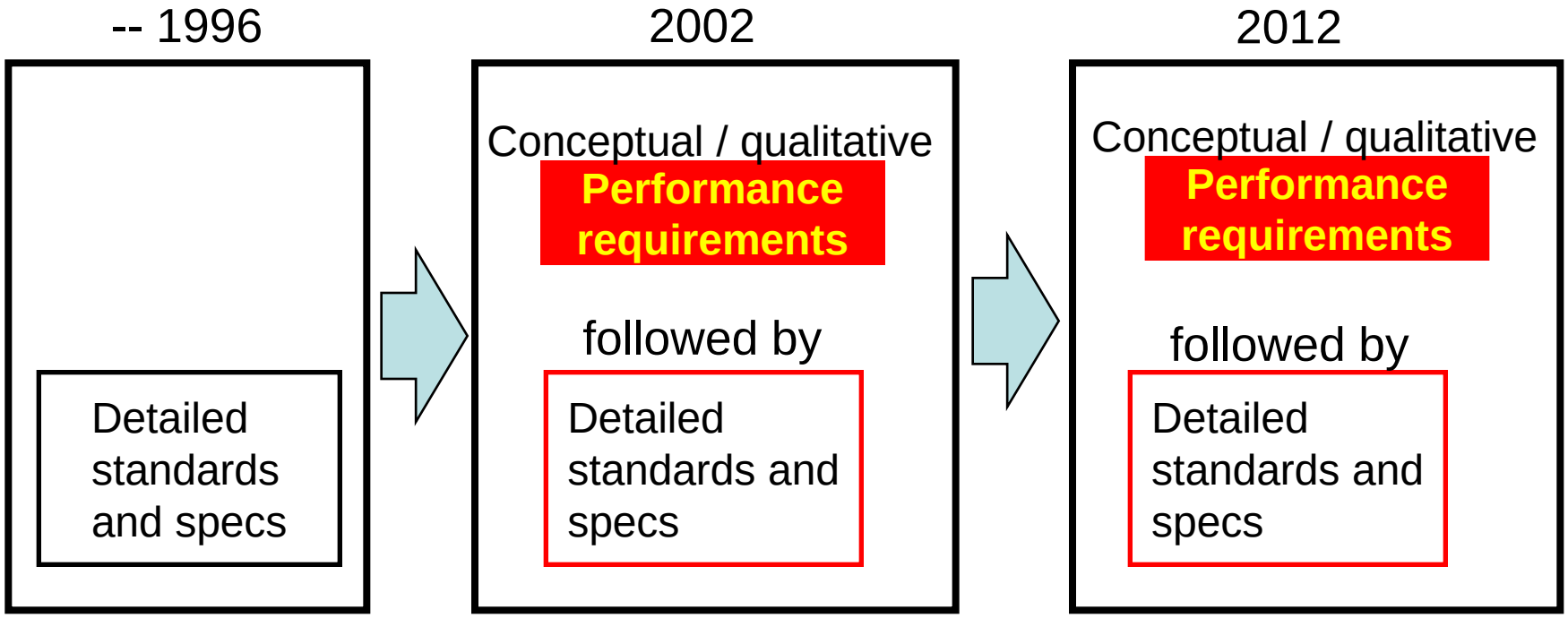
# 2002 & 2012 Specifications for Highway Bridges

1. International trend in promoting performance-based codes to ease trade barriers (ISO2394 (1998))
2. Flexible acceptance to innovative technologies in construction projects to meet diversifying technical proposals
3. Needs for durable and maintenance-friendly structures

**Advent of Performance-based Specifications**

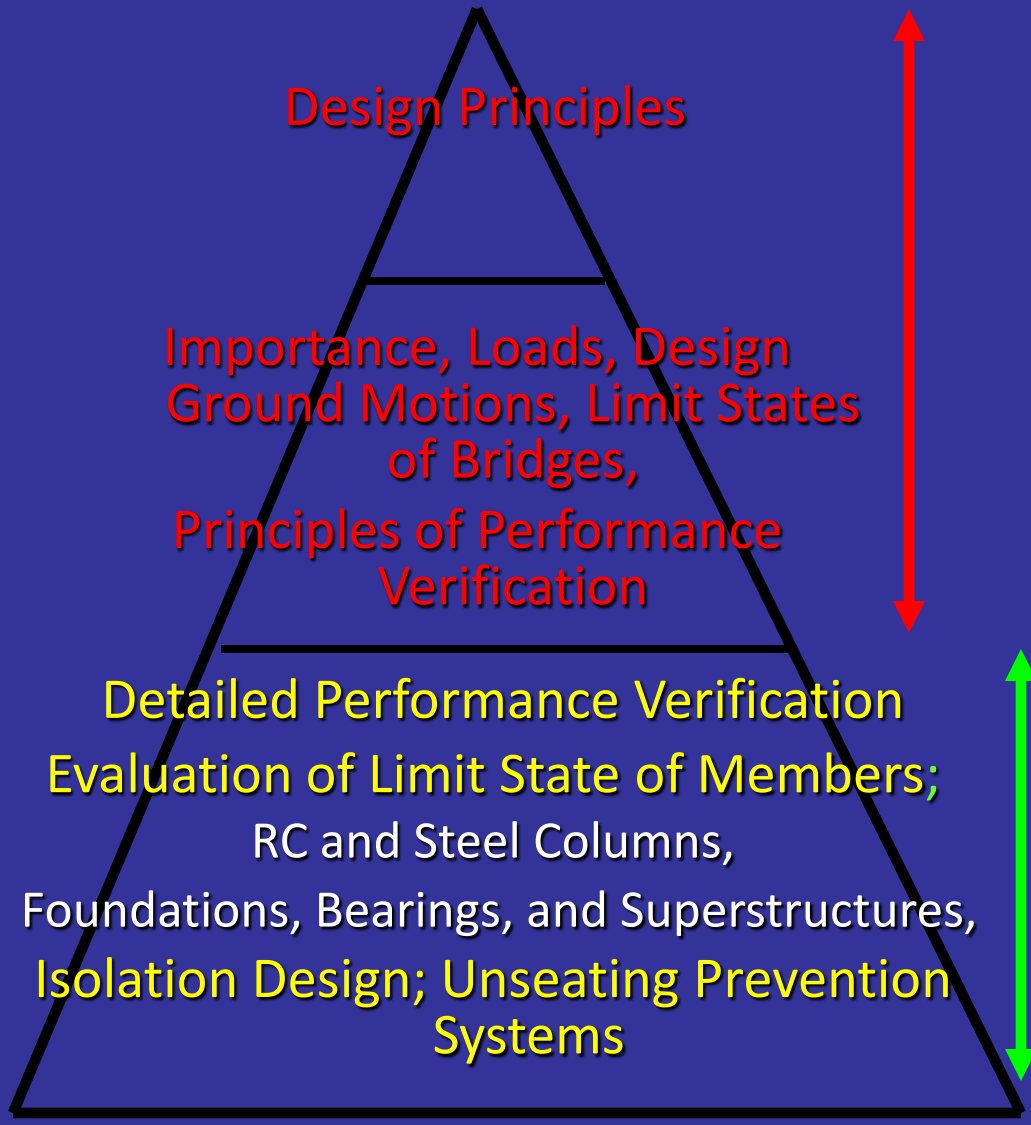
1) From prescriptive to performance-based: Required performance criteria were philosophically set out, as requested by ISO2394
2) Performances comes first and mandated. Standards are regarded as acceptable solutions. Alternatives can be confirmed to see if the alternatives offer equivalent or greater performances than the standards.
3) Prescriptions for durability demands on fatigue in steel members, and chloride ingress in concrete members, durable RC deck slab design etc were shown.
4) A maintenance planning and relevant countermeasures are required in initial design.

# Need to articulate more regarding performance requirements and evaluation procedures




- To accept professional ideas and proposal in structural types, modules, and materials --- Performance requirements have to be shown for competent agency to check their proposals.
- Detailed standards and specs are also necessary for competent agency to check their proposal by comparison in terms of reliability

# e.g. Hierarchy of the Specifications




**Requirements (Mandatory and unaltered)**

**Acceptable Solutions (Can use other methods after an Appropriate Verification)**

# e.g. Hierarchy in Each Article

**Concrete bridges --- Chapter 4 Details**

**Article 4.4.1 Cover depths**

1.Cover depths shall be deeper than those shown in Table-4.4.1.

2.Cover depths also shall be larger than the diameter of reinforcement bars.

| Types of members | Deck slabs, parapet walls, slab bridges shorter than 10m | Girders | |
|---|---|---|---|
| | | Factory-made precast girders | Others |
| Minimum depths | 30mm | 25mm | 35mm |

**Concrete bridges --- Chapter 6 Details**

**Article 6.6.1 Cover depths**

*1.Cover depths shall be designed to secure bonds between concrete and reinforcement, prevent from corrosion of reinforcement, and make reinforcement insensitive to fire.* ***<<Performance criterion>>***

2. Article 1 is satisfied when cover depths are given larger than the values specified in Table-6.6.1 and the diameter of reinforcement. ***<<Acceptable solutions>>***

# Sharing problems

- Fast construction

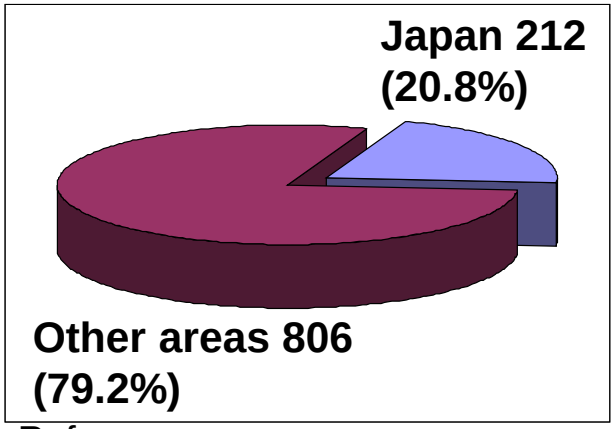
  e.g.

  – Urban Areas

- Maintenance friendly design

# Maintenance-friendly structures

**Frequency of earthquakes over M6 (yr1999-2008)**




Reference;
*White Paper* on Disaster Management

**Fatalities in recent large quakes**

| Mo/Yr | Name | M |
|---|---|---|
| Sept 2003 | 2003 Tokachi-Oki | M8.0 |
| Oct 2004 | 2004 Niigataken-Chuetsu | M6.8 |
| Mar 2005 | Hukuokaken-Seihouoki | M7.0 |
| Mar 2007 | 2007 Notohanto | M6.9 |
| July 2007 | 2007 Niigataken-Chuetsuoki | M6.8 |
| June 2008 | 2008 Iwate-Miyagi Nairiku | M7.2 |

Source;
*Japan* Meteorological Agency *www.jma.go.jp/*

# Bridge Scour

| Earthquake | | | Collapsed | Flood | | Damaged |
|---|---|---|---|---|---|---|
| 1964 | Niigata | (M7.5) | 8 | 1972 | Baiu Front | 1,572 |
| 1968 | Tokachi | (M7.9) | 0 | 1982 | Typhoon | 586 |
| 1978 | Izu Island | (M7.0) | 0 | 1983 | Typhoon No.10 | 422 |
| 1978 | Miyagiken-oki | (M7.4) | 1 | 1985 | Baiu Front | 212 |
| 1982 | Urakawa-oki | (M7.1) | 0 | 1990 | Typhoon No.19,20 | 270 |
| 1983 | Nihonkai-chubu | (M7.7) | 0 | 1991 | Typhoon No.18 | 145 |
| 1993 | Kushiro-oki | (M7.8) | 0 | 1993 | Typhoon No.13 | 108 |
| 1993 | Hokkaido-NW | (M7.8) | 0 | 1995 | Baiu Front | 110 |
| 1994 | Hokkaido-E | (M8.1) | 0 | | | |
| 1994 | Sanriku | (M7.5) | 0 | | | |
| 1995 | Hyogoken-nanbu | (M7.2) | 9 | | | |

**Typhoon No.9, Sep 2007**

Source;
http://www.nikkei.co.jp/news/main/im20070907SSXKF007807092007.html

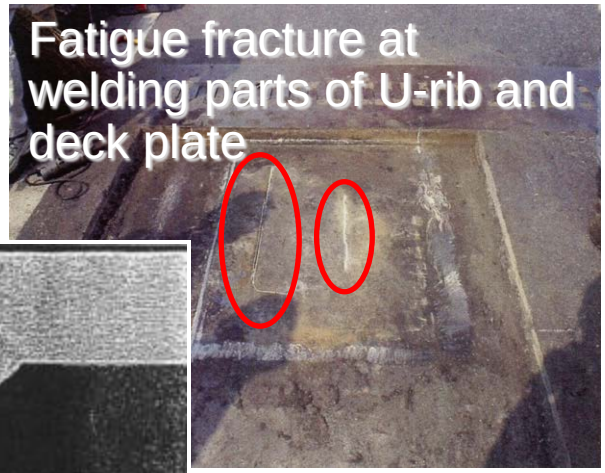
# Severe cold to tropical hot weather

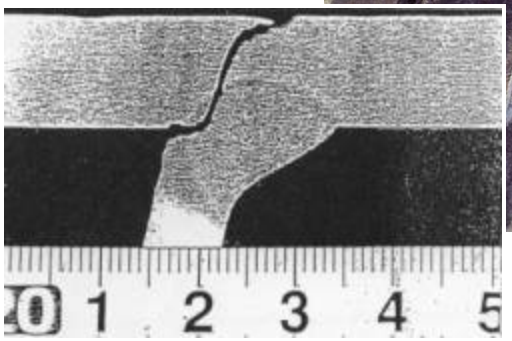
Not only thermal effects but also humidity and chloride conditions are severe to the durability of bridges.

# A further protection is required for bridges built on the shoreline


# Major disress

**(A1)**



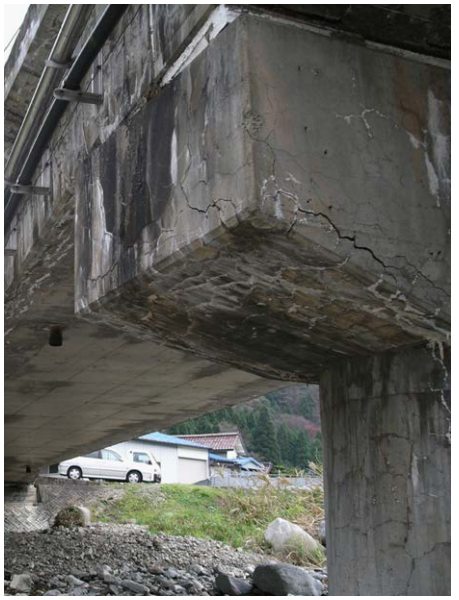
**(A2)**

Fatigue fracture in a steel main girder, Yamazoe Bridge, R25, constructed in 1971.

**(B)**

Anatomic survey for Kuretsubo overpass, R7, constructed in 1965, that suffered from salt attack.

**(C)**



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