Building Construction and BIM in Japan

Japan Federation of Construction Contractors, Research and Development Committee
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JFCC Research and Development Committee

■ Japan Federation of Construction Contractors (JFCC)
  ● The construction contractors organization which works to resolve the various systems and issues related to the construction industry.
  ● 138 contractors have joined.

■ JFCC Research and Development Committee
  ● The committee which addresses the research, development and improvement of building technology supporting for social and building needs.
Building Construction in Japan
- Construction Investment
- Design-Build System
- Design Division of Contractor
- Research and Development in Contractor
- Project Contract Type

Current Status of BIM in Japan
- Trends of BIM in the world
- Trends of BIM in Japan
- BIM Activities of JFCC

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Building Construction in Japan
Trends in Construction Investment

- Construction investment was reduced to 50% of the peak in 2010 and began to increase in earthquake recovery demand from 2011.
The majority of private investment is building work.

- Private Residential Building: 31.2%
- Private Non-residential Building: 15.8%
- Private Civil: 11.0%
- Government Residential Building: 0.9%
- Government Non-residential Building: 4.3%

JFCC: Construction Industry Handbook 2013
Japanese Design-Build System

JFCC: Japanese Multi-disciplinary Contractors with Their Own Design Divisions

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Japanese Design-Build System

Historical reasons

- Traditionally, Japanese society has relied on an architectural system in which a master carpenter (toryo) is responsible for both the design and the construction of buildings.
- Clients put their faith in this system, which, over the year, has been refined and steadily developed by various contractors and their design divisions.

Advantages of the System

- Clearly defined responsibilities for the design and construction of buildings.
- Assured quality based on construction-technological feedback.
- Accelerated project delivery.

The system can produce high-quality buildings rapidly and economically.
Design Division of Contractor

- 55 major member contractors of JFCC have design divisions

Trends in the ratio of design department employees

JFCC Design Committee : Design department annual questionnaire 2012

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## Ratio of Design-Build Projects

### Design-Build Rate

<table>
<thead>
<tr>
<th></th>
<th>Design-Build order volume</th>
<th>Design-Build Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed Alone</td>
<td>2,099,531 Million Yen</td>
<td>31.4%</td>
</tr>
<tr>
<td>Designed Together</td>
<td>310,024 Million Yen</td>
<td>4.6%</td>
</tr>
<tr>
<td>Alone + Together</td>
<td>2,409,555 Million Yen</td>
<td>36.0%</td>
</tr>
</tbody>
</table>

- Design-Build Rate = Design-Build contract volume / Building Work order volume
- Building Work order volume (in Japan) = 6,679,580 Million Yen
- Designed Together: designed in collaboration with other companies
- In the case of joint venture project, the amount was entered in accordance with the equity.

JFCC Design Committee: Design department annual questionnaire 2012

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Research and Development in Contractor

Trends in R & D Expenses

- R & D expenses of the construction industry are less than those of other industries. However, some major companies invest about 10 billion yen per year.

Trends in the ratio of R & D Expenses to Sales

Expenses in 2011: 113 billion yen

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Research and Development in Contractor

- 36 major member contractors of JFCC perform research and development.
- Total R & D expenses to sales: 0.56%
- 28 contractors own experimental facilities

R & D expenses to sales (Billion Yen)

JFCC R & D Committee: R & D annual questionnaire 2012

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Research and Development in Contractor

Breakdown of R & D expenses

- Quality & Productivity: 36%
- Safety & Security: 24%
- Global Environment: 21%
- Amenity & Health: 6%
- Others: 12%

Quality & Productivity
Concrete, Skeleton, Construction Method, Automation, Maintenance

Global Environment
Energy saving, CO2 Reduction, Soil Remediation, Water Purification, Alternative Energy

Safety & Security
Earthquake Resistant, Seismic-Response Control, Base Isolation, Seismology

Amenity & Health
Sound, Vibration, Temperature, Humidity

Others
Engineering, BIM

JFCC R & D Committee:
R & D annual questionnaire 2012
Fixed price contract is common in building industry.

- **Fixed Price (lump sum) Contract**
  - The contractor agrees to complete the project for a specific period of time and the client agrees to pay a fixed amount of money.

- **Bill of Quantities Contract**
  - The contractor agrees based upon the contract documents with the quantity table that the client has provided.

- **Guaranteed Maximum Price Contract**
  - The contractor is responsible for cost overruns, unless the GMP has been increased. Savings resulting from cost underruns are returned to the client or distributed.

- **Unit-price Contract**
  - The client agrees a unit price of labor and materials. Total cost will vary depending on the increase or decrease in these quantities.

- **Cost-plus (Cost Reimbursement) Contract**
  - The contractor is paid for all of its allowed expenses to a set limit plus additional payment to allow for a profit.
Current status of BIM in Japan
## Trends of BIM in the world

- BIM Guidelines are developed and BIM is being mandatory

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>NIBS</td>
<td>National BIM Standard</td>
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<tr>
<td>US</td>
<td>GSA</td>
<td>BIM Guide Series 1～6</td>
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<tr>
<td>US</td>
<td>Wisconsin</td>
<td>BIM Guideline and Standard for Architect &amp; Engineer</td>
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<tr>
<td>US</td>
<td>BuildingSMART US &amp; Penn. State Univ.</td>
<td>BIM Project Execution Planning Guide Ver.1</td>
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<td>Finland</td>
<td>Senate Properties</td>
<td>BIM Requirements Vol.1～9</td>
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<td>Denmark</td>
<td>bips</td>
<td>CAD Manual 2008</td>
</tr>
<tr>
<td>Singapore</td>
<td>BCA</td>
<td>BIM Regulation Submission Pilot Guideline</td>
</tr>
<tr>
<td>Australia</td>
<td>CRC</td>
<td>National Guideline for Digital modeling</td>
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<tr>
<td>Korea</td>
<td>MLTM</td>
<td>BIM Application Guide</td>
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<tr>
<td>Korea</td>
<td>PPS</td>
<td>BIM Roadmap</td>
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IAI Japan Junichi Yamashita: Present and Future of BIM in the World and Japan
Trends of BIM in the world

• Clients are active in the adoption of BIM
  • Senate Properties
    • An unincorporated state-owned enterprise which manages a major part of the real estate in Finland.
  • Main Objectives of “Requirements 2007”
    “With the help of three-dimensional assessment of design solutions, it aims at improving quality and the information exchange between the parties, reducing the number of design errors, increasing the efficiency of the design process and ensuring that the end result conforms to the objectives.”
  • The client will pay the modeling and administrative costs of BIM indirectly.
Trends of BIM in Japan

- 2010.3 Ministry of Land, Infrastructure and Transport (MLIT) announced “Start of BIM pilot project in government building and repairs”.

- 2012.7 Japan Institute of Architects (JIA) released the BIM guidelines.
  - It shows the agenda and expected effect of BIM to architects.

- 2012.09 MLIT Government Buildings Department began to study for the development of BIM modeling rules.
Trends of BIM in Japan

Comparison with the guidelines of overseas

Nation Level
- US NIBS
- Korea MLTM

Agency / Organization Level
- Finland Senate Properties
- US Wisconsin
- US GSA
- Korea PPS

Project Level
- Norway, Oslo New National Museum
- BIM Pilot Project
Trends of BIM in Japan

Contractors are expecting effects of BIM as follows:
- Acceleration of the process of reaching a consensus with a client and a designer.
- Improvement of the coordination process between subcontractors, fabricators and manufacturers.
- Improvement of the productivity and shortening construction period by front-loading.

Subcontractors, fabricators and manufacturers are expecting effects of BIM as follows:
- Improvement of the coordination process between contractor.
- Improvement of the manufacturing process by data linkage.
- Reduction of rework due to front-loading.
Trends of BIM in Japan

Contractors are active participants in the design competition using BIM.

- **Build Live Japan**
  - Virtual design competitions organized by IAI Japan
  - Competing for the completeness and novelty of BIM work in 48 hours.

- **Grand Prize Winners**
  - Build Live Tokyo 2009
  - Build Live Tokyo 2009 Part II
  - Build Live Tokyo 2010
  - Build Live Kobe 2011
  - Build Live Chiba 2012
  - Build Live Japan 2013
  - Maeda Corporation
  - Shimizu Corporation
  - Obayashi Corporation, Shibaura institute of Technology
  - Shibaura institute of Technology
  - Obayashi Corporation

(IDDS & BIM One day Seminar 2013)
Trends of BIM in Japan

- Procurement of BIM modeling work is spreading abroad.

![Map of Asia showing connections to China, India, Vietnam, and Philippines]
BIM Activities of JFCC

- Building Construction Committee, Information Technology Promotion Section, BIM special Section
  - Organized in 2010, 15 Contractors and 21 observer companies such as subcontractors, manufacturers, fabricators and BIM software vendors.
  - Purpose:
    - Promoting the standardization of specifications and usage.
    - Increasing the benefits of BIM in construction stage.
  - 2011: Published “Investigation of BIM usage in subcontractors, manufacturers and fabricators”
BIM Activities of JFCC

- 2012: Organized “BIM meeting for Subcontractors, Manufacturers and Fabricators”
- 2012: Performed “Cooperative Digital Mock-up Trial”.
- 2013: Started development of “Guidelines for BIM collaboration in construction stage”.

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Conclusion

Building Construction in Japan
- Major contractors have design divisions and can produce high-quality building economically in a short period of time by design-build system.
- Major contractors also perform research and development not only for the building quality and productivity but also for the global environment, the safety and the security.
- Fixed price contract is common in building industry.

Current Status of BIM in Japan
- Development of BIM Guidelines has been delayed from pioneering countries.
- The client side expectations for BIM is not strong yet. Architects and contractors are working on BIM for the purpose of their productivity improvement.

BIM Activities of JFCC
- BIM special section organized in 2010 and worked for increasing the benefits of BIM in construction stage.