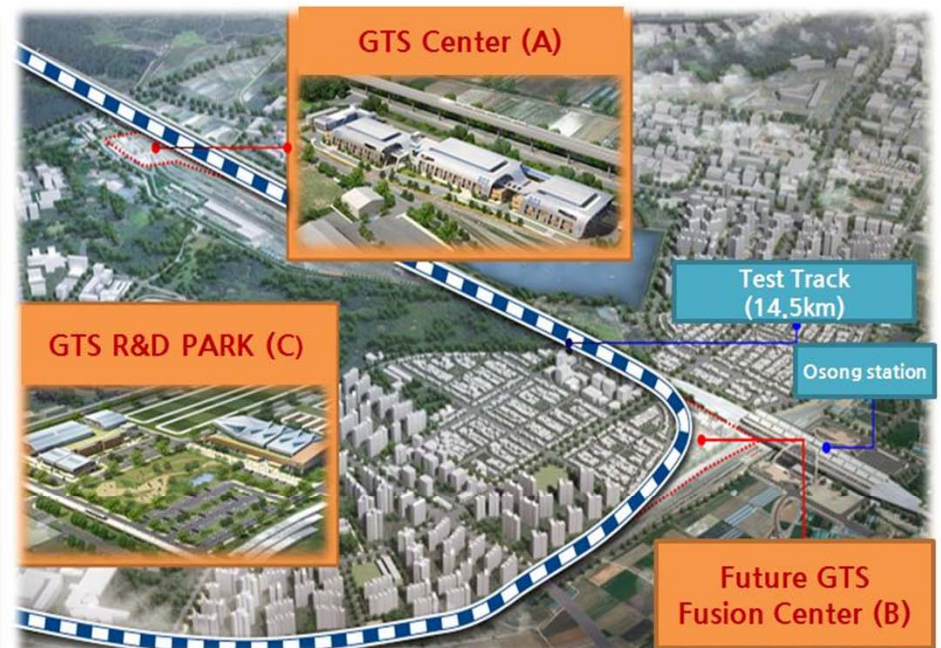


# Intelligent Transport System (ITS) and Applications to Railways in Korea

Geneva, Switzerland, 24<sup>th</sup> October, 2013  
Soon-Man HONG, Ph.D., CPA,  
President of Korea Railroad Research Institute

# KRRI is...

Korea Railroad Research Institute (KRRI) is a national research institute specializing in railways and innovative transport technologies. It has 451 employees and 410 are expert researchers in various fields. New Transport Science Technopolis will be constructed in Osong for the innovative transport technology R&D. The annual research budget is about \$118 million USD. KRRI is located only 30 minutes away from Seoul.



- ⚙️ Design a loop-type test track (14.5km)
- ⚙️ Real-scale test facilities(85,000㎡), R&D park(210,000㎡) and certification center(23,000㎡) in the center area of country



# What KRRI has done so far ...



**High Speed Train (350km/h)**  
commercialized 240 cars in Seoul-Busan  
and Honam-Jeolla lines



**High Speed Train (430 km/h )**  
First Korea's electric multiple unit  
(4th speed record in the world)



**Tilting Train**  
maximum 220km/h in conventional line



**CNG-Hybrid Bimodal Tram**  
Autonomous operation system



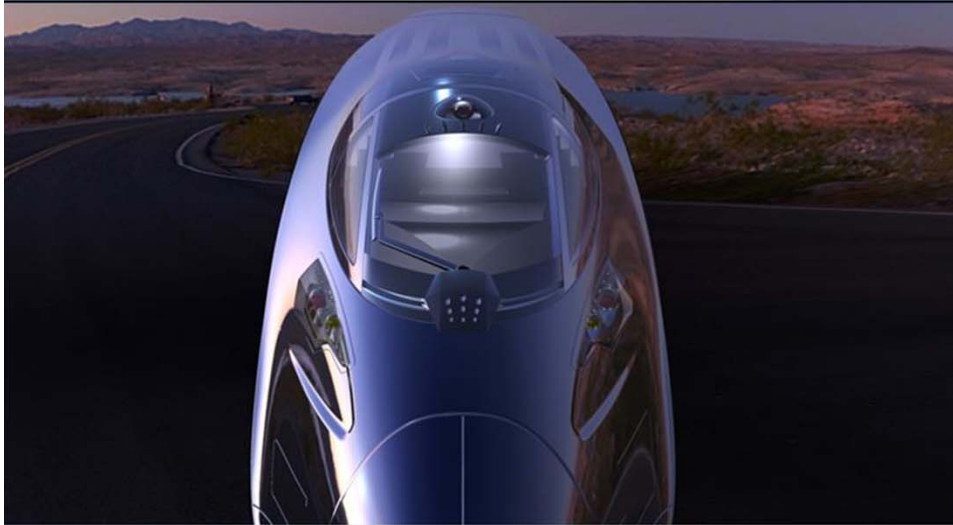
**Light Rail Transit System**  
Tire wheel type (4th in the world)



**Wireless Tram System**  
Battery powered low-floor tram



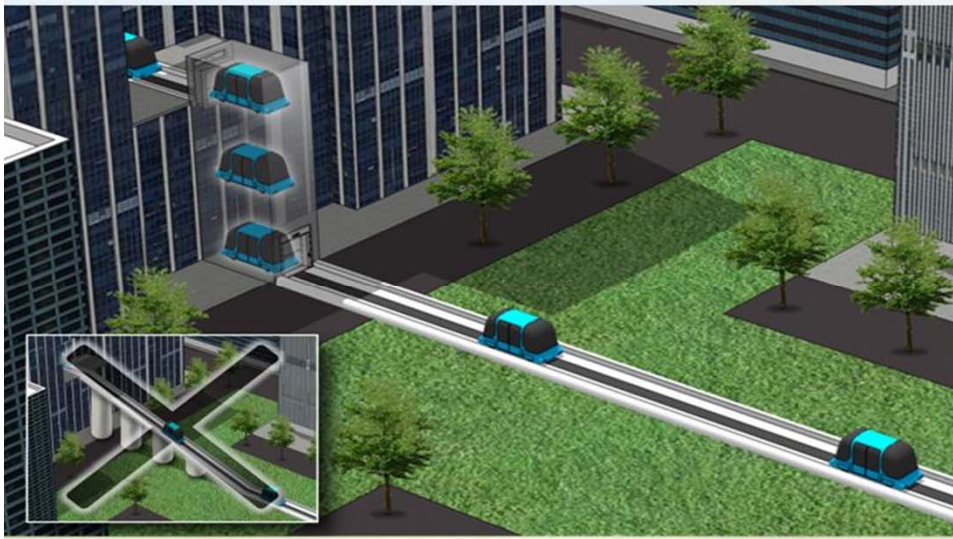
# What KRRI is working on...



**High Speed Train (500km/h)**  
aims for the 2nd world record



**Mountain Tram**  
supports the winter Olympics



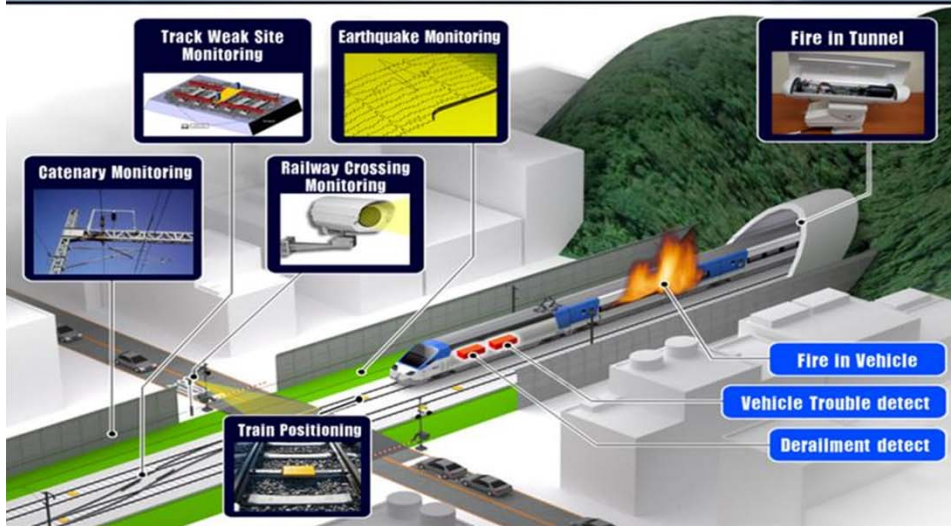
**Future PRT**  
capable of moving in both horizontal and vertical directions



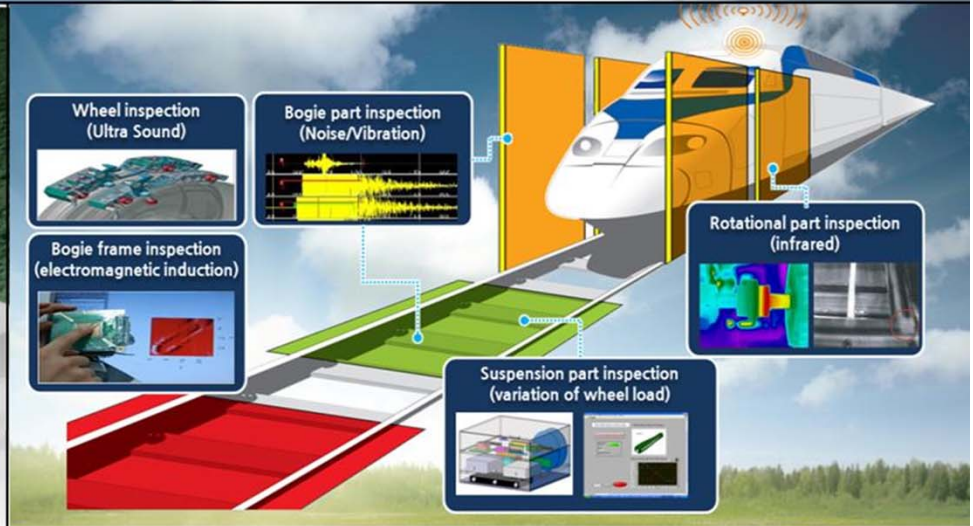
**Near-surface subway**  
runs along the urban roads



# What KRRI is working on...



**Real-time Safety Monitoring System**  
makes much safer & efficient railroad service



**Real-time Non-destructive Scanning**  
enables convenient and efficient maintenance



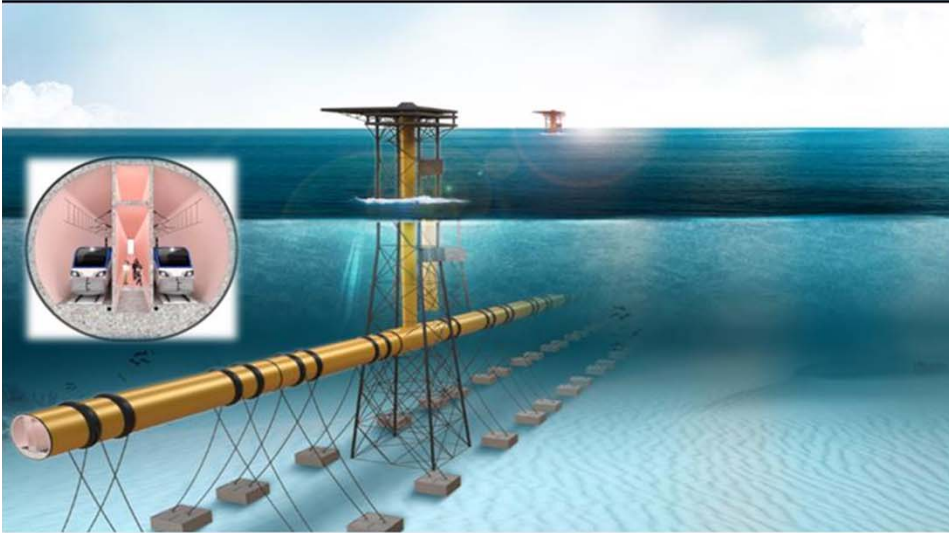
**Wireless power transmission**  
enables transmitting high power



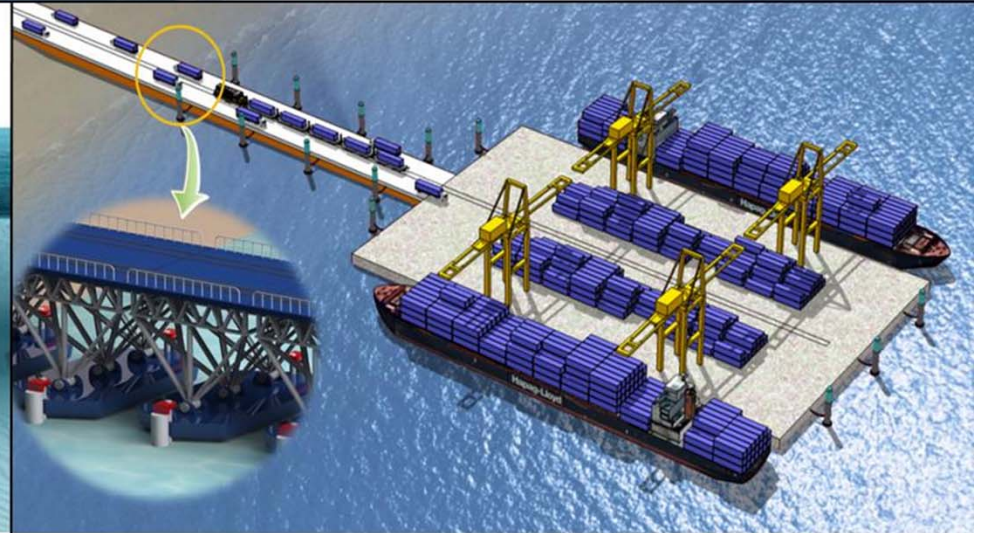
**Train Control with LTE-R**  
enables accurate train control in the high speed



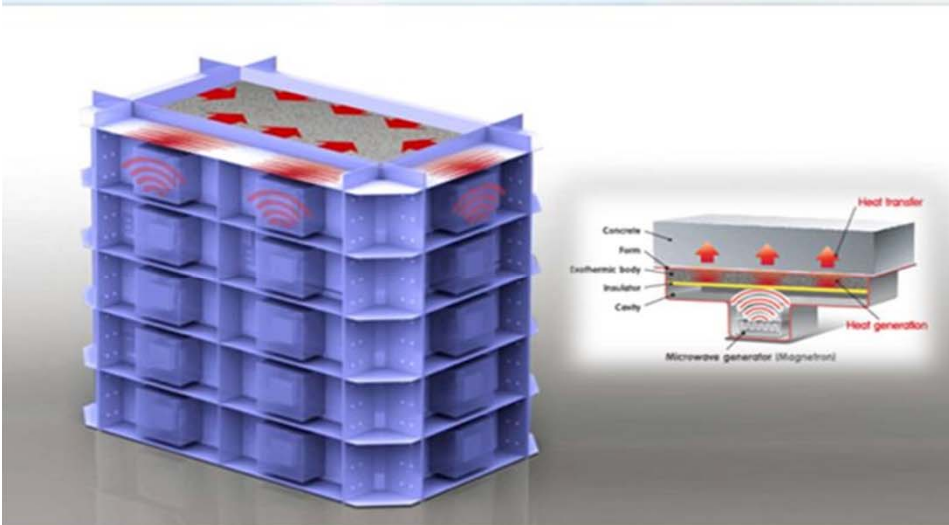
# KRRI is leading the future with innovation.



**Pipeline type Floating tunnel**  
reduces construction time & cost



**Movable floating bridge**  
connects to mobile harbor



**Fast Concrete Curing**  
within a single day



**Rail Canal**  
Ships climb up mountains

# Contents

- I. Korea's Competitiveness for ITS
- II. ITS technology to railway





# Korea's competitiveness for ITS

- Korea has the strongest IT industry in the world.
  - The largest share (37%) in the world's smart phone market
  - Highest percentage of smart phone use (67%) in the world
  - The highest Internet accessibility in the world
- Intelligent transport system technologies are also advanced.
  - ITS for highway is applied to various fields all over the country.
- Innovative technologies for ITS railways are being developed based on Korea's advanced IT.







# ITS technology to railway

## Objective

For passengers

- Safe travel
- Punctual operation
- Convenience

For operators

- Maintenance cost reduction
- Operation efficiency

## Necessary technology

Core technologies

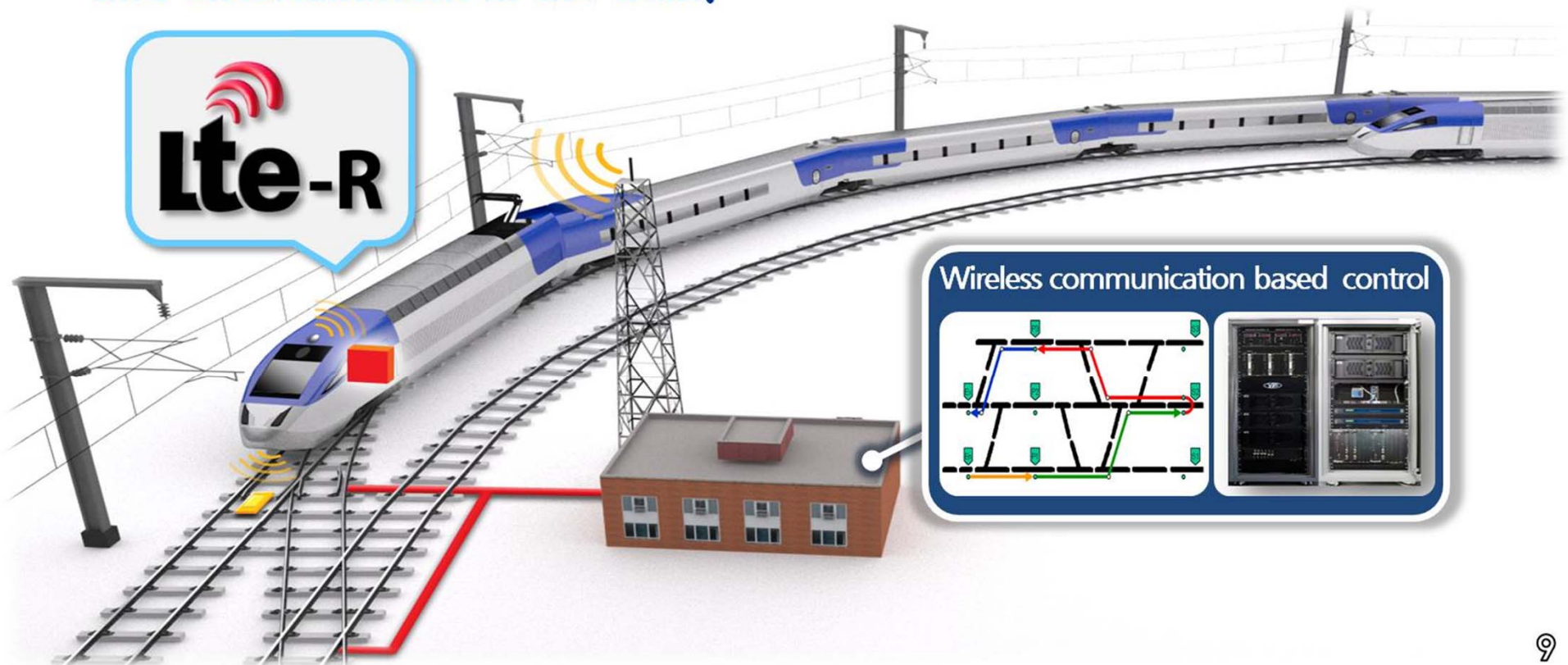
- Fast and stable IT network
- Accurate location acquisition

Applications

- Enhance passenger convenience
- Support safe train operations

# ✓ Train control with new LTE-R technology

- Precision train control system with LTE-R are being developed.
  - It is five times faster than current GSM-R technology.
  - LTE-R control system for urban train is under test at Daebul test line.
  - Research on HST LTE-R control system will be started in 2014.
- This LTE-R will be used also for safety monitoring, communication, and entertainment in the train.



## ✓ LTE internet service for passenger convenience

- LTE internet service for passengers is in service since 2012.
  - Korea has launched the world's first wireless internet service for HST passengers in 2008.
- Advanced railway IT will be developed to provide faster, stable, but free wireless internet service at the train speed of 400kph or higher.



# ✓ Accurate train positioning system

- The research on accurate train positioning system having on-board train positioning system with low-cost transponder began in 2013.
  - It will provide the train location with  $\pm 1\text{m}$  accuracy at 400kph.
- Precision train control with this system will increase the track capacity by 40% and this system makes accurate maintenance possible.
  - \* Operating interval : 3  $\rightarrow$  2.5 min. in the case of high-speed train



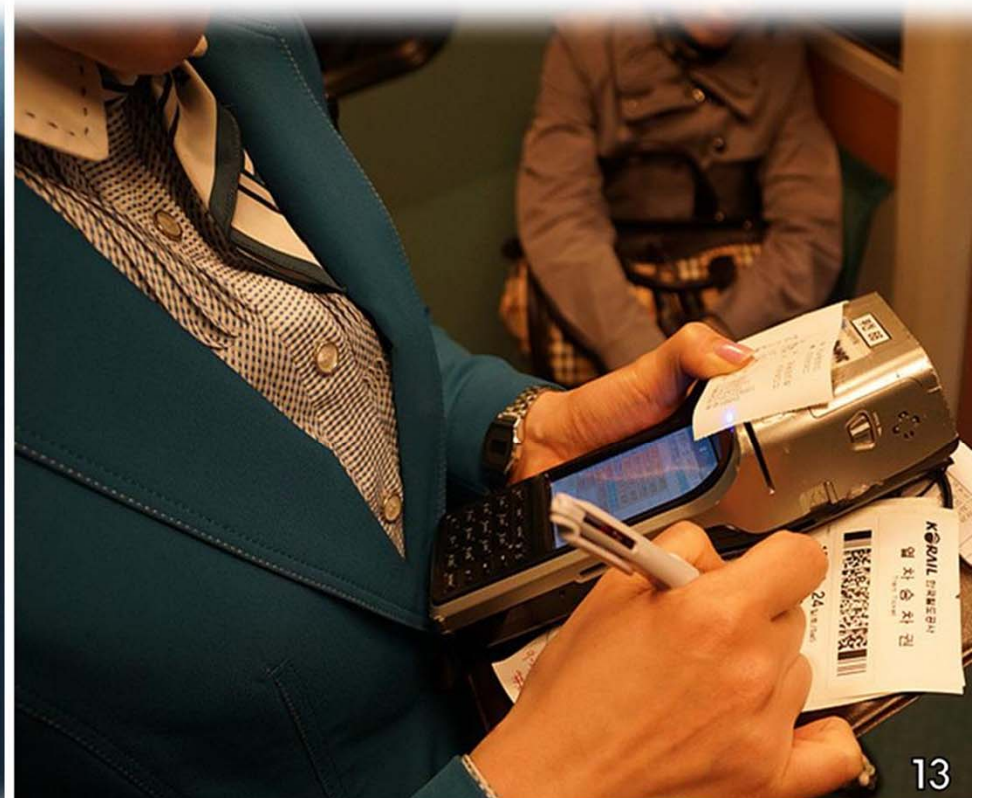
# ✓ Integrated information system for transit

- Optimal path of minimal travel time can be calculated using all available public transport modes (i.e. train, bus, subway, walking).
  - Provide optimal path with travel time and fare considering real-time traffic conditions
- People can easily access this information via PC, smartphone, etc.



## ✓ Smart booking and checking

- Passengers make real-time ticket reservation for inter-city rail by mobile payment system on smartphones or tablets.
  - Reservation, cancellation and schedule change are possible anytime, anywhere.
- Inspectors check tickets on the mobile devices in the trains, without disturbing passengers.



# ✓ One card system for all urban transits in Korea

- Passengers can pay their fare for all urban transport modes (subways, urban rail, buses, and taxis) nationwide with a single smart card.
- Passengers can use any of pre-paid, credit cards and smartphones.
- Statistics on passenger travel routes generated by this single smart card system can be utilized to design optimal transit routes.



# ✓ Personalized travel information

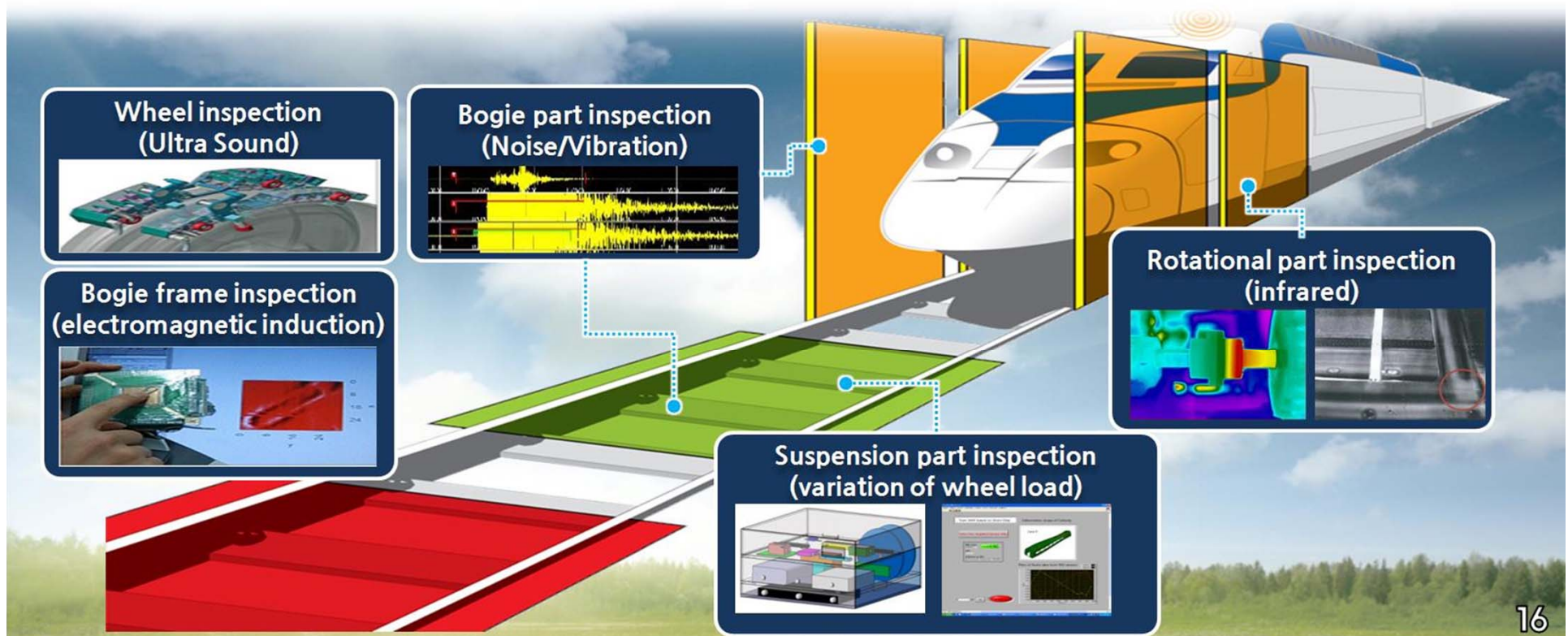
- Government has a plan to provide the personalized travel information to the passengers.
  - Ordinary people, the disabled, the elderly, passenger with child, etc.
- Research on this travel information system will start in 2014.





# ✓ Real-time non-destructive scanning

- Real-time non-destructive scanning to detect unusual conditions of trains at the depot enables rapid and convenient inspection without disassembling or contact.
- Smart sensors, like ultra sound detector, infrared camera, microphone array, and advanced information technologies are being applied.



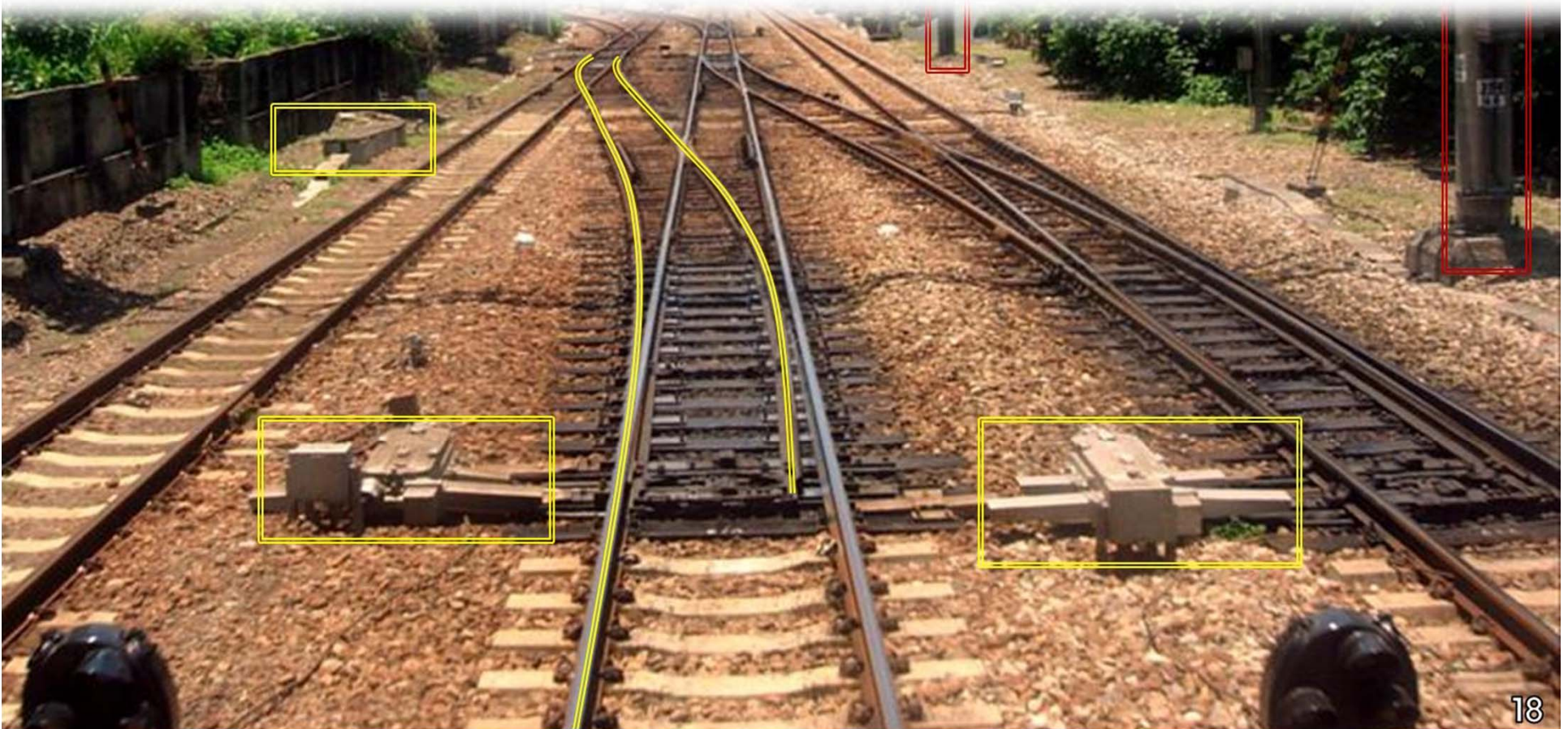
# ✓ Rail-equipment maintenance with smart phone

- The rapid identification and repair of railway equipment are possible using smart phone and barcode on equipment.
- This efficient management system can reduce the maintenance time and labor forces.



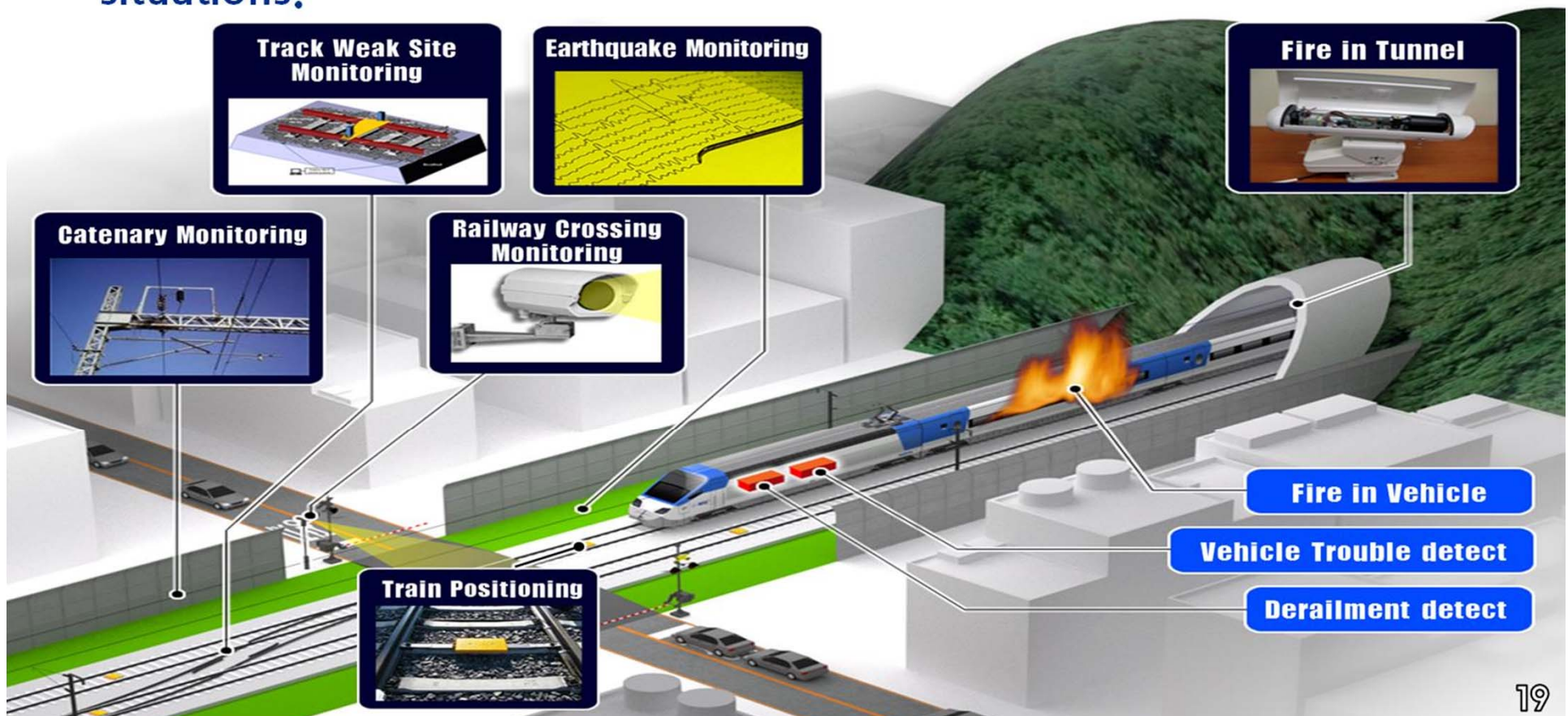
## ✓ Rail-facility position information system

- On-board information acquisition system is being developed to get accurate positions of rail-side facilities.
  - Obtain 3D positional and their geometrical information
- The efficiency of rail infrastructure maintenance will be improved.



# ✓ Real-time safety monitoring system

- Real-time monitoring system evaluates safety using sensors attached on rolling stocks and infrastructures.
  - natural disaster, ground settlement, fire in vehicle, derailment , etc.
- It enables rapid and efficient reactions in unusual or emergency situations.



# ✓ Centralized train control center (CTC Center)

- CTC Center evaluates the condition of each train by analyzing various monitored data.
- Advanced control system is being developed to control trains properly based on vehicle and infrastructure conditions.



# ✓ Pilot site for ITS railways

- New ITS technology for railway will be tested on Wonju-Gangneung HSR line connecting Seoul to Pyungchang Winter Olympics site in 2018.

**Wonju-Gangneung High-speed line**

- Length : 120,8 km
- Max. speed : 250 km/h
- Construction period : 1997~2018

**Real-time Safety Monitoring System**

- Real time Infra Monitoring
  - Track
  - Catenary
  - Earthquake
  - Fire in Tunnel
- High speed inspection-car
- Real time Vehicle Monitoring
  - Fire
  - Derailment
  - Collision

**Train Control with LTE-R**

- High speed rail Control with Wireless Communication
- Wireless Communication Network for Railways
- Wireless Communication based control

**High Efficiency Power System**

- Energy Management
- New Renewable Energy
- Regenerative Energy

Map labels: Wonju, Pyungchang, Gangneung, 2018 Winter Olympics logo.

A young girl with long dark hair, wearing a white dress, is shown from the side, pointing her right index finger upwards towards the sky. The background is a bright blue sky filled with scattered white clouds. The overall scene conveys a sense of aspiration and looking towards the future.

**KRRI is leading new ITS technologies  
for railway to improve its operation  
efficiency worldwide.**