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Asset Management of Japanese Expressways after the Earthquake

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NEXCO

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- Earthquake feature
- Damage situation
- Time management to recover expressways
- Successful factors for the management
- Challenges
- Conclusions

The 2011 off the Pacific coast of Tohoku Earthquake

<Outline >

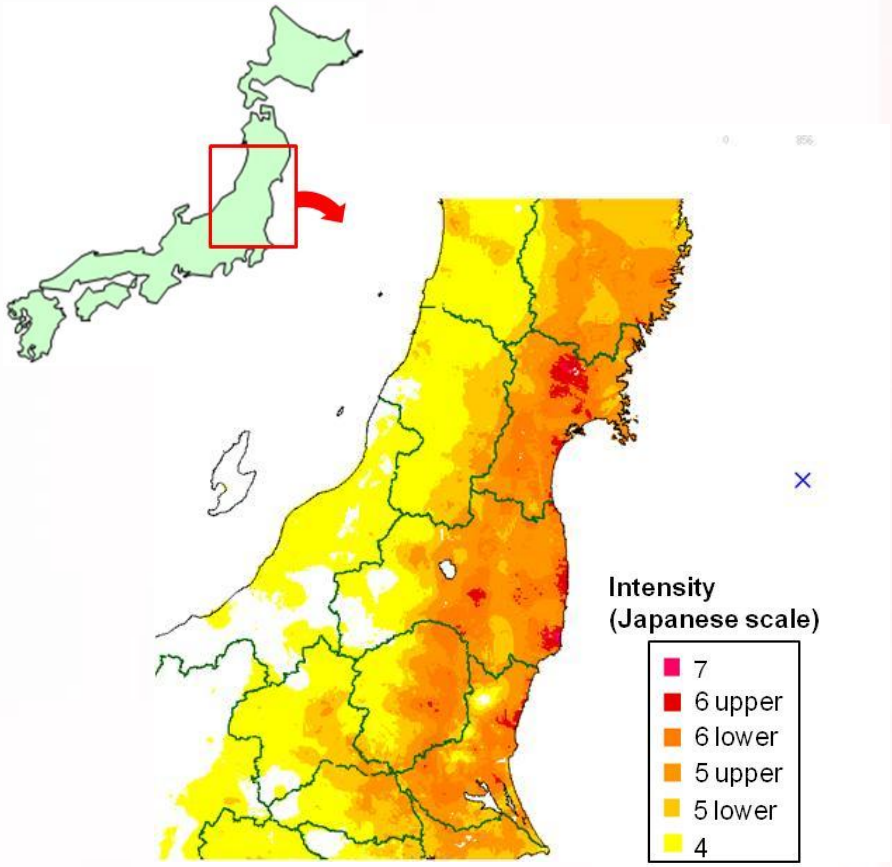
- **Date and time of occurrence**:
  March 11 2011, at 14:46pm

- **Magnitude (Mw) and intensity**: **9.0** (provisional value), **Max. intensity 7** (on Japanese scale) (Kurihara city, Miyagi)

- **Location and depth**: **Off Sanriku coast** (38.1N 142.9E, approx. 130 km east-southeast of Oshika Peninsula, depth approx. 24km)

- **Focal mechanism**: Reverse fault with pressure axis running west-northwest to east-southeast

- **Fault size**: Approx. 450km long, 200km wide
  Fault slippage: Max. 20-30m

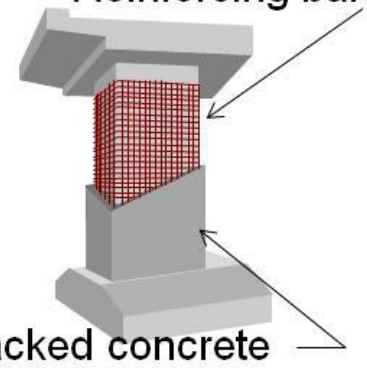


Flood Situation by Tsunami along Toll Road

Earthquake-resistant countermeasures

The anti-earthquake design standard of the bridge was revised as the result of large-scale damages of bridge by Hanshin-Awaji Earthquake (1995,M7.3)

【Earthquake-resistant reinforcement works】



■ **Almost 100% bridges completed**

1

Typical damages on bridges & Viaducts

Typical damages on pavement & embankment





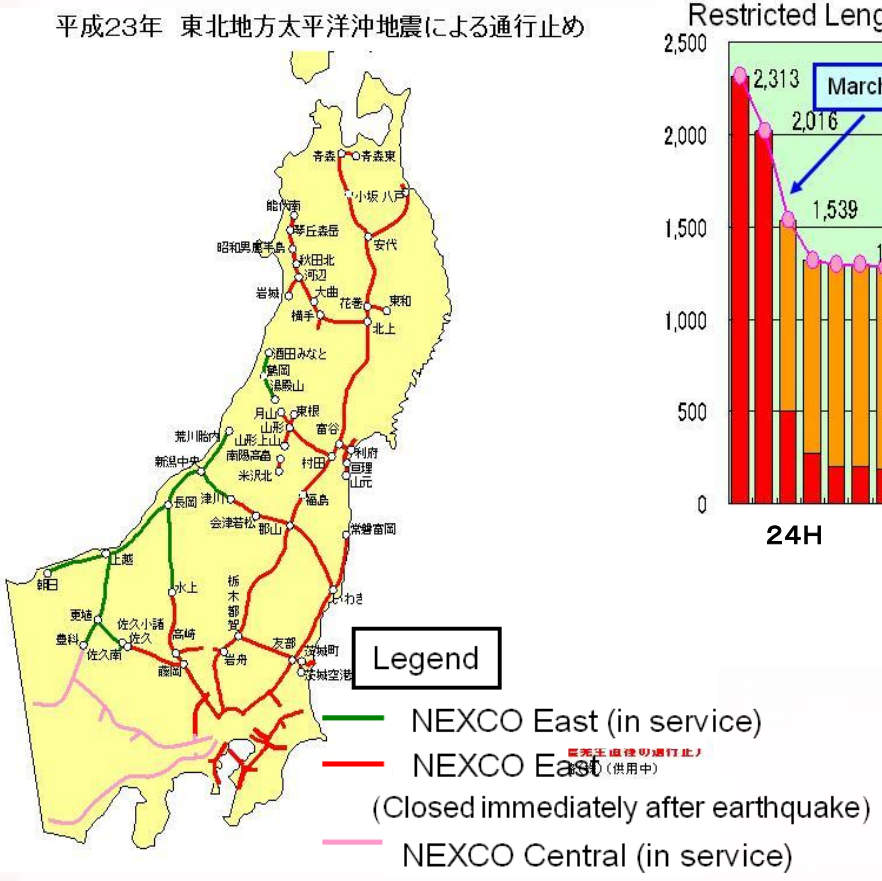

Securing Emergency Routes

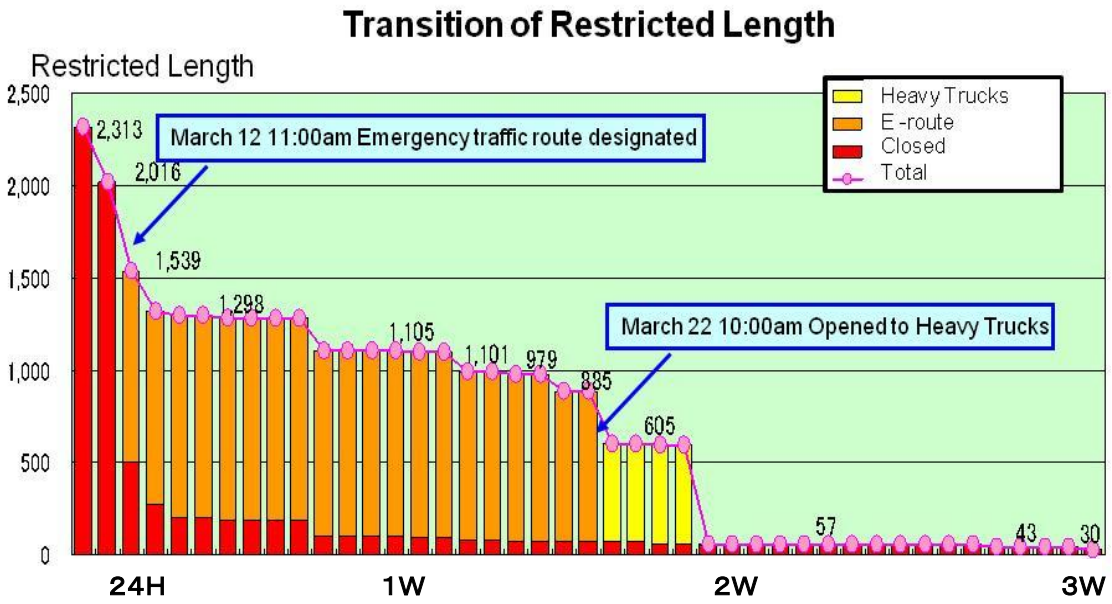
- Expressways are designated as the first prioritized emergency routes to carry foods, medical goods and emergency staff like rescue corps
  Necessary time to reopen expressways after the Earthquake by NEXCO East

Tohoku Expressway
Jouban Expressway } 20 hours 14 minutes
Banetsu Expressway
Sendaitobu Toll Road - 45 hours 14 minutes

Road closures and transition of restricted length of expressways

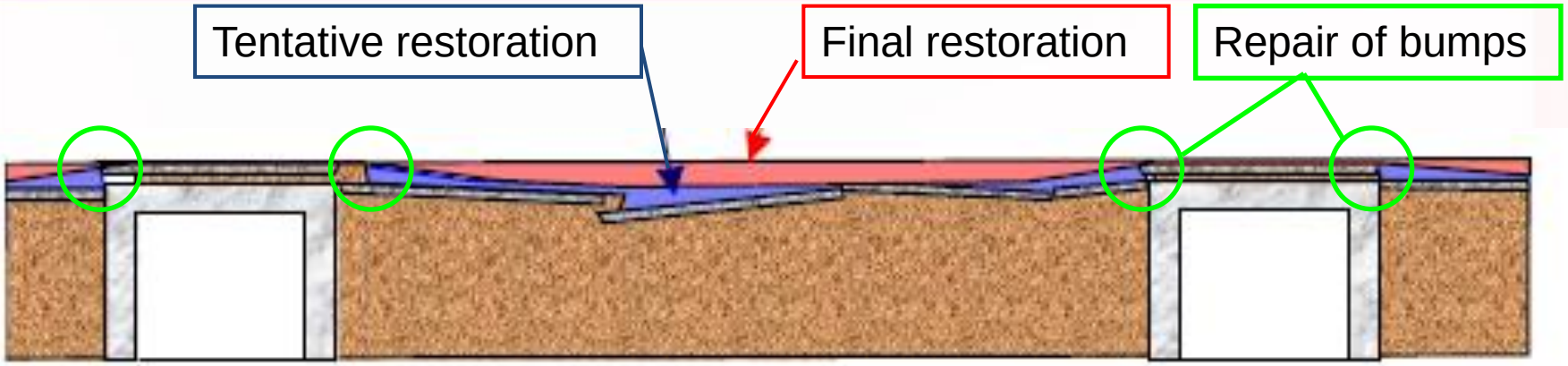
Road closures caused by the Earthquake





- NEXCO East Expressway closed : 2,300km (Max)
(Tohoku Branch Office 96%, Kanto Branch Office 89%)
→ Restrictions had been lifted on approx. 770km by 24 hours later
- Emergency traffic route : 1,090km (Max)

Steps to recover expressway pavement



1st step Repair of bumps for emergency vehicles

2nd step Tentative restoration with slower speed limit

3rd step Final restoration with normal speed limit

※Budget for recovery (Pave, Bridge, Facility etc.)

Disaster recovery budget or maintenance budget
by NEXCO-EAST (ordinary disasters)

➡ Disaster recovery loan from government (special case)

Management example to recover collapsed embankment

Collapse 3/11 16:00

3/14 11:00 Removing collapsed embankment

3/15 13:00 Constructing subgrade

3/16 17:00 Paving

3/17 15:00 Setting guard-cable

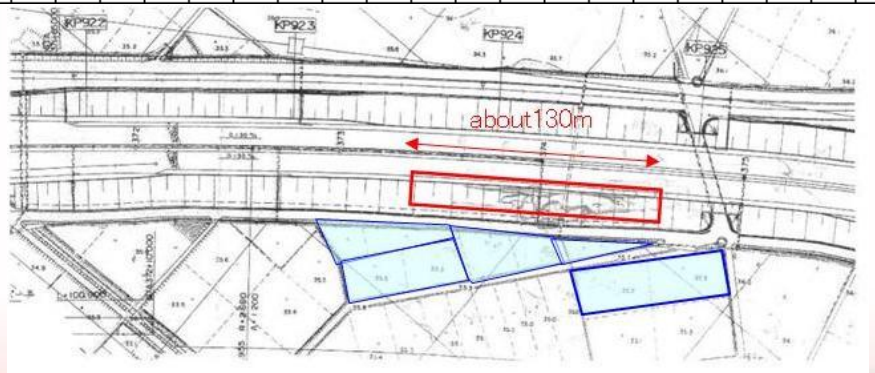
Completion 3/17 19:00

Completion of Repair Works(6 Days)

（Provisional restoration of pavement）

Time table for repair works

	Amount	3/11 (0 6 12 18)	3/12 (1)	3/13 (2)	3/14 (3)	3/15 (4)	3/16 (5)	3/17 (6)
Inspection		Earthquake						
Research & Design			Nexco-RI, Nexco-Engineering Company					
Removal of Pavement								
Tennancy of estate								
Removal of Soil	4,700m3							Machine & Labor
Embankment	4,500m3			Procurement			Rain	
Pavement	1190t							
Safety facilities								Completion

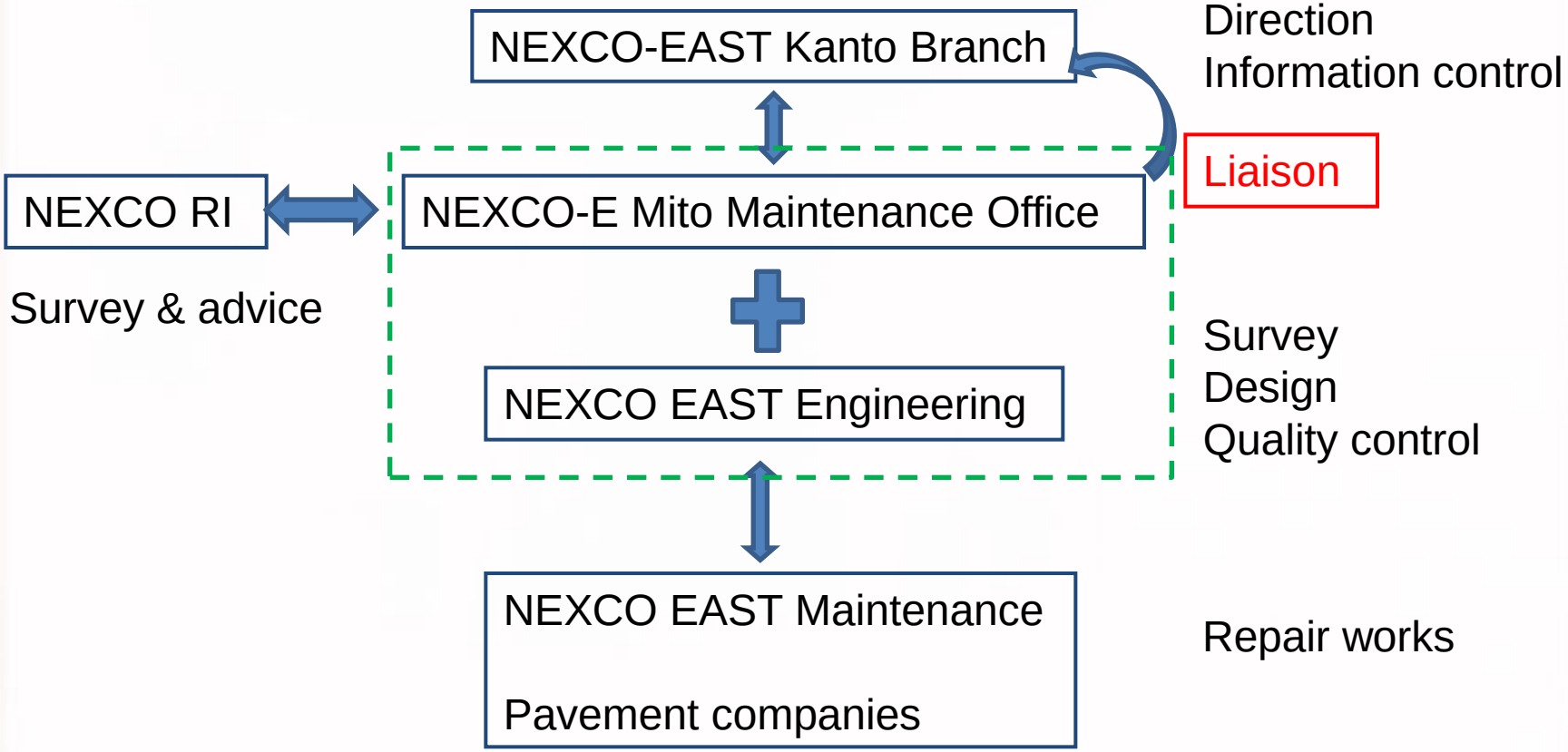


Successful factors for the management(1)

Organization & procurement aspects

- Lessons from past disasters (Role, Information control etc.)
- Rapid formation of teams under collaboration of NEXCO-EAST and group companies
- Multi-year contract with nation-wide pavement companies
- Collaboration treaty with contractors
- Smooth procurement of materials_from local suppliers
- 24 hour basis stuff & labor management

Role of organizations and information control



Successful factors for the management(2)

Technical aspects

- Rapid survey and decision making for design & repair works
- More focus on the speed of repair works than mix design & quality of pavement
- Gravel for easy quality control & rapid repair to build embankment

Challenges

1) Securing certain communication methods just after the earthquake

2) Keeping long-term good relation with contractors and suppliers

3) Keeping risk management knowledge in younger generation

Conclusions

1) Historical earthquake caused huge tsunami damage and major parts of expressways have comparatively little damage by the jolt

➡ Prioritized budget allocation to anti-earthquake measures

2) Securing emergency routes and effort to recover expressways in short term were well done

➡ Good time management activities

3) Some success-factors are lessons from past disasters(Role, Information control), collaboration among NEXCO-EAST, group companies, and contractors

➡ Successful risk management

END

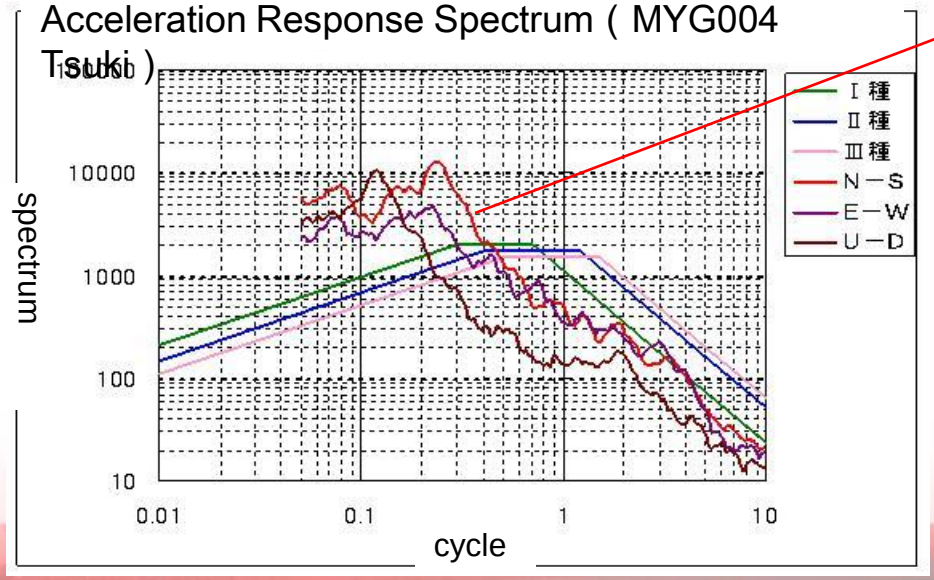
Thank you for your support from all over the world!

Feature of Earthquake Wave

Reservation Points		Max. Accel. (gal)	Max. velocity (kine)	S.I. Level
MYG004	(Tsuki)	2933.2	111.3	6.6
MYG012	(Shio)	2018.9	61.1	6.0
IBR003	(Hita)	1845.2	72.5	6.4
MYG013	(Send)	1807.8	81.4	6.3
IBR013	(Hoko)	1762.3	76.7	6.4

Huge Damage if followings are observed simultaneously

- Max. Accel 800gal more
- Max. Velocity100kine more



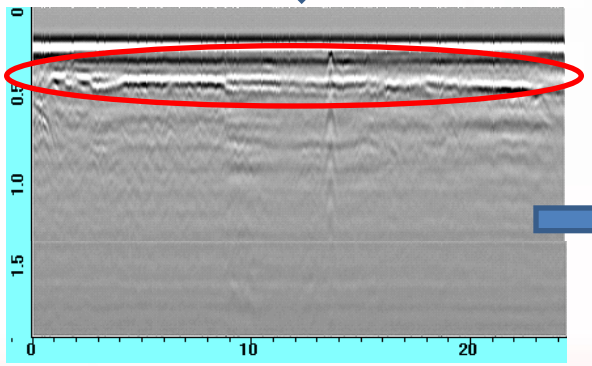
Feature

Structures with short natural period are got strong response

Natural period of Sendaitobu Viaduct (one after next picture) is about 1.3 sec

Survey and repair of pavement (Plan)

Cavity research by GPR



Temporary asphalt plant

Reclaimed Bi(30%)
Reclaimed AsB(50%)