# Disaster Prevention

In order to secure safe and reliable road networks, construction of arterial high-standard highways, urban ring roads and other disaster-resistant roads has begun. Since roads are an important part of disaster relief, measures to respond to and reduce the damages of earthquakes, storms and heavy snows on roads are also being implemented.

## Earthquake

On March 11, 2011 a massive earthquake and the following giant tsunami caused an enormous amount of damage to the roads in Japan
(National Highway 6, Hirono-machi, Fukushima Prefecture)
(Photo: Tohoku Regional Development Bureau)

## Heavy rain


Massive collapse from the top of the slope
Heavy rain in July 2020
(National highway 3, Ashikitamachi Kumamoto Prefecture)

## Heavy snow

In February 2014 there was a record-breaking heavy snow in the Kanto region
(Japan Self-Defense Force clearing the snow on Route 20)
(Photo: Mainichi Shimbun)

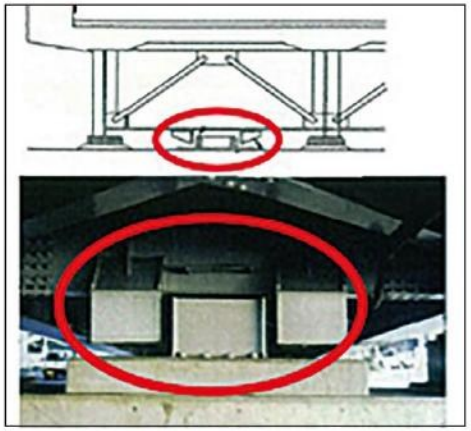
# Measures against Earthquakes (1)

In addition to bridge collapse prevention measures, the MLIT accelerates other anti-seismic measures for expressways and national highways under the jurisdiction of MLIT to prevent a large surface gap, including reinforcement and replacement of supports, based on the probability of large earthquake. In specific, the ministry reinforces support of bridges for immediate recovery from damages and takes other measures where the reinforcement is not possible.

▪Measures for immediate recovery

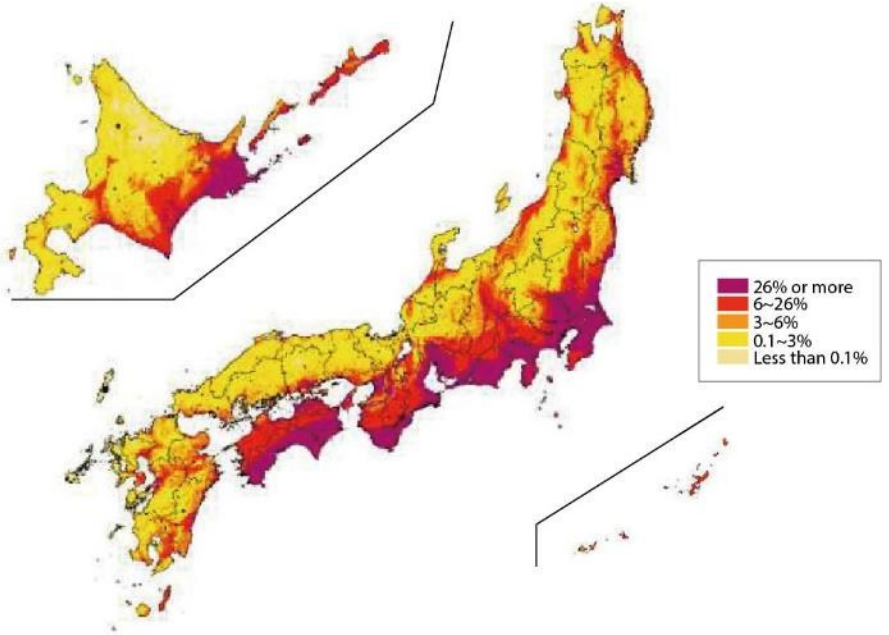
Bridge collapse prevention measures
+
Reinforcement/replacement of supports

Example of a support reinforcement



Structure to diverge horizontal force

▪Probability of an earthquake with a seismic intensity of 6- or higher in 30 years



# Measures against Earthquakes (2)

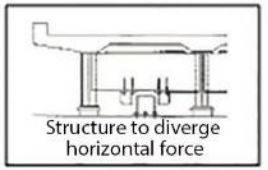
■Example of earthquake preparedness

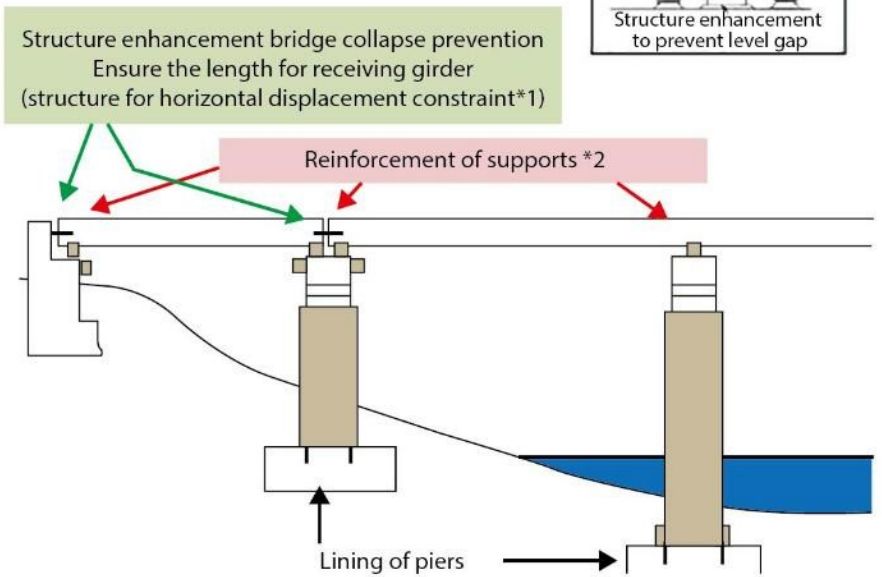
Implement bridge collapse prevention measures that add an ability of immediate recovery of functions.

Bridge collapse prevention measures towards immediate recovery of functions (Level 2 in the Seismic resistance performance)

[Measures]
- Structure enhancement for bridge collapse prevention
- Reinforcement of piers
- Reinforcement of supports

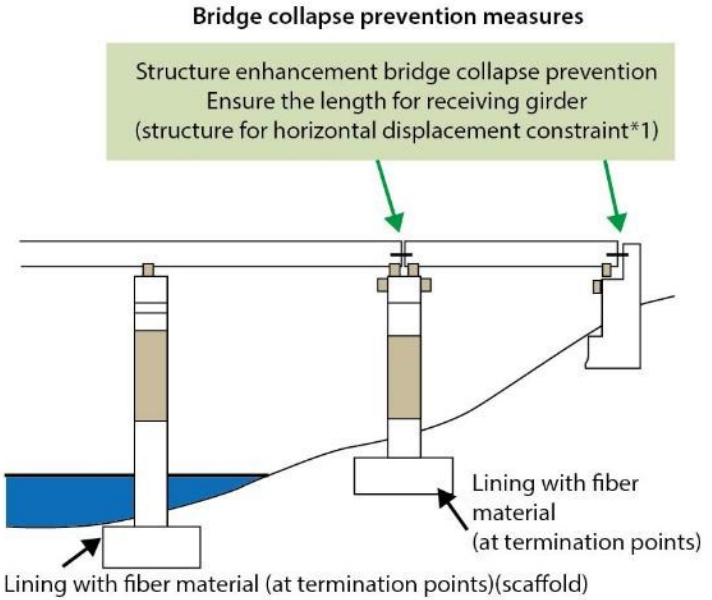
-Replacement of supports
-Structure enhancement to divert horizontal force
-Structure enhancement to prevent level gap




Bridge collapse prevention measures
(Level 3 in the Seismic resistance performance)

[Measures]
- Structure enhancement for bridge collapse prevention
- Reinforcement of termination points of pier

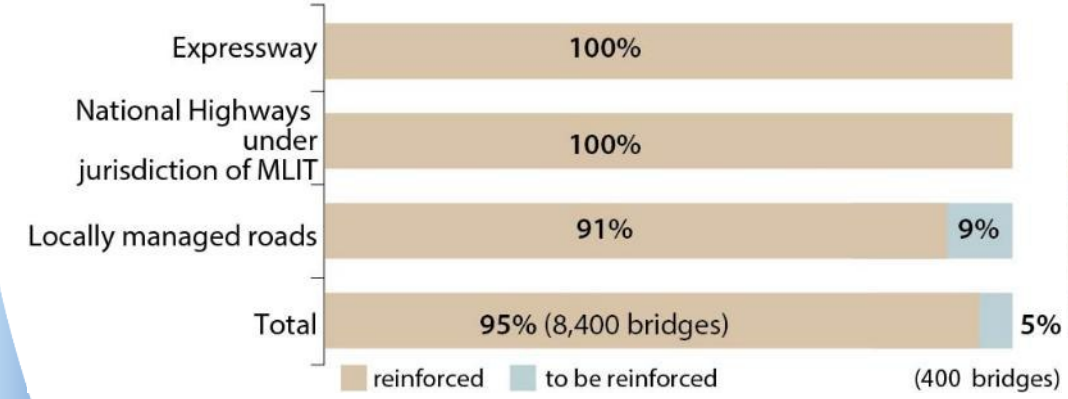


# Measures against Earthquakes (3)

■A seismic retrofitting of overpass

-Overpasses over expressways and national highways under jurisdiction of MLIT are given priority on the collapse prevention measures in the next 5 years (400 bridges are owned by local governments as of November 2016).

**Progress of overpass collapse prevention measures for expressways and national highways under jurisdiction of MLIT**




**Overpass**


**Examples of the measures**

[Structure enhancement for bridge collapse prevention]

[Reinforced pier]

# Measures against Earthquakes (4)

■Seismic strengthening for bridges with rocking piers

Seismic strengthening is conducted by the end of FY 2019 for bridges with rocking piers over expressways, national highways under jurisdiction of MLIT (450 bridges).



**Example of seismic reinforcement**

# Challenges of seismic retrofitting identified after Kumamoto Earthquake (April 14, 2016)

(1) A bridge with rocking piers was collapsed by Kumamoto Earthquake. There remains the possibility that measures in the past were insufficient to avoid collapse, considering peculiarities of Kumamoto Earthquake (consisting of 2 strong quakes) and structure itself.

(2)Several overpasses over expressways and national highways under jurisdiction of MLIT have not been reinforced for collapse prevention (completion rate is 91% as of November 2016 for those owned by local governments).

(3) Although collapse prevention measures have been completed for all the emergency transportation routes (consisting of expressways and national highways under jurisdiction of MLIT), the seismic reinforcement (including reinforcement of bridge shoes) that promptly enables emergency transport vehicles to pass the routes has not been completed (completion rate is 77% as of March 2017).

(1) Collapsed a rocking pier over Kyusyu Expressway (Prefectural road Ogawa-Kashima Line, Furyo Daiichi Bridge)

(2) Locally owned overpasses (have not been reinforced)

(3) Damages on supports and main girders of a bridge (Heiryu Bridge, Oita Expressway)

# Countermeasures for heavy rains (1)

## ▪ Protection of road slopes

Following works are used for slope protection from a heavy rain.
-Rock fall prevention fence work: installation of fence to protect from rock falls. Fence is installed along the road to catch falling rocks.
-Pocket-type rock fall prevention net work: installation of a net to catch falling rocks where they start falling.
-Wire rope that tie a rock: the rope will fix some rocks that may fall in the future.
-Concrete crib work: covers and fixes a slope that may collapse in the future.
-Concrete crib + anchoring: in some cases, concrete structure is supported by additional anchors.

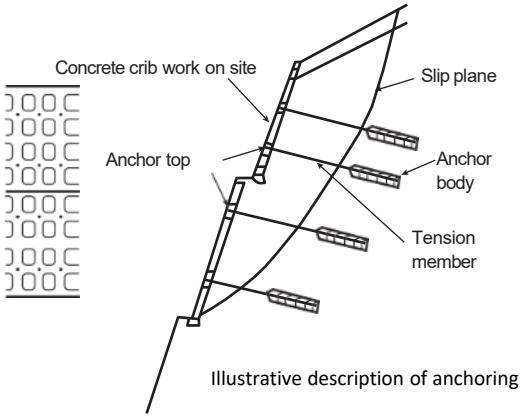
Rock falling protection fence

Pocket-type rock falling protection net

Wire rope work

Concrete crib work

Crib work + anchoring

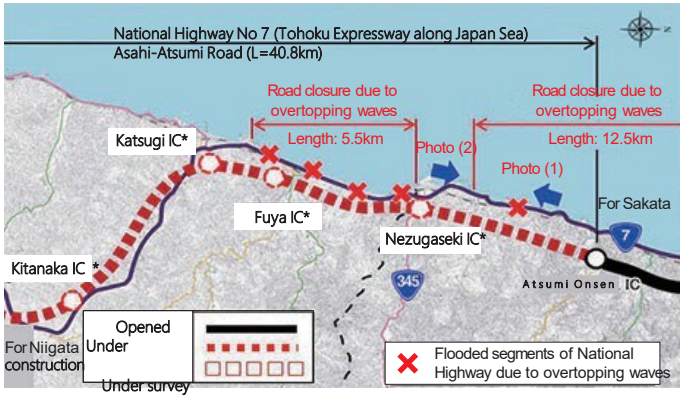


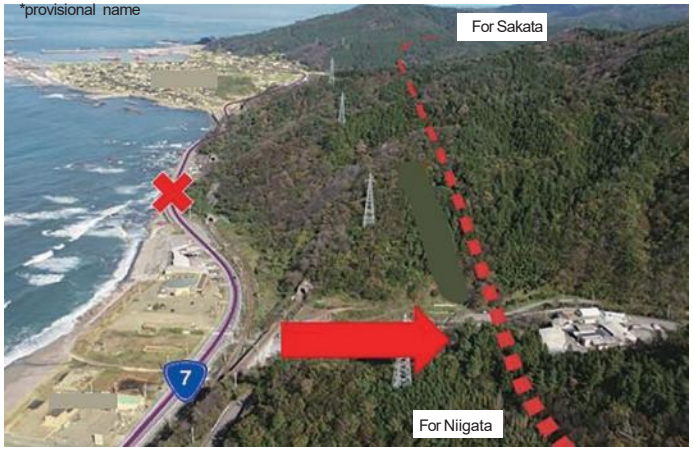

Illustrative description of anchoring

# Countermeasures for heavy rains (2)

## ■ Enhancement of road network for redundancy

In the areas with frequent heavy rain, development of arterial high-standard roads is promoted to provide redundancy, rather than individual spot improvements. Given that overtopping waves frequently force to close National Highway No 7 around the border between Niigata and Yamagata, the Asahi-Atsumi Road is going to be developed as a high-standard road at a distant from the sea shore to ensure redundancy at the event of disaster and reliable transportation between regions.




High-standard Arterial Highway is developed to ensure alternative route in the event of disaster (example of Asahi-Atsumi Road)

(1) Wracks from overtopping waves (On April 4, 2012 in Wasada, Tsuruoka)

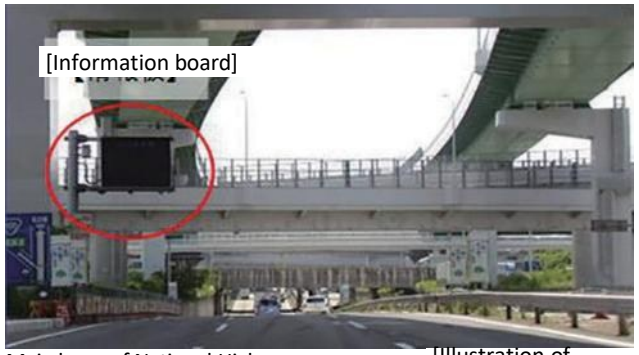
(2) Congestion due to traffic restrictions (On April 4, 2012 in Nezugaseki, Tsuruoka)

# Countermeasures for heavy rains (3)

## ▪ Protection of road from flooding

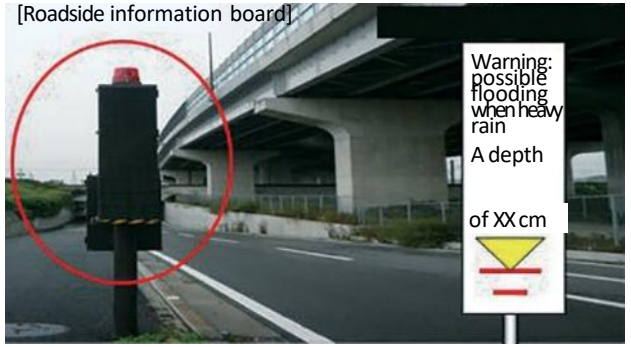
In urban areas, there are about 3,500 underpasses across the country as of April 1, 2015. A heavy rain exceeding the capacity of a drain pump under the underpass will make a pool on the underpass.
In the event of such a heavy rain, we will close the road and provide information for road users.

**Example of road information provision**




Main lanes of National Highway

[Illustration of roadside signage]



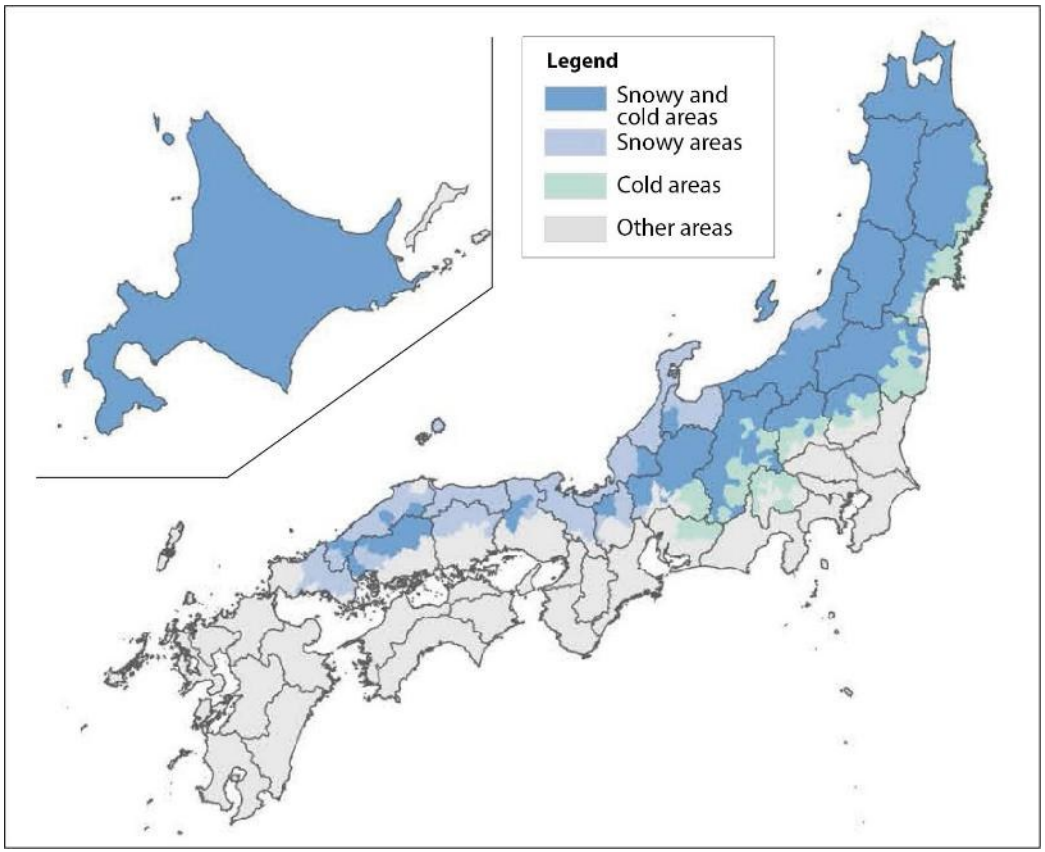

Service road

**Example of drain pump**

# Countermeasures for snowfall (1)

Heavy snowfall hampers every year the improvement of living standards and industrial development of the residents. Sustainable support is required to minimize the impact of the snowfall.

- Purpose of countermeasures for snowfall




Vehicles stuck on road due to heavy snow
(Sanin Region, 2016)

Snow protection work
(Hokuriku Regional Development Bureau)

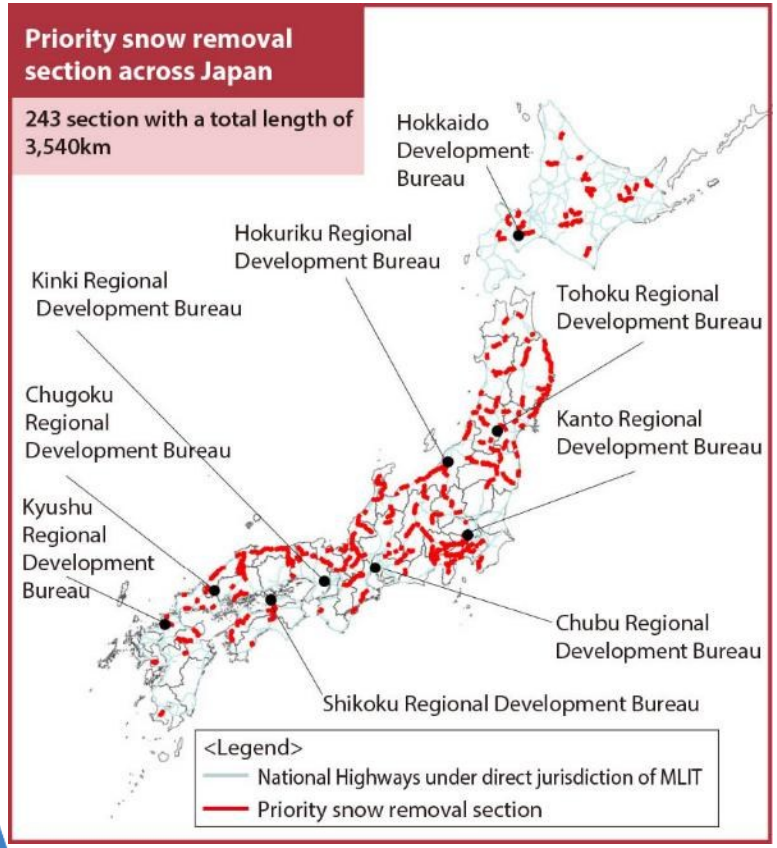
Removal of vehicles at a standstill on road
(Shikoku Regional Development Bureau)

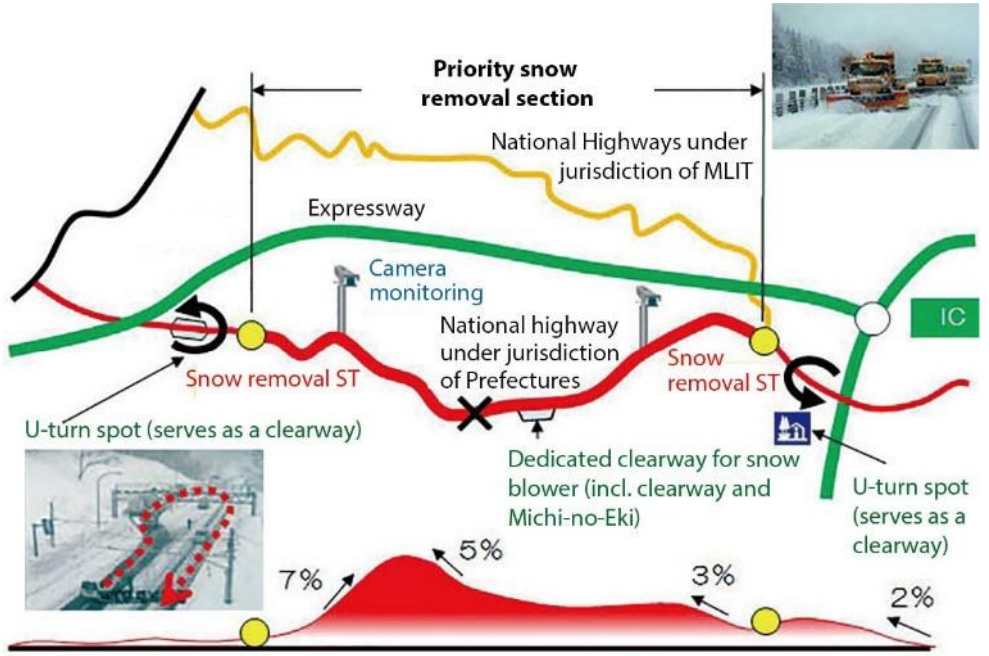
About 60% of the country is in cold and snowy area where a quarter of the population lives.

# Countermeasures for snowfall (2)

■ Advance Restrictions of Road Traffic on heavy snow

This refers to a section identified as a standstill-prone location in the event of heavy snow especially for heavy vehicles on a steep slope. This section receives intensive and efficient snow removal preferentially. 224 road sections were identified as priority snow removal section across Japan.



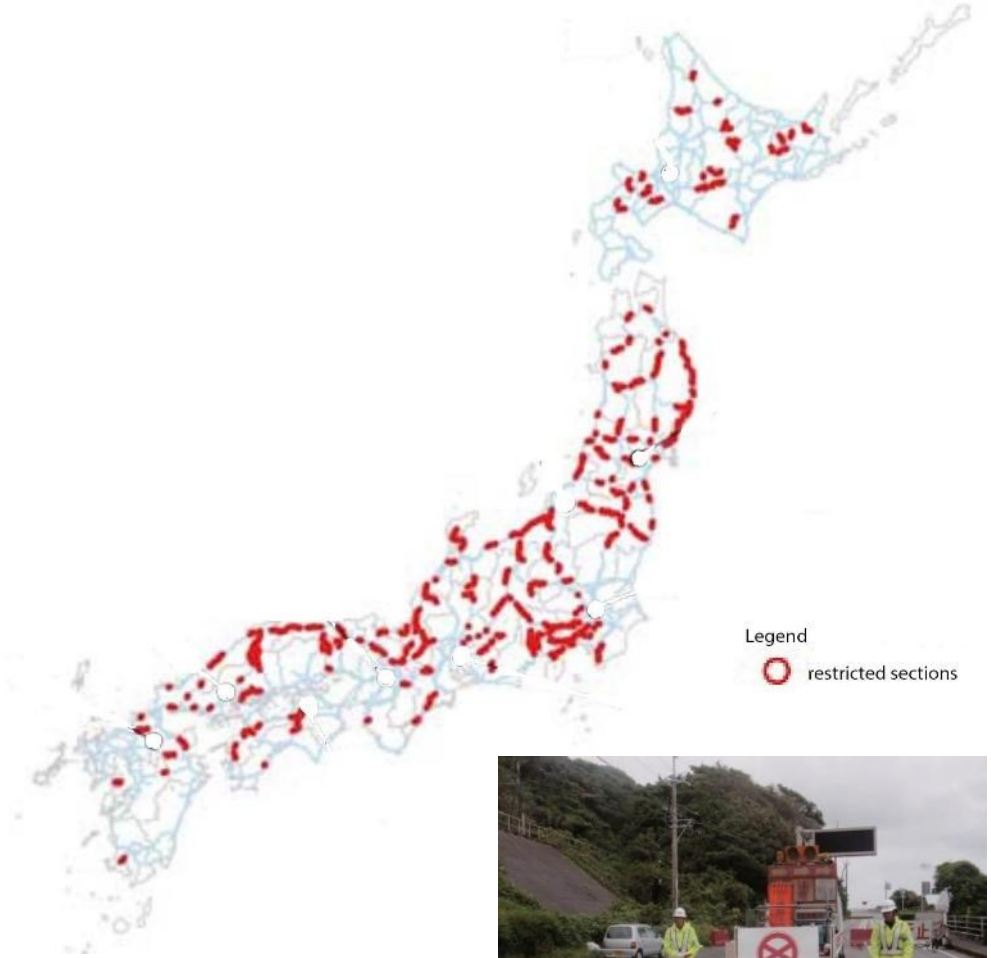

Illustrative description of "Priority snow removal section"

# Initiatives for Advance Restrictions of Road Traffic

■ Restricted sections (national highways under jurisdiction of MLIT)

- In light of the accidental bus fall at Hida River in 1968, we started implementing traffic restrictions in advance based on the "Guidelines for Road Traffic Restrictions in the Event of Extreme Weather" in 1969.
- Restriction standards were set based on “the continuous rainfall” measured by telemeter rain gauges installed at each restricted section.
- national highways under jurisdiction of MLIT : 175 sections, 980 km (total 4%) (As of April 1, 2014)

・Excluding particularly restricted sections against overtopping waves, road flooding, avalanches, etc.
・At the time the system was established (1969), 210 sections
・Set traffic restriction standards based on continuous rainfall.
・Restrictions will be lifted when the rainfall volume stays less than 2 mm/h for 3 hours, the road is patrolled, and safety is confirmed.



# Ensuring smooth freight transportation during disaster

■ Restricted sections
(national highways under jurisdiction of MLIT)

After the Kumamoto Earthquake in 2016, 50 locations were closed on the emergency transportation routes which extends to about 2,000 km in Kumamoto Prefecture. To ensure smooth freight transportation whether it is a normal time or at the event of disaster, the MLIT is committed to improving accessibility to key locations as well as enhancing functions of arterial network to support stable economy and everyday life by supporting and investing on a priority basis.

Closure of emergency transportation routes after Kumamoto Earthquake
(As of April 17, 2016, which is 24 hours after the event)