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International Forum on Water Supply @ Portmesse Nagoya

Life-Span Extension and Renewal of Pipes

-Approach to sustainable water supply by Japan Water Industry-

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Outline

1. Background

2. Challenges & JFE's Approaches

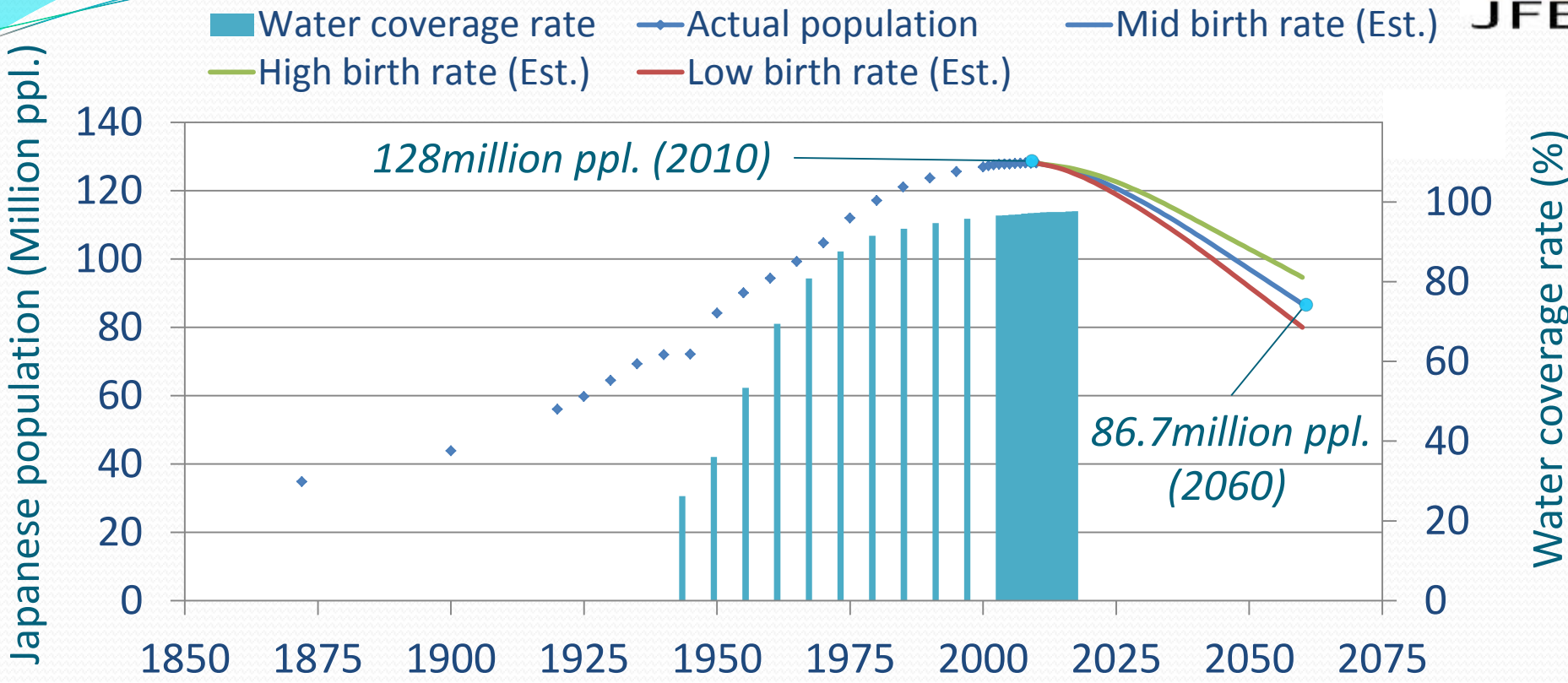
3. Life-Span Extension of Water Steel Pipe

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

5. Seismic Upgrade of Pipe (for Crossing Faults)

6. Summary

1. Background -Japanese population & water coverage rate-

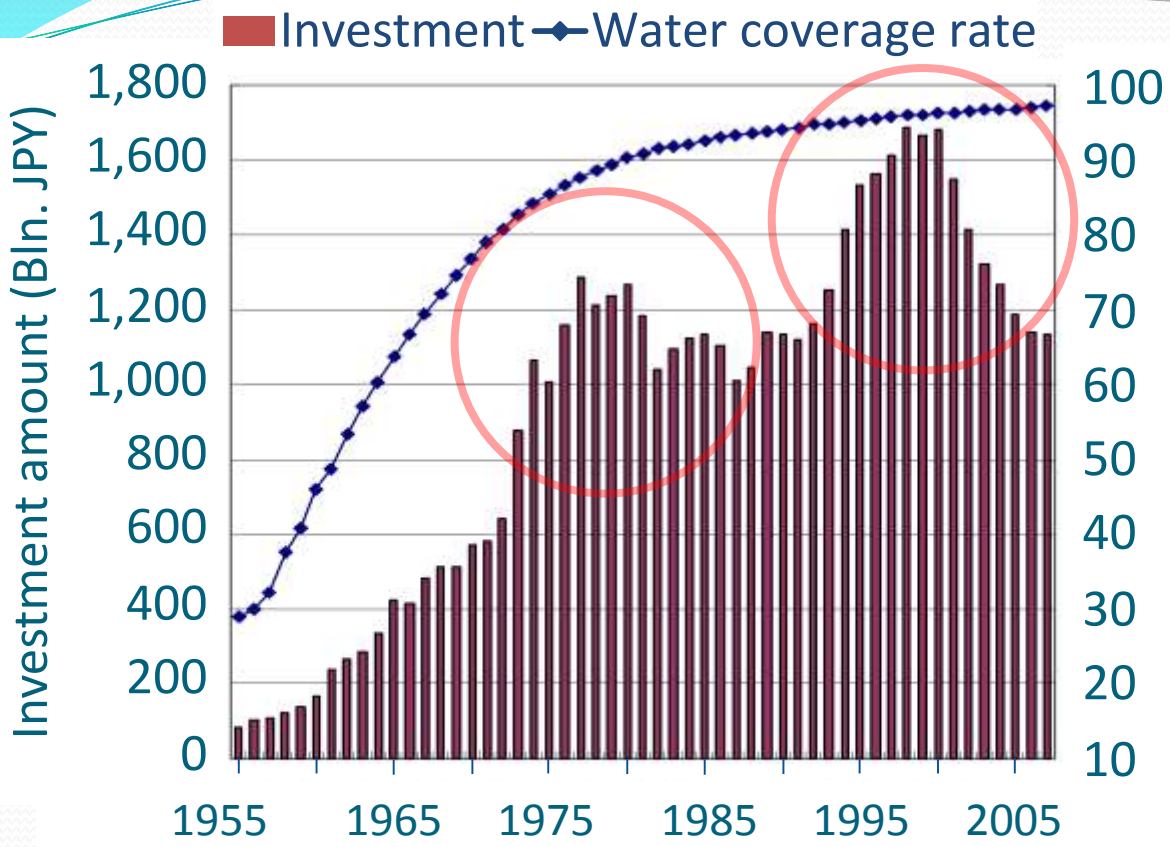


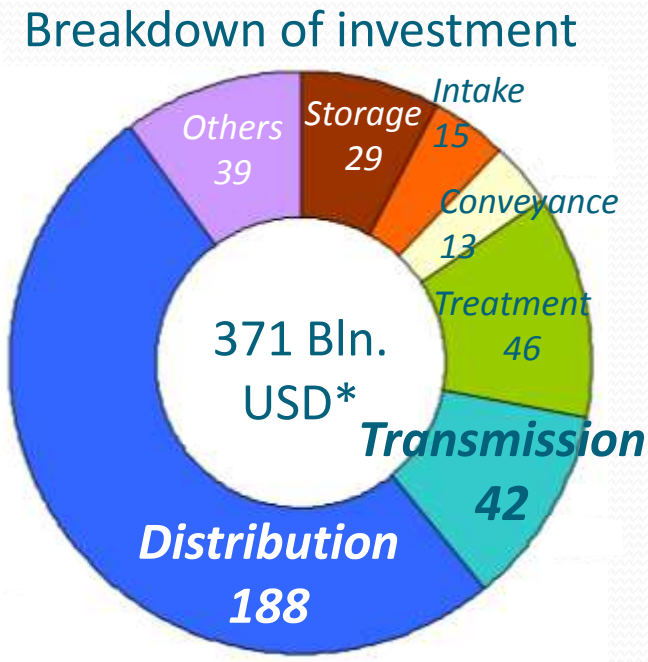
* In case of med death rate

[References] National Institute of Population and Social Security Research, Future Estimated Population in Japan, 2012.01
Ministry of Health, Labour and Welfare, Transition of 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.

1. Background -investments to water supply sector, and breakdown-



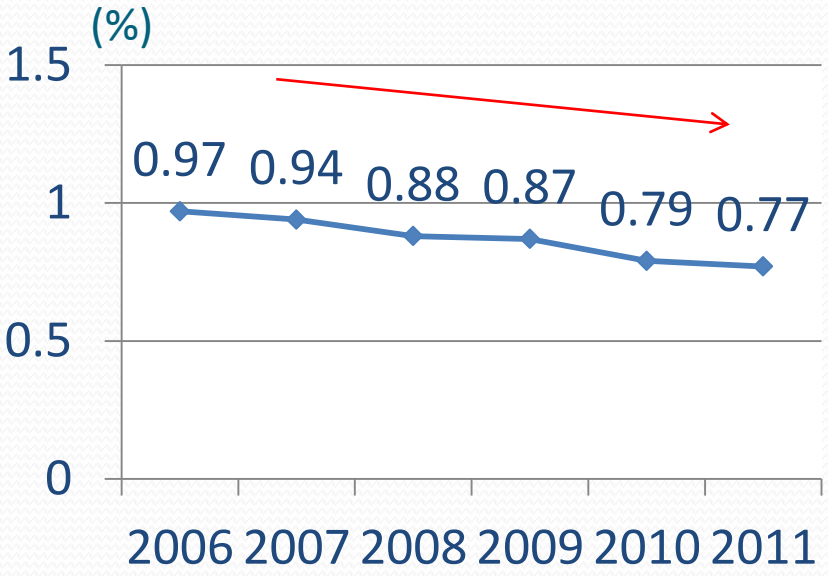


[Reference] Ministry of Health, Labour and Welfare, Handbook of Asset Management for Water Supply Sector, 2009.7

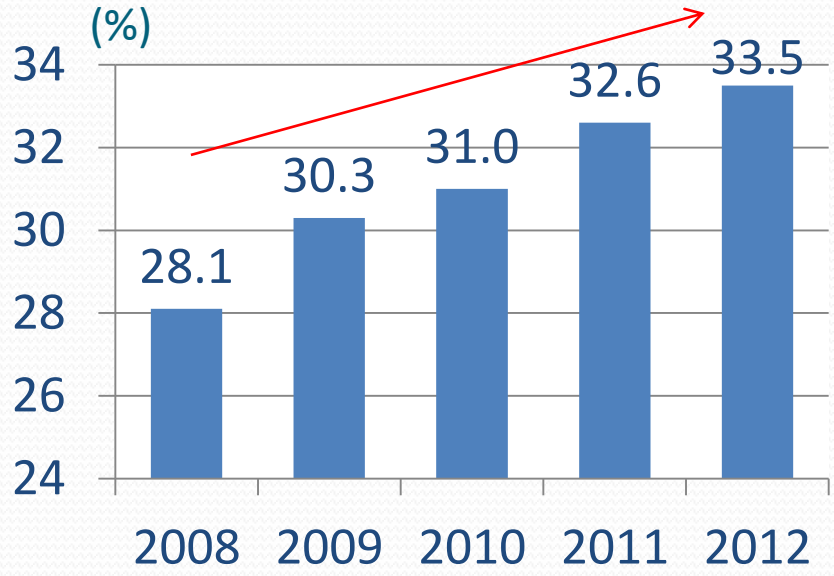
- Total investments to water supply sector in Japan: 371 Billion USD (2005 price)
- Investment reached 2 peak in 1970's and 1990's.
- Two thirds of investments are for transmission and distribution; mainly pipelines.
- Legal durable year is 40 years for pipe in Japan.
  - ➢ Pipe-renewal demands are increasing now, to replace aged pipes.

1. Background -pipe renewal and seismic upgrade-

Pipe renewal rate



Conformance rate of seismic capacity (only main pipelines)



[References] Water Supply Statistics
Ministry of Health, Labour and Welfare, Implementation of Seismic Upgrade for Water Supply Facilities

- 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-

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Challenges

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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.

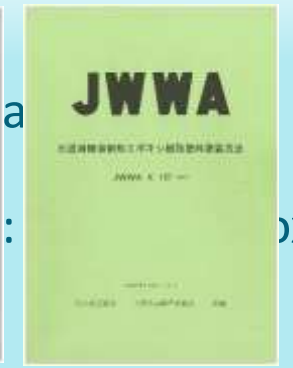
How to Extend Life-span of Water Steel Pipe

- 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 Ste

- JWWA K157「Method of Solvent-less Epoxy Co a
  (Revision on 16th Jan. 2013)
- JIS G3443-4「Coated Steel Pipes for Water Ser : oxy Coatings」
  (Revision on 20th the end of Oct. 2014 on schedule)



3. Life-span Extension of Water Steel Pipe -internal coating-

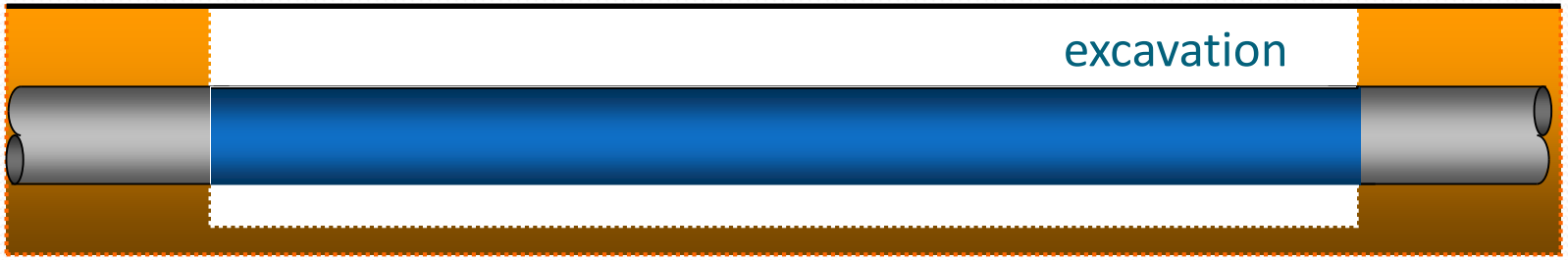
- Hand painting was(is) utilized as on-site coating on general.

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

Manhole 600A

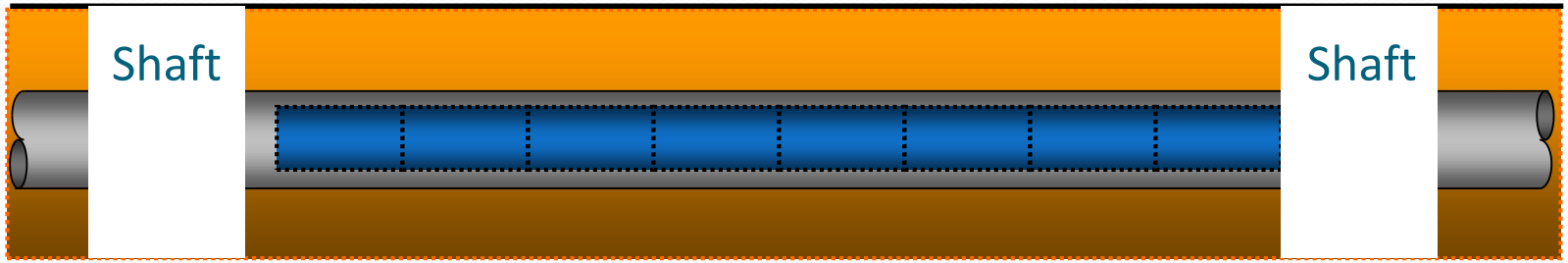
4. Pipe Renewal -pipe-in-pipe method-

(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

写真

Rolled Steel Pipe

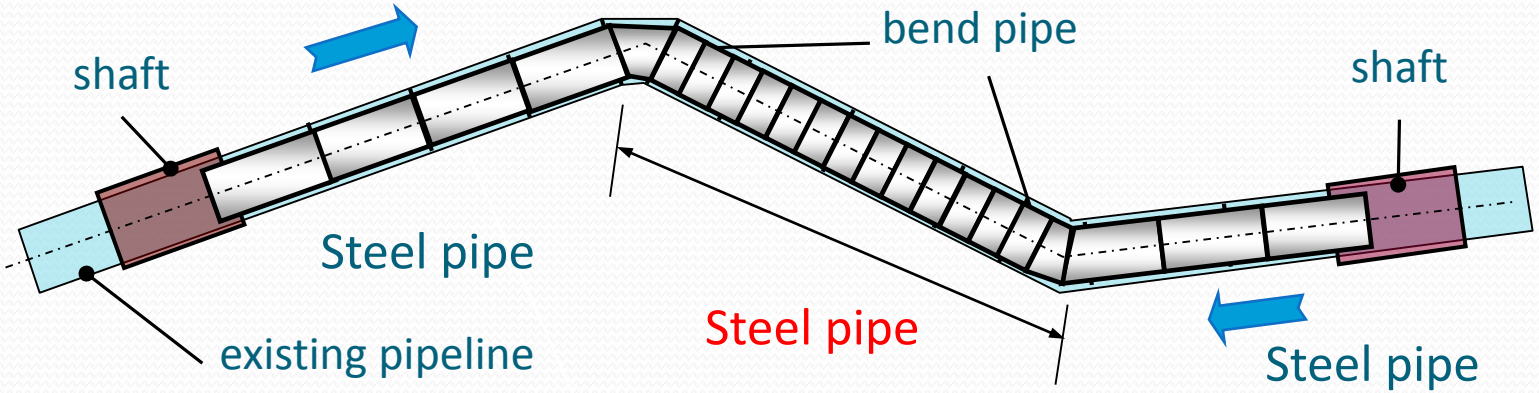
Before expansion

After expansion

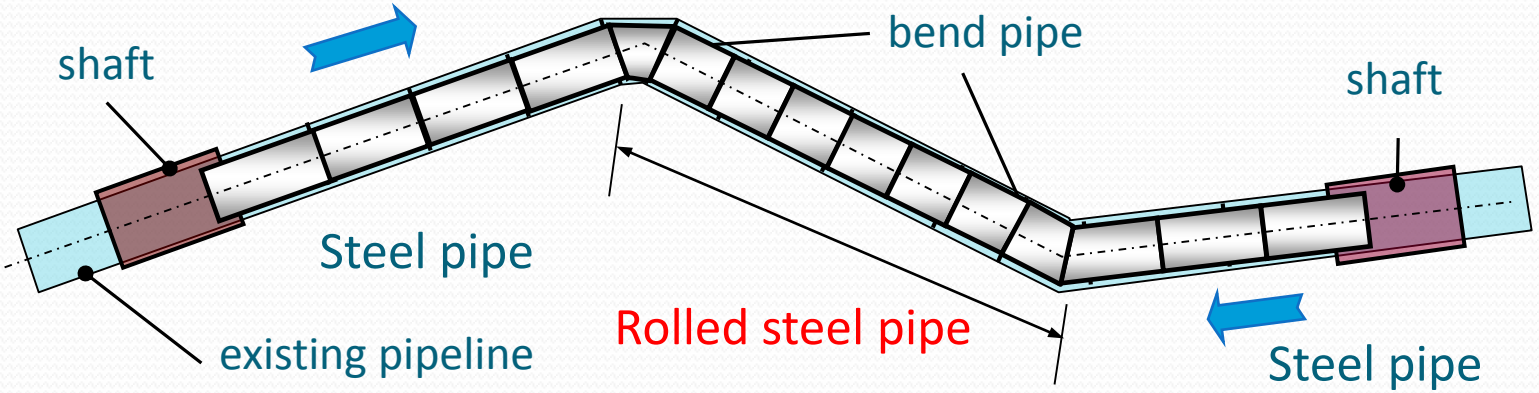
4. Pipe Renewal -pipe-in-pipe method-

- 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



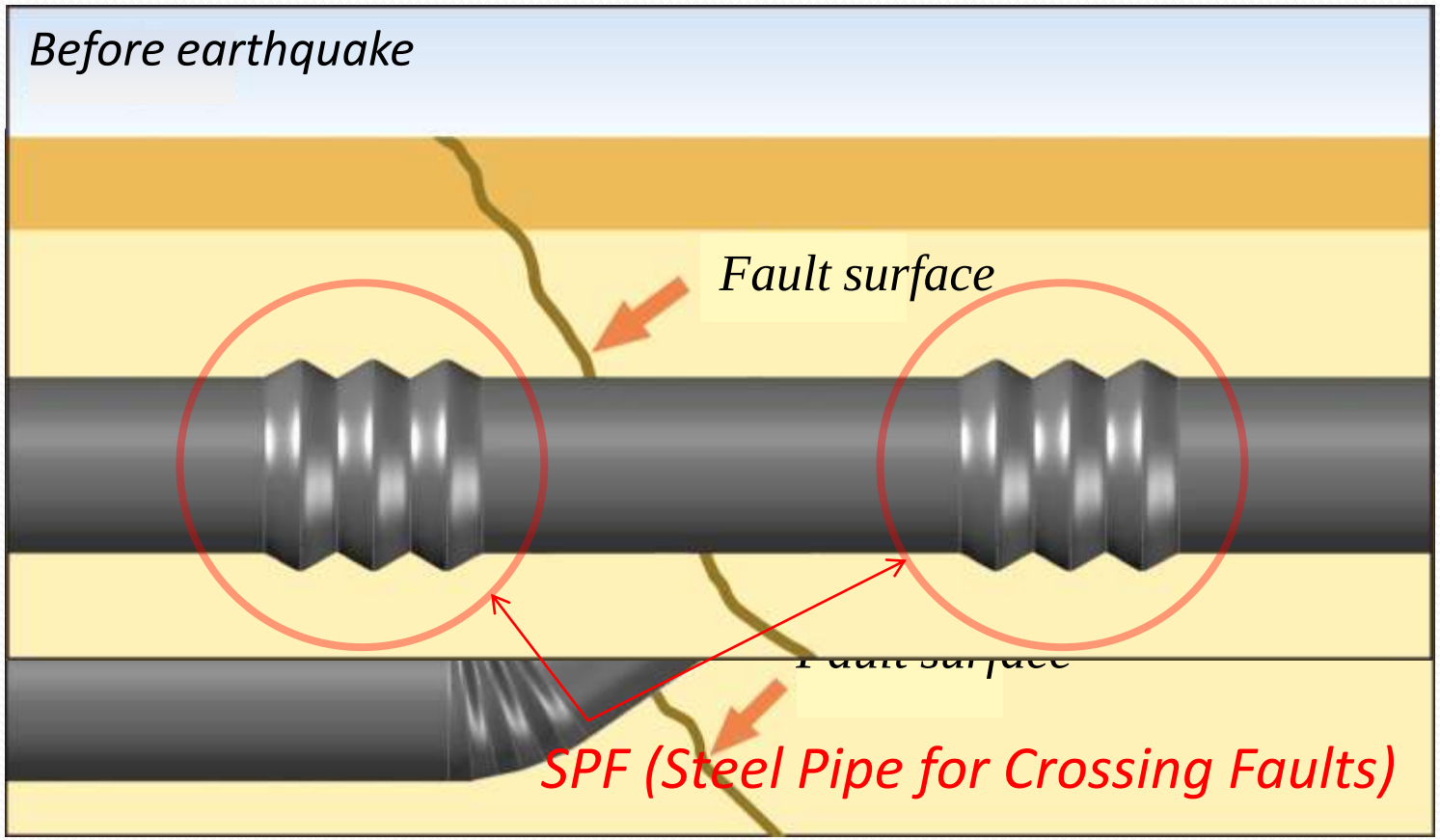
4. Pipe Renewal -pipe-in-pipe method, pipe transportation-

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!!