Practice of Value Engineering in Korea Expressway Design
Name: Lee, Eui-Joon

Profession: Expressway Engineer

Certificates: PE (Professional Engineer)

Work Experience:
- Korea Expressway Corporation: From 1989 to present
- Caltrans, USA: From Jan 2006 to Jan 2007

Membership of Professional Associations:
- Executive Member, Korean Committee of PIARC (World Road Congress)
- AASHTO Bridge & Structure committee Member
- Advisory Member, Academic Committee of Road and Airport Professional Engineer
- Member, International VE Society
- KEC, Best Man of The Year (2008yr)
1. Korea Overview
2. About KEC
3. Design VE in KEC
4. Our Best Practices
1. Korea Overview
1. Korea Overview
1. Korea Overview

President
Lee, Myung-Bak

Secretary of MLTM
(Ministry of Land, Transport and Maritime Affairs)
Chung, Jong-Hwan

KEC Director
Lieu, Chullho
1. Korea Overview

**Area**
- 99,620Km² (CA: 423,970km²)

**GNP**
- $17,690 (CA: $41,805)

**Population**
- 47 million (CA: 36 million)

**Total Length of Road**
- 103,098 Km (CA: 270,492 Km)
- [Ex: 3,447 Km]
- [EX: 13,400 Km]

**Vehicles Registered**
- 17 million (CA: 28 million)
2. About KEC
2. About KEC (KOREA EXPRESSWAY CORPORATION)

- **Establishment**: Feb 15, 1969 establishment of KEC (CALTRANS : 1895)

- **Purpose**

  By the year 2010, KEC will have expanded its expressways to a total length of **4,000km**. This will have been to allow all to travel in comfort and safety while enriching their lives.
2. About KEC

Construction
Widening
Maintenance

Research & Development

Subsidiary Facilities
Installation and Management

Connected Area Development
2. About KEC

Vision

Our goal is to become a first-class national corporation, providing top-quality expressway services by building upon our assets and expertise.

To this end,

We will cultivate future-oriented human resources, create differentiated technologies, and continue innovating our business structure.
2. About KEC

- **Employee**
  - Total: 4,559  *(CALTRANS: 21,320)*
  - Engineer: 2,550  *(CALTRANS: 2,509)*
  - Office Worker: 1,175
  - Sales Person: 834

- **Organization**
  - 5 Division, 3 Office, 19 Division
  - Regional Headquarters(6), Construction Office(14), Expressway & Transportation Research Institute,
    Expressway Traffic Information Center
2. About KEC

The Board of Directors

Organization under The direct control

Technology Division
Construction Division
Road Division
Marketing Division
Management Division

Regional Headquarters(6)

President

Auditor

Transportation Research Institute
Construction Office(14)
Expressway Traffic Information Center

Regional Headquarters(6)

Video
2. About KEC

- **Total Length of Expressways**

  - **26 Line**
  - **3,447km**

- 8 lane: 340km
- 6 lane: 439km
- 4 lane: 2,277km
- 2 lane: 155km

- Private Investment: 236km
2. About KEC

Financial Affair

Total Assets: $33,845 million

Revenue Detail

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Road Management Revenue</td>
<td>$2,206</td>
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<tr>
<td>Incidental Revenue</td>
<td>$723</td>
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<td>Investment</td>
<td>$1,055</td>
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<tr>
<td>Debt</td>
<td>$3,376</td>
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Expenditure Detail

<p>| | |</p>
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Expressway Construction</td>
<td>$2,249</td>
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<tr>
<td>Maintenance &amp; Improvement</td>
<td>$1,517</td>
</tr>
<tr>
<td>Repayment</td>
<td>$2,931</td>
</tr>
<tr>
<td>Etc</td>
<td>$663</td>
</tr>
</tbody>
</table>

Budget of 2009

Total Budget: $7,360 million

- Toll Income: $6.0 million/per day ($2,206 million/per year)
- Annual Daily Traffic: 3.3 million (121,033 million/per year)
3. Design VE in KEC
KEC’s VE HISTORY

- 1996 Highway Design Evaluation Office (9 persons)
- 1997 First Design VE in KEC
- 2000 VE in design stage has been mandated under the Construction Technology Management Act of KOREA
  - Construction projects costing over $50 million
- 2003 Design VE for the PPP (Public-Private Partnership Project)
  - Seoul~Chunchen Highway
- 2004 Establishment Design VE Team-2 (6 Persons)
- 2005 Expansion of VE Consulting range
  - Construction projects costing over $10 million
Design Evaluation Division

Managing Director

Design Evaluation Team
- Team Leader
  - Design Evaluation
  - Design Consulting
  - R&D
  - Team member: 9 persons

Expressway Design VE Team
- Team Leader
  - Road Design VE
  - Structural Design VE
  - Tunnel & Foundation Design VE
  - Team member: 8 persons

VE Project Development Team
- Team Leader
  - Design VE for the PPP (Public-Private Partnership Project)
  - Team member: 8 persons
VE Team Composition/Operation

- VE Team Leader
- VE Team Manager

Inner staff
- Road & Traffic (1~2 persons)
- Maintenance & construction (1~2 persons)
- Structure & Environment (1~2 persons)
- Tunnel & Foundation (1~2 persons)
- Facilities & Mitigation (1~2 persons)

Outside Specialists

1~3 Specialists / each part

※ Specialist Pool : KEC 840 persons, Outside 470 persons
VE Team Composition/Operation

- **VE team composition** (2 team 19 members)
  (Specialty : Road, Structure, Soil, Facilities, etc)

- **Co-work Network**
  (ITS, Maintenance, Hi-pass, Research, CM, etc)

- **Using inner professional staffs in KEC**
  (CVS 33, Ph.D 70, PE 140 holders)

- **Using outside specialists in expert Group**
  (about 460 experts)
VE Promotion Strategy

- VE P.R. (Public Relation)
- MOU (KEC with City, Province, Oversea agency)
- Design VE competition
- National VE conference
- Exchange Oversea Activities
- Training VE experts
- Publish VE-related Books
- Receive VE-related Awards
Various P.R Activities

- **Publish VE**
  - History of Highway
  - Construction Technology of bridge and tunnel
  - Innovative maintenance
  - Traffic management
  - Next generation growth strategy

- **VE portal website**
  - VE Procedure
  - Capacity of Design VE
  - Knowhow of Design VE
  - Accomplishments
  - VE Effects
  - http://www.ex.co.kr/simsa/
  - Major innovations
Various P.R Activities

- **VE Roadshow**

  - Korea: About 100 times
    (Government, Public Institution, Construction company, etc)
  - Contents: Design VE concepts, Practices

  - Oversea: About 10 times
    (Cambodia, Indonesia, Vietnam, etc)
  - Contents: Useful technology of Design VE
Memorandum Of Understanding

Domestic

- MOU with domestic government agency
  - Seoul metropolitan city
  - Kyeongsangnamdo(Province)
  - Kyunggido(Province)(In process)

- Contents
  - Exchange construction Technology
    (e-learning, in-field investigation etc)
  - Design VE consulting
  - PPP Design VE consulting

- Future Plan
  - Expand with other government agencies such as Pusan city etc.
Memorandum Of Understanding

**Oversea**

- **MOU**
- Total 19 agencies in 16 Countries

- Dispatching 2 staffs to Vietnam Expressway Corporation
- To provide technical assistance and cooperation activity
- To develop overseas projects
- To implement Cambodia’s Smart Road CM project by KOICA

- Dispatching 1 staff to World Bank Jakarta Office
- To benchmark practices of WB & International cooperation
- To study and consult Indonesian toll road policy
- Dispatching 2 staffs to Ministry of Public Works
- To work on a technical assistance and cooperation activity
- To develop overseas projects
- To implement Sri Lanka Mahanama Bridge CM project by KOICA
Design VE competition

- Derive interest for Design VE
- Derive practical solution for project problems
- Annual event from 2005 yr

[Given VE project in 2008]
Solve habitual traffic jam of Seoul Ring Road from Kyeyang to Jangsu

7 team applied and Present their proposals
National VE Conference

- Object: Exchange experience and technology
- Attendee: Public Institution, Academic Institution, etc
- Contents: Discussion VE policy, Invitation of CALTRANS officer, Technical Sessions

Discussion VE policy

Keynote Speaker

- Location: Incheon, Songdo
- Contents: Discussion of VE policy, Technical Sessions, etc
Exchange Oversea Activities

Caltrans Activities

- Exchange engineer CALTRANS & KEC
  - Lee, Eui-Joon, 2006.1~2007.1
  - Kim, Daeyoung, 2009.1~Present

- Rotation Work
  - Structure Maintenance
  - Geotechnical Services
  - Districts, Design & Engineering Services
  - Research & Innovation Center
I-10
Singleton Road Interchange
Value Analysis Study

- Presentation of Preliminary Results
- August 2, 2006

VA Team
- Team member 8 persons
  including Team Leader

Method
- Proposed VA Study Alternatives
- 6EA, $6,794,000 Savings

Exchange Oversea Activities
Exchange Oversea Activities

- **Invitation of Oversea experts (2007.9)**
  - Barton Newton & Kookjoon Ahn from CALTRANS
  - Title: “Bridge Management in CA”

- **Invitation of Oversea experts (2008.9)**
  - James Davis & S.K.Moon from CALTRANS
  - Title: “Project Risk Management of San Francisco-Oakland Bay Bridge”
Register to SAVE International as a member in 2002.

Participate annually to “SAVE(International VE conference)" since 2004

“SAVE International 47th Annual Conference" (2007.5)
- Discuss best practices
- Benchmarking of practices of VE
- Presents VE practices of Incheon Grand Bridge

“SAVE International 48th Annual Conference" (2008.6)
- Survey of VE practices

“SAVE International 49th Annual Conference" (2009.6)
Training VE Experts

CVS

- CVS (Certified Value Specialist)
- Start the education from 2001
- Total 37 people certified
Publish VE-related Books

- Practices in Design VE
- Guidelines for Design VE
- Design VE Function Analysis and Technique
### Receive VE-related Awards

<table>
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<tr>
<td>• 1&lt;sup&gt;st&lt;/sup&gt; rank</td>
<td>• 2&lt;sup&gt;nd&lt;/sup&gt; rank</td>
<td>• 1&lt;sup&gt;st&lt;/sup&gt; rank</td>
</tr>
<tr>
<td>• Korea Management Association and Consulting</td>
<td>• Ministry of Land, Transportation, and Maritime Affairs</td>
<td>• Korea Management Association and Consulting</td>
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</table>

[Image of award certificates and photos]
Accomplishments of Design VE

- Accomplishments in Korea
- Accomplishments in Oversea
## Design VE Accomplishment (NP)

<table>
<thead>
<tr>
<th>Year</th>
<th>Contents</th>
<th>Number of Proposal</th>
<th>Cost Saving (million dollar)</th>
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<tr>
<td>'97</td>
<td>15Lines 74sections 267cases</td>
<td>5,605</td>
<td>150</td>
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<tr>
<td>'98</td>
<td>17 /69 / 182</td>
<td>3,406</td>
<td>57</td>
</tr>
<tr>
<td>'99</td>
<td>14 / 56 / 109</td>
<td>2,005</td>
<td>53</td>
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<td>'00</td>
<td>10 / 24 / 46</td>
<td>625</td>
<td>14</td>
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<td>'01</td>
<td>10 / 28 / 54</td>
<td>687</td>
<td>41</td>
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<tr>
<td>'02</td>
<td>9 / 59 / 100</td>
<td>1,003</td>
<td>114</td>
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<tr>
<td>'03</td>
<td>10 / 59 / 59</td>
<td>603</td>
<td>85</td>
</tr>
<tr>
<td>'04</td>
<td>7 / 54 / 59</td>
<td>1,015</td>
<td>44</td>
</tr>
<tr>
<td>'05</td>
<td>11 / 55 / 83</td>
<td>955</td>
<td>153</td>
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<tr>
<td>'06</td>
<td>13 / 69 / 76</td>
<td>984</td>
<td>60</td>
</tr>
<tr>
<td>'07</td>
<td>14 / 34 / 42</td>
<td>756</td>
<td>47</td>
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<tr>
<td>'08</td>
<td>8 / 26 / 28</td>
<td>376</td>
<td>26</td>
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**Total**

$\text{\$ \ 845 Million Saving}$

![Cost Saving Graph](image-url)
## Design VE Accomplishment (PPP)

<table>
<thead>
<tr>
<th>Project</th>
<th>L (km)</th>
<th>Proposal</th>
<th>Cost Saving (US dollar)</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seoul-chunchon</td>
<td>61.4</td>
<td>1,050</td>
<td>$78 million</td>
<td>MLTM</td>
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<tr>
<td>Seosuwon-pyungtaek</td>
<td>38.5</td>
<td>649</td>
<td>$128 million</td>
<td>MLTM</td>
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<tr>
<td>Youngin-seoul</td>
<td>22.9</td>
<td>960</td>
<td>$126 million</td>
<td>MLTM</td>
</tr>
<tr>
<td>Daegu 4th</td>
<td>10.5</td>
<td>62</td>
<td>$45 million</td>
<td>DAEGU</td>
</tr>
<tr>
<td>Pyungtaek-siheung</td>
<td>42.6</td>
<td>354</td>
<td>$29 million</td>
<td>MLTM</td>
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<tr>
<td>Yangji-pokok</td>
<td>7.0</td>
<td>38</td>
<td>$6 million</td>
<td>YONGIN</td>
</tr>
<tr>
<td>Suwon-kwangmyung</td>
<td>26.4</td>
<td>69</td>
<td>$25 million</td>
<td>MLTM</td>
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<tr>
<td>Youngcheon-sangju</td>
<td>89.9</td>
<td>61</td>
<td>$51 million</td>
<td>MLTM</td>
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<td>Kwangju-wonju</td>
<td>57.0</td>
<td>58</td>
<td>$20 million</td>
<td>MLTM</td>
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<tr>
<td>Pusan new port</td>
<td>15.3</td>
<td>35</td>
<td>$8 million</td>
<td>MLTM</td>
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<tr>
<td>Changwon-pusan</td>
<td>22.5</td>
<td>39</td>
<td>$6 million</td>
<td>GSND</td>
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<tr>
<td>Dohwa-dukgae</td>
<td>5.8</td>
<td>25</td>
<td>$2 million</td>
<td>YANGJU</td>
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<tr>
<td>Seosuwon-osan</td>
<td>12.0</td>
<td>48</td>
<td>$4 million</td>
<td>GYUNGGI</td>
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<tr>
<td>Ulsan bridge</td>
<td>5.7</td>
<td>50</td>
<td>$8 million</td>
<td>ULSAN</td>
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<tr>
<td>Masan-changwon</td>
<td>4.35</td>
<td>17</td>
<td>$3 million</td>
<td>YANGJU</td>
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<tr>
<td>Kwangmyung-seoul</td>
<td>19.8</td>
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<td>MLTM</td>
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<tr>
<td>Seoul-munsan</td>
<td>34.7</td>
<td></td>
<td></td>
<td>MLTM</td>
</tr>
<tr>
<td>Sukdong-sosa</td>
<td>7.0</td>
<td></td>
<td></td>
<td>BJFEZ</td>
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</table>
Overseas VE Project

- **2006 Yr**
  - Mahanama Bridge in Sri Lanka
  - Siem Reap Bypass Road in Cambodia
  - Circular Link Highway (Mosul-Kirkuk) in Erbil, Iraq

- **2007 Yr**
  - National Roads in the Philippines, Vietnam

- **2008 Yr**
  - Vientiane province in Laos, Vietnam, Cambodia
4. Our Best Practices
**Ex1 Improve the function of Junction**

- **Overpass the existing expressway and needs many structures (10 bridges)**
- **Improve the vertical curve and minimize the number of structures (6 bridges)**
- **Cost saving $46 million**
• Prevent accident from opposite lane
• Construct eco-friendly road
• Increase construction cost ($ 1.4 hundred/m)

ex2 Improving median barrier in I.C.
**Improve the Climbing line**

- Length of Climbing lane in Expressway: 104 places/190km [6% of total road length]
- 14 places are closed
- 90 places are operating in present

- Increase Traffic utilization rate **7.5%** (5.6→13.1%)
- Raise Vehicle speed **17.7km/h** (51.7km/h→69.4km/h)
- Increase Service level at end point (C ⇒ B)
- Cost Saving: $0.27 million/year & Reduce CO₂ emission 73 ton/year
Optimize J.C.T ramp widening

- Widening Bridge (Length 310m)
- Access lane is too long
- Eliminate Widening Bridge
- Cost Saving ($3.7 million)
Change the material of cross beam

- Cast-in-place with form and staging
- Safety is low
- Inefficient Constructability
  → Increase construction period

- Preinstall Anchor Plate
- Safety is high
- Increase construction cost
  ($1.9thousand/each)
Change plan of Ingye I.C
• Change the place of I.C Head and assess lane
• Improve curvature (R=3000, 4000m → R=2000, 2500m)
• Reduce 2 Bridges, Saving the cost ($3.9million)
Compact car road

- Each 2 lane 10.4m plan (truck + vehicle)
- Truck occupying percent is relatively small
- Stiff vertical slope (S=6.89%)
- Traffic jam will be occurred due to trucks

- Compact car road is planned
- Saving construction cost
- Reduce traffic jam
- $V = F \uparrow / C \downarrow$
Investing in VE gives one hundred – fold return