Griffith 2007.11.14

Inspection, evaluation and Maintenance

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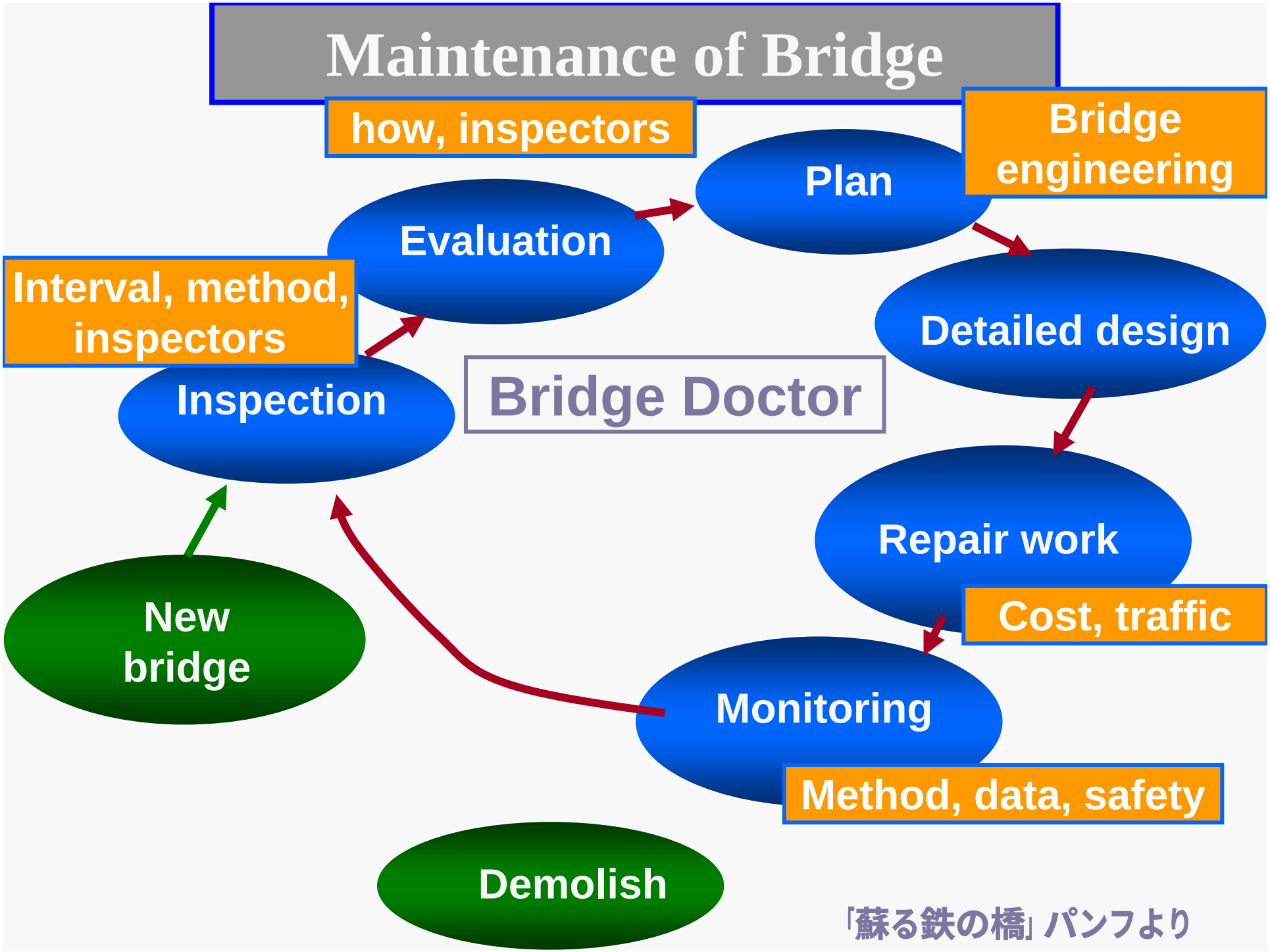
Introduction

1. Bridge Management system
2. **Inspection, evaluation and maintenance**
3. Fatigue of steel members
4. Stress measurement and Bridge Weigh-in-Motion
5. Retrofitting, example of orthotropic steel deck
6. Corrosion and anti-corrosion measure

1. Bridge inspection
2. Example of bridge inspection system of Japanese National Roads
3. For easy inspection
4. Evaluation
5. Maintenance
6. Some examples of poor inspection in Japan


Maintenance of Bridge
how, inspectors
Bridge engineering
Plan
Evaluation
Interval, method, inspectors
Detailed design
Inspection
Bridge Doctor
Repair work
Cost, traffic
New bridge
Monitoring
Method, data, safety
Demolish
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Example of bridge inspection (modified 2004)

Daily inspection: once every day from patrol cars.

Check safety of road surface.

Inspection on Foot: occasionally on foot.

Check with telescope under the bridge.

Periodic inspection: 10 years interval.

Visual inspection close to structural member.

Detailed inspection: when needed.

For new type of problem using NDT equipment.

Special inspection: after typhoon or earthquake.

Visual inspection.

Daily inspection, Inspection on foot

Daily inspection

Safety of road surface.

Expansion joints.

Inspection on foot.

Any deterioration under the bridge.

Danger to the third party.

Periodic inspection, every 5 years

Periodic inspection

Visual inspection, but close to inspection points using special lift.



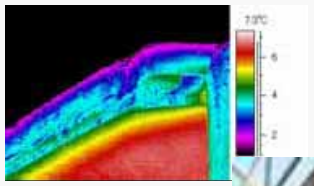





Detailed inspection and special inspection

Detailed inspection

Inspection for particular deterioration often s using NDT equip.



Special Inspection

After Typhoon and earthquake, usually by visual inspection on foot.

Kobe Earthquake 1995

Tools to help better inspection

Good access to details:	System for easy inspection (Japan vs. Germany)
Training program for inspectors:	Lectures and on-site training. Corrosion map, fatigue crack map
Advice by experts:	On-site training. Corporation with researchers.
Tools:	Paint View, remote sensing, monitoring
Evaluation:	

Easy access for better inspection

Trockou B. (Germany)

Access to expansion joints

Easy access for better inspection

Luzerndorf B. (Germany) Roadside space for inspection

Poor access prevented better inspection

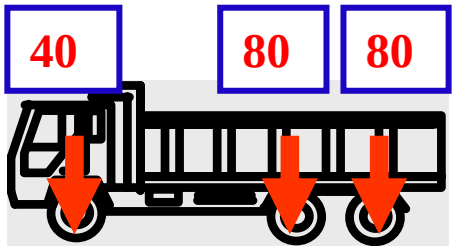
Poor Case 1: No inspection deck for slow lane.

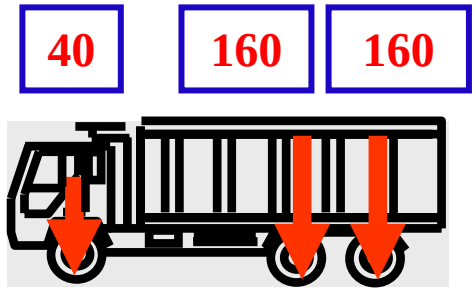
Crack of 1 m long was found in Oct. 2006.

What to inspect?

- No knowledge, no seen.
- See, observe, inspect, watch, consult, grasp, etc.
- Corrosion map, fatigue crack map, etc.
  (traffic condition, repair history, etc.)
- **Priority**
  1. Structural deficiency
  2. Danger to the third party
  3. Expected fast rate of deterioration
  4. Others

Overloaded Dump Truck?



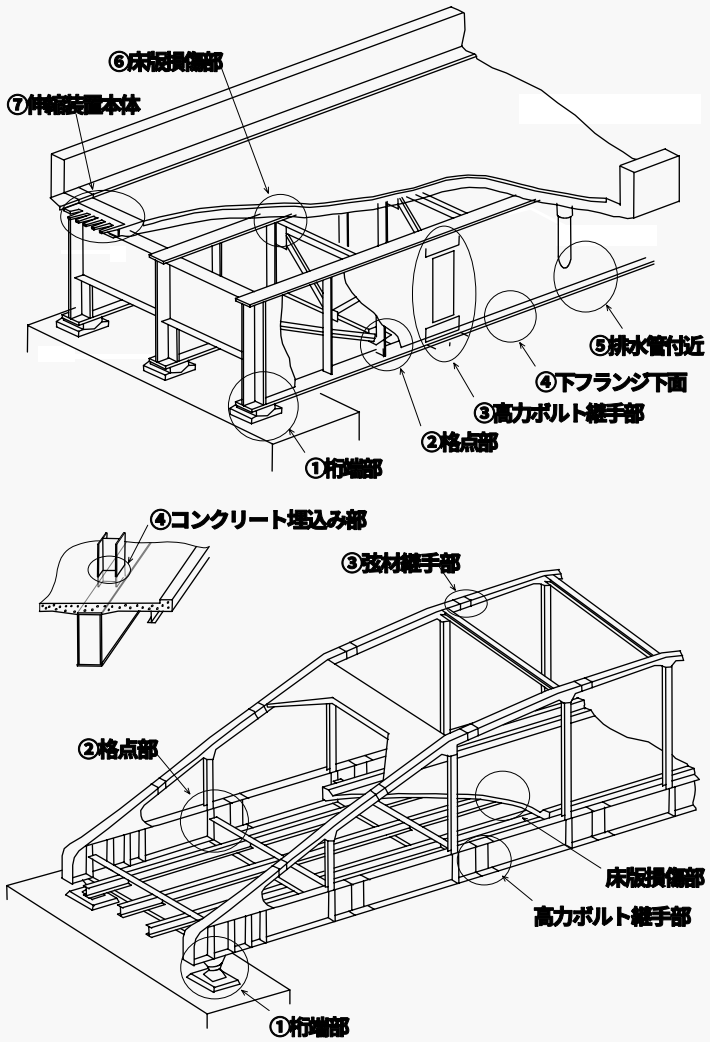


Indonesia

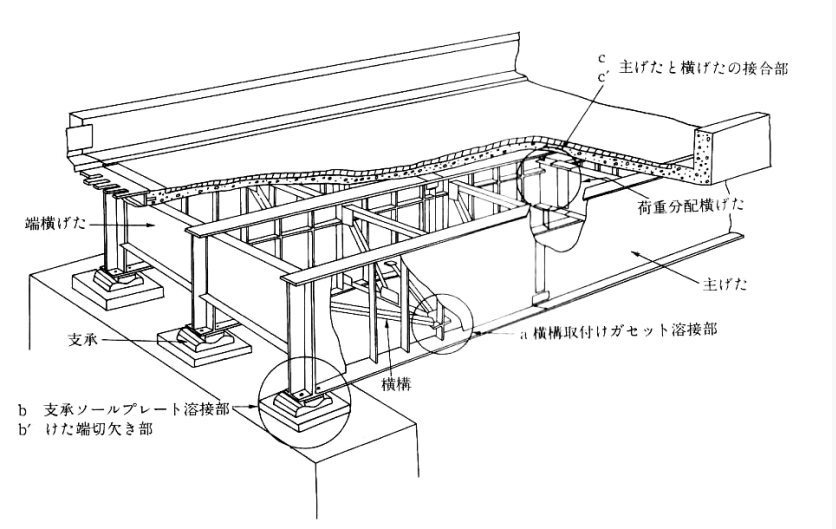
Dump truck to be used for cargo with volume.

Information prior to inspection (General)

Corrosion Map



Fatigue Crack Map

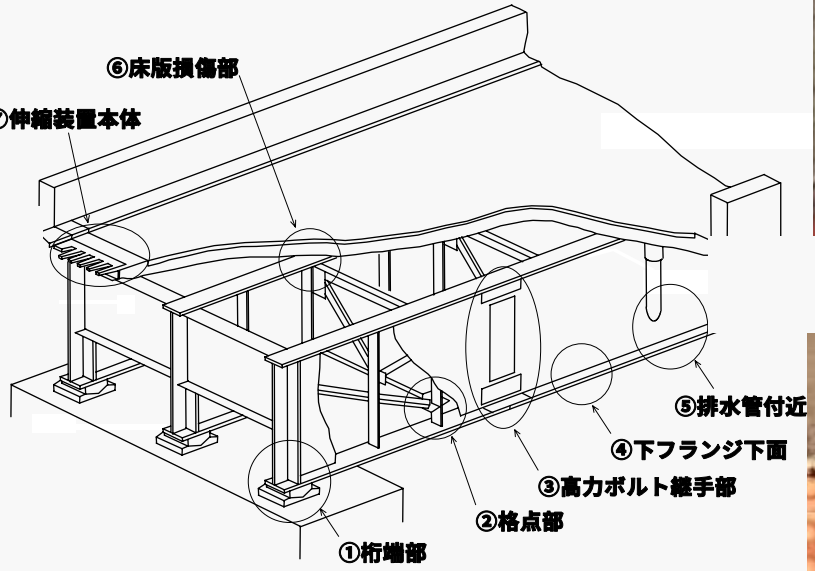


Such information can be used to educate inspectors.

Each country has its own trend of damages.

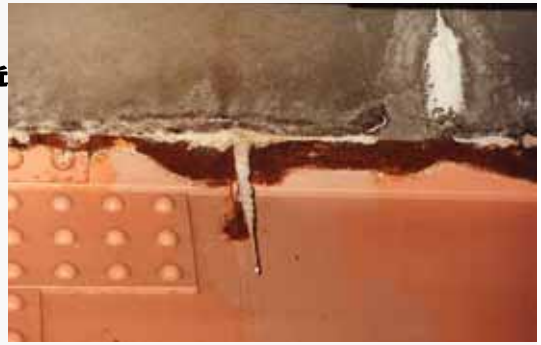
Corrosion Map (Plate Girder)

Shoe and Girder End



Drain

Panel Point



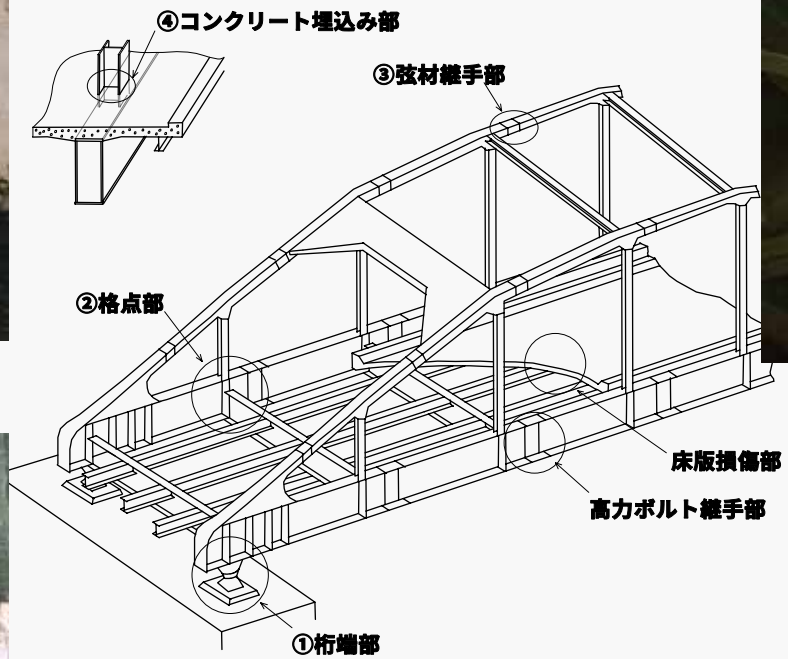
Bolted Joint

Lower Flange

Expansion Joint

Corrosion Map of Langer Bridge

Girder End



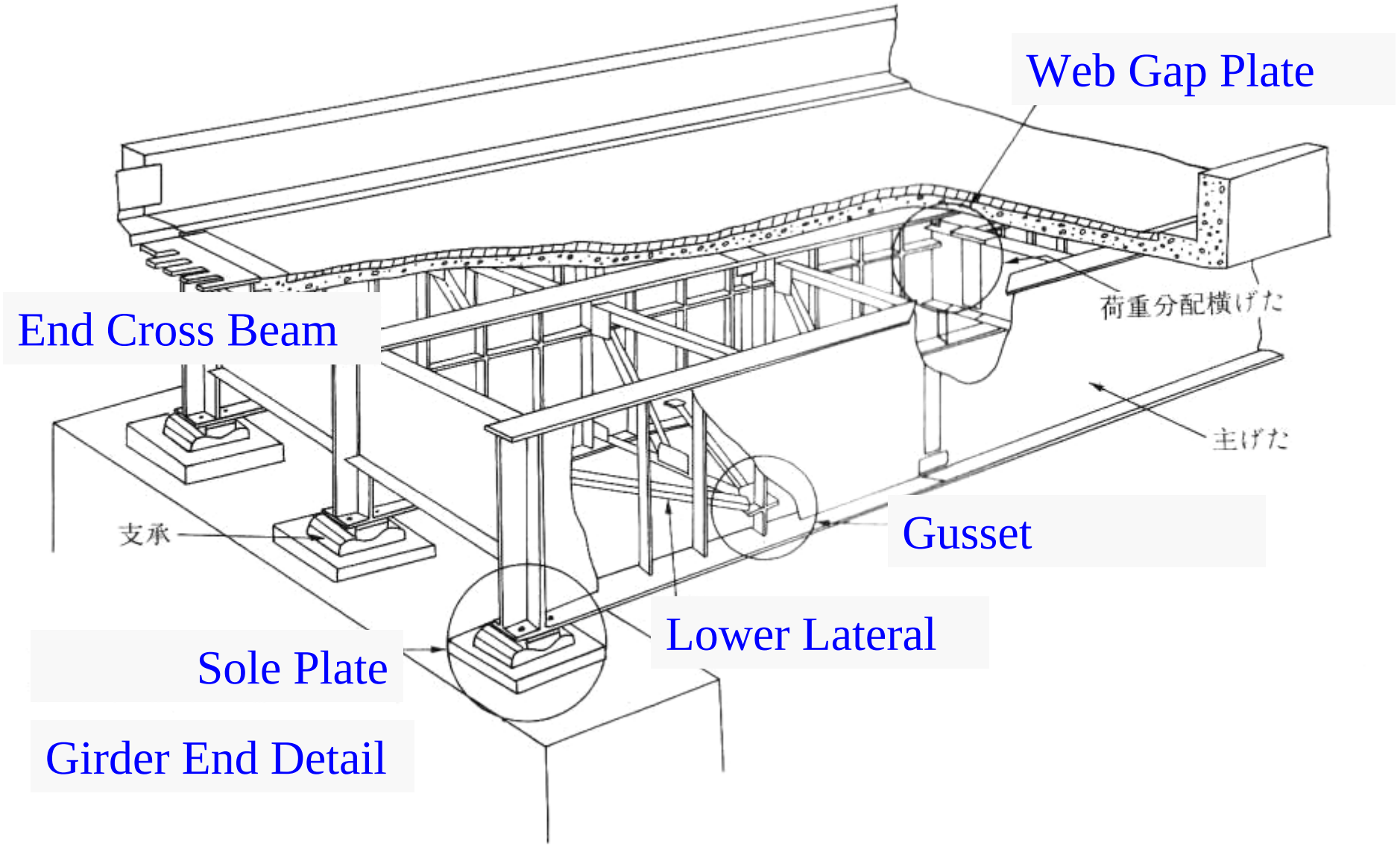
Panel Point

Panel Point

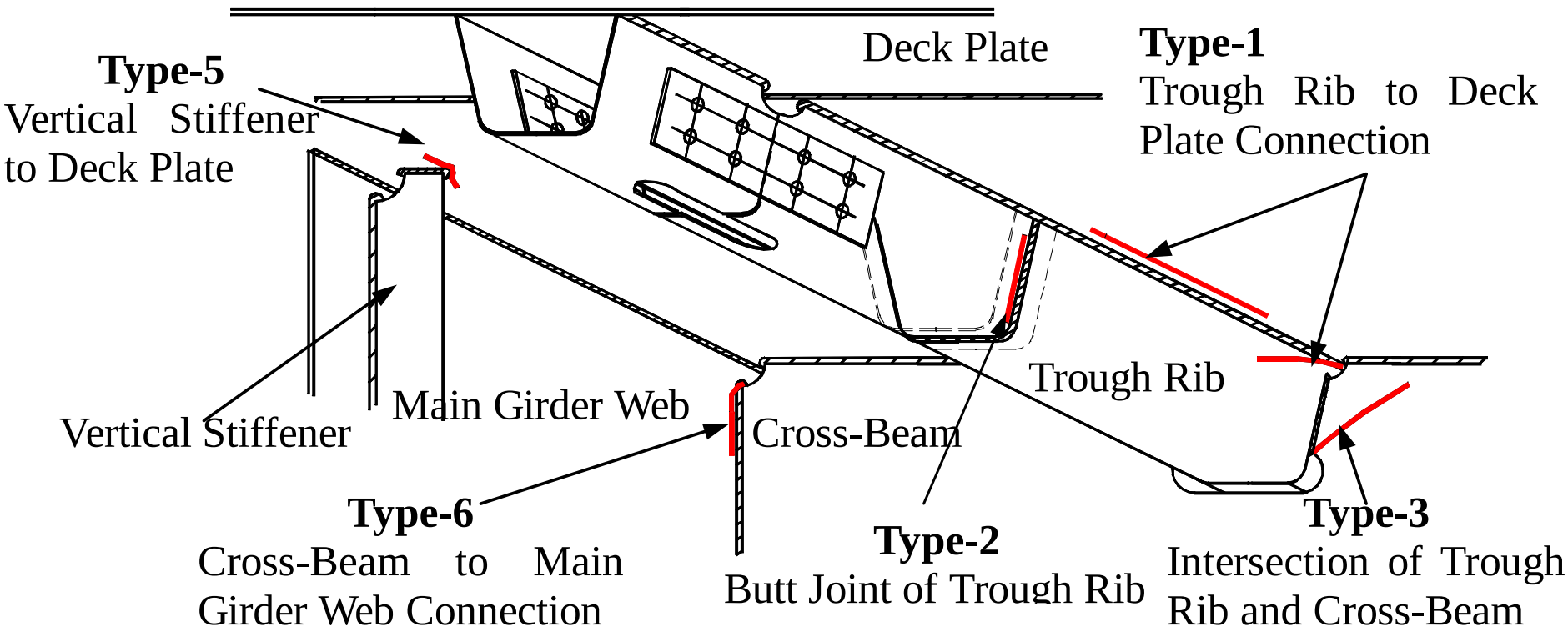
Joints

Steel and Concrete

Fatigue Crack Map (Plate Girder)

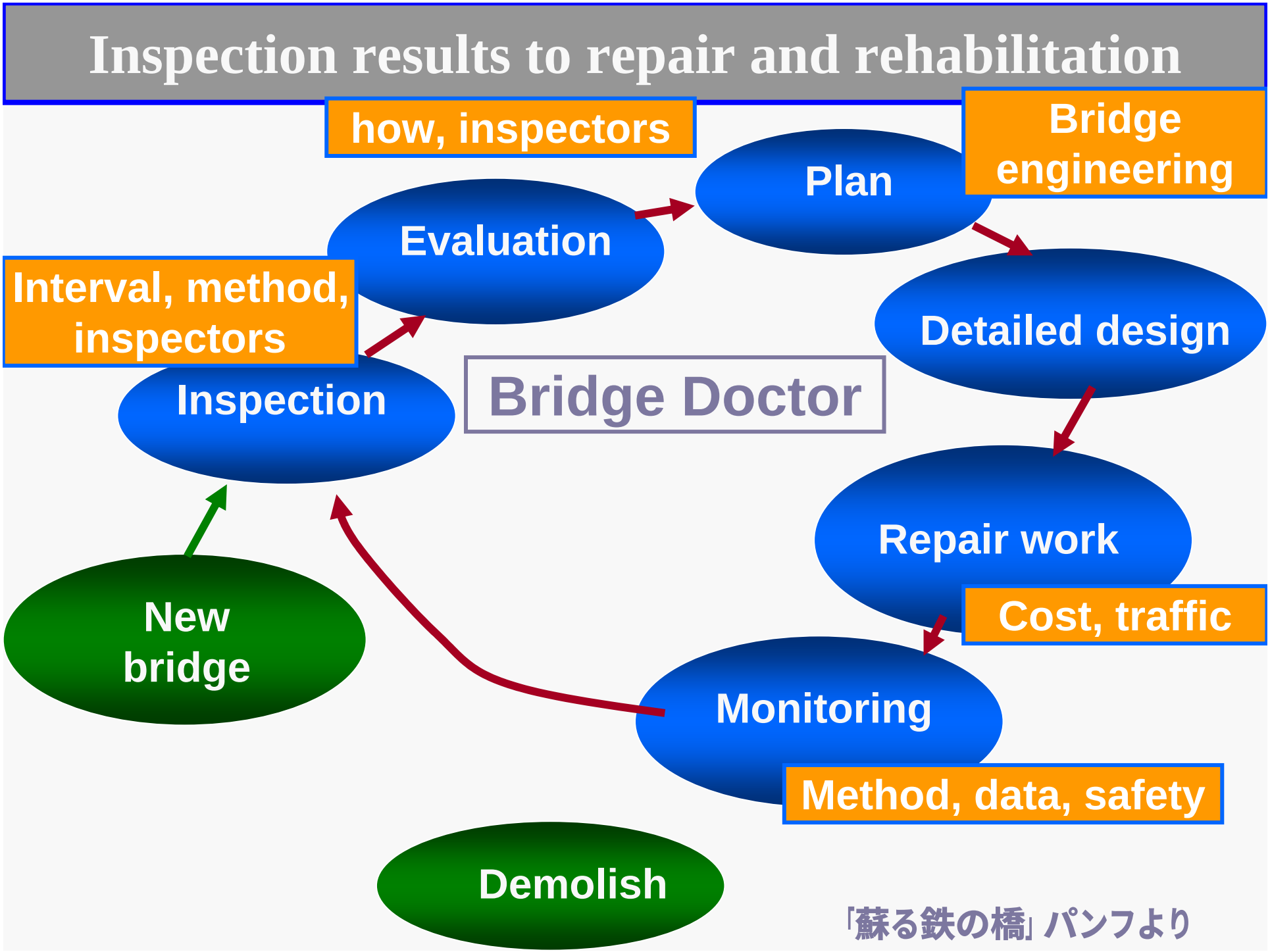


Fatigue Crack Map (Orthotropic Steel Deck)



Courtesy MEX

Inspection results to repair and rehabilitation



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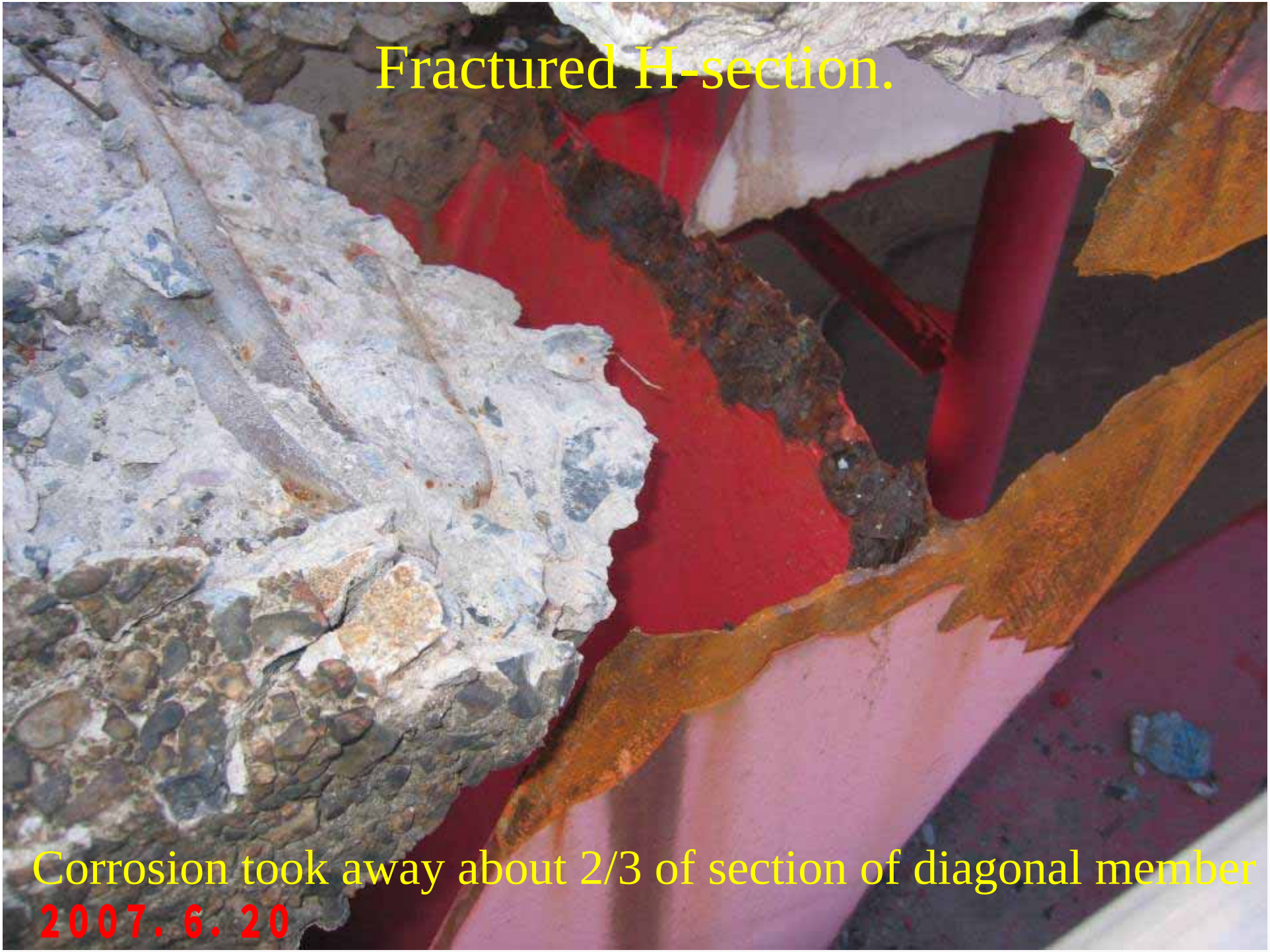
Example of poor inspection

One of diagonal member of truss failed due to corrosion in June, 2007 near Nagoya.

Support was placed around 5:00 pm


Fractured H-section.
Corrosion took away about 2/3 of section of diagonal member
2007. 6. 20


Bridge was inspected 18 months before.
Inspectors failed to find such deterioration.
Paint was placed on patina.
Nobody checked when the bridge was re-painted.