XXIV^th World Road Congress Mexico 2011
Mexico City 2011.

Seismic Retrofit of Asphalt Pavements Using Confined-Reinforced Earth

Tsutomu ISHIGAKI

- NIPPO Corporation Research Institute, JAPAN
- Senior Research Engineer
- ishigaki_tsutomu@nippo-c.jp

NIPPO

CONTENTS

- Introduction
  - Eartquake induced damages experienced in Japan
  - Problem statemant

- Confined-Reinforced Earth (CRE)
  - Structure
  - Applications for seismic retrofit of asphalt pavement
  - Materials
  - Construction
  - Full scale in-situ test results

2011 The Great East Japan Earthquake (M9.0)

@Kyodo（2011）

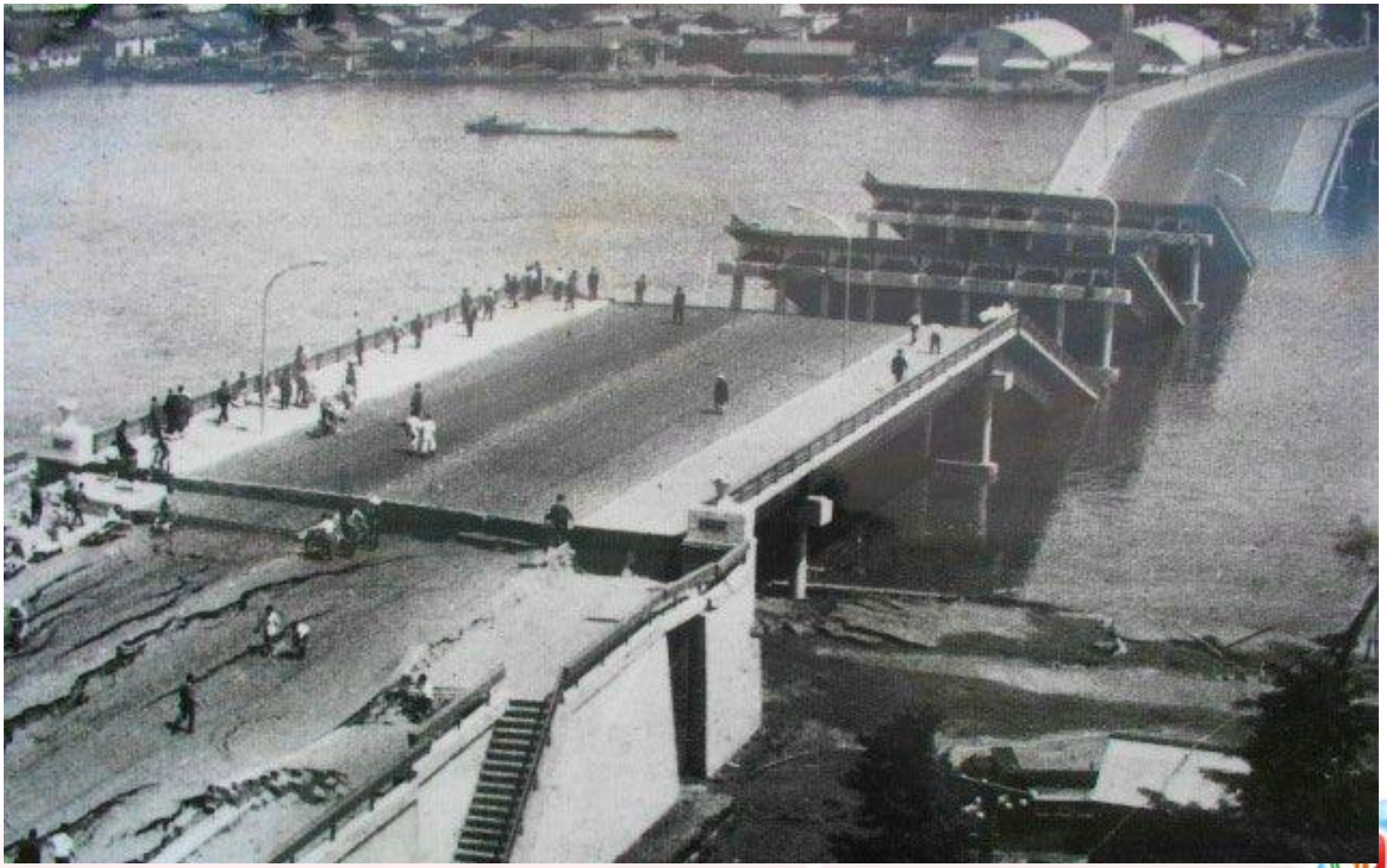
2011 The Great East Japan Earthquake (M9.0)

@Kyodo（2011）

2011 The Great East Japan Earthquake (M9.0)

@Kyodo（2011）

1964 Niigata Earthquake (M7.5)



1995 The Hanshin Awaji Great Earthquake (M7.3)

2009 Noto Earthquake (M6.8)

Pasco（2009）

2011 The Great East Japan Earthquake (M9.0)

East Nippon Expressway Company Ltd（2011）

2007 Niigata Prefecture Chuetsu Earthquake (M6.8)

@Zenkousoku（2007）

2007 Niigata Prefecture Chuetsu Earthquake (M6.8)

2011 The Great East Japan Earthquake (M9.0)

East Nippon Expressway Company Ltd（2011）

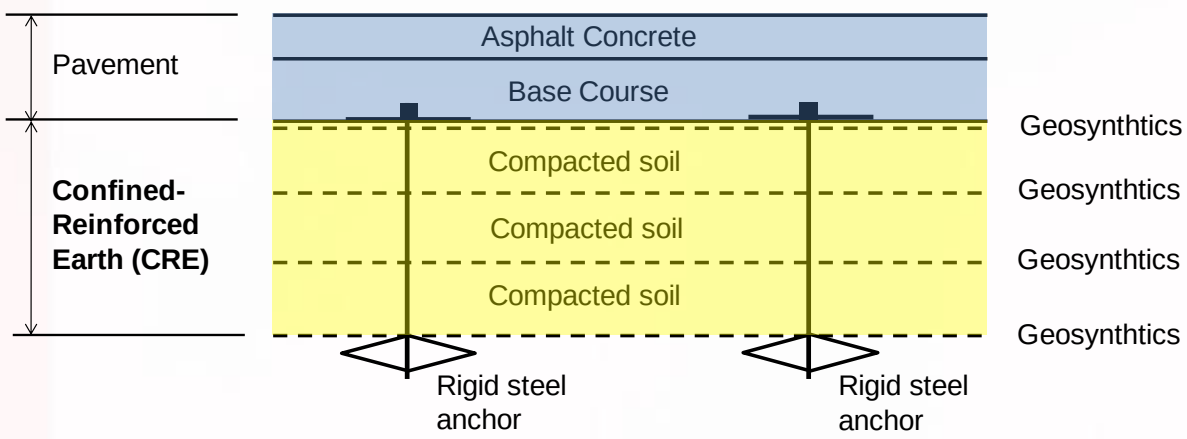
2007 Niigata Prefecture Chuetsu Earthquake (M6.8)

MLIT/NEXCO（2007）

Introduction
Problem statement

- Reducing the risk of earthquake-induced damages to road is needed to promote safety, disaster mitigation and recovery.
- Traffic is easily intercepted by the severe earthquake-induced damages to road pavements.
- It is strongly needed for minimum road pavement performance to keep the emergency traffic remain in service despite severe earthquake.
- A seismic retrofit technique of asphalt pavements using Confined-Reinforced Earth (CRE) is newly developed.

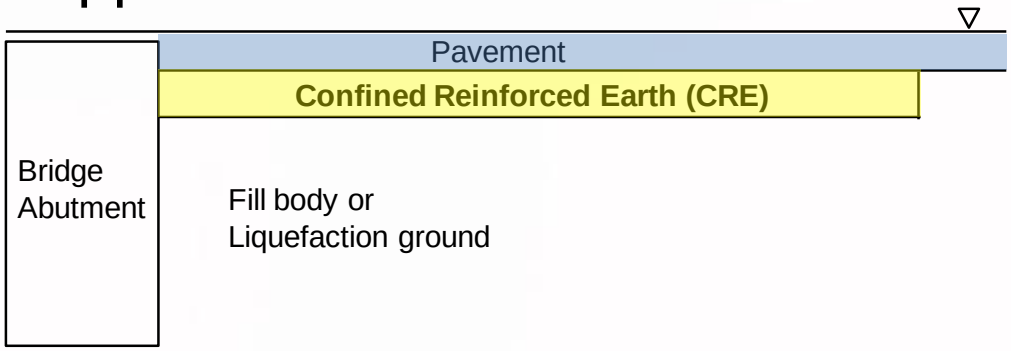
Confined-Reinforced Earth (CRE) Structure



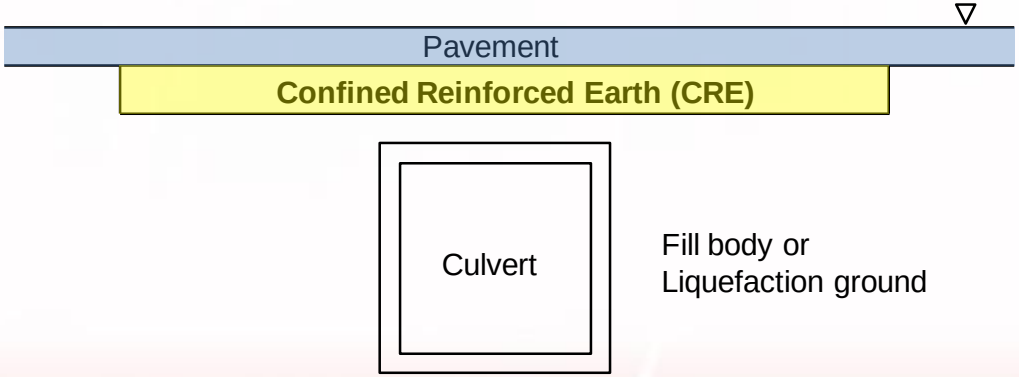
- Compacted soil layers reinforced by geosynthetics & confined by the rigid anchors
- High flexural rigidity of CRE for overcoming weakness of subgrade in tension and flex / bending

Confined-Reinforced Earth (CRE) Applications

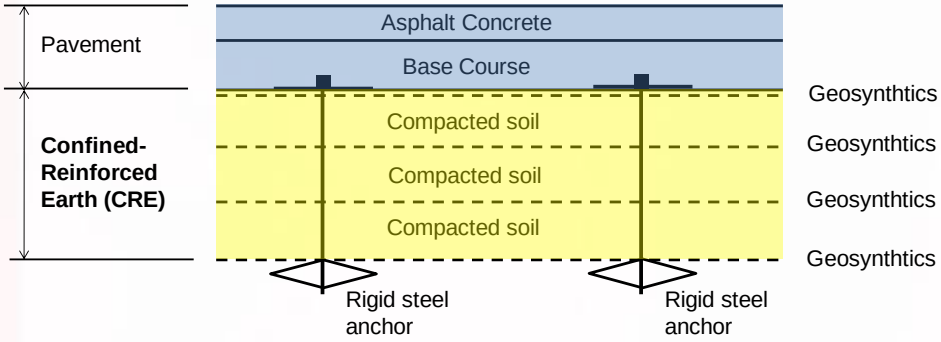
- For Bridge approach settlement



- For Box culvert approach differential settlement



Confined-Reinforced Earth (CRE) Materials



1) Compacted crushed stone

2) Geosynthetics

3) Rigid anchor

Confined-Reinforced Earth (CRE) Construction

1) Geosynthetics placement

2) Laying

3) Compaction

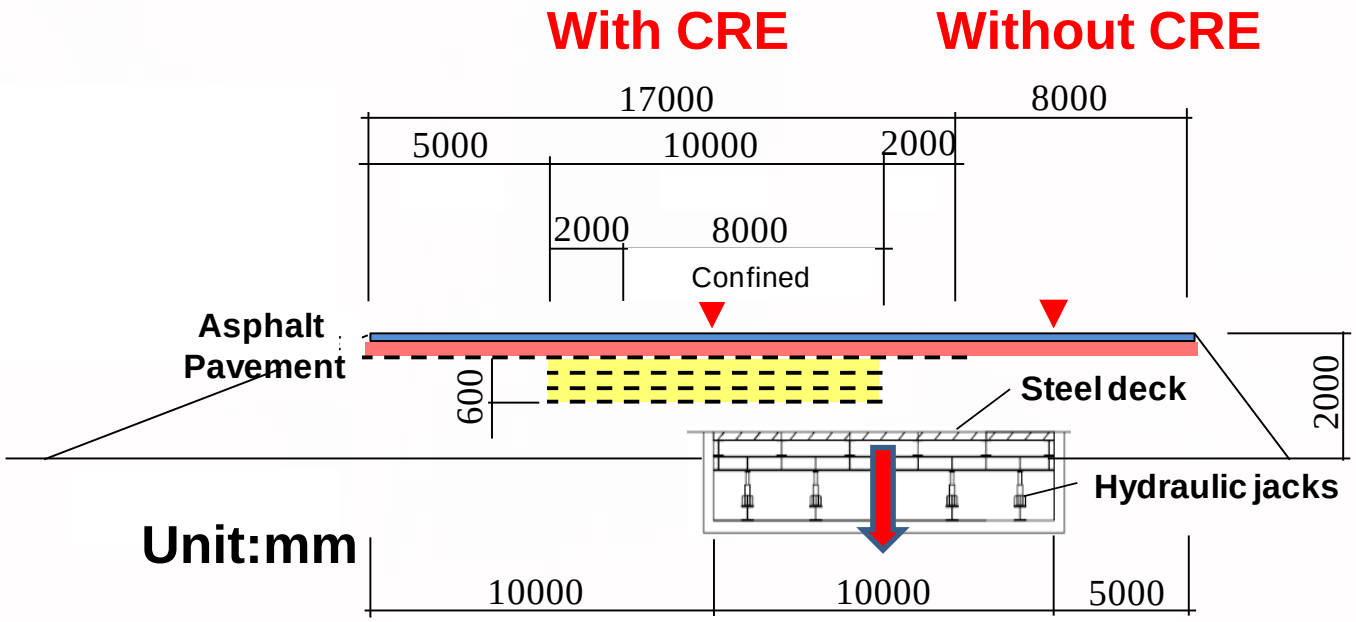
4) Anchor driving

5) Anchor locking

6) Confining

Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

- Trial embankment for simulating differential settlement of earthquake-induced damages to road pavements



- Forced differential settlement from 0 to 550mm

Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

- Test results of 550mm differential settlement

Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

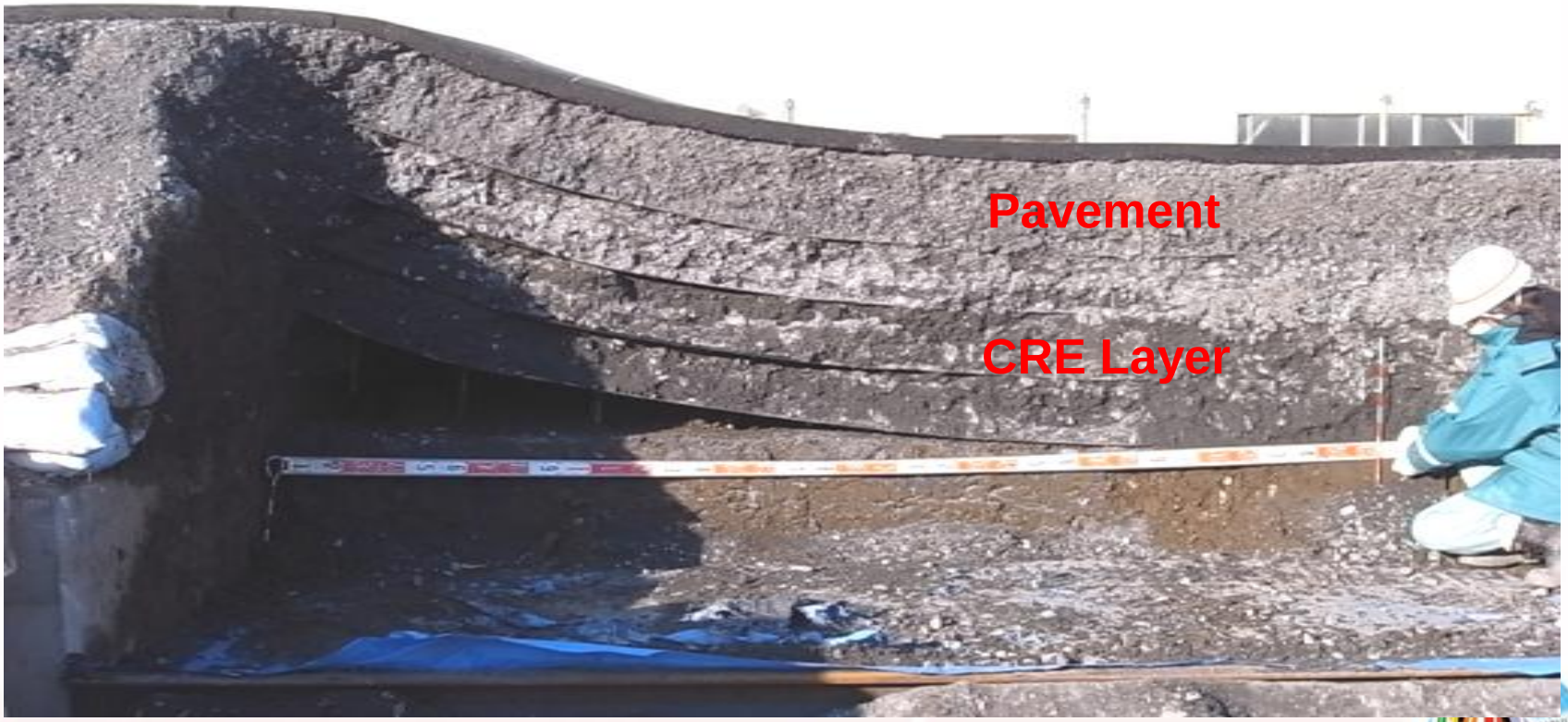
- Test results of 550mm differential settlement

With CRE

Without CRE

Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

- Test results of 550mm differential settlement



Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

- Test results of 550mm differential settlement

With CRE

Confined-Reinforced Earth (CRE)
Full-scale in-situ test (NEW DATA)

- Test results of 550mm differential settlement

With CRE


NIPPO

Thank you for your warm support