出國報告（出國類別：開會）

第10屆臺日鐵路實務交流定期會議

服務機關：交通部鐵道局
姓名職稱：呂新喜 副局長
温志輝 副總工程司
謝金玫 簡派正工程司
張祚昌 副工程司
派赴國家/地區：日本
出國期間：民國112年12月4日至12月7日
報告日期：民國113年2月29日

摘要

為加強臺日兩國鐵道運輸整體合作發展，臺日雙方於2013年簽署「加強鐵路業務交流及合作瞭解備忘錄」，每年輪流於臺日兩地召開實務級之定期會議，本（第10）屆會議訂於民國112年12月5日於日本東京舉行，本局與日本國土交通省鐵道局就自動駕駛車輛之安全性、智慧鐵道等議題，進行經驗交流與討論，並於同日參與我國社團法人中華軌道車輛工業發展協會（CRIDA）與日本一般財團法人海外鐵道技術協力協會（JARTS）簽署第三國市場合作備忘錄，期促進臺日雙方於鐵道產業合作之機會。

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壹、目的

交通部鐵道局（原交通部高速鐵路工程局）及日本國土交通省鐵道局於2013年開始定期舉行交流會議，陸續針對鐵路運轉、安全與防災、拓展海外高鐵市場等有關鐵道運輸、營運監理議題，進行意見交流及經驗分享。近年來資通訊技術蓬勃發展，逐步導入應用於鐵道運輸環境，故本次會議之討論議題擴展至提升無人駕駛系統安全措施、發展智慧鐵道等層面，就新技術應用方面進行意見交換，作為後續政策推動參考。

另在兩局努力促成之下，我國社團法人中華軌道車輛工業發展協會（CRIDA）與日本一般財團法人海外鐵道技術協力協會（JARTS），於民國112年12月5日簽署第三國市場合作備忘錄，期促進雙方民間業者交流，增進我國與日本廠商於第三國鐵道市場合作之機會。

貳、行程

本次行程自民國112年12月4日至12月7日止，共計4日，本局由呂副局長新喜率員，與中華軌道車輛工業發展協會何理事長煖軒，及佳豐機械設計工業股份有限公司、優緹科技有限公司、神通資訊科技股份有限公司、華電聯網股份有限公司、桃園大眾捷運股份有限公司、中興工程顧問股份有限公司等國內廠商，共同參加第10屆臺日鐵路實務交流定期會議，行程期間拜會日本車輛製造株式會社、參訪 JR 東海濱松工場等，詳細行程如表1。

表 1-行程表

日期	行程摘要	地點
12月4日 (星期一)	1、去程（臺北松山機場至東京羽田機場） 2、會議行前準備	東京
12月5日 (星期二)	1、【上午9時30至11時30分】拜會日本車輛製造株式會社 2、【下午2時00至 5時00分】第10屆臺日鐵路實務交流定期會議，討論議題如下： (1)自動駕駛車輛之安全性（Safety of Driverless Vehicles） (2)智慧鐵道（Smart Railways） (3)第三國市場合作（Third Country Market Cooperation）	東京
12月6日 (星期三)	【下午2時00至 3時45分】參訪 JR 東海濱松工場	靜岡
12月7日 (星期四)	返程（東京羽田機場至臺北松山機場）	東京

參、過程

一、拜會日本車輛製造株式會社

本局與中華軌道車輛工業發展協會及同行國內廠商，於112年12月5日上午拜會日本車輛製造株式會社位於東京之辦公室，相互交流各公司之鐵道相關產品及未來發展願景，期促進各方合作之機會。謹對於各廠商於會議中之說明內容，摘述如下：

(一)日本車輛製造株式會社

日本車輛製造株式會社（以下稱日本車輛製造(株)）本社位於愛知縣名古屋市，創立於1896年9月，員工數約2,200人，其事業群包括：鐵道車輛、運輸用機械、建設機械、工程機械等，截至2019年已產製逾4000輛之新幹線車輛，目前為東海旅客鐵道株式會社（JR 東海）子公司。日本車輛製造(株)曾供應之鐵道車輛包括：台灣高鐵700T 型列車、臺灣鐵路 EMU 700型、EMU 800型、TEMU 2000型等列車，及日本新幹線營運中之 N700系、N700S 列車等，目前建設中之中央新幹線使用之磁浮列車，預計未來也將交由日本車輛製造(株)生產，其營運速度將達500公里/小時。

(二)神通資訊科技股份有限公司

聯華神通集團創立於1952年，經營範圍包括：電腦、消費電子、IT 通路，系統整合、軟體研發、石油化學、特殊氣體、食品等領域，全球員工數約368,000人。聯華神通集團於1974年成立神通資訊科技股份有限公司（以下稱神通資科），並致力於運用物聯網裝置閘道器（IoT Devices Gateways）、物聯網生態系統（IoT Ecosystem）、雲端平台（Cloud Platform）、人工智慧分析（AI Analytics）等技術，以建立1個智慧城市系統架構作為目標願景。神通資科參與國內多項智慧交通專案，其中涉及鐵道系統部分，包括：

1、高鐵：自動收費系統、通訊系統、T Express (APP)等。

2、捷運：自動收費系統、通訊系統、電力供應及分配系統、駕駛模擬系統等。

3、輕軌：自動收費系統、開放支付系統（Open Payment System）等。

神通資科也參與國外之鐵道建設專案，包括：中國福州地鐵、印度清奈捷運、

越南胡志明市捷運、印尼雅加達捷運、泰國曼谷捷運紅線等路線之自動收費系統。

神通資科主要提供7項智慧化應用服務，包括：資料儲存（Data Storage）、即時串流服務（Real-Time Streaming Server）、人工智慧分析（Artificial Intelligence Analysis）、視覺化工具包（Visualization Toolkit）、應用程式介面（Application Programming Interface）、平台管理（Platform Management）、警報通知（Alarm Notification）等。

(三)華電聯網股份有限公司

華電聯網股份有限公司（以下稱華電聯網）成立於1994年5月，員工數約800人，經營範圍包括：ICT 資通訊、智能應用（監控/環控/交控）、媒體應用（TIDS）、電信加值整合解決方案等，未來將朝向資通訊、數位媒體、智慧應用、資安等4大領域發展。有關資安部分，華電聯網已於2019年同時通過「ISO 27001：2013資訊安全管理系統」及「ISO 27701：2019隱私資訊管理系統」。華電聯網參與國內鐵道建設實績，包括：

1、高鐵：L 型顯示器新增工程採購案。

2、臺鐵：電務智慧化提升計畫（環島光纖傳輸網路系統更新工程）、板橋站列車資訊系統修護工程、平交道錄影儲存設備雙重化工程、月台監視器設備、左營~鳳山間10車站監視系統影像整合及傳送等。

3、捷運：軌道電路設備遠端監控系統、骨幹網路光纖電纜增設改善案等。

華電聯網對於未來智慧交通發展目標，將提供5G 專網佈建、4K 安全監控及 AI 影像辨識服務、愛心接駁旅運服務、移動旅運資訊服務、環境監控營運戰情室等技術服務。

(四)中興工程顧問股份有限公司

財團法人中興工程顧問社於1970年初成立，係為各項重大工程建設提供專業技術與人力，後為響應政府企業民營化政策，於1993年成立中興工程顧問股份有限公司（以下稱中興工程），持續執行相關工程顧問服務業務。中興工程有15個技術部門，分別隸屬於水利及電力、土木及建築、環工、軌道、機電、工程管理等6個事業責任中心之中，員工數約1,850人。中興工程業務範圍包括：研究、規劃、設計、

監造、營運管理、專案管理、統包工程等項目，工程專案主要集中在亞洲地區、東南亞、中亞、中美洲等區域。

軌道事業責任中心具有高速鐵路、傳統鐵路、捷運系統等經驗實績，其中捷運部分，中興工程在國內曾參與包括：臺北捷運萬大線、桃園捷運綠線、機場捷運、臺中捷運、高雄捷運、新北捷運環狀線、三鶯線、淡海輕軌、安坑輕軌、汐東捷運及規劃中基隆捷運之規劃、設計或監造等業務，在國外市場也曾參與雅加達捷運、馬尼拉捷運等建設案。

圖 1-本局同仁與日本車輛製造株式會社代表合影

二、第10屆臺日鐵路實務交流定期會議

(一)目的

我國與日本自2013年簽署加強鐵路業務交流及合作瞭解備忘錄以來，每年輪流於臺日兩地定期召開會議，對於鐵路營運經驗、人才培訓、安全管理、鐵道系統技術標準規範、第三國鐵道市場合作等議題，進行意見交流與經驗分享。

隨著鐵道系統技術發展，國內陸續導入無人駕駛中運量捷運系統，除營運中之臺北捷運文湖線、新北捷運環狀線、臺中捷運綠線外，另包括目前建設中之新北捷運三鶯線、桃園捷運綠線等。無人駕駛捷運系統之優點在於減少駕駛員人力需求、降低人為操作錯誤之風險，但其缺點為運行中且無乘務員隨同之捷運車輛，將難以因應臨時發生之突發狀況。以112年5月10日臺中綠線事故為例，豐樂公園站附近建案使用的塔式吊車前桁架，掉入營運路線中，但因未能即時通知行控中心，致列車仍於車站出發並運轉進而撞擊入侵物，造成嚴重事故。故無人駕駛系統應如何防範類似情事發生，係為1項重要課題。

另資通訊技術發展迅速，推動智慧鐵道產業發展，將物聯網（Internet of Things）、大數據（Big Data）、雲端運算（Cloud Computing）、人工智慧（Artificial Intelligence）等先端科技導入鐵道運輸，藉以強化旅客服務、列車控制、維修、安全面之即時監控及資訊回饋應用等，有利於鐵道運輸業者提升服務品質及營運安全，成為當前鐵道運輸發展趨勢。

隨著國內鐵道建設逐步發展，目前已有高速鐵路、傳統鐵路、捷運、輕軌等多項鐵道系統營運中，雖然前述鐵道之核心機電系統仍由國外廠商供應，但國內廠商也逐步掌握供電系統、通訊系統、軌道系統、車輛系統部分設備之設計、製造能力，故期望藉由我國社團法人中華軌道車輛工業發展協會（CRIDA）與日本一般財團法人海外鐵道技術協力協會（JARTS）簽署第三國市場合作備忘錄，增加國內鐵道設備廠商與日本鐵道系統廠商合作之機會，共同參與第三國鐵道市場，擴大鐵道產業產值規模。

綜上，本次112年12月5日下午於日本東京召開「第10屆臺日鐵路實務交流定期

會議」，謹對於自動駕駛車輛之安全性（Safety of Driverless Vehicles）、智慧鐵道（Smart Railways）、第三國市場合作（Third Country Market Cooperation）等3項議題進行討論。

(二)出席人員

1、我方

(1)交通部鐵道局：呂新喜 副局長、温志輝 副總工程司、謝金玫 簡派正工程司、張祚昌 副工程司。

(2)台北駐日經濟文化代表處：何坤松 副組長。

(3)社團法人中華軌道車輛工業發展協會：何煖軒 理事長、張瓊文 專案經理。

(4)佳豐機械設計工業股份有限公司：高慧伶 董事長。

(5)優緹科技有限公司：黃玉緹 董事長。

(6)神通資訊科技股份有限公司：陳錫裕 副總經理、鍾政道 處長。

(7)華電聯網股份有限公司：杜孟郎 副總經理。

(8)桃園大眾捷運股份有限公司：謝明融 副主任、李鴻志 正工程司。

(9)中興工程顧問股份有限公司：余遠添 副總經理、周易陵 正工程司。

2、日方

(1)國土交通省：金指和彥 國際統括官補佐官

(2)國土交通省鐵道局：堀信太朗 課長、小俣誉 專門官、川野正貴 係長、金山友喜 係長。

(3)外務省：渕上正悟 課長補佐。

(4)西日本旅客鐵道株式會社：溝口敦司 課長。

(5)一般財團法人海外鐵道技術協力協會：志村務 理事長、木村直人事業部長。

(三)討論議題

1、自動駕駛車輛之安全性（Safety of Driverless Vehicles）

(1)日本國土交通省鐵道局簡報「檢討導入完全無人運轉車輛」（Consideration Towards the Introduction of Automatic Operation）

培訓及確保足夠之駕駛員、維修人員對於地方的鐵路營運機構是個重要課

題，因此，為了維持鐵路業務順利進行，須導入自動駕駛系統。在日本國內部分新交通系統已逐步導入自動駕駛系統，前述新交通系統皆有共同點，包括：營運路線全部為高架化、月台型式為全封閉式月台門，因此可以確保其他人員無法隨意進入營運路線內，與之相反，在有平交道之路線上仍未導入自動駕駛系統，因此，為了在有平交道之路線上使用自動駕駛系統，將通過導入感測器、通訊技術以確保營運安全。

日本於2018~2022年邀請學者專家、鐵路營運機構召開研討會討論，結論為依據 GOA 2.5、GOA 3、GOA 4等規範，所應具備之系統設備及乘務員功能。列車駕駛自動化等級（Grade of Automation，GoA）係依據 IEC 規範，其中 GOA 2.5係指有1位乘務員於列車最前方，僅於發生緊急狀況時停止列車，該乘務員不具駕駛員資格。GOA 2係指有1位駕駛員於列車駕駛室，隨時注意行車狀況，遇危險時停止列車。故在日本分辨 GOA 2、GOA 2.5之方式，即最前方之隨車人員若具駕駛員資格稱為 GOA 2系統，若不具駕駛員資格稱為 GOA 2.5系統。

若營運路線為 GOA 3、GOA 4之自動駕駛系統，營運速度達120公里/小時且具有平交道時，將藉由下列方式防止外部因素干擾列車營運，在鐵軌周圍設置圍欄、於平交道設置感測器確保路線淨空等。

(2)交通部鐵道局簡報「提升無人駕駛系統安全措施」（Safety Improvement of Driverless Vehicles）

目前在臺灣營運中之無人駕駛系統包括：臺北捷運文湖線、新北捷運環狀線、臺中捷運綠線等3條路線，皆屬於 GoA 4等級無人駕駛系統。對於智慧鐵道異物偵測系統部分，分為道旁設備偵測、列車偵測等2個模式，其採用常見的異物偵測裝置有3類，分別為攝影機、雷達、光學雷達，其特色說明如下：(1)攝影機：提供高解析度以及豐富顏色資訊的影像，成本相對較低。但在惡劣天氣下以及夜晚，將難以提供清晰的影像。(2)雷達：具備距離量測的用途，藉由發射電磁波監測物體的距離以及相對速度，不受惡劣天氣影響。但雷達僅能提供有限解析度，不易辨識物體。(3)光學雷達：利用雷射光束以及其反射訊號的時間間隔計算感測器與物體的精確間距，光達的解析度較好，能提供較為精細

的路況資訊。但使用光達需要強大的運算能力來處理資訊，且光達感測器較為精細，故價格較高。

智慧鐵道異物偵測系統仍存在技術不成熟、無使用實績等2項課題，故目前之因應措施為，(1)辦理風險評估：鐵路興建機構辦理臨軌工程時，應於工程設計、施工階段進行風險評估，明確律定潛在危害工項及減輕對策。(2)改善設備：增設緊急停車按鈕，並置於工作人員或旅客易碰置處。(3)辦理教育訓練：加強、規範和實施緊急手勢信號，並訓練工作人員熟悉。

2、智慧鐵道（Smart Railways）

(1)西日本旅客鐵道株式會社（以下稱JR西日本）簡報「應用新技術的創新鐵道解決方案」（Introduction of Innovative Railway Solution Using New Technology）

截至2022年3月統計數據，日本鐵道路線總長度約28,000公里，從業人員約200,000人。其中 JR 西日本營運路線包括：新幹線、都市路網及其他運輸路線等，總長度4,903公里，共計1,174個車站，從業人員22,715人。JR 西日本於2018年提出未來20年發展願景，分別為(A)進一步提供安全、穩定的運輸系統；(B)藉由提供鐵道運輸服務，協助當地提升吸引力；(C)創造永續發展的鐵道運輸系統。為了實現上述願景，JR西日本提出了各項解決方案，摘要說明如下：

A、狀態檢修與時間序列的資料分析（CBM with Time-series Data Analysis）

CBM（Condition Based Maintenance）係藉由監視物體實際狀態，決定是否進行維修作業。其作業方式為建置能預測故障之AI模型，顯著降低驗票閘門零組件成本並提高品質。

B、使用智慧手機追蹤維護管理（Track Maintenance Management Using Smartphones）

以低成本的智慧型手機取代車輛振動監測裝置，置於駕駛室的智慧型手機能監測車輛振動情形。

C、屋頂影像診斷（Roof Image Diagnosis）

於屋頂設置影像診斷設備，並運用影像分析技術，減輕檢測負擔。

D、AI監視器自動偵測（Automated Detection by AI Surveillance Cameras）

在既有的監視器裝置 AI 以自動偵測異常狀況，將使車站具有即時監測功能並提供所需協助。

E、大阪車站發展（Development of Osaka Station）

JR 西日本的技術願景實現於大阪車站，並作為1個創新實驗場域。包括：全罩式且自由滑動之月台門、人臉辨識之驗票閘門、個人化引導標置等。

(2)桃園大眾捷運股份有限公司（以下稱桃園捷運）簡報「智慧捷運發展歷程與數據整合應用」（Smart MRT Development History and Data Integration Application）

桃園捷運目前營運機場捷運路線，路線長度約53公里，每日運量約10萬人次，服務範圍包括：臺北生活圈、林口生活圈、桃園機場、桃園生活圈等區域。交通部鐵道局於2021年起推動「建立5G 智慧鐵道運輸及監理環境計畫」，並由桃園捷運作為智慧鐵道應用的示範場域。

桃園捷運於2020年進行小型 IoT 裝置設計，於2021年取得鐵道局補助後，開始規劃雲平台、各項 IoT 專案規劃、AI 圖像辨識開發，至2023年已有初步成果。其中雲平台相關設計係採用鐵道局制定的標準規範，該項規範包括：資訊安全、通訊介面、數據編碼等，目前雲平台係採用 OPEN STACK 作為雲平台管理的解決方案，通訊介面標準化採用 MQTT、KAFKA、RESTFUL API 等多種資料交換介面，數據編碼標準化採用 JSON、CDMID 編碼等格式，藉由標準化編碼將能滿足數據整合需求。藉由 IT 網路、OT 網路、5G 網路收集的數據，依照標準介面、標準協議上傳至桃捷雲平台，再上傳至鐵道雲平台（鐵道局的雲平台），此模式未來將套用於其他鐵道營運機構。

桃園捷運取得數據的方式有3種，分別為感測器類、旁聽解析類、影像辨識類，以此取得列車（列車控制管理系統、車載號誌介面、號誌天線數據等）、軌旁（號誌軌道電路、轉轍器、地震感測、雨量與風速計等）、車站（機房溫度監測、月台門系統、電梯電扶梯、泵浦、票務系統等）、外部資料等數據，並將前述數據以地理圖層顯示方式呈現，以利整體檢視所有數據資料。另進行資料收集及監視的 SCADA 系統，在設備故障時才告警通知，未來桃園捷運

將設計1套新系統，在設備即將故障時即進行預警通知。期望未來進一步於列車營運時同步作檢測，以藉由智慧鐵道相關應用進而確保營運安全。

圖 2-日本國土交通省金指補佐官致詞

圖 3-本局呂副局長致詞

圖 4-臺日鐵路實務交流定期會議

3、第三國市場合作（Third Country Market Cooperation）

我國社團法人中華軌道車輛工業發展協會（CRIDA）與日本一般財團法人海外鐵道技術協力協會（JARTS）簽署合作備忘錄（Memorandum of Cooperation），期促進雙方民間業者交流，增進我國與日本廠商於第三國鐵道市場合作之機會。

圖 5-臺日鐵道相關協會簽署合作備忘錄(1/2)

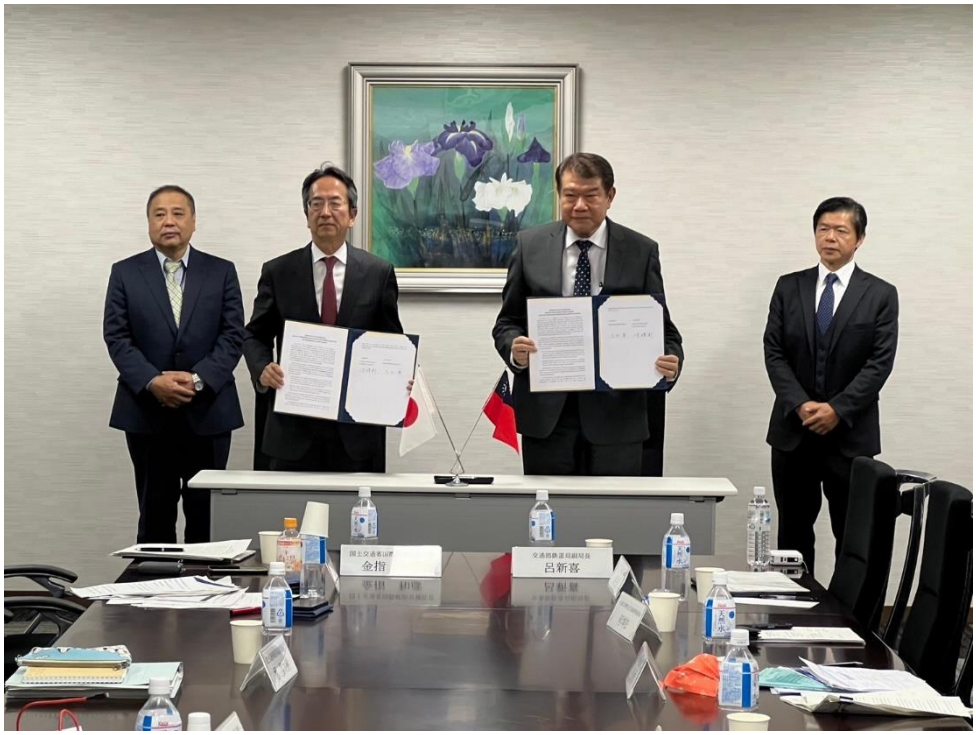


圖 6-臺日鐵道相關協會簽署合作備忘錄(2/2)

三、參訪 JR 東海濱松工場

112年12月6日行程係參訪東海旅客鐵道株式會社（JR 東海）位於靜岡縣之濱松工場，濱松工場成立於1912年11月，占地面積約318,000平方公尺，員工數約667人，並設有總務課、會計課、車輛檢修課、設備課、車輛情報課、教育中心、業務改革推進中心、車體中心、零部件中心、轉向架中心、檢查中心等部門。濱松工場於1965年開始執行新幹線車輛檢查及維修作業，目前東海道新幹線 N700A、N700S 列車大修作業，皆於濱松工場進行。

新幹線列車檢修作業分為4類，包括：營運前檢修（Pre-service Inspection）週期為48小時；定期檢修（Regular Inspection）週期為6萬公里或45天；轉向架檢修（Bogie Inspection）週期為60萬公里或18個月；大修作業（General Overhaul）週期為120萬公里或36個月。完成1列新幹線列車大修作業約14天，濱松工場1年約完成50列車大修作業。有關大修作業流程、車廂檢查及維修、設備檢查及維修、轉向架檢查及維修、出場檢查等作業，說明如下：

(一)大修作業流程

1、進場檢查（Shop-in Inspection）

2、準備工作（Preparation Work）：拆下集電弓、車門等設備，並將1列車拆分為數個單獨之車廂。

3、車廂舉升（Car Body Lifting）：使用千斤頂將轉向架從車廂拆下。

4、拆卸設備（Dismounting Equipment）：將位於地板下之設備從車廂拆下。

5、車廂維修（Car Body Repair）：確認車窗玻璃已更換、車門已安裝且功能正常，及車廂各項缺陷已維修完成。

6、車廂噴漆（Car Body Painting）：使用機器人自動對車廂噴漆。

7、安裝設備（Mounting Equipment）：檢查及維修安裝於車廂上之設備。

8、車輛安裝（Car Remounting）：使用千斤頂將車廂安裝於轉向架。

9、出場檢查（Shop-out Inspection）：確認新幹線列車是否能正常運轉。

(二)車廂檢查及維修（Inspection and Repair of Car Bodies）

1、拆下集電弓（Removing the Pantograph）：拆下位於車頂之集電弓，並送工場進行檢查及維修後，再重新安裝於車頂上。

2、安裝駕駛室車門（Attaching the Door for Driver’s Cabin）：使用輔助裝置安裝90公斤重之車門。

3、車廂拋光（Car Body Polishing）：使用尼龍刷拋光車廂，以預備噴漆作業。

4、安裝地板下之設備（Mounting Underfloor Equipment）：所有設備經過詳細檢查及維修後，再安裝於車廂上。

(三)設備檢查及維修（Inspection and Repair of Equipment）

1、空氣壓縮機測試（Air Compressor Test）：進行功能測試，以確認是否能正常產出煞車系統、車廂傾斜系統等所需之壓縮空氣。

2、電路板維修（Circuit Board Repair）：對煞車系統、車廂傾斜系統所使用之電路板，進行維修及更換，

3、ATC 測試（Automatic Train Control System Test）：ATC 是控制新幹線列車運轉之重要安全設備，須使用專用之測試設備，進行詳細診斷測試。

4、清潔空調設備（Air Conditioning Equipment Cleaning）：經過清潔後確認空調系統效能，以提供舒適之乘車環境。

(四)轉向架檢查及維修（Inspection and Repair of Bogies）

1、輪軸探傷（Wheel Axle Flaw Detection）：進行詳細超音波/磁粉/纖維鏡檢查，確認輪軸為無缺陷狀態。

2、車輪對準（Wheel Truing）：車輪及車軸須同時對準，精度為0.1 mm。

3、轉向架框之超音波檢測（Ultrasonic Inspection of Bogie Frames）：使用超音波探測器，詳細確認轉向架框無缺陷。

4、轉向架總成/轉向架走行測試（Bogie Assembly / Bogie Running Test）：通過嚴格檢查之輪軸、馬達、彈簧等設備將組裝於轉向架框上。1個完整之轉向架將進行時速300公里以上之運轉測試，以確認軸箱溫度、齒輪箱溫度、各部位振動、噪音等皆無異常。

(五)出場檢查（Shop-out Inspection）

1、單元測試/整車測試（Unit Test / Trainset Test）：每個車輛（Car）皆是由1個車廂及2個轉向架所組成，然後4個車輛組成1個單位以進行功能測試。4個單位將組成1列16個車輛之列車組，接著使用最新之測試設備，對每個裝置及電路進行整體測試。駕駛室之車載電腦螢幕也須進行測試，以確認通訊系統、ATC系統、車門開關等皆無異常。

2、正線運轉測試（Main Line Test Run）：最後在濱松及名古屋之間進行正線運轉測試，以確認啟動、加速、減速、停止等列車性能。完成正線運轉測試後則回復列車營運。

圖 7-致贈 JR 東海濱松工場禮品

圖 8-本局同仁與 CRIDA 代表於新幹線 N700列車前合影

肆、心得及建議

一、心得

(一)經由本次會議瞭解，為確保營運路線安全，日本採用無人自動駕駛系統時，其營運路線皆採高架化（專用路權）、全封閉式月台，此舉與國內無人駕駛系統之營運模式皆相同。另為避免異物入侵營運路線，導致發生無人駕駛列車撞擊事故，又考量於列車、道旁裝設感測器作偵測，尚無相關實績確保準確率及安全性，故目前作法仍以加強乘務員教育訓練、設置緊急停車按鈕等方式辦理。

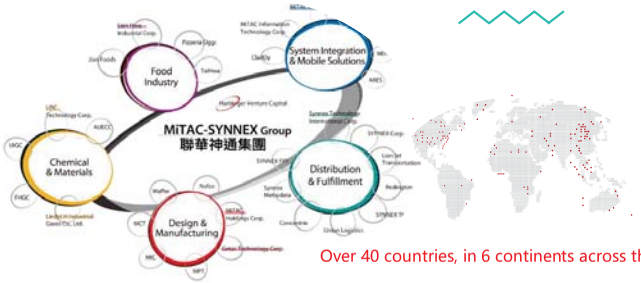
(二)於鐵道運輸導入物聯網、大數據、雲端運算、人工智慧等資通訊技術，用於發展智慧鐵道，係繼鐵道電氣化、高速化、列車運轉自動化之後，鐵道系統的重要變革，亦是目前鐵道先進國家運輸業者的發展方向，期望藉以提升旅客服務品質、強化營運維修能量等。其中提升旅客服務品質的具體應用包括：自動調整車廂內溫度、顯示車廂擁擠度、整合其他接駁運具之即時行車資訊等；另強化營運維修能量包括：裝置感測器以即時監視系統設備狀態、建置 AI 模型作為系統設備故障預警等。但智慧鐵道系統若由鐵道營運機構各自發展，將因數據編碼、介面格式相異，致資訊難以相互交換等問題。

(三)目前國內已具有供電、軌道、自動收費等鐵道系統技術，但因較少與其他系統整合，及參與國外鐵道建設經驗，且仍缺乏車輛、號誌等核心機電系統技術，故期望藉由臺日鐵道民間團體簽署合作備忘錄之契機，促進雙方民間業者交流，增進我國與日本廠商於第三國鐵道市場合作之機會。

二、建議

本次會議瞭解日本鐵道營運機構也積極發展智慧鐵道相關應用，但目前尚未有智慧鐵道相關國際標準規範可供依循，若由鐵道營運機構各自發展智慧鐵道系統，對於未來推動鐵道營運監理、交通行動服務（Mobility as a Service, MaaS）等業務，須取得營運機構相關數據資料時，將面臨數據編碼、介面格式相異，致資訊難以相互交換等問題，故建議後續仍應持續建構鐵道系統數據編碼、介面格式標準化等作業，並協調國內營運機構配合辦理。

MiTAC SYNNEX SUMMARY



- Food industry-Lien Hwa
- Chemical- UPC
- Manufacture- MIC / MCT / Getac
- Distribution- SYNNEX GROUP
- System Integration- MIT

Over 40 countries, in 6 continents across the world

Group Synergy

- **MiTAC-SYNNEX Group, was founded in 1952**
- **MiTAC Inc. Established in 1974 is the parent company of MiTAC Group**
- **USD$ 90 Billion Turnover in 2022**
- **368,000 employees worldwide**

System Architecture of a Smart City

IoT Devices Gateways	IoT Ecosystem	Cloud Platform	AI Analytics	Applications
RFID& Sensors	OGC	**MiAIOT**	Descriptive	**Transportation**
CCTV Camera	International	AWS	Diagnostic	Banking
Auto Gate	Standard	Azure	Predictive	Education
Kiosk	Information	GCP	Prescriptive	Manufactory
Streetlight	Exchange	IBM Cloud		Enterprise
				Government

Smart Trans. Taiwan Project

MRT

- **Automatic Fare Collection System (AFCs)**
- **Communication Multi-Function Terminals**
  - Power Supply & Distribution System
  - Cab Driving Simulation System
  - Cab Intelligent Surveillance System
  - Environmental Monitoring System
- Software/Hardware Design and Manufacture of Railway Vehicle Equipment

Light Rail

- **Automatic Fare Collection System (AFCs)**
  - Open Payment System (EMV)

High Speed Rail

- **Automatic Fare Collection System (AFCs)**
  - Operation Management System
  - Communication System
  - QR Code -T Express (APP)

Airport

Automatic Immigration Clearance System (3e-Gate)

- Biometrics Match System
- Logic Algorithm software of passing
- Facial Recognition System

Bus e-Ticketing

- **Bus e-ticketing system**
- Driver Console (DC)
- Bus Validator (BV) – CSC & QR Code Ticketing

Railway

- **Automatic Train Protection (ATP)**
- Signaling Monitoring System
- Signaling System & Alarm System
- Tunnel Central Monitoring System
- Axle Counter System
- Elec. Interlocking for Light Rail System

Highway

- **Electronic Toll Collection System (ETC)**
- Traffic Surveillance System
- Dubai-Oman Border Automatic Immigration Clearance System

Smart Airport 3e Project

Automatic Immigration Clearance solution
eChecking, eBorderControl, eBoarding

Third Generation
e-Gate System
for
Taoyuan-Airport

- e-Gate is an automated security inspection solution designed for border control applications
- Biometric features
  Facial recognition Fingerprint recognition
- Philippines 2nd E-Gate

OneMiTAC

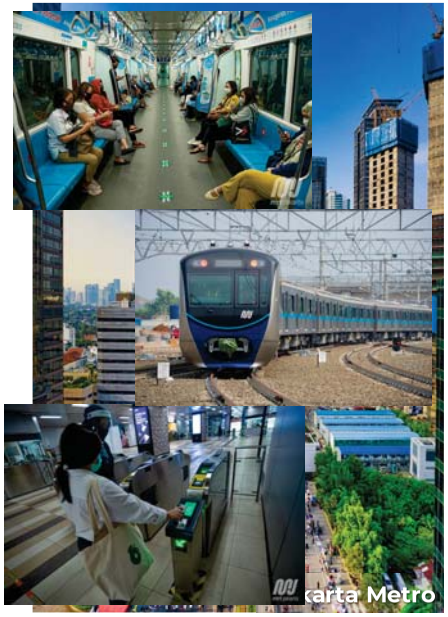
Smart Trans. Oversea Projects

AFC Consulting Services

- **Ukraine**, Odessa City
  E-Gate-Automatic Immigration Clearance
- **Philippines**, Manila Airport
  Automatic Immigration Clearance System:

AFCs-Automatic Fare Collection System:

- **China**, Fuzhou Metro
- **Hong Kong**, Airport Express Line (QR-Code)
- **India**, Chennai Metro
- **Vietnam**, HCM City Metro
- **Indonesia**, Jakarta Metro
- **Thailand**, Red Line



MiTAC Experiences in e-Ticketing

TAIWAN

Mass Rapid Transit (MRT) | Aviation | High Speed Rail | Railway

Bus | Highway

Automatic Fare Collection System
Communication System
Power Supply & Distribution System
Cab Intelligent Surveillance System
Environmental Monitoring System
Software/Hardware Design and Manufacture of Railway Vehicle Equipment
Automatic Train Protection (ATP)
Signaling Monitoring System
Signaling System & Alarm System
Tunnel Central Monitoring System for railway and high-speed railway
Axle Counter System
Operation Management System
Electronic Toll Collection System (ETC)
Traffic Surveillance System
Flight Safety Assessment Consulting Service Airport Navigation Aids System
Low Level Wind shear Alert System (LLWAS)

MiTAC's End-Customers in e-Ticketing

* Thanks for the opportunity to cooperate with Japanese Company in ASEAN AFC software

Smart Cloud Platform

The Future Of Smart City

MiAIOT, an AIoT platform designated for smart city.
It can thoroughly analyze IoT Big Data and use AI technology to provide governments and enterprises with decisions on municipal administration,
city construction, process control, asset management and epidemic prevention. Sensors connected with MiAIOT are able to use any protocol.
With the international standards (OGC),
MiAIOT can convert IoT and Non-IoT data at high speed.

C

MiAIOT Goal

2017

Connecting Device & Sensor to the internet

Data Collection

Smart Maintenance

OGC Standards

2019

Machine learning

Data Analytics

Pattern Recognition

Robotic Process Automation

2021

Real-Time Data Insights

Predictable Future Problem

Connect Standard Procedure

Auto-Reply Demand

MiAIOT 7 Major System

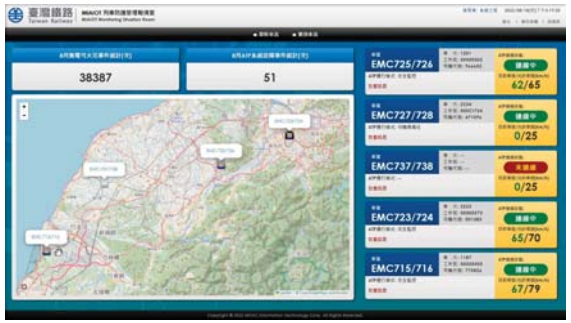
We are Intelligence in action

1. Data Storage
2. Real-Time Streaming Server
3. Artificial Intelligence Analysis
4. Visualization Toolkit
5. Application Programming Interface (API)
6. Platform Management
7. Alarm Notification

MiAIOT intel.

5G Train Safety Management Platform

MiTAC's **5G Railway Safety Management System** was developed based on MiTAC's in house AIoT platform-"MiAIoT" and integrated AI inference system 5G gateway.
The system consists of cloud-based train operating data exchange, real-time train warning system, AI equipment abnormality prediction, and feeding all the crucial information to a situation "war room" and will assist the digital transformation of Taiwan's rail industry in the future.



OneMiTAC

MiAIOT

5G Train Safety Management System On Train Unit

- Collect Train ATP & TCMS on line status
- Transmit collected status back to Train Safety Management Platform
- Precise Train Positioning system on Platform
- ATP MMI redundancy function
- 5G Driver Roster Dispatching
- Driver Assistant Functionalities
- Train Pantograph video AI analysis & alert for big sparking & cable abnormal
- Train pantograph video uploading.

Design for ALSTOM

On Train Display Unit

Design for 台灣高鐵 TAIWAN HIGH SPEED RAIL

To Be

700T LCD Display Unit

Made In Taiwan

Design for 台灣高鐵 TAIWAN HIGH SPEED RAIL

Light Rail Electronic Interlocking P.O.C. Project

MiTAC

TEST SITE at New Taipei LRT

Developing the Electronic Interlocking System for Light Rail –

SIL 4 PLC is used with IXL logic inside.
Follows EN50126, EN50128, EN50129 standard

Build up the Capability to co-work with international signaling venders –

. Auto Development Software Tools
. Simulation test Tools
. IXL logic development capabilities
. RAMS process & documentations

2023 – Taiwan M.O.T.C. launch TPASS Cards

Taipei MRT auto Gate

Taiwan Rail Validator

Bus Ticket Validator

How to use the TPASS monthly common cards ?

The first-use must be in 30 days after card purchased.
It can be used unlimitedly in the 30 days on the restricted public transportation modals in the applicable area.

How to do TPASS next period purchasing ?

10 days before TPASS monthly card expired, card holder can do the next period purchase in Metro or TRA TVM or PAM.
After next period purchased, the valid period extend 30 days automatically.

EN
D

MiTAC Enables the TPASS function

- In addition to the effort of the Card Issuance Companies –
  Easy Card, iPASS, iCASH for card issuing and clearance & settlement function implementation and services.

  MiTAC together with another e-ticketing system Service Providers for Bus eTicketing & metro works very hard with Transportation Service Providers such as Taipei / New Taipei Rapid Transit Companies, Taoyuen/ Taichung / Kaoshung Rapid Transit Companies, Taiwan Railway Association, Bus Companies in Taiwan
  Completed the system upgrading in 4 months – from system requirement development, designing, implementation, to test & commissioning , go-live support.

- **MiTAC contributed to the following Ticketing System upgrading:**
  Common card reader firmware, Interfacing to card issuer design change.
  Taipei Metro System – Gate, PAM, TVM, SC & CC
  Taiwan Railway System – Ticket Validator, Gate (Oct.), CC
  Taipei Bus Ticketing System – Bus Ticket Validator, CC
  New Taipei Light Rail System – Platform Ticket Validator, TVM

華電聯網股份有限公司
杜孟郎 副總經理

2023年12月4日

 1

華電聯網公司簡介

- 智慧交通　鐵道 / 機場 /公路
- 交通部淡海D-City 5G車聯網發展
- 5G專網應用　經驗分享

 2

華電聯網公司簡介

國內前三大系統整合商
擅長大型ICT工程專案

董事長 陳國章先生

成立於 1994/5/4

員工人數 約800人

資本額 14億

110年營收 60.7億

股票代號 OTC:6163

公司據點	✓ 總部：新北市 ✓ 辦事處：桃園、中壢、新竹、臺中、臺南、高雄、花蓮、臺東(共九個) ✓ 海外公司：華寬系統集成技術有限公司
營業內容	✓ ICT資通訊、智能應用(監控/環控/交控)、媒體應用(TIDS)、電信加值整合解決方案 ✓ 主要客戶：政府、電信、交通、企業
合作夥伴	✓ 戰略夥伴：研華科技(法人大股東)合作智慧城市、物聯網、5G專網 ✓ ICT國內外大廠密切合作： NetApp, Cisco, Juniper, Dell, Bigstack, VMware, NVIDIA, F5, A10, Trend Micro, Checkpoint, AXIS ...
企業經營	✓ 2022年中華徵信社調查 電腦系統整合業 全國第三大公司 ✓ 曾獲得公共工程金質獎、國家品牌玉山獎首獎、金炬獎等 ✓ 全國第一家獲得ISO 27001/27701雙認證系統整合廠商

 3

華電聯網四大發展領域

5G　資通訊 ICT　智慧應用 Smart

Hwacom 華電聯網・超乎想像 Ace for Any

數位媒體 Digital Media　資安 Security

4

第1家通過ISO資安雙驗證

資安認證

2019年**全台首家同時**通過
「ISO27001:2013資訊安全管理系統」
「ISO27701:2019隱私資訊管理系統」
驗證的系統整合服務商。

OIS

Open Information Security
開啟資安系統股份有限公司

代表客戶及服務領域 – 500+大型客戶

電信事業
- 中華電信
- 是方電訊
- 遠傳電信
- 亞太電信
- 台灣之星
- 台灣大哥大

媒體事業
- 中華電信MOD
- 凱擘大寬頻
- 中嘉網路
- 東森電視
- 民視交通電視台
- 年代新聞
- 北都有線
- 露天拍賣

高科技事業
- 聯發科技
- 群創光電
- 聯詠科技
- 瑞昱半導體
- 旺宏電子
- 羅技電子
- 頎邦科技
- 力晶半導體
- 中美晶
- 全錄科技

公共事業
- 交通部台灣鐵路管理局
- 台北捷運公司
- 桃園捷運公司
- 台灣高鐵
- 交通部國道高速公路局
- 交通部公路總局
- 桃園國際機場公司
- 松山機場
- 臺北市/新北市/桃園市/台中市
- 三總/臺大/ 高雄市立聯合醫院
- 內政部警政署刑事警察局
- 台灣電力公司
- 台灣中油公司
- 經濟部

智慧交通

- **鐵道** /機場 /公路

軌道相關實績

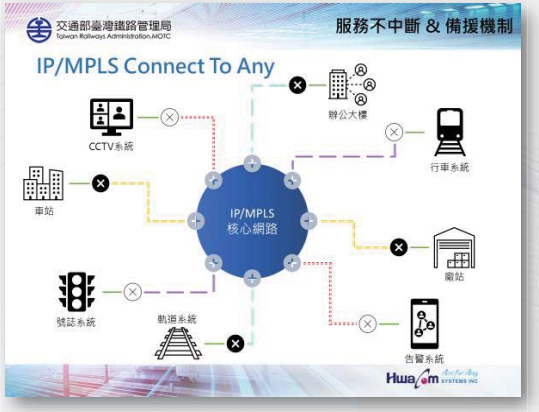
臺鐵局
- ■台鐵**全局網路**擴充及更新案
- ■臺鐵電務智慧化提升計畫(**環島光纖傳輸網路**系統更新工程)
- ■台鐵月台監控系統
- ■**板橋車站 列車資訊系統**改善工程
- ■平交道錄影儲存設備雙重化工程
- ■台鐵平交道支線控制系統(POC)

鐵道局
- ■左營/高雄/鳳山**列車資訊系統**工程
- ■左營=鳳山間等10車站監視系統影像整合(臺鐵局應變中心及路警所)
- ■ **鐵道雲平台**

桃園捷運
- ■ **骨幹網路**光纖電纜增設改善案統包工程
- ■ **桃捷雲平台**
- ■ 桃捷軌道電路監控

台灣高鐵 TAIWAN HIGH SPEED RAIL
- ■**高鐵 旅客資訊系統**(PIS)改善汰換案-第三標L型顯示器新增工程採購案

台鐵局 新一代MPLS骨幹網路

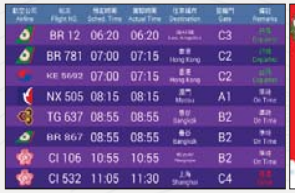


交通部鐵道局 智慧鐵道雲平台

列車時刻表顯示 (台鐵、高鐵)

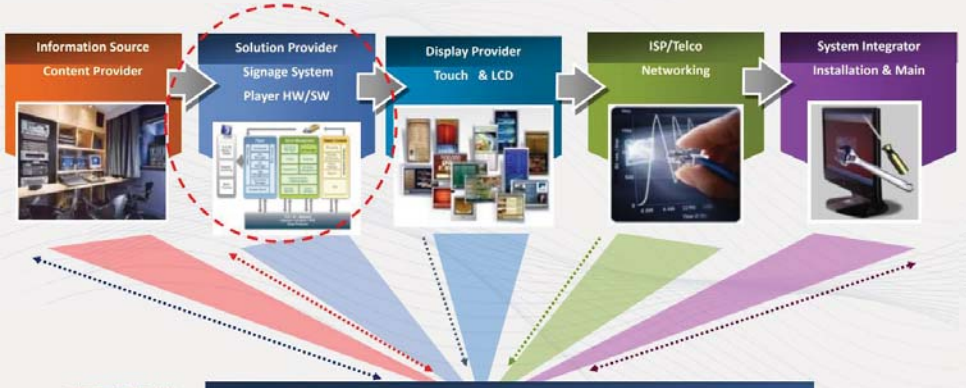
列車時刻表顯示(TIDS) +多媒體影音推播加值服務

安全且完整的資訊影音管理平台，整合各個不同來源的資訊、廣告、影音
提供客製化排版編輯功能與簡易的管理介面，滿足不同資訊廣告呈現需求.



所有資訊廣告設備在統一的管理平台上管理，
工作人員可以管理各種需求的資訊廣告內容

專注在多媒體影音推播加值服務



應用實績

Passenger Information : Railway, MRT, Airport
Advertisement : Banking , Hospital , Restaurant

台鐵鳴日號

5G沉浸式展演

5G 智慧展演

以 AR 數位技術、感測器互動技術為核心，搭配多媒體做虛實融合展示，提供彷彿無邊際的互動體驗，以不同的顯示媒介方式展現多層次的視覺與互動效果，提高觀賞的樂趣與驚奇感，讓人大開眼界。

四大核心技術

1. 5G傳輸設備
2. 虛擬投影 / 沉浸式投影
3. AR 智慧眼鏡+虛擬資訊
4. 智慧互動系統

5G旅運新服務

1.5G專網佈建
- 頻寬專屬使用
- 門號可分群分類管理
- 管理及應用服務可落地
- 不與外網連接，增加安全性

3.愛心接駁旅運服務
- 服務人流資訊數位化管理
- 載具即時定位利於中心管理
- 人流分析迅速提供彈性調度
- 提升愛心接駁整體服務效率
- 減少支援人力投入(人力統計)
- 提升旅客滿意度

2.4K 安全監控及AI影像辨識服務
- 支援航廈內短期施工影像監控
- 整合影像辨識，提供異常主動提醒
- 提供戶外區域或臨時性CCTV建置更大彈性
- 解決光纖佈線問題
- 提供移動監控服務

4.移動旅運資訊服務
- 機場圖資服務
- 溫馨防疫提醒資訊
- 差異化資訊推播服務
- 減少支援人力投入(人力舉牌)
- 提升旅客滿意度

5.環境監控營運戰情室
- 影像資料彙整分析
- 異常事件追蹤提醒
- 系統資料介接
- 角色權限管理

超乎想像案例 – 2023 華電聯網榮獲2個金質獎

提名專案2：臺鐵電務智慧化提升計畫(環島光纖傳輸網路系統更新工程)
業主：交通部臺灣鐵路管理局
華電角色：建置商 **臺灣鐵路管理局**
專案簡介：在臺鐵195個車站建置全數位化的環島IP MPLS，協助臺鐵推動交通雙軸轉型，提升智慧化、數位化、永續發展為目標。

提名專案1：高速公路北區交通控制系統更新提升工程第R15標現場設備工程
業主名：交通部高速公路局北區養護工程分局
華電角色：建置商 **國道高速公路局**
專案簡介：打造北區交通控制系統更新提升工程第R15標現場設備網路，強化資訊安全、穩定設備運作、提升維護效能，實現「路往雲端智慧隨行」願景。

華電聯網榮譽榜

2011	2012	2013	2014	2015	2016	2023
金路獎 交通部	IP機上盒出貨量 在MRG中排名 亞洲第8位和 全球第14位	金質獎 公共建設 委員會	國家品牌 玉山獎 優秀企業	金炬獎 10家 最優秀企業	金鋒獎 10家 最優秀企業	金路獎 交通部	金質獎 1.高公局 2.台鐵局

Hwacom 華電聯網・超乎想像
Ace for Any

THANK YOU

SINOTECH ENGINEERING CONSULTANTS, LTD.
中興工程顧問股份有限公司

Railway Engineering Division

Major Projects / Experiences

2023.12



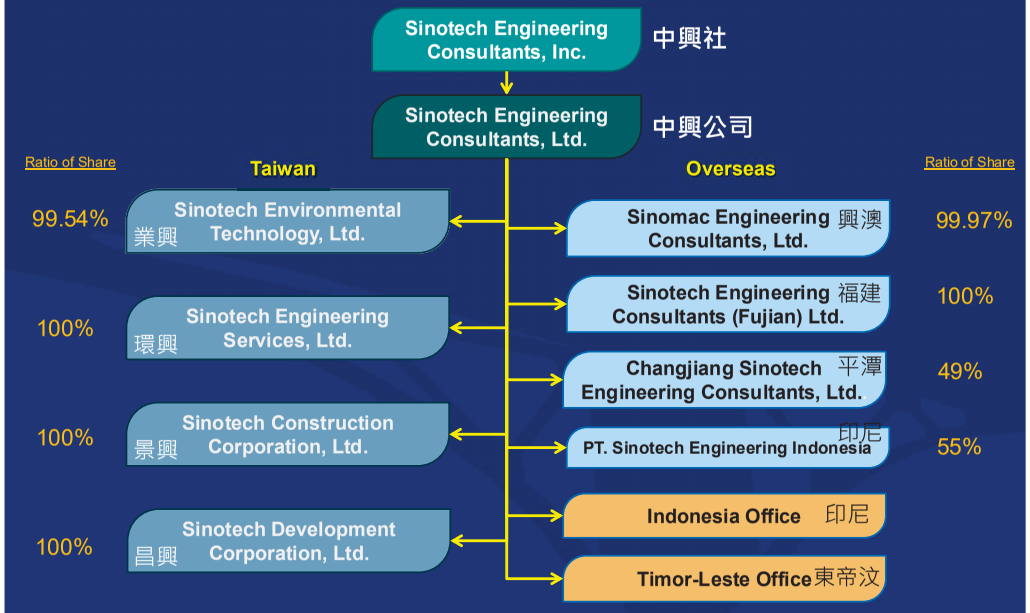

CONTENTS

- Sinotech Company Overview
- Organization of Railway Engineering Division
- Major Projects & Experiences

SINOTECH ENGINEERING CONSULTANTS, LTD.

- Spin-off of engineering consultancy services of Sinotech Inc.(establish in 1970)
- Established in 1993
- Capital- USD 57.4 Million
- No. of employees- 1,850 as of Dec. 2023
- Annual turnover- USD 231 Million in Year 2022
- 15 functional departments, 4 Domestic & 4 Overseas Subsidiaries, and 2 Overseas Offices
- 4,500+ and 240+ projects completed in Taiwan and overseas respectively

SINOTECH ENGINEERING GROUP



COMPANY ORGANIZATION

- Board of Directors Chairman
  - President Exec. Vice President
    - Railway Engineering Division
      - Railway Engineering Dept.
      - Mass Transit Engineering Dept.
    - Mechanical & Electrical Engineering Division
      - Systems and Electrical Engineering Dept.
      - Mechanical Engineering Dept.
      - E&M Construction Supervision Dept.
    - Civil Engineering & Architecture Division
      - Structural Engineering Dept.
      - Land Development, Highway & Aviation Eng. Dept.
      - Architectural Engineering Dept. (including Engineering Aesthetic Center)
    - Environmental Engineering Division
      - Environmental Engineering Dept.
    - Construction Management Division
      - Constr. Management Dept.
      - Southern Taiwan Project Center
      - Central Taiwan Project Center
    - Water Resources & Power Engineering Division
      - Geotechnical Engineering Dept.
      - Power Engineering Dept.
      - Water Resource & Hydraulic Eng. Dept.
    - Supporting Division
    - Chief Engineer / BIM & Innovation Committee
    - Occupational Safety & Health Management Center

Scope of Services & Field of Activities

Lifecycle Services

- Feasibility Studies
- Planning
- Design
- Construction Supervision
- Operation Management
- Project Management
- Turnkey Projects

Diverse Fields of Activities

Architecture & Civil Engineering
- Architecture
- Landscaping
- Land Development
- Urban and Rural Develop
- Industrial Estates
- Science Park
- High-Tech Factories
- Eco-Engineering
- Transportation
- Structural Engineering
- Airports
- Highways
- Bridges

Environmental, Mechanical, and Electrical Engineering
- Electrical Engineering
- Mechanical Engineering
- Waste Management & Disposal
- Soil & Groundwater Pollution Remediation
- Air Pollution Control
- Water & Wastewater Treatment

Water Resource & Power Development
- Water Resources
- Harbor Infrastructure
- Energy
- Coastal and Ocean Engineering
- Power Development
- Geotechnical Engineering
- Tunnels
- Soil and Water Conservation

Railway, Engineering
- Railway Core Systems
- High-Speed Rail
- Mass Rapid Transit
- Railway Core Systems

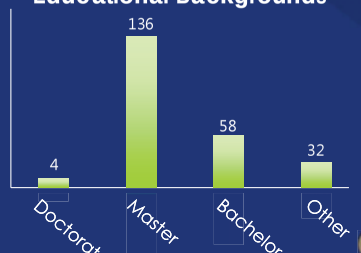
CURRENT STATUS OF OVERSEAS BUSINESS – PROJECTS DISTRIBUTION.

ORGANIZATION OF RAILWAY ENGINEERING DIVISION

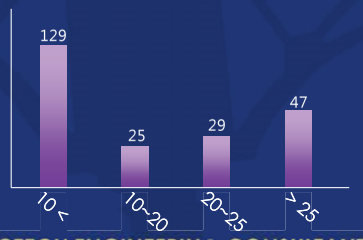
Railway Engineering Division

	Engineers
Railway Engineering Dept.	52
Mass Transit Engineering Dept.	86
Project Office	92
	230

Educational Backgrounds



Years of Experience

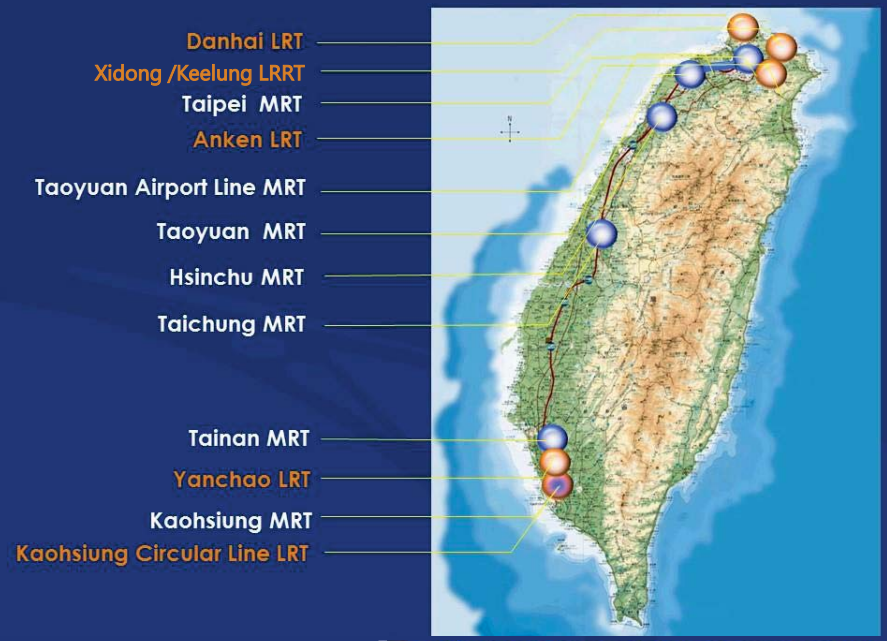


WHOLE LIFE CYCLE EXPERIENCE AND CAPABILITY

Item	Planning	Design	Construction Supervision	Project Management
High Speed Railway	V	V	V	
Convention Railway	V	V	V	V
Mass Rapid Transit System	V	V	V	V

Capabilities cover all spectrum of Project Lifecycle

MRT & LRT PROJECT EXPERIENCE IN TAIWAN



TAIPEI METROPOLITAN AREA MRT STATUS AND FUTURE VISION

Stage 1(completed)
- Operational length 136.6 km, 121 Stations
- Average daily transport ridership 2 million

Stage 2(approved)
- Under design and construction length 66.9 km, 73stations

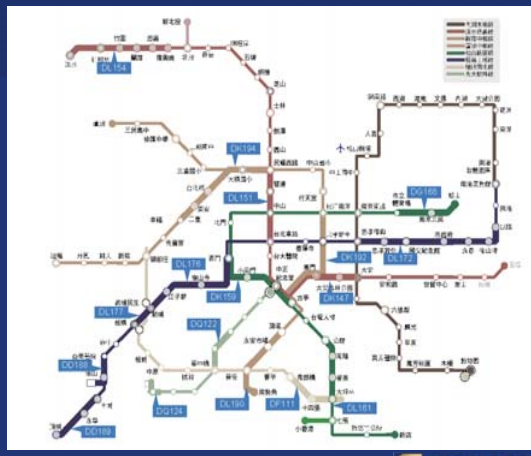
Stage 3(planned)
- Extend Taipei MRT network more than 270 km
- Average daily transport ridership over 3.6 million

TAIPEI MRT NETWORK

Design | Project Management | Construction Supervision

Client: Department of Rapid Transit, TCG
Location: Taipei City, New Taipei City
Construction Scope: 87.35 Km, 75 Stations (203.5 Km, 194 Stations totally)
Service: Planning, Detail Design, Construction Consultation

>40%



Design | Project Management | Construction Supervision

TAIPEI MRT CIRCULAR LINE PHASE I

Client: Department of Rapid Transit, TCG
Location: Taipei City, New Taipei City
Construction Scope: US $465 million, 2 stations, 1 depot
Service: Surveying, Geological Investigation, Detailed Design

Design | Project Management | Construction Supervision

TAIPEI MRT CIRCULAR LINE EAST SECTION

Client: Department of Rapid Transit, TCG
Location: Taipei City
Construction Scope: US $3,366 million, 13.25Km ,10 stations,1 Depots
Service: BASIC Design

Design | Project Management | Construction Supervision

TAIPEI MRT WANDA LINE PHASE I + II

Client: Department of Rapid Transit, TCG
Location: New Taipei City
Construction Scope: US $1,896 million, 17 stations, 1 depot
Service: Detailed Design

Design | Project Management | Construction Supervision

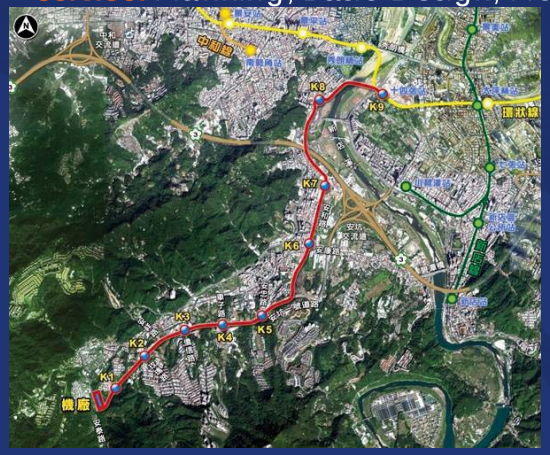
DANHAI LIGHT RAIL

Client: New Taipei City Government
Location: New Taipei City
Construction Scope: US $500 million, 20 stations, 1 depot
Service: Project Management, Basic Design

Design | Project Management | Construction Supervision

ANKENG LIGHT RAIL

Client: New Taipei City Government
Location: New Taipei City
Construction Scope: US $737 million, 9 stations, 1 depot
Service: Planning, Basic Design, Project Management



Design | Project Management

XIDONG LRRT

Client: New Taipei City Government
Location: New Taipei City
Construction Scope: US $719 million, 5.56 Km, 6 Stations, 1 Depots
Service: Planning, Project Management, Basic Design

Design | Project Management | Construction Supervision

KEELUNG- NANKANG COMMUTER RAILWAY PROJECT

Client: Railway Reconstruction Bureau, MOTC
Location: Taipei and Keelung City
Construction Scope: 16.5 Km, 13 stations, 1 depot
Service: Planning

Design | Project Management | Construction Supervision

SAN-YING RAPID TRANSIT SYSTEM

Client: New Taipei City Government
Location: New Taipei City
Construction Scope: US $1,132 million, 12 stations, 1 depot
Service: Construction Supervision

Design | Project Management | Construction Supervision

TAOYUAN AIRPORT LINK MRT

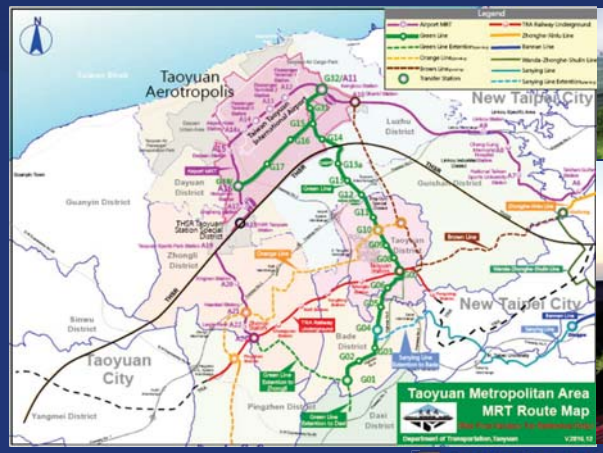
Client: Bureau of High Speed Rail, MOTC
Location: Taipei City, New Taipei City, Taoyuan City
Construction Scope: US $1,821 million, 51.3 Km, 23 Stations, 2 Depots
Service: Project Management, System Integration, Construction Supervision

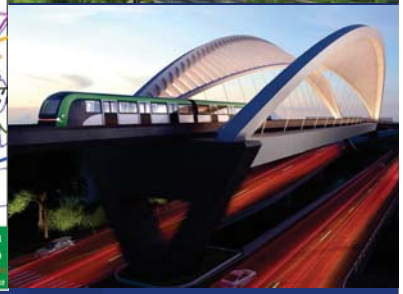


Design | Project Management | Construction Supervision

TAOYUAN MRT GREEN LINE

Client: Office of Rapid Systems, Taoyuan
Location: Taoyuan City
Construction Scope: US $2,576 million, 28.4 Km, 21 Stations, 1 Depots
Service: Project Management, Construction Supervision



Planning | Project Management | Construction Supervision

HSINCHU LIGHT RAIL NETWORK

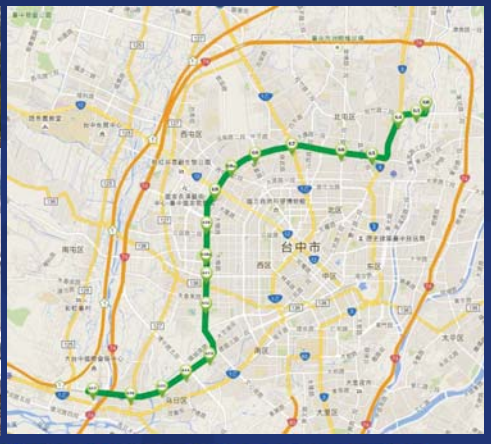
Client: Department of Transportation, HCG
Location: Hsinchu City
Construction Scope: 25.9 Km, 24 Stations (US $2,037 million)
Service: Planning


Design | Project Management | Construction Supervision

TAICHUNG MRT

Client: Department of Rapid Transit, TCG
Location: Taichung City
Construction Scope: US $823 million, 8.6 Km, 9 Stations, 1 Depot
Service: Planning, Detail Design, Construction Supervision.



Planning | Project Management | Construction Supervision

TAINAN MRT NETWORK

Client: Bureau of Transportation, TCG
Location: Tainan City
Construction Scope: 99.4 Km, 106 Stations (US $6,022 million)
Service: Planning

Design | Project Management | Construction Supervision

KAOHSIUNG MRT

Client: Mass Rapid Transit Bureau, KC
Location: Kaohsiung City
Construction Scope: US $5.7 billion, 42.6 Km, 38 stations, 3 depots
Service: Planning, Basic Design(2 lines), Detail Design(3 lots) and Construction Supervision

Design | Project Management | Construction Supervision

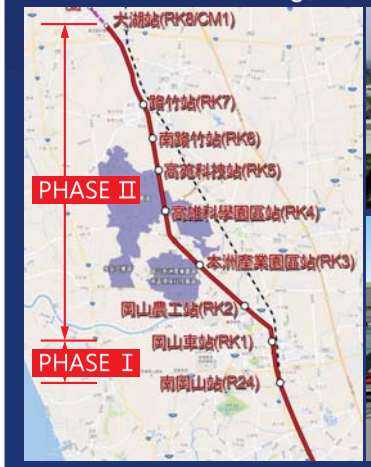
KAOHSIUNG CIRCULAR LIGHT RAIL

Client: Mass Rapid Transit Bureau, KC
Location: Kaohsiung City
Construction Scope: US $413 million, 19.6 Km, 32 Stations, 1 Depot
Service: Planning, Construction Supervision

Design | Project Management | Construction Supervision

GANGSHAN & LUJHU MRT EXTENSION LINE

Client: Mass Rapid Transit Bureau, KC
Location: Kaohsiung City
Construction Scope: 13.09 Km, 8 stations
Service: Planning, Basic Design(phase Ⅰ)



MRT & LRT PROJECT EXPERIENCE IN SOUTHEAST ASIA

Design
Project Management
Construction Supervision

JAKARTA LRT PROJECT – CORRIDOR 1 (PHASE 1) KELAPA GADING–VELODROME – PACKAGE P102

Client: T.Y.LIN International, Taiwan (PT WIJAYA KARYA (PERSERO)

Location: Jakarta ,Indonesia

Construction : 4 stations, 1 depot

Service: E&M design for station and depot

Design
Project Management
Construction Supervision

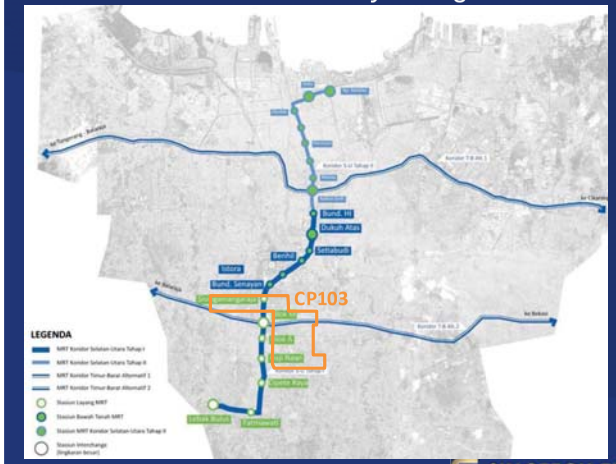
JAKARTA MRT CP103

Client: Obayashi – Shimizu – Jaya Konstruksi JV

Location: Indonesia

Construction Scope: US$126 million, 3.8 Km, Viaducts and 4 Stations

Service: The Third Party Design Verifier



Design
Project Management
Construction Supervision

FEATURE OF JAKARTA MRT CP103

- Japanese Code required for design and verification
- Independent check covering all designs including architecture, structure, geotechnical & MEP
- Japanese Code & Eurocode/BS comparison
- Eurocode/BS for detail design check & special check with Japanese code

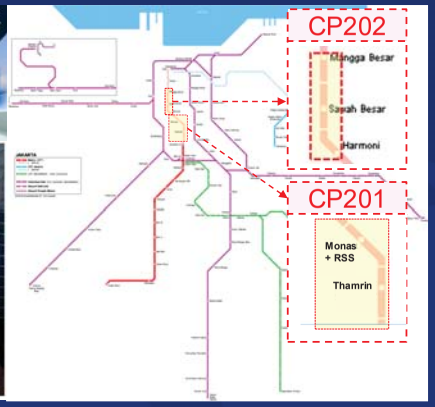
JAKARTA MASS RAPID TRANSIT SYSTEM PHASE 2 - CP201 & CP202

Client: SHIMIZU - ADHI KARYA JOINT VENTURE

Location: Jakarta City

Construction Scope: **CP201-**2 underground stations, 1 Receiving Substation, 3 shield tunnel ; **CP202**- 3 underground stations, 4 shield tunnel

Service: Third Party Verifier Consultant



HO CHI MINH CITY URBAN RAILWAY CONSTRUCTION PROJECT

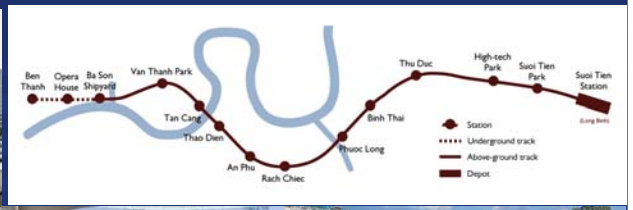
BEN THANH – SUOI TIEN SECTION (LINE 1)

Client: GRC GENERAL RESOURCES Co. (Hitachi, Ltd.)

Location: Ho Chi Minh City , Vietnam

Construction Cost: US$1.1 billion , 14 stations, 1 depot

Service: Consulting services of Utilities Fixing



Macau LRT Project – Taipa Line

Client: SF Civil Engineering Consultants Co. Limited

Location: Taipa Macau

Construction Cost: US $1,367.3 million, 9.3km, 11 stations

Service: Interface Management of Depot construction

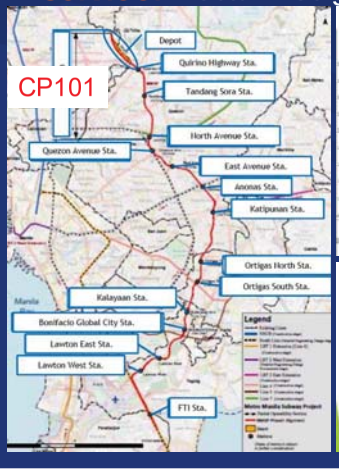
METRO MANILA SUBWAY PROJECT Phase 1 (CP101)

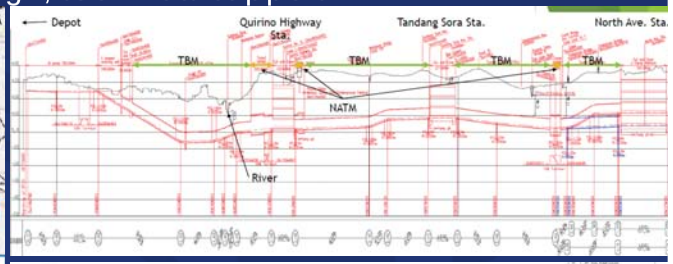
Client: Nippon Civic Consulting Engineers Co., Ltd (NCC)(JP)
Nippon Koei Co., Ltd (NK) (JP)

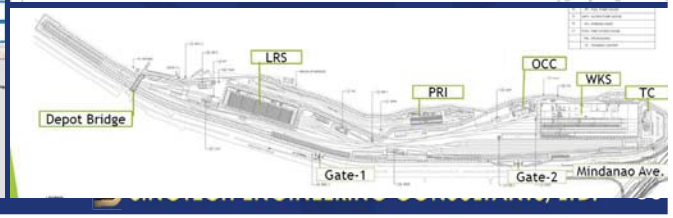
Location: Manila, Philippines

Construction Cost: 7.0 Km 3 Stations, 1Depot

Service: Detail Design, technical support







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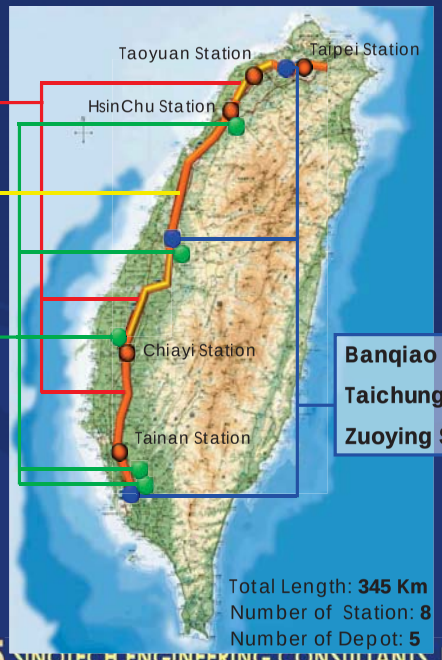
附件3

HIGH SPEED RAILWAY PROJECT EXPERIENCE IN TAIWAN

C210、C215(Tunnel)
C260、C270(Viaduct)
All Line Track Slab

Independent Assessor for Nangang Extension and Three New Stations

Liuchia Depot
Wujih Depot
Taibao Depot
Yanchao Main Workshop
Zuoying Depot



THSR CONTRACT C210、C215 、C260、C270

Client: Obayashi (JP), Bilfinger Berger (GM)
Location: Taoyuan, Hsinchu, Changhua, Chiayi
Construction Expense: US $2,130 million
Service: Detail Design. Tunnel : 20 Km, Viaduct : 111 Km

Design
Project Management
Construction Supervision

THSR CONTRACT T210、T220、T230、T240

Client: Taiwan Shinkansen Trackwork JV (JP)
Location: Taipei to Kaohsiung
Construction Expense: US $82 million
Service: Trackwork Detail Design & Construction Design.

Design
Project Management
Construction Supervision

THSR TAICHUNG AND ZUOYING STATION

Client: Taiwan High Speed Rail Co.
Location: Taichung county and Kaohsiung city
Construction Expense: US $252 million
Service: Detail Design.

Design
Project Management
Construction Supervision

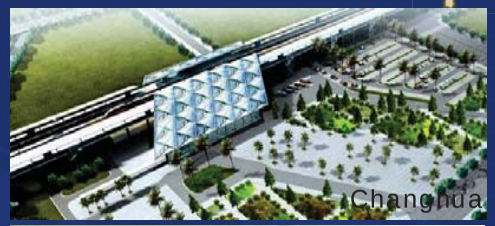
THSR 5 DEPOTS

Client: Taiwan High Speed Rail Co.
Location: Zuoying, Yanchao, Taibao, Wujih, Liuchia
Construction Expense: US $433 million
Service: Detail Design, Construction Supervision. (JV PBI)

Design
Project Management
Construction Supervision

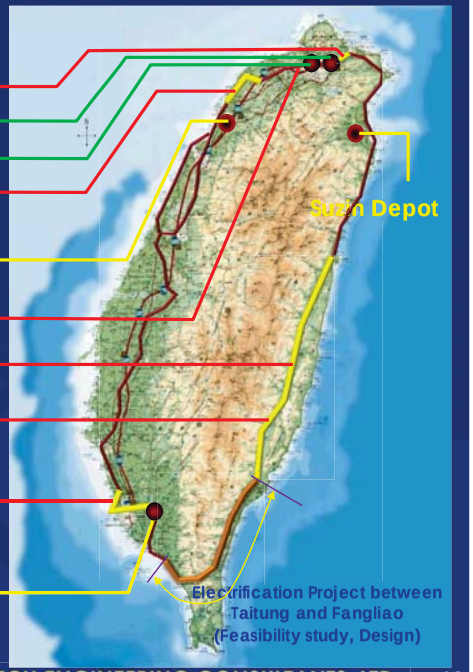
THSRC CONTRACT X580 INDEPENDENT ASSESSOR

Client: Lloyd's Register Rail (Asia) Limited
Location: Taipei, Miaoli, Changhua, Yunlin
Construction Expense: US $272 million
Service: Independent Assessor for Nangang Extension and Three New Stations



CONVENTIONAL RAILWAY PROJECT EXPERIENCE IN TAIWAN

Nangang Project DL NO.6
SonShan Station Lot
Banqiao Station Lot
Railway Track Elevated Project Taoyuan Section
Fugang Depot
Shulin Railroad Grade Separation
Electrification Project between Hualien and Taitung
Double-Tracks Project between Hualien and Taitung
Kaohsiung Project
Pingtung Station and Depot



Total Length: **1060 Km**
Number of Station: **275**

BANQIAO STATION LOT

Client: Railway Reconstruction Bureau, MOTC
Location: Taipei
Construction Expense: US $387 million
Service: Detail Design, Project Management, Construction Supervision, including HSR, CR, MRT and Bus stations.

Design
Project Management
Construction Supervision

SONSHAN STATION LOT

Client: Railway Reconstruction Bureau, MOTC
Location: Taipei
Construction Expense: US $260 million
Service: Detail Design, Construction Supervision, including HSR, CR and Bus stations.

Design
Project Management
Construction Supervision



SINOTECH ENGINEERING CONSULTANTS, LTD. 45

KAOHSIUNG PROJECT

Client: Railway Reconstruction Bureau, MOTC
Location: Kaohsiung
Construction Expense: US $2,139 million, 9.75 Km, 7 Stations
Service: Project Management, Construction Supervision

Design
Project Management
Construction Supervision






SINOTECH ENGINEERING CONSULTANTS, LTD. 46

FUGANG DEPOT (WORKSHOP)

Client: Taiwan Railways Administration, MOTC
Location: Taoyuan, Hsinchu
Construction Expense: US $420 million, Taipei Workshop relocation
Service: Project Management, Construction Supervision

Design
Project Management
Construction Supervision




SINOTECH ENGINEERING CONSULTANTS, LTD. 47

TAOYUAN URBAN DISTRICT RAILWAY UNDERGROUND PROJECT(NORTH SECTION)

Client: Railway Bureau, MOTC
Location: Taoyuan
Construction Expense: US $901 million, 9.05 Km, 4 stations
Service: Detail Design, Construction Supervision

Design
Project Management
Construction Supervision




SINOTECH ENGINEERING CONSULTANTS, LTD. 48

RAILWAY TRACK ELEVATED PROJECT YILAN SECTION

Client: Railway Reconstruction Bureau, MOTC
Location: Yilan
Construction Expense: US $820 million, 16.1 Km, 5 Stations
Service: Planning.

Design
Project Management
Construction Supervision

SINOTECH ENGINEERING CONSULTANTS, LTD. 49

ELECTRIFICATION PROJECT BETWEEN HUALIEN & TAITUNG

Client: Railway Reconstruction Bureau, MOTC
Location: Hualien, Taitung
Construction Expense: US $468 million, 155.5 Km, 30 Stations
Service: Detail Design & Construction Supervision.

Tunnel	Length (m)
溪口 Xikou	2,720m
光復 Guangfu	2,380m
自強 Zhiqiang	2,603m
山里 Sanli	5,090m
Total	12,793m

Design
Project Management
Construction Supervision

SINOTECH ENGINEERING CONSULTANTS, LTD. 50

DOUBLE-TRACKS PROJECT BETWEEN HUALIEN & TAITUNG

Client: Railway Reconstruction Bureau, MOTC
Location: Hualien, Taitung
Construction Expense: US $1,433 million, 112.1 Km
Service: Planning, Basic Design, Detail Design+Construction Supervision (South section)

Design
Project Management
Construction Supervision

, LTD. 51

ELECTRIFICATION PROJECT BETWEEN TAITUNG & FANGLIAO

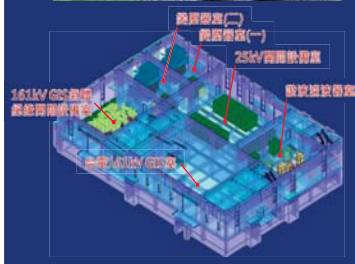
Client: Railway Reconstruction Bureau, MOTC
Location: Pingtung, Taitung
Construction Expense: US $710 million, 98.2 Km, 14 Stations
Service: Detail Design

Design
Project Management
Construction Supervision

SINOTECH ENGINEERING CONSULTANTS, LTD. 52

TRA South Link Line Electrification Turn-key Project

Client: Shihlin Electric &Engineering Corporation
Location: Pingtung County, Taitung County
Construction Cost: US $226.5 million, Complete E&M System
Service: Project Management, Detail Design



TRA NANGANG PROJECT DL NO.6

Client: Railway Reconstruction Bureau, MOTC
Location: Taipei
Construction Expense: US $106 million (Core system)
Service: Detail Design.

Design
Project Management
Construction Supervision

YANGON – MANDALAY RAILWAY IMPROVEMENT PROJECT PHASE 1

Client: Oriental Consultants Co., Ltd. (JP)
Location: Yangon –Taungoo, Myanmar
Construction Scope: 270 Km, 483 Bridges and 46 Stations
Service: Trackwork Basic and Detail Design

Design
Project Management
Construction Supervision

SINOTECH ENGINEERING CONSULTANTS, LTD.

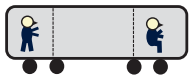
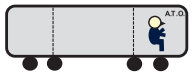
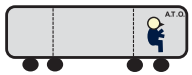
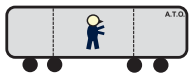
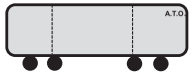
The End

Consideration towards the Introduction of Automatic Operation

Engineering Planning Division,
Railway Bureau, MLIT
December 5, 2023

MLIT
Ministry of Land, Infrastructure, Transport and Tourism

[① Reference material] Classification by railway crew type (level of automation)

Automation level (Definition by IEC(JIS) *)	Image of crew style (Main tasks of staff are in square brackets)	Domestic implementation status
GOA0 On Sight Train Operation (TOS)	 Driver (and conductor)	Tram
GOA1 Non-automated Train Operation (NTO)		General routes with level crossings, etc.
GOA2 Semi-automated Train Operation (STO)	 Driver [Train startup, emergency stop operation, evacuation guidance, etc.]	Some subways etc.
GOA2.5 (automatic operation with staff who performs emergency stop operations.) ⇒ Not defined by IEC and JIS	 Person in charge at the front of the train [emergency stop operations, evacuation guidance, etc.]	None
GOA3 Driverless Train Operation (DTO)	 staff on board the train [Evacuation guidance, etc.]	Some monorails
GOA4 Unattended Train Operation (UTO)	 No attendant on board	Some new transport system, etc.

* **IEC 62267 (JIS E 3802):** Definition based on autonomous urban orbital passenger transportation system
(**IEC :** International Electrotechnical Commission ; an international standardization organization that creates international standards in the field of electrical and electronic technology)
GoA : Grade of Automation

[① Background/Study Status]Studying automatic operation technology without a driver on board for railways

MLIT

Background and purpose of the study

- It has become difficult to secure and train drivers, maintenance workers, etc. , and the shortage of staff is a serious problem , especially on local railways.
⇒In order to maintain the railway business , there is a need to introduce automatic operation without a driver.
- We examine the technical requirements for maintaining and improving safety and convenience for the introduction of automatic operation, targeting common routes such as those with level crossings. Some new transportation systems have already introduced automatic operation without a driver on board.

Current status of railways regarding automatic operation

[New transportation, etc. automatic driving system]
- Elevated crossings, screen-type platform doors, etc. have been installed on all lines with the assumption that automatic operation will be possible .


elevated structure


Platform screen door

[General routes with level crossings]
- Railway is built with the assumption that a driver is on board , thus automatic operation hasn't been introduced due to safety and stability reasons.
- For local railways , it is difficult to make large-scale capital investments for automatic operation .

It is necessary to consider the technical requirements for automatic operation.


Horizon (non-elevated structure)


Level crossing


No platform-screen doors

Railway Autonomous Driving Technology Study Group

[Composition]
Chairperson: Takafumi KOSEKI, Professor, Graduate School of the University of Tokyo
Committee Members: Academic experts, JR, major private railway operators, small and medium-sized private railway operators, research institutes, Railway Bureau (MLIT)
[Event status]
The first study group meeting was held on December 3, 2018, and a total of eight study group meetings were held by March 2, 2022. Published the "Summary of the Study Group on Automatic Operation Technology for Railways" on September 13, 2022.

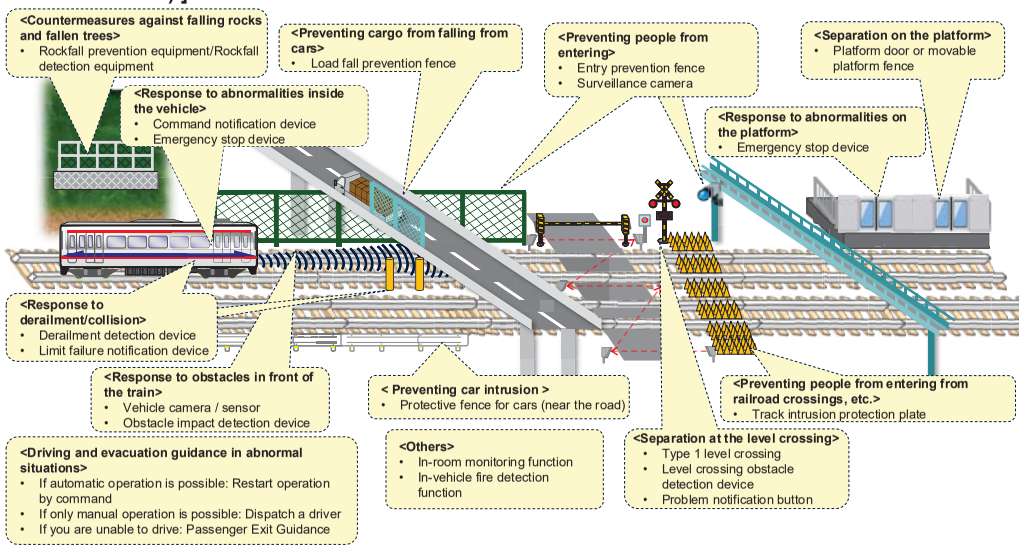
Study contents

- Clarify the basic concept of the systems that should be equipped and the roles of the staff, etc. on board according to the automation level of GOA 2.5, GOA 3, and GOA 4.

[② Issues to consider] Consideration regarding GOA3 and GOA4 (examples of technologies for introduction)

MLIT

[Image of installing GOA3 and GOA4 on general routes with level crossings (maximum speed of about 120 km/h)]



[③ Schedule] Schedule for introducing automated driving on general routes

September 30, 2023

Auto-mation level	Business operator	2018 ～ 2020	2021	2022	2023	2024	2025 ～	2030 ～ (FY)
GOA2.5	JR Kyushu (Kashii Line)	December 2019 ~ February 2020 / From December 2020					Target period: end of FY2024	
	Nankai (Wakayama Port Line)				From August 2023 (end date to be determined)			
	Nankai (Takashihama Line)					Operation verification undetermined		Commercial operation undetermined
	Tokyo Metro (Marunouchi Line)						Scheduled for FY2025	
	Osaka Metro (Chuo Line)					Scheduled for FY2024		
	JR West (Osaka Loop Line, etc.)	February 2020				Operation verification undetermined		Commercial operation undetermined
GOA3	JR East (Conventional line)	2018 ～ 2022 (GOA2)				Operation verification undetermined		Commercial operation undetermined
	JR East (Joetsu Shinkansen)					Operation verification undetermined		Target Period: Mid-2030s
	Tobu (Daishi Line)				Scheduled for FY2023 or later			
GOA4	JR East (Joetsu Shinkansen *)		GoA4 assumption October to November 2021			Operation verification undetermined		Target period: late 2020s

* Train, which is not in service, between Niigata Station and Niigata Shinkansen Vehicle Center

Operation verification : Commercial operation

交通部鐵道局
Railway Bureau, MOTC

Safety improvement of driverless vehicles

Unattended Train Operation

Taipei Metro Wenhu Line	Line length 25.7 km Speed 70 km/hr Rubber tyred Bombardier CBTC (ATO GoA 4)
New Taipe Metro Circular Line	Line length 15.4 km Speed 80 km/hr Steel Wheel Hitachi CBTC (ATO GoA 4)
Taichung Metro Green Line	Line length 16.71 km Speed 75 km/hr Steel Wheel Alstom CBTC (ATO GoA 4)

Intelligent Railway Foreign Object Detection (1/3)

1 Wayside

- **GERMANY**
  Nuremberg U-Bahn U3 Line **(Optical)**
- **USA**
  New York City Subway 7 Line **(CCTV)**
  New York City Subway L Line **(CCTV)**
  New York City Subway Archer Avenue Lines **(CCTV)**

2 Rolling Stock

- **JAPAN**
  JR East Nikko Line **(CCTV+LiDAR)**
  JR East Utsunomiya Line **(CCTV+LiDAR)**
  Tobu Kinugawa Line **(CCTV+LiDAR)**
  JR Kyushu Kashii Line **(CCTV+LiDAR)**
  JR East Keihin–Tōhoku Line **(CCTV+LiDAR)**

	Camera	Radar	LiDAR
Resolution	High	Low	High
Color	High	Low	Low
Weather Condition	Low	High	High

Intelligent Railway Foreign Object Detection (2/3)

CONCERNS

Immature Technology

- ✓ Accuracy rate under 99.9%
- ✓ Error signal risk
- ✓ Unable to achieve SIL4

No Actual Achievements

- ✓ Still in testing phase
- ✓ Unable to evaluate benefit

Intelligent Railway Foreign Object Detection (3/3)

STRATEGY

Risk Assessment

Railway operators conduct risk assessments for projects close to tracks, and develop potential hazard items & mitigation strategies

Improve Equipment

Add an emergency stop button and place it where staff or passengers can access it easily

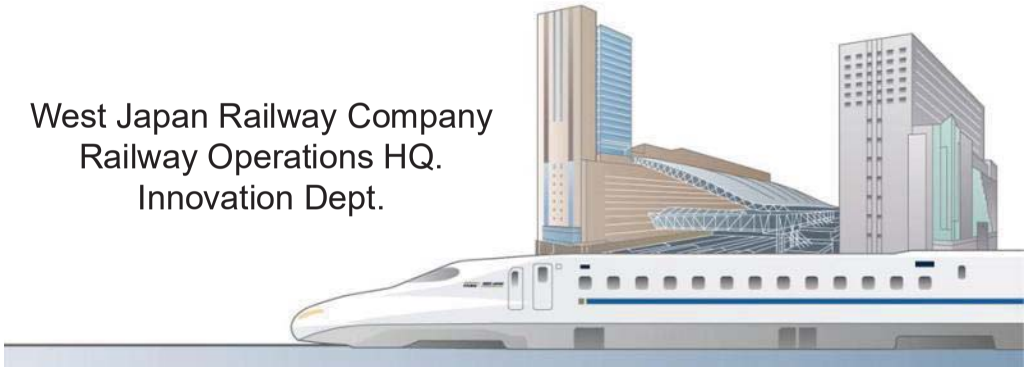
Education Training

Strengthen and standardize emergency hand signals, and train staff

Thank you for your attention

Introduction of innovative railway solution using new technology

West Japan Railway Company
Railway Operations HQ.
Innovation Dept.



CONFIDENTIAL

Dec, 2023

Agenda

1. Overview of West Japan Railway Company
2. Mission and vision of Innovation Dept.
3. Introduction of innovative railway solution using new technology

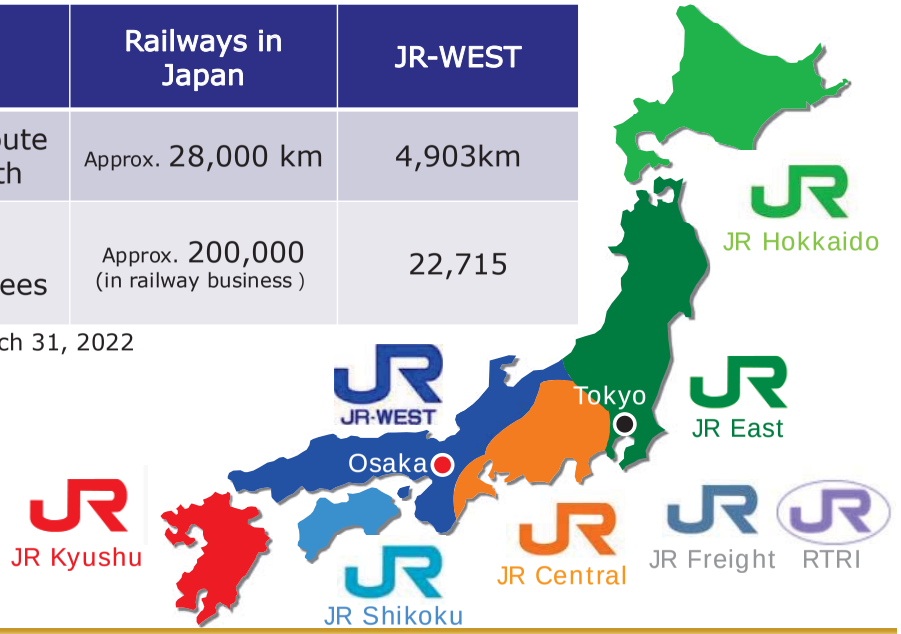
CONFIDENTIAL

Dec, 2023

1. ㊀Railways in Japan

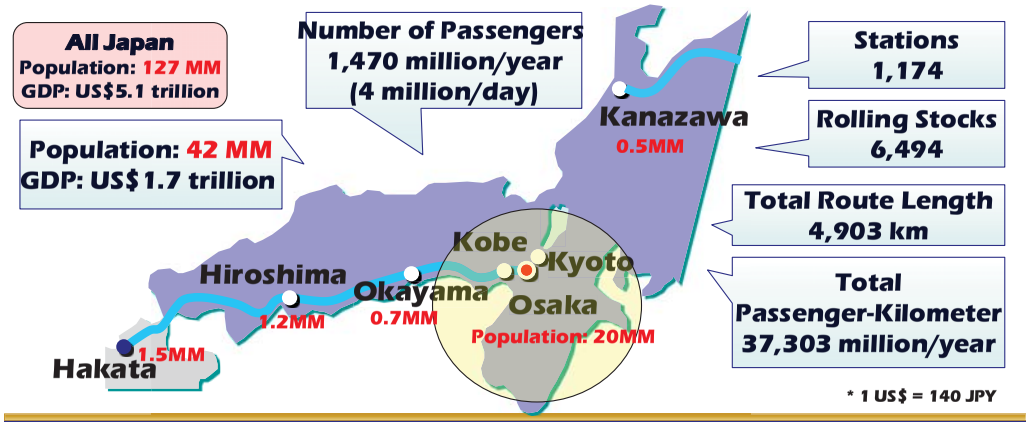
	Railways in Japan	JR-WEST
Total route length	Approx. 28,000 km	4,903km
No. of employees	Approx. 200,000 (in railway business)	22,715

As of March 31, 2022



1. ㊀Company Overview (as of 31 Mar. 2022)

Establishment	Employees	Businesses	Subsidiaries
1 April, 1987	JR-West 22,715 JR-West Group 46,779	· Transport · Retail · Real Estate · Others	150 (incl. 61 consolidated subsidiaries)
Common stock US$1.6 billion			



1．⊛Operating Area

West Japan Railway Company

	Total	Shinkansen	Conventional Line	(Urban Network)	(Other Lines)
Route Length(km)	4,903.1	812.6	4,090.5	-	-
Number of Passengers [million/year]	1,425	36	1,397	1,155	270
Passenger-Kilometer [million/year]	34,110	7,717	26,392	20,934	5,457

Shinkansen

Urban Network (Kyoto-Osaka-Kobe)

Other Lines

1．④Corporate Organization

West Japan Railway Company

President

- Supporting HQ, for the Victims of the Derailment Accident on the Fukuchiyama Line
- Inquiry & Auditing Dept.
- Corporate Governance HQ.
- Corporate Strategy HQ.
- Regional Revitalization & Development HQ.
- Digital Solution HQ.
- Tokyo HQ.
- **Railway Operations HQ.**
- Construction Dept.

Railway Operations HQ.

- Transport Safety Dept.
- Railway Operations Planning Dept.
- Customer Satisfaction Dept.
- Marketing Dept.
- **Innovation Dept.**
- Station Operations Dept.
- Transport Dept.
- Rolling Stock Dept.
- Track & Structures Dept.
- Electrical Engineering Dept.
- Safety Research Institute
- Structural Engineering Office
- Shinkansen Dept.

2．⊖Mission of the Innovation Dept.

West Japan Railway Company

Mission　Continue to bring new value through innovation

Organization　Organization that embodies the Technology Vision

Innovation in existing businesses

Change planning
- Future planning

Cross organization
- Future safety system
- Railway system
- Productivity improvement PMO
- Global environment (GX)
- Development management

Each division operation
- Station
- Transport
- Rolling stock
- Track
- Electrical equipment, etc.

Challenge of expanding revenue

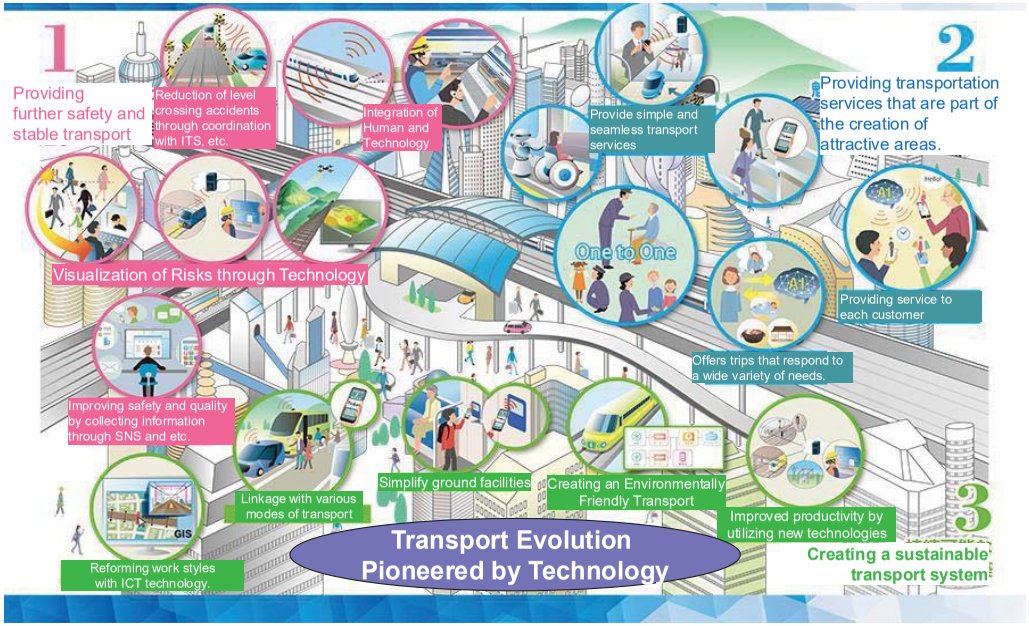
- Technology monetization
- Global Strategy

Propulsion Engine

- *Data science　・OI*
- *Intellectual property strategy*
- *VE　・Stage gate*

2．⊖Technology Vision ～JR-West's goal for the next 20 years～

West Japan Railway Company



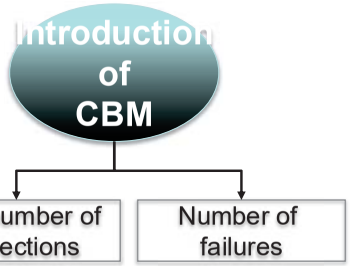
3. ㊀ CBM with time-series Data Analysis

West Japan Railway Company

CBM with time-series Data Analysis

Overview AI model capable of predicting failure.
故障を予測できるAIモデル

Proposal Significant cost reduction and quality improvement of ticket gate components.
改札機器部品の大幅なコスト削減と品質向上を実現



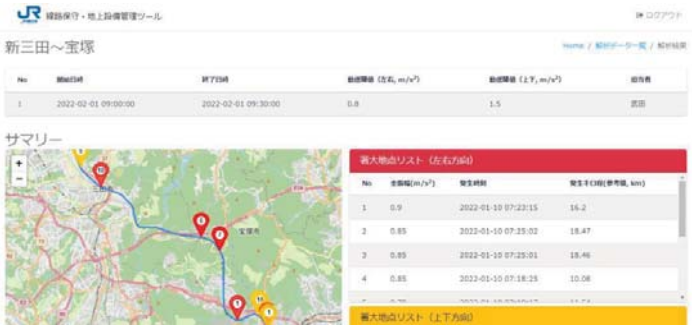
3. ㊁ Track maintenance management using smartphones

West Japan Railway Company

Track maintenance management using smartphones

Overview Replace vehicle oscillation monitoring device with smartphones at a lower cost.
車両挙動監視装置を安価でスマホへ置き換え

Proposal Smartphones on the train's front cab, it is possible to measure the vibration
列車の運転台上のスマートフォンで、振動を測定することが可能



Detection of large fluctuated area with fluctuations measurement

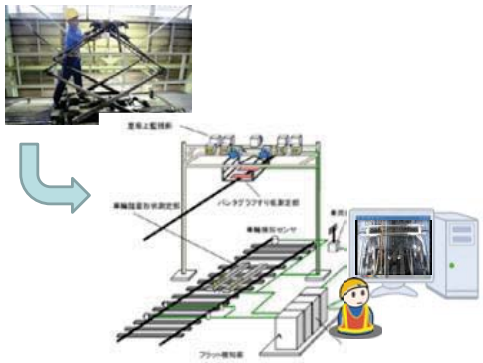
3. ㊂ Roof image diagnosis

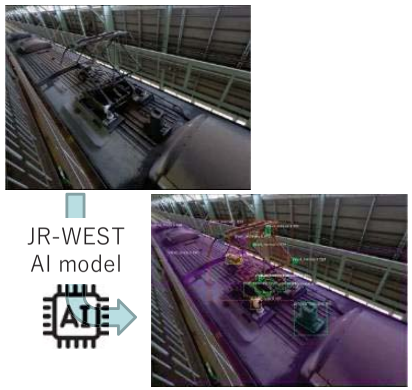
West Japan Railway Company

Roof image diagnosis

Overview The equipment realizes labor saving in inspection.
検査の省力化を実現

Proposal Introduction of image diagnostic equipment on rooftops capable of image analysis
画像分析可能な屋根上画像診断装置を導入





3. ㊃ Automated detection by AI surveillance cameras

West Japan Railway Company

Automated detection by AI surveillance cameras

Overview Automate abnormality detection on the surveillance cameras
監視カメラの異常検知を自動化

Proposal Enabling the use of AI in the existing surveillance cameras
既存の監視カメラシステムをAI化可能


Area intrusion detection


Dangerous object detection


Abnormal behavior (collapse) detection

Execution Real-time detection at stations for quick detection of required assistance
駅におけるリアルタイム検知で、要介助者をいち早く発見

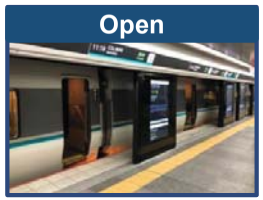
3. ⑤ Development of Osaka Station

Development of Osaka Station **“Tested for innovation”**

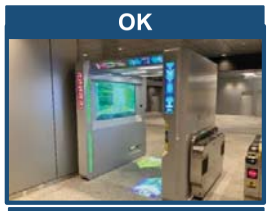
Overview JR-West technology vision is actualized in Osaka Sta. as a testbed for innovation.

イノベーション開発した技術を「大阪駅」に集め、JR西日本技術ビジョンの具体化に挑戦

Full height free-sliding platform doors



Facial recognition ticket gate



Guidance signs for specific individuals

Thank you
for your kind attention

Cautionary Statement Regarding Forward-looking Statements

- This presentation contains forward-looking statements that are based on JR-West’s current expectations, assumptions, estimates and projections about its business, industry, and capital markets around the world.
- These forward-looking statements are subject to various risks and uncertainties. Generally, these forward-looking statements can be identified by the use of forward-looking terminology such as “may”, “will”, “expect”, “anticipate”, “plan” or similar words. These statements discuss future expectations, identify strategies, contain projections of results of operations or of JR-West’s financial condition, or state other forward-looking information.
- Known or unknown risks, uncertainties and other factors could cause the actual results to differ materially from those contained in any forward-looking statements. JR-West cannot promise that the expectations expressed in these forward-looking statements will turn out to be correct. JR-West’s actual results could be materially different from and worse than expectations.
- Important risks and factors that could cause actual results to be materially different from expectations include, but are not limited to:
  - · expenses, liability, loss of revenue or adverse publicity associated with property or casualty losses;
  - · economic downturn, deflation and population decreases;
  - · adverse changes in laws, regulations and government policies in Japan;
  - · service improvements, price reductions and other strategies undertaken by competitors such as passenger railway and airlines companies;
  - · infectious disease outbreak and epidemic;
  - · earthquake and other natural disaster risks; and
  - · failure of computer telecommunications systems disrupting railway or other operations
- All forward-looking statements in this material are made as of March 17, 2023 based on information available to JR-West as of March 17, 2023 and JR-West does not undertake to update or revise any of its forward-looking statements or reflect future events or circumstances.

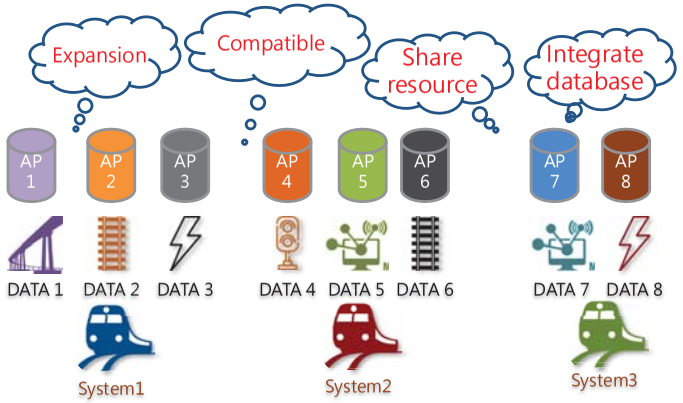
交通部鐵道局
Railway Bureau, MOTC

Smart MRT Development History and Data Integration Application

Promotion Strategy of Taiwan Smart Railway Transportation - Sustainable Development of Smart Railway Ecology

Building Smart Railway IoT Platform, Formulate Standard:

- ✓ Manual inspection & circular→Real-time alarm & circular
- ✓ Prevention maintenance →Predictive maintenance
- ✓ Predictive operation information & human decision→ Real-time operation information & AI decision



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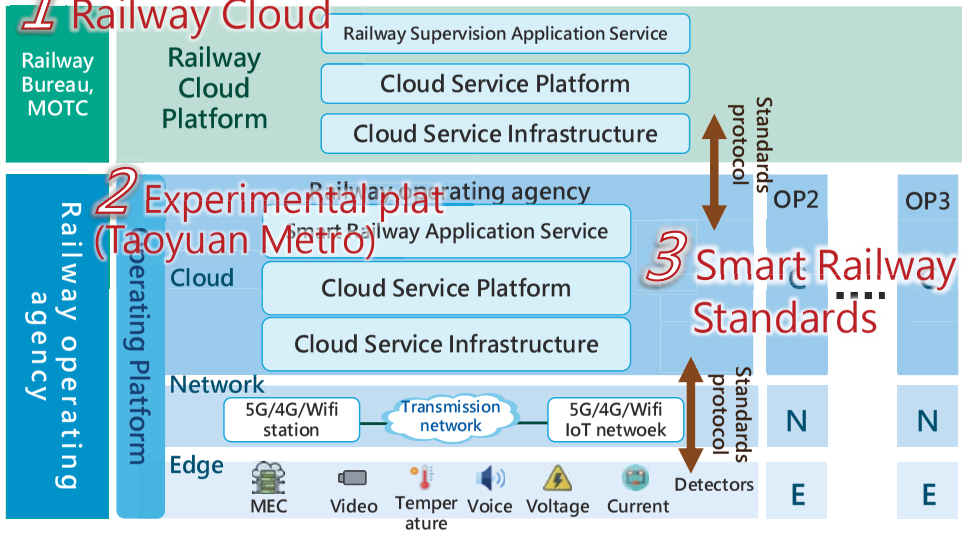
附件7

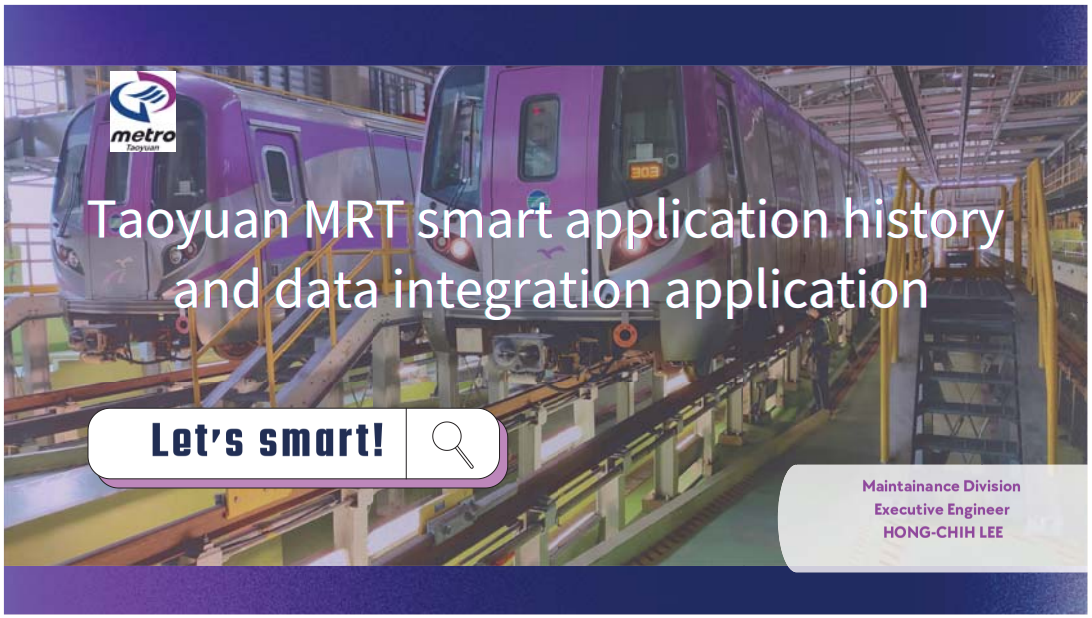
Promotion Strategy of Taiwan Smart Railway Transportation - Important Work



- Building interagency cloud framework, connect information island

交通部鐵道局
Railway Bureau, MOTC

Thank you for your attention



Taoyuan MRT smart application history and data integration application

Let's smart!

Maintainance Division
Executive Engineer
HONG-CHIH LEE

AGENDA

ABOUT US

- All 23 stations(53+KM)
- Average Passenger Capacity：100,000+ /day
- Service Area：Taipei，Linko，Taoyuan Airport，Tauyuan。
- Transfer Transportation：Taoyuan Airport、THSR、Taipei MRT、BUS、UBIKE

Let's begin!

PROJECT TIMELINE

Our Mile Stone

Angel Funding From The Railway Bureau, MOTC

2020 Infancy
- Immature IoT
- Developing systems in the laboratory

2021 Planning
- Cloud platform planning
- IoT project planning
- image recognition development

2022 Construction
- Cloud platform construction
- IoT project execution
- video recognition development

2023 Preliminary Success
- Cloud platform enabled
- Real-time data integration application
- Big data analysis applications
- Object recognition application

CLOUD PLATFORM AND STANDARDIZATION

Develop cloud platform, information security, communication interface and data encoding in accordance with the standards and regulations formulated by the Railway Bureau of the Ministry of Transport

Cloud platform

OPEN STACK + K8S

Features: Containerization, microservices, rapid deployment and parallel expansion

Communication interface standardization

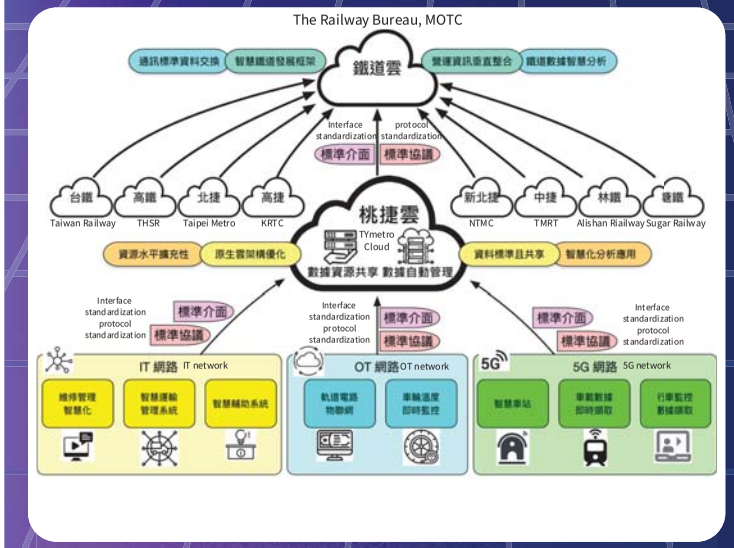
MQTT+ KAFKA + RESTFUL API

Features: Multiple interfaces to obtain data to meet different needs.

Data encoding standardization

JSON + CDMID

Features: Common coding reduces data cleaning time and meets data integration needs.



Overall structure

Each railway company can exchange data, vertically and horizontally integrate and apply intelligently according to the standard framework.

DATA ACQUISITION STRATEGY

Big Data

感測器類 Sensor

部署感測器量測受測物，並將量測結果回傳分析。

Image recognition

影像辨識類

採用影像辨識技術，將影片或圖形進行訓練辨識，轉化成數據資料。

Data mirroring

旁聽解析類

採用數據擷取技術，讀取設備間詢問 (request) 與回應 (response) 內容，並解析內容之意義。

TYPE OF DATA

8-9 million pieces of data per Day

TRAIN

- TCMS Data
- CMS Interface Box Data
- ESSR Data

WAY SIDE

- signal track circuit
- Rail Switch
- earthquake sensing
- Rain gauge and anemometer

STATION

- temperature monitoring
- platform door system
- elevator & escalator
- pump
- Ticket System

External Data

- Airport Company
- Ministry of Environment
- Ministry of Transport
- PARKING LOT
- Ubike

SMART INSIDE RAIL MAP INFO SYSTEM

System features:
1. Integrate real-time data and present it in a geographical layer display. Users can overview the data required for operations at a glance through the system.
2. Use color to distinguish changes in data volume,Provide warning messages.

COMMUTER 28 EXPRESS 11

1.Dynamic display of train information
2.Airport time-sharing traffic volume
3.Traffic volume between stations
4.Air quality and wind
5.PARKING LOT & UBIKE
6.Operation synchronization detection

SUBSYSTEM DEVELOPMENT

A monitoring system developed based on operational experience

SCADA Data re-application

1 Alerts and Early Warnings

Redefine the rules of alarms and early warnings to make up for the shortcomings of the original system.

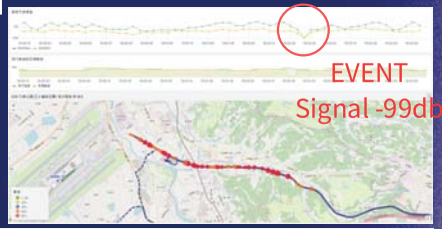
2 Redundancy and expansion

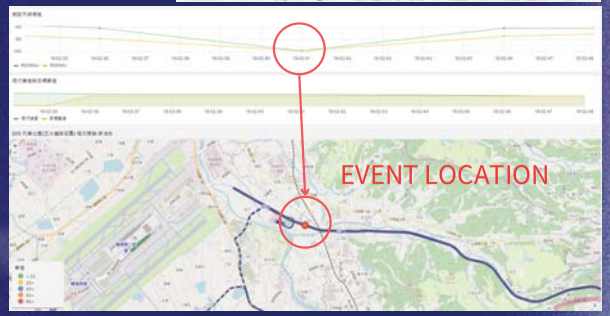
Data obtained from two different systems and data of the same type can be mutually backed up, or integrated to expand their functions.

OPERATION SYNCHRONIZATION DETECTION

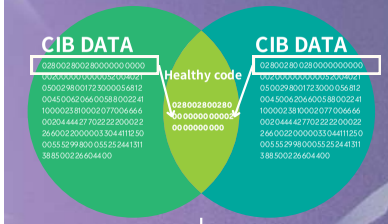
CHECK ANYWHERE

Dynamic health checks during operation to identify problems that could not be detected in the past.





Healthy Code



if != Healthy Code

CHECK

ATO Failed
APR Failed
Dopplor
ATP Failed
MCU Failed
speedometer

ESTABLISH HEALTH MODELS FOR INSTANT COMPARISON