

5G Communication based Automated Vehicle Test-bed

K-City



01 Overview of K-City

Location of KATRI

Located at the Automated Vehicle R&D

center of Korea

- Permanent-standing companies (6)

: GM Korea, Ssangyong Motors, Renault Samsung, Mando, Bosch Korea, and Jatco

- Annually, the cars are jointly used by

88 organizations (in 2017)

including Manufactures, research institutes, IT, Commutation company, and universities.



01 Overview of K-City

Proving Ground

Advanced tracks

Total cost
\$1.242bn

Total length
28.5km

Test track layout features

- Natural drain through existing reservoir
- Maintain original topography
- Increase Vehicle safety & Minimize R&D test track
- Easy access to every track (close entrance)
- Maximize efficiency of Test facility management
- Economic and easy to construct

Test Facility

10 of the Facility

- Construction Equipment Inspect Facility
- General Test Facility
- Environmental Test Facility
- Driving and Braking Test Facility
- Impact Test Facility
- Crash Test Facility
- Noise&EMC Test Facility
- Advanced Vehicle Test Facility
- Tire Assessment Test Facility
- Construction Equipment Safety Defect Test Facility



01 Overview of K-City

Overview of the establishment

- **(Goal) Provision of various on-road environments (road, traffic, and communications)**
 - Simulated testing of possible accidents (crashing) that may happen during the driving
 - ▶ Simulate real world and simulation to support technologies development
 - ▶ Verify safety of automated vehicles
- **(Location) KATRI P.G. (Hwaseong City, Gyeonggi Province)**
 - **The area of the current ITS testing circuit is 360,000 m² out of the total area of 2,150,000 km²**
- **(Budget) Total 1.9M\$ (Government 1.7M\$, Private 0.2M\$)**
 - K-City Construction costs 1.1M\$
- **(Schedule)** Aug. of '17, Groundbreaking for K-City
Nov. of '17, Motorway Open
Nov of '18, entire sections Open



- 14 testing roads were established in the largest scale in Korea (2013)

* It is expected that the establishment schedule and cost will be saved through utilizing the existing roads and facilities.

02 Establishment of K-City



02 Establishment of K-City

Establishment of on-road assessment environment

- Road, traffic, and communications environment similar to the actual road conditions will be established.

Motorway

Dedicated road for high-speed driving



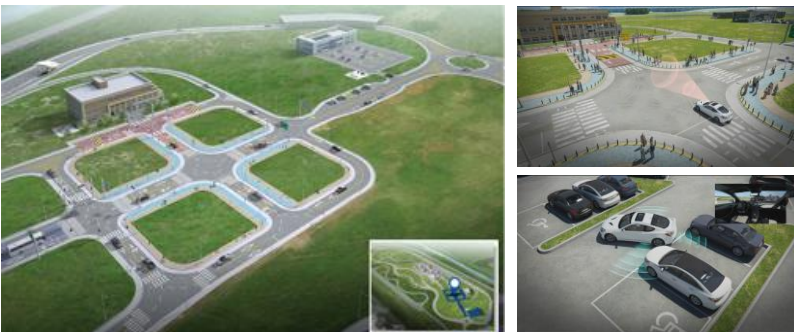
Urban-center road

Environment of urban-center road traffic



Community & Automated parking

pedestrian-centric road and parking facilities.



Rural road

rural road where infrastructure is insufficient



02 Establishment of K-City

Opened at Motorway

- (date) '17.11.07.
- (facilities) main lane(5th lane), merging/ demerging section, guiderail, tollgate, median, sound proof wall, bus only lane (total 7 item)



02 Establishment of K-City

Establishment of various communications systems

- Various communications systems for 5G, 4G(LTE), WAVE, and Wi-Fi

5G

- Realization of ultra-high speed/large-capacity data collection



(Reference)
5G demonstration(KT)

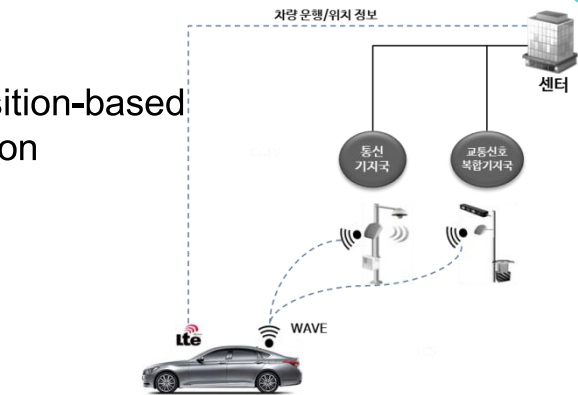


(Reference)
5G demonstration(SK Telecom)



4G(LTE)

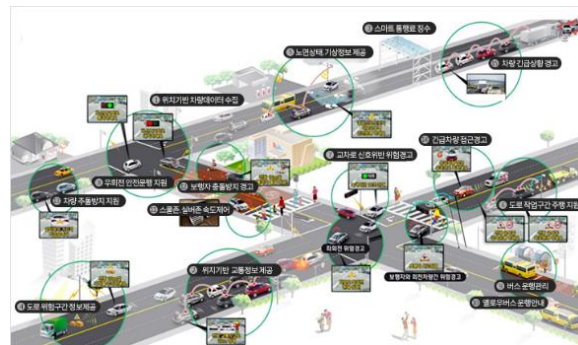
- Collection of position-based vehicle information



(Reference) Collection 4G-based vehicle information

WAVE

- Provision of traffic information
- Provision of region-specific information



(Reference) C-ITS service (WAVE-based)

Wi-Fi

- Synchronization of assessment systems
- Synchronization of Automated Vehicles

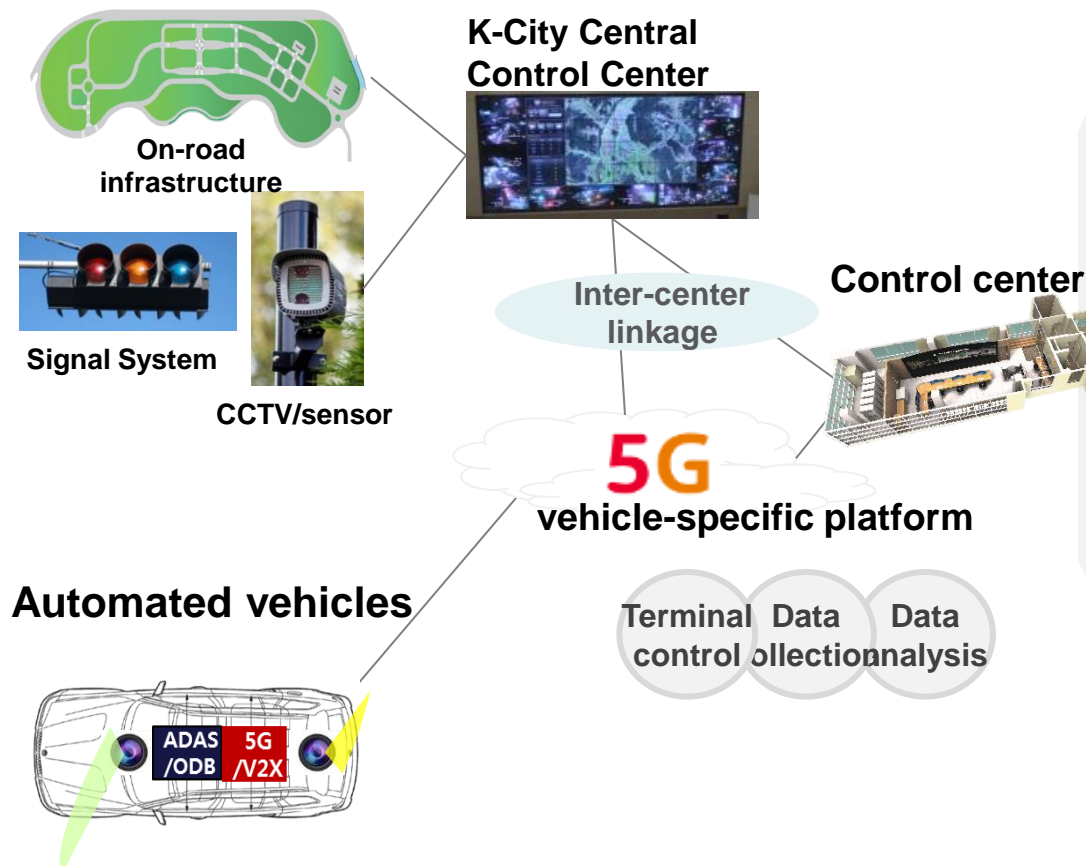


(Reference) Communications for Automated Vehicle assessment systems (Wi-Fi)

02 Establishment of K-City

Establishment of 5G Network and Data Support Center

- Center controls automated vehicles by means of 5G network and a vehicle-specific platform
- Its utilization will be improved in the future in linkage with the C-ITS infrastructure of the K-City



Video wall of the automated vehicle control system



Track and driving situation | Event and in-driving vehicle
Vehicle view info. | Driving record | Vehicle condition |
| Video call | On-vehicle camera (CCTV) | HD-Map

03 Event of related K-City & Autonomous Vehicles

⦿ (February 5, 2018) World's first demonstration of the inter-vehicle operating technologies of automated vehicles that utilize 5G communications

- “automated vehicles make dialog with 5G technologies: They stop within 0.001 s upon the ‘child detected’ warning”
- (Key attendants) Kim Hyunmi, Minister of the Land, Infrastructure, and Transport



04 How to utilize the K-City

Building K-City

Safety performance
assessment technologies

Test bed establishment

Utilization method

National certification facilities for Automated Vehicles

- Verification of car safety criteria
- Assessment of car safety levels
- Safety criteria harmonized with international criteria

Research infrastructure

- Utilized by manufacturers, universities, etc. in technical development
- Support for technical development utilizing the test bed

➔ Preparation of various operating support methods including a K-City Partnership program.

- Provision of opportunities to industries, research institutes, and the academia for direct utilization
- Implementation of joint researches with industries, research institutes, and the academia