Revolutionary Steel Plate Temporary Bridge

SKO - Beam

Location Map

Jaber Al Ahmed Al Sabah Bridge Subiya Causeway
Established in 1994, SKO EMC (S-KO Engineering Management Construction) has accumulated the state-of-the-art technology with a number of projects with its license in dismantling steel structure and scaffolding and reinforced concrete business. It started long-span temporary bridge construction in 2000 with SKO long-span temporary bridge method using prestressing. Starting from Gyungin Canal Project, SKO EMC was engaged in many projects including Samrangjin Bridge (project owner: Gyeongnam Provincial Office & primary contractor: Hyundai Construction), Machang Bridge (an SOC project & primary contractor: Hyundai Construction), Suyeong Bridge 1 (primary contractor: Lotte Construction) and Suyeong Bridge 4 (primary contractor: Sambu Construction) both of which are in Busan, Railroad behind New Port (project owner: KORAIL & primary contractor: HDC), Yeongdo Bridge which is Korea’s first offshore temporary bridge for bypassing (primary contractor: Lotte Construction) and many other temporary bridge design and construction projects along with a number of reinforced concrete and scaffolding works.

With its technology and management gained over years’ of project experience, SKO EMC was certified ISO 9001/ISO 14001 in 2009 (for steel structure construction, dismantling of scaffolding, and reinforced concrete work), settling not only quality management but also green management within its system. SKO EMC expanded investment in technology to receive certification from KOITA for R&D center and INNO-BIZ certification from SMBA.

SKO EMC participated in Urban Maglev Railway commercialization project (primary contractor: GS Construction) using its patent method of SKO-Beam Temporary Bridge and completed the project in perfection. It also participated in Double-Track project connecting East Daegu and Yeongcheon (primary contractor: Daelim Construction) and more recently it participated in Causeway Project in Kuwait with Hyundai Construction. In 2001, SKO EMC expanded its business to real estate development. Its first project as the developer was Hyundai Hyel in Seoul which is a mixed development of residential and commercial areas with Hyundai Construction and it is now developing an officetel building in Shinseoldong Station in Seoul.

In 2009 SKO EMC established its representative office in Singapore to tap the possibility of expanding business into the international market. Its efforts resulted in the opportunity to participate in Jaber Al Ahmed Al Sabah Bridge Bubiya Causeway – Kuwait project. It is continuing its efforts to develop other markets in the Middle East, South East Asia and Africa.

SKO EMC will continue to develop new technology and deploy thorough quality management to satisfy every customer.

Sincerely,
SKO EMC
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep, 1994</td>
<td>Established (capital: KRW300M)</td>
</tr>
<tr>
<td>Dec, 1994</td>
<td>Acquired civil work license (license number: Gyeonggi 94 #02-19)</td>
</tr>
<tr>
<td></td>
<td>Acquired reinforced concrete work license (license number: Gyeonggi 94 #10-26)</td>
</tr>
<tr>
<td>Oct, 1996</td>
<td>Raised capital to KRW700M</td>
</tr>
<tr>
<td>May, 2000</td>
<td>Started SKO long-span temporary bridge work with prestressing</td>
</tr>
<tr>
<td>Nov, 2000</td>
<td>Acquired steel structure construction work license (license number: Uijeongbu 2000~21-1)</td>
</tr>
<tr>
<td>Feb, 2002</td>
<td>Changed name to SKO Construction Co, Ltd.</td>
</tr>
<tr>
<td>Mar, 2004</td>
<td>Changed CEO to JongChul Lee</td>
</tr>
<tr>
<td>Jul, 2005</td>
<td>Completed Hyundai Hyel construction (developer: SKO, constructor: Hyudain Construction)</td>
</tr>
<tr>
<td>Feb, 2006</td>
<td>Changed name to SKO EMC Co, Ltd.</td>
</tr>
<tr>
<td>Aug, 2006</td>
<td>Relocated HO to 251-137 Gui-1-dong, 2F Regal Building, Gwangjin-gu, Seoul</td>
</tr>
<tr>
<td>Dec, 2006</td>
<td>Selected as a major subcontractor for Lotte Construction</td>
</tr>
<tr>
<td>Oct, 2008</td>
<td>Acquired scaffolding/structure dismantling work license (Gwangjin 08-06-02)</td>
</tr>
<tr>
<td>Jun, 2009</td>
<td>Established Singapore Rep Office (RO UEN: T09RF0088C)</td>
</tr>
<tr>
<td>Sep, 2009</td>
<td>Acquired ISO 9001/ISO 14001 certificate</td>
</tr>
<tr>
<td>Oct, 2009</td>
<td>Reported overseas construction/structure, scaffolding/structure dismantling, reinforced concrete</td>
</tr>
<tr>
<td>Jan, 2010</td>
<td>Certified R&amp;D Center</td>
</tr>
<tr>
<td>Jan, 2010</td>
<td>Certified INNOBIZ</td>
</tr>
<tr>
<td>Jun, 2011</td>
<td>Acquired patents on SKO-Beam</td>
</tr>
<tr>
<td>Jan, 2012</td>
<td>Started overseas business: Causeway Project- Kuwait</td>
</tr>
</tbody>
</table>
## SKO-BEAM Temporary Bridge Method applied to BIM Design

<table>
<thead>
<tr>
<th>Project</th>
<th>Sheikh Jaber Al-Ahmad Al-Sabah Causeway Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>15 months</td>
</tr>
<tr>
<td>Location</td>
<td>Kuwait / from Shuwaikh Port to South Island</td>
</tr>
<tr>
<td>Owner</td>
<td>Ministry of Public Works / Kuwait</td>
</tr>
<tr>
<td>Contractor</td>
<td>Hyundai Construction</td>
</tr>
</tbody>
</table>
| Size    | MAIN : L=4,650m, B=8.0m  
FINGER : L=32M, B=10.0M (40EA) |
SKO-BEAM Method

Revolutionary Steel Plate Temporary Bridge

Overview of SKO-Beam

- Moment of Inertia
  - Steel plate (2 spots)
  - Reduction by 50%

- Steel plate (4 spots)

Old Method

- Moment of Inertia
  - $I_x = 494,868 \text{ cm}^4$
  - $I_y = 1,829,375 \text{ cm}^4$

- Steel plate (4 spots)

Structure of SKO-Beam

- Main girder (3 spots)

- Bent (3 spots)

- Variable

- Deck part

- Deck

- Girder

- Variable

- Girder

- Yard fabrication - girder

Long span

- Steel plate structure $\rightarrow$ long span temporary bridge (max. 60m)

Economical

- Reduction in steel usage by 30% $\rightarrow$ cost saving

Constructability

- Reduction in bent spots and process $\rightarrow$ period reduction

Quality

- Yard fabrication $\rightarrow$ quality control

Serviceability

- Reduction in noise, better roadworthiness, larger drain area $\rightarrow$ better serviceability

Safety

- Deck plate installed as one unit $\rightarrow$ Safer

Ultra low girder (reduction up to 66cm)

- Prevents derailing of deck plate
- Reduces drive noise
- Secures water drain area
- Improves roadworthiness

Ultra low girder (reduction up to 66cm)

- Prevents derailing of deck plate
- Reduces drive noise
- Secures water drain area
- Improves roadworthiness

- Safe SKO-Beam
- Yard fabrication - girder
- Deck plate
- Girder + deck plate

Weak lateral buckling strength

- Too many deck plates
- High main girder
- Too many substructure bents
- Road width
Advantages of SKO-Beam Method

Variable Design Width

Design width of old method

- Deck plate requires 4, 6, 8, 10m

Design width fit for various road conditions → reduces cost

Mechanical Effect

Comparison of section with other methods (Project X)

<table>
<thead>
<tr>
<th>Category</th>
<th>SKO-Beam</th>
<th>D*B</th>
<th>H**P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section area</td>
<td>1,016</td>
<td>496</td>
<td>304</td>
</tr>
<tr>
<td>Moment of inertia(I3)</td>
<td>1,791,818</td>
<td>948,064</td>
<td>288,313</td>
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<tr>
<td>Moment of inertia(I2)</td>
<td>4,860,841</td>
<td>22,910</td>
<td>15,895</td>
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<tr>
<td>Section modulus(Zac)</td>
<td>36,202</td>
<td>14,943</td>
<td>7,964</td>
</tr>
</tbody>
</table>

Comparison of stress between SKO-Beam (with 30% less steel) and other methods (Project X)

<table>
<thead>
<tr>
<th>Category</th>
<th>Span Length</th>
<th>Z (Za)</th>
<th>Area (cf)</th>
<th>Max Moment (kN.M)</th>
<th>Min Moment (kN.M)</th>
<th>Axial-Force (kN)</th>
<th>Stress (Mpa)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKO-Beam</td>
<td>40.0m</td>
<td>36,202</td>
<td>1.016</td>
<td>4,565</td>
<td>-4,935</td>
<td>-419.619</td>
<td>-645.818</td>
<td>None</td>
</tr>
<tr>
<td>D*B</td>
<td>20.5m</td>
<td>14,943</td>
<td>496</td>
<td>1,455</td>
<td>-2,595</td>
<td>-291.477</td>
<td>-298.374</td>
<td>Prefixon</td>
</tr>
<tr>
<td>H**P</td>
<td>20.0m</td>
<td>7,964</td>
<td>304</td>
<td>920</td>
<td>-1,239</td>
<td>-249.94</td>
<td>-98.07</td>
<td>Prefixon</td>
</tr>
</tbody>
</table>
S-KO's Certificate
## S-KO’s Projects

### Temp. Br. for Yeongdo Br
- **Site:** Yeongdo-gu, Busan
- **Purpose:** Bypass
- **Specification:** 28m x 280m
- **Load condition:** DB-2.4
- **Contractor:** Lotte Construction
- **Owner:** Lotte Shopping
- **Method:** S-KO Prestress

### Temp. Br. for Machang Br.
- **Site:** Yeongdo-gu, Busan
- **Purpose:** Construction
- **Specification:** 8m x 1000m
- **Load condition:** DB-2.4
- **Contractor:** Gyeongnam Pr. Office
- **Owner:** Busan
- **Method:** S-KO Prestress

### Temp. Br. for Suyeong Br. 1
- **Site:** Suyeongcheon, Busan
- **Purpose:** Bypass
- **Specification:** 21m x 220m
- **Load condition:** DB-2.4
- **Contractor:** Lotte Construction
- **Owner:** Busan
- **Method:** S-KO Prestress

### Temp. Br. for Suyeong Br. 4
- **Site:** Busan
- **Purpose:** Construction
- **Specification:** 8m x 343m
- **Load condition:** Crain 130 ton
- **Contractor:** Sambu Construction
- **Owner:** Busan
- **Method:** S-KO Prestress

### Saengrim-Samrangjin Road Expansion
- **Site:** Saengrim-Samrangjin
- **Purpose:** Construction
- **Specification:** 8m x 420m
- **Load condition:** DB-2.4
- **Contractor:** Hyundai Construction
- **Owner:** Gyeongnam Pr. Office
- **Method:** S-KO Prestress

### Temp. Br. for Railroad for Busan New Port
- **Site:** Gimhae, Gyeongnam
- **Purpose:** Construction
- **Specification:** 10m x 156m
- **Load condition:** Crain 130 ton
- **Contractor:** HDC
- **Owner:** KRNA
- **Method:** S-KO Prestress

### Temp. Br. At Gimpo Gulpocheon
- **Site:** Gulpocheon, Gimpo
- **Purpose:** Bypass
- **Specification:** 20m x 72m
- **Load condition:** DB-2.4
- **Contractor:** HDC
- **Owner:** SCMO
- **Method:** S-KO Prestress

### Seoul-Chuncheon Highway
- **Site:** Seoul-Chuncheon
- **Purpose:** Construction
- **Specification:** 8m x 350m
- **Load condition:** DB-2.4
- **Contractor:** HDC
- **Owner:** Seoul-Chuncheon
- **Method:** S-KO Prestress

### Maglev Commercialization Project
- **Site:** Yeongjong-do
- **Purpose:** Construction
- **Specification:** 12mx60m, 8mx70m
- **Load condition:** Crane
- **Contractor:** GS Construction
- **Owner:** KRNA
- **Method:** S-KO Beam
Workflow (Maglev Site – SKO Beam)

1. Install guide frame
2. Drive piles
3. Clear head area
4. Install lower bent
5. Assemble SKO-Beam girder
6. Install SKO-Beam girder
7. Connect cross beams
8. Install steel plate
9. Install guardrail
10. Completed work
11. Completed work
12. Completed work