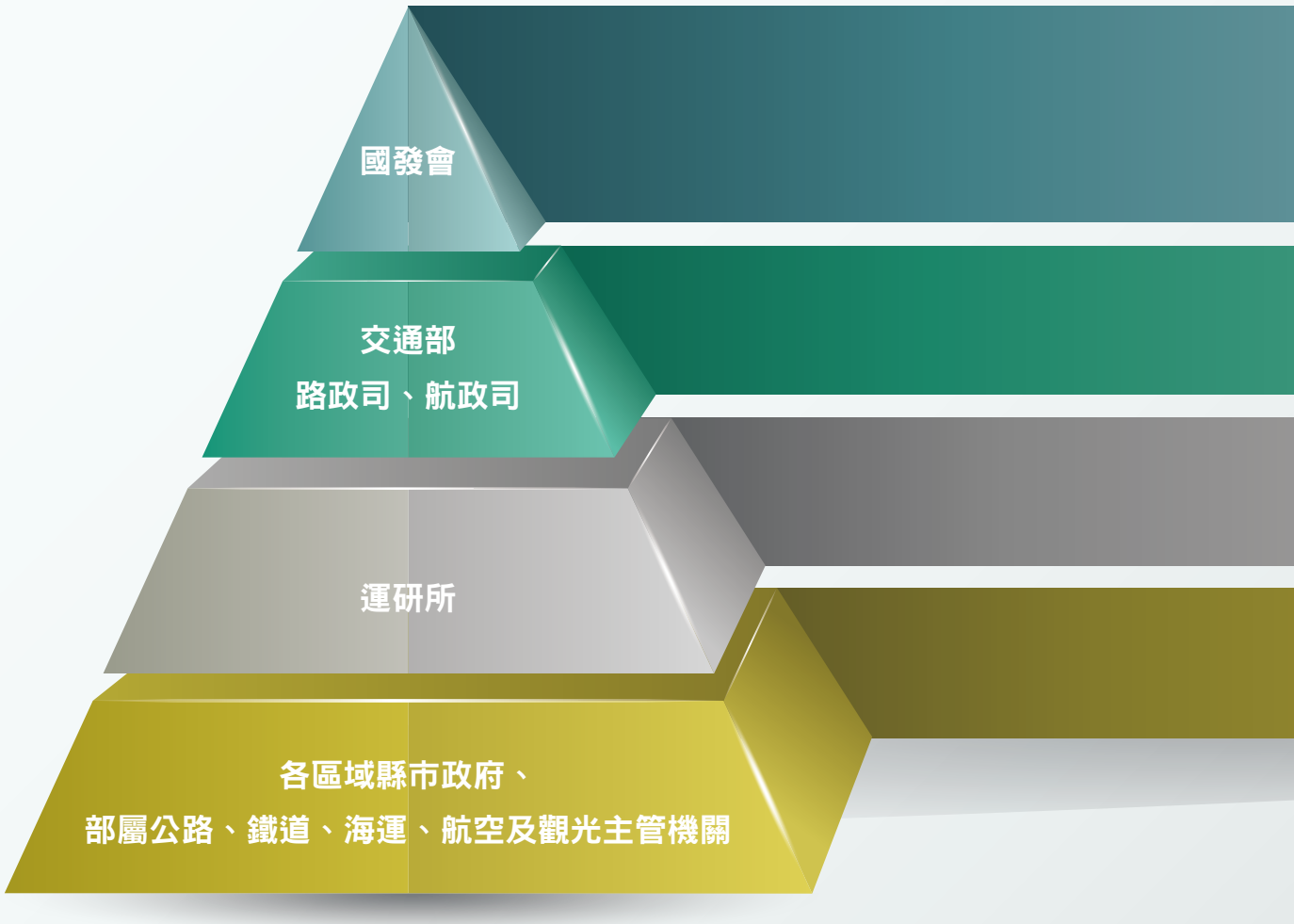
While the Institute was contemplating Taiwan's overall transportation system development, it also worked out the major transportation policy focuses and strategies for Northern, Central, Southern and Eastern Taiwan. Other than successively completing "The Overall Hualien and Taitung Areas Transportation Improvement Plan" and "The Middle Phase of the Transportation Departments' Overall Policy Making in Hualien and Taitung Areas" in 2011 and 2012, in 2014 the Institute completed "the Overall Transportation System Improvement Plan in Southern Taiwan", "the Overall Transportation System Improvement Plan in Central Taiwan", and "the Overall Transportation System Improvement Plan in Northern Taiwan" in the hope that these plans can serve as a basis for promoting traffic improvement for the Ministry of Transportation and Communication and local governments.

Through the integration of transportation infrastructure, software management and administrative actions of the central and local governments, the regional transportation service can be made more effective.

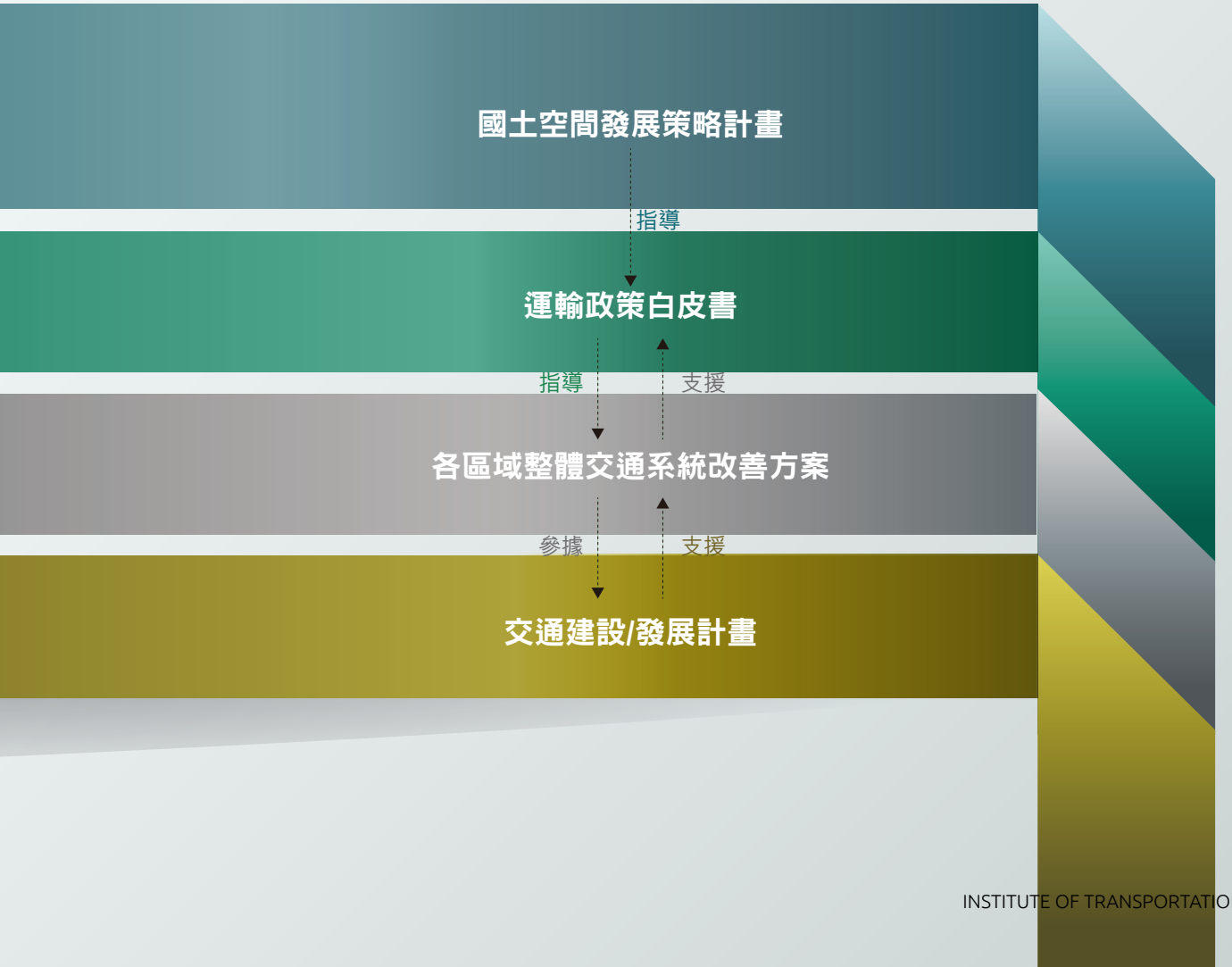
臺灣地區各區域整體交通系統改善方案在計畫功能位階上，主要是希望在國發會「國土空間發展策略計畫」及交通部「運輸政策白皮書」的指導之下，作為各區域縣市政府及部屬公路、鐵道、海運、航空及觀光等主管機關推動各項交通建設或發展計畫之參據。因此，本系列研究的內容除前半部的統計數據、運輸需求預測與分析，以及重要交通課題探討外，後半部有關個案計畫的部分則主要來自各縣市政府與主管機關所提供的資料。綜合來說，各區域整體交通系統改善方案內容涵蓋我國城際陸路運輸願景與目標、各區域社經與交通系統現況分析與預測、交通系統發展課題、區域整體發展交通施政主軸與改善策略、交通系統改善方案，以及區域內重大交通建設經費需求等，整體內容充實且架構完整，其成果除可作為交通部與地方政府推動交通施政之主要依據外，亦可作為未來修訂運輸政策白皮書之參考基礎。

圖 4-5　本系列研究計畫位階示意圖

Figure4-5　The position diagram of this research series



With guidance from the "National Spatial Development Strategic Plan" by the National Development Council and "Transportation Policy White Paper" by MOTC, the overall transportation system improvement plan in Taiwan's various regions can serve as a reference for various transportation constructions or development plans that are promoted by various regional city and county governments and their subordinate highway, railroad, marine, aviation, tourism and other administrations. Therefore, the content of this research series, besides the statistical data, the prediction and analysis on the demand for transportation and the discussions on important traffic issues, the section on individual plans was based on the information provided by the cities and counties' governments and administrations. In general, the content of the overall transportation system improvement plan in Taiwan's various regions covered the vision and objectives of Taiwan's intercity road transportation, the analyses and prediction of the present transportation system and the socioeconomic environments of various regions, the topics on the transportation system development, the major transportation policy focuses and improvement strategies in the regions' overall development, the transportation improvement plans, and the funding for regional major transportation construction and other areas. With its substantial content and extensive structure, the results of this improvement plan can be the basis for MOTC and local governments' policy making in their transportation administration. It can also serve as a reference for the future revisions of the "Transportation Policy White Paper".



主要研究成果如下：

1. 從國土空間階層網絡觀點檢視臺灣城際陸路運輸建設計畫，擘劃我國城際陸路運輸願景與目標如下：

   (1) 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。

   (2) 西部地區以高鐵為主，臺鐵與公路為輔。

   (3) 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「一日生活圈」的概念下，勾勒各區域間陸路運輸時間目標如下：

單位：小時

區域 \ 期程		現況	中程（110 年以前）	長程（110 年以後）
北部區域	臺北→臺東 (北迴鐵 1+ 花東鐵 2)	4 (2+2)	3.5 (2+1.5)	3 (1.5+1.5)
中部區域	臺中→臺東 (高鐵 + 南迴鐵 3)	3.75 (0.75+3)	3.25 (0.75+2.5)	2.25 (0.75+1.5)
	臺中→花蓮 (高鐵 + 北迴鐵)	2.75 (0.75+2)	2.75 (0.75+2)	2.25 (0.75+1.5)
南部區域	高雄→臺東 (南迴鐵)	3	2.5	1.5
	高雄→花蓮 (高鐵 + 北迴鐵)	3.5 (1.5+2)	3.5 (1.5+2)	3 (1.5+1.5)
東部區域	臺東→臺北 (花東鐵 + 北迴鐵)	4 (2+2)	3.5 (2+1.5)	3 (1.5+1.5)

註 1：「臺鐵南港至花蓮提速改善計畫可行性研究」業經行政院 100.11.14 同意辦理，目前由本部鐵路改建工程局辦理綜合規劃中，未來將在兼顧運量需求、環境保護與社會公平等條件下，沒有預設立場與時程，審慎評估與推動。

註 2：花東鐵路預計中程完成瓶頸路段雙軌化及全線電氣化。

註 3：臺鐵預計中程完成整體購置及汰換車輛計畫，南迴鐵路預計長程完成電氣化。

The major research findings are the following:

A. After reviewing Taiwan's intercity land transportation construction plan from the perspective of the nation's spatial hierarchical network, , the vision and objectives of Taiwan's intercity land transportation are as follows:

(A) The linear major lines are mainly railroads, while the public highways provide a transportation network.

(B) In western Taiwan, the Taiwan High Speed Rail is the principal transportation method, with Taiwan Railways and highways being secondary methods.

(C) In Eastern Taiwan, Taiwan Railways, which has increased its speed, serves as the backbone and is supported by the public highways, which provide a transportation network. With the concept of "one day living circle", the goals for transit time between each region via land transportation are as follows:

Unit: hour

Region \ Phase		Present	Mid-Term Phase (Before 2021)	Long-Term Phase (After 2021)
Northern Taiwan	Taipei → Taitung (North-Link Line1+ Taitung line 2)	4 (2+2)	3.5 (2+1.5)	3 (1.5+1.5)
Central Taiwan	Taichung → Taitung (Taiwan High Speed Rail+South-Link Line3)	3.75 (0.75+3)	3.25 (0.75+2.5)	2.25 (0.75+1.5)
	Taichung → Hualien (Taiwan High Speed Rail+North-Link Line)	2.75 (0.75+2)	2.75 (0.75+2)	2.25 (0.75+1.5)
Southern Taiwan	Kaohsiung → Taitung (South-Link Line)	3	2.5	1.5
	Kaohsiung → Hualien (Taiwan High Speed Rail+North Link Line)	3.5 (1.5+2)	3.5 (1.5+2)	3 (1.5+1.5)
Eastern Taiwan	Taitung → Taipei (Taitung line +North Link Line)	4 (2+2)	3.5 (2+1.5)	3 (1.5+1.5)

Note 1: "The Feasibility Study on Nangang to Hualien,Taiwan Railways Speed Improvement Project" was given a green light to proceed by the Executive Yuan on November 14, 2011. Currently, the Reconstruction Bureau of Taiwan Railways is handling the comprehensive planning of this project. The Bureau will keep the demand of traffic volume, environmental protection, social justice in mind in the future, and it will have no preconceived stance and schedule for the project. Prudent assessments will be made to push the project forward.

Note 2: The Taitung line is expecting to complete the double track project in the bottleneck sections and the electrification of the entire line during the mid-term phase.

Note 3: Taiwan Railways is expecting to complete the project of purchasing and replacing trains during the mid-term phase. The South-Link Line is expecting to complete the electrification for the entire line during the mid-term phase.

2. 依據各區域社經與交通系統發展特性，以及運輸需求分析與預測結果，確認各區域交通發展課題如下：

(1) **北部區域交通系統發展課題**

A. 北部區域人口眾多且集中、總產值高，通勤休閒及貨物流通旅次負擔嚴重。

B. 民主選舉首長更替，計畫推動優先順序不同，造成交通建設與服務延宕。

C. 跨都會運輸交通壅塞問題有待改善。

D. 桃園國際航空城發展及聯外運輸系統有待強化建構。

E. 基隆港與臺北港二大國際港轉型及聯外運輸系統有待改善。

F. 北部區域整體鐵道運輸（臺鐵、高鐵臺北站及都會區捷運）容量與服務有待提升。

G. 高快公路路網及瓶頸點改善需加速整合與改善。

H. 北部區域公共運輸發展仍有提升空間。

I. 人本且永續的智慧交通生活環境待持續建構。

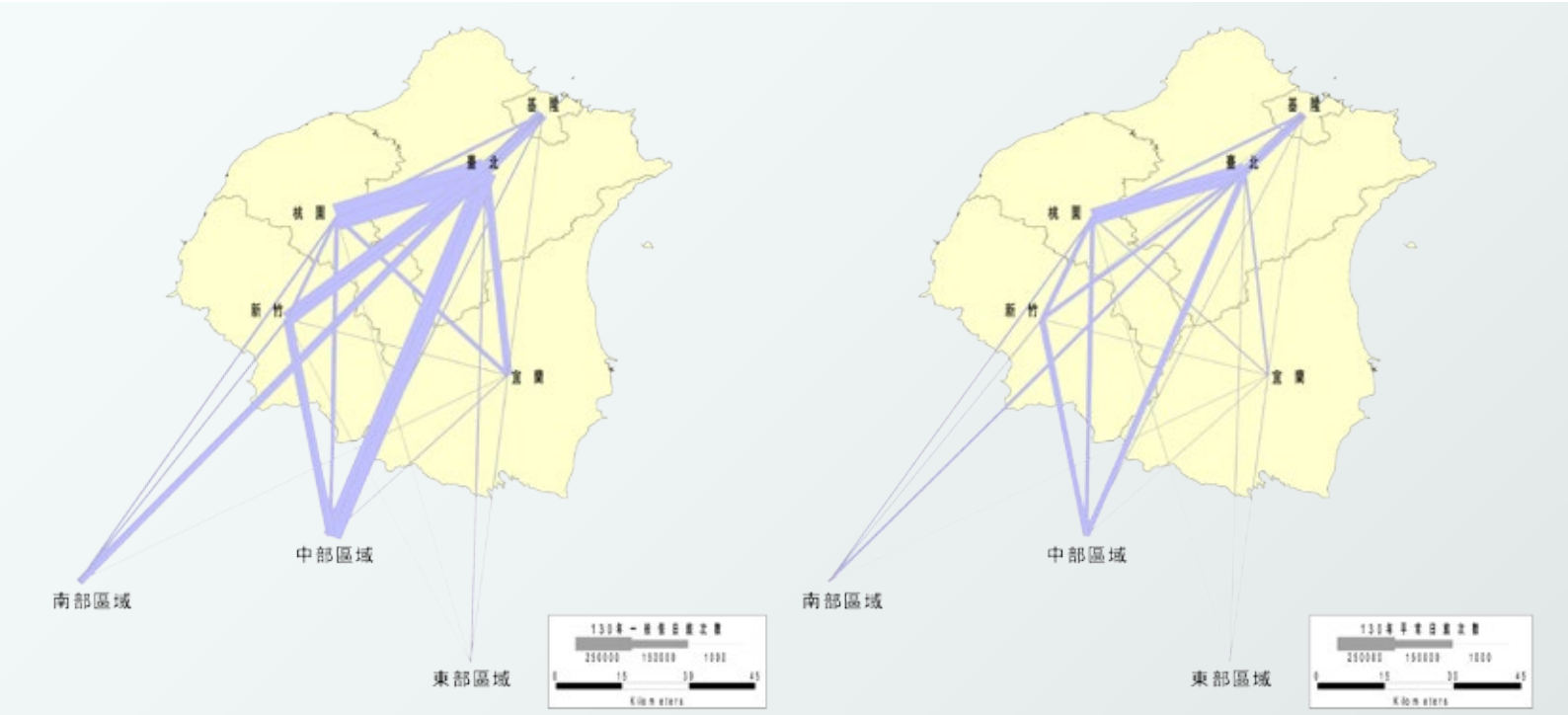
J. 離島地區聯外運輸效能待提升。

K. 北宜走廊假日交通壅塞亟需改善。

L. 北淡路廊聯外運輸瓶頸亟需改善。

圖 4-6　目標年北部區域城際間旅次分布示意圖

Figure 4-6　Sketch map of target goals for Intercity Travel Distribution in Northern Taiwan



B. Based on the characteristics of each region's social, economic and transportation system development and the result of the analyses on the transportation demand and prediction, the transportation development issues for each region are identified and listed as follows:

(A)Issues on the transportation system development in Northern Taiwan

a. Northern Taiwan has a large concentrated population with high total output value. It has an extremely high volume of traffic generated by commuting, leisure and cargo distribution.

b. With democratic elections and changes in leaders, projects' priorities have been shifted around, which has caused delaysto the transportation construction and service.

c. The problem of severe intercity traffic congestion needs to be addressed.

d. Thedevelopment of Taoyuan Aerotropolis and its connecting transportation system needs to be improved.

e. The transformation and the connecting transportation systems of the Port of Keelung and the Port of Taipei need to be improved.

f. The capacity and service of the overall railroad transportation inNorthern Taiwan (Taiwan Railways, Taipei Station of Taiwan High Speed Rail and the city's mass rapid transit) need to be improved.

g. The integration and improvement of the high speed highway network and the bottleneck sections need to be accelerated.

h. The development of public transportation in Northern Taiwan still has room to improve.

i. People-centered and sustainable intelligent transportation and living environments needs to be continually constructed.

j. The efficiency of the connecting transportion in outlying islands needs to be improved.

k. Congested traffic in theTaipei-Yilan Corridor during the holidays needs to be improved urgently.

l. The bottleneck in the connecting road of the Taipei-Tamsui Corridor needs to be improved urgently.

(2) 中部區域交通系統發展課題

A. 臺中港與臺中機場運輸需求型態轉變，場站設施及聯外交通供給面臨擴充需要。

B. 臺鐵、高鐵及臺中都會區捷運系統之布局與服務功能需要更多結構化的布局。

C. 國快道與臺中都會區公路系統之路網結構需重新檢討並貫通關鍵性斷鏈，且臺中 - 彰化與臺中 - 南投等主要運輸走廊既有運輸瓶頸需要改善。

D. 私人運具依賴度高，公共運輸市占率偏低。

E. 中部山城地區進出國道、修復中斷省道與環境保育衝突。

F. 人行道、寧靜區與自行車等人本交通的概念尚待強化並融入有關建設。

(3) 南部區域交通系統發展課題

A. 高雄港國際競爭力面臨考驗。

B. 高雄機場發展面臨轉型。

C. 高雄港市發展需完整高快速路網服務。

D. 區域運輸供給相對充裕，應強化運輸系統管理。

E. 配合環島鐵路電氣化，臺鐵車輛需求應及早因應規劃。

F. 都會區鐵路立體化經費龐大，需審慎評估推動。

G. 既有公路網部分路段存在瓶頸。

H. 公共運輸系統競爭力仍處劣勢。

(B) Issues on the transportation system development in Central Taiwan

a. As the transportation demands for Taichung Port and Taichung Airport have changed, the ports' facilities and their connection transportation need expanding.

b. The layout and the services of Taiwan Railways, Taiwan High Speed Rail and Taichung's mass rapid transit system need to be more structured

c. The structure of the national highway network and Taichung metropolitan highway system needs to be reviewed and critical connecting roads need to be linked. The bottlenecks on the major corridors connecting Taichung-Changhua and Taichung-Nantou need to be improved.

d. High dependence on private transportation, low percentage of public transportation.

e. The entrance to the national highway from the mountainous regions in Central Taiwanand repairs to the damaged provincial highways conflict with environmental protection.

f. The ideal of sidewalks, quiet zones,bicycle lanes and other people-centered transportation needs to be upheld and integrated with the related constructions.

(C) Issues on the transportation system development in Southern Taiwan

a. The international competitiveness of the Kaohsiung Port is being tested.

b. Kaohsiung Airport is in need of transformation.

c. Comprehensive integrated high speed road network service is needed to accomodate the develpment of Kaohsiung harbor city.

d. Since regional transportation is quite sufficient, the transportation management system should be improved

e. To accomodate the electrification of the roundabout Taiwan railroads, the demand for trains from Taiwan Railways should be planned for as soon as possible.

f. Massive funding is needed to conduct grade separation on the railroads in urban areas, and this should be reviewed and implemented prudently.

g. Bottlenecks in certain sections of the existing highway network.

h. The competitiveness of the public transportation system is still lacking.

(4) **東部區域交通系統發展課題**

A. 砂石及礦產運輸應尋求替代方案。

B. 綿長且狹窄的東部軸線需尋求多種運具相互整合的可能性。

C. 蘇花段、南迴段等瓶頸必須設法有效改善。

D. 運輸資源平常日閒置率甚高，必須採更積極的態度妥善處理。

E. 面對花東地區的砂石運輸、運輸瓶頸路段、大眾運輸質量及人本運輸環境缺乏等問題，必須審慎以對。

F. 需要兼顧運輸系統的效率面與公平面，包括核心地區相對運輸效率再提升的可能性與必要性，滿足偏遠地區 (含離島) 的基本運輸效率。

3. 在「健全高快速路網，強化國際海空競爭」及「推動都市縫合之鐵路立體化，促使都會均質發展」等二項施政主軸下，研提各區域整體交通系統改善策略如下：

(1) 北部區域整體交通系統改善策略

A. 充實國際桃園機場與基隆港、臺北港之海空港軟硬體設施，建構開放與具國際競爭力之關鍵節點。

B. 循序建構優勢分工的區域鐵道運輸網。

C. 串連快速公路關鍵性斷鏈、消弭既有公路瓶頸路段。

D. 強化跨域協調整合平臺整合功能。

E. 建構低碳、智慧的公共運輸及人本交通服務環境。

F. 完善離島港埠設施滿足地區發展需求。

(D) Issues on the transportation system development in Eastern Taiwan

a. There should be an alternative plan for the transportation of sandstone and minerals. b. The integration of various transportation methods should be done to meet the needs of the long and narrow routes in Eastern Taiwan.

c. The bottlenecks in Suhua Highway and South-Link Highway should be addressed effectively.

d. The high idling rate of the transportation resources on regular days should be handled more actively and effectively.

e. The problems of transporting sandstone in Hualien and Taitung areas, bottleneck sections in roads, the quality of the public transportation, and the lack of a people-centered transportation environment should be addressed prudently.

f. To handle the basic transportation effectiveness in the remote regions (including outlying islands), the possibility and necessity of improving transportation efficiency in the core areas and the effectiveness and fairness of the transportation system should be considered.

C. With the two major policy administration focuses: "Improving the highway network and strengthening the competitiveness of international sea and air traffic" and "promoting railroad dimensionalization in cities and balancing developments between cities", the improvement strategies for the regional overall transport systems are as follows:

(A)The improvement strategies for the overall transportation system in Northern Taiwan

a. Advancing the software and hardware facilities of Taoyuan International Airport, the Port of Keelung and the Port of Taipei; constructing internationally competitive open prominent features.

b. Constructing advantageous divisions of the regional railroad transportation network sequentially.

c. Linking up critical connecting highways, solving the bottlenecks at designated highway sections.

d. Strengthening cross area coordination and integration platform.

e. Constructing a low carbon, intelligent public transportation system and a people-centered transportation service environment.

f. Advancing outlying islands' port facilities to accomodate the demands of the area developments.

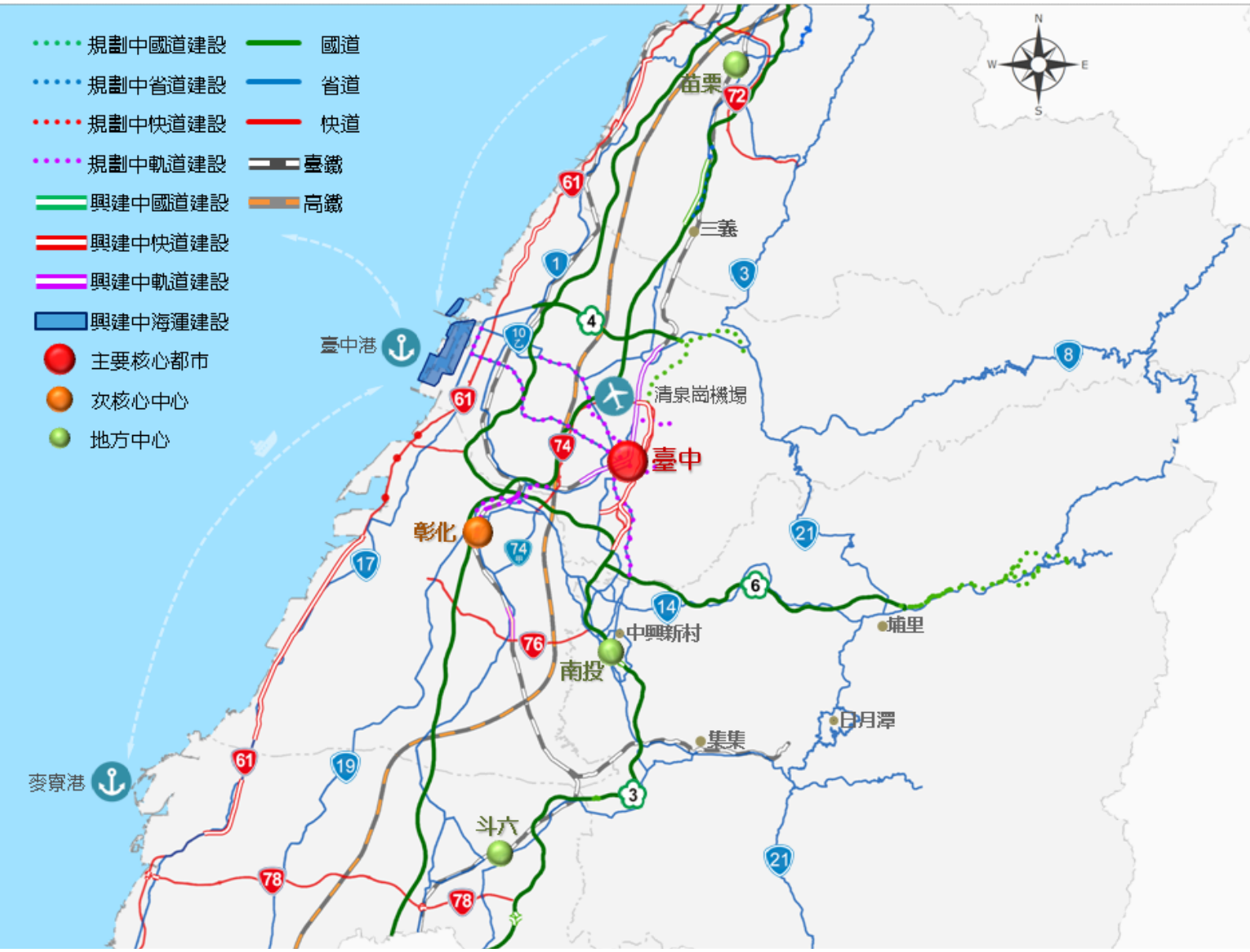


圖 4-7　中部區域整體運輸系統發展示意圖

Figure 4-7　The Sketch Map of the Overall Transportation System Development in Central Taiwan

(2) 中部區域整體交通系統改善策略

A. 海空運輸：推動臺中機場、臺中港與國內其他機場及港埠之整合發展

B. 鐵道運輸：型塑優勢分工的區域鐵道運輸網

C. 公路運輸：因應區域多核心發展，持續補強階層式公路系統

D. 公共運輸與人本交通：構築友善運輸環境並擴大服務範圍

E. 觀光運輸：創建彈性供給、理性管理的觀光運輸樣態

(B) The improvement strategies for the overall transportation system in the central region

a. Sea and air transportation: promoting the integrated development of Taichung Airport, the Port of Taichung, and other domestic airports and ports.

b. Railroad transportation: constructing advantageous divisions of the regional railroad transportation network.

c. Highway transportation: to accommodate the region's multi-center development, constantly reinforcing the hierarchical highway system.

d. Public transportation and people-centered transportation: constructing a friendly transportation environment and expanding its service range.

e. Tourism transportation: constructing a flexible transportation supply, managing tourism transportation trends rationally.

(3) 南部區域整體交通系統改善策略

A. 厚植高雄港與高雄機場之國際海空競爭力，帶動產業加值與轉型。

B. 著重高雄港聯外高快速公路網的建構及鐵公路關鍵性斷鏈的貫通消除區域鐵公路瓶頸，健全路網效益與品質。

C. 逐步提昇南部區域公共運輸市占率，強化公共運輸之發展，落實人本運輸與環境。

D. 加強高鐵、臺鐵及公路公共運輸及市區公車間之管理與整合。

E. 建置智慧化運輸資訊系統，採用交通工程及管理手段加強分流策略，提高公路整體效率。

F. 積極推動橋梁耐震補強、老舊橋梁改建等，對於潛在危險路段，以交通管理、交通工程、或以道路工程等方式進行改善，以提升行車安全。

(4) 東部區域整體交通系統改善策略

A. 發展理念：識別並強調區域獨特性。即以觀光及交通系統串聯所有產業，聯外運輸以軌道為主，公路為輔，同時在區內營造人本交通環境。

B. 策略架構：紓解壓力，彌補縫隙。包括消除鐵路瓶頸，強化運輸服務功能、品質與聯外公路安全，並且規劃建構花東區內優質景觀廊道，以及加強生活與觀光運輸服務。

C. 鐵路運輸整體方向及策略：消除瓶頸，整體提升鐵路運輸服務，包括改善鐵路運輸安全與瓶頸、鐵路營運觀光化、動力一元化及機會公平化。

D. 公路運輸整體方向及策略：建立安全、可靠、優美的東臺灣公路系統，包括改善公路運輸安全與瓶頸、公路優美化、公路休閒化及公路人性化。

(C) The improvement strategies for the overall transportation system in Southern Taiwan

a. Extensively developing the international competitiveness of the Port of Kaohsiung and Kaohsiung International Airport, promoting value-added industries and industry transformation.

b. Focusing on constructing the Port of Kaohsiung's connecting highway network and linking up the critical connecting railroads to prevent the bottlenecks in regional railroads, enhancing the road network's efficiency and quality.

c. Gradually increasing the percentage of the public transportation in the southern region, strengthening the development of the public transportation, implementing a people-centered transportation and environment.

d. Improving the management and integration of Taiwan High Speed Rail, Taiwan Railways, public transportation on highways and city bus services.

e. Constructing intelligent transportation information systems, adopting and emphasizing the diversion strategy approach in transportation constructions and management, improving the overall highway efficiency.

f. Actively pushing forward shock-proof reinforcement in bridges and reconstruction of old bridges, improving potentially hazardous roads through transportation management, transportation construction or road construction and other approaches to improve traffic safety.

(D) The improvement strategies for the overall transportation system in Eastern Taiwan

a. Development concepts: identifying and emphasizing regional uniqueness, linking all the industries through tourism and the transportation system. Railroads are the major connection to areas outside of the major regions, with the support of highways. Creating a people-centered transportation environment in the areas.

b. Policy framework: allevating stress, sealing up gaps by preventing bottlenecks in the railroads, and strengthening the transportation service's functionality, quality and the safety of highways connecting to outside areas. Planning and constructing superior landscaping corridors in Hualien and Taitung areas, improving tourism and everyday transportation service.

c. The overall direction and strategies for the railroad transportation: preventing bottlenecks, enhancing overall railroad transportation service by improving railroad transportation safety and bottlenecks, promoting railroad tourism, eliminating trip transfers and promoting equal opportunities.

d. The overall direction and strategies for the highway transporation: constructing a safe, reliable and delightful Eastern Taiwan highway system by improving safety and bottlenecks on highway transportation, beautifying highway landscaping, leisurizing and personalizing highways.

E. 鐵公路運輸整合策略。即依據需求規模、不同區位條件及周邊資源條件，進行階層化、因地制宜及制度化之整合。

F. 加強生活與觀光運輸服務，強調獨特性、服務分眾化、環境人本化、設施綠化及道路景觀美化。

4. 在納入改善方案之個案計畫方面，主要包括已核定及未核定部分，本系列研究完整收納公路、鐵道、海運、航空及觀光等系統之多項個案計畫，其計畫納入原則依據運輸系統之不同，分別考量因素如下圖所示。

圖 4-8　各區域交通改善方案之個案計畫納入原則示意圖

Figure 4-8　The Schematic Diagram of the Individual Case Inclusion Principles for Regional Traffic Improvement Plans

e. Integrating strategies for railroads and highways: conducting stratified, site-specific, systematic integration according to the demanded scale, different areas' conditions and the conditions of surrounding resources.

f. Improving tourism and everyday transportation service, emphasizing uniqueness, service division, people-centered environment, conducting landscaping on roads and facilities.

D. From the inclusion of the individual case aspect, the research included both the approved and not yet approved cases. This research series comprehensively included many individual cases of highways, railroads, sea, air, and tourism transportation systems. The principle of inclusion was varied according to each transportation system, as shown below:

（三）山地原住民鄉（區）交通改善計畫

臺灣地區山地原住民鄉（區）區域遼闊，約占全省土地面積之 53%，大多重山疊嶺，地勢陡峭，道路種類繁多，受環境限制，設計標準不一，致山地交通遠不及平地便捷流暢；而山區地質不穩，每遇豪雨、地震，道路即易崩坍流失，影響鄉（區）部落聯外通勤通學交通，並不利其產業與觀光的發展，有必要全面檢討改善。交通部為維護山地原住民鄉的行車安全，遂於 102 年初責成本所辦理「山地原住民鄉（區）交通改善計畫」，針對 30 個山地原住民鄉（區），逐一蒐集其人口、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，據以研擬包括道路安全改善、交通管理措施，與非典型公共運輸之建置等各項改善措施。

本計畫經本所邀集原住民族委員會、國家發展委員會、行政院主計總處、行政院農業委員會水土保持局、內政部營建署、交通部路政司、道安委員會、公路總局、觀光局等有關單位，組成「山地原住民鄉（區）交通改善規劃小組」，針對道路安全改善部分訂定篩選原則，並由本所相關人員擔任幕僚作業，針對各山地原住民鄉（區）公所提報之道路交通改善需求逐項進行實地現勘後，提報小組會議進行第一階段原則審查，再依初審結果邀集相關縣市政府進行第二階段逐案協商，確認各道路改善計畫之辦理項目與經費需求，共篩選納入 23 鄉（區）111 項道路交通改善計畫，道路屬性分別為公路系統之鄉（區）道、農路與其他類（包含部落連絡道、聯外道路、村里道路等），計畫總經費約 3.36 億元。

為加速規劃作業，本所並配合開發「山地原住民鄉（區）道路交通改善需求調查系統」，整合平板電腦及行車錄影設備之拍照、註記、錄影、定位及軌跡記錄等功能，快速且完整的記錄各改善道路包括：路線軌跡、改善需求、全程影像等資訊，並在 Google Earth 介面上忠實呈現道路實況，讓規劃小組能迅速有效的作出決策。此外，因應山區網路訊號不穩特性，特別開發離線版本，讓現勘人員在無網路環境下亦可使用相關功能，而對於車輛無法抵達故須步行現勘路段，亦可利用平板電腦記錄所需軌跡，大幅提升系統可靠度及適用範圍。該系統除榮獲交通部 103 年創新獎管理類甲等獎外，並分別於 103 年 5 月及 104 年 3 月提供公路總局及新北市政府辦理山區公路災害勘查及養護巡查作業。

(3) Mountain Indigenous Villages (Districts) Transportation Improvement Plan

Mountain indigenous villages (districts) are vast, accounting for about 53 percent of Taiwan's total land area. Most are in rugged mountain areas. The design criteria of roads vary because of environmental constraints, which cause transportation in mountain areas to be much less convenient than it is in other places. Geological instability makes roads susceptible to heavy rain and earthquakes, affecting not only those going to work or school but also the development of industry and tourism. It is necessary to conduct an overall improvement program. In order to ensure traffic safety in mountain indigenous villages (districts), the IOT was assigned the creation of a transport improvement plan for indigenous villages (districts) in mountainous regions by the MOTC in early 2013. The plan involves the collection of population, industry, road traffic, and other related data from 30 mountain indigenous villages (districts) along with a review of the transportation demands of commuters, tourists and local industries. The purpose of this plan is to provide improvement methods for traffic safety, transportation management methods, alternative public transportation, etc.

The IOT has invited the Council of Indigenous Peoples, the National Development Council, the Directorate General of Budget, Accounting and Statistics, the Soil and Water Conservation Bureau, the Construction and Planning Agency of the Ministry of the Interior, the Department of Railways and Highways, the Road Traffic Safety Committee, the Directorate General of Highways, and the Tourism Bureau to form an Mountain Indigenous Village (District) Transportation Improvement Committee. The committee was tasked with setting criteria for traffic safety improvement and doing the first stage examination on the road improvement projects reported by the indigenous villages (districts) after the staff members made onsite surveys. According to the results, the staff members discussed the contents and budget of each project with different indigenous village (district) in the second stage. The committee finally selected 111 road improvement projects from 23 villages (districts). The category of roads includes country road, agricultural road, and others (including the roads which connect indigenous peoples' neighborhoods, and neighbor townships or villages). The budget for this plan is approximately NT$336 million.

To speed up the planning process, the IOT developed a "Mountain Indigenous Villages (Districts) Transportation Improvement Demand System", which integrated photographing, noting, video recording, satellite positioning/GPS, and other functions of tablet PC and driving recorder . It speedily and completely records each road that was requested for improvement, including route track, improvement demand, full image and other information. Also, it can

另本所亦根據公路總局公告資料，彙整完成「山地原住民鄉（區）道路大客車禁行路段表」計 190 條禁行路段，並規劃以鄉區小巴士方式，來因應在地通勤（通學）與觀光旅遊的需求，並考量與部落社區結合，讓在地住民能充分參與服務規劃，讓需求與供給更加契合。

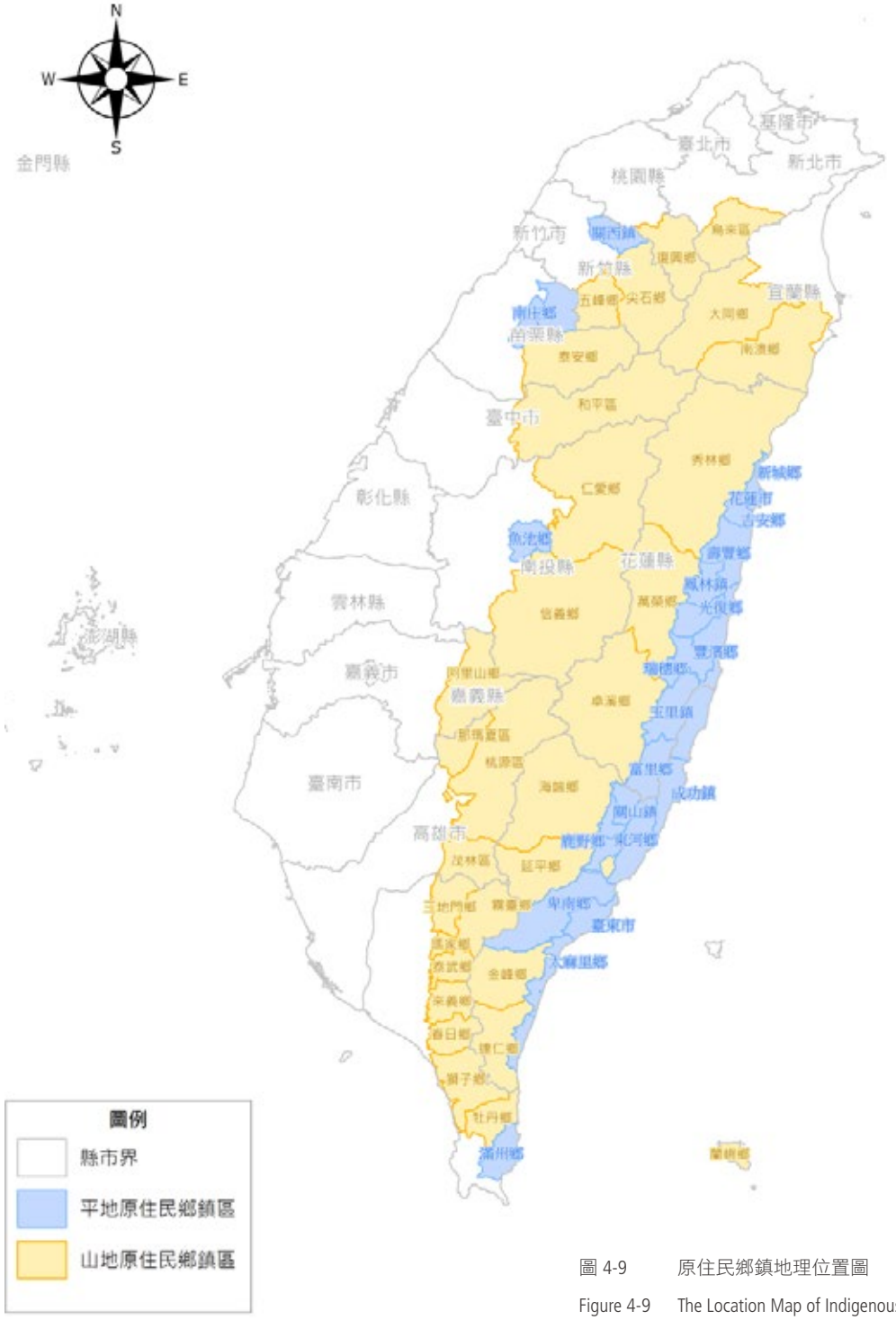


圖 4-9　原住民鄉鎮地理位置圖

Figure 4-9　The Location Map of Indigenous Villages and Towns

accurately display the road condition through the interface of Google Earth, so the committee can quickly make effective decisions. In addition, to accommodate to the unstable network signal in the mountain areas, an off-line version of the system was especially developed, so the function could still be worked in a no-network environment. As for the roads where cars are unable to reach and which require on-site inspection on foot, a tablet PC can record its tracks, substantially increasing the system's reliability and applicable scope. The system was awarded an Innovation Award Grade-A award in the management category by the Ministry of Transportation and Communication. In May 2014 and March 2015, the system was offered the Directorate General of Highways and the New Taipei City Government to administrate mountain area highway disaster inspections and highway inspections.

Moreover, the Institute has compiled a list of "Large Buses Restricted Routes in the Mountain Indigenous Villages (Districts)" according to the information of the Directorate General of Highways. A total of 190 restricted routes were listed. Minibus transportation in rural areas was implemented to accommodate the demands of local commuting (to school) and tourism. With the consideration of integrating tribe communities, local residents can fully participate in service planning, so that the demand and supply can fit even more closely.

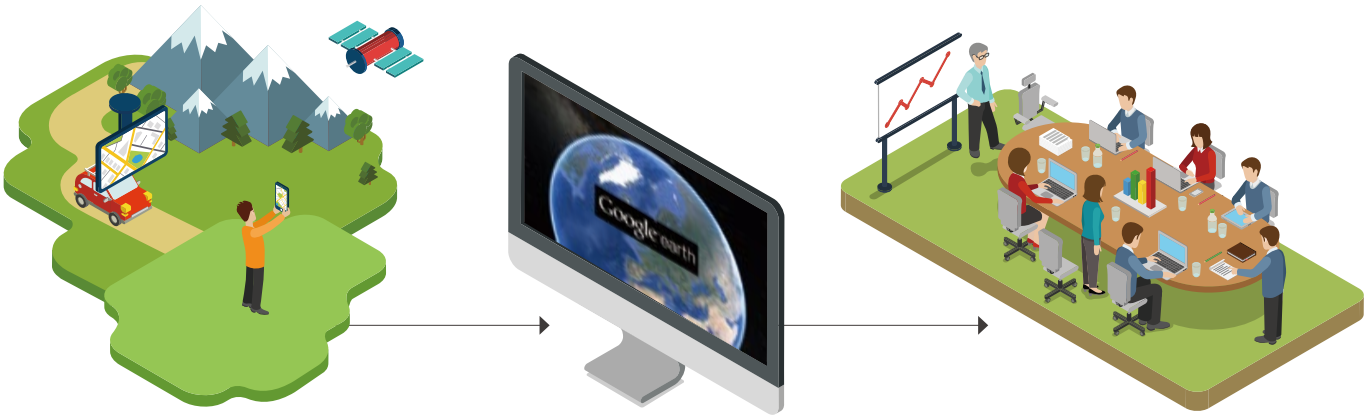


圖 4-10　現勘審議運作流程圖

Figure 4-10　The Flow Chart of the On-site Inspection, and Discussion Process

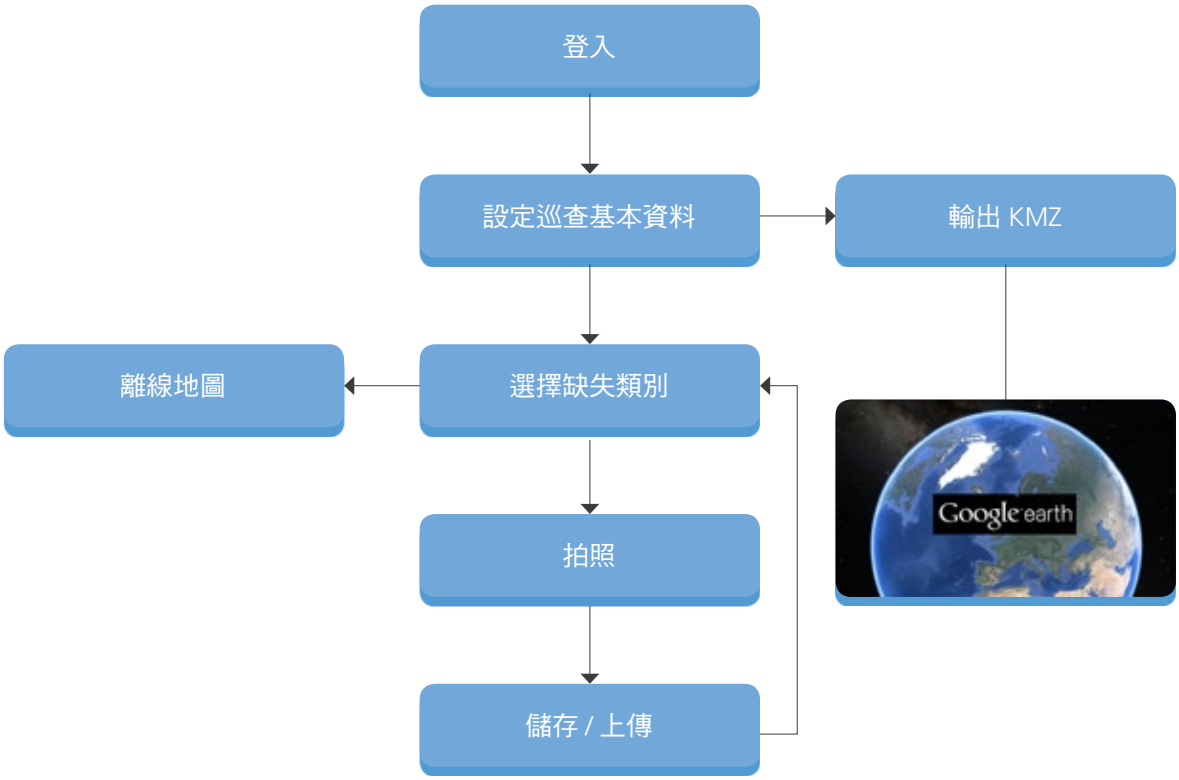


圖 4-11　山地原住民鄉（區）道路交通改善需求調查系統作業流程圖

Figure 4-11　The Mountain Region Indigenous Villages (Districts) Transportation Improvement Demand Inspection System Operation Flow Chart

圖 4-12　山地原住民鄉（區）道路交通改善需求調查系統登入畫面

Figure 4-12　The Login Screen of the Mountain Region Indigenous Villages (Districts) Transportation Improvement Demand Inspection System

圖 4-13　山地原住民鄉（區）道路交通改善需求調查系統記錄畫面

Figure4-13　A Record of the Mountain Region Indigenous Villages (Districts) Transportation Improvement Demand Inspection System

圖 4-14 山地原住民鄉（區）道路交通改善需求調查系統缺失紀錄照片

Figure 4-15 A Poor Road Condition Picture from the Mountain Region Indigenous Villages (Districts) Transportation Improvement Demand Inspection System

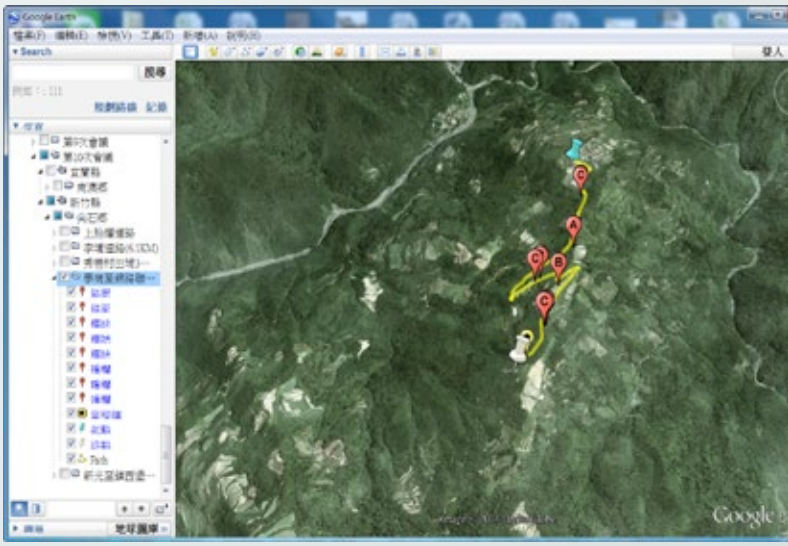


圖 4-15 山地原住民鄉（區）道路交通改善需求調查系統缺失紀錄照片

Figure 4-15 A Reported Damaged Roads Picture from the Mountain Region Indigenous Villages (Districts) Transportation Improvement Demand Inspection System

圖 4-16 現況照片 (1)-- 路面損壞

Figure 4-16 An On-site Picture (1)-Damaged Pavement

圖 4-17 現況照片 (2)- 彎道缺護欄及反光鏡

Figure 4-17 An On-site Picture (2)-The Lack of Rail and Reflector at the Curve

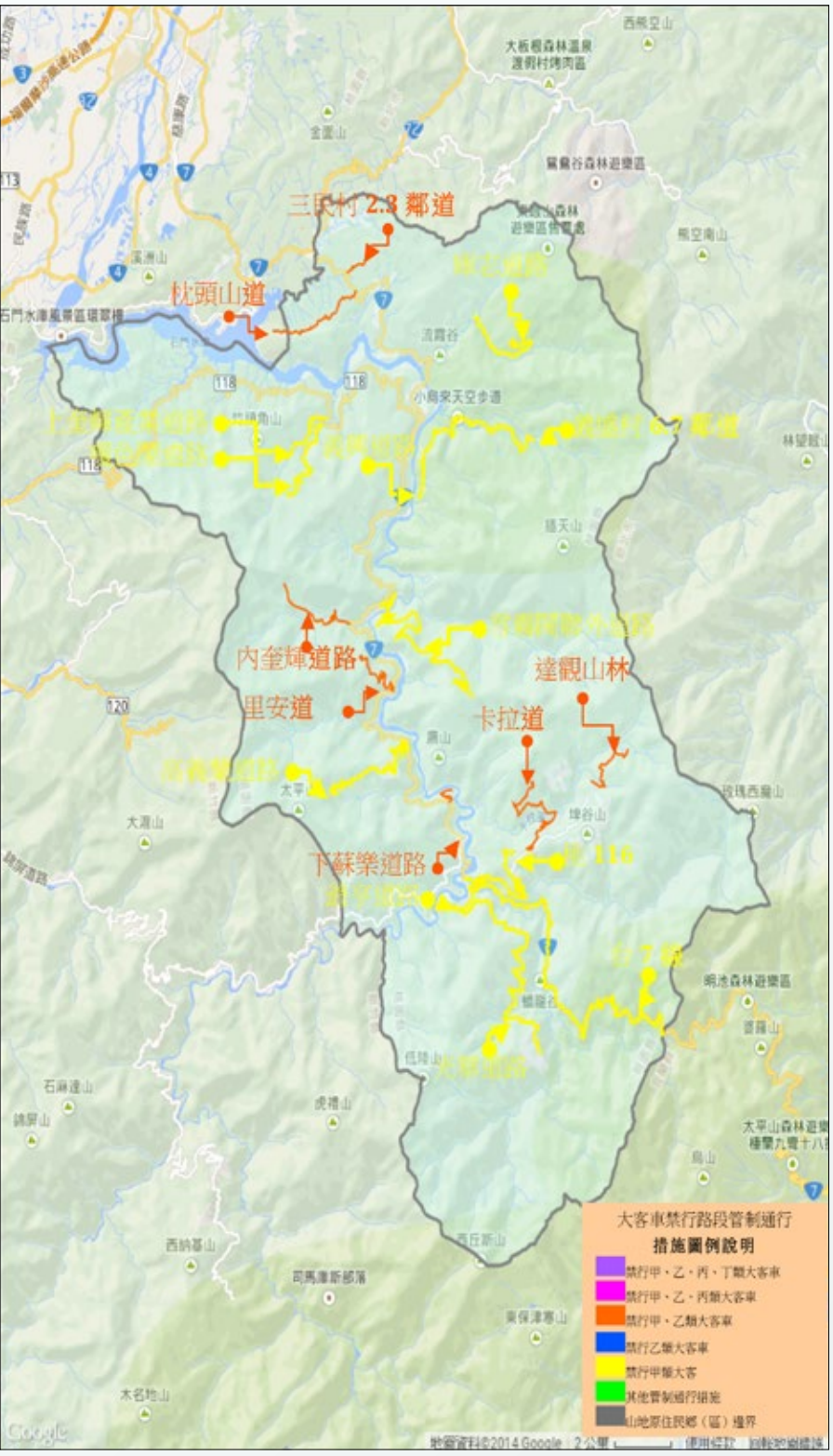


圖 4-18　大客車管制路線位置圖—桃園縣復興鄉

Figure 4-18　The Location Map of the Large Vehicle Control Routes

圖 4-19　改善路線位置圖—桃園縣復興鄉

Figure 4-19　The Location Map of the Improved Routes-Fuxing Village, Taoyuan City

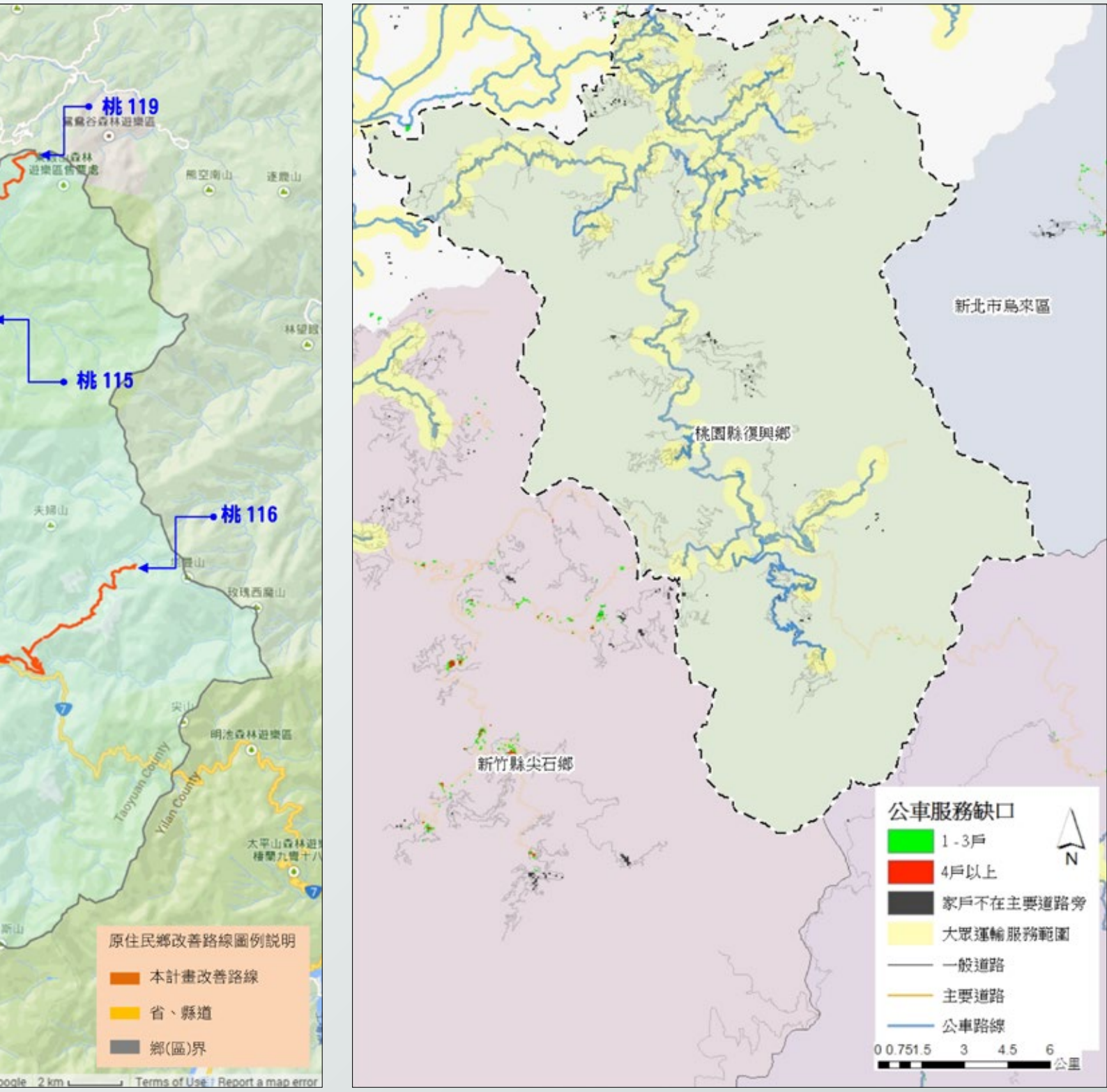


圖 4-20　公共運輸空間服務涵蓋示意圖—桃園縣復興鄉

Figure 4-20　The Public Transportation Service Coverage Sketch Map-Fuxing Village, Taoyuan City

二、海空運輸

(一)國籍航空公司競合問題之研究

隨著民航政策的改變以及外在環境的變化，國內國籍航空公司家數也隨之變化；截至2013年底，臺灣目前有8家國籍航空公司（華航、長榮、復興、華信、立榮、遠東、威航及虎航），且已連結大陸約50個機場，兩岸航線的班次數、座位總數以及載客人數也約占臺灣所有航空市場約四分之一；另外低成本航空公司（low cost carrier, LCC）自2004年12月，由新加坡籍捷星航空公司首度來臺營運桃園—新加坡航線；自此之後，東南亞多家LCCs陸續來臺經營運，為因應近年來大幅進軍臺灣航空市場的低成本航空公司，中華航空公司與新加坡最大的低成本航空公司Tigerair合資，成立台灣虎航（Tigerair Taiwan），復興航空則獨資成立威航（V Air），讓原本二大二中的國籍航空公司態勢，再新增二家LCC，對於國內航空市場也造成一定衝擊。

國籍航空公司主要仍以飛航國際及兩岸定期航線為主；但由於臺灣目前航網不足，因此在現有航權分配上，各家航空公司無法有效串連航網，造成力量分散；而臺灣在無國內航空市場支持下，必須整合各航空公司，以更有效力營運方式提升國籍航空公司競爭力。因此，為因應國際發展趨勢與市場發展方向，並探討國籍航空公司競爭與合作問題，提出下列可行之策略，作為政府未來施政之參考：

1. 法規政策彈性調整

我國現行民航法規，因應民航市場變遷與實際需要，對於業者申請設立經營與新闢或增加航線已調降門檻，增加市場的潛在競爭性。此外，對於民航運輸業聯營行為，均採彈性開放的態度。

另外航空產業業者認為在航權協議、航權分配與機場發展等資源上，相關政策宜朝向積極開放的角度，配合業者實際營運的需要做適切的調整；在航空公司營運彈性上，希望能加速簽修航約，讓國際聯盟成員衍生的共用班號合作得以發揮效益，並修訂相關法令規範，讓業者得以因應實際需要而彈性營運。

2. Sea and Air Transportation

(1) Study on the issue of coopetition of Taiwan-Registered Airlines

With changes in civil aviation policy and external environment, the number of domestic airlines has changed. As of the end of 2013, there were 8 Taiwan-registered airlines (China Airlines, EVA Air, TransAsia Airways, Mandarin Airlines, Uni Air, Far Eastern Air Transport, V Air and Tigerair Taiwan). Currently, about 50 destinations in mainland China are connected. The number of flights, as well as available seats and passengers, of cross-strait routes, accounts for about a quarter of Taiwan's air market. In addition, in December 2004, Jetstar Airways of Singapore began to operate passenger services on Taoyuan-Singapore and v.v. route, and it was the first low cost carrier(LCC) to serve Taiwan. Since then many Southeast Asias low cost carriers serve Taiwan. China Airlines launched Tigerair Taiwan, a joint venture with Singapore's largest low cost carrier, Tigerair. Also, TransAsia Airways set up its wholly owned subsidiary - V Air. The changes definitely have a certain impact on domestic air market.

Taiwan-registered airlines mostly fly international and cross-strait routes. Given insufficient network and inefficient allocation mechanism of traffic rights, they cannot focus their resources and make best use of the network. In order to enhance their competitiveness, those airlines must be integrated. To react to international trend and market development, and to probe the issue of coopetition of Taiwan-registered airlines , the Institute has put forward following feasible strategies for the government's reference:

A. Flexible Adjustment of Policies and Regulations

To react to the changes in the civil aviation market and the actual demand, Taiwan's civil aviation regulations have lowered the threshold for airlines to apply for operation and establish new routes. That increased the potential competition in the market. Besides, the government has also adopted an open and flexible attitude to code-sharing of airlines. The airline industry hopes that the related policies should move toward a positive open direction in terms of air services agreement, traffic right allocation, airport development and other resources, and can be appropriately adjusted to coordinate with the industry's needs. The industry also looks forward to accelerating the pace of air services negotiations, so airlines can benefit from code sharing with airlines in the same airline alliances. Besides, it is necessary to revise relevant laws and regulations so that the industry will be able to operate flexibly to address the actual demands.

2. 競合方案施行策略

經由相關文獻回顧與發展趨勢分析，以及對於航空公司業者與民航主管單位之訪談，我國空運市場可能發展情境，主要取決自貿協定與經貿發展、航權協議與天空開放、以及陸客中轉開放進程等三項因素所影響，本研究也據此設定「遲緩」、「適度」與「積極」等三種情境，作為航空公司可能競合方式擬定的基礎，並針對國籍航空競合議題從市場開放、市場區隔與國際聯盟等競爭方式，以及從營運合作與公司合併等合作方式提出可行對策方案，可作為政府未來研提國際民航政策之參考。

表 4-2　國籍航空公司機隊組成一覽表

Table 4-2 Taiwan Registered Airlines' Fleets

航空公司 Airline Company	機型 Aircraft Type	架數 Number of Aircraft	架數總計 Total Number of Aircraft
中華航空 China Airlines	A330-300	23	77
	A340-300	6	
	B737-800	15	
	B747-400	12	
	B747-400F	21	
長榮航空 EVA Air	A318-112	1	68
	A321-211	9	
	A330-200	11	
	A330-300	3	
	B747-400	5	
	B747-400F	3	
	B747-400SF	6	
	B777-300ER	17	
	MD-11F	6	
	MD-90	7	

B. Coopetition Program and Implementation Strategy

Through the review of the related literature, the analysis on the development trend and interviews with airlines and the civil aviation authority, we found that the possible development scenario for Taiwan's air transportation market mainly depends on three factors: free trade agreement and economic development, air services agreements and open sky, and the opening up process for mainland China passengers to transit via Taiwan. Based on that, this study painted three scenarios: "slow", "moderate" and "positive". Airlines can utilize them to draft their possible coopetition approaches and strategies. As for the issue of coopetition of Taiwan-registered airlines, the institute has presented feasible countermeasures for the government's reference from different aspects: market liberalization, market segmentation and airline alliance, operation coordination and corporate merger.

航空公司 Airline Company	機型 Aircraft Type	架數 Number of Aircraft	架數總計 Total Number of Aircraft
華信航空 Mandarin Airlines	E-190AR	8	8
立榮航空 Uni Air	ATR72-212A	9	20
	DHC-8-311	4	
	MD-90	7	
復興航空 TransAsia Airways	A320-232	5	23
	A321-131	5	
	A321-231	1	
	A330-300	2	
	ATR-72-212A	8	
	ATR-72-500	2	
遠東航空 Far Eastern Air Transport	B757-200	2	10
	MD-82	5	
	MD-83	3	

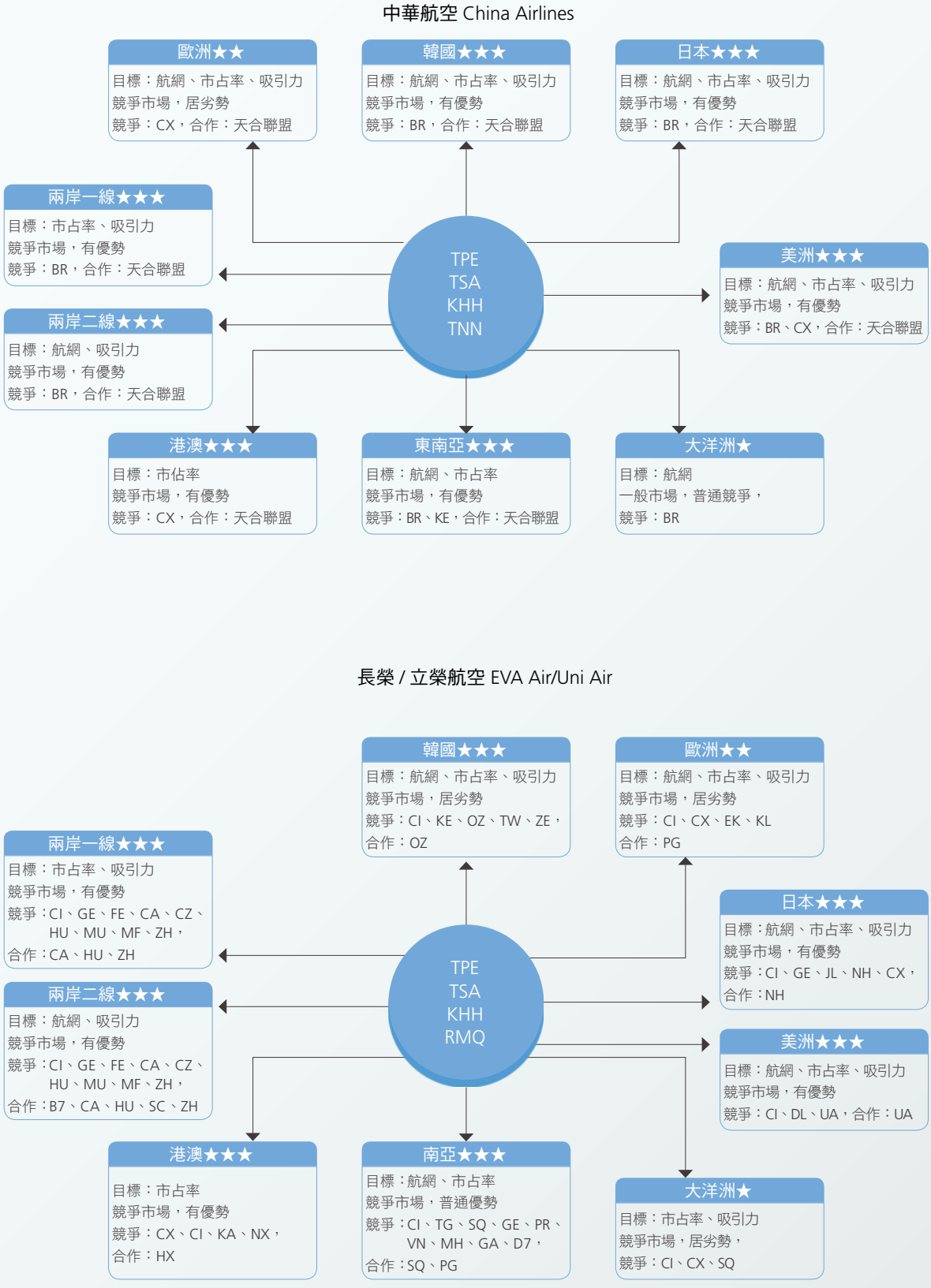
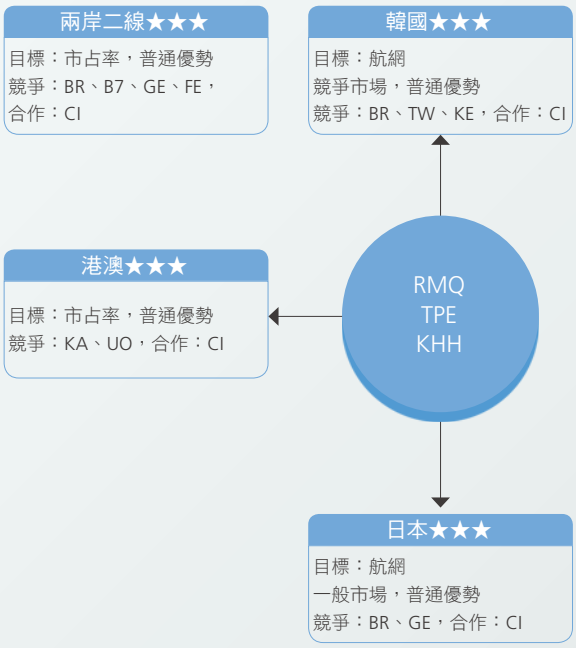


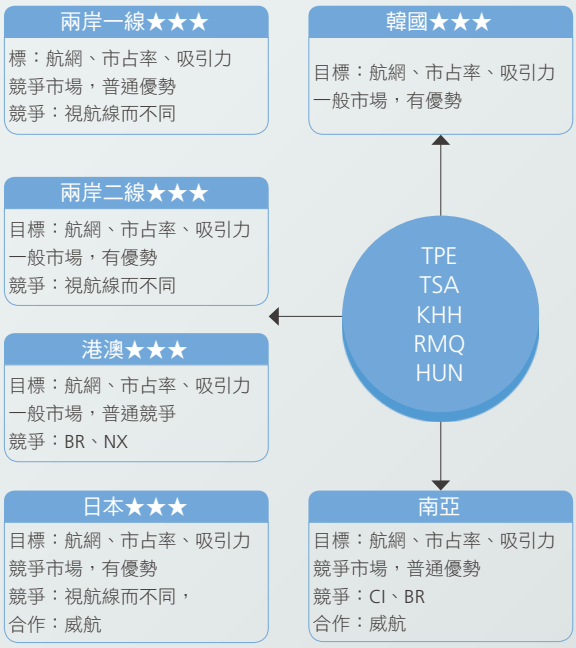
圖 4-21　國籍航空公司國際市場特性

Figure 4-21　Taiwan Registered Airlines' International Market Characteristics

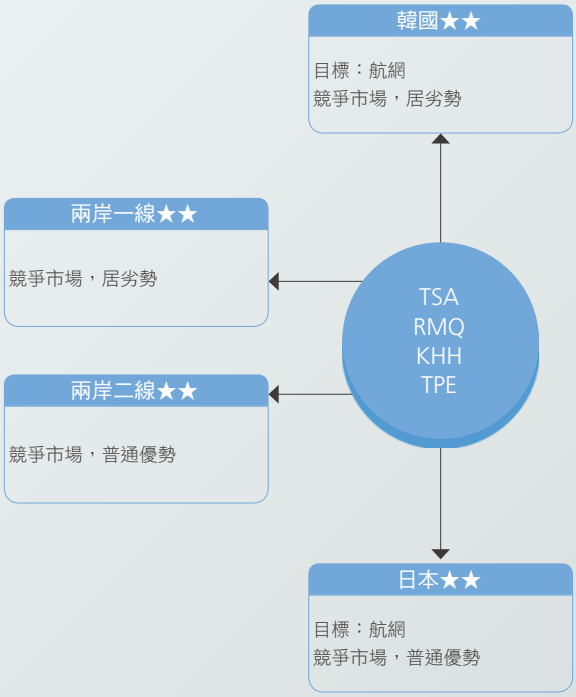
華信航空 Mandarin Airlines



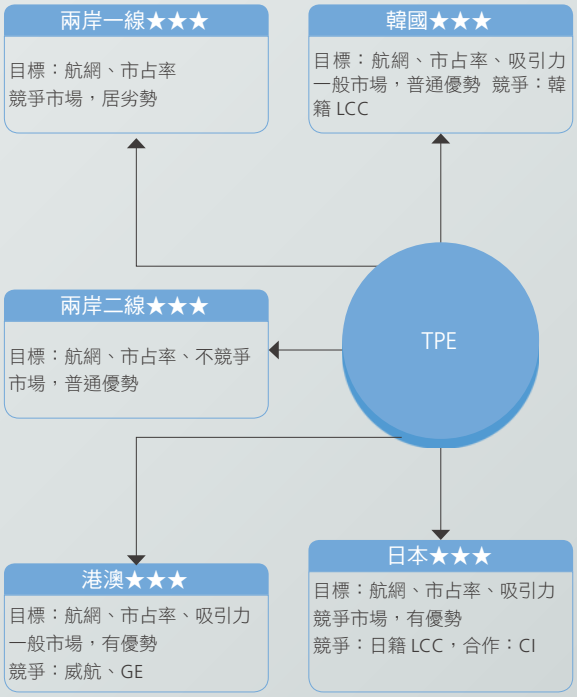
復興航空 TransAsia Airways



遠東航空 Far Eastern Air Transport



臺灣虎航 Tigerair Taiwan



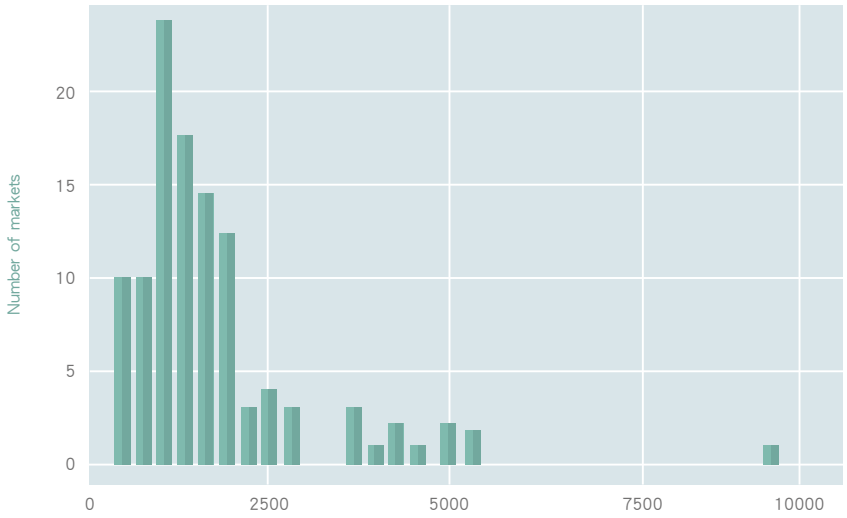


圖 4-22　國籍航空公司國際暨兩岸航空市場集中度分布

Figure 4-22　Taiwan Registered Airlines' International and Cross-strait Market Concentration Distribution

圖 4-23　國籍航空公司國際暨兩岸航空市場集中度分布：依區域分

Figure 4-23　Taiwan Registered Airlines' International and the Cross-strait Market Concentration Distribution by Regional Division

表 4-3　策略方案與建議作法

Table4-3　Strategies and Suggestions

策略 Strategy	方案 Scheme	效益評估 Benefit Evaluation				
		業者 Industry			消費者 Consumer	
		航網規模 Air network scale	市場占有率 Market share	規模經濟 Economies of scale	航空票價 Air fare	旅運便利性 Travel convenience
國際市場競爭 Competition in the international market	市場開放—低成本航空公司加入 Open up market - for low cost carriers to enter	★	★★	★	μμ ★	★
	市場開放—傳統航空公司加入 Open up market - for legacy airlines to enter	★★	★	★	★	★★
	市場區隔—建置第二營運基地 Market segmentation - build the second operation base	★★	★★	★★	★★	★★
	國際聯盟—引入第三國際聯盟 Airline alliance - introduce the third airline alliance	★★★	★★	★★	★★	★★★

註：★表示正面效益　▼表示負面效益

Note: Represents positive benefit　▼ Represents negative benefit

策略 Strategy	方案 Scheme	效益評估 Benefit Evaluation				
		業者 Industry			消費者 Consumer	
		航網規模 Air network scale	市場占有率 Market share	規模經濟 Economies of scale	航空票價 Air fare	旅運便利性 Travel convenience
國籍航空合作 Cooperation among Taiwan-Registered Airlines	營運合作—航材共同備用 Operation cooperation - reserve common aviation materials	★	★	★★	★	★
	營運合作—修護工廠共營 Operation cooperation - co-run aircraft maintenance laboratories	★	★	★★★	★	★
	公司合併—跨集團公司間 merger of corporate groups	★★	★★★	★★★	▼▼	★★
	公司合併—母子公司間 merger of parent company and its subsidiary	★	★	★★◎	▼	★★◎
	公司合併—國內航線業者間 merger of domestic airlines	★	★	★★★	▼	★

（二）港灣壓艙水管理之內國法化探討 - 港域環境的守門員

1. 壓艙水公約規範及現狀

船舶不當排放壓艙水而導入之外來生物種，對於目的地海域之生態環境及人類健康可能造成重大的威脅，並進而導致經濟上之嚴重損失。此一問題已引起國際社會高度重視，因此國際海事組織（International Maritime Organization, IMO）已於 2004 年通過了《國際船舶壓艙水及沈積物控管公約》（International Convention for the Control and Management of Ships' Ballast Water and Sediments, BWM 公約），以作為國際間維護海域資源免於受到外來生物種侵害的共同法源依據。此公約本文有 22 條，包括一般性的法律條款以及壓艙水管理上的技術性條款，且有附則 A 至 E 五件，涵蓋船舶管理和控制、壓艙水管理的標準、及檢驗與發證要求等細則；此外，IMO 亦制定有關壓艙水技術指導之規範 14 項。BWM 公約中關於壓艙水管理之核心規定為附則 D 中之壓艙水管理的標準，D-1 標準規定壓艙水大洋更換標準，船舶原則上應在距離最近陸地至少 200 海浬和水深至少 200 公尺以上的位置依公約規定進行壓艙水交換。D-2 標準則為處理過後壓艙水排放之性能標準，各項指標生物如霍亂弧菌、大腸桿菌、腸球菌等須符合規定之濃度。依公約之設計，D-1 之換水標準要求僅是過渡措施，各船舶依其建造日期及壓艙水櫃容積，有不同之逐步實施 D-2 標準之期程；待進入 D-2 標準後，船舶都需安裝 IMO 認證之壓艙水處理設備方能於處理後排放。依公約現行規定，在 2017 年過後締約國之所有船舶皆須符合 D-2 標準，然而因公約目前尚未生效，IMO 正研擬將全面實施 D-2 標準之期程向後延展五年至 2022 年。

(2) Investigation on Institutionalizing Harbor Ballast Water Management-A Harbor Environment Keeper

A. The Ballast Water Management Convention and Present Situation

Ships improperly discharge ballast water which can carry exotic organism species and possibly expose major threats to the destinations' ecological marine environment and human health, consequently leading to serious economic losses. This problem has already stirred the international community's serious attention. In 2004, the International Maritime Organization (IMO) adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) to serve as the international common legal basis for protecting the marine resources against the invasion of exotic species. There are 22 articles in the convention; they include general legal provisions and technical terms for ballast water management. In addition there are 5 Regulations (A to E) in the Annex of the convention covering ship management and control, standards for ballast water management, inspection and certification requirements, and other rules. Moreover, the IMO also drew up 14 Guidelines about ballast water technical-issues. In the BWM Convention, the core requirements for ballast water management are in the Regulation D "Standards for Ballast Water Management". D-1 regulation spells out the ballast water exchange standards. In principle, ships should conduct ballast water exchange at least 200 nautical miles away from the nearest land and water depth at least 200 meters, according to the convention's regulations. D-2 regulation is about ballast water performance standard after treatment. Indicator microbes such as Vibrio cholerae, Escherichia coli and Enterococci shall comply with the specified concentrations listed in the provisions. According to the design of the convention's D-1 regulation, the ballast water exchange standard is only for transitional measures. Each ship according to its date of construction and the volume of its ballast water tank has different stages of implementation of D-2 standards. According to the D-2 standards, ships are required to install IMO certified ballast water treatment equipment, and to discharge ballast water after the treatment. According to the present provisions of the convention, after 2017 all the ships from the contracting party have to comply with D-2 standards. The convention, however, is not yet in effect. The IMO is presently working on extending the deadline of fully implementing D-2 standards by five years, i.e. 2022.

From June 1, 2004 to May 31, 2005 the convention was open for countries to sign at the headquarters of the IMO. When it reaches above 35% of the total world merchant shipping tonnage, and after at least 30 countries have signed, ratified, accepted and approved it, the convention will enter into force after 12 months. Until December 8, 2014, there were about 43 countries which had signed and the shipping capacity occupied about 32.54% of the total shipping tonnage. Therefore, it can be expected for the convention to take effect soon. In fact, at this stage, the convention has not yet entered into force; however, several countries

本公約自 2004 年 6 月 1 日起至 2005 年 5 月 31 日在國際海事組織總部開放供各國簽署，之後繼續開放供各國加入，且將在世界商船總噸位 35% 以上，且至少 30 個國家簽署、批准、接受、核准後，即可於 12 個月後正式生效，截至目前為止（2014 年 12 月 8 日）已有 43 個國家簽署，總噸位占 32.54%，因此本公約之生效應是指日可待之事。事實上，在 BWM 公約尚未生效的階段，若干國家如美國、澳洲及日本等國，在其國內即已針對壓艙水管理制定有相關法規。由此可見，船舶壓艙水管理法制化已屬國際間之趨勢，即使台灣未能成為 BWM 公約的締約國之一，但一方面由於台灣經濟貿易高度仰賴船舶運輸，另一方面台灣港口與近岸水域確實亦存在著外來生物種入侵之風險，因此在我國如何將壓艙水管理予以法制化乃屬刻不容緩之課題

2. 各國執行方式

目前公約雖尚未生效，然而已有相當多的國家依公約 D-1 標準之精神，訂定國內法進行國內之壓艙水管理，如阿根廷、澳大利亞、巴西、加拿大、智利、喬治亞、以色列、韓國、立陶宛、紐西蘭、挪威、秘魯、俄羅斯、烏克蘭、英國、及美國等 16 國，皆要求船舶進港前壓艙水需進行大洋交換，以防止外來種入侵。上述國家中僅巴西、加拿大、韓國、紐西蘭、俄羅斯等 5 國有簽署 BWM 公約，其餘如美國、澳洲等 11 國雖尚未簽署公約，卻因國內有明確嚴重之壓艙水導入外來種案例，已以嚴格之國內法保護本國之海域生態系統，更有甚者如巴拿馬，雖然未簽署公約，卻以超越公約要求之方式，規定巴拿馬境內之船舶嚴禁排放壓艙水。在壓艙水處理後排放水之 D-2 標準部分，由於目前公約尚未達法定生效門檻，國際上僅有美國家開始針對新造船及部分現有船舶執行 D-2 標準，所有船舶在 2016 年 1 月 1 日起，進入美國時皆須符合公約之 D-2 標準。

以美國為例，在壓艙水管理的執行方式上有兩個最重要的權責機關：美國海岸防衛隊（United States Coast Guard, USCG）以及壓艙水管理專責小組（Task Force）。後者係由多個平行的政府機關首長或高階行政官員協力共同構成，包括美國漁類及野生動物管理局（United States Fish and Wildlife Service, USFWS）、陸軍部工兵署土木工程部、商務部大氣海洋局（National Oceans and Atmosphere Administration, NOAA）、農業部、環境保護局（Environmental Protection Agency, EPA）及 USCG 的重要負責人。從美國的執行方

such as the United States, Australia and Japan have already domestically implemented relevant regulations related to ballast water management. This shows it is the international trend to institutionalize ship's ballast water management. Despite the fact that Taiwan could not be one of the contracting parties for the BWM Convention, as Taiwan's economic trade is highly dependent on ship transportation, and indeed there is an existing risk of alien species invasion, determining how Taiwan can institutionalize ship's ballast water management, is therefore an urgent task.

B. BWM Implementation Approaches by Various Countries

Despite the fact that the convention is not yet in effect, many countries have already adopted the convention's D-1 regulation to institutionalize ballast water management domestically, such as Argentina, Australia, Brazil, Canada, Chile, Georgia, Israel, South Korea, Lithuania, New Zealand, Norway, Peru, Russia, Ukraine, the United Kingdom and the United States. All of these countries request that ships conduct ballast water exchange at sea before entering their ports to prevent the invasion of alien species. Only five countries: Brazil, Canada, Korea, New Zealand and Russia have signed the BWM Convention among the above listed countries. The rest, such as the United States and Australia have not yet signed the convention. However, as there are clearly severe cases of alien species invasion caused by discharging ballast water in their territorial sea, they have implemented strict domestic laws to protect their countries' marine ecosystems. What is more, Panama, even though it didn't sign the convention, goes beyond the requirements of the convention and strictly prohibits ships from discharging ballast water in Panama's canal. Regarding the D-2 regulation-ballast water performance standards after treatment, as presently the convention has not yet reached its threshold to be legally in force, internationally, only the United States has begun to enforce D-2 standards on newly constructed ships and some existing ships. Starting January 1, 2016 all ships must comply with the convention's D-2 standards when entering United States.

In case of America, there are two critical authorities in implementing ballast water management: the United States Coast Guard (USCG) and the Ballast Water Management Task Force. The latter consists of many executives at the same level from government agencies or higher levels of the administrative officers, including the United States Fish and Wildlife Service (USFWS), the United States Army Corps of Engineers (USACE), the National Oceans and Atmosphere Administration (NOAA), the Department of Agriculture, the Environmental Protection Agency (EPA), and the commander from the USCG. The execution approach of the USA shows that it defines, through the laws which confirm and are clearly stated, that ballast water management involves the specifications from numerous authorities and agencies. The laws further identify and integrate the tasks that all the authorities and agencies are responsible for. The Ballast Water Management Task Force is responsible for front end research and evaluation of ballast water, as well as conducting researches on methods of preventing alien species

式上可知，美國乃是透過法律明文規定的方式，確認壓艙水管理乃涉及眾多權責機關之規範事項，並進一步將所有權責機關之所應負責之工作事項予以確定與整合。美國壓艙水管理專責小組負責的工作事項主要為壓艙水的前端研究與評估，並負責研究出遏止外來種在美國國境散佈之方法，同時在壓艙水管制的相關事務上作為 USCG 首長的諮詢或共同執行單位，而 USCG 首長除了和專責小組共同進行前端研究調查外，還需要再諮詢過專責小組的前提下制定出管理壓艙水之辦法與標準。

美國依《國家入侵物種法》另制定有《壓艙水處理辦法》以作為具體實施壓艙水管理的法源依據，其對於船舶壓艙水的處理要求主要有二：1. 船舶得在專屬經濟海域（EEZ）外之水體進行壓艙水交換，且是在距離岸邊至少 200 海浬，水深至少 200m 之處進行，並須符合法定之排放標準。2. 亦得透過安裝及操作經過海岸巡防局認可之壓艙水管理系統（ballast water management system, BWMS）進行處理，以符合法定排放標準。此外，美國在州政府層級上，有五州對於壓艙水問題訂出州法，以保護本州水域生態不受其他州之外來物種侵襲。台海兩岸之間國與國間之定位不明，在一中各表或是一個中國前提下，其實是可仿效美國州與州之間的管理模式，針對台海兩岸生態系統有顯著差異之事實，制訂兩岸間往來船舶之壓艙水管理事項。

3. 我國目前各權益關係人意見

與壓艙水管理相關之權益關係人分別為政府公部門、航運公司、船舶設備產業、及其他民間環保團體與學術界等外部機構，公部門中包括交通部航港單位、國營港務公司、環保單位，屬於對壓艙水管理具有直接影響者，包括相關法規之制定與執法；航運公司主要為國內各航商，屬於將受到壓艙水管理規範直接影響者。目前國內對壓艙水管理並未有較強之反對聲音，普遍認壓艙水管理為未來之趨勢，即使是未來將因壓艙水管理而受直接影響之航商，亦認為生態保護極為重要，且我國航商船舶遍及世界各地，當國外普遍採用壓艙水公約之管理方式時，台灣在壓艙水管理須符合國際情勢，且為了保護本國海域生態系統及早將公約精神國法化。

針對公部門部分，針對未來公約如何適用及修法因應，權責機關間主導與配合、機關協力等尚有疑慮（詳於下節）。直接受規範管理之航商，則對壓艙水管理之核心規定 D-1 及

from spreading along the territory of the USA. Meanwhile, it serves as a consultative advisory body in ballast water management-related matters for the USCG executive, or as a partner of the execution unit. The USCG executive, other than conducting the front end research together with the Task Force, works out the methods and standards of ballast water management based on consultation with the Task Force.

Based on the "National Invasive Species Act", America also lays down the "Ballast Water Management Requirements" as the legal basis for effectively executing ballast water management. Its requirements for the ballast water treatment mainly focus on two concerns: 1. ships should conduct ballast water exchange outside the exclusive economic zone (EEZ), at least 200 nautical miles from the nearest land and in water at least 200 meters in depth, while also having to comply with the legal ballast water treatment standards. 2. Ships also have to install the ballast water management system, BWMS that is certified by the United States Coast Guard, and perform the ballast water treatment to comply with the legal ballast water treatment standards. At the state level of the US state governments, 5 states have introduced state laws to address ballast water problems to protect their aquatic ecological environment against alien species invasion from other states. The national status of Taiwan is ambiguous from the cross-strait, regardless of status as one China with different interpretations, or as one China. The models of state to state in America can indeed be emulated to address the situations which exist significant differences in the cross-strait ecological systems in fact. The regulations on the cross-strait ships' ballast water management have to be lay down at once.

C. Present Sentiment of the Stakeholders in Taiwan

The stakeholders related in the task of ballast water management are the government departments, shipping companies, the ship equipment industry, other civil environmental groups, academia, and other external agencies. The public sector that has direct impact on ballast water management includes: the Maritime and Port Bureau, MOTC; Taiwan International Ports Corporation, Ltd.; Environmental Protection Units, as well as the units that implement and enforce the relevant laws and regulations.

The shipping companies refer to the domestic commercial shipping carriers, a group upon which the regulations of the ballast water management have a direct impact. Presently there is no strong voice against the ballast water management in Taiwan. Most believe that ballast water management is the future trend. Even the carriers that are going to be subject to the regulations of the ballast water management consider that the ecological protection is very important. Taiwan's merchant fleets travel all over the world. When most countries adopt the ballast water management standards of the convention, Taiwan's ballast water management must comply with

D-2 標準，有較大之歧見。一般認為可依公約設計的循序漸進時程，先進行 D-1 標準管理再進行 D-2 管理，因為目前國際間大致上一依循此模式規範壓艙水，大型航商在世界各國航運早已受到部分國家之 D-1 標準管理，且為了未來即將上路之 D-2 標準，目前國內之新造船大致上皆預定安裝 IMO 認證之壓艙水處理設備。部分航商甚至考量台灣立法之速度緩慢費時，建議可擱置 D-1 標準而直接採用 D-2 標準。然而，規模較小之航商認為現有船舶加裝壓艙水設備以符合 D-2 標準是沉重之經濟負擔，建議現階段執行 D-1 標準即可。由於台灣非聯合國會員國無法簽署公約，然而我國對國際公約一向採取自願性遵守之方式。未來在有必要的情形下，仍可繼續沿用壓艙水交換區域管理模式而不受公約 D-2 標準之約束。現階段台灣僅執行 D-1 標準而 D-2 標準部分未來考量我國之最大利益再作決定，是值得我國深思的因應模式。國際上部分與我相同之非締約國如澳洲，因不受公約拘束，目前皆採取此觀望模式，然而未來公約生效後，這些目前僅執行 D-1 標準之非締約國，是否會簽屬公約或進一步執行 D-2 標準，是我國未來在擬定管理標準時需密切注意的。

the international standards. Moreover, to protect Taiwan's marine ecosystem, the standards of the BWM Convention should be domestically institutionalized as soon as possible.

As for the public sector, how it applies and revises the current laws to cope with the convention in the future, how authorities lead and fit in with each other, and how organizations coordinate with each other on the related matters, raise doubts (the details are discussed in the next section). The shipping carriers that are directly regulated uphold great differences in the D-1 and D-2 standards of the core regulations of ballast water management. Most favor following the convention's step by step schedule, first to comply with D-1 regulations and then to the D-2, as most countries generally adhere to the BWM Convention's schedule and regulations. Large shipping carriers in their international routes have already been subjected to D-1 regulations by some countries and will need to comply with D-2 standards in the future.

Presently, ships that are domestically built are generally scheduled to install the IMO certified ballast water management system equipment. Some shipping carriers even consider that the speed of the legislation in Taiwan is slow and time-consuming. They suggest skipping D-1 standards and directly adopting D-2 standards. However, smaller scale shipping carriers think it is a heavy economic burden to install ballast water management equipment that complies with D-2 standards in the current ships and prefer to just implement D-1 standards at the present stage.

Due to Taiwan not being a member of the UN, it is unable to sign the convention. However, Taiwan has always adopted a voluntary compliance attitude towards international conventions. In the future, when it is necessary, it can continue to use the ballast water exchange zone's management approach without being subject to the restrictions of the D-2 standards of the convention. At the present stage, they suggest Taiwan only implements D-1 standards. As for the D-2 standards, the government would decide after considering the maximum interests for Taiwan. This is a valuable approach for Taiwan to address the issues. Internationally, Australia, which is not a contracting party like Taiwan, and is not restricted by the convention, takes a wait and see attitude at present. However, in the future, after the convention takes effect, whether countries that are currently implementing D-1 standards, but are not contracting parties, will sign the convention or move forward to implement D-2 standards, Taiwan needs to pay close attention to this matter when drafting the BWM management regulations in the future.

4. 我國相關法制現狀

船舶不當排放壓艙水而導入之外來生物種，對於目的地海域之生態環境及人類健康可能造成重大的威脅，並進而導致經濟上之嚴重損失，因此簡單言之，亦即船舶排放具有生物性污染之物質而導致海洋環境品質遭受減損。就此一問題之解決而言，現行法規當中最直接相關者，即屬《海洋污染防治法》中第六章「防止船舶對海洋污染」之相關規定。

在相關規定當中，最核心規定即屬第 29 條第 1 項，其規定「船舶之廢、污、水、油、廢棄物或其他污染物質，除依規定得排洩於海洋者外，應留船上或排洩於岸上收受設施。」就此規定而言，如果適用範圍包括船舶壓艙水的話，則原則上可以依據此一規定，並透過相關子法之擬定，要求船舶必須符合相關規定方得排洩於海洋，或命其應留於船舶上或依規定排洩於岸上收受設施。因此，《海洋污染防治法》能否用以作為壓艙水管理之法源的關鍵點乃在於第 29 條中所謂之「其他污染物質」在解釋上是否亦包含壓艙水在內。就此而言，有權解釋之中央主管機關行政院環境保護署，似乎擔心若將前述之「其他污染物質」解釋為包含船舶壓艙水，則自己將同時成為船舶壓艙水管制之主管機關，而始終堅持反對的立場。

然而事實上，鑑於航政主管機關較能勝任船舶污染管理之任務，《海洋污染防治法施行細則》第 19 條即規定：「本法第二十六條有關設置船舶防止污染設備、第二十七條有關船舶對海洋環境有造成污染之虞者之認定、第二十九條有關船舶之排洩及第三十條所稱船舶之適當防制排洩措施，依船舶法、商港法及航政主管機關之相關規定與國際公約或慣例辦理。」因此，即便將第 29 條中所謂之「其他污染物質」解釋亦包含壓艙水在內，則進一步亦是由航政主管機關依據交通部所主管之法規例如《船舶法》及《商港法》等更進一步具體的規定，進行規範與管制，實無須過度擔憂。

D. The Current Situation of Relevant Legal system in Taiwan

Improperly discharged ship's ballast water could carry exotic organism species and possibly impose severe threats to the destinations' marine ecosystem and human health, consequently leading to serious economic losses.

To put it simply, ships may discharge ballast water that contains substances of biotic pollution which are detrimental to the quality of marine environment. To solve this problem, Chapter 6 of the Marine Pollution Control Act, the Prevention of the Pollution of the Sea by Ships, is the most relevant provision within the current laws and regulations system.

The core of the related provision is the first paragraph of Article 29, which stipulate "The wastewater or sewage, oil, waste and other polluting substances of a ship shall remain on board or be emitted into on-shore reception facilities with the exception of those circumstances in which it may in accordance with the law be emitted into the sea." According to this Article, if it is applicable to ballast water, in principle, the competent authority could under the authorization of this provision draft related subordinated regulations laws to require ships to discharge ballast water into the sea only when the ballast water treatment complies with the related regulations or to remain on board or be emitted into on-shore reception facilities in accordance with provision. Therefore, whether the Marine Pollution Control Act can be the legal basis of ballast water management, the key point depends on the interpretation of "other polluting substances" in Article 29, i.e. whether its covers ballast water. As to this dispute, the Environmental Protection Administration, Executive Yuan hereafter as "EPA" , as the Central authorities which reserves has the authority to interpret the Marine Pollution Control Act, seems to worry if the term of "other polluting substances" were interpreted as including ballast water, EPA could have to be in charge of the ballast water management. Thus, it EPA has always stuck to the stand of the opposition.

In fact, the navigation competent authority is more competent to deal with the ship pollution management task. Article 19 of the Marine Pollution Control Act Enforcement Rules prescribes "Matters related to the installation of shipboard pollution prevention equipment in Article 26 of this Act, the determination of the concern of pollution of the marine environment by ship in Article 27, emissions from ships in Article 29, and the appropriate measures for the prevention of emissions from ships referred to in Article 30 shall be handled pursuant to the Ship Act, Commercial Port Act and relevant regulations of the navigation competent authority, or in accordance with international conventions and customary practice." Therefore, Insofar, even the interpretation of term of "other polluting substances" in Article 29, cover ballast water as well, the aforementioned concern of EPA seems to be not necessary. Because, the navigation competent authority is still in charge of implementation of the related laws and regulations supervised by the Ministry of Transportation and Communications, such as the Ship Act, and the Commercial Port Act etc.

然而，值得注意的是，基於以下兩項因素在領海以外指定壓艙水交換區以及公告壓艙水更換標準仍有其必要。首先，儘管依公約現行規定，在 2017 年過後締約國之所有船舶皆須符合 D-2 標準，然而因公約目前尚未生效，IMO 正研擬將全面實施 D-2 標準之期程向後延展五年至 2022 年。因此在 D-2 標準正式全面實施之前，D-1 仍有過渡實施之必要。其次，就目前兩岸之法律關係而言，兩岸船舶並非涉及國際船舶之管理，且往返兩岸之船舶多數非屬大型船舶或隸屬大型船商之船舶，就實際層面來看恐難以期待能全面符合 D-2 標準，因此若無壓艙水交換區之指定公告相關法源的華，未來將可能造成管理上之漏洞，隨著兩岸往返船舶頻繁，此一問題實不可小覷。

而壓艙水交換區之指定與更換標準之公告皆已超出商港或船舶本身的管制範圍，因此已無法僅透過交通部所主管之法規例如《船舶法》及《商港法》作為規範依據，相反地，必須回到《海洋污染防治法》進行修法方能使壓艙水管理法制趨於完備。此觀《海洋污染防治法》第 2 條即可自明，其規定「本法適用於中華民國管轄之潮間帶、內水、領海、鄰接區、專屬經濟海域及大陸礁層上覆水域。於前項所定範圍外海域排放有害物質，致造成前項範圍內污染者，亦適用本法之規定」。然而，所謂「有害物質」依據《海洋污染防治法》第 3 條第 1 款之定義，係指「依聯合國國際海事組織所定國際海運危險品準則所指定之物質」。因此，若無透過修法將「有害物質」擴大定義，使其亦包含船舶壓艙水的話，則將導致 D-1 無法有法源依據。

如前所述，依據《海洋污染防治法施行細則》第 19 條之規定，有關船舶造成海洋污染之認定及排放限制等，乃依「船舶法、商港法及航政主管機關之相關規定與國際公約或慣例辦理。」而《商港法》第 38 條第 1 項「商港區域內，船舶之廢油水、廢棄物或其他污染物質，應留存船上或排洩於岸上收受設施。」，因此可以透過「其他污染物質」此一「不確定法律概念」的解釋，將壓艙水納入此處之「其他污染物質」，即可透過現行法規加以管制。再者，對於壓艙水處理設備，可在《船舶法》中與船舶設備相關的章節增修條文；對於抵港前壓艙水資料申報。

However, based on the following two factors, it is remarkable that it is necessary to announce the ballast water exchange zone outside the territorial waters and ballast water replacement standards. Firstly, even though in accordance with the current provisions of the convention, after 2017, all the ships from the contracting party will have to comply with D-2 standards; the convention is not yet in effect. The IMO is presently working on extending the deadline for fully implementing D-2 standards by five years, to 2022. Therefore, before the D-2 standards are officially fully implemented, D-1 regulation is necessary for transitional measures. Secondly, on the aspect of current legal cross-strait relations, the ships of the cross-strait are not subject to international ship management, and the majority of the ships that shuttle across the strait are not large ships, nor do they belong to large commercial shipping carriers. From a practical viewpoint, it is difficult to rightly expect that all ships can fully implement D-2 standards. Thus, without the related legal announcement about the ballast water exchange zone, in the future, it will likely result in loopholes in the management. As ships frequently travel across the strait, this problem indeed should not be overlooked.

However, the tasks of designating the ballast water exchange zone and specifying ballast water exchange standards are all beyond the competence of commercial ports or ships' control. Those tasks cannot only be completed based on the laws and regulations supervised by the Ministry of Transportation and Communications, such as the Ship Act and Commercial Port Act. Contrarily, the government must go back to the Marine Pollution Control Act and try to amend the law in order to make the legal system infallible in the ballast water management area. This view can be confirmed by Article 2 of the Marine Pollution Control Act which stipulates "This Act shall apply to the intertidal zones, internal waters, territorial seas, contiguous zones, exclusive economic zones and waters superjacent to the continental shelf under the jurisdiction of the Republic of China. This Act shall also apply to those circumstances in which the discharge of hazardous substances in marine areas outside of the areas designated in the foregoing paragraph causes pollution within the areas designated in the foregoing paragraph." However, the so-called "hazardous substances" in accordance with section 1, Article 3's definition, refer to "a substance designated in accordance with the International Maritime Dangerous Goods Code determined by the United Nations International Maritime Organization." Therefore, if the government is unable to amend the law to broaden the definition of "hazardous substances" to include ship's ballast water, it will result in D-1 standards lacking a legal basis.

As mentioned above, according to Article 19 of Marine Pollution Control Act Enforcement Rules, the determination of the concern of pollution of the marine environment by ships and their emission limits "shall be handled pursuant to the Ship Act, Commercial Port Act and relevant regulations of the navigation competent authority, or in accordance with international conventions and customary practice." In the first paragraph of Article 38, the Commercial Port Law prescribes "Waste oil, waste, or other pollutants of ships within the commercial port area should be kept on the boat or emitted into the reception facilities on shore." Thus, through this "indefinite law concept" the government could classify ballast water as "other pollutants"; BWM can then be controlled by current regulations. Furthermore, regarding ballast water treatment equipment, the government could add or amend the article content in the ship equipment-related articles of the Law of Ships to request a ballast water data declaration before reaching the ports.

5. 修法方向建議

由於商港法已有管制污染的條文，故不須對法令進行修正，但仍有必要對《商港法》與《商港港務管理規則》的條文內容作出解釋和增訂，以把壓艙水包含在污染物中並增設處理壓艙水的辦法。亦即將《商港法》第 37 條第 1 款：「商港區域內，不得為下列污染港區行為：一、船舶排洩有毒液體、有毒物質、有害物質、污油水或其他污染物之行為。」中之有害物質解釋為：「依聯合國國際海事組織所定國際海運危險品準則所指定之物質，及未依法處理之船舶壓艙水。」。而為了讓壓艙水管理法制具有一致性，作為海洋污染防治一般法的《海洋污染防治法》亦應同步地在第 3 條第 1 款的有害物質之定義修正為「依聯合國國際海事組織所定國際海運危險品準則所指定之物質，及未依法處理之船舶壓艙水」。

屬於《商港法》第 19 條之相關子法的《商港港務管理規則》第 3 條，亦增訂要求入港船隻提供壓艙水紀錄等，以了解船隻在航線上排放和汲取壓艙水的情形，而提供資料的相關內容與形式則由《商港法》的主管機關提出並公布。

與《船舶法》第 24 條相關之子法《船舶設備規則》亦應進行增列規範內容，亦即《船舶設備規則》第 172 條中的防止污染設備上應該增列壓艙水處理設備，同時在《船舶設備規則》第五編防止汙染設備下，增設關於壓艙水處理設備的相關規定。第 174 條中增列壓艙水處理設備之定義：「十四、壓艙水處理設備：指處理上述三種壓艙水中所夾帶之外來種和有害微生物之設備。」第 216 條建議修正為：「油輪符合海水污染管理規則…應符合下列之規定：一、在港口或離岸終端站所排洩者為依法處理過之隔離壓艙水或清潔壓艙水。」

E. Suggestions on the Direction of Amending the Laws

As the Commercial Port Law already has articles to deal with pollutants, there is no need to conduct amendments to the law. However, interpretations and addenda to the article contents of the Commercial Port Law and the Regulations on Port Services at Commercial Ports are still necessary to include ballast water in the "other pollutants", and to add ballast water treatment methods to the articles. Also in the first paragraph of Article 37, the Commercial Port Law prescribes "The following acts that pollute the commercial port are prohibited within a commercial port area: 1. Ships that emit toxic liquids, toxic substances, harmful substances, sewage, oil and water or other contaminants." The "harmful substances" here need to be defined as "a substance designated in accordance with the International Maritime Dangerous Goods Code determined by the United Nations International Maritime Organization and ship's ballast water that has not been handled according to the laws." In order to be consistent in the legal system concerning ballast water management, the general Marine Pollution Control Act needs to simultaneously revise its first paragraph of Article 3 to amend the definition of hazardous substance to "a substance designated in accordance with the International Maritime Dangerous Goods Code determined by the United Nations International Maritime Organization and ship's ballast water that has not been handled according to the laws."

Article 3 of the Regulations on Port Services at Commercial Ports, the subordinated law of Article 19 of the Commercial Port Law, needs to be revised to request ships to submit ballast water records before entering the ports to find out how ships derive and discharge ballast water during their routes. The contents and the format of the declaration are determined and announced by the authority of the Commercial Port Law.

The Regulations on Equipment of Ships, the subordinated law of Article 24 of the Law of Ships, also needs to revise its article content in its Article 172 to add ballast water treatment equipment in its pollution prevention equipment. In additional, in Part 5: pollution prevention equipment of the Regulations on Equipment of Ships, the related provisions for ballast water treatment equipment need to be added. In Article 174 the definition of ballast water treatment system needs to be prescribed as "14. Ballast water treatment equipment refers to the equipment that handles the abovementioned 3 types of ballast water which contain exotic species and harmful microorganisms." Regarding Article 216, it is suggested to be revised as "ships which comply with the Regulations for Administrating the Pollution of the Sea... shall meet the following requirements: 1. Ballast water that is discharged at ports or offshore terminal stations is the treated isolated ballast water or clean ballast water."

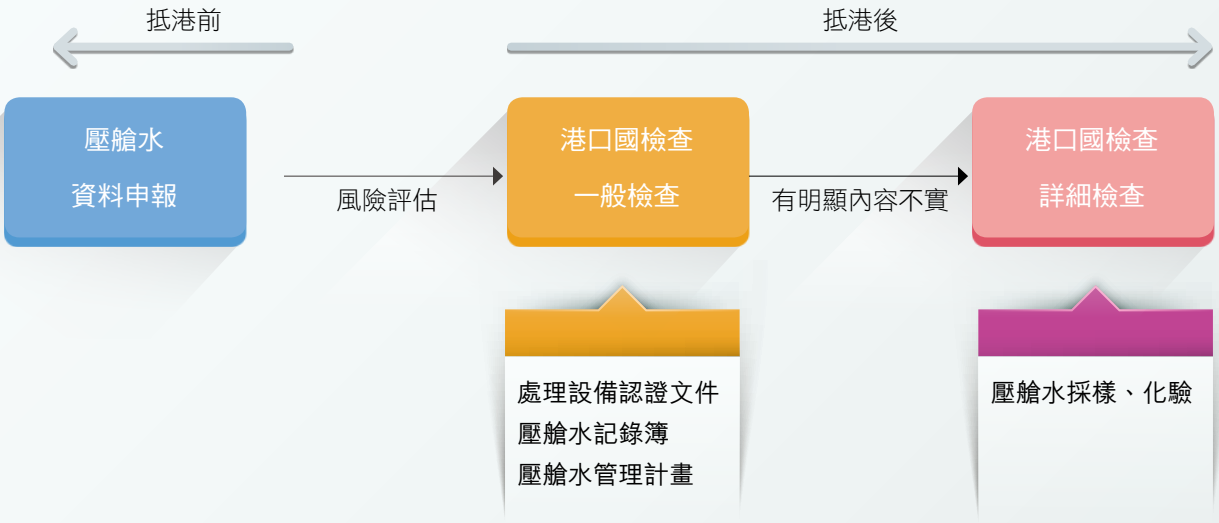
最後如前所述，基於壓艙水管理法制之完整性，以及相關法制上的一致性，建議除了解釋《商港法》與《船舶法》外，還要修正《海洋污染防治法》才能使壓艙水的管制臻於完善。除了《海洋污染防治法》亦應同步地在第 3 條第 1 款的有害物質之定義修正為「依聯合國國際海事組織所定國際海運危險品準則所指定之物質，及未依法處理之船舶壓艙水」之外，亦應增訂公告壓艙水交換區與更換標準。

6. 壓艙水管理與執行方式

壓艙水管理流程示意圖如圖 4-24 所示，可區分為船舶進港前之壓艙水相關資料之申報，及進港後之港口國檢查。我國目前可依商港法，在現有之「船舶入港或出港預報表」中增加壓艙水管理相關之申報項目，則可要求船舶進入國際商港港區 24 小時前，據實填具預報表供主管機關備查。進港之港口國檢查主要以一般之書面檢查為主，即檢查船上是否有壓艙水管理計畫、壓艙水記錄簿、及有效之處理設備證明文件等；若船舶未持有有效證書或有明確證據支持其違反相關規定，則可以根據船舶狀況個別檢驗不符合證書資料的項目；當船長或船員不熟悉壓艙水的管理計畫時，或是也未執行管理計畫，則港口國可以進行詳細且具體的檢查，如採集壓艙水水樣並檢驗是否符合 D-1 標準或 D-2 標準，惟採樣檢驗甚難驗證船舶是否符合 D-1 標準。圖 4-24 之壓艙水管理流程是目前公約所規畫之管理方式，待我國各相關部會釐清權責並修法後，執行上應無太大爭議。

圖 4-24　壓艙水公約規範之壓艙水管理流程示意圖

Figure 4-24　Flow Chart of Ballast Water Management in the Ballast Water Management Convention



Lastly, as mentioned above, based on the integrity of the legal system regarding ballast water management and the consistency of the related laws, it is suggested that other than interpreting the Commercial Port Law and the Law of Ships, section 1 of Article 3 of the Marine Pollution Control Act needs to be revised at the same time; the definition of hazardous substances needs to be revised to be "a substance designated in accordance with the International Maritime Dangerous Goods Code determined by the United Nations International Maritime Organization and ship's ballast water that has not been handled according to the laws." Also the announcement of the ballast water exchange zone and its exchange standards need to be added as well.

F. Ballast Water Management and Implementation Approach

The flow chart of ballast water management is as shown in Figure 4-24. It divides the process into 2 sections: a ballast water-related information declaration before the ship's arrival and the port state control after the ship enters the port. Taiwan presently could follow the Commercial Port Law and add ballast water management- related items to declare in the current "Declaration Form for Ship's Entrance or Departure." Thus it can request ships to fill in the prior declaration form 24 hours before the arrival at international commercial ports for the authorities' reference. The port state control is mainly a paper audit which checks whether there is a ballast water management plan, ballast water record and valid certificates of ballast water treatment equipment. When ships cannot provide valid certificates or show clear grounds of violating relevant regulations, the authorities could inspect the items that do not match the certificate's information individually according to the ship's condition. When ship captains or seafarers are not familiar with ballast water management plans or did not implement the management plan, the port state could conduct a specific comprehensive inspection, such as collecting ballast water samples and testing them to see whether the samples comply with D-1 or D-2 standards. However, sampling inspection is quite difficult to verify whether or not the ship complies with D-1 standards. Figure 4-24, a flow chart of ballast water management, is the convention's present management approach. After all relevant authorities in Taiwan have clarified the responsibilities and amended the laws, there should no longer be any major controversy regarding the implementation.

針對上述壓艙水管理有較大不同見解之核心規定，即 D-1 標準與 D-2 標準之執行期程與規劃，本研究建議如下：

(1) 立即執行 D-1 標準之規定，規定台灣領海內不得排放未交換之高風險壓艙水，即船舶進入領海前需完成壓艙水交換。針對源於台灣東、南、北部的國外航線，可讓船舶自行決定大洋交換之區域；而台灣西部之兩岸航線，由於無法找到距最近陸地至少 50 海里，水深至少 200 公尺的地方進行交換，我國可在台海中線與領海間，尋找與其它海域使用無衝突且海流較強勁處，指定壓艙水交換區。

(2) 在 D-1 標準實施過程中，研究評估其防止壓艙水導入外來種之效率，並留意國際上各國實施 D-2 標準之趨勢，由主管機關就保護台灣海域環境及維護我國商港發展與競爭力，並依國際情勢審慎決定 D-2 標準之實施時間。

7. 結論

依據前述之分析，目前在壓艙水管制上要執行的項目有：

(1)《商港法》之解釋與公告

(2)《船舶法》衍伸的法規命令之修訂與公告

(3)《海洋污染防治法》修法與公告

(4) 壓艙水管理辦法之制定

對《商港法》的解釋可使未經處理的船舶壓艙水列為有害物質，而成為被管制的對象，並禁止其在商港內的排放，同時亦可以透過預報表的設計以了解壓艙水的來源，同時確認船隻是否有依法處理其攜帶的壓艙水。

對《船舶法》衍伸的法規命令之修訂則是針對船隻處理壓艙水設備作出進一步的規制，要求船舶處理壓艙水設備符合一定的規格檢驗，以確保能夠清除壓艙水內所夾帶的外來種生物與微生物。

As there are major differing opinions concerning the core regulations of ballast water management in the views mentioned above, i.e. D-1 and D-2 standards' implementation schedule and planning, this research suggests the following:

(A) Immediately implementing the regulations of D-1 standards, stipulating that it is forbidden to discharge un-exchanged high risk ballast water in Taiwan territorial waters, i.e. ships must complete their ballast water exchange before entering the territorial waters. Regarding the international routes on Taiwan's east, south and north side, ships can decide on the location for their oceanic ballast water exchange. The cross-strait routes on the west side of Taiwan, as it is impossible to find a place that is at least 50 nautical miles from the nearest land and in water at least 200 meters in depth to perform ballast water exchange, Taiwan could designate a ballast water exchanging zone by searching other sea areas that are free of conflicts and possess strong currents.

(B) During the process of implementing D-1 standards, the government could research and evaluate the efficiency of exotic organism species invasion prevention, and pay close attention to the international trend of other countries implementing D-2 standards. With protecting Taiwan marine environment and advancing Taiwan's commercial ports' development and competitiveness in mind, the authorities could prudently decide the D-2 standards implementation schedule according to the international trend.

G. Conclusion

Based on the above analyses, the tasks on ballast water management control that need to be implemented include:

a. the administrative interpretation and public announcement on the Commercial Port Law,

b. the revision and promulgation of the derived laws of the Law of Ships,

c. the revision and promulgation of the Marine Pollution Control Act,

d. the stipulation on the ballast water management approach.

For the interpretation of the Commercial Port Law, the untreated ballast water can be listed and considered as "harmful substances". The government needs to prohibit ships to discharge ballast water within commercial ports; at the same time, through the design of the prior declaration, the authorities could find the source of ballast water while determining whether the ship's ballast water was treated in accordance with the regulations.

但《商港法》適用範圍僅能及於商港內而不能及於商港外，若要對壓艙水管制有一個完善的規劃，勢必得針對《海洋污染防治法》進行修法，使管制範圍能夠擴及我國整體海域，並透過授權制定壓艙水管理辦法以整合相關機關，使其共同合作去達成避免船舶壓艙水破壞我國海域環境這個目標。

總觀三種不同的法令，於壓艙水的管制上《商港法》和《船舶法》的母法上並不需要修正現有的條文，而只須對於現行條文和其衍生出的法規命令，作出解釋與增訂並公告，而在《海洋污染防治法》上則需要修正母法以把壓艙水列入管轄的範圍，故考量到壓艙水公約即將生效，我國必須要擁有針對壓艙水管制法令的現狀以及修法所需要的時間，本研究團隊建議《商港法》和《船舶法》的主管機關應先對這兩條法令以及衍生的法規命令進行解釋與增訂，因為使這兩條法令發揮壓艙水管制的效力並不需要透過修法，而只要由主管機關執行即可生效。而《海洋污染防治法》亦應同時進行修法，以補足《商港法》和《船舶法》在壓艙水管制措施上的不足之處，待《海洋污染防治法》修法完畢後，則根據其授權制定壓艙水處理辦法，使壓艙水管制的分工和各法令間的合作模式更為明確。建議的執行順序流程如圖 4-25。

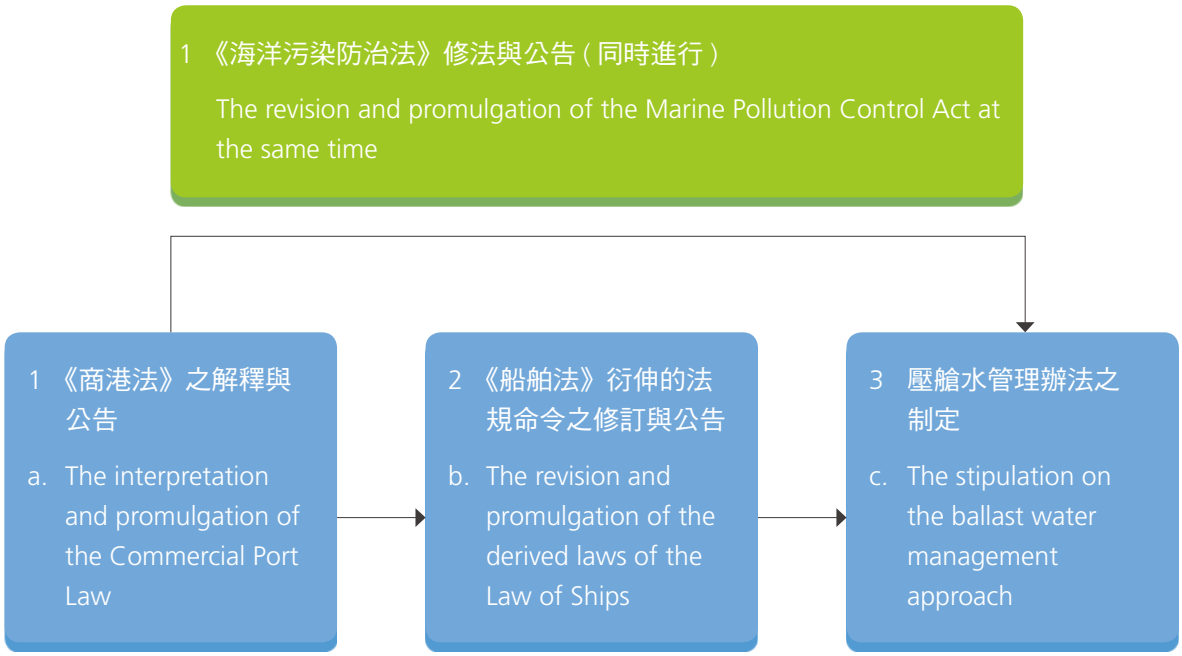


圖 4-25　我國壓艙水修法之建議執行順序流程

Figure 4-25　The Order for Executing the Law Amendments for Ballast Water in Taiwan

As for the revision of the derived laws of the Law of Ships, further regulations are needed for ships' ballast water treatment equipment, to ensure ships' ballast water treatment equipment complies with the standards and specification tests, and to guarantee the ships are capable of removing alien species and microorganisms in the ballast water.

The applicable scope of the Commercial Port Law is limited to commercial ports and not outside of the ports. However, in order to devise an infallible plan in the ballast water management regulations, amending the Marine Pollution Control Act is inevitable. So the control range could be expanded to Taiwan's entire sea area. The authorities could be authorized to stipulate the approach of ballast water management and to integrate the relevant authorities. With the authorities' coordination, the goal of preventing damage to Taiwan's marine environment can be achieved.

Out of these three different laws, the enabling statute of the Commercial Port Law and the Law of Ships do not need to amend their present articles for the ballast water management control. The present articles and their derived laws only need to be interpreted, elaborated and announced. However, the parent law of the Marine Pollution Control Act does need to be amended to include ballast water within its scope of jurisdiction. With the consideration that the BWM Convention will be in force soon, Taiwan must have laws to regulate the current ballast water management and time to revise its laws.

The research team suggests that the authorities of the Commercial Port Law and the Law of Ships first interpret and elaborate the laws and their derived laws, as these two laws could immediately take effect on ballast water control with the authorities' implementation, without amending the laws. At the same time the Marine Pollution Control Act needs to be amended to overcome the insufficiency of the Commercial Port Law and the Law of Ships on the ballast water control measures. After the Marine Pollution Control Act is amended, the authorities need to authorize the authorities to stipulate the approach for ballast water treatment and to clearly define the ballast water control division and cooperation between the authorities, according to the regulations. The suggested order for the execution process is shown in Figure 4-25.

圖 4-26　100 年國內首部電動公車啟用海報

Figure 4-26　Commissioned Poster for the First Electric Passenger Bus in 2011

三、永續運輸

(一)「新一代開啟綠色智慧運輸新紀元 - 電動公車」

世界各國為因應全球環境變遷，減緩溫室氣體排放效應，在政策擬定均著重節能減碳並積極推動相關措施。在交通運具方面，電動車輛具有低污染排放與低噪音之優點，相較於一般使用汽油或柴油的傳統車輛而言，是非常值得推廣的綠色運具。但客運業者對於電動公車之維修成本、電池維護汰換、續航力、以及充電便利性方面等普遍存在疑慮，因此電動車使用率偏低。

公共運輸系統因具有固定的站場、路線、頻率、駕駛群等特性，路權及營運管理受到管制，政策主導性強，推動電動公車可能成為未來各國發展之趨勢，基於環境永續發展及綠色運輸之理念，交通部於 99-101 年公路公共運輸補助計畫中核定部分縣市申請購置電動

3. Sustainable Transportation

(1) Electric Passenger Buses – Actuating a New Era of Green Intelligent Transportation

In response to global environmental changes and the reduction of greenhouse gas (GHG) emissions, numerous countries worldwide have listed energy saving and carbon reduction as core items in policy formulation and are actively promoting relevant measures. In terms of transportation, electric vehicles' (EVs) manifest advantages of low pollution discharge and low noise generation, making them extremely eco-friendly compared to conventional gasoline- or diesel-based vehicles. However, passenger transport providers remain skeptical about the repair costs, battery maintenance and replacement, endurance, recharging convenience, and other factors concerning electric passenger buses (EPBs). Thus, the utilization rate of EVs in this industry is relatively low.

Due to the characteristics of public transport systems, such as fixed stops, routes, frequencies, and driver groups, the right of way and the operation and management (O&M) of such systems are heavily restricted by relevant policies. Subsequently, the implementation of EPBs may become a future development trend. Based on the concepts of environmental sustainability and development and green transportation, the Ministry of Transport and Communications (MOTC) provisioned for the procurement and implementation of EPBs in a number of cities and counties in Taiwan in relevant motorway public transportation subsidization plans between 2010 and 2012, and these EPBs have gradually started O&M recently.. Alternatively, the Ministry of Economic Affairs (MOEA) announced the *Pilot Project for Intelligent Electric Vehicles* in an attempt to enhance industrial competitiveness. The project includes the commissioning of EPBs as urban passenger buses into its scope of guidance and subsidization. Moreover, the Environmental Protection Agency (EPA) also provided subsidies for the implementation of EPBs in a number of cities and counties.

公車，並於近期陸續上路營運管理。另一方面，為提升產業競爭力，經濟部亦推動「智慧電動車先導運行計畫」，並將市區大客車使用電動公車納入輔導補助範圍，而環保署方面，亦有針對部分縣市進行電動公車補助。

於交通部、經濟部、環保署通力推動下，自 2011 年至今已有 100 餘輛電動公車於道路上運行。行政院於 4 月 29 日政務會議訂定 10 年 1 萬輛電動公車的發展藍圖。對既有車輛營運管理績效評估與成本分析，成為未來永續發展的重要關鍵課題。

「公路公共運輸電動客車經營與運作績效調查」透過回顧國內外 EPBs 技術發展以及營運管理概況相關文獻，掌握世界電動公車發展動態，作為我國技術發展參考依據。並針對國內現有營運管理中之電動公車營運管理情形進行量化與質化分析，蒐集車輛實際營運管理妥善情形以及能源使用效率資料，並透過訪談了解產業環境課題。此外，本計畫亦分析電動公車之內外部成本，釐清其成本結構與特性。

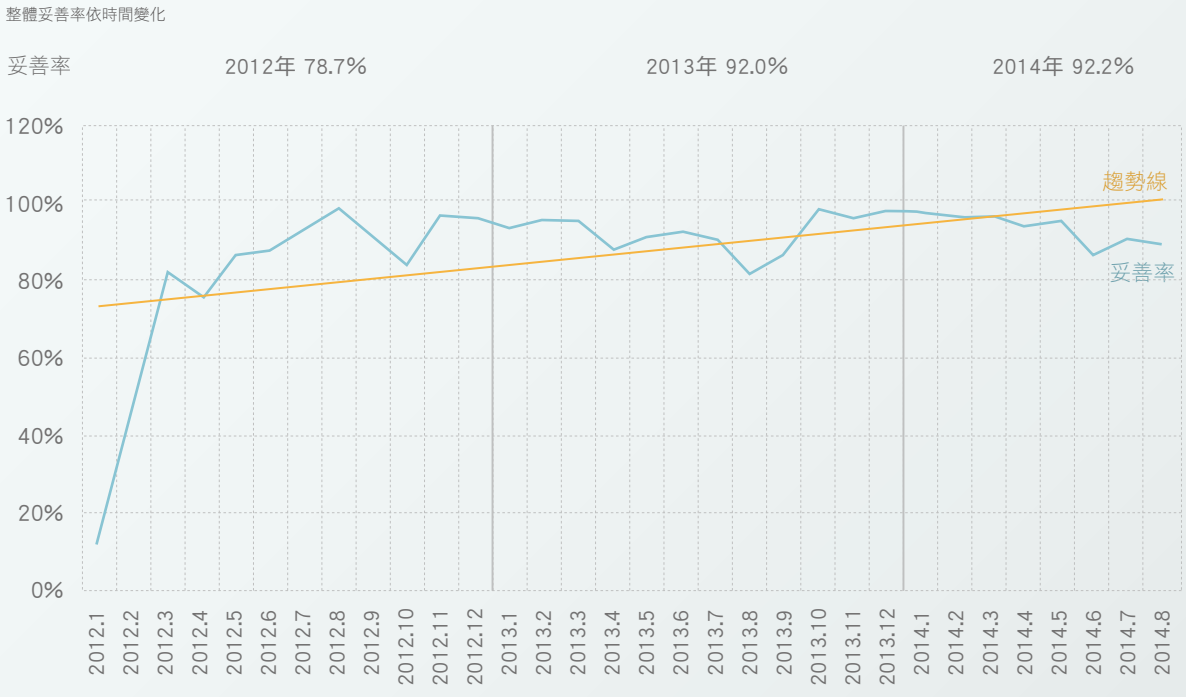


圖 4-27　電動公車整體妥善率趨勢

Figure 4-27　The Overall Availability Trend of Electric Passenger Buses

Under the collective efforts of the MOTC, EPA, and MOEA, roughly 100 EPBs have been commissioned since 2011. In addition, the Executive Yuan announced its commitment to commissioning 10,000 EPBs within the next decade in the Administrative Conference held on 29 April. In this context, assessing the O&M performance of the current EPBs and analyzing expenditures are important aspects for sustainable development.

In the *Survey on the Operation and Management Performance of Public Electric Passenger Vehicles* (hereafter referred to as "the Project"), a review of extant domestic and overseas literature concerning the technological development of electric passenger buses and current O&M status was performed to elucidate the development trends of EPBs worldwide. The review results can then serve as a reference for similar technology development in Taiwan. In addition, qualitative and quantitative analyses were also conducted on the O&M of EPBs in Taiwan, where information relating to the availability conditions of EPBs, as well as their energy utilization conditions, was collected, and interviews were conducted to highlight relevant environmental issues in the industry. Moreover, the Project analyzed the internal and external expenditures of EPBs to elucidate their cost structure and characteristics.

表 4-4　大客車能源效率比較

Table 4-4 Energy Efficiency Comparison of Passenger Buses

甲類大客車 Class A Passenger Buses	能源效率 Energy Efficiency	當量轉換 (每元行駛里程) Equivalent Conversion(KM/NT$)
Electric 電動	0.70 km/kwh	0.175 km /NT$
Diesel 柴油	2.13 km/l	0.08 km /NT$

綜整本計畫調查及訪談成果，解析經營與產業現況課題，可歸納電動公車推動主要瓶頸為妥善率不穩定以及使用成本高昂。本計畫深入解析其中原因，釐清關鍵課題，提出未來推動策略包括：建立電動公車績效監管平台、建立跨部會協作機制、強化產業輔導措施、補貼與管制併行政策、強化後勤維修系統，以及研擬電動公車租賃機制。並據以提出未來短、中、長期推動期程及後續相關研究課題之建議。

本計畫有助於客運業者瞭解現況電動公車營運管理相關績效，進而規劃未來電動公車購置時程及營運管理路線。另外，提供主管機關未來在推動電動公車及政策擬定之參據。

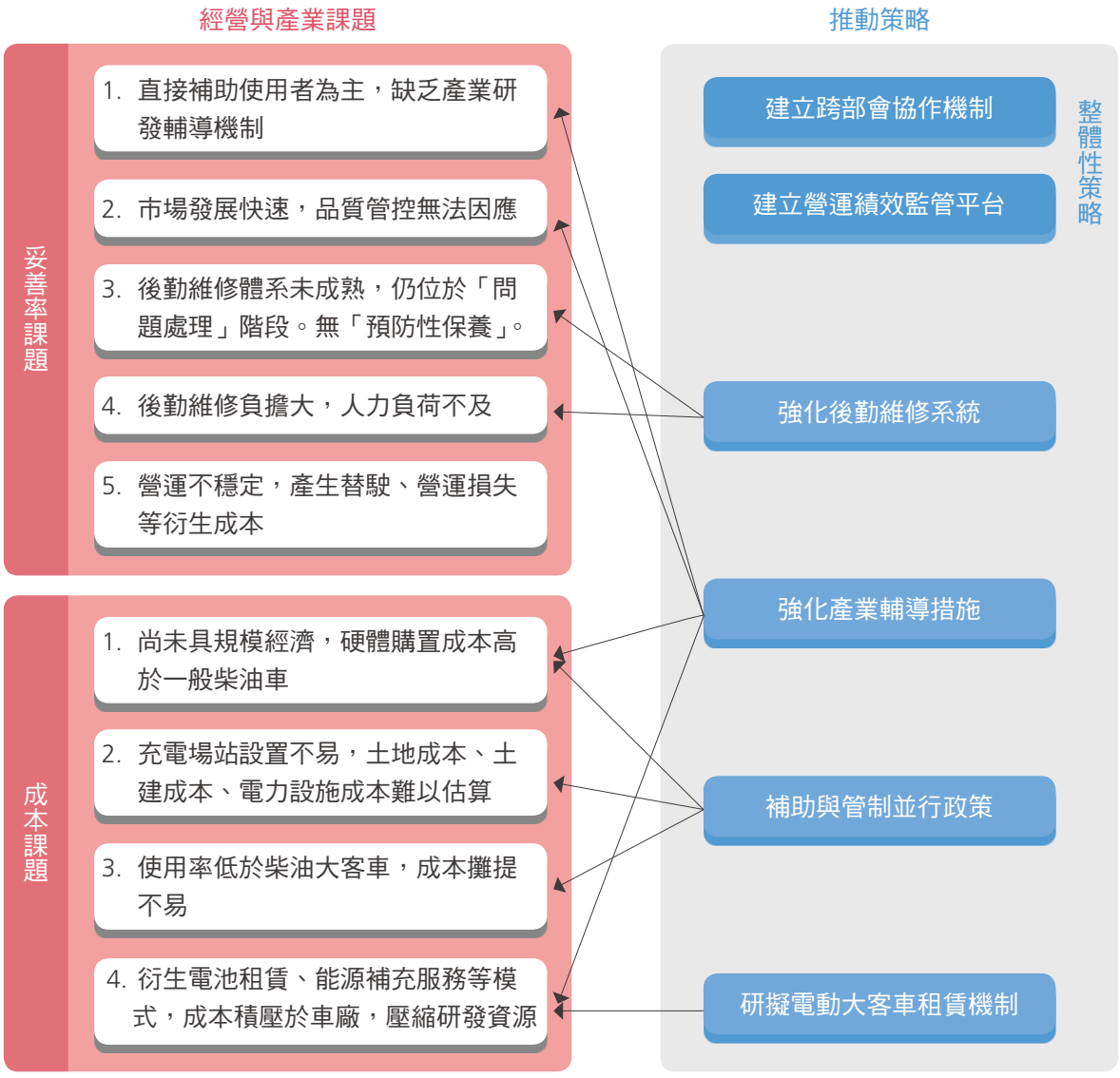


圖 4-28　電動公車課題與推動策略示意圖

Figure 4-28　Representational Diagram of the Issues and Promotional Strategies for Electric Passenger Buses

The survey and interview findings obtained in the Project were then summarized and used in discussions relating to operation and industry issues. The primary bottlenecks encountered in the promotion of EPBs are irregular availability and excessively high utilization costs. The reasons for these bottlenecks were comprehensively analyzed in the Project to identify the core problems and propose future strategies. These strategies include creating an O&M performance-monitoring platform, establishing an inter-ministerial coordination system, reinforcing industry guidance measures, implementing parallel subsidization and regulation policies, strengthening back-end repair systems, and formulating a lease system for EPBs. The Project then proposed short-, mid-, and long-term goals and procedures for the promotion of EPBs and suggestions for subsequent research based on these strategies.

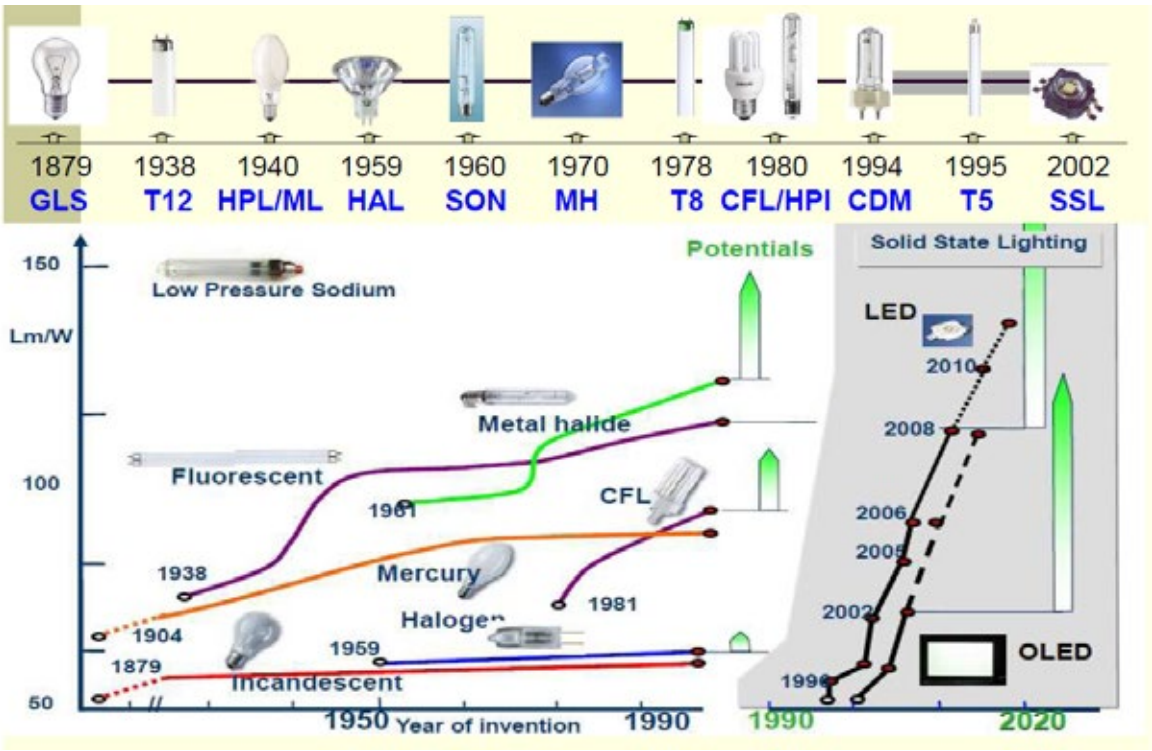
The Project contributes to a greater understanding of the current O&M performance of EPBs. This information can be used to plan for the future procurement and O&M orientation of EPBs. Additionally, the results of the Project can serve as a reference for competent authorities in the promotion of EPBs and formulation of related policies.

圖 4-29　政策引導機制示意圖

Figure 4-29　Representational Diagram of the Policy Guidance Mechanism

(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 年底前，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。另根據工研院 IEK 統計，至 2014 年我國車燈市場規模約 183 萬盞左右。



Source: http://www.pida.org.tw

圖 4-30　照明科技演進示意圖

Figure 4-30　The Evolution of Lighting Technology

(2) Green Energy – LED Street Lighting

To enable Taiwan to become a leader in green energy within the next decade and guide the transition of Taiwanese society into one of low carbon and high industrial value, the Executive Yuan announced the activation of the *Dawning Green Energy Industry Program* (hereafter referred to as "the Program") on 23 April 2009. Regarding LED lighting, the Program aims to actuate Taiwan to become the world's largest LED light and module supplier by 2015, aiming for a national output of NT $ 540 billion. To achieve this goal, the Executive Yuan further launched the *LED Street Lighting Demonstration* Project in 2009, selecting 47 demonstration locations in various cities and counties in Taiwan to replace the energy-consuming mercury streetlights with LED alternatives. In 2011, a further NT $110 million was invested in the promotion of the *High-Performance and Energy-Saving Street Lighting Demonstration Project,* as well as the *Demonstration Project for the LED Street Lighting Energy-Saving Program* in 2012 and the *Mercury Street Lighting Decommissioning Project* in 2014. The Executive Yuan anticipates the complete replacement of all 815,000 mercury streetlights nationwide (constituting 51.9% of the overall streetlights) by 2018, estimating a reduction of 518 million watts and 317,000 metric tons of CO2. According to the statistics released by the Industrial Technology and Research Institute (ITRI) on its Industrial Economics and Knowledge (IEK) Website, the overall number of streetlights in Taiwan as of 2014 was roughly 1.83 million.

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 the MoEA 未來 LED 路燈汰換計畫，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，紀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。本計畫選用基本規格應符合：發光效率 ≧ 100 lm/W、輸出功率（100~150）W、色溫 ≦ 4000 K、演色指數 ≧ 70 模擬平均照度 ≧ 7.5 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/m2 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.）≦ 15 %。

The majority of the streetlights in Taiwan are mercury based, comprising roughly 940,000 fixtures. These streetlights consume over 900 million watts each year, yet only generate 35 lm/W and pose the risk of mercury contamination. Thus, these mercury streetlights do not meet current environmental and energy-saving requirements. At present, the Bureau of Energy, MoEA, has expanded on the application of LED lighting products in public infrastructures by launching the *Demonstration Project for the Application of LED Streetlights,* successfully replacing more than 284,000 mercury streetlights with LED alternatives from 2008 to 2013. This increased energy-saving efficiency by 60%, thereby saving roughly 180 million watts per year and reducing CO_2 emissions by 110,000 tons. Streetlights are installed to primarily promote road and pedestrian safety, direction identification, and reduce accidents. National freeways and highways, which are primarily managed by the MoTC, extend across various geographical terrains, such as plains, hills, mountains, and cities, where each area manifests different lighting requirements. LED streetlights are different from conventional streetlights in terms of light source characteristics, directionality, color rendering index, color temperature, secondary optics, pole height, lamp weight, maintenance method, and cost, and thus have a great impact on streetlight designs. Numerous developed countries, including America and Japan, are currently still using demonstration implementation methods to accumulate related experience, which will serve as a reference for future full-scale implementation. In response to LED streetlight replacement projects proposed by the MoEA, transportation departments must collaborate and urgently develop promotional methods and measures that simultaneously provision for road safety, energy saving, carbon reduction, and lighting equipment O&M costs.

The present study initiated the LED Streetlight Testing Project on Provincial Highway 3B (Longyuan Road) in 2014. Based on the US Energy Star standards, the streetlights were lit for 6,000 hours, and the cost effectiveness of actual implementation was recorded and analyzed. The results can serve as a reference for the MoTC and MoEA on the promotion of LED streetlight policies. The Department of Industrial Technology (DOIT), MoEA, announced the test specifications and requirements in the 11th Standard Reconciliation Meeting. The project team selected the basic specifications announced by the DOIT, including luminous efficiency $\geqq$ 100 lm/W, output power (100~150) W, color temperature $\leqq$ 4000 K, CRI $\geqq$ 70, simulated average illuminance $\geqq$ 7.5 lx, and simulated luminance uniformity $\geqq$ 0.25. Illumination conditions were based on the Traffic Engineering Manual, where the illumination standard for average luminance is 7 lx or more, luminance uniformity (ratio between minimum luminance and average luminance) must be greater than 0.25, and average brightness must 0.5 cd/m2 or more. The standards and specifications of CNS 10779 M5 were also referenced, where overall uniformity (ratio between minimum brightness and average brightness) must be greater than 0.35 and the threshold increment must be $\leqq$ 15 %.

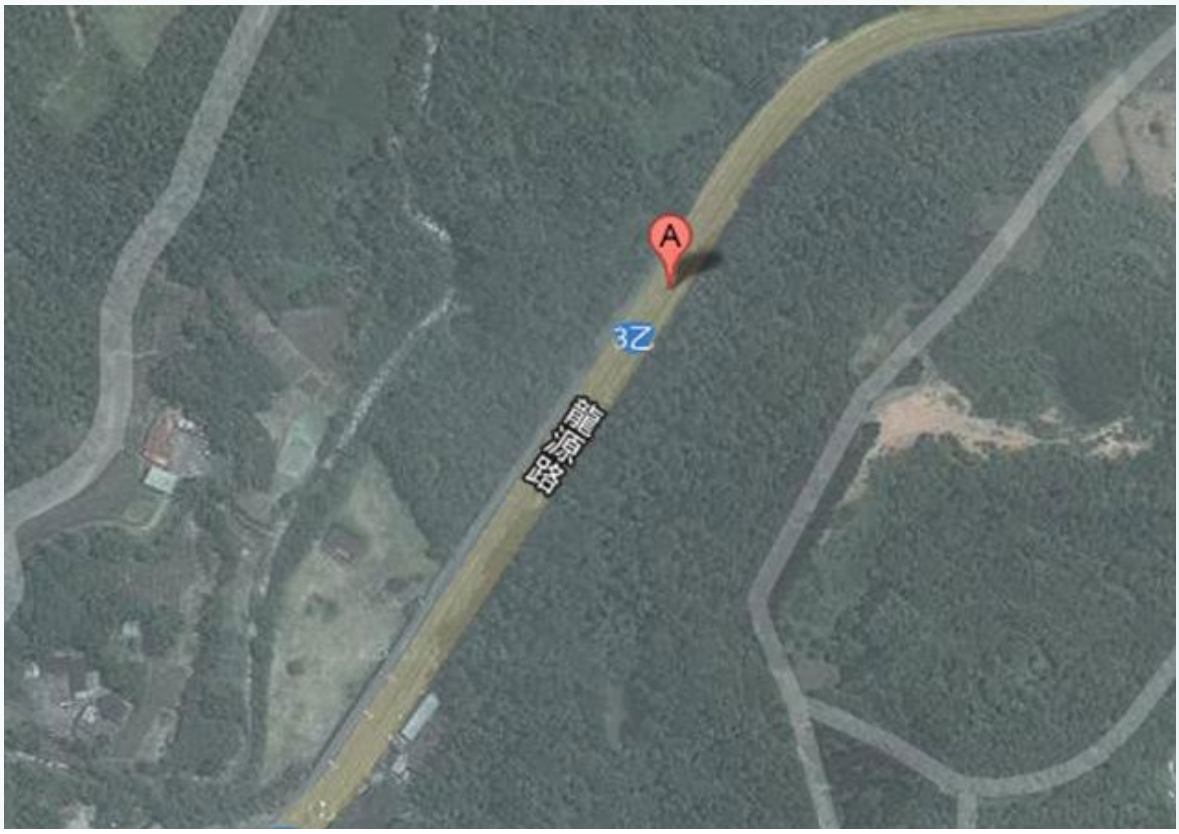


圖 4-31　測試計畫地點

Figure 4-31　Project Test Location

本計畫之主軸為進行 LED 路燈現場及長期測試驗證，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，為將來高快速公路或省道置換與新設路燈之參據。本計畫於 103 年度前期（約 1,000 小時），將進行較密集之量測，以建立管制圖及初步分析，改進未來 5,000 小時之量測程序與關鍵參數訂定。此外，持續彙整分析國內外在 LED 路燈之建置成果與經驗，分門別類以定量手法比較其間之異同與趨勢，並與前述實驗結果相互比對，以期獲得相輔相成之 LED 路燈裝設決策參考。

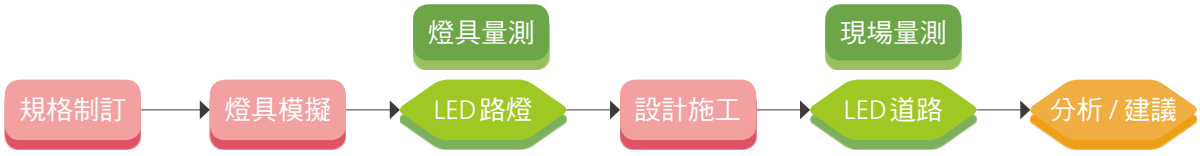


圖 4-32　本計畫之進行過程

Figure4-32　The Progress of the Present Project

圖 4-33　台 3 乙線 LED 路燈測試區實景圖

Figure 4-33　The LED Streetlight Test Area on Provincial Highway 3B

The core objective of the present study was to conduct a long-term in-situ experiment on LED streetlights. The data collected from the experiment were used to analyze the changes in the physical efficiency of LED streetlights over time and under different climates and electromechanical conditions. These results can then serve as a reference for the replacement or new installation of streetlights on national freeways and highways. Intensive measurements were taken during the initial stages of the project (roughly 1,000 hours) in 2014 to establish a control chart and perform preliminary analyses, which were used to improve the measurement procedures and key parameters in the following 5,000 hours. Additionally, the project continued to compile and analyze LED streetlight implementation results and experiences from domestic and foreign studies. This data was categorized, and a quantitative method was used to compare the differences, similarities, and trends over similar periods. This data was also compared to the preceding experiment's results in an attempt to obtain complementary LED streetlight installation policies and references.

(三) 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，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」，揭櫫我國二氧化碳排放量於 2025 年要回到 2000 年的水準，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」。為務實推動我國綠能低碳目標之達成，國家發展委員會於 103 年召開會議，滾動檢討部門排碳（減碳）分配量之規劃與我國已宣布 2020、2025、2050 年排碳（減碳）目標差距之因應措施。

資料來源：104 年全國能源會議會務簡報

Source: 2015 National Energy Conference Briefing

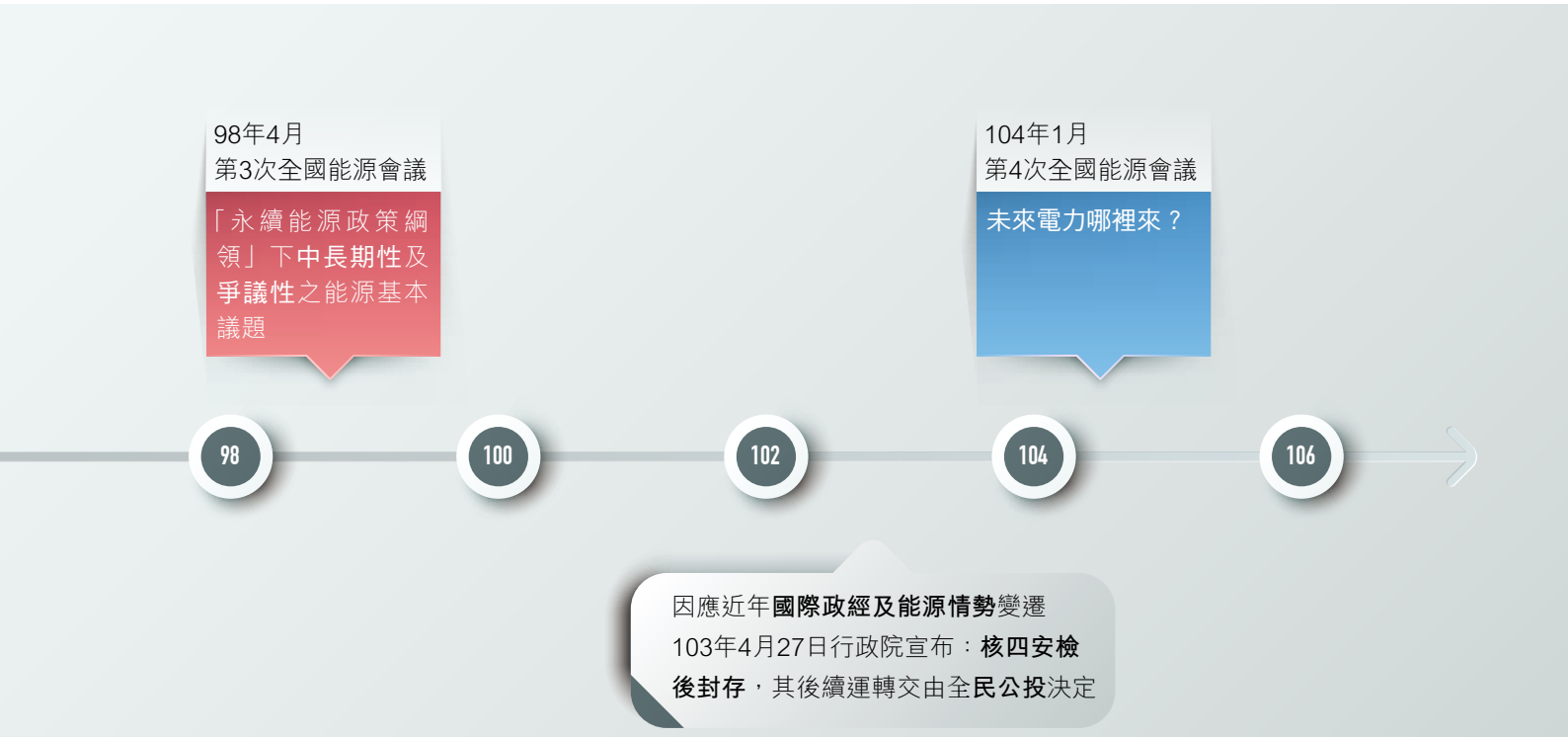
圖 4-34　我國全國能源會議召開歷程

Figure 4-34　Progress of National Energy Conferences Held in Taiwan

(3) Sustainable Development of Green Transportation

Since the passing of the Kyoto Protocol, movements to promote energy saving and carbon reduction in response to climate change have intensified worldwide. As a member of the global village, Taiwan has a responsibility to act on the worldwide trend of energy saving and carbon reduction. Thus, the Executive Yuan has held four energy conferences since 1998 and promoted various energy saving and carbon reduction movements based on the resolutions reached at these conferences.

Additionally, the Executive Yuan passed the *Sustainable Energy Policy Framework* in the 3095th Executive Meeting on 5 June 2008, approving the reduction of CO_2 emission volumes in Taiwan in 2025 to levels recorded in 2000. The Executive Yuan further established the Committee for the Promotion of Energy Conservation and Carbon Reduction in December 2009 (renamed the Committee for the Promotion of Green Energy and Low Carbon on 20 May 2014) to oversee the implementation of the *Overall Action Plan for Green Energy and Low Carbon in Taiwan.* To realistically reach the green energy and low carbon objectives in Taiwan, the National Development Council reviewed the volumes of carbon emissions (reduction target) allocated to various departments in the 2014 annual meeting, and announced countermeasures for the gap in carbon emissions (reduction target) for 2020, 2025, and 2050.



十大標竿方案 /35 標竿型計畫

01 健全法規體制

一、 健全溫室氣體管理法規體制（環保署）
二、 擬訂「永續能源基本法」(經濟部)
三、 制定「再生能源發展條例」與「能源管理法」修正條文後續子法（經濟部）
四、 推動綠色稅制（財政部）

02 改造低碳能源系統

五、 推動再生能源新紀元計畫（經濟部）
六、 降低發電系統碳排放（經濟部）
七、 推動智慧電網計畫（經濟部）
八、 推動核能發電合理使用評估方案（原能會）

03 打造低碳社區與社會

九、 建構低碳社區（環保署）
十、 打造低碳城市（環保署）
十一、 建設低碳島（環保署、經濟部、交通部）
十二、 推動節能減碳生活社會運動（環保署、經濟部）

04 營造低碳產業結構

十三、 推動產業節能減碳（經濟部、國科會）
十四、 進行能源密集產業政策環評（經濟部）
十五、 推動綠能產業旭升方案（經濟部）
十六、 推動農業節能減碳（農委會）

05 建構綠色運輸網絡

十七、 建構綠色無接縫公路運輸系統（交通部）
十八、 推動建構便捷大眾軌道運輸網（交通部）
十九、 建構智慧化道路服務（交通部）
二十、 建構人本導向之交通環境（內政部）
廿一、 全面提升新車效率水準（經濟部）

資料來源：104 年全國能源會議會務簡報

Source: 2015 National Energy Conference Briefing

圖 4-35　國家綠能低碳總行動方案

Figure 4-35　Overall Action Plan for Green Energy and Low Carbon in Taiwan

06

營建綠色新景觀與普及綠建築

廿二、 推動新建綠建築及推推廣使用節能減碳綠建材（內政部）
廿三、 推動智慧綠建築（經濟部、內政部）
廿四、 推動建築物節能減碳標示制度（內政部）
廿五、 推動造林計畫（農委會）

07

擴張節能減碳科技能量

廿六、 農委會推動能源國家型科技計畫（國科會）
廿七、 進行全方會能源科技人才培育方案（國科會）

08

推動節能減碳公共工程

廿八、 建構永續低碳公共工程規範及機制（工程會、經建會）
廿九、 推動公共工程全生命週期品質管理機制納入節能減碳（工程會）
三十、 強化政府採購流程與規範內化節能減碳機制措施（工程會）

09

深化節能減碳教育

卅一、 教育部暨所屬機關學校全面落實節能減碳計畫（教育部）
卅二、 營造永續綠校園及建立學校節能減碳評鑑制度（教育部）
卅三、 強化節能減碳教育（教育部）

10

強化節能減碳宣導與溝通

卅四、 全民節能減碳溝通宣導計畫（新聞局、研考會、人事行政局、經濟部及其他各部會）
卅五、 推動國際節能減碳環境外交（外交部、環保署）

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，並有相關綠運輸發展策略。而為實踐交通部施政目標，交通部自 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，並能同時考量經濟行為、能源消耗與運輸需求之關聯性，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，另交通部於 103 年度再擴充「補助低碳運具」與「軌道基礎建設」兩項評估策略，並可搭配前期所建立國際油價上漲、公共運輸票價補貼、汽燃費隨油徵收、軌道建設投資、電動車補助等與運輸部門設計相關節能減碳策略，共同進行組合評估分析。103 年交通部已「行政院綠能低碳推動會」針對各部會之減碳目標，並研擬全國能源會議議題背景資訊中有關運輸部門電力需求預測資料。

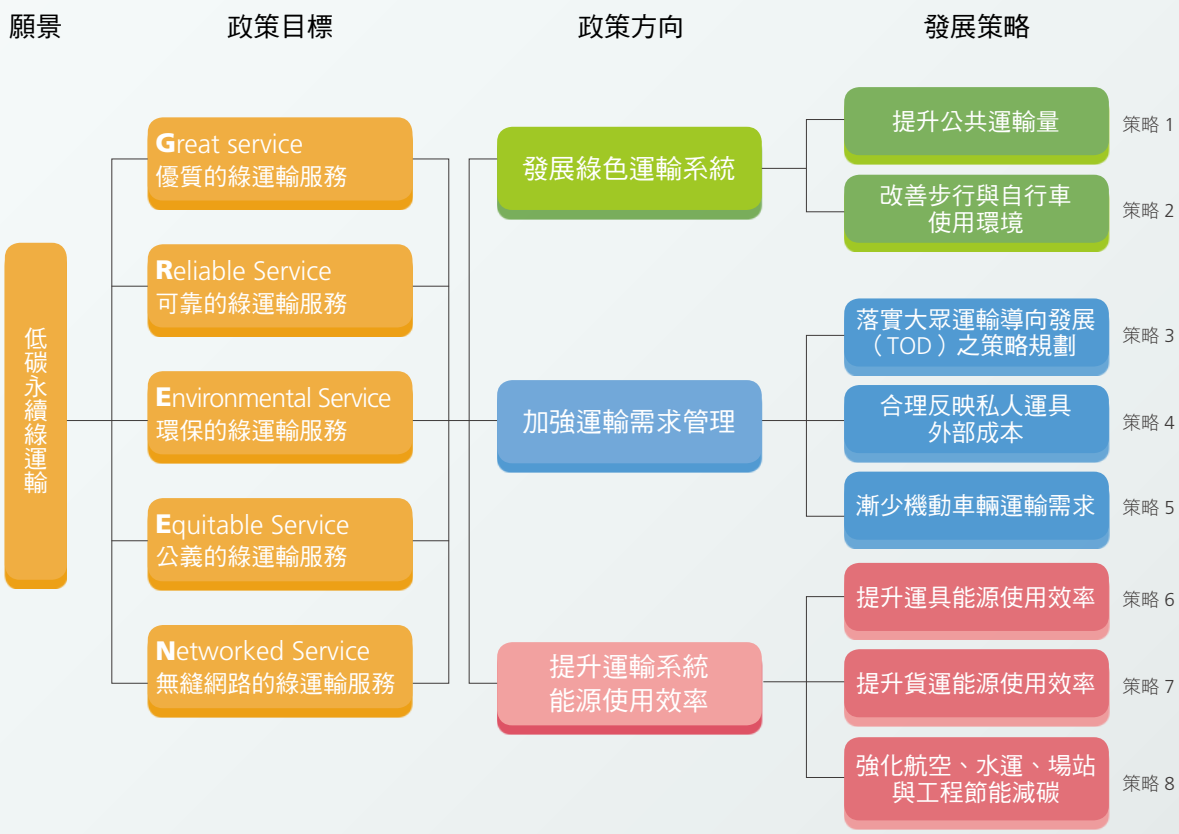


圖 4-36　我國綠運輸發展策略

Figure 4-36　The Green Transportation Development Strategies in Taiwan

In response to the aforementioned trends and national policies, the MoTC chose "promoting sustainable green transportation and implementing energy saving and carbon reduction policies" as the core objectives in transportation-related policies, consequently introducing various green transportation development strategies. To achieve the objectives laid out by the MoTC, the Institute of Transportation (IoT) has focused considerable efforts into developing evaluation modules for the various energy saving and carbon reduction strategies adopted by transportation departments since 2007. These modules can consider the associations between economic behavior, energy consumption, and transportation needs to comprehensively assess the effectiveness of the energy saving and carbon reduction strategies and measures used by various transportation departments. These modules can serve as tools to assess the GHG emission objectives and relevant polices of the transportation departments in Taiwan. Based on a series of studies conducted to develop support systems for transportation departments for the formulation of climate change policies, these studies are currently able to analyze the carbon reduction effectiveness of transportation departments by looking at the amount of overall national resources invested. Additionally, the IoT again elaborated two evaluation strategies in 2014, namely, "low carbon transport subsidization" and "rail infrastructure." The MoTC designed various energy saving and carbon reduction strategies with transportation departments by combining various data previously collected, including international fuel prices, public transportation fare subsidies, vehicle fuel consumption fees expropriated based on fuel, rail construction investments, and EV subsidies. These strategies were then used in an integrated evaluation analysis. In 2014, the IoT collaborated with the MoTC in researching and announcing the carbon reduction objectives of the various transportation departments for the Committee for the Promotion of Green Energy and Low Carbon, highlighting the estimated power requirements of the various transportation departments from the background information proposed in the national energy conferences.

此系列計畫中持續維護已建置之「運輸部門能源消耗與溫室氣體排放整合資訊平台」，該平台整合交通部「車輛動態能源消耗與溫室氣體排放特性之研究」、「智慧型運輸系統節能減碳與成本效益評估工具暨資料庫之示範與推廣」、「臺灣港埠節能減碳效益提升之研究」及「安全駕駛行為與節能策略之研究」等相關能源科技研究的成果，並提供我國歷年各部門與各運輸系統之能源消耗估算資料，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。

此外，交通部於 103 年亦透過「交通部綠運輸節能減碳成果及未來推動方向之研究」，檢視我國推動綠運輸之具體成效，滾動檢討綠運輸推動困境與挑戰，並提出未來努力方向，以提供交通部後續推動綠運輸之參據。

相關實績證交通部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。

圖 4-37　運輸部門因應氣候變遷政策決策支援系統介面

Figure 4-37　Transportation Department Climate Change Policy Formulation Support System Interface

These plans continue to maintain the established Energy Consumption and Greenhouse Gas Emissions of the Transport Sector Integrated Information Platform. This platform integrates numerous energy technology research results proposed by the IoT. These include: *A Study on Vehicle Dynamic Energy Consumption and Greenhouse Gas Emission Characteristics; An Energy Conservation, Carbon Reduction, and Cost Effectiveness Evaluation Tool for Intelligent Transportation Systems and Database Demonstration and Promotion; The Study to Promote the Benefit of Energy Conservation and Carbon Reduction in Taiwan's Harbor Areas; and A Study on Safe Driving Behaviors and Energy Conservation Strategies.* Subsequently, the platform offers historical energy consumption estimations for various departments and transportation systems in Taiwan, which expert scholars may use to identify the latest transportation energy saving and carbon reduction statistics and research information. These data can simultaneously serve as a reference for the formulation of energy saving transportation and carbon reduction policies. Moreover, export scholars can use the platform to share and exchange information.

Furthermore, the IoT proposed the *Ministry of Transportation - A Study on Green Transport Energy Saving and Carbon Reduction Results and Prospects* to examine the tangible performance for the promotion of green transportation in Taiwan and perform a rolling review of the difficulties and challenges of promoting green transportation. In addition, the IoT proposed suggestions for future efforts, which can serve as a reference for the MoTC for the subsequent promotion of green transportation.

In terms of relevant performance and achievements, the IoT continues to focus efforts into researching the promotion of green transportation to assist the MoTC in achieving sustainable development in its transportation departments and implementing energy saving and carbon reduction policies. (The relevant performance and achievements of the IoT in promoting green transportation proves the importance of the IoT's continued efforts in this area in helping the MoTC in implementing sustainable development, energy saving, and carbon reduction policies for its transportation departments.

四、運輸安全

（一）高齡者之駕駛模擬儀學習效果與作業負荷

人類壽命的延長是人類追求的目標，人口的老化更是一個先進國家必然會發生的現象。根據聯合國世界衛生組織的定義，高齡者人口比例達 7% 時，稱為「高齡化社會（ageing society）」，達到 14% 時稱為「高齡社會（aged society）」，倘若高齡者人口比例達到 21% 時，則稱為「超高齡社會（super-aged society）」。台灣自民國 82 年高齡者人口突破 7% 後，開始進入高齡化國家。根據內政部戶政司 102 年統計資料顯示，台灣 65 歲以上人口已達 275 萬人（約佔 11.8%），預估在 107 年時，台灣就會正式成為高齡國家（高齡者比例達 14%），至 114 年高齡人口比例將達到 20%，邁入超高齡社會（super aged society），人口老化加劇趨勢非常明顯。

隨年齡增長、身體老化，視聽覺、資訊處理之認知功能及運動反應能力自然退化，勢必影響開車時的靈敏度。根據交通部統計，民國 99 年 65 歲以上高齡人口僅 17.1% 會開車、37.2% 會騎機車，但 45 至未滿 65 歲則有 52.1% 會開車、76.4% 會騎機車，預估未來 10 年，高齡駕駛汽、機車的人口將呈現倍數增加。交通部運輸研究所研究顯示，70 歲以上高齡者開車時的反應時間，比一般青壯年駕駛多 50 ～ 70 % ，美國疾病控制和預防中心統計數據顯示，65 歲以上高齡駕駛每年死於車禍的人數，約是青少年車禍致死數的兩倍，因此進行高齡者駕駛管理，有其必要性，絕非歧視高齡者、剝奪其開車權利。

交通部運輸研究所研發建置之駕駛模擬儀，可用以觀察駕駛績效與訓練等研究，亦證實駕駛模擬具有評估駕駛能力之應用參考，故駕駛模擬儀之操作應可作為高齡駕駛能力檢測或訓練之工具，並能避免實車上路之風險。

過去雖有多篇研究運用駕駛模擬儀探討高齡者駕駛能力，然駕駛模擬儀操作的學習適應性如何，或是多次操作學習之訓練成果及作業負荷等課題，仍未有此方面之研究，本研究針對高齡者模擬駕訓之學習成效及作業負荷進行探討。

4. Transportation Safety

(1) The Learning Effectiveness and Workload of the Driving Simulator for Older Drivers

As human life expectancy continues to increase, population aging has become an inevitable problem in advanced countries. According to the definition proposed by the World Health Organization, a society is considered an "aging society" when 7% of the overall population are senior citizens. The society then enters an "aged society" when the percentile reaches 14% and a "super-aged society" after 21%. Taiwan's senior population exceeded 7% in 1993, making Taiwan an aging society. According to the 2013 statistics announced by the Department of Household Registration, Ministry of Interior, Taiwan's over-65 population has reached 2.75 million people, occupying roughly 11.8% of the overall population. The statistics further estimated that Taiwan would formally enter an aged society in 2018, with older citizens occupying 14% of the overall population. This figure was subsequently projected to rise to 20% in 2025, propelling Taiwan into a super-aged society. These statistics clearly show the increasing severity of the aging population problem.

People's cognitive ability to process audio and visual information and their motor responses naturally degrade as they grow older and their bodies begin to age. According to statistics announced by the MOTC, 17.1% and 37.2% of older citizens over 65 could respectively handle a vehicle and motorcycle in 2010. However, 52.1% and 76.4% of older citizens between the ages of 45 and 65 could respectively handle a vehicle and motorcycle. These statistics further projected that the number of older drivers/riders will double in the next decade. An IOT research study indicated that the response time for older drivers over 70 was only 50% to 70% that of general mid-aged drivers. In addition, statistics announced by the US Disease Control and Prevention Center indicated that the number of older drivers over 65 who died in traffic accidents was twice that of young adult drivers. Therefore, the management of older drivers is essential. Such management should neither discriminate against older citizens, nor deprive them of their driving rights.

The driving simulator developed by the IOT can be used to observe driver performance and for training purposes, and to verify that driving simulation can serve as a feasible application reference for the evaluation of driving ability. Thus, the driving simulator can be used as a tool for assessing or training the driving abilities of older drivers and prevent potential risks the road.

Numerous previous studies have employed driving simulators to assess the driving abilities of older drivers. However, no studies have analyzed the learning adaptability of operating driving simulators and the training achievements and workloads of repeated use. The present study aimed to investigate older drivers' learning achievements and workloads for operating driving simulators.

本研究應用學習曲線來評估高齡者於使用駕駛模擬儀的學習成效，以了解年齡層對駕駛完成時間及學習率的影響，同時以 NASA-TLX 主觀負荷來評估不同年齡族群間作業負荷之差異，探討年輕與高齡族群於使用駕駛模擬儀進行訓練時，對完成第一次所需時間、與學習率及主觀作業負荷評估之影響。

本研究採立意抽樣，選擇擁有駕照與成熟駕駛經驗之駕駛，排除駕駛新手及有影響駕駛績效生理因素之駕駛，共選定 10 位年輕人（年齡約 30-45 歲）與 10 位高齡者（年齡約 60-65 歲）進行駕駛模擬儀的操作實驗。

本實驗場地為長 2.5 公尺，寬 2.5 公尺的方形實驗室，各項設備配置圖如下圖 4-38 所示

（a）上視圖　(a) Top View

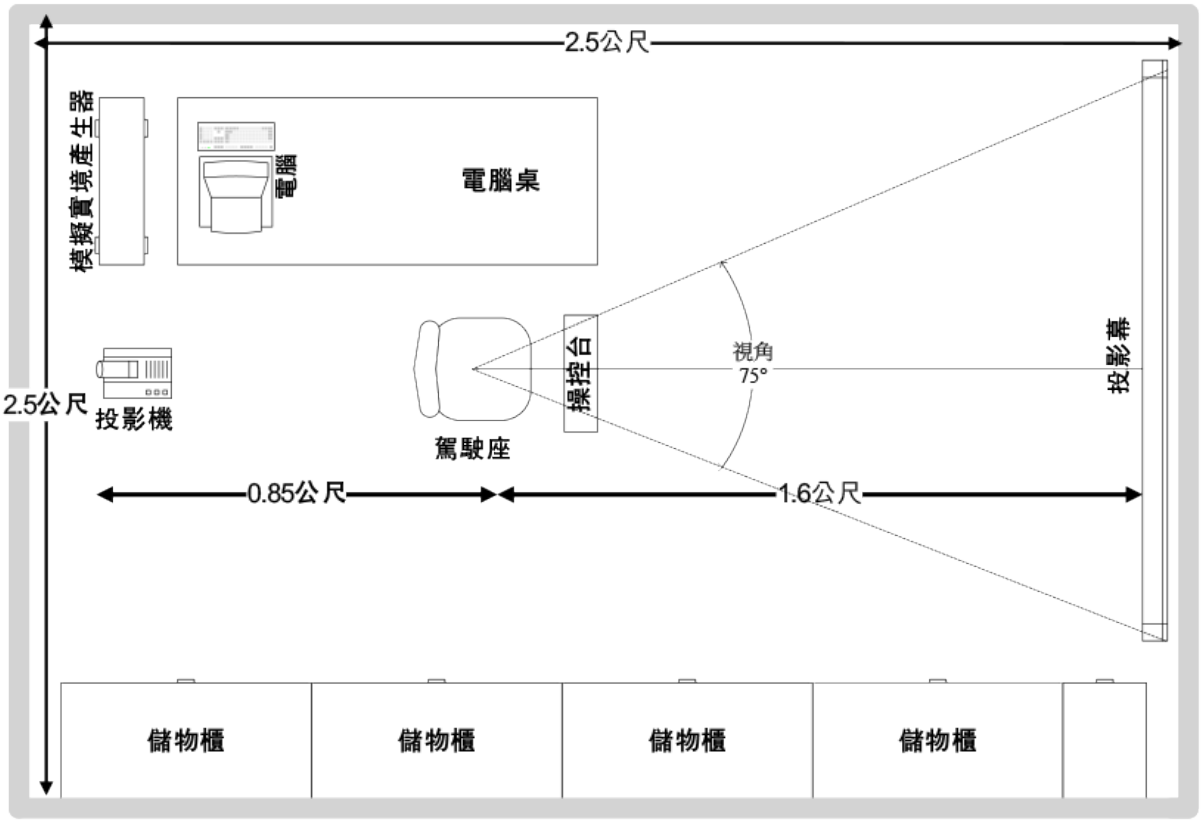


圖 4-38　實驗室位置配置圖

Figure 4-38　Laboratory Layout

The present study examined the learning curves of the participants to evaluate the learning effectiveness of driving simulators and elucidate the influences that age has on completion time and learning rate. The NASA Task Load Index (NASA-TLX) for measuring subjective mental workload was simultaneously used to evaluate the difference in workloads of participants in various age groups, and determine the evaluation influences that the time, learning rates and subjective workloads it takes for young and older drivers to finish the first simulation.

A purposive sampling method was employed to select licensed drivers with extensive driving experience. New drivers and those with physiological factors that may influence driving performance were excluded from this study. A total of 10 young (aged 30 to 45) and 10 older (aged 60 to 65) drivers were selected to participate in the driving simulation experiment.

The experiment site was a L2.5m,W2.5m laboratory area. The equipment layout is illustrated in Fig. 4-38.

(b) 側視圖　　(b) Side View

駕駛模擬儀如圖 4-39 所示

The driving simulator is illustrated in Fig. 4-39.

圖 4-39 駕駛模擬儀

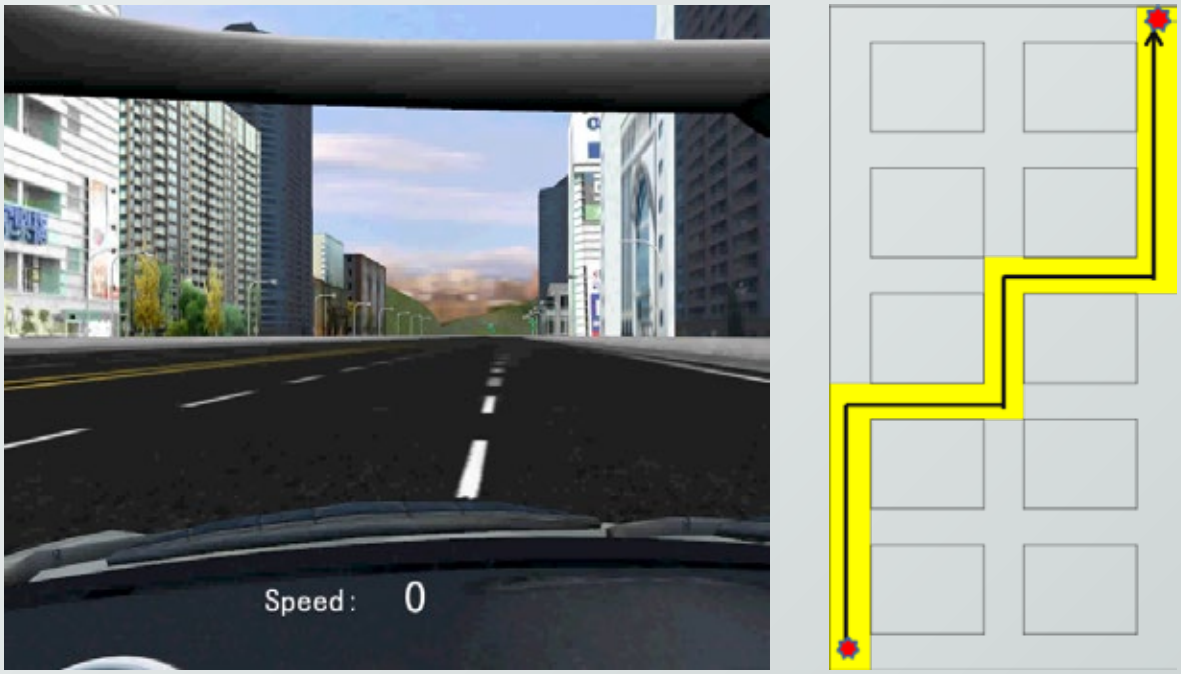
Figure 4-39 The Driving Simulator

本研究為探討高齡者與年輕人，於駕駛模擬儀操作學習上，第一次完成理論時間及學習率（Learning rate）之差異，並了解學習過程的作業負荷變化情形。

實驗結果發現高齡者第一次完成時間明顯較年輕人久，此時間之差距，代表高齡的反應變慢，處理訊息能力及適應力下降，所需操作時間變長，故相較於年輕人，高齡者採用較低的駕駛速度以補償個人能力之退化。但年齡雖對學習率則無顯著影響。在駕駛模擬儀操作的 NASA-TLX 作業負荷方面，隨著連續 10 回合的學習操作過程，作業負荷有顯著的降低趨勢，尤其高齡者較年輕人有更明顯的負荷降低情形，代表高齡者初始調適至後期熟練的學習過程，負荷感受明顯減少，即年輕人負荷變化情形不如高齡者明顯，此與上述高齡者有較年輕高的認知適應問題一致。

實驗場景如圖 4-40 所示。

The experiment scenario is illustrated in Fig. 4-40.



(b)場景圖 (b)The Scenario (a)路線圖 (a) The Route

圖 4-40 駕駛路線場景圖

Figure 4-40 The Simulation Route

The present study aimed to elucidate the differences between the first completion time and learning rate of the young and older drivers using the driving simulator, and consequently determine the variations in the workload of the participants during the simulation process.

The experiment results indicated that the first completion times of older drivers were significantly longer than the times of young drivers. This discrepancy denotes that senior citizens required a longer time to complete the simulation due to slower responses and decreased information processing ability and adaptability. Compared to the younger participants, senior drivers reduced their driving speed to compensate for the decline in cognitive capacity. However, age did not significantly influence the learning rate. Regarding the NASA-TLX, mental workloads showed a significant declining trend after operating the simulation 10 consecutive times. This trend was more apparent in the senior drivers, suggesting that the workloads experienced by the senior drivers significantly declined from their first

在駕駛模擬儀操作的 NASA-TLX 作業負荷方面，我們發現作業負荷隨著練習次數增加而顯著降低。而在 NASA-TLX 作業負荷的性別方面，發現各年齡層女性作業負荷均顯著高於男性之現象，尤其高齡者男、女性差異更明顯，此代表駕駛模擬儀操作學習上，女性須付出更多努力調整適應，尤其高齡女性感受最深，故對於女性之駕駛模擬儀操作，可能更須多留意操作負荷等問題。

駕駛模擬儀已證實具有評估駕駛能力之功能，本研究目的為探討高齡者操作模擬駕訓之學習成效及作業負荷，以做為未來運用駕駛模擬儀檢測或訓練駕駛能力之參考，並藉此強化高齡駕駛管理，評估高齡駕駛能力及學習力。

本研究證實高齡者採用降速以補償駕駛能力不足，估初期操作時間較長，即駕駛所需反應時間或距離須增加，此潛在因素對於對交通號誌之設計或法規之規定都必須納入考量，或對於車輛科技之高齡應用亦能納入加以評估。

另對於駕駛模擬儀用以訓練高齡者駕駛能力部分，亦得到正向肯定結果，未來可納入高齡駕駛訓練之考量，而本實驗受限於設備及場景限制，後續可針對不同難易程度之路況或特殊道路場景設計，探討不同環境下之訓練成效。本研究成果可提供交通部、交通部道路交通安全督導委員會、交通部公路總局及地方路權單位參採，以提升我國交通安全績效。

use of the simulator to becoming proficient in the simulation. By contrast, the variations in workloads of the younger drivers were not as evident, which is consistent with the aforementioned finding that older drivers have more cognitive adaptation problems compared to young drivers.

The NASA-TLX for operating the driving simulator results showed that workloads significantly decreased concurrently with the number of operations. In terms of gender, the workloads of female drivers were significantly higher than the male drivers in all age groups. This difference was more evident between older male and female drivers, suggesting that female drivers needed to exert more effort in adapting to the driving simulator, particularly older female drivers. Thus, more attention should be paid to workload when females are operating the driving simulator.

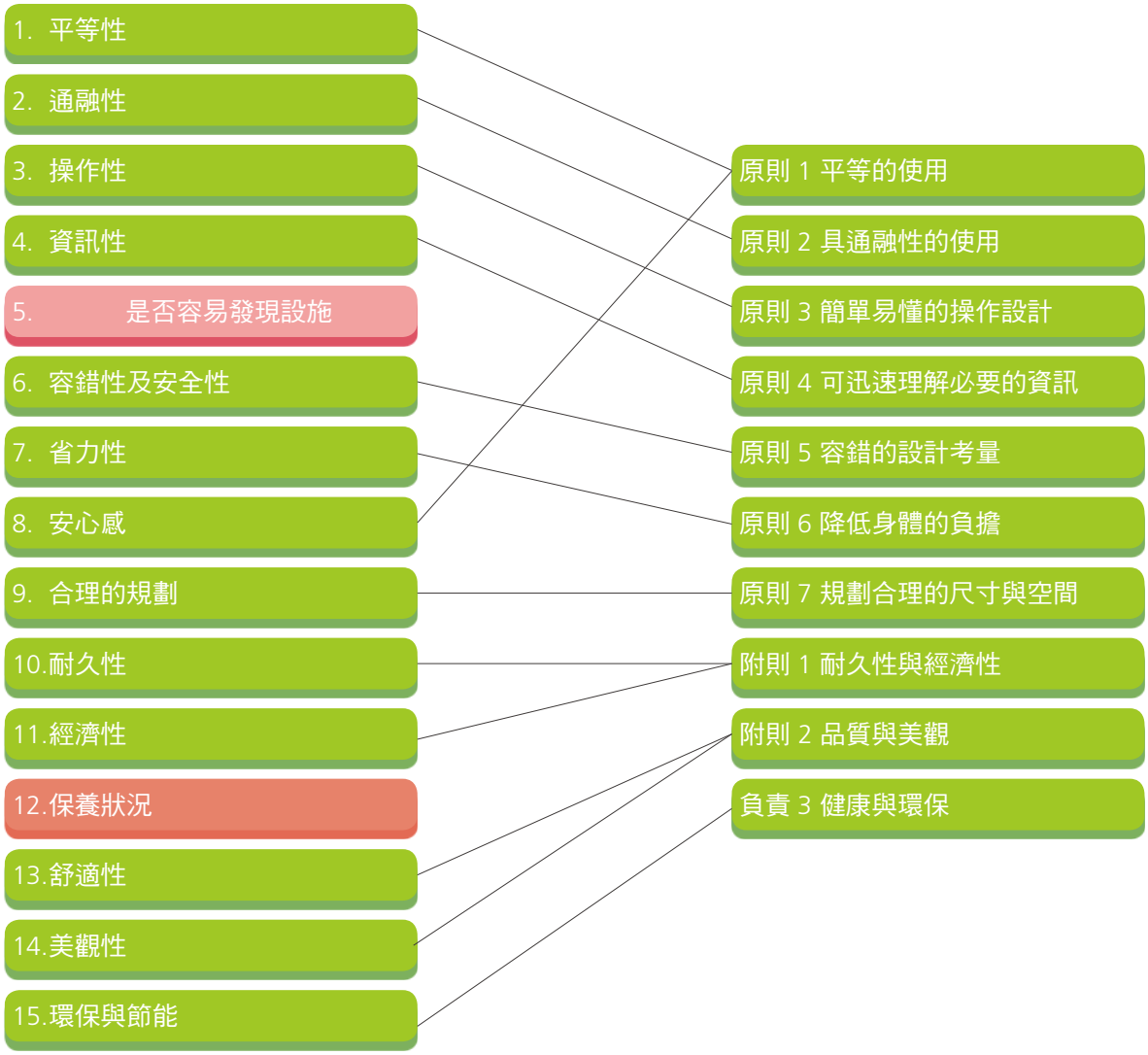
The driving simulator has been verified to possess the applicable functions to evaluate driving ability. The present study aimed to investigate the learning efficiency and workloads of older drivers when operating the driving simulator. The results obtained in the present study can serve as a reference for future employment of a driving simulator to test or training driving abilities, thereby strengthening the management of older drivers and evaluating their driving and learning abilities.

The present study found that older drivers typically reduce driving speed to compensate for their lack of driving ability. This was essentially because prolonging the operation time increases both driver response time and stopping distance. The implicit factors uncovered from these results must be considered when designing traffic signs or formulating various regulations and older drivers should be taken into account in the evaluation process of vehicle technology.

The driving simulator showed positive results when used as a training device for the driving abilities of older drivers. Thus, the simulator can be included into future training courses for older drivers. However, the experiments conducted in the present study possessed equipment and location limitations. Future studies can design routes with varying levels of difficulty or special contexts to highlight training effectiveness in different environmental contexts. The results of the present study can be serve as a reference for the MOTC, Road Traffic Safety Committee, Doctorate General of Highways, and other local road authorities to enhance the traffic safety performance in Taiwan.

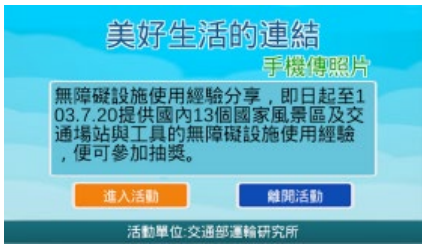
（二）無障礙運輸設施使用分析與改善方向 ‧ 通用性思考

透過通用設計方法來尋求無障礙觀光及交通環境改善的方向與內容，已為國際作法，實因觀光風景區及交通運輸環境具有使用者眾多、族群範圍廣之特性，相關的設計應採通用設計的理念，「在最大限度的可能範圍內，不分性別、年齡與能力，適合所有人方便使用的產品與環境之設計」，讓所有人容易使用。而交通運輸環境之通用設計（Universal Design，UD）評價指標共 15 項。但通用設計方法中之核心觀念為使用者參與，即蒐集民眾實際使用觀光風景區及各交通場站與運具無障礙設施之經驗，係為落實通用設計的第一步。故 IoT 於 103 年辦理「礙分享」，以上網及行動 App 兩途徑請民眾分享其使用無障礙設施之正面（設置妥當而容易使用）與負面（設置不適當而不易使用）經驗。



(2) Analysis on and Improvement Directions for the Use of Barrier-Free Transport Facilities – A Reflection on Universality

The use of universal design methods to improve the direction and content of barrier-free tourism and transportation environments is a common approach worldwide. This is primarily because tourist locations and transportation environments have large and diverse user bases, and therefore by applying universal design concepts that satisfy "product and environment designs that can be conveniently used by everyone to the greatest extent possible, regardless of gender, age, or ability," products and environments can be easily accessed by all people. In terms of transportation, universal design comprises 15 evaluation indicators. However, the core concept for universal design is user participation. In other words, collecting the actual experiences of users concerning their use of environment- and transportation-related barrier-free facilities is the first step in universal design. In this context, the IoT launched "Barrier-Free Sharing" in 2014, which is a webpage- and mobile application-based (app) program that allows people to share their positive (appropriately placed and easy to use) and negative (inappropriately placed and difficult to use) experiences regarding their use of barrier-free facilities.



所蒐集之經驗資料先以頻次分析方法，探求民眾使用無障礙設施之正面與負面經驗，以及正負面經驗在設施種類與所在位置之分布，再以交通運輸環境之通用設計指標意義，解析民眾使用無障礙設施之經驗，以檢視這些無障礙設施於民眾實際使用時尚有那些問題。經解析民眾表達的正面、負面經驗，係反應某些通用設計面向，而「合理的規劃」是民眾無障礙設施使用經驗的重要指標，「省力性」、「平等性」、「是否容易發現設施」、「容錯性與安全性」等 4 指標亦為需加以重視之指標。

交通運輸系統中的使用者眾多，往往可能攜帶行李、結伴同行，且運輸活動並非民眾的旅次目的，一般係期待能以付出較少心力、較少體力、較短時間之方式，安全地完成此活動。以電梯為例，設施需在當地環境中有「合理的規劃」，即其尺寸、坡度、位置等設計需具實際使用上之合理性，否則會使某些使用者難以使用設施，衍生平等使用的問題（平等性），而使用時也會因需遷就不合理設計導致耗費較多心力與體力的問題（省力性）。此外，若僅在設施本身設置適合近距離觀看之指標，且對夜間環境之使用考量較為不足，則亦會造成使用者不容易找到設施（是否容易發現設施），進而導致在民眾使用設施前便需花費較多心力及體力尋找設施（省力性），或者因未發現到該設施而無法使用（平等性）。

The collected data is first processed using a frequency analysis to examine the positive and negative experiences of users concerning their use of barrier-free facilities and determine the distribution of these experiences based on location and type of facility. Then, the universal design indicator definitions for transportation environments are used to elucidate the user experiences concerning their use of barrier-free facilities and highlight the existing problems that people encounter when using these facilities. By analyzing users' positive and negative experiences, researchers are able to identify the dimensions of universal design, where "reasonable planning" is a key indicator for users' experiences concerning their use of barrier-free facilities, and "effortlessness," "equality," "identifiability," and "error tolerance and safety," are the indictors that require increased attention.

A large number of passengers use transportation systems. They often carry luggage or are accompanied by others. Consequently, transportation activities are not people's travel priorities, and they typically expect to complete these activities safely with minimal effort and time. In terms of elevators, the facilities must be "reasonably planned" according to the local environment, where the dimensions, slope, and position of the facility must rationally comply with practical use. Improper installation would hinder specific groups of people from using the facility, which would lead to fair use problems (equality) and an increase in physical and mental efforts to compensate for unreasonable designs (effortlessness). Additionally, facilities that are installed solely on appropriate distance and overlook nighttime applications may become difficult to identify for users (identifiablity), consequently increasing users' physical and mental efforts to find the facilities (effortlessness) or hindering them from use because the facilities cannot be found (equality).

UD Dimensions	Positive Experiences (Elevator)		Negative Experiences (Elevator)	
	a	Experience 民眾經驗	b	Experience 民眾經驗
Reasonable Planning		Large space 空間大。		Too small; only fits one wheelchair 電梯太小只能一台輪椅就無法裝人。
		Large space; large entrance; favorable design 空間很大，進入的走道也很大，設計很好。		The elevator is a little small 電梯有一點小。

UD Dimensions	Positive Experiences (Elevator)		Negative Experiences (Elevator)	
	a	Experience 民眾經驗	b	Experience 民眾經驗
	   	The clear indication of the barrier-free facility enables seniors with limited mobility to find the elevator easily by following the indicators 標示清楚的無障礙設施，讓行動不便的長者，可以依標示快速的找到電梯搭乘。		The lighting at night is insufficient, and the elevator is not clearly indicated. It takes a long time to find the elevator. 夜晚照明不足，而且電梯標示不明顯，在附近找很久才找到。
Identifiability		The MRT station has barrier-free elevators immediately next to the entrance/ exit. Clear guidelines are provided on the floor and the elevators are close to the information desk. This is extremely convenient and comforting for users. 捷運出入口，一進入就有無障礙電梯，且地上有明確的引導線，加上靠近服務台，對於使用者很方便，而且安心。		The elevator is too small and unclearly indicated. No clear indications are attached to the front of the elevator, making it difficult to find. 電梯太小，標示不清，而且電梯正面也沒有張貼明顯的牌子，讓人很難找到。

再以進出建築物及建築物內斜坡道為例，斜坡道之彎繞程度顯然是導致正面與負面使用經驗之關鍵設計，因斜坡道之彎繞程度會直接牽涉使用時的體力耗費程度（省力性）。

經由民眾對於目前觀光及交通運輸環境之無障礙設施使用經驗分析可發現，與正面使用經驗之無障礙設施比較，負面使用經驗之設施多於規劃設計時未能落實通用設計觀念，以致未能進一步以使用者在當地環境中之使用行為作為設計核心所致，故為持續提升我國觀光及交通運輸環境無障礙設施之設置品質，未來應加強規劃設計人員在通用設計理念及實踐方式方面的教育訓練，以提升無障礙設施之品質。

UD Dimensions	Positive Experiences (Elevator)		Negative Experiences (Elevator)	
	a	Experience 民眾經驗	b	Experience 民眾經驗
Effortlessness		The ramp in front of the elevator is smooth and easy to navigate, allowing me to effortlessly push the stroller. 電梯出口的斜坡道平順好走，嬰兒車走來省力。		The zigzag ramps are long and narrow. It is difficult for wheelchairs and people with luggage to pass by. 字型的斜坡道，長又窄，輪椅跟對方行李很難差身而過！
		The ramp is directly in front of the exit, which is easily accessible to wheelchair users. 斜坡道就在出口前面，輪椅族出入輕鬆也方便。		The curving and bending ramps are too small and easily blocked by motorcycles. 三彎兩拐的斜坡道，出口小，易被機車擋道！

In terms of barrier-free ramps inside and outside of buildings, the curvature of ramps is evidently the key design factor influencing positive and negative usage experiences. This is because the curvature of the ramps directly affects the amount of effort required to navigate the ramp (effortlessness).

An analysis of users' experiences concerning their use of extant tourism- and transportation-related barrier-free facilities indicated that the majority of the negative experiences derived from facilities that failed to satisfy universal design concepts. Thus, these facilities were not designed based on users' actual usage behaviors in the local context. To continue improving the quality of tourism- and transportation-related barrier-free facilities in Taiwan, the training of designers in universal design and application must be reinforced.

五、智慧科技應用

(一)「掌握競爭力先機 – 貨物流向」

依據世界貿易組織（WTO）公佈 2013 年度貿易統計報告，我國進出口商品貿易總額達 5750 億美元（出口為 3,050 億美元，進口為 2700 億美元），為全球第 18 大貿易國。2014 年 5 月份世界銀行公佈的物流績效指標（LPI），我國自 2007 年以來由 21 名提升至 19 名，而「通關效率、貿易運輸基礎設施、物流服務能力、國際貨運安排、貨物追蹤及即時性」等六項國際評比則是衡量績效的重要參考指標。IoT 藉由盤點既有運輸物流資料，建立我國運輸與貨物流向分析機制，提出資料缺口改善建議，以提供資訊統合分析進行決策支援，並運用世界銀行物流績效指標（LPI）資料，建立我國運輸物流競爭力分析機制，研議提升我國國家運輸物流競爭力之政策構想。

由全球商品貿易的角度，我國進出口貨物流向與物流競爭力之關聯強度是一個值得探討的重要議題，包括探究貨物種類、貨物流向、流量、流速與運輸載具（空運、海運或公路）等是關鍵分析因素。目前我國貨物流向相關資料係由 the Executive Yuan 主計總處、國發會、the MoTC、財政部、the MoEA 等提供，惟因所屬機關各自就轄管權責，依據特定目的，進行資料彙整與統計，所分析因子不一定能完全涵蓋，另關港貿單一窗口的中央資料庫也是資料分析的重點，但源頭必須盤點與重新檢視相關重要因素，包括貨物流向主導者、相關運輸單證、貨物流向的載運者。

5. Intelligent Technology Application

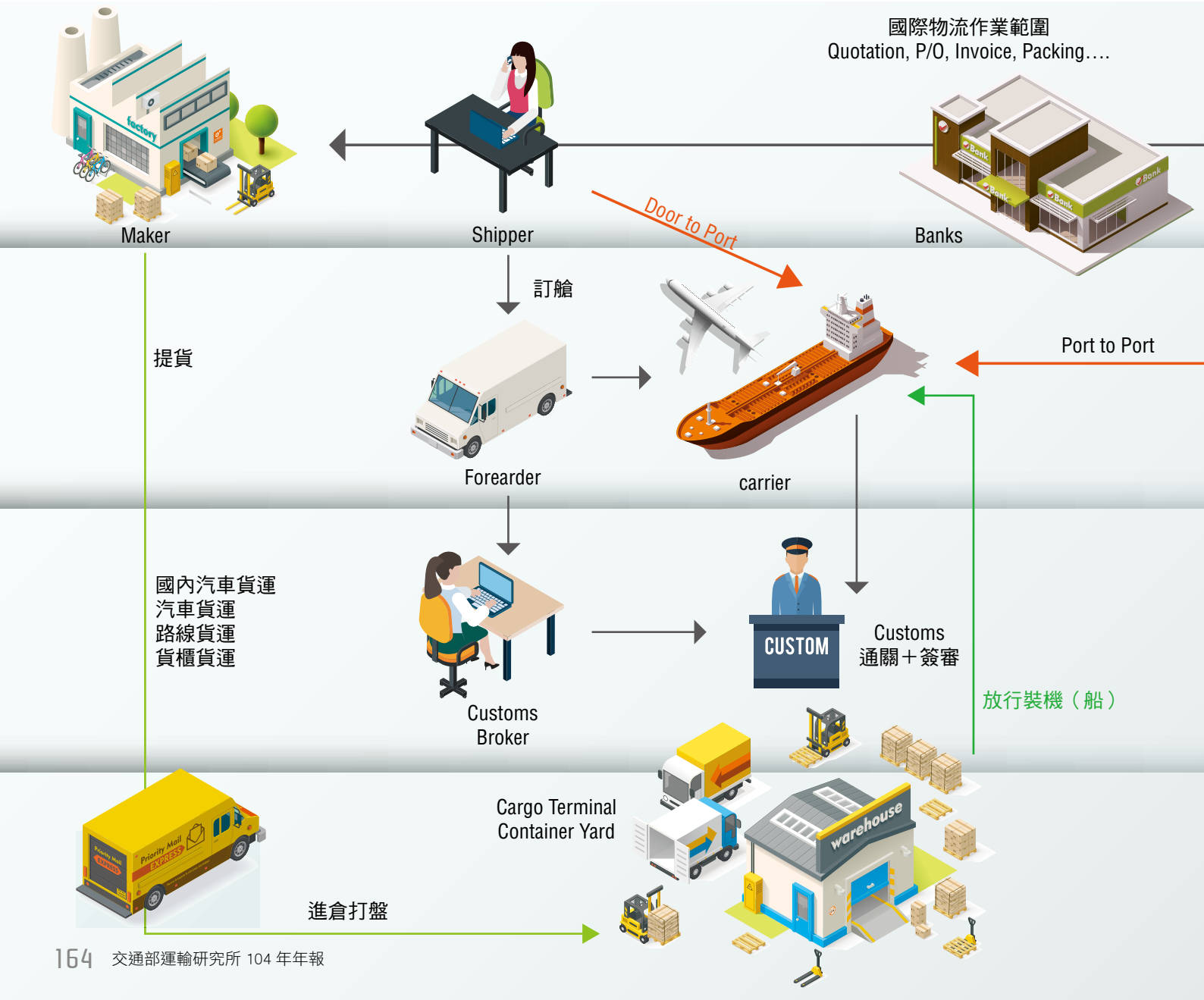
(1) Controlling Competitive Initiative – Flow of Goods

According to the trade statistics announced by the World Trade Organization (WTO), the overall imports/exports in Taiwan reached US $575 billion in 2013 (US $305 billion and $270 billion for exports and imports respectively), ranking 18th among the world's leading trade countries. According to the Logistics Performance Index (LPI) announced by the World Bank in May 2014, the LPI of Taiwan rose from a rank of 21 in 2007 to 19 in 2014, with the international ratings of "customs clearance efficiency," "trade and transportation infrastructure," "logistics service capability," "international freight organization," "cargo tracking," and "immediacy," being the key indicators of performance. By reviewing extant transport and logistics information, the IoT established a transportation and flow of goods analytical mechanism, including the proposal of information gaps and improvement suggestions, and an information integration analysis was performed to support decision-making. In addition, the LPI information announced by the World Bank was utilized to create a transportation and logistics competition analytical mechanism in an attempt to formulate policies to elevate the national transportation and logistics competitiveness of Taiwan.

From the perspective of global commodity trading, the extent of association between the import/export flow of goods and logistics competitiveness in Taiwan is a key issue of discussion, including an investigation into key analysis factors of types of goods, flow of goods, volume, and velocity of flow, and transport type (air, sea, or road). Information relating to the flow of goods in Taiwan is primarily provided by the Directorate-General of Budgeting, Accounting, and Statistics, Executive Yuan, National Development Council, MoTC, Ministry of Finance, and MoEA. Each authority undertakes data integration and calculations based on their individual responsibilities, and thus may not encompass all analytical factors. Additionally, the Survey Research Data Archive, which is the single window for port trading, is also an essential information analysis database . However, sources must be checked and key factors re-evaluated, including the key controllers of the flow of goods, relevant transport documents, and carriers of the flow of goods.

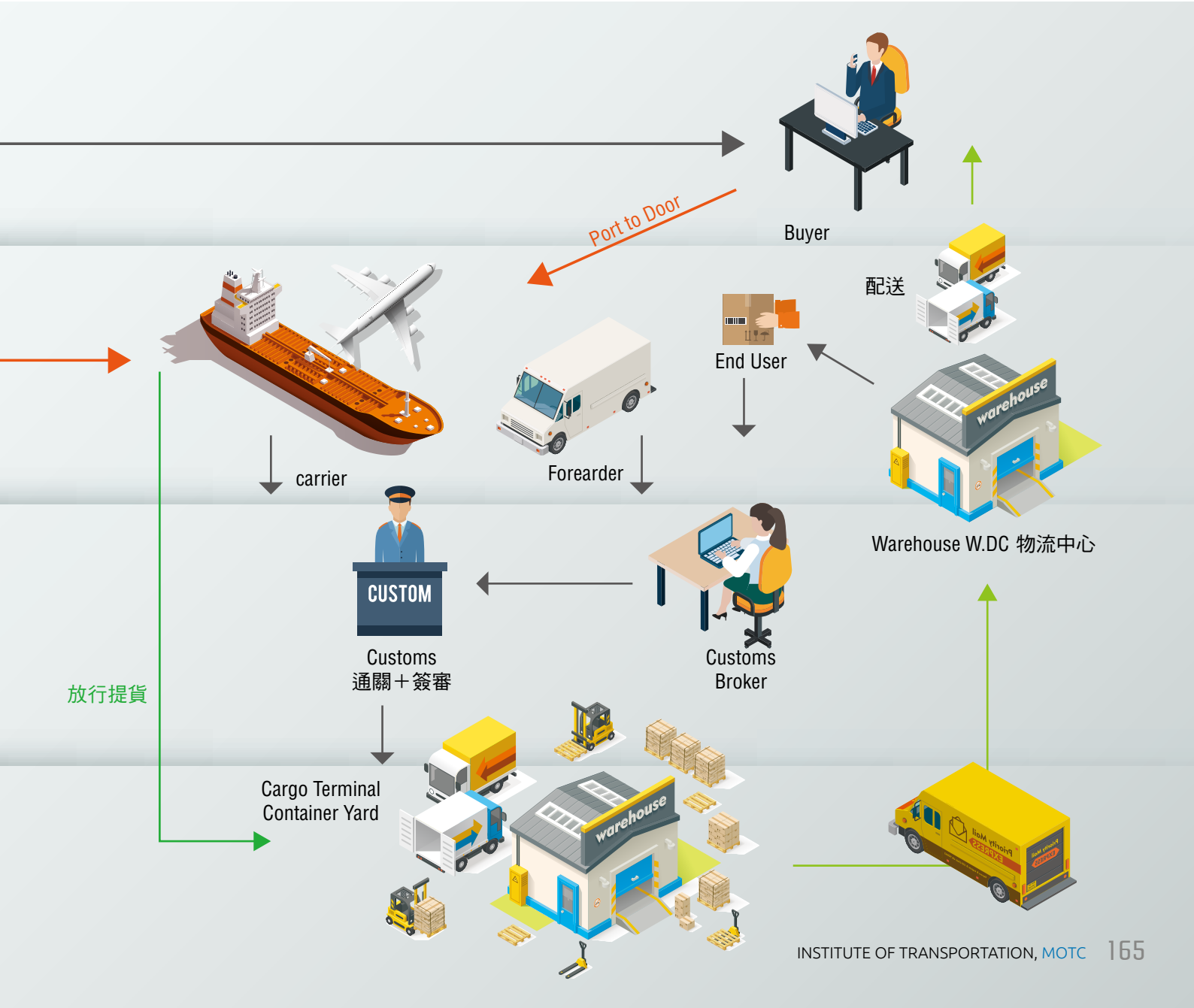
1. 內陸運輸是供應鏈中的最後一哩路

內陸運輸是供應鏈中的最後一哩路（the last mile），也是關鍵的一哩，以目前我國內陸貨物運輸 O&M 狀況及智慧化程度，要提升物流績效指標（LPI）中有關「即時性」或「貨物追蹤」的能力，還有很大的努力空間。基於汽車運輸業在國內貨物運輸與物流發展上扮演重要角色，許多經濟活動都需要藉由汽車貨運來完成這最後一哩的服務，惟長期以來國內缺乏有效的機制與方法來蒐集貨運流向資料，導致蒐集完整且精確的貨運資料是非常困難，因此 IoT 研擬「我國汽車貨運業資料蒐集與應用作業規範（草案）」及建立「優良汽車貨運業者」標章之認證機制（草案），期以循序漸進方式提升貨運業者有系統性的進行 O&M 資料填報，促使政府與業者都能更有效蒐集汽車貨運 O&M 資料與發揮加值應用效益。



A. Inland transportation is the last mile in the supply chain

Inland transportation is the last mile in the supply chain. It is also the key mile. According to current O&M conditions for inland logistics and the extent of intelligentization, greater efforts can be focused into increasing the "immediacy" and "cargo tracking" ratings of LPI. The vehicle transportation industry plays a crucial role in the development of cargo transportation and logistics in Taiwan, where motor freight is often required to complete the last mile in many economic activities. However, Taiwan has always lacked an effective mechanism or method to collect data concerning freight flow, hindering the compilation of a complete and accurate set of freight information. In response, the IoT formulated the *Operating Regulations for the Collection and Application of Motor Freight Information in Taiwan (Draft)* and established the Authentication Mechanism for *"Outstanding Motor Freight Vendors" (Draft)* in an attempt to stimulate freight vendors to report O&M information in a progressive manner. This facilitates both the government and freight vendors in collecting motor freight O&M information and expedites the benefits of value applications.



2. 海空運輸之貨物流向究竟是由誰主導？

根據世界銀行之「物流績效指標（LPI）」、「經商環境指標（DB）」與世界經濟論壇之「促進貿易指標（ETI）」等國際評比指標相關研究顯示，較佳的運輸物流績效與貿易擴張、出口多樣化、吸引外國投資及經濟成長等均有密切關係。但是國際海空運輸之貨物流向究竟是由誰主導？

進口商（買家） Importers (Buyers)	有絕對的選擇權決定向最合宜的供應商（賣方）下訂單，例如當貿易條件 (Trade Term) 為船上交貨 (FOB) 離岸價格時，係由進口商（買方）支付運費，而有權利選擇其載運之海空運送方式及航線服務，也影響其貨物流向及載具途徑。 Buyers have the absolute right to choose the most favorable supplier (seller). For example, when free on board (FOB) is stipulated in the trade terms, the importer (buyer) is responsible for the cost of shipping. The right to choose the freight method and route services also influence the flow of goods and carrier route.
出口商（賣家） Exporters (Sellers)	當貿易條件為成本加保險費加運費 (CIF) 及成本加運費 (C&F) 時，係由出口商（賣方）支付運費而有權決定其國際海空運之運送服務及貨物流向。 When cost, insurance, and freight (CIF) and cost and freight (C&F) are stipulated in the trade terms, the exporter (seller) is responsible for the cost of shipping. Consequently, exporters have the right to choose the carrier services and flow of goods for international air and sea shipping.
船公司 / 航空公司 Shipping and Airline Companies	有其固定的航權與航線，並可透過旗下海空運代理行或承攬業者銷售其艙位，因此選擇船公司或航空公司即是代表這次出貨的運送途徑。其間可能複合式聯運或經第三地轉運的情形發生 These companies hold fixed traffic rights and routes and can sell storage space through their affiliated air and sea shipping agencies and contractors. Therefore, selecting a shipping or airline company denotes the method in which the shipment shall be shipped. During the shipping process, composite intermodal transport or third-party transport may be used.

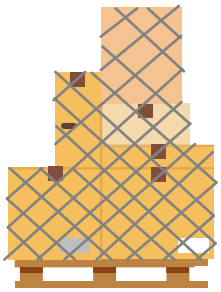
B. Who controls the flow of good in sea and air transport?

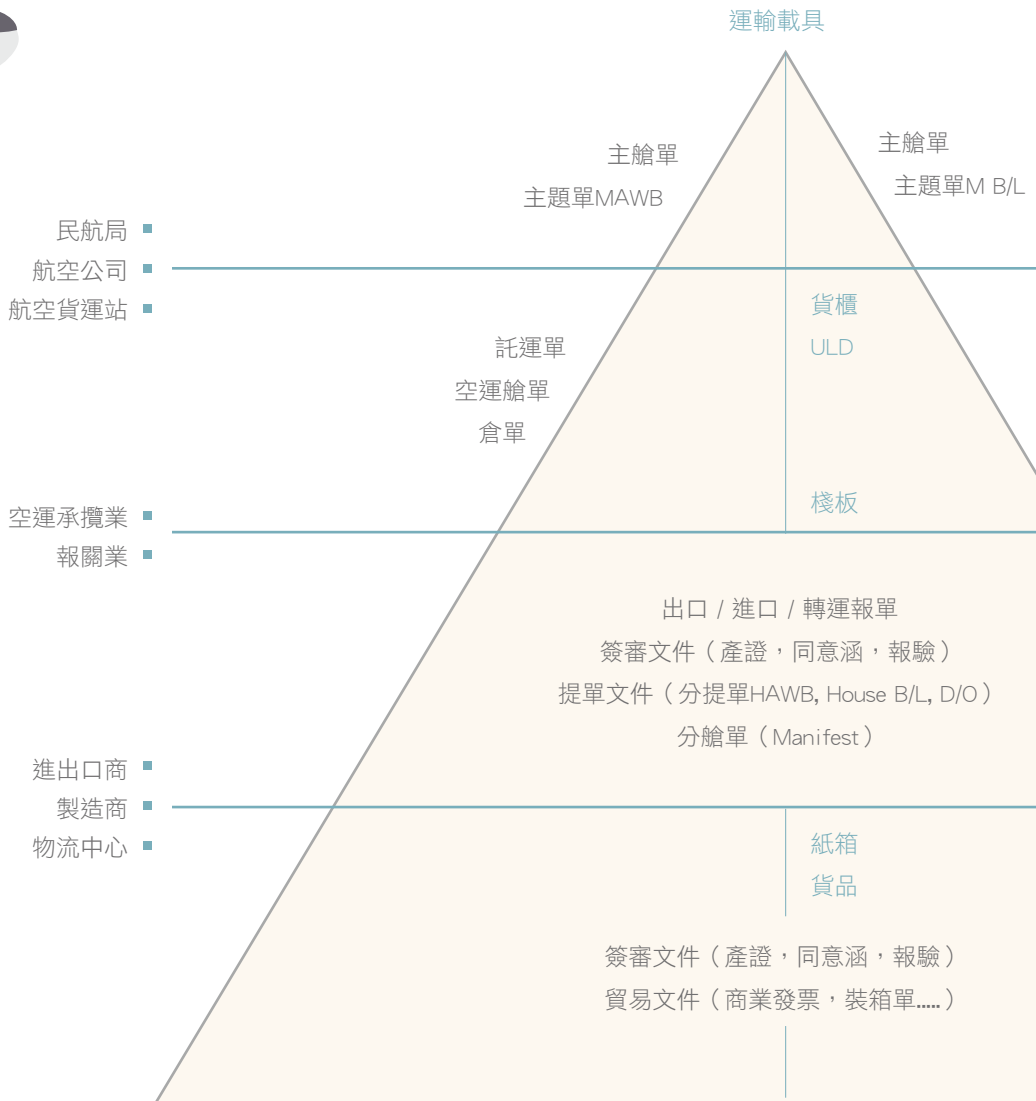
Studies relating to the LPI and "Doing Business (DB)" indicator proposed by the World Bank, and the Enabling Trade Index (ETI) proposed by the World Economic Forum show that favorable transport and logistics performance is closely related to trade expansion, export diversification, attracting foreign investors, and economic growth. However, the controllers of international air and sea transport remain to be elucidated.

海空運代理行或承攬業者 Air and Sea Transport Agencies and Contractors	承攬業者雖然未擁有船隻及飛機，但是卻能運用全球船公司及航空公司之運輸載具及艙位來承攬運送客戶所交付的任務，也直接影響貨物流向的安排。 Although agencies and contractors do not own cargo ships or planes, they are able to complete the tasks commissioned to them by their clients by utilizing the carriers and storage spaces of global shipping and airline companies. Thus, they directly influence the flow of goods.
港口 / 機場 Seaport and Airports	港口或機場可以經由優惠配套方式或增強基礎設施的方式吸引船空司或航空公司的停靠起降，也產生對貨物流向的直接影響。 Seaports and airports attract shipping and airline companies to use their facilities by offering discounts or improving basic infrastructure. Thus, they directly influence the flow of goods.
政府機關 Government Agencies	政府部門可經由與國際貿易談判取得最優國待遇的關稅減免或零關稅，例如區域全面經濟夥伴協定 (RCEP)、跨太平洋夥伴協定 (TPP) 等自由貿易協定 (FTA) 均是經由各國政府積極加入區域貿易協定取得優惠關稅，將直接影響買賣雙方採購的版塊移動，連帶牽動全球貨物流向的移動。 Government agencies may receive the highest tax exemptions or deductions through international trade negotiations. For example, free trade agreements (FTAs), such as the Regional Comprehensive Economic Partnership (RCEP) and the Trans-Pacific Partnership (TPP), are the tax discounts obtained by the government through vigorous participation in regional trade agreements. These discounts directly influence buyer/seller trends, which jointly influence the global flow of goods.

3. 海空運輸之貨物流向資料在哪？

不同運輸產業分工之下，所需具備行業規範及申報單據亦不同，如何取得原始單據內容的資料，掌握貨物流向及承載內容物，以完整分析貨物流向、流量及物流績效統計。IoT 依照海運產業鏈及空運產業鏈，加以分層整理出不同運輸載具與相關貿易運輸文件關聯，找出與貨物流向相關的原始資料（Raw Data）源頭，取得正確資料來源，有助於解讀產業經營現況，了解市場的潛在需求與發展趨勢，進而訂定適切的海空運輸產業發展政策。





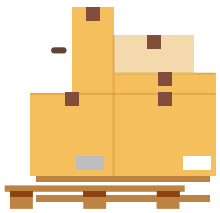
C. **Where is the information concerning the flow of goods conducted via sea and air transport?**

Different industry regulations and declaration documents are required under different transport industry divisions. Consequently, obtaining information concerning original source documents helps analysts determine the flow of goods and carrying content, which facilitates a complete analysis of the flow of goods, volume, and logistics performance statistics. Based on maritime and airfreight chains, the IoT hierarchically characterized the association between transport carriers and related shipping documents to highlight the raw data sources involving the flow of goods and obtain accurate data sources. This facilitates analysts in interpreting current industrial management conditions, understanding potential market demands and development trends, and consequently establishing appropriate development policies for the sea and air transport industries.

- 港務局
- 船公司
- 貨櫃場

海運艙單
貨櫃裝載明細表
進出倉單

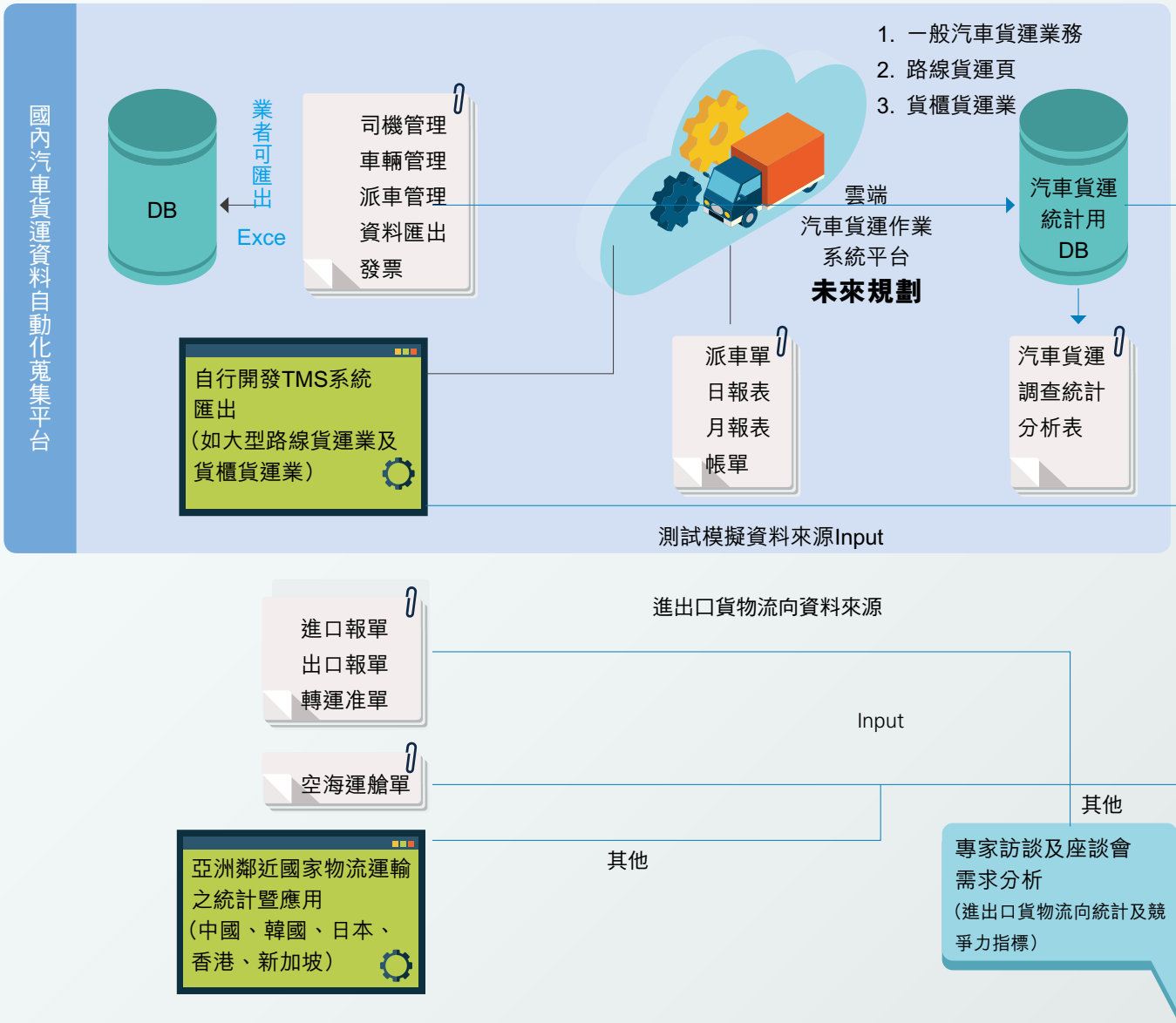
- 海運承攬業
- 報關業



- 進出口商
- 製造商
- 物流中心

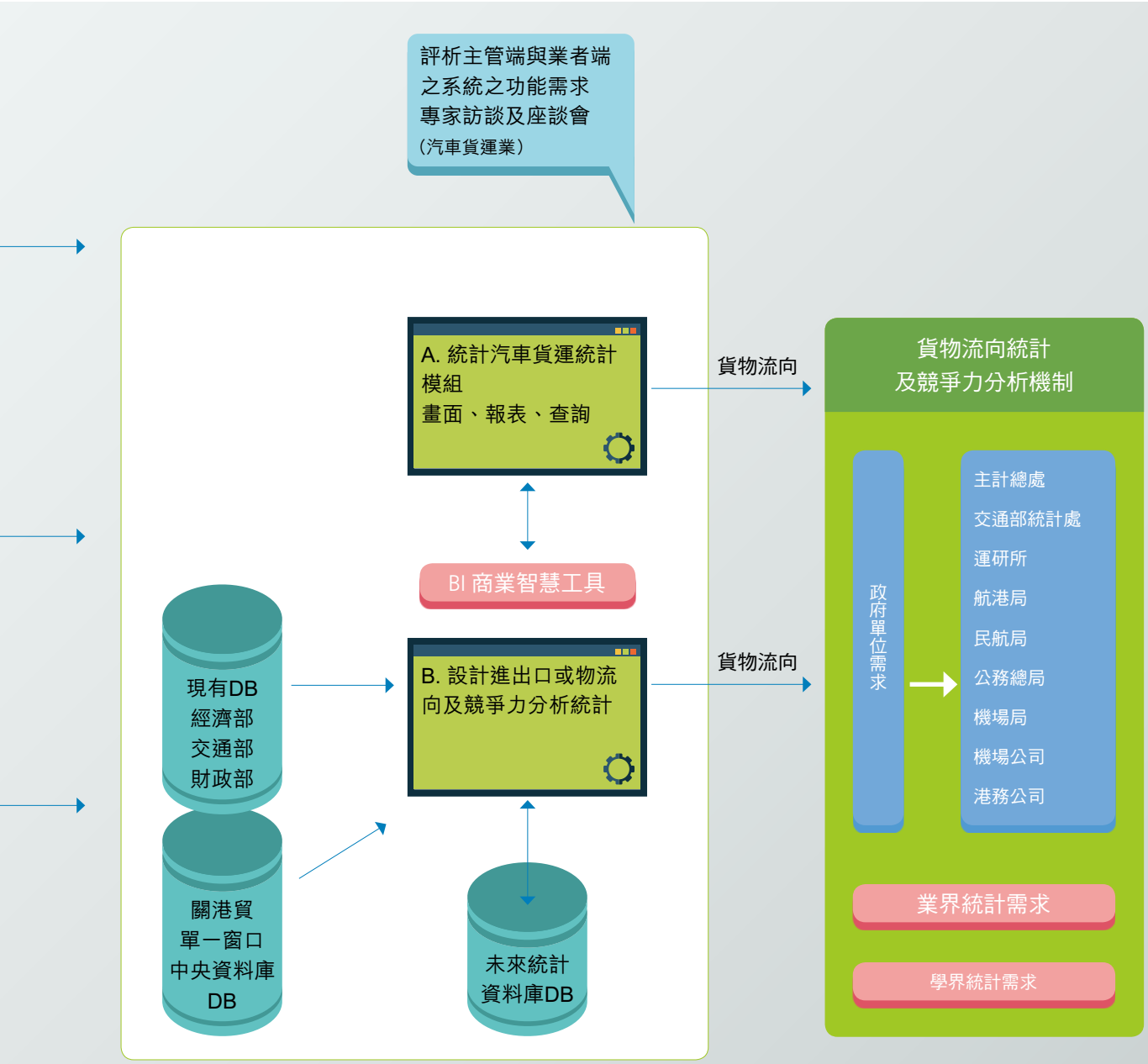
4. 戶及戶（Door to Door）進出口貨物流向陸、海、空資料無縫串接

貨物不會自己由賣方手上自動跑至買方手上，皆需要透過運輸工具進行貨物的運送，而國際物流服務亦是藉由陸、海、空等複合運輸體系，達到貨物流通的目的。考量完整運輸物流資料庫之建置有助於相關決策支援系統之發展，IoT 建立我國貨物流向統計分析系統概念架構，期能藉由汽車貨運自動化資料蒐集平台的規劃與進出口報關資料及關港貿單一窗口的中央資料庫進行串連，完整掌握進出口貨物之運輸與貨物流向分析資料，提升我國國際物流競爭力發展之關鍵政策方向與機會。



D. Door-to-door import/export flow of goods – Seamless integration of land, sea, and air data

Goods cannot autonomously shift from seller to buyer. They are shipped using various means of transport. International logistics services typically utilize land, sea, and air transport systems to achieve the flow of goods. In consideration of this, the establishment of a comprehensive transportation logistics database is beneficial for the development of relevant decision support systems. Thus, the IoT established a conceptual framework for a domestic flow of goods statistical analysis system in an attempt to comprehensively elucidate the analytical data of transport and flow of imported/exported goods through the planning of an automated motor freight data collection platform and the integration of concatenation of import/export customs information and the Survey Research Data Archive, thereby improving key policy directions and opportunities concerning the development of Taiwan's international logistics competitiveness.



（二）港灣環境資訊系統 - 藍色公路

臺灣四面環海，地處歐美兩大航運幹線上，隨著兩岸航線的陸續開通，海上運輸交通日益繁忙，海上航行安全也日益受到重視。然而臺灣附近水域的地形環境複雜，又受季風及颱風影響，海象可說是變化莫測，而港區周遭之水理特性，除外海海象環境，更受制於港灣結構物的影響，常有局部性的效應產生，此都對船舶進出港的操航安全有極大之影響。

所以對於海上交通運輸之航行安全，臺灣海域海氣象環境資料及相關資訊之完整獲得與提供相當重要。於是 IoT 發展整合型態之港灣環境資訊系統，包含即時港灣海氣象觀測資訊、海象模擬資訊、藍色公路、港區地震資訊、模擬資訊及港區大氣腐蝕等如圖 4-41 所示，利用資訊技術整合即時海氣地象觀測與模擬資料，彙整提供港灣各項資訊包括即時觀測數據、模擬資料、攝影影像、歷時圖表、動畫圖及各類統計圖表等資訊，提供查詢與展示。均可透過有線和無線資訊網路（網址：http://isohe.ihmt.gov.tw）即時提供港埠管理單位、全國災害防救中心、中央主管機關及國內外船舶業者相關人員查詢。

圖 4-41　港灣環境資訊系統

Figure 4-41　The Harbor Environment Information System

(2) Harbor Environment Information System – Blue Highway

Taiwan is an island nation located on two key European and American navigation routes. The maritime transport industry in Taiwan has become increasingly busy with the gradual opening of routes between Taiwan and China, and there is a consequent awareness of maritime transport safety. The ocean terrain surrounding Taiwan is extremely complex and frequently subject to monsoon winds and typhoons, rendering this area extremely unpredictable. The waters surrounding the ports of Taiwan are influenced by not only the outer oceanic environment, but also the harbor structures, which often cause localized effects. These factors significantly affect the navigation safety of ships entering or exiting these harbors.

Therefore, the comprehensive collection and provision of oceanic and meteorological environmental information of Taiwan's oceans and other relevant information is essential for ensuring the navigation safety of maritime transportation. In this context, the IoT developed an integrated harbor environment information system to instantaneously provide information regarding harbor oceanic and meteorological environments, ocean simulations, blue highways, harbor earthquakes, tsunami simulations, and harbor atmospheric corrosion as shown in Fig.4-41 Information integration techniques were used to instantaneously integrate oceanic and meteorological environmental information and simulation information to provide various categories of harbor information, such as instantaneous observation data, simulation information, photographic images, historical and latest charts, animated charts, and various statistical charts and graphs for users to consult. This information can also be instantaneously provided to port management units, the National Disaster Prevention and Relief Center, central competent authorities, and domestic and international shipping industries through wired or wireless information networks (website: http://isohe.ihmt.gov.tw).

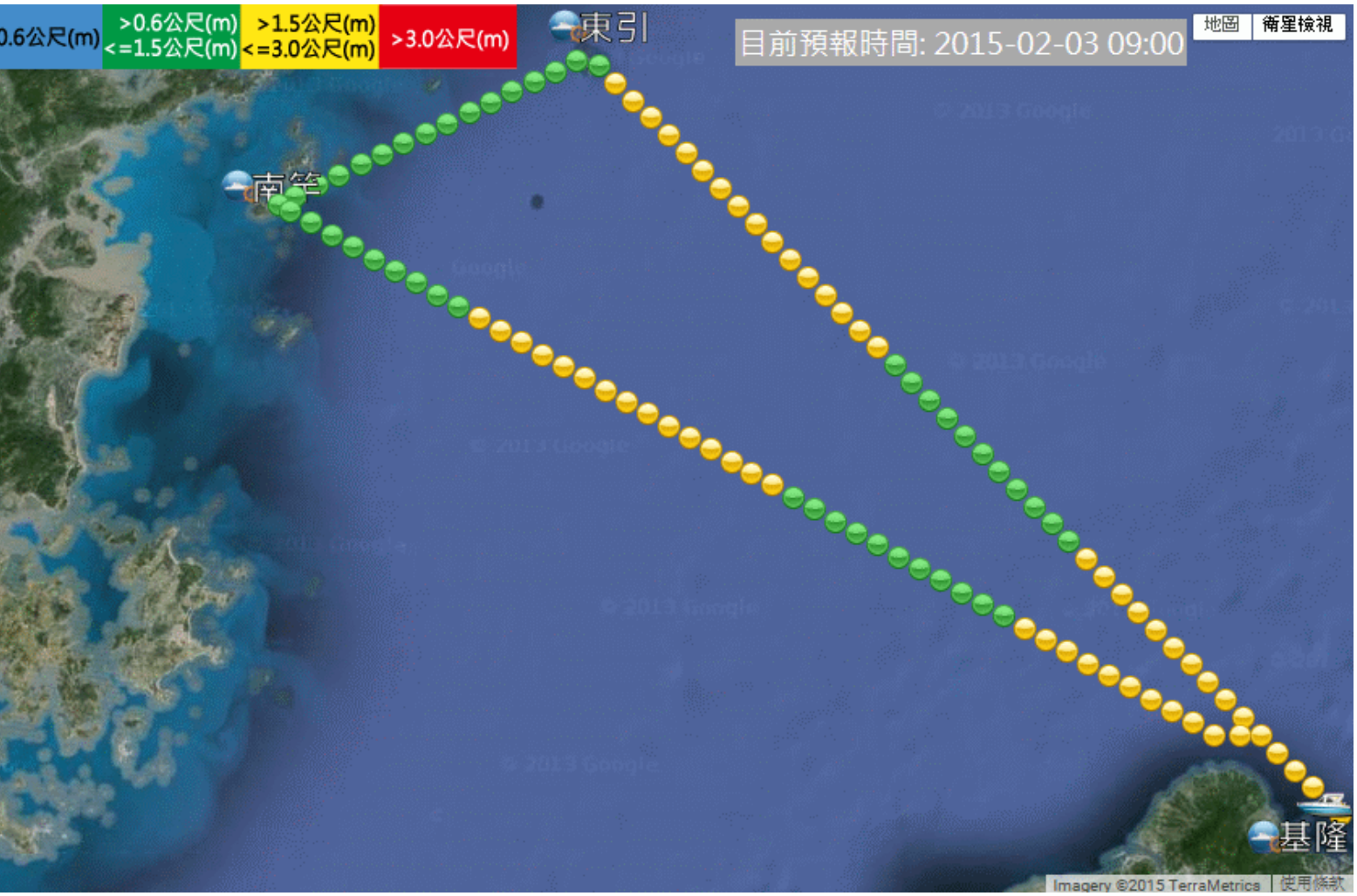


圖 4-42　藍色公路查詢畫面

Figure 4-42　Blue Highway Query Screen

港灣環境資訊系統內發展藍色公路，為結合即時海氣觀測資訊、海象模擬資訊及船舶自動識別系統之應用系統。依據固定船班之船舶實際航行軌跡，加以彙整成各航線位置，並提供航線上即時風速、風向、波高及波向等海氣象模擬資訊與船舶即時所在位置、航行方向、航行速度、目的地港口及預計抵達時間等船舶動態資訊套疊如圖 4-42 所示，目前已建置基隆 - 東引 - 馬祖（南竿）、基隆 - 平潭、基隆 - 台州、臺北 - 平潭、臺中 - 平潭、臺中 - 廈門、臺中 - 馬公、布袋 - 馬公、高雄 - 馬公、蘇澳 - 花蓮以、東港 - 小琉球、臺東 - 綠島 - 蘭嶼、臺東 - 蘭嶼和墾丁 - 蘭嶼等 14 條藍色公路航段如圖 4-43 所示。因此藍色公路，具有整合即時海氣觀測與數值結果涵蓋全面性、即時性與預測性之港區環境資訊，並與船舶自動識別系統連結，以提供給港埠管理單位、船長、航商及遊客等，使其對航線之自然環境狀況能有較確實完整的掌握。

Blue highways are generated in the Harbor Environment Information System to produce an application system that combines instantaneous oceanic and meteorological environmental information, ocean simulation information, and automatic identification systems. The system analyzes the actual navigation routes of scheduled ships to create various navigational positions and provide real-time oceanic and meteorological simulation information on the navigation routes, such as wind velocity, wind direction, and wave height. The system also analyzes real-time dynamic information, such as position, navigation direction, navigation speed, destination harbor, and estimate time of arrival as shown in Fig. 4-42. Currently, 14 blue highway segments have been established, comprising Keelung-Dongyin-Matsu (Nangan), Keelung-Pingtan, Keelung-Taizhou, Taipei-Pingtan, Taichung-Pingtan, Taichung-Xiamen, Taichung-Magong, Budai-Magong, Kaohsiung-Magong, Suao-Hualien, Donggang-Xiaoliuqiu, Taitung-Green Island-Lanyu, Taitung-Lanyu, and Kenting-Lanyu as shown in Fig. 4-43 Therefore, blue highways integrate instantaneous oceanic and meteorological environmental information and port environment information with comprehensive, instantaneous, and predictive numerical achievements. This information is linked to the automatic identification systems of ships. This system can be used by port authorities, ship captains, shipping companies, and tourists, allowing them to gain a better and more comprehensive understanding of the natural environment conditions of the navigation route.

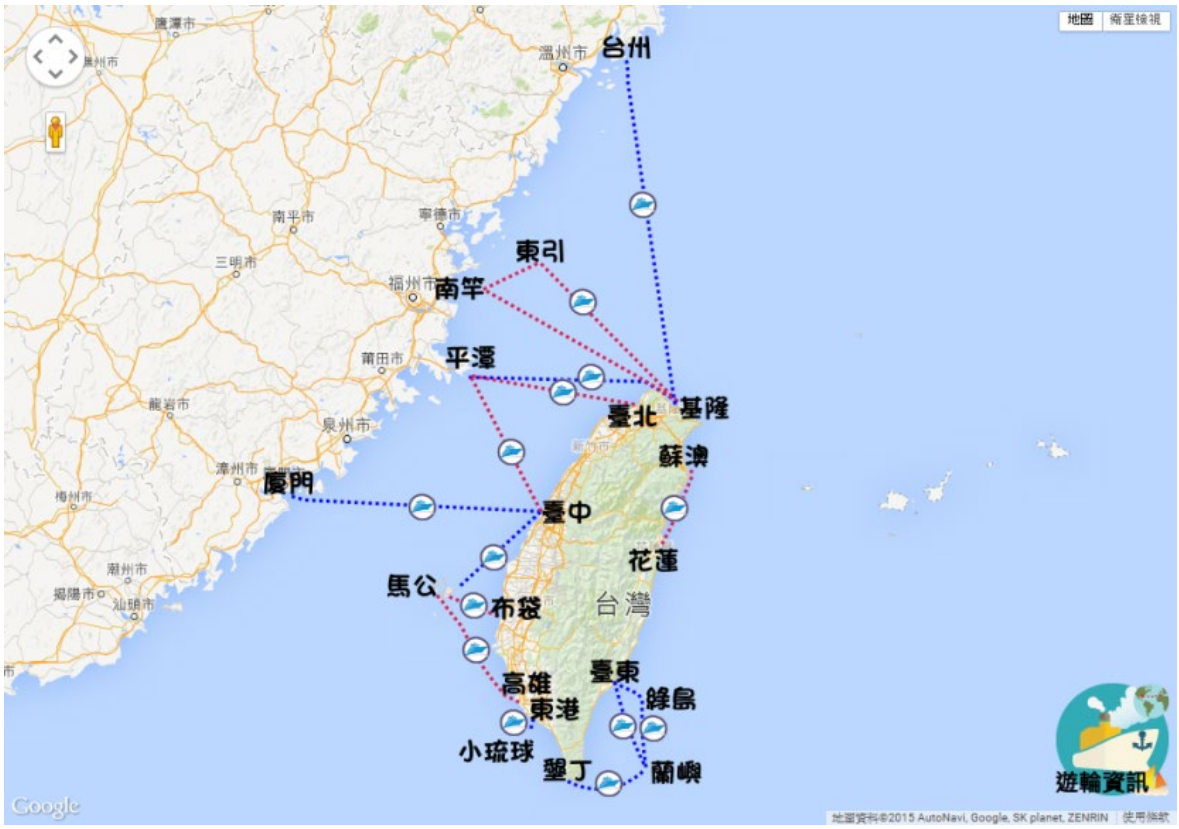


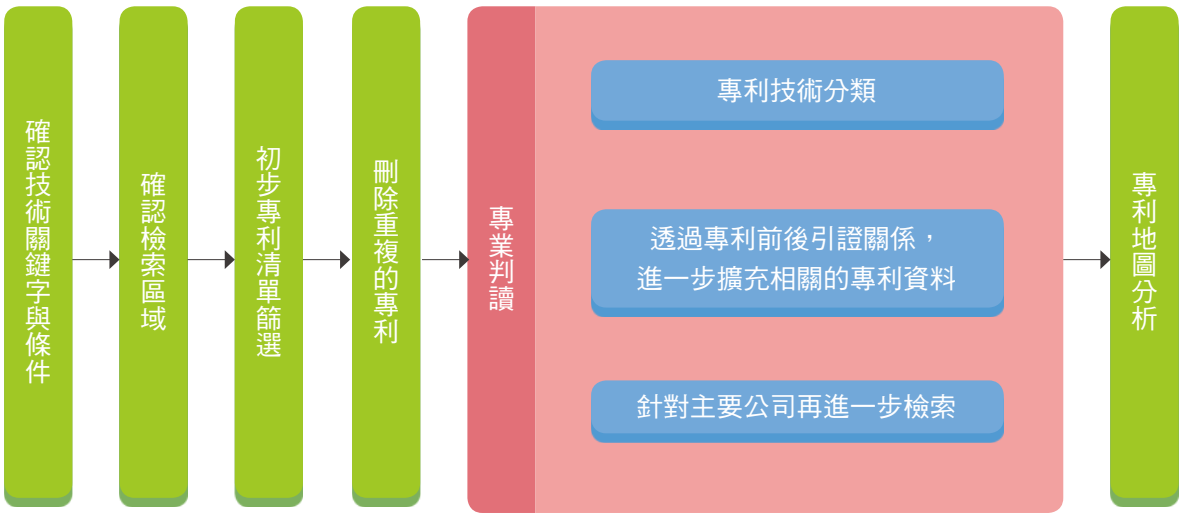
圖 4-43　藍色公路航段

Figure 4-43　Blue Highway Navigation Segments

（三）促進科技計畫研發成果推廣應用、提供交通科技知識分享服務

研發成果智慧財產管理已成為國內外企業或組織必須面對的課題，我國於民國 101 年 10 月 17 日行政院科技會報討論通過「智財戰略綱領」，並擬定 6 大戰略重點與 27 項實施要項，由 5 部會分頭執行，其中「創造運用高值專利」與「活化流通學界智財」即為兩大戰略重點，顯見政府對於智慧財產佈局的重視及其重要性。

由現今極度注重專利佈局之科技發展環境可窺知，科學技術研究與智慧財產權研究務必雙軌並行，方可確保各項科技研發成果之智財權獲得適切保護。此外，藉由智慧財產權之研究，亦可發掘各項專利技術之發展方向，了解應產業實際需求及相關技術發展趨勢，從而得以規劃及研發適切之未來創新技術，協助促進產業升級。有鑑於此，本所配合年度科技研究計畫及交通部預定推動之重要科技發展服務，同步實施相關技術之智慧財產權研究，以提供本所各計畫創新研發成果之專利申請以及後續研究方向建議，並襄助交通部完成相關科技發展服務計畫之智財權議題探討，以及從智慧財產權角度，提供交通部建置相關服務系統之可行性方向建議。此外，本所並辦理各項創新研發成果之授權規劃與技術移轉，使得各項研發成果有效提供公部門及產業界實施運用，以促進交通施政成果並提升相關產業之技術，以達成科學技術基本法與產業創新條例促進科技發展與產業創新之制訂目標。



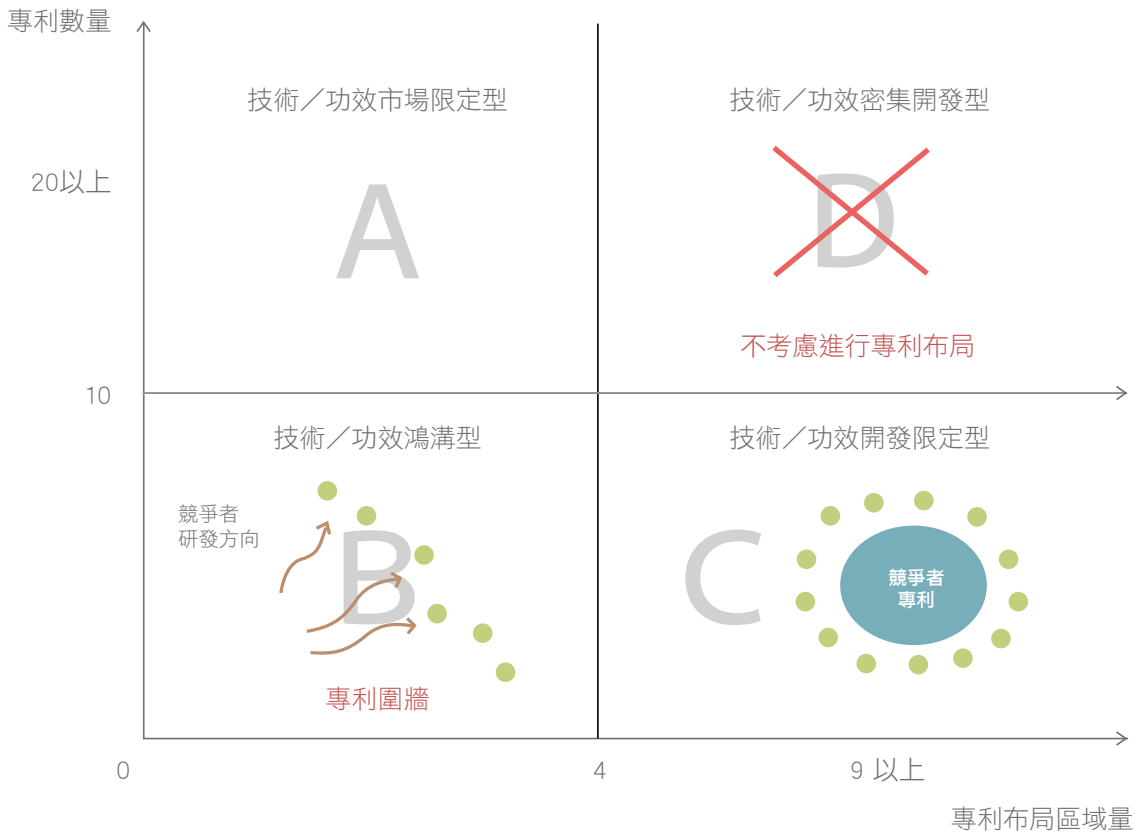
(3) Promoting the development and application of technology R&D projects; providing sharing services for transportation-related technological knowledge

The management of the intellectual property of research achievements has become an essential problem that domestic and foreign companies and organizations are required to address. The "Intellectual Property Strategic Agenda" was passed in the Board of Science and Technology discussion by the Executive Yuan on 17 October 2012, where 6 major strategies and 27 implementation items were introduced. Each of the five ministries has been assigned a portion of the strategies and implementation items. Among the six strategies, "creating and applying high-value patents" and "activating and circulating academic intellectual property" are regarded as the primary strategies, highlighting the value and importance the government has attached to intellectual property.

The current substantial value attached to the technological development environment of patents suggests that scientific/technological research and intellectual property research must be concurrently conducted to ensure that the intellectual property of various technology R&D achievements is appropriately protected. Therefore, through intellectual property research, the development directions of various patenting techniques can be uncovered and trends relating to actual industry requirements and technique development can be identified, facilitating researchers in appropriately planning for and developing future innovative techniques and promoting the improvement of industry. In this context, the IoT plans to collaborate in various annual technology research projects and the MoTC plans to launch key technology development services in an attempt to engage in intellectual property research for relevant techniques. Suggestions can then be formulated, which can be provided to the IoT to facilitate the patent application and subsequent research direction for various innovative R&D projects, as well as to the MoTC to facilitate the completion of intellectual property investigations for various technological development service projects, and establish relevant service systems based on intellectual property. In addition, the IoT shall handle the authorization planning and technology transfer of various innovative R&D achievements to effectively incorporate various R&D achievements into government departments and industries, thereby facilitating transportation policy achievements and improving relevant industrial technologies. Consequently, new science and technology laws and industrial innovation regulations can be formulated to facilitate technology development and industrial innovation.

鑒於構建知識管理機制，除可提高組織學習效率及建立組織學習文化外，藉由提供研發成果知識分享服務，亦可促進我國科技研究之學術交流發展，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，IoT 依循產業創新條例之規範方向，持續進行各項研發成果知識管理系統資料 maintenance 更新及功能升級，並將各項計畫研究成果、各國創新交通技術參考專利以及交通運輸領域相關期刊文獻及研究論文，逐步整合於 IoT 知識管理系統資料庫中，並利用「交通科技知識分享服務網」之網路介面，提供我國產、官、學、研各界人員線上查詢服務，以藉由實踐知識分享，促進我國產業技術之創新發展。此外，為提高組織學習效率及建立組織學習文化，IoT 並針對組織內部之顯性與隱性知識，完成知識管理系統之建置與 maintenance，以達成專業知識永續傳承之目標。

The establishment of a knowledge management system will not only enhance organization learning efficiency and cultivate learning cultures, but also facilitate the academic exchange and development of technology research in Taiwan through the provision of R&D achievement knowledge sharing services. This system can further prevent the repeated investment of research resources and efforts into already protected intellectual property, which causes the unnecessary wastage of research funding and human resources. Based on the orientation of industry innovation regulations, the IoT continues to focus efforts on the maintenance of updating and upgrading various R&D achievement knowledge management systems. The IoT is also focusing on the progressive integration of research achievements of various projects, reference patents of various countries relating to innovative transportation technologies, and published studies and research papers in the field of transportation into the IoT Knowledge Management System database. In addition, the IoT developed the "Transportation Technology Knowledge Sharing Service Website" network interface, offering an online query service for users serving in the industrial, government, academic, and research sectors in an attempt to promote the innovative development of Taiwan's industrial technologies through knowledge sharing. To elevate organizational learning efficiency and cultivate learning cultures, the IoT further examined the internal implicit and explicit knowledge of organizations to complete the establishment and maintenance of the knowledge management system, thereby achieving a sustainable legacy of professional knowledge.



未來，IoT 在智慧財產管理應用方面，將持續致力於提升科技計畫之研發效能，並努力落實研發成果之授權應用，以「促進產業創新、改善產業環境、提升產業競爭力」為目標，提供國內相關產業技術發展協助，並帶動我國交通運輸科技與交通建設之發展，增進整體運輸效能；在知識管理與知識分享服務方面，則將持續 maintenance 知識管理資料庫，提供最新專利技術及相關研究文獻知識分享服務。IoT 期望藉由以上努力，促使國內各項交通科技、交通環境與交通服務更為先進、親和、便民。

Regarding the future management and application of intellectual property, the IoT aims to continue focusing efforts on enhancing the R&D effectiveness of technology projects and fulfilling the authorized application of R&D achievements, thereby achieving the objectives of "promoting industry innovation, improving industry environment, and enhancing industry competitiveness." Through this process, the IoT anticipates facilitating the development of domestic industry technologies, actuating the development of Taiwan's transportation technologies and infrastructures, and promoting overall transportation performance. In terms of knowledge management and knowledge sharing services, the IoT aims to continue maintaining knowledge management databases and providing knowledge sharing services for the latest patented technologies and relevant research papers. By focusing efforts into the aforementioned areas, the IoT aims to improve transportation technologies, transportation environments, and transportation services, and make these items more accessible to the public.

05

落實應用實績

Implementation of application performance

INSTITUTE OF TRANSPORTATION, MOTC

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：

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 104 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。103 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，並協助交通部就國家發展委員會 103 年「國家建設總合評估規劃」補助經費案研提審查意見，且協助交通部審核各機關提報 102 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，協助交通部研提部門綱要計畫架構，以期整合部門綱要計畫與中程施政計畫。

To meet the Ministry of Transportation and Communications' (MOTC) policy objectives of "building intelligent transportation system, promotion of sustainable green transportation, and compliance with carbon reduction," this institute is committed to utilizing the technology plan research and development results to promote the MOTC's policy. In cooperation with Taiwan's domestic transportation environment, the results of research and development on related transportation technology software and hardware systems will be transferred to various traffic management authorities or local governments for application. This will be done to enhance the traffic management effectiveness of various transportation management authorities and local governments. Below is a brief introduction of related performance results.

Handling the annual budget consideration and case project review for the "MOTC Mid- to Long-Term Plan for each Sub-Category"

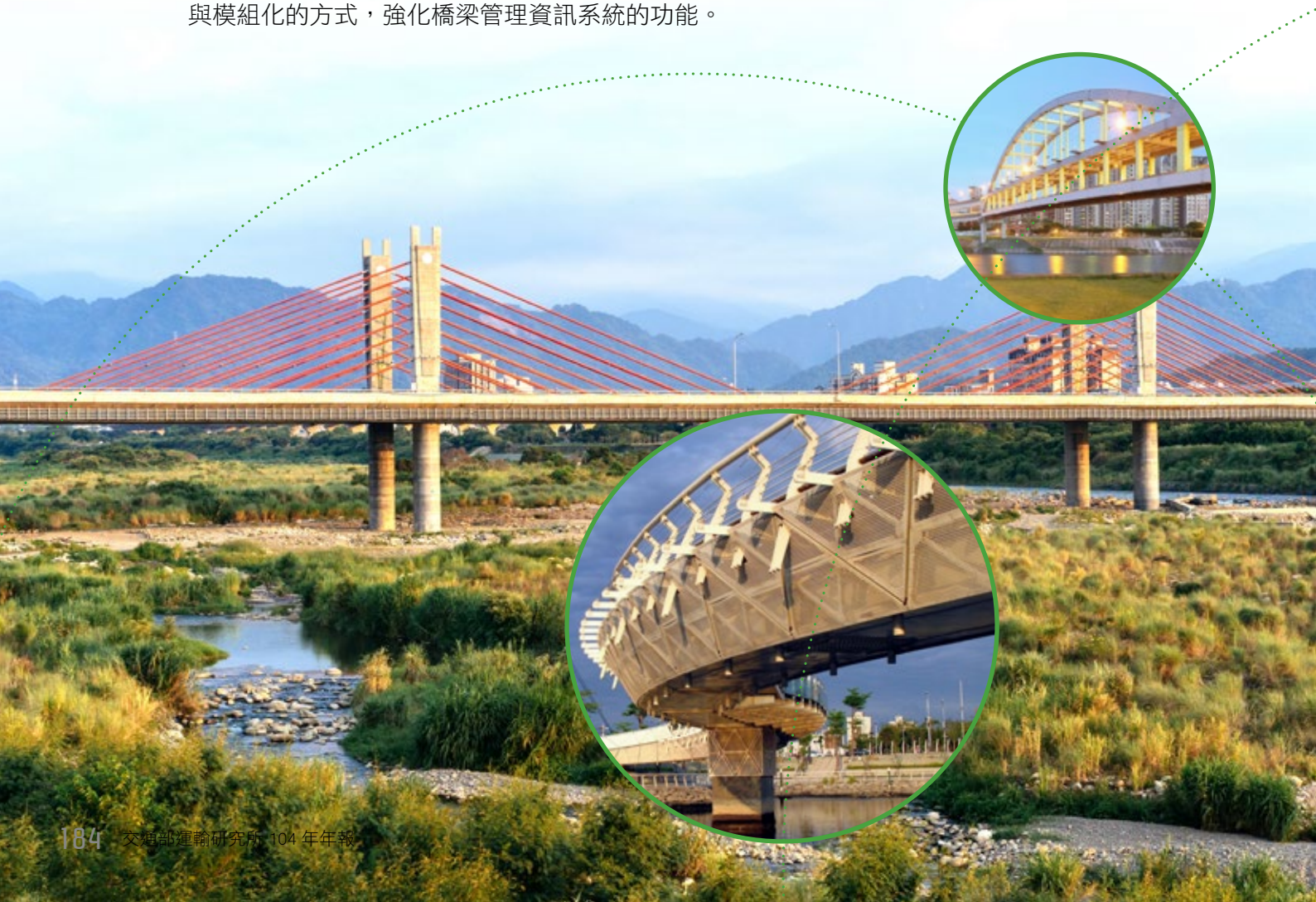
The institute handled research related to the "Transportation sector's mid- to long-term public infrastructure development work evaluation", cooperated with the MOTC's 2015 advance review of public infrastructure and transportation departments, and assisted in the reporting of preparation of mid- to long-term development plans. In 2014, in addition to helping the MOTC in the consideration and assessment of related construction plan cases, the institute also attended the various traffic construction improvement project review meetings and consultative meetings, assisted the MOTC in providing research case funding review comments on the National Development Council's (NDC) "2014 Aggregated National Construction Assessment Plan", and assisted the MOTC in evaluating the "Evaluation and Review of the Results of 2013 Major Public Infrastructure Projects" submitted by various organizations. In addition, the institute cooperated with the NDC in the editing of adjusted mid- to long-term plans, assisted the MOTC in researching and proposing the structure of the department plan outline to integrate the department's plan outline with the medium-term policies.

辦理「區域整體交通系統改善方案」

本所長期以來一直扮演「臺灣地區整體運輸系統規劃者」的角色，並在交通部的指導下完成多項指標性的研究報告。在規劃臺灣地區整體運輸系統發展同時，亦同時擘劃北、中、南、東四大區域之交通施政主軸與策略。本所先後於 100 ～ 101 年完成「花東地區整體交通系統改善方案」與「花東地區交通部門整體施政中程計畫」，續於 103 年完成「南部、中部及北部三大區域整體交通系統改善方案」，期能作為交通部與地方政府推動交通改善之參據，並藉由整合中央與地方之交通建設、軟體管理及行政作為，讓區域交通服務發揮更大成效。

辦理橋梁維護管理作業評鑑

為落實橋梁安全管理與維護，以提升臺灣橋梁使用安全與改善交通環境安全，本所於 103 年 5 月完成 102 年度縣市政府評鑑作業，公布評鑑結果；另於 103 年 7 ～ 8 月辦理北、中、南 3 場「臺灣地區橋梁管理資訊系統」教育訓練，約計訓練 1,000 人次另外，自 103 年度正式辦理縣市政府橋梁檢測外部稽核作業，透過三級品管制度，確保各縣市政府落實執行橋梁檢測與維護作業；同時，進行二代橋梁管理資訊系統之開發作業，期以構件化與模組化的方式，強化橋梁管理資訊系統的功能。



Implementation of the "Overall Regional Transportation System Improvement Program"

The institute has long played the role of the "overall regional transportation system planners of Taiwan," and completed a number of indicative research studies under the guidance of the MOTC. While planning the development of Taiwan's overall regional transport system, the program also simultaneously maps out the main points and strategies of transportation policies for northern, central, eastern, and southern Taiwan. The institute also completed the "Hualien-Taitung Overall Regional Transportation System Improvement Plan" and the "Hualien-Taitung Regional Overall Medium-Term Governance Plan for Transportation Departments" from 2011 to 2012. In 2013, the "Southern, Central, and Northern Taiwan Overall Transportation System Improvement Project" was completed, and this can serve as a reference for the MOTC and local governments when improving transportation. The integration of central and local transportation infrastructure, software management, and administration can allow for more effective regional transportation services.

Implementation of Bridge Maintenance Management Task Evaluation

The implementation of safety management and maintenance of bridges enhances Taiwan's bridge usage safety and improves traffic environment safety. In May 2013, the institute completed its 2012evaluation of local governments and published its results. From July to August of 2014, three "Taiwan bridge management information system" education sessions were held in northern, central, and southern Taiwan, training approximately 1000 people. External bridge audits and inspections officially began in 2014, using three quality control systems to ensure the implementation of inspections and maintenance operations by local governments. At the same time, development of second generation bridge management information systems began. This system uses a component and modular approach to enhance the functions of bridge management information systems.

協助交通部推動「公路公共運輸提昇計畫 (102 ～ 105 年)」

交通部自 99 年起推動「公路公共運輸發展計畫（99 ～ 101 年)」，執行以來，公共運輸市占率自 98 年的 13.4％ ，已逐年提升至 102 年的 15.2％ 。本計畫並於 102 年榮獲世界公共運輸國際協會（UITP）頒發「亞太政治承諾獎項」最佳殊榮。為延續前述計畫之推動成果，交通部賡續推動「公路公共運輸提昇計畫（102 － 105 年)」，為期 4 年。本計畫 103 年度預算數為 39 億 2,388 萬 4,000 元，本所配合交通部賡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。依據資料顯示，103 年公共運輸載客量較 102 年成長約 2.7%，較 98 年度成長約 20%。

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，103 年度截至 12 月底出席會議及審查案件達 259 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，103 年度參與內政部都市計畫委員會審查桃園航空城等重大變更案，截至 12 月底計出席會議 168 次、審查案件達 337 案；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 52 次、審查案件達 31 案。

Assisting the MOTC in promoting the "2013-2016 Road and Public Transportation Improvement Plan"

From 2010, the MOTC began promoting the "2010-2012 Surface Public Transport Reconstruction Campaign." After its implementation, the market share of public transportation went from 13.4% in 2009 to 15.2% in 2013. This project won the "Asia Pacific Political Commitment Award" at the 2013 Grow with Public Transport International Awards organized by the International Association of Public Transport. To continue the achievements of the previous project, the MOTC announced the "2013-2016 Surface Public Transport Reconstruction Campaign." In 2014, this project had an annual budget of NT$3.923884 billion. This department works in coordination with the MOTC to offer continued supervision and assistance for local governments to promote this plan, thus strengthening the quality and energy of the entire country's public transportation service. According to the data shown, the number of passengers taking public transportation in 2014 grew by 2.7% from 2013, a rate approximately 20% higher than in 2009.

Handling the deliberation and tracking of the "Environmental Impact Assessment - Traffic Impacts Case Assessment"

This institute continues to cooperate with the MOTC in the assessment and issue tracking of the environmental impact of development projects conducted by subordinate bureaus. The instutute also worked in cooperation with the Executive Yuan's Environmental Protection Administration to conduct various traffic impact assessments on development projects. As of the end of December, 2014, 259 cases have been reviewed and discussed at meetings.

Cooperation with the Ministry of the Interior (MOI) in the consideration of "Urban and Regional Planning Cases"

The institute has continuously cooperated with the MOI in the deliberation of urban planning and regional planning projects of subordinate bureaus and various counties and cities in Taiwan. In 2014, the institute was a part of the MOI's Urban Planning Commission and participated in the evaluations of the Taoyuan Aerotropolis project and other major modification projects. By the end of December in 2014, the institute had participated in 168 evaluation meetings and evaluated 337 cases. In addition, the institute cooperated with the MOI's Regional Development Committee to modify the "Regional Department Projects" in the "National Regional Development Plan", provided research on the "Regional Transportation System Project," and participated in the evaluation of relevant development projects. As of the end of December, the institute had participated in 52 meetings and evaluated 31 cases.

辦理院頒「道路交通秩序與交通安全改進方案」

有關行政院「道路交通秩序與交通安全改進方案」已進行至第 11 期（民國 102 ～ 104 年），每期方案實施 3 年。依據院頒方案之重點項目與實施要領，本案由交通部道安委員會主辦，針對各縣市、高公局、公路總局等機關前一年度之相關計畫執行情形辦理督導與考評，執行院頒方案年終視導工作。本所主要支援「道路交通工程與設施」項之考評，並於 104 年 5 月完成各機關 103 年院頒方案推動工作之考評。

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。103 年底已完成第 32 期「臺灣地區易肇事路段改善計畫」，本（104）年正規劃第 33 期之計畫。以 100 年（第 29 期）計畫改善地點 125 處之執行成效為例，改善前（99 年）與改善後（102 年）肇事件數減少 16%、死亡人數減少 18%、受傷人數減少 9%，成效良好。

協助交通部推動「全國道安強化扎根行動」計畫

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，自 103 年起推動「全國道安扎根強化行動」計畫，目標在 109 年達到降低死亡人數 27%（以 100-102 年平均死亡人數為基期），受傷人數於 105 年開始零成長，109 年降至 102 年水準以下。本所除協助交通部擬定整體行動計畫，支援該行動計畫之推動外，並配合辦理「機車交通政策白皮書」、「院頒『道路交通秩序與交通安全改進方案』之檢討與修正」等政策研究，以及「混合車流情境之機車交通安全工程設計方法研究與驗證」、「汽機車安全駕駛教育訓練平台整合及維護－機車風險感知學習素材及應用」等基礎應用研究，提供中央與地方機關、民眾與民間單位之實務應用。成效良好。

Implementation of the Executive Yuan's "Road Traffic Order and Traffic Safety Improvement Program"

The Executive Yuan's "Road Traffic Order and Traffic Safety Improvement Program" has already reached its 11th phase (2013-2014), with each planning phase being carried out over three years. According to the key points of the program and its implementation essentials as announced by the Executive Yuan, the MOTC's Road Safety Committee is in charge of the program. The goal of this project is to monitor and assess the implementation status of the project by local governments, the National Freeway Bureau, the Directorate General of the Highways, and related agencies as well as carry out year-end inspections. The institute primarily helps with the evaluation of the "Road Traffic Engineering and Facilities" part of the program. The appraisal of project promotion by the aforementioned agencies in 2014 was completed in May, 2015.

Implementation of the "Taiwan Area Accident-Prone Roads Improvement Project"

In cooperation with the Executive Yuan's "Road Traffic Order and Traffic Safety Improvement Plan," local governments were provided with road safety (supervisory) reports and research that utilized technical analysis of improvement projects to help improve traffic safety in problem areas. By the end of 2014, Phase 32 of the "Taiwan Area Accident-Prone Roads Improvement Project" had already been reached, and Phase 33 of the plan began this year (2015). In 2011 (Phase 29), the effective implementation of the plan was shown in the improvement of 125 locations. Thus, if we compared the situation from before the improvements(2010) to after the improvements (2012), there was a decrease in accidents by 16%, fatalities by 18%, and injuries by 9%, showing overall good results.

Assisting the MOTC in the implementation of "Strengthen the National Road Safety Campaign" Program

The MOTC, in cooperation with the United Nation's "Decade of Action for Road Safety 2011-2020" to improve domestic road safety, began the "National Strengthening the Roots of Road Safety Campaign" in 2014. This program has the goal of reducing traffic related deaths by 27% by 2020 (using the average of the annual number of traffic deaths from 2011-2012 as the basis), zero growth in the number of traffic injuries starting in 2016, and putting traffic fatalities below 2013 levels by 2020. In addition to assisting the MOTC in the development and promotion of this campaign, the institute also conducts this campaign in accordance with the "Scooter Traffic Policy White Paper" and the Executive Yuan's reviewed and revised "Road Traffic Order and Traffic Safety Improvement Program" among other related policies and research, as well as "Engineering Design Methods Research and Verification for Scooter Traffic Safety in Mixed Traffic Situations," "Automobile and Scooter Safety Driver Education Platform Integration and Maintenance – Scooter Risk Perception Learning Materials and Applications" to provide central and local government agencies, the public, and private entities with practical applications. This program has had good results.

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 103 年完成交通部推動綠運輸成果及未來方向檢討報告，除持續進行運輸部門節能減碳政策的滾動檢討，及適時修訂運輸部門節能減碳策略與行動方案外，並建置完成「運輸部門因應氣候變遷政策決策支援系統」，對於運輸部門後續推動各項節能減碳政策之經濟效益可提供初步評估分析結果，以作為交通部暨地方政府交通主管機關節能減碳政策施政之參據。

辦理「臺灣綠色港埠建置之研究」

港埠發展需一併考量環境永續性和社會公義性，達到港埠永續發展之目標，為國際港埠發展之趨勢。本研究除針對港埠實質之空間進行整體檢視及整合性之規劃外，並完成制定綠色港埠可供應用之操作模式及評估準則草案、港埠及周邊優良環境品質之實質計畫、與推動「綠色港埠」之行動計畫。截至 103 年 9 月，高雄港、臺中港及基隆港均已通過歐盟「生態港」（Eco Ports）第一階段自我檢視方法（self diagnosis method, SDM）認證，高雄港並於 103 年 10 月 3 日完成第二階段港埠環境檢視系統（port environmental review system, PERS）認證之書面與現地審查，10 月 14 日正式通過 PERS 認證，高雄港已成為歐洲海港組織第一個在亞太地區取得生態港認證資格的港口，該基金會主席亦於 11 月 14 日親臨高雄頒發認證證書，並參與由高雄港務分公司主辦、本所與中山大學合作辦理「臺灣綠色港埠推動成果研討會」。

Implementation of the drafting of the "Transport Sector Carbon Reduction Policy and Promotion Strategies" as well as conducting research on the evaluation, decision-making and support system of related policies

In cooperation with the Executive Yuan's "Green Energy and Low Carbon Committee" and the directions from the MOTC, the "Green Transportation Promotion" working group, composed by people from the institute, has already finished the section of the "National Low-Carbon Green Energy Action Plan" that the MOTC is responsible for. In addition, in cooperation with NDC and MOTC evaluations, we also drafted seasonal and annual action plan implementation reports. In 2014, the institute completed review report on the results of the MOTC's green transportation promotion and its future direction. Besides providing a rolling review of the s carbon reduction policies of transportation departments and timely revisions of the energy saving and carbon reduction strategies and action plans of in the transport departments, the institute has also completed the "Transport Sector Response to Climate Change Policy Decision Support System." This system cam provide preliminary assessment results on the economic benefits of the subsequent carbon reduction policies that transportation departments have promoted, and these results can serve as a reference for the implementation of carbon reduction policies by the MOTC and the competent transportation authorities of local governments.

Implementation of the "Taiwan Green Seaport Construction Research"

The development of seaports needs to take into consideration both environmental sustainability and social justice. In addition, the sustainable development of seaports is a trend in international seaport development. This research provides the overall survey and integration plans for seaport space, and it has also completed the development of operation methods and assessment guidelines legislation drafts for green seaports, a program for promoting environmental quality in seaports and its surrounding areas, and the promotion of the "Green Seaports" action plan. As of September 2014, the Kaohsiung, Taichung, and Keelung Ports have already passed the European Union's EcoPorts self-diagnosis method (SDM) certification. On October 3, 2014, Kaohsiung Harbor completed the port environmental review system (PERS) certification process, and officially received the PERS certification on October 14th. Kaohsiung Harbor has become the first Asia-Pacific port to receive the EU's EcoPorts certification. On November 14th, the chairman of the EcoPorts foundation visited Kaohsiung to issue the certificate and participate in the "Taiwan Green Seaports Promotion Results Workshop" organized by the Taiwan International Ports Corporation, Ltd., Kaohsiung Branch and the Kaohsiung City Government Transportation Bureau.

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。

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 103 年底已召開 10 次會議，共協商、追蹤 71 項重要議題與交辦事項，並參與交通部「開發建設」分組 10 次會議及行政院專案小組 9 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。

Implementation of the "Aboriginal Township (District) Traffic Improvement Plan"

In 2013, information on the population, industry, and road traffic in 30 mountain aboriginal townships (districts) was gathered. This information was reviewed and analyzed to find the local traffic needs of students, commuters, and tourists. The results from this information were used to search for ways to improve measures for road traffic safety improvement, control of road vehicle types, and atypical public transportation development. Currently, the research has already reported on which roads need improvement in aboriginal areas. The initial phase field investigation and evaluation and the second phase of funding negotiation has been completed. A total of 111 roads were selected for the improvement project. This project has also incorporated the items in items the "2014 Indigenous Tribe Special Road Improvement Program" after review by the Council of Indigenous Peoples. This project has a total funding of NT$336 million and became the "Mountain Area Aboriginal Village (District) Traffic Improvement Plan" report at the end of 2014. This report was forwarded to relevant MOTC units as reference for annual follow-ups for transportation improvements.

Implementation of the "Taoyuan Aerotropolis External Transportation Plan"

To promote Aerotropolis related construction plans, on October 17, 2012, the MOTC created the "Taoyuan Aerotropolis Core Program Project Group – 'Construction Development' Division." This group functions as the "external connecting transportation system" working group, and was jointly established by relevant units convened by the institute. This working group is responsible for the four projects on the access highways connected to the Aertropolis project; namely, the western extension of the exit ramps of National Highway 2, National Highway 1A, change of Provincial Highway 15, and Provincial Highway 4 section improvement. The group also oversees the construction of the five roads connecting the airport and the Aerotropolis and the "Taoyuan Aerotropolis MRT Line." As of the end of 2014, a total of 10 meetings have been held, tracking 71 key issues and action items. The working group also participated in ten meetings with the MOTCs Construction Development Division, along with nine meetings with the Executive Yuan's project group. Future meetings will continue to monitor matters of supply and demand for the access transportation system and coordinate related matters to promote the plan.

協助交通部推動「聰明公車」計畫

本所賡續技術輔導交通部公路總局辦理「公路汽車客運動態資訊管理系統建置案」。目前臺灣本島及金門地區民眾均可透過候車亭 LED 看板、電話查詢、網路查詢或手機 APP 掌握公車預估到站時間。此外，本所利用公車動態資訊系統資料庫結合地理資訊系統、人口分布資料及營運資料等，研發「先進公共運輸系統整合資料庫加值應用系統」，並推廣應用至宜蘭縣、桃園市、新竹市、嘉義市、台南市、屏東縣與金門縣等縣市政府，協助交通主管機關快速掌握所轄區域之公共運輸服務缺口狀況及運輸資源配置調整可能帶來的影響，使運輸服務供給更符合民眾所需。

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，同時針對重大鐵公路建設之氣候變遷調適策略、脆弱度評估指標、風險評估及調適資訊平台等辦理相關研究。另依據交通部指示，協助國家發展委員會完成該會「建置氣候變遷調適網站資訊平台」計畫，並協助審查各地方政府氣候變遷調適計畫。

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。103 年度配合永續會辦理「永續發展研析及公民參與專案工作計畫」，與交通部及相關部會進行經費分攤協商，以及協助辦理永續會前述專案工作計畫相關作業。

Assisting the MOTC in promoting the "Smart Bus" Plan

The institute has provided continued technical guidance to the Directorate General of the Highways, MOTC in implementing the "Establishment of Highway Passenger Car Dynamic Information Management System" project. Currently on the islands of Taiwan and Kinmen, people can use the LED billboards at bus stops, telephones, the internet, and cell phone apps to check the estimated arrival time of buses. In addition, the institute also integrated the dynamic bus information database with geographic information systems, population distribution information, and operational information to develop the "Advanced Public Transportation System Integrated Database and Value-Added Application System." This system has been promoted and used in Yilan County, Taoyuan City, Hsinchu City, Chiayi City, Tainan City, Pingtung County, and Kimen County, and other counties and cities to assist transportation authorities to quickly grasp the current public transportation situation in the areas under their jurisdiction. This information may be used to influence the allocation of transportation resources, so as to better serve the transportation needs of the public.

Assisting the MOTC in the drafting of a transportation construction climate change adaptation strategy and action plan

In accordance with the Executive Yuan National Development Council's "Promotion of Climate Change Adaptation Policy Framework and Action Plan" project, the institute shall assist the MOTC in its responsibility for adjusting relevant local authorities for a "living infrastructure" through administrative work. The institute shall archive and examine all content provided by subordinate government organizations for the climate change adaptation action plan, and provide specific recommendations. At the same time, the institute has conducted related research based on major rail and road construction climate change adaptation strategies, vulnerability assessment indicators, risk assessments, and adjustment of information platforms. The institute has also, under the direction of the MOTC, assisted the National Development Council in completing the "Construction of the Climate Change Adaptation Information Website Platform" project, and will assist in the review of the local government climate change adaptation plan.

Drafting the "Transportation Sector Sustainable Development Policy and Promotion Strategy"

This institute has already completed the drafting and amendment of the "ROC Sustainable Development Policy Program – Transportation Development" action plan in accordance with directions from to the Executive Yuan's National Council for Sustainable Development and the MOTC. The institute will also cooperate with the Council for Sustainable Development, and continue to conduct rolling revisions of the action plan and have relevant subordinate authorities promote the plan. In 2014, in accordance with the Council for Sustainable Development's implementation of the "Sustainability Research & Analysis, Civic Engagement Project Work Plan", the MOTC and its related departments conducted negotiations on the allocation of funding and assisted in implementation of tasks related to the aforementioned action plan conducted by the Council for Sustainable Development.

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

配合交通部推動科學技術發展目標－「強化各項基礎資料之蒐集與資訊系統建立之機制」，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。各港口之觀測資料除提供即時性資訊作為船隻航行安全維護，並進行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。

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。

Research conducted on the "Applications of the Long-Term Sea State and Meteorological Data Observed in the Waters Surrounding Taiwan's Main Seaports"

In accordance with the MOTC's promotion objectives for scientific and technological development – "to strengthen the collection of the basic data and establish information systems," this research prioritizes the creation of a long-term sea meteorological observation website for monitoring the waters near Taiwan's international and domestic seaports. Information from the observation of ports provides real-time information to maintain safe navigation, and is used for the building and application of a forecast model. In addition, the information is used to analyze the impact of climate change and create a dynamic information management system for seaports. This research publishes sea conditions observational information in annual reports and journals. The research functions as an important reference for the domestic needs of government, and every year this research provides nearly 40 research results to meet demands from all sectors, and these results can serve as a reference on seaport and shore engineering design and environmental evaluations.

Implementation of "Holistic Transportation Planning" and research on a series of transportation strategies

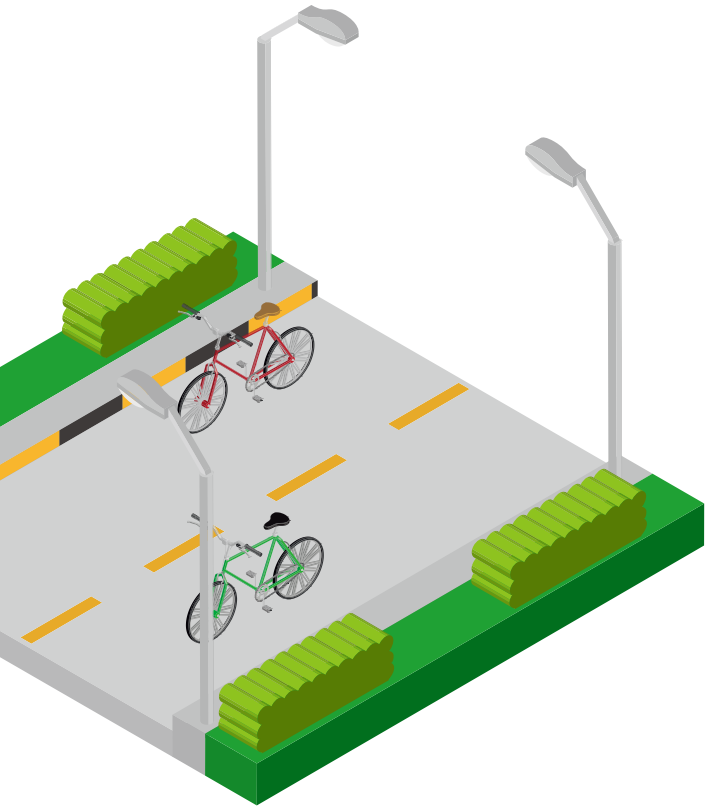
Holistic transportation planning is the main blueprint and reference the government uses in formulating future transportation construction plans and policies. Holistic transportation planning began in 1976, and in a period of 10 years 4 stages of the plan were complete. Taking into consideration recent climate change, global industrial trends, national development, the spatial structure of the land, and other factors causing rapid changes in the environment, the future of public transport service demands will likely also change. These socio-economic trends and changing transportation mentioned above will greatly influence the parameters of socioeconomics and modes, relationship among modules, and overall explanatory power of modes. The fifth Overall Transportation Plan was launched in 2014. In order to grasp these special travel characteristics, our institute investigated the national (including Taiwan, Penghu, and Kinmen) large-scale characteristics of intercity travel in 2014 and 2015 to understand the level of inter-city travel on the transportation system on normal days and holidays. The results of this investigation was used as a basis for the development of city transporation for meeting actual intercity transport demands, and to more accurately predict future supply and demand situations on the transportation system. Related transportation system blueprints and strategic analysis has also been conducted so that the results of the the fifth stage of Holistic Transportation Planning can be published, and these results can serve as a reference for the future development of overall transportation development planning and policy.

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

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」暨操作軟體，並持續修訂「2011 年臺灣公路容量手冊」及分析軟體，辦理坡度路段公路容量模擬模式之研究，期使運輸系統容量分析過程標準化並提高評估效率；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。103 年度公路容量分析軟體教育訓練於北區及中區各辦理 1 場次，共計 65 人參訓。

辦理全國自行車道安全、連續與友善環境檢視

因應全球暖化與能源危機，響應節能減碳運動已成為公私部門努力推動的重點。在交通運輸方面，亦不餘遺力的推廣自行車作為日常生活綠色交通工具。自近年來各部會及各地方政府皆列有自行車道建置計畫執行，截至 103 年底全國自行車道長度已逾 4,000 公里，除硬體興建外，如何讓各地的自行車道正常維運，永續提供民眾騎乘更是施政的重點。爰此，本所於 103 年辦理首次全國自行車道檢視計畫，結合各縣市政府、體育署等單位半年多的努力，完成「全國自行車道安全、連續與友善環境檢視計畫報告」。藉由全面性體檢，可提醒自行車道主管關機（縣市政府與交通部公路總局、觀光局）除硬體興建外，更應重視自行車道的管養，藉以提升自行車道品質，並保障民眾騎乘安全。



辦理「商港整體發展規劃 (106 ～ 110 年)」

本所依行政院及交通部指示自民國 84 年起每 5 年辦理商港整體規劃，主要目的係為構建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，提昇港埠服務水準，降低產業運輸成本，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。

Developing Taiwan's "Transportation System Capacity Analysis" manual and analysis software to promote its use

In 2013, the institute released the first version of the "2013 Taiwan Railway Capacity Manual" and operating software. The institute also continued to revise the "2011 Taiwan Highway Capacity Manual" and analysis software, as well as implement research on the simulation of the slope of a stretch of highway. This allows for the analysis process of the capacity of the transportation system to be more standardized and improves the efficiency of the assessment. In addition, the training of central and local government transportation personnel was expanded to include personnel from consulting companies and students from university transportation departments. This allows the transportation system analysis and evaluation capabilities of professional transportation personnel to be enhanced. The 2014 Highway Capacity Analysis Software Education and Training held sessions in northern and central Taiwan, and there were a total of 65 participants.

Examination of safe, continuous and environmentally-friendly national bicycle lanes

Due to global warming and the energy crisis, the carbon reduction campaign has become the focus of both public and private promotional efforts. No effort has been spared in the promotion of the bicycle as an everyday form of green transportation. In recent years, all ministries and local governments have emphasized the building of bicycle paths. As of the end of 2014, nationwide bicycle paths have reached 4,000km in length. In addition to further bicycle path construction, regular bicycle path maintenance and operation to provide for sustainable bicycle riding has also become a government focus. As such, the institute implemented the first national bicycle path examination plan in 2014. This plan combined the work that local governments and the Sports Administration, Ministry of Education did over a period of more than half a year to create the "Safe, Continuous, and Environmentally Friendly National Bike Path Plan Report." This report reminds relevant government agencies (local governments, Directorate General of Highways, the MOTC, and the Tourism Bureau) that outside of the construction of the bicycle lanes, they should also pay attention to the maintenance of bicycle lanes. This will enhance the quality of the bicycle paths and will protect rider safety.

Implementation of the "2017-2021 Commercial Port Overall Development Plan"

In 1995, the institute started to conduct overall planning of commercial ports every five years as per directions from the Executive Yuan and the MOTC. The main purpose of this directive is to guide the direction of future overall construction of Taiwan's commercial ports, elaborate upon the development strategies of commercial ports and port development directions, and serve as the master plan for the future development and construction plans of individual seaports. This will allow for the effective utilization of seaports resources, enhance port service standards, reduce industrial transportation costs, enhance the international competitiveness of Taiwan's seaports, and serve as a reference for the future development and construction plans of various commercial ports.

協助臺鐵局建立列車排點之資訊化及系統化

列車班表支配各類軌道資源（人、車輛、軌道），為車輛運用、乘務人員運用、運轉整理及列車調度計畫的基礎，亦為營運規劃作業最核心的工作之一。本所於 102 年度完成符合臺鐵實務應用之鐵路列車自動排點系統雛型，提供鐵路列車排點所需功能。103 年度接續辦理系統成果移轉及功能擴充，包括於臺鐵局提供駐點服務，協助系統試用，蒐集回饋意見，適時辦理教育訓練，推廣系統應用。功能擴充部分，開發列車運行模擬、列車班表穩定性分析等模組，並提升操作介面友善性。此系統除能輔助臺鐵局排點作業之自動化與資訊化外，並可應用於鐵路公共投資方案營運面之深度評估。

推動「觀光遊憩區導入智慧型運輸系統計畫－ i^3 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 i^3Travel 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。

Assisted the Taiwan Railways Administration (TRA) in establishing the informatization and systemization of train schedules

The train schedule controls the use of various resources (people, vehicles, tracks) and is the basis on which railroad cars, personnel, train opeation, and train dispatching are used and conducted. It is also a core facet in the planning of operation. In 2013, the institute completed the prototype of an automatic train scheduling system that fit the practical application of the TRA, and the system provides all the functions needed for train scheduling. In 2014, the institute conducted the transfer system's operation results and expanded its functions expansion were released. The results included on-site services at the TRA, trial use of the assistance system, collection of feedback, timely handling of education and training, and the promotion of systems applications. For the expansion of functions, train operation simulation and train schedule stability analysis modules have been developed, and user interface friendliness has been enhanced. This system offers the automatization and informatization of TRA train scheduling. This can be used in the in-depth assessments of railway operations in public investment programs.

Promotion of the "Implementing Smart Transportation Systems in Tourism Areas Plan – i^3 In Love with Traveling"

This plan uses the concepts of "low-carbon tourism" and "smart transportation" and combines the three ideas of i3Travel – innovative thinking, intelligent information services, and service integration – to turn the Sun Moon Lake Scenic Area into the "First Low-Carbon Intelligent Sightseeing National Scenic Area in Taiwan." In 2014, the project integrated the lake area's low-carbon transport systems (electric lake bus, electric cars, bicycles, gondolas, and electric boats) with high-quality local businesses. The plan also promotes Sun Moon Lake low-carbon electronic sightseeing tickets. The Sun Moon Lake National Scenic Area Administration, EasyCard Corporation, Industrial Technology Research Institute, the Nantou Bus Company and other public sector and non-governmental organizations have partnered together to establish a convenient travel and purchasing environment within the scenic area. This allows visitors to use just one card during their stay at Sun Moon Lake to enjoy tailored, customized, and exquisite travel services. The combination of the establishment of low-carbon tourism and the intelligent consumption sightseeing service environment is expected to bring in NT$ 200 million in purchased tickets, and it is estimated that it will effectively reduce the usage rate of private transportation to 18%, and significantly reduce carbon emissions by over 50%. This may serve as a new form of tourism service for the domestic tourism industry.

「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。本年度計畫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。

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。103 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「建立我國常態貨物流向統計與物流競爭力分析機制」研究，分析國際間對於物流競爭力評比指標之運用機制及發展經驗，建立我國國家運輸物流競爭力指標系統，以強化既有運輸物流服務之競爭力。本研究已完成「我國運輸物流競爭力分析機制」與「我國進出口貨物流向分析機制」，除協助建立我國進出口貨物流向定期性之常態資料庫外，亦可協助國內運輸物流產業結構轉型及與國際標準接軌。另外，可提供政府規劃運輸物流相關政策評估之參考及應用。

System maintenance and expanded services for the "Traffic & Trans Service Center" integrated website

This website continues the integration of national, provincial, and local highway traffic information, urban road traffic information, and land, sea, and air public transportation information. This information is presented as open data to the outside world and can be used for value-added applications. More than 300 value-added organizations (of which 25% are government agencies, 10% are academic applications, and 65% are private enterprises) already provide various types of transportation information services, such as vehicle navigation and public transportation travel planning inquiry services. This year, the website places emphasis on the continuation of providing real-time traffic information, establishing a standard format for road events, and stipulation of the notification mechanisms. It will also assist the MOTC in planning the next stage of the domestic traffic information service policy.

Implementation of the "Holistic Research and Development on the Transportation and Logistics Management System"

The main subject of this research is transportation and logistics. The research seeks to reexamine related policies from the MOTC in response to the dynamic adjustments in Taiwan's logistics industry development policies and global logistics trends. In accordance with the Executive Yuan's "International Logistics Industry Development Action Plan" of 2014, research on "establishing an analysis mechanism on the statistics of the normal flow of goods and logistic competitiveness" was conducted. This research analyzed the use and development experiences of logistical competitiveness indicators, leading to the establishment of the national transportation and logistics competitiveness indicator system. This system strengthens the competitiveness of existing transportation and logistical services. This research has completed the "Taiwan Transportation and Logistics Analysis Mechanism" and the "Flow of Imported/Exported Goods in Taiwan Analysis Mechanism." These two mechanisms can assist in establishing a database Taiwan that regularly monitors the flow of imported/exported goods in Taiwan and help the domestic logistics industry in transforming and keeping abreast with international standards. They can also serve as a reference for the government in planning the evaluation of policies related to transportation and logistics.

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」，預計於 102 年度起汰換 25 萬盞水銀路燈。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，已完成省道丘陵區 LED 路燈測試規劃，103 年起於台 3 乙線 9 ～ 10K 處進行 6,000 小時之 LED 路燈測試，至 103 年 12 月已完成 1,000 小時期初測試。研究成果可作為我國推動國、省道建置 LED 路燈之參據，並提供經濟部未來產品標準制定參考。

推動及執行「智慧型航行與監測系統」

為持續提升臺灣海運相關產業的競爭力，並因應國際 e- 化航行之趨勢，貫徹政府「加強海洋科技研發、永續發展海洋產業」的施政目標，本研究結合了臺灣現有航運技術與電子資通訊技術，針對臺灣海運開發出一套智慧化與本土化的航行監測系統。本研究的主要目的就是整合前期研究所建立的電子航行圖（ENC）資料庫系統為基礎，再加上目前國際標準化的船舶自動識別系統（AIS）資料庫系統，依據國際航行有關的標準架構下，實現臺灣海域 e- 化航行的最終目標。本研究目前已經完成電子航行圖（ENC）資料庫及船舶自動識別系統（AIS）資料庫的建置、綠色智慧領航之航路規劃等有關智慧化海運方面的系統之研發與其運作的基本模式，將可提供給交通部、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。

Implementation of the "Provincial Highway Hilly Area LED Streetlight Test Plan and Cost Benefit Analysis" project

In December 2011, the Executive Yuan approved the "Expand the Installation of Energy-Saving LED Streetlights Project" with the expectation of reducing the use of mercury-based lights by 250,000 starting from 2013. In accordance with the Ministry of Economic Affairs' future LED streetlight replacement plan, the MOTC was required to take into account traffic safety, carbon reduction, and lighting equipment maintenance, operation, and management costs when formulating plans and supplementary measures for replacing streetlights. Based on these requirements, starting from 2013, the institute began conducting a number of studies on the cost-effectiveness of LED street lighting, and the provincial highway hilly area LED lamp test plan was completed. A 6,000 hour LED road light test conducted on 9000-10,000 lights along Provincial Highway 3 started at the beginning of 2014, and 1000 hours of testing was completed by December 2014. The research results of can be used as reference data for the installation of LED streetlights on National and Provincial highways, as well as provide the MOEA with a reference when formulating future product standards.

Promotion and implementation of "Intelligent Navigation and Monitoring Systems"

To enhance the competitiveness of Taiwan's ocean-related industries, respond to the international e-navigation trend, and implement the government policy goal of "strengthen marine science and technology research and development, and achieve the sustainable development of the marine industry policy," this study combines existing Taiwan-owned shipping technology electronic communication technology to develop an intelligent and localized navigation monitoring system for Taiwan's ocean shipping industry. The primary objective of this study is to use the integration of electronic navigation charts (ENC) database systems developed in previous research as a basis, and then merging it with the current international standard Automatic Identification System (AIS) database system. This was done in accordance with relevant standard structures for international navigation to achieve the ultimate goal of e-navigation in Taiwan waters. This study was completed through the building of ENC and AIS databases, green intelligent navigation route planning, and other things related to the research and development of intelligent ocean shipping systems and fundamental modes of operation. This will serve as a reference for the MOTC, Maritime and Port Bureau, MOTC, the Coast Guard Administration, related port companies, and the civil shipping industry.

推動「港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傳輸系統，建立完整海情資料庫，並將臺灣各港區之海氣地象與港灣相關環境資訊，以動態網頁與手持裝置 App 相互搭配顯示方式，透過「港灣環境資訊網」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。本系統建置成果於每年 3 月辦理使用者年度會議時進行推廣運用並彙整使用者意見作為年度系統修正參考。近年來並與交通部中央氣象局、基隆、臺中、高雄、花蓮等港務分公司、成功大學近海水文中心、成功大學水工試驗所及宜蘭縣政府環境保護局簽訂合作備忘錄。此外，亦與經濟部水利署達成相關海象資料之互助合作協議。

辦理「港灣與濱海地區構造物現況調查與維護之研究」

本研究除對港灣碼頭、防波堤、濱海建物之現況及大氣腐蝕影響因子，進行現地調查外，更就金屬材料腐蝕防治之需求，建立臺灣地區大氣腐蝕環境分類資訊系統，並驗證港灣設施維護管理系統之適用性，作為港灣設施檢測程序、劣損診斷、維護管理與構造物防蝕規範制定，及未來公共工程建設或建廠時所需設計與維護之參考依據。102 年度已完成花蓮港新舊東堤、西堤、1 至 25 號碼頭及航道岸壁之現況調查、安全檢測評估及鋼板樁防蝕效能評估，並完成「花蓮港港灣構造物維護管理系統」提供使用。103 年度完成「基隆港港灣構造物維護管系統」與高雄港構造物現況調查評估作業。

Implementation of the "Bay and Harbor Sea State Information Service System"

This system is a complete database on sea conditions and was created through the integration of all the major domestic harbor real-time meteorological observation systems, numerical simulation forecasting systems, sea blue highway, harbor area seismic information, tsunami simulation information, port atmospheric corrosion system, and real-time video transmission systems. In addition, the system displays sea and weather related environmental information on a dynamic website and cell phone apps. The "Harbor Environment Information Website" offers instantly available information to the public, harbor management authorities, the domestic and international shipping industry, and other related staff queries. This enhances navigation safety, improves operational efficiency, and helps with developing a protocol for disaster emergency measures. The results of this system is shared at the annual users' conference every March, and the opinions of users are collected to serve as a reference to improve the system. In recent years, the Central Weather Bureau and subsidiaries of the Taiwan International Ports Corporation, Ltd. in Keelung, Taichung, Kaohsiung, and Hualien, National Cheng Kung University's Coastal Monitoring Center and Hydraulics Laboratory, and the Yilan County Environmental Protection Agency (EPA) have signed a memorandum of cooperation. In addition, a mutual cooperation agreement was reached with the Water Resources Agency of the MOEA regarding relevant sea and weather information.

Implementation of "Research on the Investigation and Maintenance of Harbor and Waterfront Structures."

This research investigates the atmospheric corrosion factors on harbor piers, breakwaters, and coastal construction and establishes an atmospheric corrosion environmental classification information system for Taiwan due to demands for the prevention of the metal corrosion. This research will also verify the applicability of harbor facilities maintenance management systems and set the standard for conducting harbor facilities testing procedures, deterioration diagnosis, maintenance management, and structure corrosion. It will also serve as a reference for the construction of public works and the future design and maintenance for construction projects. In 2013, the investigation of the current status, safety evaluation and assessment, and effective evaluation of anti-corrosion corrugated steel was completed at the Hualien Harbor's old and new eastern embankment, western embankment, piers 1-25, and the waterway wharf. The "Hualien Harbor Harbor Structure Maintenance Management System" was also completed for future use. In 2014, assessment for the current situation of the "Keelung Harbor Maintenance Management System" and the Kaohsiung Harbor structures was completed.

辦理「風險式與自主式鐵路安全管理制度之實務調查與分析」

先進國家之鐵路系統多著重於業者自我安全管理與內部稽核，並透過安全管理報告之提供，以達到政府監理機構對鐵路業者之安全要求。為改善我國鐵路安全管理制度，本研究首先回顧鐵路運輸業者推動風險式與自主式鐵路安全管理制度之經驗、作法與趨勢，並調查國內鐵路業者間實施的落實程度，擬定適用於鐵路系統之年度安全管理報告書格式，並以阿里山森林鐵路為範例，撰寫安全管理報告。最後針對國內法規及監理制度，建議推動風險式與自主式安全管理制度之對策及作法，及提出現有法規修正建議。本研究所回顧之文獻除可供鐵路業界參考外，研究成果亦可協助未來鐵道局在提昇鐵路安全管理。

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（103）年度辦理「公路公共運輸電動客車經營與運作績效調查」與「軌道運輸系統營運統計資料與績效評量指標整合規劃」2項研究，其中，「公路公共運輸電動客車經營與運作績效調查」主要盤點全國電動公車現況營運績效及問題，發現電動大客車推動關鍵瓶頸包括：妥善率不穩定以及使用成本高昂。本研究並提出後續電動公車發展之改善建議及意見，包括：電動大客車營運績效監管資訊平台規劃與建置、電動大客車租賃模式研究與實施方案評估、電動大客車駕駛行為分析等。另外，「軌道運輸系統營運統計資料與績效評量指標整合規劃」除分析比較國外績效指標與國內軌道機構現行之績效指標外，亦探討就蒐集之原始資料如何進行解析應用，可提供主管機關與軌道營運機構參考及應用。

Implementation of "Risk and Autonomous Railway Safety Management System Practical Investigation and Analysis"

The railway systems of advanced countries' place more emphasis on safety management and internal audits of companies in the industry, and they provide safety management reports to meet the safety demands of government supervisory agencies of the railway industry. In order to improve Taiwan's railway safety management system, this research first reviewed the experiences, practices, and trends of railway transportation industry's promotion of risk and autonomous railway safety management systems. In addition, it examined the extent of the systems implementation within domestic railroad companies to develop a suitable format for the safety management reports of the railway system. This research used the Alishan Forest Railway as an example to write asafety management report. Finally, this research also proposed measures and practices for the promotion of risk and autonomous safety management systems, and proposed amendments to existing regulations. In addition to serving as a reference for the railway industry, the results of this research can also assist in the improvement of future railway safety management.

Implementation of "Advanced Public Transportation System Holistic Research and Development"

Energy conservation, reduction of carbon emissions and the development of public transportation systems has gathered the world's attention. In order to enhance the domestic market share of public transportation, and reduce the use of private transportation, it is necessary to introduce low-polluting, island-wide green transportation tools and use systematic analysis methods to enhance the efficiency of rail transportation systems and services and in turn improve public transportation services. In 2014, two studies were conducted, namely the "Examination of the Management and Operational Performance of Public Electric Buses" and the "Integrated Plan for Rail Transportation System Operational Statistics and Performance Assessment Indicators." The "Examination of the Management and Operational Performance of Public Electric Buses" study focused on checking the national electric bus operational performance and problems, and found that electric bus usage has two critical bottlenecks: unstable availability and high usage costs. This research and subsequent follow-up studies gave suggestions for improvement proposals and comments, including: the planning and establishment of an information platform to monitor the operating performance of electric buses, research of the electric buses leasing model and evaluation of its implementation plan, and electric bus driving behavior analysis. The "Integrated Plan for Rail Transportation System Operational Statistics and Performance Assessment Indicators" study conducted a comparison and analysis of international and domestic railway performance indicators. It also discussed how to analyze and apply the collected raw data to provide a reference for competent authorities and the rail operating agency.

辦理全國自行車道安全、連續與友善環境檢視

因應全球暖化與能源危機，響應節能減碳運動已成為公私部門努力推動的重點。在交通運輸方面，亦不餘遺力的推廣自行車作為日常生活綠色交通工具。自近年來各部會及各地方政府皆列有自行車道建置計畫執行，截至 103 年底全國自行車道長度已逾 4,000 公里，除硬體興建外，如何讓各地的自行車道正常維運，永續提供民眾騎乘更是施政的重點。爰此，本所於 103 年辦理首次全國自行車道檢視計畫，結合各縣市政府、體育署等單位半年多的努力，完成「全國自行車道安全、連續與友善環境檢視計畫報告」。藉由全面性體檢，可提醒自行車道主管關機（縣市政府與交通部公路總局、觀光局）除硬體興建外，更應重視自行車道的管養，藉以提升自行車道品質，並保障民眾騎乘安全。

辦理「創新交通科技研發成果之智財權研究與知識分享」

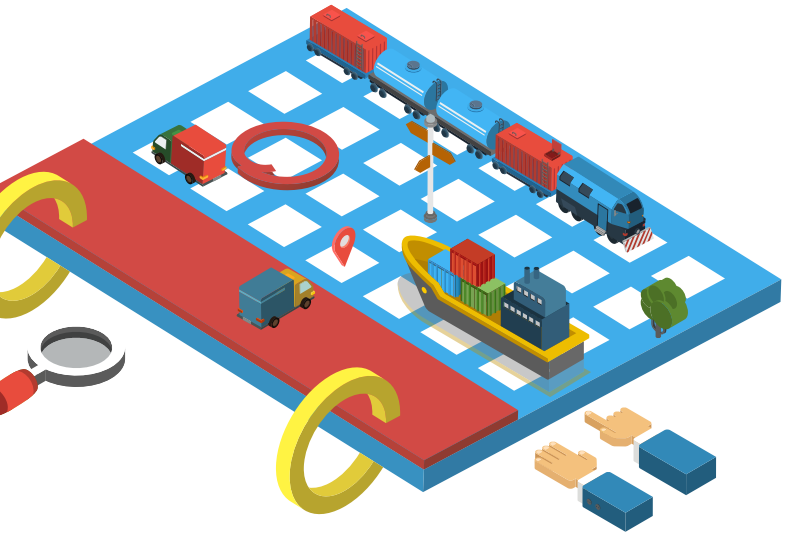
本案針對本所科技計畫創新研發成果，進行可專利性分析與授權應用推廣，共計完成「一種連續影像之處理方法」中華民國發明專利申請及「區域公共運輸服務環境評估系統與方法」中華民國新型專利取得，並完成本所「先進公共運輸系統整合資料庫加值應用系統」無償授權國內 7 縣市政府交通單位使用。此外，本案亦設置完成「交通科技知識分享服務」網站，提供本所研發成果、期刊論文及當前重要交通科技國際參考專利文獻知識分享服務，藉以促進我國交通運輸科技研究之技術交流，並可避免相關研究資源與能量重複投入於已取得智財權保護之技術，造成研究經費與研究人力之浪費。

Examination of safe, continuous and environmentally-friendly national bicycle lanes

Due to global warming and the energy crisis, the carbon reduction campaign has become the focus of both public and private promotional efforts. No effort has been spared in the promotion of the bicycle as an everyday form of green transportation. In recent years, all ministries and local governments have emphasized the building of bicycle paths. As of the end of 2014, nationwide bicycle paths have reached 4,000km in length. In addition to further bicycle path construction, regular bicycle path maintenance and operation to provide for sustainable bicycle riding has also become a government focus. As such, the institute implemented the first national bicycle path examination plan in 2014. This plan combined the work that local governments and the Sports Administration, Ministry of Education did over a period of more than half a year to create the "Safe, Continuous, and Environmentally Friendly National Bike Path Plan Report." This report reminds relevant government agencies (local governments, Directorate General of Highways, the MOTC, and the Tourism Bureau) that outside of the construction of the bicycle lanes, they should also pay attention to the maintenance of bicycle lanes. This will enhance the quality of the bicycle paths and will protect rider safety.

Implementation of the "Intellectual Property Rights Research and Knowledge Sharing for the Results of Innovative Transportation Technology Research and Development"

This research uses the results from the institute's technological project research and development to conduct a patentability analysis and promote authorization and application. This study completed a ROC invention patent application for "a processing method for continuous imaging" and obtained a new ROC patent for "regional public transport service environment assessment system and methods." In addition, the research also completed the "Advanced Public Transportation System Integrated Database and Value-Added Application System" and authorized the free use of this system to the transportation departments of 7 cities and counties in Taiwan. Moreover, this research also completed the creation of the "transportation research knowledge sharing" website that provides the institute's R&D results, journal articles, and knowledge sharing services for current international patent documents on major transportation technology. These measures are to promote the technical exchanges of scientific and technological research in transportation technology in Taiwan. This also prevents the investment of related research resources and energy into technologies that are already protected by intellectual property, which causes wasted research funding and manpower.



06

大事紀要
Calendar of Events

INSTITUTE OF
TRANSPORTATION, MOTC

以下簡述本所 103 年度辦理完成之各項大事紀要：

Brief descriptions of major completed projects in 2014:

月份 Month	日期 Day	辦理事項 Projects
3 月 March	14	辦理「102 年桃園縣鄉道橋梁檢測及縣鄉道橋梁巡查」教育訓練 Organized the "2013 Taoyuan County Road and Bridge Inspection" education and training session
	17~6.21	辦理「經濟合作協定人力建構」教育訓練 Organized the "Economic Cooperation Agreement on Manpowered Construction" education and training session
	31	103　港灣環境資訊服務系統使用者會議 2014 Annual Harbor Environmental Information Service System User Conference
4 月 April	14	辦理「大眾運輸導向發展策略圓桌會議」 Organized the "Public Transport Oriented Development Strategy Roundtable" Meeting
	15	辦理「大眾運輸導向發展策略國際論壇」 Organized the "Public Transport Oriented Development Strategy Forum"

月份 Month	日期 Day	辦理事項 Projects
5 月 May	16	辦理「公路坡度路段模擬模式之應用」技術講習 Organized the "Application of the Road Slope Simulation" technical seminar
	19	辦理「德國鐵路民營化及電子票證核心技術發展應用」專題演講 Organized the "German Railway Privatization and Electronic Ticket Core Technology Development" keynote speech
6 月 June	19	辦理「中長程計畫審議決策支援系統實務應用簡介與實機操作」研究會 Organized the "Practical Application and Hands-On Experience of the Mid- to Long-Term Plan Review Support Systems" research meeting
	20	「PRT 簡介暨 PRT 系統規劃及設計 - 林口新市鎮應用概念」專題演講 "PRT Introduction, System Planning, and Design – Application of the New Linkou City Concepts" lecture
7 月 July	9	辦理「海西航運對台灣的挑戰」海運培訓課程 Organized the "Challenges that Haixi Shipping Challenges Poses to Taiwan" maritime shipping training session
	10	辦理「海運物流研究」海運培訓課程 Organized the "Ocean Shipping Logistics Research" ocean shipping training session
	16	辦理「航空產業發展現況與未來發展方向」空運培訓課程 Organized the "Aviation Industry Development Status and Future Directions" aviation shipping training session
	16	辦理「103 年度橋梁維護管理訓練講習」 Organized the "2014 annual bridge Maintenance and Management Training Seminar"
	18	辦理「運輸產業論壇」 Organized the "Transportation Industry Forum"

月份 Month	日期 Day	辦理事項 Projects
8 月 August	6	辦理「兩岸三地船噸結構現況分析」空運培訓課程 Organized the "Analysis of Current Tonnage Structure in Taiwan, China, Hong Kong, and Macau" aviation shipping training session
	13	辦理「全球海運發展趨勢對貨櫃碼頭開發之影響」空運培訓課程 Organized the "Global Trends Affecting Ocean Shipping Container Terminals" aviation shipping training session
9 月 September	19	臺歐低碳智慧運輸論壇 Taiwan-Europe Intelligent, Low-Carbon Transportation Forum
	25	辦理「國籍航空公司競合問題之研究」座談會 Organized the "Research on National Airline Competition Problems" Forum
10 月 October	3	2014 年臺灣港務公司經營策略與公司治理研討會 2014 Taiwan International Ports Corporation Business Strategy and Corporate Governance Seminar
	3	辦理「臺灣公路容量分析軟體 THCS(2014 年版) 實機教育訓練」- 臺北場 Organized the "Taiwan Highway Capacity Analysis Software (THCS; 2014 edition) real machine education and training" in Taipei
	7	辦理「臺灣公路容量分析軟體 THCS(2014 年版) 實機教育訓練」- 臺中場 Organized the "Taiwan Highway Capacity Analysis Software (THCS; 2014 edition) real machine education and training" in Taichung
	27	辦理「先進公共運輸系統整合資料庫加值應用系統」教育訓練 Organized the "Advanced Public Transportation System Integrated Database and Value-Added Application System" education and training session
	29	辦理「無人飛行載具發展趨勢與創新應用」空運培訓課程 Organized the "Unmanned aerial vehicle development trends and innovative applications"

月份 Month	日期 Day	辦理事項 Projects
11 月 November	13	辦理「臺灣港群貨櫃運輸發展課題、策略與對策」座談會 Organized the "Developmental Problems, Strategies and Countermeasures for Taiwan Transportation" forum
	14	高雄港亞洲首座生態港埠成果研討會 Organized the "Kaohsiung Harbor - the First Asian Ecoport" workshop forum
12 月 December	2	「智慧型運輸系統節能減碳示範與推廣」期末成果研討會 "Intelligent Transportation System Demonstration and Promotion of Energy Saving and Carbon Reduction" final results and workshop discussion
	5	辦理「航空製造業的創新和臺灣業界的商機」空運培訓課程 Organized the "Aviation Manufacturing Industry Innovations and Business Opportunities in Taiwan" training and education session
	8	港灣海氣象模擬技術及資訊應用 Harbor wealth simulation technology and information applications
	9	台日港灣設施維護管理講習 Taiwan-Japan harbor facilities maintenance management course

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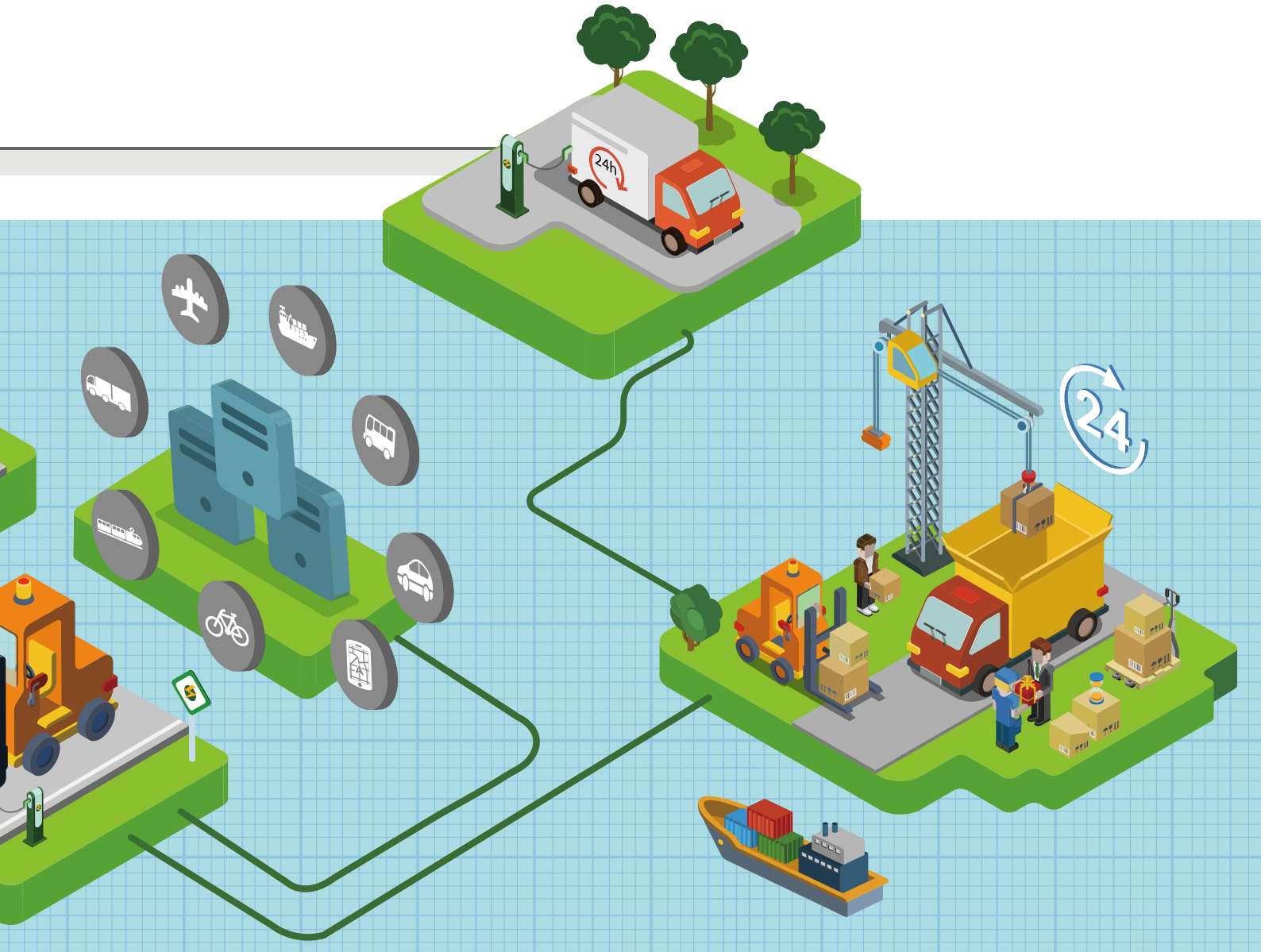

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