

FIELD TRIP TO SHOBARA HILLS AND ENVIRONS

Organized by : Japan Landslide Society (Kansai Branch)

Date : 28th September, 2011

Departure point : Faculty of Science and Engineering car parking lot.

Number of personnel: Seven (7)

FIELD GEARS USED:

- Protective head-gear (Helmet).
- Potable water can(s).
- Foot-gears.
- Safety eye wears.
- Rain coats/ Umbrellas.
- Geologic compass (Prof. F. Wang).
- Field knap-sacks.
- Personal computers.
- Measuring tapes.
- Stationeries.
- Digital cameras.
- Topographic base maps (1: 50000).
- Landslide pictures.

Field trip to Shobara Hills and environs was organized by Japan Landslide Society (JLS), Kansai branch which Geoscience department of Shimane University has members in attendance.

We left the faculty parking lot in company of our Professor, (Prof. F. Wang), on the wheels of the 4×4 SUV owned by Geoscience department of Shimane University.

After a brief stop for lunch in a restaurant in Hiroshima Prefecture, we joined other colleagues from other Universities. At about 1230hrs, we left our meeting point in a convoy of two (2) vehicles: a 40-seater bus and our car.

Observations on Route 183

Two distinctive landslides were observed on route 183. From the topographic base map, the landslides are located at Site #1 and Site #1C respectively.

Their characteristic features are described as follows:-

Site #1C:

Site 1C is located at the eastern side of route 183 near Shinjocho Town. The distance of the landslide site to the major road was estimated to be about 2km. The site is located farther away from houses and settlements therefore, no visible hazard was seen.

Dip direction of slope: West

Material composition: Colluvium.

Site #1:

Site #1 is located in the southern part of Hirako Town, along route 183. Based on estimation, the distance between the landslide site and the major road was taken to be about 1.8km. No visible damage was seen because the location of the landslide is not very close to houses.

Dip direction of slope: East.

Material composition: Colluvium

However, corrective measures should be taken because high magnitude debris and mud flow should not be neglected considering the elevation of hills and steepness of slopes surrounding the inhabited areas.

Geologic Setting of Shobara Hills

Shobara Hills is located in the northern part of Hiroshima Prefecture. The altitude of the hills range between 200m and 1200m above sea level (asl) with steep slopes measuring less than 40°. Shobara Hills and environs are underlain by rhyolite of Mesozoic Age. Mean annual temperature is about 12.8°C while mean annual rainfall is about 1610mm.

General Characteristics of Landslides Studied Along Route 445, Shobara

- The initial movement of unstable materials was by sliding especially near the head scarp of the landslides. Liquefaction of the sliding material by intense rainfall brought about debris and mud flows.
- Majority of the landslide sites visited has length averaging 12km with width of about 5km (special reference to Site #5). Landslide dimension of 5km × 3km has been recorded by Igwe and Fukuoka (2010) in Shobara. Where the hills are close to the highway, the original dimensions of the landslide could not easily be known due to remediation works that has been done on the highway to make it accessible to vehicles again.
- Generally, a close observation from a distance of about 50m on Shobara Hills show a characteristic side-by-side feature of the Hills. The landslide surfaces (failure plane), were seen to be reddish to brownish coloured while the stable vegetation cover lies adjacent to the landslide surface. This characteristic feature is similar to an unripe (green) orange that is peeled in a like fashion where its skin is removed in spaces of 3cm. Prof. F. Wang termed the phenomenon '**Skin Failure.**'
- The energy of the mud and debris flow was adjudged to be of high magnitude. The result was observable in the field as big boulders, rocks and uprooted trees were deposited at the toes of the landslides.
- The characteristic shape of landslides observed on route 445 is trapezoidal.
- Pumice, (an extrusive volcanic rock formed by sudden cooling of pressurized magma) was adjudged to be probably, the main liquefying material within the landslide. Pumice is known for its ability to retain water due to 'holes' created in it during the escape of pressurized gases. This statement is yet to be supported with experimental results.



fig 1: Characteristic material composition at toe of landslide #5



fig 2: Remediation work at Site #4



fig 3: Characteristic differential "peeling" of some parts of Shobara Hills



Geotechnical Remediation Works on Route 445

Almost all the sites visited on route 445 are undergoing remediation works. This could be attributed to the steepness of slopes, material composition of the landslides and the elevation of the hills within the area. The various remediation techniques employed are described as follows:

- **Concrete Check Dam A:**

This was seen at Site #4. The landslide occurred in July, 2010 after an intense rainfall causing heavy debris flows which crossed the highway (route 445) and attacked a house situated just opposite the landslide and in front of a drainage channel. One fatality was recorded with total destruction of the property (Igwe and Fukuoka, 2010).

- **Concrete Check Dam B:**

This was seen at Site #5. The landslide in this site has the longest length. The associated debris flow was said to cross the major road and continued downstream. No fatality or

damage was recorded because the area was covered by vegetation. Length of the Check dam was measured to be 85.5m while height is 10m. Total volume of the dam is 3957.4m³.

- **Drain Pipes:**

To monitor and control groundwater level within the subsurface which may initiate slope failure, drainpipes were seen installed at distinct areas of the slope to direct groundwater out of the subsurface.

- **Reinforced Earth Walls:**

At places where slopes are near-vertical, reinforced earth walls are constructed to hold the unstable material from collapsing.

- **Gabion Walls:**

Down south, along route 445, between landslide site #2 and #4, gabion walls were seen erected on the western side of the highway to hold the near-vertical slopes and prevent slope failure.

Other Remediation Techniques used are: *Rock curtain, wire mesh, anchors and bolts.*



Fig 4: Gabion Walls at site #2



Fig 5: Anchors, dowels and bolts



Fig 6: Gabion Walls at the Site #4



Fig 7: Check Dam at Site #5

Off we go.....Climb the hill!

We rounded off the field trip with an adventurous climbing of one of the hills located at Site #3 to see the main head scarp of the landslide. I was amazed to see the strength and vigor of almost all the senior professors as they made their way up the thick forest of the hilly slope. I almost gave up but was astonished when I looked up front and saw my professors slowly but meticulously ascending the hill. They will pause sometimes to catch their breath at the same time collecting samples from the slope surfaces and analyzing it with intense but lovely argument. It was really fun.



Fig 8: Ascending the hilly slope of Site #3



Fig 9: Upstream face of Site #5 showing tree stumps and cleared debris path

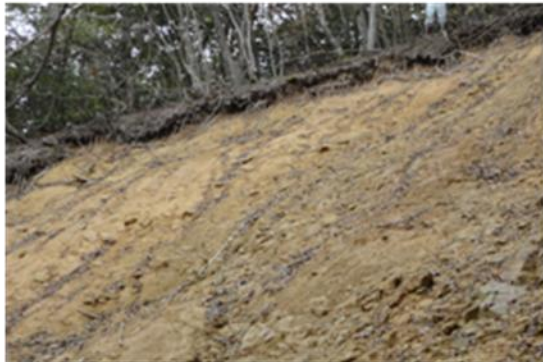


Fig 10: Head scarp of Site #3



Fig 11: Professors taking a break (Site #3)

Alas! We made it to the head scarp. I remember sticking my hands on thorny weeds at the same time hearing my professor beckoning on me to keep it steady! From the head scarp down-slope, the length of the slope surface was estimated to be more than 4km. I also saw my professor using his compass to take some readings which I presume might be slope angle, distance, and elevation.

At about 1700hrs, we left Shobara Hills and went back to Hiroshima. We had party in a posh hotel where we were lodged and went to bed around 1130hrs.

The next day (29th, September, 2011) was mainly technical paper presentation by professors and researchers. The paper presentation ended around 1500hrs. We left Hiroshima after exchanging pleasantries with our friends and colleagues and drove back to Shimane University.