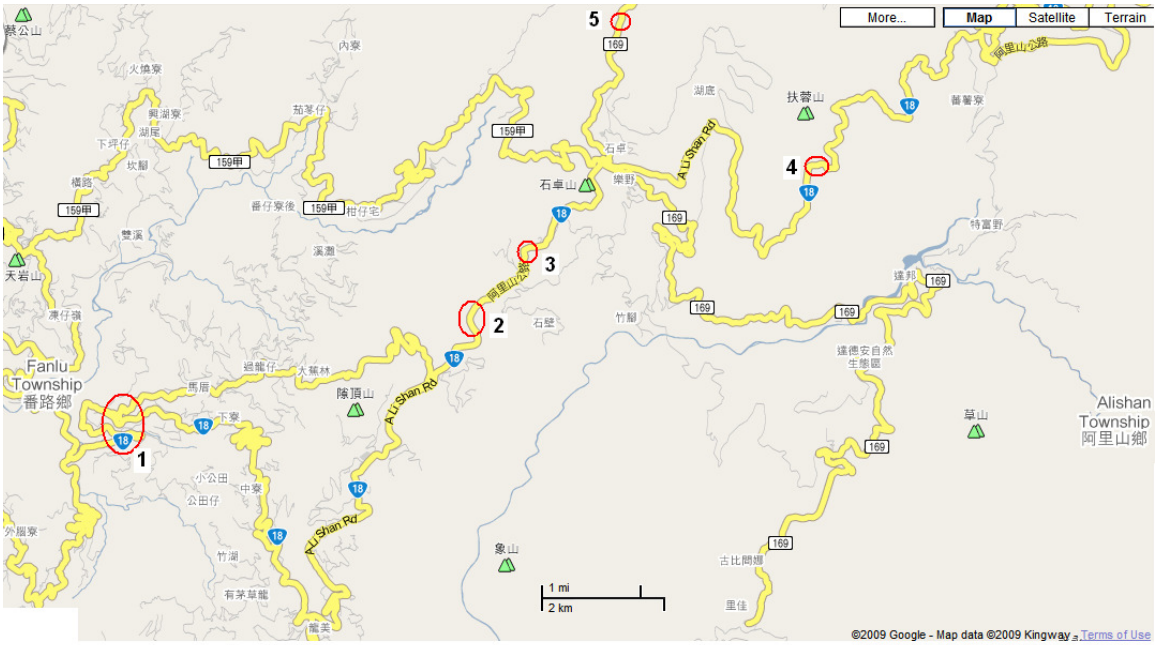
5. ROUTE 18 - Alishan Highway
5.1 General

Route 18 is the only access road to the Alishan Township. Alishan is a mountainous area, and it is one of the most important tourist destinations in Taiwan. The region is also an important agricultural area for tea; some parts of the mountains have been cleared for beetle nut and tea plantations. This action drew criticism as a major cause of soil erosion. Alishan is also home several aboriginal tribes.

Photo 5-1-1. Beetle nut plantation.

Photo 5-1-2. Tea plantation.

Many sections of Route 18 were damaged by Typhoon Morakot. Reconstruction may take up to 2 years, posing a serious threat to the local economy. The damages of the following sites (1-5) are presented in this report.



5.2 Site 1

Sept 2, 2009; 10:15 am (23°26'03"N 120°37'06"E elev 393-497 m)

Photo 5-2-1. The road was buried by a debris flow which traveled from the top of a mountain down to a stream.

Photo 5-2-2. A retaining wall damaged by landslides.

Photo 5-2-3. Another damaged retaining wall.

Photo 5-2-4. Gabions were used in the lower part of the slope.

Photo 5-2-5. Pavement damaged by slope movement.

Photo 5-2-6. An electricity transmission tower damaged by landslides.

Photo 5-2-7. The beetle nut plantation was damaged by soil movement. Part of Route 18 and other landslide sites can be seen in the photo.

5.3 Site 2

Sept 2, 2009; 11:36 am (23°27'03"N 120°40'37" elev 1224 m)

At this site, a shed was constructed to protect the highway from debris flow and to divert the debris toward the valley. Since the shed was built in more than one section, soil movement caused differential settlement of the road within the structure. Part of the shed also moved laterally.

Photo 5-3-1. Debris flow was seen at one end of the shed. Part of the shed was buried.

Photo 5-3-2. Differential settlement of road inside the shed.

Photo 5-3-3. One of the sections of the shed displaced relative to the stable section.

Photo 5-3-4. The other sections did not exhibit relative displacement.

A short distance away from the shed, a large stretch of highway collapsed due to landslides.

Photo 5-3-5. Landslides damaged several hundred meters of the existing roadway. The mountain was cut to create a new access road.

Photo 5-3-6. The surrounding area was dotted with many landslides.

5.4 SITE 3

Sept 2, 2009; 12:13 pm (23°27'36"N 120°41'07"E elev 1240 m)

This was the site of a large landslide. The highway was lost and an access road was constructed.

Photo 5-4-1. Landslides. Note the original location of highway and new access road

5.5 SITE 4

Sept 2, 2009; 2:33 pm (23°28'22"N 120°43'55"E elev 1483 m)

Photo 5-5-1. Another site with the shed.

Photo 5-5-2. Construction joints remained intact; these did not show evidence of relative displacement.

Photo 5-5-3. Several hundred meters of the highway were lost due to a landslide.

5.6 SITE 5

Sept 2, 2009; 3:58 pm (23°29'36"N 120°42'01"E elev 1375 m)

This debris flow site was located at Route 169.

Photo 5-6-1. Source of debris flow can be seen in the distance, up the mountain.

Photo 5-6-2. Debris flow with boulders and gravel of various sizes. The road has been cleared for traffic.

Photo 5-6-3. A building partially buried by debris flow

Photo 5-6-4. The Jersey Barrier was reported to have blocked the water from draining during heavy rainfall

Photo 5-6-5. A different form of barrier which allowed free drainage of rainwater.

Photo 5-6-6. The loss of foundation due to landslides led to the collapse of many retaining walls.

5.7 OTHER SITES

There were numerous landslides in the area, as can be seen below.

Photo 5-7-1. Landslides

Photo 5-7-2. Landslides

Photo 5-7-3. A closer view of huge landslides of Photo 5-7-2

Photo 5-7-4. Landslides