Restoration efforts of the Aso Bridge District affected by a massive landslide

阿蘇大橋地区大規模崩壊斜面の復旧状況について

国土交通省

Sand control group, Kumamoto branch office, Kumamoto earthquake counterplan office , Kyushu Regional Development Bureau, MLIT

国土交通省 九州地方整備局 熊本地震災害対策推進室 熊本分室 砂防班

Overview of the landside

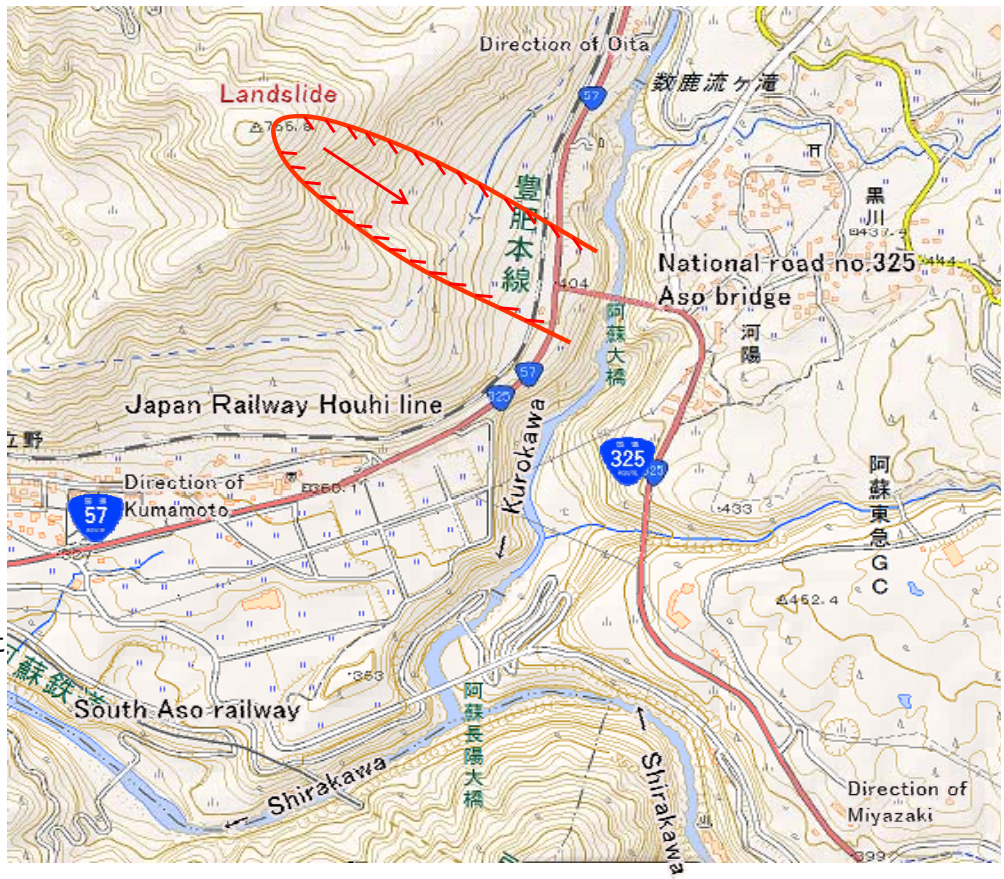
Kyushu Regional Development Office, MLIT

＜Dates of the disaster＞
1:25 a.m.April 16th 2016
※Occurrence of a quake

＜Damages＞

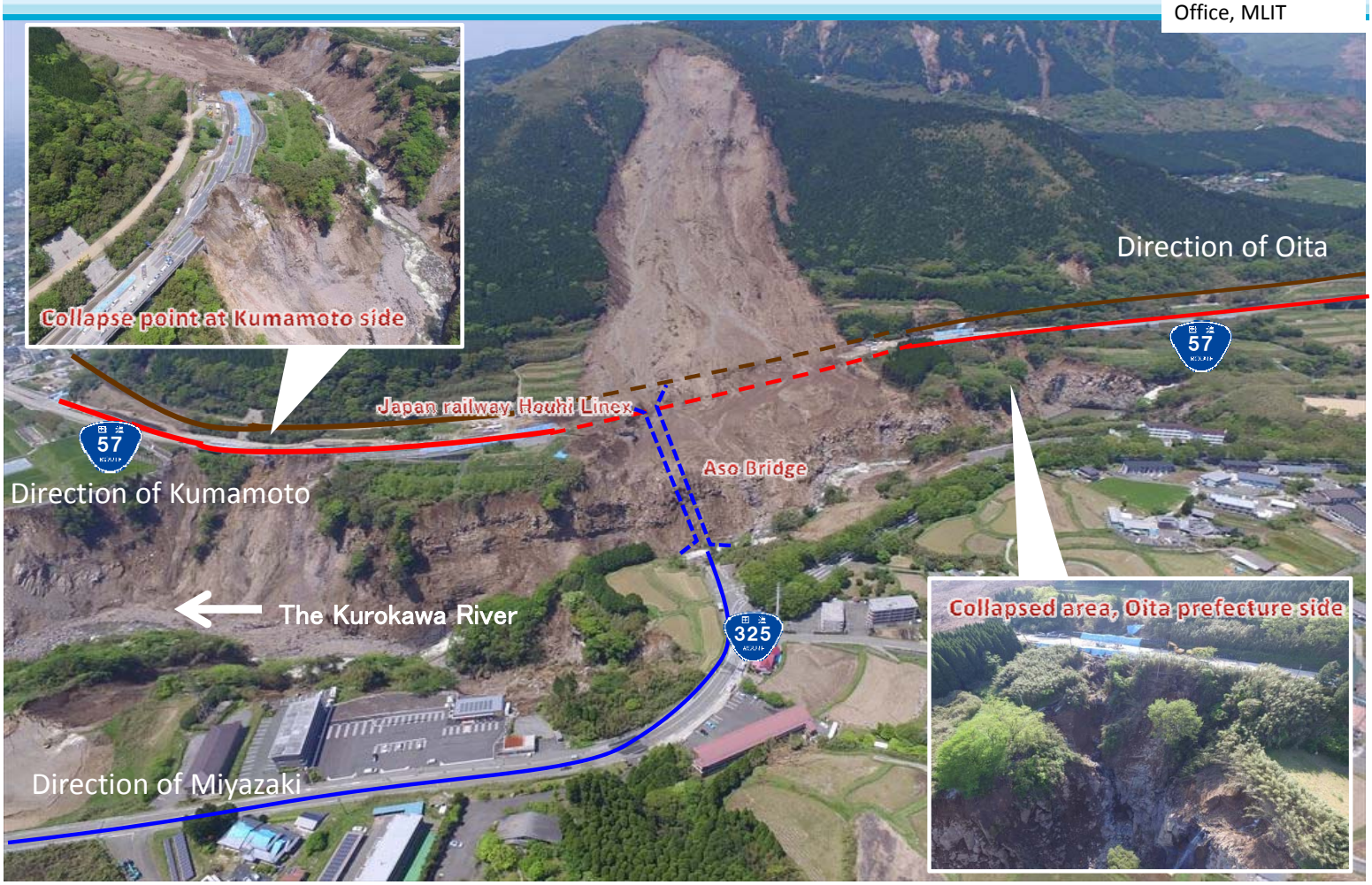
・Public infrastructure
National Road no. 57（Aso bridge area）
National road 325 Aso Bridge
Japan Railway Houhi Line

＜Scale of landslide＞
・Length of landslide approx.700m
・Width of landslide approx.200m
・Volume of earth and sand
approx. 0.5 million m3
（Estimation by aerial laser measurement soon after the quake）



Damages by the collapse at Aso Bridge area

Kyushu Regional Development Office, MLIT

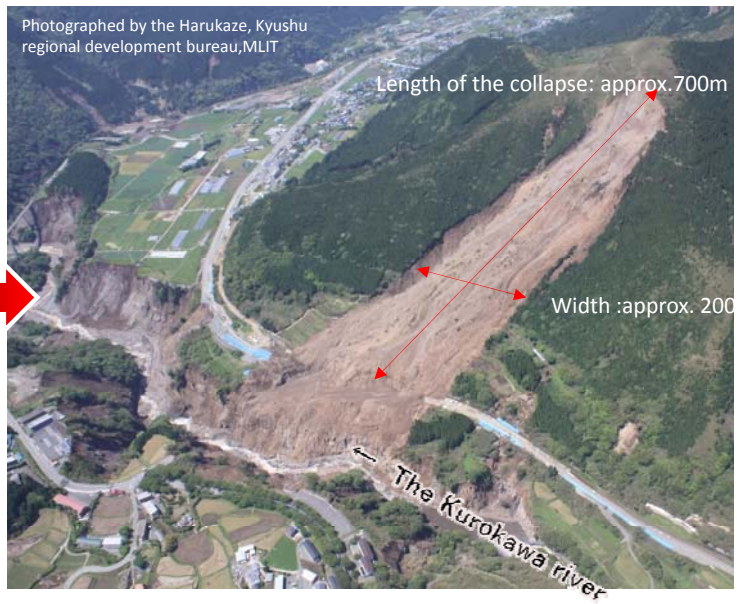


Status of the collapse of slope

Kyushu Regional Development Office, MLIT

Before the collapse

After the collapse



Photo① Landslide at the top

Photo② Top of the collapsed cliff

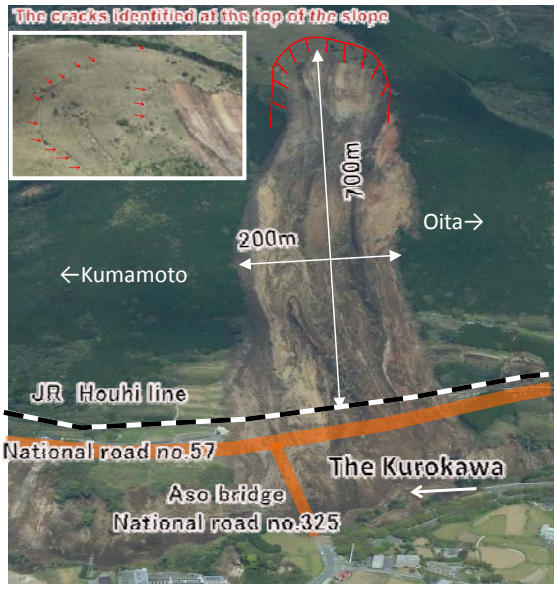
Photo③ Cracks near the collapsed cliff

In regard to the massive collapse of the slope at Aso bridge area triggered by the Kumamoto earthquakes in 2016, emergency construction works are underway to prevent secondary disasters that could be caused by collapse of the remaining large volume of sand at upper area of the slope

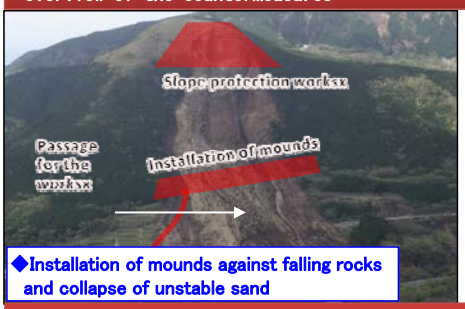
Overview of landslide disaster

Tateno, Aso village, Aso County, Kumamoto Prefecture

- ○April,16m 2016,Kumamoto earthquake
- ○Status of damages
  National road no.57,National road no.325, Japan railway Houhi line
- ○Major countermeasure works
  Earthworks and building of mounds, Slope protection works（Cost ：Two billions）
- ○Start of the works: May 5th ,2016
- ○Due to the cracks as well as unstable earth and sand, left at the top of the slope, the works are undertaken by using construction machines for automatic operation.



Overview of the countermeasures



◆Installation of mounds against falling rocks and collapse of unstable sand

◆Removing of the unstable sand at upper side, followed by the slope protection works

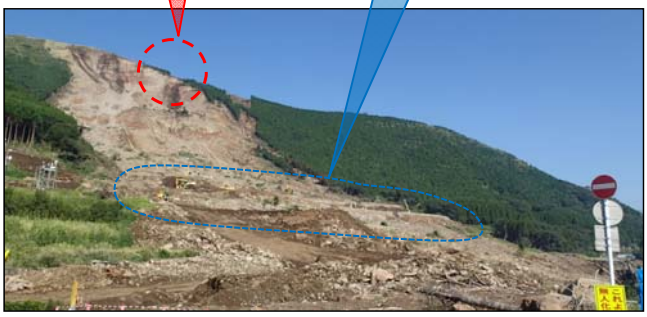
Status of the works

Steps of the works

- Installation of monitoring system
- Developing passages for the works
- Building of mounds
- Elimination of unstable sand
- Slope protection works

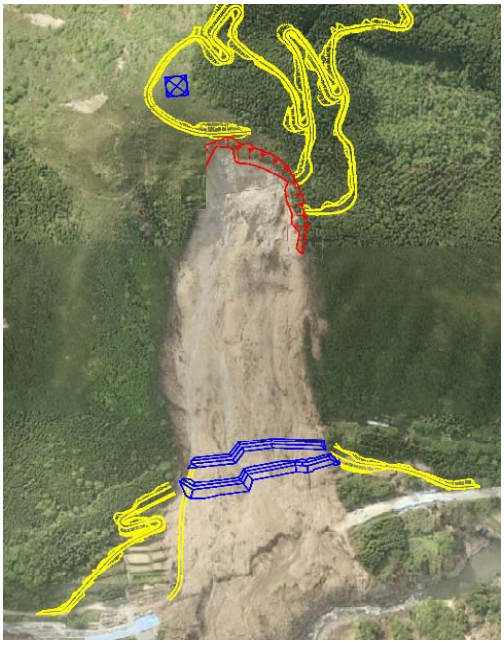
◆Eliminating unstable sand
Photographed on Oct. 2nd

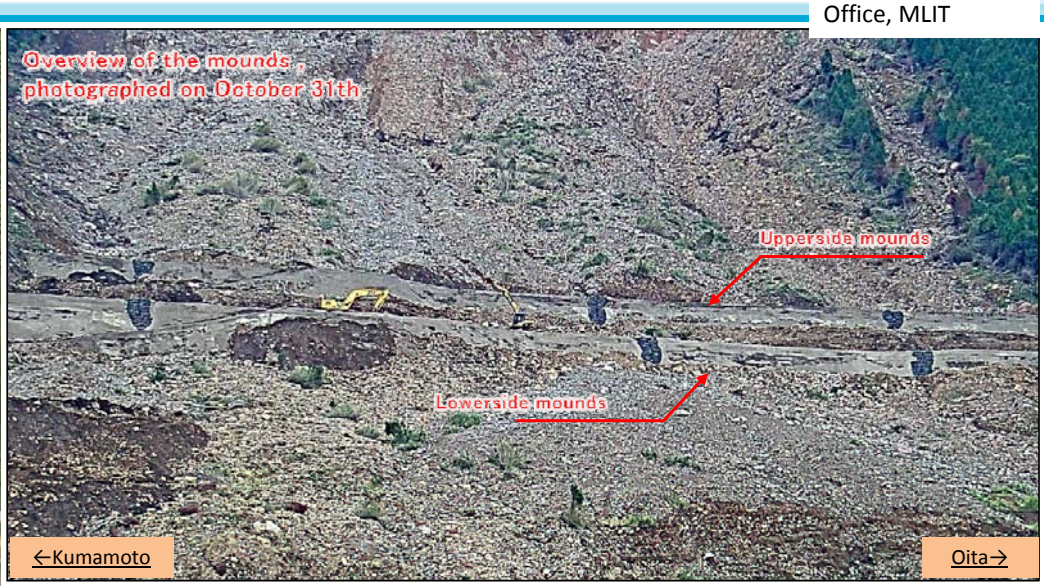
◆Completed mounds
Upper side



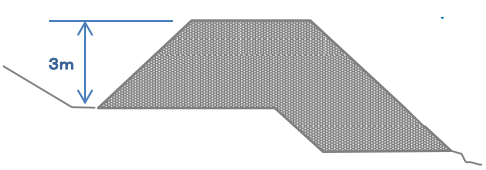
Elimination of unstable rocks left by gully erosion

Kyushu Regional Development Office, MLIT





Mounds



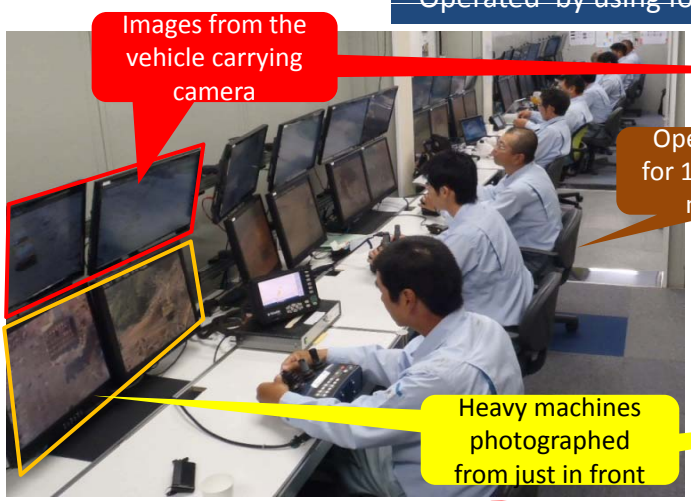
Status of the mound, October 27th from Kumamoto side

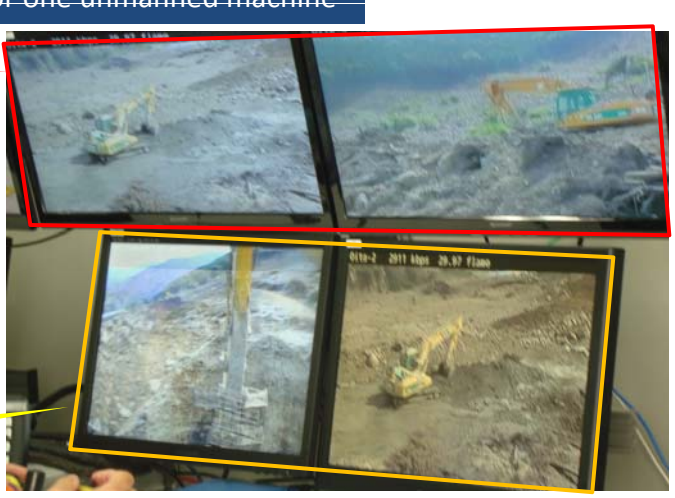
Status fo the mound,Octover 30th from Oita side

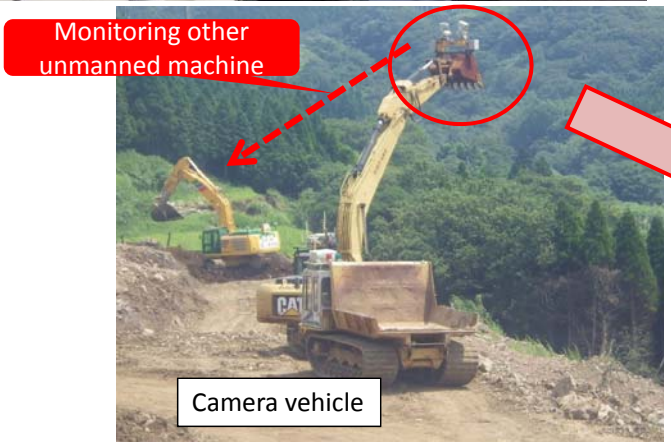
Operation of the unmanned machine for construction works

Kyushu Regional Development Office, MLIT

Operated by using four monitors for one unmanned machine







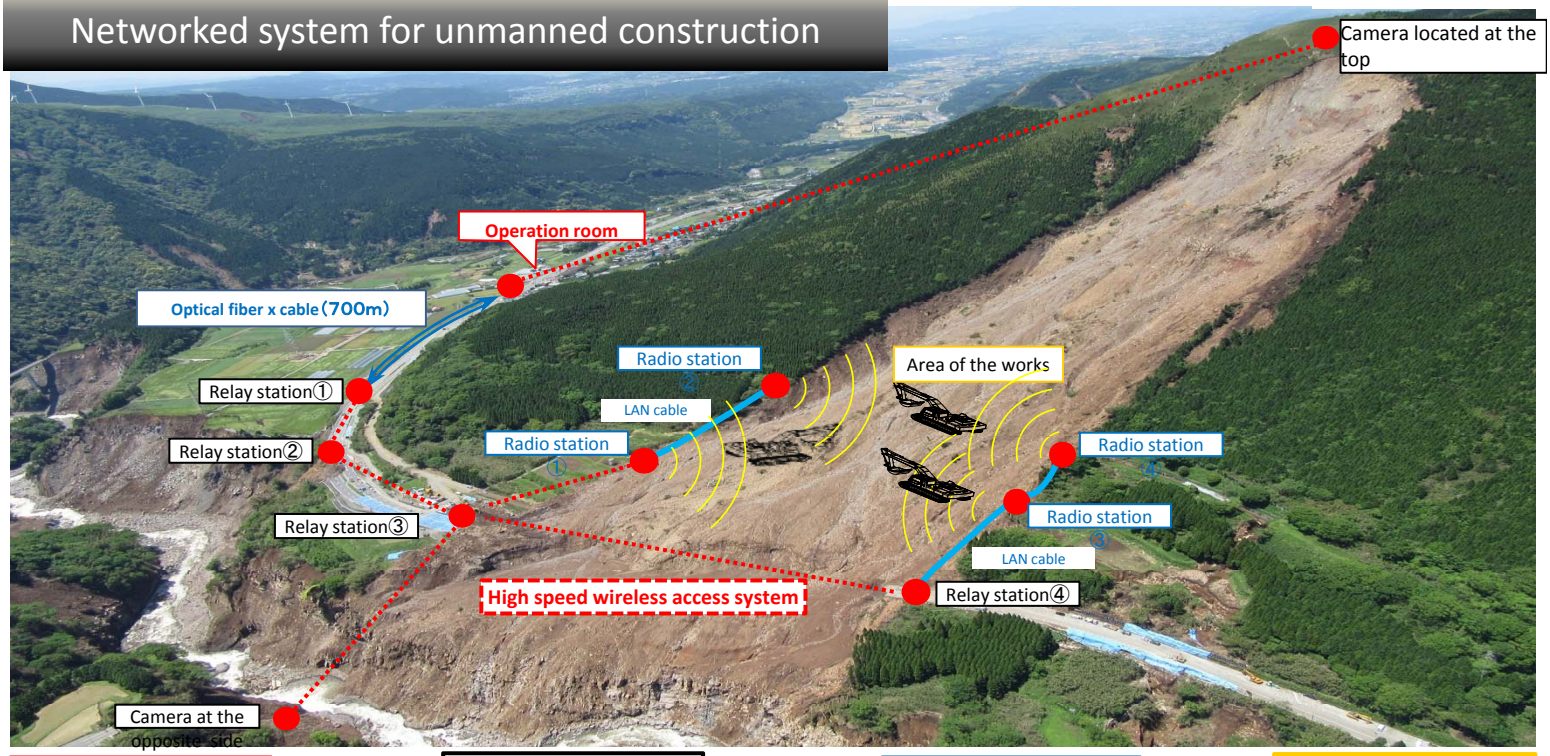
Zooming

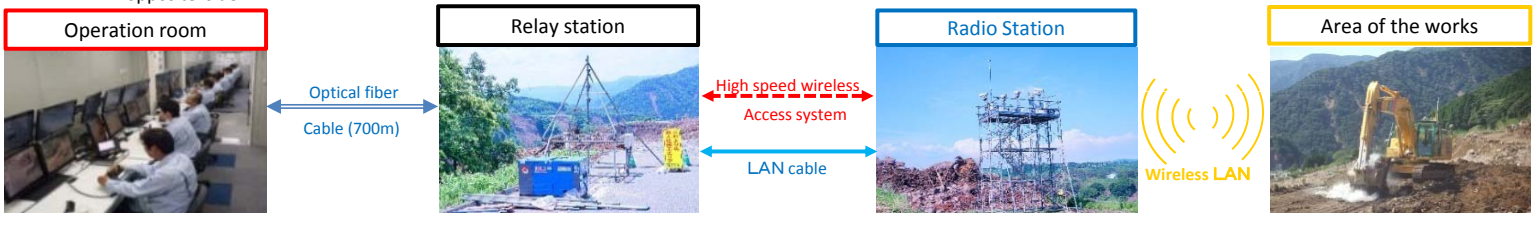
Monitoring camera (capable of multi angle operation)

An overview of the unmanned construction system

Kyushu Regional Development Office, MLIT

Networked system for unmanned construction





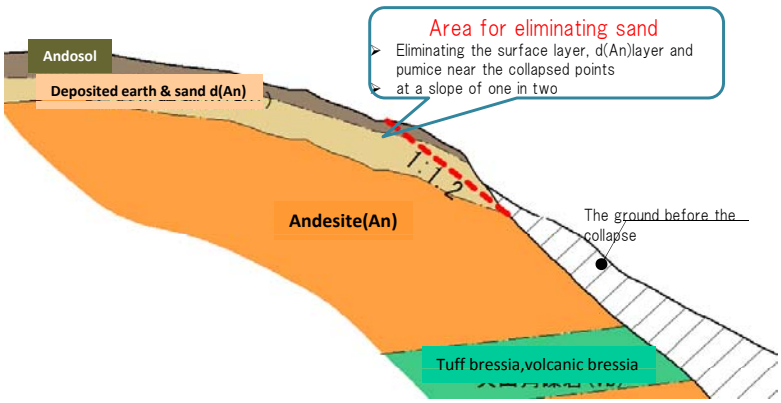
Area of the works of eliminating unstable earth and sand

Kyushu Regional Development Office, MLIT

☞ Area of the works

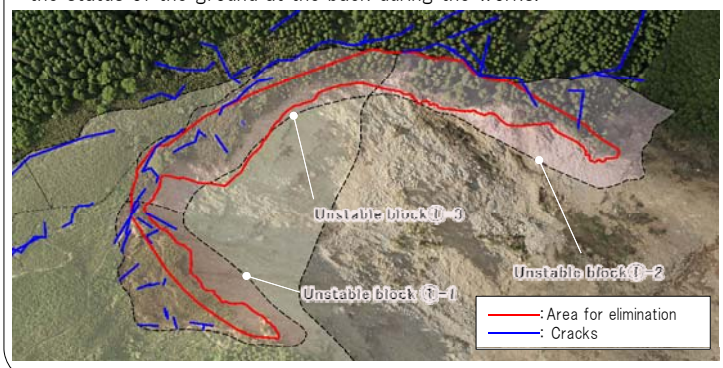
Surface layer of andosol, deposited earth and sand (d(An)), and pumice found at the areas surrounding the collapsed points where the ground rises

A cross section for elimination of earth and sand



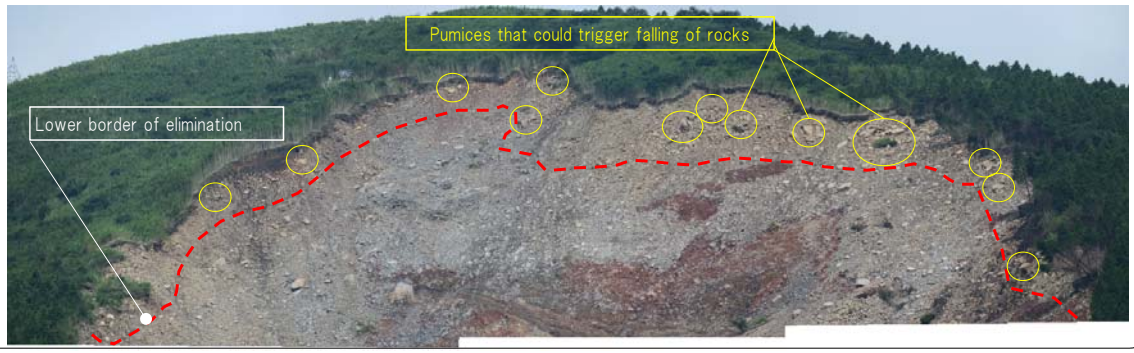
(2) Upper border of the works

- Block ①-2: Upper border is defined up to the crack of the unstable block, due to the changes identified by dynamic observation, and the significant difference in level between the cracks behind.
- Brock ①-1,Block①-3: Basically the area cut from the lower border at
- a stable gradient of one in two, with necessary adjustment depending on the status of the ground at the back during the works.



(1) Lower border of the works

- Lower border of elimination was defined by measuring the collapsed surface by UAV, and examining the status of pumice that could trigger falling of stones.



Status of the works for eliminating unstable earth and sand

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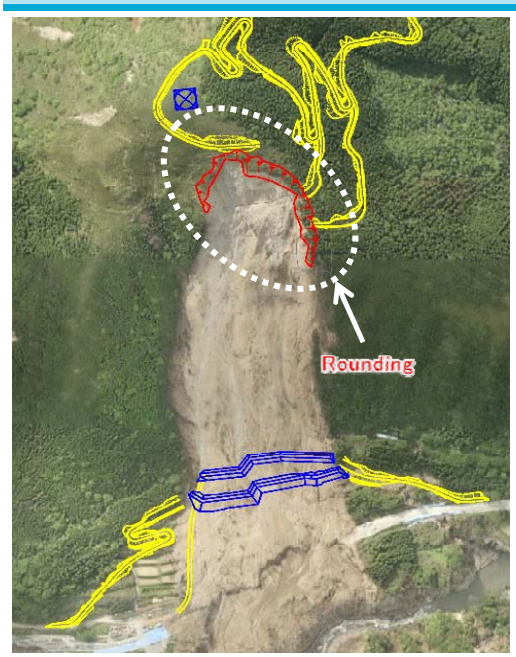
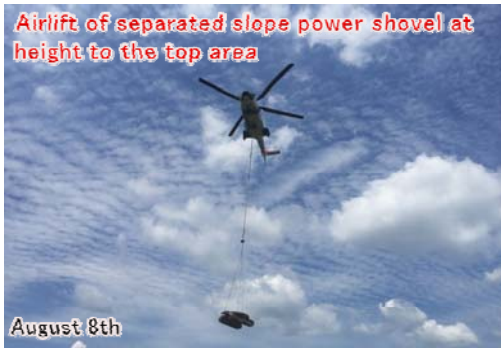


Overview of method of construction 〔Safety climber method〕



Status of the works for eliminating unstable earth and sand

Kyushu Regional Development Office, MLIT

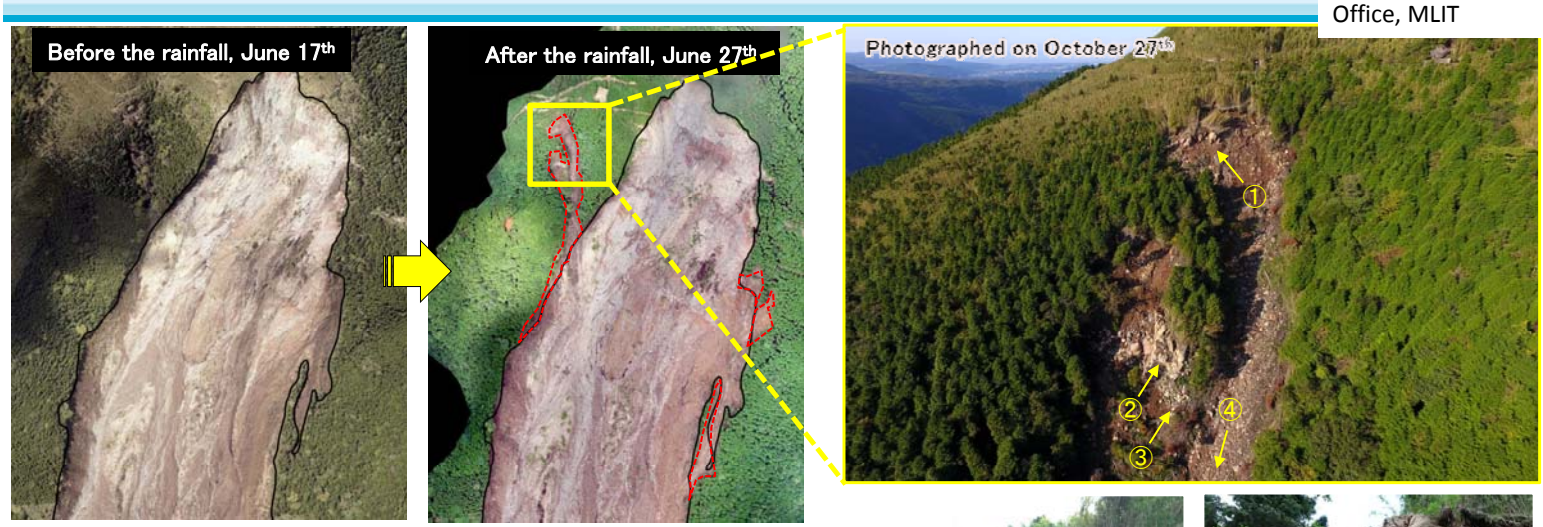
- Elimination of unstable sands, stones that may trigger falling of stones
- Start of works: August 31th by using three slope power shovel at height
- Completed in two months and half on November 10th

Before the works August 23rd

Status of the works October 25th

Elimination of unstable rocks left by gully erosion

Kyushu Regional Development Office, MLIT



Heavy rainfall on June 20th accelerated the gully erosion

Rock climbing method of construction