Life-Span Extension and Renewal of Pipes
-Approach to sustainable water supply by Japan Water Industry-

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Outline

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2. Challenges & JFE’s Approaches

3. Life-Span Extension of Water Steel Pipe

4. Pipe Renewal (Pipe-in-pipe method)

5. Seismic Upgrade of Pipe (for Crossing Faults)

6. Summary
1. Background - Japanese population & water coverage rate -

- Population reached a peak in 2010, and decrease by 32% until 2060.
- Water coverage rate was 97.5% in 2010.
  - Service population and water revenue are decreasing.

Ministry of Health, Labour and Welfare, Transition of Water Coverage Rate
1. **Background**

- **Investments to water supply sector, and breakdown:**
  
- **Total investments to water supply sector in Japan:** 371 Billion USD (2005 price)
  
- **Investment reached 2 peak in 1970’s and 1990’s.**

- **Two thirds of investments** are for transmission and distribution; mainly **pipelines**.

- **Legal durable year is 40 years** for pipe in Japan.

  - **Pipe-renewal demands are increasing** now, to replace aged pipes.

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**Breakdown of investment**

- **Distribution:** 188
- **Transmission:** 42
- **Treatment:** 46
- **Conveyance:** 13
- **Storage:** 29
- **Intake:** 15
- **Others:** 39

*39.7 Trn. JPY

*USD 1.00 = JPY 107(20141021)
1. Background –pipe renewal and seismic upgrade-

Pipe renewal rate

Conformance rate of seismic capacity (only main pipelines)

<table>
<thead>
<tr>
<th>Year</th>
<th>Pipe renewal rate (%)</th>
<th>Seismic capacity conformance rate (%)</th>
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</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.97</td>
<td>28.1</td>
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<tr>
<td>2007</td>
<td>0.94</td>
<td>30.3</td>
</tr>
<tr>
<td>2008</td>
<td>0.88</td>
<td>31.0</td>
</tr>
<tr>
<td>2009</td>
<td>0.87</td>
<td>32.6</td>
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<tr>
<td>2010</td>
<td>0.79</td>
<td>33.5</td>
</tr>
<tr>
<td>2011</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.77</td>
<td></td>
</tr>
</tbody>
</table>

[References] Water Supply Statistics

- Pipe renewal rate is decreasing year by year.
  - It takes **130 years** to replace all pipes in case of present pace; **0.77%**.
- Conformance rate of seismic capacity is increasing year by year.
  - **Seismic upgrade** should be carried out with pipe renewal.
2. Challenges & JFE Approaches

**Challenges**
- To revise a master plan, based on adequate service area
- To speed up pipe renewal and seismic upgrade, when service population and water revenue are decreasing.

**JFE Approaches**
1. Revision of Pipe Implementation
   - To prolong pipe renewal cycle
     ➢ Development of life-span extension type of water steel pipe

2. Pipe Renewal
   - To install pipes in urban area
     ➢ Utilization of pipe-in-pipe method

3. Seismic Upgrade
   - To secure cross section area of passing water, after earthquake
     ➢ Development of steel pipe for crossing faults
2. Challenges & JFE Approaches -construction in metropolitan-
Challenges

- To revise a master plan, based on adequate service area
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JFE Approaches

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   - To secure cross section area of passing water, after earthquake
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3. Life-span Extension of Water Steel Pipe

Waterworks’ Needs
- Pipe renewal rate: **0.77%** in 2011
  - Expected durable year of new pipe is more than **100 years**.

How to Extend Life-span of Water Steel Pipe
- Coating should be thicker, according to technical development.
  - (Present) External coating: OK (durable for 100 years)
  - (Present) Internal coating: NG

  - 0.4mm (Traditional type) → 1.0mm (Life-span Extension type)

Standard of Life-span Extension type of Water Steel Pipe
- JWWA K157 「Method of Solvent-less Epoxy Coating for Water Supply」
  (Revision on 16th Jan. 2013)
- JIS G3443-4 「Coated Steel Pipes for Water Service - Internal Epoxy Coatings」
  (Revision on 20th the end of Oct. 2014 on schedule)
3. Life-span Extension of Water Steel Pipe -internal coating-

- Hand painting was/is utilized as on-site coating on general.

- Life-span extension type is difficult to paint, because of thick coating.
  - To develop coating machine, which is used inside pipe on construction site.
4. Pipe Renewal -pipe-in-pipe method-

(1) Open-cut method

- To replace pipes, by same or bigger diameter.
- To have negative impacts on neighborhood, road traffic and environment.

(2) Pipe-in-pipe method

- To replace pipes, by smaller diameter.
- Not to affect road traffic, and reduce soil volume from excavation.
4. Pipe Renewal -pipe-in-pipe method-

- Steel Pipe
- Rolled Steel Pipe →
  1. To secure cross-section area more widely
  2. To pass at existing bend pipe more long

**Steel Pipe**

**Rolled Steel Pipe**

Before expansion  After expansion
4. Pipe Renewal -pipe-in-pipe method-

- Steel Pipe
- Rolled Steel Pipe →

(1) To secure cross-section area more widely
(2) To pass at existing bend pipe more long
- The number of welding is reduced.

1) In case of using steel pipe only

2) In case of using rolled steel pipe
4. Pipe Renewal -pipe-in-pipe method, pipe transportation-
4. Pipe Renewal - pipe-in-pipe method, pipe installation -
4. Pipe Renewal -pipe-in-pipe method, pipe installation-
4. Pipe Renewal - pipe-in-pipe method, welding -
5. Seismic Upgrade for Crossing Faults

- Amount of horizontal displacement in the fault is assumed to be more than 2m.
- Leakage occurs due to pipe buckling or crack, if pipe undergoes displacement.
- “SPF” is adapted to the measurement to protect in the active fault.
6. Summary

• To solve water issues in Japan by technical development

• JFE’s Approaches
  ➢ Life-Span Extension of Water Steel Pipe
  ➢ Pipe Renewal (Pipe-in-pipe method)
  ➢ Seismic Upgrade of Pipe (for Crossing Faults)

• To contribute to the sustainability of waterworks, together with public sector.

• To contribute to solve water issues all over the world forever and ever.
Thank you very much for your kind attention!!