Project 1:
THE TEST ROAD OF KOREA

Project 2:
DEVELOPMENT OF MATERIALS AND
DESIGN-CONSTRUCTION TECHNOLOGIES FOR
THE SUSTAINABLE AND MULTI-FUNCTIONAL PAVEMENT

Project 3:
SMART HIGHWAY PROJECT
THE KOREAN TEST ROAD
Contents

✓ INTRODUCTION
✓ TEST SECTIONS
✓ INSTRUMENT AND EQUIPMENT
✓ MEASURING SYSTEM
✓ PLAN OF RESEARCH
INTRODUCTION

➢ Objectives
➢ Outline
➢ Overall View
Objectives

To Develop Korean Pavement Design Guide

To Improve Pavement Performance & Increase Service Life of Pavement

To Reduce Construction and Maintenance Costs
Outline

- 7.7km Long Two-Lane Expressway
- Construction Cost: US$19,000,000
- Research Expenses: US$3,750,000
Overall View

Joongbu Inland Expressway

Start Point STA. 1+530

Office STA. 3+940

End Point STA. 7+960

Yeoju JCT

Keumdang Br.

Yondai Br.

Samseung 1 Br.

Test Road

25 PCCP Test Sections 2830m

33 ACP Test Sections 2710m
TEST SECTIONS

- Variables
- PCCP Sections
- ACP Sections
Variables

PCCP
- Pavement Type
- Slab Thickness
- Subbase Material
- Subbase Thickness

ACP
- Surface Material
- Base Material
- Base Thickness

Total 25 Section
Total 33 Section
PCCP Sections

[Diagram showing PCCP sections with various layers and labels such as JCP, CRCP, Bend Breaker, BB3, Aggregate, Lean Concrete, and Frost Resistant Layer.]
INSTRUMENT AND EQUIPMENT

- Sensors
- Weigh-in-motion (WIM)
- Weather Station
## Sensors

- **1897 Sensors of 11 Kinds to Measure**
  - Pavement Behavior
  - Traffic and Environmental Loads

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Strain Gauge</th>
<th>Soil Pressure Gauge</th>
<th>MDD</th>
<th>Curling Displ. Gauge</th>
<th>Joint Displ. Gauge</th>
<th>Thermistor or Thermo-couple</th>
<th>Frost Depth</th>
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<td>PCC</td>
<td>Steel</td>
<td>AC</td>
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Weigh-in-motion (WIM)

- Accumulative Vehicle Weight, Speed, Wandering
- Applicable up to 200km/hr
- High Accuracy (Error Rate < 3%)
Weather Station

- Weather Conditions in Test Road
- Ambient Temperature
- Solar Radiation
- Wind Speed and Direction
- Rainfall
MEASURING SYSTEM

- Type of Measurement
- Type of Data
- Data Acquisition
Type of Measurement

- **Automatic (Continuous) Measurement**
  - Pavement Response to Climate Condition
  - Temperature, Water Content
  - Weather Data
  - Accumulative Axle Load from WIM System

- **Manual (Seasonal) Measurement**
  - Pavement Response to Traffic Load
  - Strain, Soil Pressure, etc.
## Type of Data

<table>
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<tr>
<th>Measurement Type</th>
<th>Type of Data</th>
<th>Measurement Method</th>
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<tbody>
<tr>
<td><strong>Automatic</strong></td>
<td>Weather Condition, Pavement Temperature, Pavement Moisture</td>
<td>Every 30 Minutes</td>
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<td>Traffic Information</td>
<td>Continuous Collection</td>
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<tr>
<td><strong>Manual</strong></td>
<td>PCCP Strain, Soil Pressure</td>
<td>Dynamic Load Test</td>
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<td>Joint Movement, Curling</td>
<td>FWD Impact Load Test</td>
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<td>72 Hours Observation</td>
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<td>FWD Impact Load Test</td>
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<td>Dynamic Load Test</td>
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<tr>
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<td>FWD Impact Load Test</td>
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Data Acquisition

- **Automatic Measurement (15 Main Sections)**
  - Install both Data Logger & Circuit Box at Each Section
  - Data Transfer to Main Server through Fiber-optic Cable Network

- **Manual Measurement (58 All Sections)**
  - Install only Circuit Box at Each Section
  - Data Collection through Vehicle Mounted Data Logger(Data Acquisition System)
  - Manual Data Transfer
System Layout

Automatic
- Weather Station
- Weigh-in-motion
- Environment Load

Weather Condition
- Traffic Information
- Pavement Temperature, Moisture, Behavior etc.

Site Office

Manual
- Traffic Load
- Environment Load

Pavement Behavior

Main Office

Optical communication

Manual Data Collection
PLAN OF RESEARCH

- To Set Up Research Infrastructure
- To Establish Test Road Operation Plan
- To Develop Korean Pavement Design Guide
- To Use the Data for Other Pavement Research Projects
DEVELOPMENT OF MATERIALS AND DESIGN-CONSTRUCTION TECHNOLOGIES FOR THE SUSTAINABLE AND MULTI-FUNCTIONAL PAVEMENT
Contents

☑ OUTLINE
☑ BACKGROUND
☑ OBJECTIVES
☑ SUBJECTS
☑ SCHEDULE
Organization

Project Manager

Korea Expressway & Transportation Research Institute

Group 1 Manager

Group 2 Manager

35 Research Institutes, Universities, Companies
**Period**

August 2006 ~ August 2011 (5 years)

**Budget**

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<th>Fund</th>
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<td>Matching Fund</td>
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Needs for the Pavement of New Concept which is Sustainable and Multi-functional
OBJECTIVES

Realization of the Sustainable and Multi-functional Pavement

Four Key Objectives

- User-Oriented Multi-functional Pavement System
- Durable new Pavement Materials And Application Technologies
- Advanced Construction Technologies Using Non-destructive and IT Technologies
- Advanced Pavement Maintenance Technologies
SUBJECTS

DEVELOPMENT OF MATERIALS AND DESIGN-CONSTRUCTION TECHNOLOGIES FOR THE SUSTAINABLE AND MULTI-FUNCTIONAL PAVEMENT

DEVELOPMENT OF SUSTAINABLE AND MULTI-FUNCTIONAL PAVEMENT SYSTEM
- Water-reserved Pavement to Mitigate Heat Island Effect
- Colored Pavement and Durable Block Pavement
- Surface Treatment Methods for Low Noise Pavement
- Durable Asphalt Pavement System and Bridge-deck Pavement System
- Snow Melting System Utilizing Alternative Energy
- Embedded Bridge Joint System

DEVELOPMENT OF ADVANCED CONSTRUCTION AND MAINTENANCE TECHNOLOGIES FOR PAVEMENT
- Quality Control Technologies Using Non-destructive and IT Technologies for Pavement Construction
- Advanced Quality Control System for Asphalt Concrete Mixture
- Quick Repair Technologies for Concrete Pavement
- Mid-Temperature Asphalt Pavement for Overlay
- Decision Making Aid System for Local Roads
SCHEDULE

Year 1
- Development of Element Technologies
  - Previous Research Review
  - Fundamental In-house Experiment
  - Development of System Module
  - Design of Prototype

Year 2
- Integration and Test
  - In-depth In-house Experiment
  - Development of System Module
  - Manufacturing Prototype
  - On-site Test
  - Proposal for the rights Of Intellectual Property

Year 3
- Year 4
- Year 5

Year 4
- Systematization and Application
  - In-site Evaluation and Complementary
  - Development of System and Equipment
  - Acquisition of the rights of Intellectual Property

Year 5
Contents

Ⅰ. OUTLINE
Ⅱ. Background
Ⅲ. RESEARCH & APPLICATION
OUTLINE

- Research Period
- Budget
- Organization
Research Period: 2007~2016 (10 years)

Budget: US$ 150mil. + Construction cost

Organization

SMART Highway Research Group

Subgroup 1

Subgroup 2

Subgroup 3

Subgroup 4
Background

- Speed Change
- Evolution of Information Technology
- Automobile Technology
- Prospect of Future Technologies
Evolution of Information Technology

IT

Society

Constraint in Space and Time

~ 2000

Main Frame, PC, Server

Note book, PC, Multi-Printer

Information

2000 - 2010

Mobile Phone, Satellite TV, Digital TV, Navigation, Video Game

Ubiquitous

2010 ~

Wearable Computers

Emotional Networking

Aviation, Factory, Road, City etc

Constraint in Space and Time

Reduced Constraint in Space and Time

Free from Constraint in Space and Time
Automobile Technology

Past
- Driving Capability
- Performance Improvement

Present
- Passive Safety
  - Air Bag, ABS, etc
- Driver Protection

Future
- Adaptive Safety
  - Danger Warning, Collision and Accident Avoidance

Needs to build safer highway
RESEARCH & APPLICATION

- Concept
- Objectives
- Structure of Project
- Schedule
RESEARCH & APPLICATION

Concept

SMART Highway
Highway of New Concept
where road, information and vehicle technologies are integrated

Core Values
S.M.A.R.T.

Safety
Mobility
Sustainability
Advanced
for Tomorrow
Reliability
RESEARCH & APPLICATION

Objectives

Improve the quality of life through revolution of highway

Establishment of intelligent highway with design speed of 160km/h

Improvement of Safety
- Intelligent road facilities
- Geometric design for super-high speed
- Application of intelligent vehicle technologies

Improvement of Mobility
- Congestion free traffic
- Improvement in travel speed more than 30%
- Road-vehicle communication

Improvement of Convenience
- Application of human factor to road
- Gentrifying highway facilities for the disadvantages
- Diversification of information services
Structure of Project

Establishment of Comprehensive strategy for Smart Highway

- Core Subject 1: Core Technologies of Highway Infrastructure
- Core Subject 2: Road Communication Based Traffic Management Technologies
- Core Subject 3: Vehicle-Infrastructure Integration Technologies
- Core Subject 4: Design and Construction of Test Bed and Monitoring
CONCLUSIONS

- Safety and Sustainability are key issues

- The policy of the Korean government: willing to invest for future highways

- Chances for foreign experts to take a part in SMART Highway Project