



## The Simulation and Vehicle Testing Verification Technique for Autonomous Driving Systems



### + Feature

- The vehicle model is integrated with the six degree of freedom motion platform, and an objective evaluation method for the ride comfort of self-driving cars was established referring to ISO 2631. Besides, the traffic flow of selected self-driving route can be conducted in simulated environment (Prescan+Vissim) after investigating real traffic flow. Therefore, the co-simulation of decision-making control algorithm and traffic condition can be carried out. The first version of the basic functional test procedures for self-driving cars has been merged with the low-speed self-driving standard ISO 22737 and common scenarios in Taiwan. The revision of the basic functional test procedures has been completed including 15 basic functions and 58 scenarios.

### + Technique

- Virtual scenarios and sensor models
- MiL/SiL/HiL/Camera box/ViL simulation
- Vehicle testing driven by driving robots

### + Specification

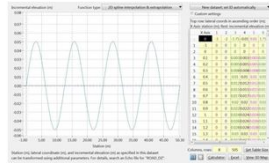
- Scenario and sensor model (Prescan), Vehicle dynamics model (Carsim), Traffic model (Vissim)
- Real-time simulating platform, Six degree of freedom motion platform
- Steering, Brake, and Accelerating control devices
- RTK DGPS, Vehicle performance measuring devices



### Simulation Verification for ADS



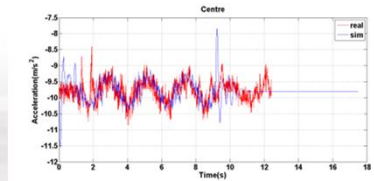
Real vehicle test



Virtual road



Vehicle model



Correlation b/t V & R



Transformation



Represent @ dynamic simulator

### Ride comfort virtual evaluation for ADS



Traffic flow investigation and model building

### Vehicle Testing Verification for ADS

基本功能測試項目	測試情境
1 停車	1)平行停車(前後有車)、2)平行停車(前後無車)、3)倒車入庫(左右有車)、4)倒車入庫(左右無車)、5)公車停靠站進站
2 車速控制與車距保持	6)直線車速控制、7)同車道併行
3 車道維持	8)直線車道維持、9)彎道車道維持、10)無標線車道維持、11)行駛空間(兩側有車)、12)行駛空間(標線縮減)
4 車輛識別與反應	13)縱向車輛識別與反應(直線①、彎道、切入②)、19)橫向車輛識別與反應、20)路邊車輛、21)路邊車輛開門
5 VRU、障礙物等識別與反應	22)縱向VRU識別與反應、23)橫向VRU識別與反應(無遮蔽)、24)(有遮蔽)、25)臨時障礙物、26)動物衝出、27)動物靜止、28)路側VRU識別與反應(動、靜態)②、30)VRU 45°, 115°衝出②
6 車道變換	32) SV執行車道變換、33)前方有車SV執行車道變換、34)鄰車道有車SV執行車道變換
7 匯入/匯出車道	35) SV縱向匯入車道
8 交叉路口行駛	36)對向來車直行(SV左轉)、37)對向來車右轉(SV左轉)、38)對向來車左轉(SV左轉)、39)橫向來車直行(SV直行)、40)對向來車左轉(SV右轉)、41)橫向來車直行(SV右轉)、42)橫向來車右轉(SV直行)
9 圓環行駛	43)進/出圓環行駛、44)進出圓環遇TV
10 行人穿越道行駛	45)行人穿越道路側行人等待、46)行人穿越道行人穿越(兩側方向)
11 迴轉	47) SV迴轉、48) SV交叉路口迴轉、49) TV迴轉
12 臨時管制識別處理	50)道路施工車道縮減
13 交通號誌設施識別與反應	51)燈號識別與反應、52)標線識別與反應、53)鐵路平交道識別與反應
14 隧道行駛	54)隧道交通號誌識別與反應、55)隧道車輛識別與距離維持
15 應急處置與人工介入能力	56)緊急停車、57)最小風險操縱測試(MRM)、58)人員接管系統操作

Revision of basic functional test procedure for self-driving cars