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日本人制限域における調査報告書

SLOPE FAILURE ANALYSIS ALONG THE MAJOR ROADS NETWORK IN NORTHERN PAKISTAN



Submitted to

Kokusai Kogyo Co., Ltd, Tokyo, Japan

Submitted by

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1. Summary

Northern Pakistan is witnessed to frequent and devastating geohazards, mainly including earthquakes and landslides. Mountain ranges in northern Pakistan including the Karakorum and Himalayas have the highest relief on Earth, highest rate of uplift, steep climatic gradient (from glacial to hyper-arid) and therefore hosting frequent and devastating geological and climatological hazards. Among these hazards, the most frequent and devastating are the different types of landslides which are frequently damaging the communication network and disrupting the traffic flow in the region. The frequent landsliding in the region can mainly be attributed to the abundance of unconsolidated, highly weathered and fractured rocks, well-developed rock discontinuities because of the active tectonics, frequent earthquakes, uncontrolled blasting for construction and repair of the roads, presence of the largest glaciers outside the polar regions, precarious locations of alluvial, lacustrine and morainal deposits; severe climatic conditions leading to rapid weathering, poor drainage conditions, scarcity of vegetation, high rates of erosion and anthropogenic activities on instable slopes. These factors suggest that slope movements in the area will continue to occur and posing high risk to the road network. Although the hazards associated with landslides cannot be completely eliminated, however, their devastating impacts can be minimized by assessment and evaluation of the prevailing hazards, understanding their triggering mechanism and accordingly develop and implement the mitigation measures.

The Kokusai Kogyo Co., Ltd, Japan with the financial support of Japan International Cooperation Agency (JICA) has initiated a study on landslide data collection survey along the major road network in the northern mountainous regions of Pakistan. In this regard, active landslides with high risk to the roads were selected by the experts from the Kokusai Kogyo Co., Ltd. The selected landslides located along the major road network in northern Pakistan, including N-35 (Karakorum Highway), N-15 (Naran-Chillas Road), N-75 (Murree-Muzaffarabad road), N-90 (Shangla-Swat Road), N-95 (Kalam Road) and N-45 (Dir-Chitral road) were sub-commissioned to a team of landslides experts from the different universities in Pakistan. The team was tasked to visit the selected landslides and collect the landslide data on a given slope chart, photographs and sketches of the landslides. The team has visited the proposed landslides along the road network and the required data is collected on the given template.

The selected roads in the study area are frequently affected by the landslide hazards. The selected roads are constructed in the mountainous topography and therefore the roads have weakened the shear strength of the slopes and triggering them to landslides. The active seismicity, fractured rocks, monsoonal climate, steep slopes and lack of effective landslide mitigation measures also contribute to frequent landsliding along the road and therefore these roads are often damaged and the traffic is disrupted leading to significant losses to the economy and human lives.

Each landslide was visited and the required information were collected on the provided slope charts, photographs and sketches was drawn on site. On most of the studied landslides, detached and hanging boulders were observed that pose serious threat to the traffic and road. Active erosion on the landslides leads to development of gullies in the landslides and debris flows. The lose debris comprised of boulders, gravels, sand and silt became an easy prey for sliding during a rainy season. The landslide mitigation measures are constructed on some of the landslides including mainly retaining walls, culverts, bridges, afforestation and check dams, however, due to lack of their regular maintenance, most of the constructed mitigation measures are not effective. Some of the studied landslides, specifically along the N-35 and N-15, are significantly large in size and very active and therefore effective mitigation measures needs to be designed and constructed to minimize the negative impacts of landslides. Among the studied roads, the N-35 as the main artery between the province of the Gilgit Baltistan and Pakistan and only land route between the China and Pakistan is facing significant and frequent problems of landsliding with damages to the human lives and economy. The collected landslide data along the selected road shall assist the agencies mainly the National Highway Authority (NHA) and Frontier Works Organization (FWO) to prioritize the landslides according to their magnitude of risk and accordingly design and implement the landslide mitigation measures.

2. Introduction

Landslides and associated hazards are frequently observed in the mountainous regions around the world. They have a devastating impacts on infrastructure and human lives (Regmi et al. 2010). It is estimated that, worldwide, around 1,000 deaths and economic losses of about 4 billion US\$ occur due to landslides every year (Lee and Pradhan 2007). Landslide induced damages are increasing mainly due to increasing urbanization, unplanned development, deforestation and effects of climate change (Kanungo et al. 2008). The communication network including roads and railways in the mountains regions are often subjected to frequent disruption and damages by the landslides along the route.

The Karakoram and Himalaya mountain ranges in northern Pakistan are prone to frequent and devastating geohazards, mainly including earthquakes and landslides. High seismic hazard in Pakistan and adjacent Indian and Afghanistan regions is due to northward movement of the Indian tectonic plate at a rate of 31 mm/year (Bettinelli et al. 2006) which is subducting beneath the Eurasian continent. This collision of the Indian and Eurasian plates resulted in development of world highest mountain ranges i.e. Karakoram, Himalaya and Hindukush mountain ranges (Rao et al. 2006). These mountain ranges have the highest relief on earth, highest rate of uplift, steep climatic gradient (from glacial to hyper-arid) and therefore hosting frequent and devastating geological and climatological hazards. The region is severally and frequently affected by earthquakes, different types of landslides, excessive erosion, impacts of climate change and flash floods (Jones et al. 1983, Bishop et al. 1998, Derbyshire et al. 2001, Hewitt 2009, Hewitt 2009). Among these hazards, the most frequent and devastating are the different types of landslides which are frequently disrupting and damaging the communication network in the region (Derbyshire et al. 2001). The frequent land sliding in the region can mainly be attributed to the abundance of unconsolidated, highly weathered and fractured geology; well-developed rock discontinuities because of the active tectonics, frequent earthquakes, uncontrolled blasting for construction and repair of the roads, presence of the largest glaciers outside the polar regions, precarious locations of alluvial, lacustrine and morainal deposits; severe climatic conditions leading to rapid weathering, poor drainage conditions, scarcity of vegetation, high rates of erosion and anthropogenic activities on instable slopes (Derbyshire et al. 2001, Kamp et al. 2008, Panzera et al. 2015, Shafique et al. 2016). These factors suggest that slope movements in the area will

continue to occur and posing high risk to the road network. Moreover, the landslides often block the rivers/streams, resulting in natural dam such as the recent Attabad Lake, with devastating impacts on highway, geomorphic consequences and disturbing the entire river system of the region. Although the hazards associated with landslides cannot be completely eliminated, however, their devastating impacts can be minimized by assessment and evaluation of the prevailing hazards, understanding their triggering mechanism and accordingly develop and implement the mitigation measures.

The Kokusai Kogyo Co., Ltd with the financial support of the Japan International Cooperation Agency (JICA) initiated landslide data collection survey along the major road network in the mountainous regions of Pakistan. In this regard, landslides with high risk to the roads were selected by the group of experts from the Kokusai Kogyo Co., Ltd. The selected landslides located in the inaccessible sites along the N-35 (Karakorum Highway), N-15 (Naran-Chillas Road), N-75 (Murree-Muzaffarabad road), N-90 (Shangla-Swat Road), N-95 (Kalam Road) and N-45 (Dir-Chitral road) were sub-contracted to a team of landslides experts from the different Universities in Pakistan. The team were tasked to visit the selected landslides and collect the hazard and risk assessment data on a given template, photographs and sketches of the landslides. The brief information of the surveyed road network is given below.

3. Geological Background

3.1. Tectonics Setting

The geological setting of Pakistan, in the framework of the modern concept of plate tectonics, is rare and matchless in the world. Himalayan orogenic belt is the result of Tertiary Himalayan collision between the Eurasian and Indian plates. As a result of this collision Kohistan Island arc formed which was sandwiched between Indian and Eurasian plate followed by closing of Tethys ocean. This era of collision and formation of orogenic belt is named as Himalayan orogeny. Geologically the tectonostratigraphic units of Northern Pakistan is extremely complex. The aftermath of the events of the collosion of plates has brought disastrous effect on the stratigraphic sequences. The area is characterized by very complex structural features and fragile rocks. In general, project area is dominated by igneous, metamorphic and sedimentary rock units.

3.2. Regional Geological Description

3.2.1 Besham to Swat Section (N-90)

3.2.1.1 Besham Basement Rocks

In the Besham Complex assemblage of rocks of different origin have been folded togather, intricately mixed, involved or otherwise complicated. Stratigraphically, Besham Complex is divided into five units. The oldest is the Besham group. It is composed of heterogeneous gneisses and metasediments. Among the heterogeneous gneisses, sodic quartzofeldspathic gneisses of Besham group is considered as Lahore granite.

The second oldest rocks, are the mafic dykes, which intruded Besham group. These dykes have been metamorphosed to amphibolite grade. The third group of rocks includes cogenetic small granitic intrusions and associated pegmatites. The fourth unit in the Besham area is 'Karora group' which rests unconformably over the earlier three units. The fifth unit is leucogranite that intrudes both the Karora and Besham groups. The upper contact of Besham group with Karora group is unconformable.

3.2.1.2 Karora Group

The term Karora Formation is used to describe a sequence of marine metasediments which was deposited unconformably over the Besham group. The unconformity is marked by metaconglomerate, which grades upwards into a thick unit of graphitic phyllite and in turn, is overlain by a jointed siliceous dolomite.

3.2.2 Besham to Chillas Section (N-35)

3.2.2.1 Kohistan Island Arc (KIA)

Kohistan is an intra-ocean island arc bounded by indus Suture Zone (Main Mantle Thrust (MMT) to south and in north by Main Karakrum Thrust (MKT). The central part of the arc arranged is mainly composed of Kohistan Batholith which comprises mainly gabbro, diorite and grano-diorite which are intruded by younger dykes and sills of leuco granites.

The southern part of Kohistan is composed of thick sequence of mafic and ultramafic rocks. These rocks may be divided into three tectano-metamorphic complex, separated by major thrust zone. The KIA is mainly comprised of Jijal, Pattan and Chillas complexes.

3.2.2.2 Jijal Complex

This is the suture zone of Indian plate at Kohistan Island arc, or upthrust slice of mantle which has come forward along suture zone. This suture zone is known as MMT. The composition of Jijal complex is peridotite and pyroxinite dunite. This garnet granulite facies metamorphosed complex is made up of ultramafic base and gabbroic top, persumbaly representing cumulates in the roots of the Kohistan arc.

3.2.2.3 Pattan Complex

Jijal complex is overlain by Pattan complex. It is slightly metamorphosed. It consist of ultramafic and mafic rocks. Mafic rocks are gabbro, diorite and gabbro-norite. The ultramafic rock is pyroxinite. It consists predominantly of amphobolites and subordinately of hornblende gneisses, diorites, granitoids with minor pegmatites and metasediments.

3.2.2.4 Chillas Complex

Ultramafic and gabbronorite rocks of the Chillas complex are intrusive into the top of the Kamila amphibolite belt. Generally separating the granitic belt from the southern amphibolite belt, this complex extends E-W for about 300km and attains a breadth of up to 40 km. More than 85% of it is made up of meta-gabbronorities; other lithologies include hypersthene quartz diorites, anorthosite, chromite layer dunnite and peridotites and retrograde amphibolities.

3.2.3 Naran to Chillas Section (N-15)

The location of MMT in the SE Kohistan was known only at two places, i.e., Jijal and Babusar Pass. The Main Mantle Thrust is a premetamorphic or synmetamorphic fault that dates the time of obduction as pre-late Eocene and possibly as early as Late Cretaceous. Obduction along the Main Mantle thrust is associated with west-southwest-vergent folds on the Indian plate. Sharda group at Kaghan Valley is exposed on the roadside from Batal to Babusar. Calc-pelites, massive and thick band marble, politic gneisses, graphitic gneisses, garnetiferous calc-pelites, feldspathised prophyroblastic Gneiss, migmatites and granite gneiss, Gittidas granite gneiss, Babun granite gneiss are present in Kaghan Valley.

It is largely comprised of metapelitic, metagreywack gneisses followed by thick amphibolitic layers and diorite dykes.

3.2.4 Swat-Kalam section (N-95)

The area is covered by various types of plutonic and a Iesser quantity of sedimentary and volcanic rocks. Quartzites, siliceous schist, phyllite, siltstone, shale and limestone of the Kalam Group (Carboniferous to Siluro- Devonion) are exposed in Matiltan - Kalarn area. Norites, diorites, and the associated rocks of the Kohistan Basic Complex (Late Cretaceous) cover a large area to the south of Kalam. They form a northeast trending belt that extends to the east in Indus- Kohistan and to the west in Dir. To the northwest, the Kalam Group is overlain by a thick sequence of silicic to intermediate lavas, tuffs and agglomerates (the Utror Volcanic Rocks) of probable Creto-Eocene age.

3.2.5 Dir -Chitral Section (N-45)

3.2.5.1 Gahirat Marble (Chitral section)

The Gahirat Limestone is a thick complex of ash grey marble grey, massive and contains coarsely crystalline marble. The rock units of Chitral area are dominated by argillaceous succession and carbonate units of Ordovician to lower Cretaceous age.

3.2.6 Murree -Kohala Section (N-75)

3.2.6.1 Murree Formation

The Murree Formation is composed of red thinly laminated siltstone, shale, clay, with subordinate intraformational conglomerate. The sandstone is fine to medium grained, pale green to grey, maroon coloured, calcareous and greywacke in nature. The beds of sandstone, clay or shale alternate with each other. This pattern shows a cyclic deposition.

4. Landslide Data Collection

4.1 Karakorum Highway (N-35)

The Karakorum highway (N-35) traverses through Himalayan-Karakoram mountain ranges in northern Pakistan which are one of the most rapidly rising mountain ranges on earth with extreme topographic and climatic environment. The route also touches along the largest glaciers outside the Polar Regions and therefore is also prone to the glaciers associated hazards. A combined impact of geo-hazards including earthquakes, landslides, debris flows, glacial erosion, flash floods, river incision, periglacial action and an unpredictable input of monsoonal rains make it a region of very high geodynamic activity. The existing Karakoram Highway (KKH), which is an important component of the China Pakistan Economic Corridor (CPEC) in near future, has been frequently subjected to damages, human loss and disruption by rock fall, sliding of debris and rock, debris flow, mudflow and flash floods. Different types of mass movements along the KKH, are triggered by natural factors including the presence of well-developed rock discontinuities, extensive unconsolidated deposits, high relief, steep natural slopes, occurrence of torrential rains and seismically active nature of the region. The anthropogenic factors including uncontrolled blasting for roads and buildings construction on slopes also contribute to the landslides in the region. These factors suggest that slope movements in the area will continue to occur and high risk to the highway despite the remedial measures. Moreover, the landslides often block the rivers/streams, resulting in natural dam such as the recent Attabad Lake, with devastating impacts on highway, geomorphic consequences and disturbing the entire river system of the region (Delaney and Evans 2017). The various types of landslides that affect the KKH include rock falls, topples, plane failures, wedge failures, debris slides, debris flows and mud flows (Kibria and Masud 2006). Moreover, the development and settlements in northern Pakistan is also concentrated along the KKH and therefore the lives of the inhabitants are also at high landslide induced risk. Therefore, it is of significant importance to evaluate and characterize the spatial and temporal distribution of the landslides along the KKH and assist the concern agencies in developing and implementation of the landslide mitigation activities. The landslides along the KKH have been extensively studied by different researchers (Hewitt 1982, Hewitt 1999, Korup et al. 2007, Hewitt 2009, Hewitt 2009, Hewitt and Liu 2010, Bacha et al. 2018, Khan et al. in press). Although the hazards associated with slope movements cannot be completely eliminated, however, their devastating impacts can

be minimized by assessment and evaluation of the prevailing hazards, their demarcation and monitoring. As a part of the study, 27 landslides were selected along the KKH (Figure 1) for their detailed characterization on the given template given in the annexure 1. The proposed mitigation measures are presented in Table 1.



Figure 1: Location map of the surveyed landslides along the N-35

4.2. Murree-Muzaffarabad road (N-75)

The Murree-Muzaffarabad road (N-75) connects the Islamabad with Muzaffarabad and passes through the Murree and Abbottabad. The road is often damaged and disrupted due to frequent and damaging landslides. The geology of the region is mainly comprised of the loose and fractured Murree Formation which is mainly covered by mudstone, siltstone, sandstone and shales of Miocene age. The region is receiving abundant rains mainly during the monsoon season from July to September. The uncontrolled blasting during the road construction on fragile slopes has significantly reduced the shear strength of the slopes that ultimately leads to landslides during the rainfall. The road is used by the tourists aiming to the Murree and Galiyat which are the famous summer resorts. The road is also of significant importance as this is the preferred route to connect the Azad Jammu and Kashmir (AJK) with the rest of the country. The selected landslides along the route were mainly old that were triggered during the road construction. The slides become active mainly during the monsoon season. Due to the importance of the road, retaining walls are often constructed along the route to stabilize the slopes which are effective in some of the studied locations. Culverts and bridges are also constructed on streams passing through the road. Vegetation is also grown and check dams were constructed on two of the studies debris flows to stabilize the slopes and protect the road. However, the existing mitigation measures are not effective on the studied debris flows and therefore needs further attention from the concern agencies in designing and construction effective mitigation measures to minimize the negative impacts of debris flows. Monitoring and detailed characterizations of the selected landslides shall evaluate the prevailing risk and assist in forecasting the landslides. As a part of the study, 05 landslides were selected along the N-75 (Figure 2) for their detailed characterization on the given template given in the annexure 2. Proposed mitigation measures are presented in Table 2.



Figure 2: Location map of the surveyed landslides along the N-75

4.3.Naran-Chillas Road (N-15)

The Naran-Chillas road (N-15) connect the city of Balakot with the summer tourists resorts in Kaghan, Naran and Chillas. The region is frequently affected by landslides mainly due to active tectonics, high seismicity, fragile geology, and steep topography. The 2005 Kashmir earthquake also triggered many landslides along the N15, some of which are still active. Topographic features of the area are mainly mountainous, undulated terrain, and high relief. Shallow landslides on steep slopes are the common phenomena in the area (Basharat et al. 2016). Due to heavy snowfall in winter, the road is often closed during the winter season, however, heavy traffic mainly of tourists is present on the road during the summers. During the summer, the N15 is also utilized as a shortcut connection between the province of Gilgit-Baltistan and down country. The region is receiving abundant monsoon rains that also contribute in triggering the landslides. River cutting of the banks also trigger landslides in the area. Along the road, retaining walls are constructed on some of the landslides to protect the road from sliding, however, mitigation measures to stabilize the slopes are mostly lacking. As a part of the study, 11 landslides were selected along the N-15 (Figure 3) for their detailed characterization on the given template given in the annexure 3. Proposed mitigation measures are presented in Table 3.



Figure 3: Surveyed landslides along the N-15

4.4.Shangla-Swat Road (N-90)

The Shangla Swat road (N-90) connects the Besham and Swat. Active seismicity, monsoonal climate, rough topography and fragile geology contribute to frequent landsliding along the N-90. However, the landslides along the N-90 are mostly shallow in nature. Deep seated and old landslides were also observed along the road. An active debris flow is present along the road which is frequently obstructing the traffic and posing threats to the downstream community mainly during the monsoon season. Landslides along the N-90 are mostly slope failure with an active rock fall. Retaining walls were constructed to protect road from sliding, however, mitigation measures to stabilize the slide is lacking. As a part of the study, 05 landslides were selected along the N-90 (Figure 4) for their detailed characterization on the given template given in the annexure 4. Proposed mitigation measures are presented in Table 4.



Figure 4: Surveyed landslides along the N-90

4.5. Kalam Road (N-95)

The Kalam road (N-95) connects the Khawzakhela town with the summer touristic sites of Kalam and Bahrain in the District Swat. The road was severally affected by the 2010 mega flood. Most of the road was swept away during the flood. Currently extensive repair work in underway to rebuild the road. Due to active tectonics, rough topography and anthropogenic activities on the steep slopes, the region is frequently affected by landslides. Active deforestation is triggering extensive surface erosion that eventually leads to landslides. Extensive scree slopes are present along the road that are slided to the road during the road repair and rainfall. Complex landslides were also present along the Kalam road comprising of rock fall at the slide crest and the detached debris act as a debris fall and flow during the rainy season. Retaining wall is built along the road to protect the road from river cutting, however, mitigation measures are lacking to stabilize the road or protect the road from landsliding. As a part of the study, 5 landslides were selected along the N-95 (Figure 5) for their detailed characterization on the given template given in the annexure 5. Proposed mitigation measures are presented in Table 5.



Figure 5: Surveyed landslides along the N-95

4.6. Dir-Chitral road (N-45)

The Dir-Chitral Road (N-45) connect the district of Chitral with the down country. Due to rough topography, active seismicity, fragile geology and anthropogenic activities on steep slopes, the region is witnessed to frequent landslides. Most of the landslides along the N-45 are shallow landslides which are mostly triggered during the rainy season.

As a part of the study, 5 landslides were selected along the N-45 (Figure 6) for their detailed characterization on the given template given in the annexure 6. Proposed mitigation measures are presented in Table 6.



Figure 6: Surveyed landslides along the N-45

5. Recommendations

- 1. A detailed study of the high risk landslides for their geotechnical and geophysical characterization and long term monitoring is strongly recommended. The study shall assist to evaluate and understand their deformation pattern and triggering mechanism. The study shall also assist to establish the triggering precursors for the landslide activity to assist the government agencies in predicting the landslides. Based on the derived results, a team of relevant experts comprising of earth scientist, geologists, engineering geologist, and civil engineer shall survey the high risk landslides and suggest mitigation measures.
- 2. A monitoring team of relevant experts shall be designed to regularly monitor the high risk landslides and monitor the prevailing condition and existing mitigation measures and accordingly suggest the repair of existing measures of suggest new mitigation measures.
- 3. A scientific research teams shall be established in the NHA and FWO for the landslides induced hazards, vulnerability and risk evaluation along the major road network in the country. The team shall establish a close liaison with the relevant academia in the country to utilize their expertise and resources in understanding the nature, causative factors and triggering mechanism of landslides in different parts of the country.
- 4. The historic record of the landslides activity along the road network shall be established and regularly updated. Such record shall assist the correlate the temporal landsliding activity with the weather and technic records to assist in landslides hazard assessment.
- 5. The road construction, extensions and repair in the landslides prone regions, shall be executed under the supervision of the landslides experts to minimize the negative impacts of landslides.
- 6. Public awareness campaign shall be launched in the landslide prone regions. Through local language pamphlets, print and electronic media the devastating impacts of landslides, the causative and triggering factors and possible mitigation measures shall be shared with the public. The afforestation shall be encouraged and deforestation shall be strongly discouraged. A close liaison shall be established between the local community and the concern agencies to share the information of the changing behavior or active deformation of the landslides. The community shall be warned of possible landslides prior to a rainfall event or rainy season to minimize the damages to the infrastructure and human lives.

7. Regular regional scale landslide monitoring/inventories shall be established with the relevant academic institutions mainly through satellite or air borne remote sensing data. Recently the European Space Agency (ESA) has launched the free satellite data from the Sentinel-II mission with 10 m spatial resolution and 5 days temporal resolution. Such data resource can be effectively utilized to regularly monitor the dynamics in the landslides from local to regional scale. For detailed characterization and mapping the Unmanned Survey Vehicles (UAV) shall be utilized in high risk landslides.

Table 1: Proposed Mitigati	on measures for studied	l slopes along N-35	(Besham to Chillas)
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S#	ID	Location	Туре	Proposed Mitigation Measures	Description	Priority
01	N-35-01	34°56'26.6" 72°52'40.3"	Slope Failure	Retaining Wall	This slope failure is actually cut slope due to the excavation for N-35 and link road above the scarp. Meta-sedimentry sequence of besham basement group is exposed along the cut slope. The rock is highly jointed and cracked. Three gullies has marked towards the valley side. Erosion along these gullies is endangering the stability of N35. Retaining wall is partially damaged.	Medium
02	N-35-02	34° 56' 36.1 72° 52' 40.6	, Debris Flow	Construction of culvert, Construction of check dams on upstream	A seasonal stream crosses the highway at this location. Small catchment area with debris fall/rock fall material are present on the upstream. Small landslide was also observed along the stream which contribute in the debris volume. Granite is exposed along the stream. Various boulders of granite size more than 1 m3 has also been observed. The culvert has been blocked due to debris material along this channel.	Medium
03	N-35-09	34°57'28.1" 72°53'1.8"	Slope Failure	Development of Drainage Channels and Construction of Retaining Wall	The landslide is located on N35. This is an old landslide that was triggered during the road construction. The landslide has active surface erosion mainly induced by the rain water and therefore gullies are present on the landslide body. On the slide, detached boulders are present that are prone to slide during a rainfall and can damage the road and traffic. The landslide is void of any trees. The slide scarp is visible. A culvert was constructed to drain the rain water from the slide, however, it is buried by the sliding debris. Tensions cracks were visible on the slide. The rainwater from the slide is flowing on the road and therefore damaging the road. The rain water needs to be properly drain out to protect to road. No mitigation measures are constructed to stabilize the landslide.	Medium

04	N-35-10	34º 58' 53.2 72º 54' 11.3	, Debris Flow	Construction of culvert, Construction of check dams on upstream	The debris flow is located on N35. It is a historically active debris flow with continuous flowing water. The water seeps beneath the road and through could lead to potential disaster and significant damages to the road. The source area of the DF is void of any vegetation except some shrubs and bushes with steep gradient of 30-40 degrees. Detached boulders, gravels, sand and silt was present at the toe of the DF above the road. During the rainy season it become active and often leads to damages to road and disruption of the traffic. Part of the DF is also prone to rock fall and slope failure. The source of the DF is a V shaped valley. No mitigation measures is constructed to protect the road from the flowing debris. Bedrock of the DF is granitic. Cracks were present on the road and therefore need effective mitigation measures to protect the road from damages.	
05	N-35-14	35°00' 11.9" 72°53' 53.90'	, Slope Failure	Construction of retaining wall	This rotational landslide is located on N35. It is historically active slope failure. The slide was mainly triggered during the 2005 earthquake and also reactivated during the torrential and prolonged monsoonal rains of 2010. The slide also become active during the rainy seasons. The scarp and upper parts of the slope is partially stable with thick vegetation. However, the portion of the landslide close to the road is still active and prone to frequent sliding and rock fall and therefore posing threats to the road. Many detached boulders and gravels are hanging on the slope posing threat to the road and traffic. No mitigation measures are constructed to protect the road from the fallen rocks or debris. Bedrock of the slide is fractured and weathered granitic rocks. Water erosion leads to development of gullies on the slide.	c

Medium

06	N-35-26	34º 02' 19.4" 72º 52' 49.3"	Rock Fall/Slope Failure	Retaining Wall/ Rock bolting, Wire mesh	The slide is active rock fall and cut slope posing great and frequent risk to road. Bedrock of the slide is highly fractured and weathered pyroxinite. The slide has hanging boulders and gravels posing threats to road and traffic. Some sections of the slide are very steep with slope of around 60 degrees. Slide is void of vegetation. During the rainy season the slide is also prone to debris flow comprising of boulders, gravels, sand and silt. Rock fall is planar in nature. Water seepages is observed on the right flank of the slide. Intersecting joints leads to wedge failure. Drainage is developed on the slope and at the stream outlets fan shaped talus are developed. No effective mitigation measures are constructed for the rock fall.	Medium
07	N-35-28	35º 02' 25.7" 72º 56' 6.8"	Slope Failure	Construction of shed/ Drainage diversion	This is an active slope failure and rock fall. The failure has historically affected the road. The wedge shape failure is found on the slide. Detached boulders and gravels are hanging on the slide that combine with the sand and silt leads to debris flow during the rainy season. The slide is void of vegetation. Bedrock is highly fractured and jointed pyroxinitic rocks. Drainage is developed on the slide and active weathering and erosion leads to development of gullies on the slide. Retaining wall is constructed to stabilize the slide, however, the right side of the retaining wall is already damaged. Rainfall is the major trigger for the slide and therefore leads to road damages and disruption of traffic during the rainy season. One of the trigger of the slide is also the freeze and thaw phenomenon. Since this slide is frequently damaging and disrupting the slide and therefore needs quick and comprehensive mitigation measures to minimize its impact on road.	High

08	N-35-29	35º 02' 34.9" 72º 56' 23.7"	Rock Fall	Retaining Wall, Rock bolting	The slide is an active rock fall. The exposed bedrock is comprised of exposed pyroxinite rock. The bedrock is highly deformed and jointed. Tension cracks were visible on the slide. Boulders and gravels were detached and hanging on the slide and therefore posing threats to the road and traffic. Rainy water induced surface erosion leads to development of gullies on the slide. Intersecting joints leads to wedge failure. Talus is visible at the slide toe. No mitigation measures is adopted to stabilize the slide. However, retaining wall is constructed to protect the road from sliding.	Medium
09	N-35-30	35º 02' 42.2" 72º 56' 27.1"	Rock Fall	Retaining Wall/ Rock bolting, Wire mesh	The slide is an active rock fall/slope failure. Gullies were observed on the slide. Talus deposits were noted at the end of the developed gullies. Wedge failure is observed on the slide. Detached and hanging boulders and gravels were observed on the slide that are prone to fall during rainy season or moving cattle and posing threat to road and traffic. Many vehicle were reportedly damaged due to fallen rocks. No mitigation measures is adopted to stabilize the slide or protect the road/traffic from falling rocks. A retaining wall is constructed to support the road. The pyroxinitic bedrock is exposed and therefore void of any vegetation.	Medium
10	N-35-31	35° 02' 42.2" 72° 56' 33"	Slope Failure	Retaining Wall	This is a deep seated multiple rotational landslide. The main body of the slide is consolidated with shrubs and grass. However, the toe of the slide which is close to the road is active due to road cutting. On the slide, detached boulders are present posing threats to the road and traffic. Active erosion on the landslide debris leads to development of gullies. Bedrock of the slide is proxininite. The slide is frequently affecting the road, however, no mitigation measures are built to stabilize the slope or the road. On the slide body benching are made by the local people mainly for the agriculture purposes. Dip direction is NW and dip angle is 40-50 degress. The slide is void of thick vegetation.	Medium

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11	N-35-39	35º 04' 13" 72º 57' 19.6"	Debris Flow	Construction of culvert, Construction of check dams, Construction of retaining wall	This is an active DF with well develop erosion channels. The DF has huge source area. The lying debris of the DF are consists of boulders, gravels, sand and silt. The accumulated poorly sorted debris in the erosion channels are already failed and still prone to slope failure. The DF has continuous flowing water, however, the water seeps beneath the road and appears again on the valley side of the road and therefore the road is prone to a disaster. No trees are present in the source area of the DF, however, shrubs and bushes are sparsely present. Boulders are mainly of Dunite and Amphibolite. The DF is frequently affecting the road, mainly during the rainy season. However, no mitigation measures are adopted to drain the water and protect the road from flowing debris. A retaining wall is constructed on the valley side of the road which is also partly damaged. Part of the source area of the DF is also prone to rock fall with detached and fragmented boulders that could also reach to the road and therefore also posing threat to road and traffic.	Medium
12	N-35-45	35º 04' 57.3" 72º 58' 45.7"	Slope Failure	Construction of retaining wall	This is an active slope failure of lose debris comprising of boulders, gravels, sand and silt. The scarp of the slope failure is clearly visible and still prone to rock failure due to presence of detached, weathered and jointed rocks. Presence of the loose debris in the upstream of slide also cause debris flow during heavy rains. Shrubs and grasses are present on the debris however, no trees are present. Active erosion and weathering on the slide leads to development of gullies. Detached boulders are present on the loose debris that often reach to the road and therefore posing threat to the road and traffic. The landslide is frequently affecting the road, mainly during the rainy season, however, no mitigation measures is constructed to stabilize the slope or protect the road from flowing and falling debris. Bed rock is composed of fragmented and jointed Dunite. Loose talus deposits are present on above and below the road.	Medium

13	N-35-53	35º 06' 17.7" 72º 59' 3.6"	Slope Failure	Construction of retaining wall	This is a deep seated multiple rotations landslide. The main body of the landslide is consolidated with presence of grasses, however, the left and right flanks of the landslide is activated mainly due to the road cutting. The debris of the slide is mainly comprised of boulder, gravels, silt and sand. Active erosion on the slide debris leads to development of well-developed gullies. Hanging boulder are also present in the debris that pose threats to the road and traffic. The slide is mainly activated during the rainy season and the loose debris can also leads to debris flow. Despite the continuous damages of the road and disruption of the traffic due to falling debris and rocks, not mitigation measures are adopted to stabilize the slide. A retaining wall is constructed to protect the road, however, it is also buried by the falling debris. A house is located on the ridge of the slide. Tension cracks and open joint are present on the slide. Talus is present on the upper and lower side of the road. Slide is void of any thick vegetation	Medium
14	N-35-54	35º 06' 48.3" 72º 59 ' 59.7'	Slope Failure	Retaining Wall, Wire Mesh, Rock Bolting	This is a complex landslide comprising of rock fall, debris flow and slope failure. Active erosion on the loose material leads to development of deep gullies that often leads to debris flow during rainy season. The exposed bed rock on the left flank of the slide has detached, fractured and jointed boulders that are prone to rock fall and therefore posing threats to the road and traffic. Three roads are passing through the slide at different heights. However, no mitigation measures are constructed to stabilize the slide. A retaining wall is constructed on the valley side of all the three roads. Tension cracks were present on the slide and it is void of thick vegetation. Talus is present above and below the road.	Low

15	N-35-56	35 ⁰ 06' 59" 73 ⁰ 00' 39.8"	Slope Failure/ Rock Fall	Retaining Wall, Wire Mesh, Rock Bolting	An active rotational complex landslide comprising of slope failure, Debris flow and rock fall. Weather, jointed and fractured overhanging bed rock are posing threats to the road and traffic. Active weathering and erosion leads to development of gullies. Debris flow induced erosion tracks are well developed. Talus material comprised on boulders, gravels and sand is present. Bed rock is comprised of Amphibolite. Although it is posing threats to the road, however, no mitigation measures are adopted. This LS needs quick attention from the concern authorities as on the valley side a medical hospital is built which is also prone from the rock fall.	Medium
16	N-35-112	35º 16' 12.3" 73º 13' 23.6"	Rock Fall	Wire Mesh, Rock Bolting	An old rock fall however no signs of fresh rock fall. A steep cliff with jointed, fractured and detached boulders. Intersecting joints leads to wedge. Cracks are open. Bed rock is amphibolite. No mitigation measures are adopted. Houses are located on the top of the ridge. A hospital is located at the valley side of the slide and therefore needs quick attention from the concern authorities.	Low
17	N-35-115	35º 13' 26.1" 73º 13' 25.2"	Slope Failure/ Rock Fall	Retaining Wall, Terracing	An active slope failure and rock fall. Originally a rock fall, however, talus of 16 m is accumulated at the rock fall toe that is prone to slope failure now. Active weathering and erosion on this talus deposits leads to development of gullies. On the rockfall cliff there are many jointed and detached boulder that poses threats to road and traffic. Wedge cutting is observed. Weathering becomes active during the rains and affecting the road. However, no mitigation measures are constructed. A retaining wall is built at the left flank of the slide, however, it is also not enough to stabilize the slide	Medium
18	N-35-116	35º 17' 42.9" 73º 12' 15.5"	Slope Failure	Tunnel	The site (Chochang) has a history of road blockade in past. It is a historical landslide, which is reactivated many times. Initially it was rockfall but now it is slope failure in debris/talus deposit. Deposit comprises of some boulders of size >6 m ³ . Geology of the site is characterized by presence of Kamila Jal Shear zone on backside, which results in intense fragmentation of Kamila Amphibolite.	High

19	N-35-117	35º 18' 5.4" 73º 11' 58.6"	Slope Failure	Retaining Wall, Culvert, Terracing	An active debris fall from an old lake deposits. The talus cone is present in the valley. Active erosion on the talus leads to development of gullies. Water is flowing through the talus and also seeps in the debris. Hanging boulder are present in the debris. The slide is active during the rainy season and can also leads to a debris flow. It is damaging the road, however, no mitigation measures are adopted to protect the road. Trenches are made on the talus to stabilize the debris.	Medium
20	N-35-119	35º 18' 35.8" 73º 11' 26.8"	Rock Fall	Construction of shed	It is impression of old rockfall. Lithology at this site is Kamila amphibolite, which is highly jointed and sheared due to closeness to KJS. Uncontrolled blasting for road excavation triggered this site. In addition to it, river is eroding the valley side of the road resulting in over steepening of the slope towards valley side. There is retaining wall towards valley side for road protection. No countermeasures for rockfall has been constructed.	Medium
21	N-35-134	35º 23' 12.3" 73º 12' 2.3"	Rock Fall/Slope Failure	Retaining wall, Rock bolting	Uncontrolled blasting for road excavation triggered this slope. Lithology is Granulite, which is highly sheared and fragmented rockmass. Slope is collecting a lot of surface runoff due to large catchment area, further leading into gully erosion.	Medium
22	N-35-162	35º 27' 46.4" 73º 14' 56.9"	Rock Fall/Slope Failure	Retaining wall, Drainage Control	The site is characterized by highly jointed Gabbro and talus deposit on slope. This talus deposit contains some boulders of size equal or greater than three m ³ . Slope failure mostly occurs during rainfall when rainwater is infiltrated into deposit. Gully erosion is prominent in debris/talus.	Medium
23	N-35-236	35º 31' 23.8" 73º 39' 59.5"	Slope Failure	Construction of retaining wall, Development of benching, Plantation	Large Talus slope with multiple scarps within the main slope failure. Small bushes can be seen on the talus deposit. During rainfall, the talus slope failure makes this site vulnerable for the continuity and safety of N-35. Due to this surface runoff, gully erosion are visible and prone to debris flow. Retaining wall about 4 feet high was built to minimize the risk but it has been damaged due to recent activity.	High

24	N-35-244	35º 31' 8" 73º 44' 9.3"	Rock Fall/Slope Failure	Construction of Retaining Wall, Culvert	Boulders of 2m ³ at toe indicates rockfall upslope. Small channel passing through slope bringing debris material hence making the gully on the slope. Gabbro of Kohistan batholith is exposed which is crushed and jointed. This crushing and jointing alongwith the blasting for N-35 are the main triggering factors of this slope.	Low
25	N-35-270	35º 28' 55.5" 73º 56' 03.1"	Debris Flow	Construction of culverts, Construction of retaining walls	Mouth of channel is very wide near road forming a fan shaped structure containing boulders of different sizes and some of size 2-3m ³ . Channel divides into two near the road: a) Eastern channel having culvert box b) Western Channel without protection Sides of channel are steep having overhangs.	Medium
26 27	N-35-272 N-35-273	35° 27' 38.1" 73° 58' 9.4" 35° 27' 33.5" 73° 58' 11 2"	Debris Flow Debris Flow	Construction of Culvert / Construction of Bridge	Two channels with large catchment area. The 272 contains small quantity of debris as compare to 273. The 273 contains considerable amount of debris containing some boulders of size 0.5 m3, which can threaten stability of the highway. Further, valley side of channels is very steep due to river erosion. Paved drainage path on valley	Medium
28	N-35-286	35° 25' 43.1" 74° 01' 25.5"	Rock Fall	Rock Bolting, Wire Mesh	side is protecting from erosion on valley side. The site is characterized by jointed gabbro. Three joint sets with average joint spacing 1-2 meters exists leading to wedging failure. Furthermore, the presence of overhangs is increasing vulnerability of the site. Talus deposit is present in gully and is flooded on the road during or after rainfall	Medium

ID Location Proposed Sr. Type Remarks **Priority** No Mitigation Measures The N-75-7 passing through a very big old landslide which comprises almost 3 km² area. Lithology of the site is characterized by claystone, siltstone and sandstone of Miocene Murree Formation. The scarp of Continuous the landslide clearly indicates that it is an monitoring of old landslide. This landslide has been landslide reactivated many times in the past, consequently, small landslides were also displacement 33° 53' 34.5" observed within the landslide. The upper Low 01 N-75-07 Landslide and 73° 24' 38.0" part of the slide is stable, however, at the establishment toe the landslide material has been of early reactivated and there is potential for future landslide. A small landslide on the right warning side has been reactivated and consider as a system potential threat to the road in future. Although, the retaining walls were built to protect the road. However. the displacement upto 4 cm has been observed in the retaining wall. A seasonal stream crosses the highway at Redesigning this location. Stream brings huge volume of and debris every year. During 2007, the debris construction of flow damaged the road completely. Big existing catchment area with debris fall/rock fall material are present on the upstream. Small culvert. landslides were also observed along the construction of Medium 33° 54'15.9" Debris stream which contribute in the debris 02 N-75-09 check dams on volume and have potential to damage the Flow 73° 24' 51" the upstream, road in future. Sandstone bed along the left Development side of the stream is dipping towards the of proper channel. Various sandstone boulders of size more than 2 m3 has also been observed. drainage The bridge and culvert has been damaged control in the past due to debris flow along this network. channel. The site is marked by the presence of landslide and debris flow. Geology of the site is characterized by active fault and Construction highly jointed claystone and sandstone. Due to erosion along two gullies debris of culvert, material has been found in the stream bed. Development Medium 33° 55' 28.9" Debris Beside, debris flow, there is also a potential 03 N-75-20 of proper landslide. Large open crack on the top Flow 73° 27' 3.5" drainage indicates its future potential failure. The control debris flow and landslide are in dangering the stability of the road. Small retaining network. walls has been constructed to protect the road. Along the stream small benching were made to minimize erosional effects.

Table 2: Proposed Mitigation measures for studied slopes along N-75 (Murree to Kohala)

04	N75-28	33 ^o 59' 16.6" 73 ^o 29' 2.7"	Debris Flow	Construction of check dams on the upstream	The site is located on a seasonal stream, where road has very sharp bend. Sides of the upstream are bounded by alternative beds of sandstone and claystone. Some boulders of size greater than 3 m3. The culvert has been constructed for the debris outflow. Vegetation is also present on both sides of the stream. As a countermeasure benching on upstream side was made which is partially damaged. Downstream side retaining walls are also present. No historic debris flow and blockage of road has been found	
05	N75-33	34º 7' 14.9" 73º 29' 35.4"	Slope Failure	Shed has been already constructed , Development of benching, Plantation of deep rooted species	Landslide was initially triggered during 1992 flood. In March 2012, landslide was reactivated during the heavy rainfall. The landslide completely destroyed 200 meter road. The continuity of traffic along this road was disrupted more than one week during March 2012. This section is cut slope consisting of sandstone and shale . The slide is still active. There are large number of open cracks and boulders. As a countermeasure NHA has constructed the shed to protect the road from debris material.	

Low

Low

Table 3: Proposed Mitigation measures for studied slopes along N-15 (Naran to Chillas)

Sr. No	ID	Location	Туре	Proposed Mitigation Measures	Remarks	Priority
01	N-15-04	34° 55' 43.4″ 73° 40' 51.4″	Landslide	Retaining Wall	This landslide is located along N-15, about 3 km away from the Naran town. It is an old rotational landslide which has been reactivated due to road construction and rainfall. The upper part of the landslide is stable with vegetation cover, however, the landslide is active at the toe. Thick forest is also present on the left side of the slide. Due to re-activation of this slide about 100 meters road has been affected. Above the road the landslide scarp is clearly visible. Many detached boulders are hanging on the landslide scarp that can damage the road and the continuity of traffic. The boulders comprising of granite and schist ranges between 1-3 m3 size was present. A retaining wall above 2 m height has been constructed to protect the road from the slide material. However, the central part of this retaining wall has been damaged due to the reactivation of the slide material. Presently, there is no high risk to damage the road, however, in the future if the whole mass of the landslide body will move, lead to the damage and block the road for the continuity of traffic. For mitigation purpose, a retaining wall with a height of 5 meters has been suggested with proper drainage control.	High
02	N-15-08	34º 56' 17.8″ 73º 40' 51.4″	Debris Flow	Culvert	This is an active debris flow with large catchment area. The debris flow origin appears from the glacier valley. The debris material mainly comprises boulders, cobble, gravel, sand and silt. The size of the boulders ranges upto 5 m ³ . The debris flow has a large amount of water in the channel posing great and frequent risk to road. Very huge material is present on both the sides of the erosional channel. The gabion wall has seen at the mouth of the channel to control the debris, however, no culvert has been constructed for the outlet of the water and debris flow material. Therefore, this debris flow posing a significant threat for the continuity of traffic on the road, particularly during heavy rainfall. According to the local inhabitants a very serious debris flow disaster occurred after every five years at the site. For the mitigation measures it has been suggested to construct the culvert for the outlet of the water flow and develop the erosional channel properly.	Medium
03	N-15-09	34° 56′ 22.4″ 73° 42′ 45.6″	Debris Flow	Culvert	The debris material might be active during the rainfall and can also lead to a debris flow disaster in future. Presently, the water is flowing through a narrow channel and along the road it is diverted through channel to reduce its impact on road damage. The loose debris comprises boulder, cobble, gravel, sand and silt. It is likely that future debris flow will continue along the slope. A retaining wall is constructed to protect the	Medium

					road which is also partly damaged. However, no countermeasures have been taken to drain the water and protect the road from the debris material. The debris flow posing risk of road damage in future.	
04	N-15-24	34º 56' 19.9″ 73º 50' 59.7″	Slope Failure	Develop the drainage control system	This slope failure is located about 100 meters away from the N-15. It is an active slope failure of loose material composed of boulder, cobble, gravel, sand and silt. On the back of the slope failure steep cliff is comprised of metamorphic rocks. Any impact to damage the road from the slope failure has not been observed. On the right side of the slope failure man made terraces has been formed. Active erosion on the slope leads to the development of the gullies. A retaining wall is built to protect the road, however, no mitigation measures have been taken to stabilize the slope failure. The slope failure is not being considered to endanger the road.	Low
05	N-15-34	34º 58' 15.8″ 73º 55' 37.1″	Debris Flow	Construction of Bridge	This is an active debris flow with large catchment area and flowing great amount of water. The debris is being mainly comprised of large boulders up to 5 m^3 size. The loose material is present on both sides of the erosional channel. About 60 meters road has been damaged due to this debris flow. The debris flow has continuous water flowing on the road. A retaining wall is constructed to protect the road, however, no mitigation measures have been taken for the outflow of the water. To protect the road from this debris flow in the future, the construction of the bridge has been suggested for the outflow of debris material.	High
06	N-15-53	35 [°] 4′ 28.0″ 73 [°] 56′ 17.9″	Landslide	Retaining Wall	This is an old rock avalanche which triggered due to any tectonic activity in the ancient time. It is presumed the rock avalanche has blocked the stream and created a lake which is known as Lalusar Lake. A channel has been constructed for the outflow of the water from the lake. The rock avalanche material is mainly composed of granite and granite gneisses. The huge boulders are present at the site up to more than 10 m ³ sizes. Presently, this rock avalanche has no impact on the road, however, in future if rock avalanche material will be remoblized it may block the water channel and disrupt the road. A retaining wall has been constructed to protect the road.	High
07	N-15-61	34 [°] 05′ 46.6″ 73 [°] 57′ 17.0″	Debris Flow	Culvert	This is an active debris flow located at the sharp bend along N-15. Presently, the erosional channel is covered with glacier and road has been severely damaged. The debris flow has very large surface run off with steep gradient. The water seeps beneath the road and boulders ranges between 1-3 m ³ are present in the channel towards valley side. Due to this steep gradient debris flow posing serious debris flow disaster which cause to damage the road and discontinuity of the traffic. A culvert is constructed for the out flow of the water, however, it does not fulfill the requirement. The active landslides were also observed both side of	High
					the river bed along the road posing risk to damage the road. A retaining wall is constructed to protect the road which has been damaged due to the debris flow. For the mitigation purpose, a culvert for the outflow of the water and debris material should be redesign and constructed.	
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08	N-15-72	35 [°] 11' 2.3" 74 [°] 02' 38.1"	Debris Flow	Depth of Channel Should be increased	The debris flow is located along N-15 with large surface runoff. The debris flow origin appears from the top of the Babusar (13700 feet asl). This debris flow has very large catchment area and long run-out. It is a permanent stream with flowing water through out the year. The main source of water in the stream is glacier and springs. The shallow channel has been observed. A culvert has been constructed for the out let of the water, however, according to the local inhabitant during the heavy rain fall the water is following on the road. Man made terraces at the side of the stream has been observed at the site. The width of the river bed is about 50 meters. The size of the boulders in the stream ranges between 1-5m ³ . Retaining wall has been constructed to protect the road. For the mitigation purposes depth of the channel should be increased for the outflow of the debris material.	Medium
09	N-15- 75-1	35 [°] 15' 36.0" 74 [°] 05' 28.1"	Debris Flow	Construction of Shed	This is an active debris flow along N-15. The debris flow event occurred in July 2017 due to a very heavy rainfall in the area. The debris flow origin from the cliff and lead to a serious debris flow disaster. According to the local inhabitant, three vehicles and local irrigation system have been damaged and road has been blocked more than a week. After one week the material has been removed from the road for the continuity of the traffic. The debris flow has very long run-out and transported a huge debris material which covered the entire road section. Still huge material is deposited along the road site. Large size of the boulders ranges between 1-5m3 are present at the site. The boulders are comprised gabbro diorite and granitic rocks. It has been observed the debris flow is drained by the seasonal water. The gradient of the erosional channel is very steep and lead to potential in future disaster and significant damage of the road. The area is still very unstable and there is a high potential for more events occur. In future, there is possibility this debris flow block the Thak Nala and create a landslide dam. A retaining wall is constructed to protect the road which has been suggested to protect the road in the future.	High
10	N-15- 75-2	35 [°] 15' 40.2" 74 [°] 05' 28.2"	Debris Flow	Construction of Shed	This active debris flow also occurred in July 2017 during heavy rainfall at the 100 meters away from the previous location. The debris flow leads to similar disaster as N-15-75-1. Due to this debris flow about 60 meters road has been partially damaged. The source of the debris flow	High

					has very steep cliff. The debris flow comprises two water channel, however, both channels have been drained by seasonal water. The erosional channel has a very steep gradient. Detached boulders of the size range between 1-5m3 was present in the channel and large number of boulders are still hanging along the road that lead to further disaster. The area is still very unstable and there is a high potential for more events occur. Due to the recent debris flow no mitigation measures have been taken to protect the road. Therefore, construction of shed is suggested to protect the road in the future.	
11	N-15-78	35 [°] 21′ 18.8″ 74 [°] 08′ 18.8″	Debris Flow	Culvert	This debris flow is located on N-15. It is an old debris flow with large catchment area. The unconsolidated debris material is present both sides of the erosional channel. A temporary house is constructed in the middle of the stream and is prone to disaster. No countermeasures have been taken to avoid the debris material on the road. Therefore the road has been damaged due to this debris flow. Presently water is not flowing in the stream, therefore, the stream has been drained by seasonal water. It is likely that future debris flow will continue on the road. For the mitigation purpose construction of the bridge or a culvert has been suggested for the smooth outflow of the water and the debris material	Medium

S#	ID	Location	Туре	Proposed Mitigation Measures	Description	Priority
01	N-90-01	34º 52' 59.2" 72º 45' 0.17"	Rock Fall/Slope Failure	Retaining Wall/ Rock bolting, Wire mesh	This is a cut slope mainly triggered due to road construction. Active erosion is present leading to water gullies. Eroded talus is present along the road. Detached boulders are present on the slide. Part of the slide is prone to debris flow and also rock fall. Tension cracks are also observed. Two roads passes through the slide. Loose debris is present on the slide. It is disrupting the road traffic mainly during the rainy season. No mitigation measures are present.	Low
02	N-90-02	34º 54' 38.3" 72º 49' 20.7"	Slope Failure	Construction of retaining wall	A rotation landslide is mainly triggered during the road construction. The slide is mainly active along the road. Active soil erosion is present leading to development of water gullies. The check dams are developed along the gullies to minimize the erosion. Hanging debris is also present on the slide. The slide is obstructing the traffic mainly during the rainfall. Detached and hanging boulders are also present. Bedrock is impermeable. Shrubs and grass is present on the slide. Talus is present mainly with the road. Spring water is present. No counter measures to protect the slide.	Low
03	N-90-03	34º 55' 25.6" 72º 50' 10.4"	Rock Fall/Slope Failure	Construction of retaining wall	This is a cut slope located on the N90. The landslides is a slope failure triggered due to construction of the road. With the Schist and granite as a bed rock of the slide, part of the slide is also prone to rock fall with detached and hanging boulders. Active soil erosion mainly during the rain, is present on the slide leading to presence of talus is present along the road and gullies on the slide. Spring water is present in the slide. No effective counter measures are present. A culvert is built to drain out the channel water. A retaining wall is built to protect the landslide.	Medium
04	N-90-04	34º 55' 11.3" 72º 49' 43.8"	Slope Failure	Construction of retaining wall	This is an old landslide which is retriggered during the construction of road. Detached boulder are present on the slide. Loose debris on the bedrock are prone to sliding. Active soil erosion on the slide leads to the development of gullies. Shrubs are present on the slide with no trees. No counter measures are present to protect the slide.	Medium
05	N-90-05	35º 27' 33.5" 73º 58' 11.2"	Debris Flow	Construction of Culvert and diversion of drainage	A very active debris flow mainly triggered during the intense monsoon rainfall of 2010 blocking the road for 3 weeks. The debris flow is active mainly during the rainy season blocking the road and obstructing the traffic. A channel is develop to drain the debris flow. Spring water is percolating in the slide debris. Active erosion leads to the development of gullies. Hanging boulders are also present on the slide. Two roads are passes through the slide.	High

Table 4: Proposed Mitigation measures for studied slopes along N-90 (Besham to Shangla)

Table 5: Pro	posed Mitigation measu	res for studied slopes	s along N-95 (Swat to Kalam)

S#	ID	Location	Туре	Proposed Mitigation Measures	Description	Priority
01	N-95-01	35º 19' 29.9" 72º 36' 41.9"	Slope Failure	Retaining Wall	A deep seated translational landslide. Loose debris of the slide is comprised of boulders, gravels sand and silt. The slide is also prone to debris flow mainly during the rainy season. Active soil erosion on the slide leads to development of gullies on the slide. Around 15 meter of slide scarp is prone to rock fall that often reach to the road. Two road are present in the slide, one the middle of the slide and second at the slide toe. The slide has the potential to damage the road and disrupt the traffic mainly during the rainy season. No countermeasure are constructed to stabilize the slide.	High
02	N-95-02	35º 20' 18.9" 72º 36' 39.0"	Debris Flow	Culvert	This is an active debris flow. Channel of the DF is well developed with detached boulders and gravels. The DF is drained by the spring water. Source of the DF is steep scrap with detached and jointed boulders. Eroded talus is present. The slide is mainly triggered during the rainy season. The DF can affect the road and disrupt the traffic. No mitigation measures are constructed to stabilize the slide.	Medium
03	N-95-03	35º 25' 19.6" 72º 36' 5.6"	Debris Flow	Culvert	An active debris flow. Water is coming in the slide from the upstream glaciers. Upstream of the debris flow is also prone to rock fall. Detached boulders are present in the DF channel. The DF can be activated during the rainfall. No counter measures are constructed to stabilize the slide.	Medium
04	N-95-04	35° 30' 58.7" 72° 33' 2.0"	Rock Fall/Slope Failure	Retaining Wall	It is a complex slide comprising of rock fall and debris flow. Debris is comprised of boulders, gravels, sand and silt. Source of debris is from steep outcrop with fractured and jointed rocks. Hanging and detached boulders are lying on the debris that are prone to sliding during the rainfall. Soil erosion leads to development of water channels in the slide. The loose material on the slide is prone to debris flow during the rainy season. Excavation of the loose debris for construction material also trigger the slide. A small retaining wall is built, however, it is also damaged due to falling rocks and not effective to stabilize the slide.	High
05	N-95-05	35° 30' 59.8" 72° 32' 7.5"	Debris Flow	Culvert and Retaining Wall	This is an old debris flow and the road is built in the debris. Debris is comprised of boulder, gravels, sand and silt. Detached boulders are lying on the debris that are prone to slide to the road. Active erosion leads to development of gullies. Scarp of the slide is prone to rock fall. Eroded talus is present along the road. Excavation of the loose debris for construction material also trigger the slide. The slide is frequently damaging the road and obstructing the traffic, however, no mitigation measures are constructed to stabilize the slide.	Medium

Table 6: Proposed Mitigation measures for studied slopes along N-45

Sr. No	ID	Location	Туре	Proposed Mitigation Measures	Remarks	Priority
01	N-45-01	35º 39' 37.3" 71º 45' 58.9"	Rock Fall	Rock Bolting	This cut slope is generated during excavation for N-45. Marble and quartzite is exposed in this section which is jointed and cracked with a risk of over hang blocks. Clayey material is found on both sides of the rock fall. Drainage is also found on the right side of the rock fall.	Low
02	N-45-02	35° 40' 54.8" 71° 45' 59.6"	Rock Fall	Rock Bolting	This cut slope is generated during excavation for N-45. Marble is exposed in this section which is cracked and some open cracks are also observed with a risk of overhang blocks. Drainage is also found on the both sides of the rock fall. Highly weathered.	Low
03	N-45-03	34º 55' 25.6" 72º 50' 10.4"	Slope Failure	Retaining Wall and Develop Drainage System	Rounded to sub rounded boulders, gravels, pebbles and cobbles with sandy, silty clayey matrix. About 0.5 to 1m thick sand layers are also abserved at different lavels along the slope. Few boulders at the top and mid of the slope failure which threaten the road and traffic. This 300 to 400 m wide road section was highly susceptible to erosion. Minor scarps are also observed. 1 feet wide drainage (damaged) is also observed at the toe of slope failure. Gullies are observed at different intervals along the slope failure.	Medium
04	N45-04	34º 55' 11.2" 72º 49' 43.9"	Slope Failure	Retaining Wall and Develop Drainage System	Rounded to sub rounded, angular to sub angular boulders, gravels, pebbles and cobbles with sandy, silty clayey matrix. About 0.5 to 1m thick sand layers are also observed at different lavels along the slope. This 300 to 400 m wide road section was highly susceptible to erosion. Gullies are observed at different intervals along the slope failure. Drainage is bounded on both sides of the slope failures. Road is often blocked during rainy seasons due to material overflow on the road.	Medium
05	N45-05	35º 47' 9.9" 71º 46' 24.7"	Slope Failure	Retaining Wall	Schist is exposed along this slope failure. 4-5 m thick alluvial deposit is also observed along the slope failure. Highly fractured rock along the slope failure. Minor scarps are also observed. 1 feet wide drainage (damaged) is also observed at the toe of slope failure. Gullies are observed at different intervals along the slope failure. Water channel for local supplies is also found at the top of the slope failure.	Medium

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	Cod	le no. N 3 5 _ 0 1	1		Evaluation sh	eet (S	lope f	ailure/R	lockfall)			Date	12/1/2	017
	Reaio	n Office	-		La	titude	. 34	4°56'26.6	"	•			Inspector	Yasir. Saiid. Shafi	que. Basharat
			_		Coordinates	aitudo	7	0052140.2	"						
ſ	lainter				LOI	igitude	/2	2~52 40.5							
					Road name		Km								
[Ca	uses]	factor	lootogon/ of oppro	Chook				[Counterman	1						
	lem	iación	3 or more correspondences	V N			i	Counterme	asurej		Type	of count	armaasuras		
hy	sed	talus slope, clear convex break of slope	2 correspondences	· · · · ·	[Disaster type]						турс	or court	termetastres		
ogra	acto	eroded toe of slope ,	1 correspondences												
top	ů –	overhang, water catchment slope	no correspondence		Rock fall										
			marked		Olana failuna	.1				Effectivene	ess of exi	sting co	untermeasures		Check
	Soil	susceptible to erosion	a little marked	V	Slope failure	N		Determination along	6-11				- form do al conservation of	and the second second	
s	•,		None		[Main check ob	ject]		Potential sio	pe failure are	prevented e	enougn, o	or, it is a	erended enougn wi	nen it is generated.	
ition	¥	high density of cracks and a weak layers,	marked		Cut slope	\sim		Potential slop	e failure are c	considerably	/ prevent	ed, or it	is considerably def	ended when it is	
puo	Roc	susceptible to erosion,	a little marked	V		N		generated.							
cal c	_	fast weathering	None		Natural slope			Potential slop	e failure are p	partly preve	nted, or i	t is partl	y defended when it	is generated.	v
logic		dip slope of bedding plane	It corresponds.		- Tatalai olopo			However, it is	not enough f	or the rema	ining fac	tors.			•
Geo	ture		None	V				There is no c	ountermeasur	e, or there	is not eff	ective e	ven if countermeas	ures are not	
_	truct	debris on impermeability bedrock,	marked	V				performed.							
	Ś	the upper part is a hard /the toe of slope is weak.	a little marked												
			None		[History]	Loval	ofdioasta	r history			Chook	Г	Expected size of disa	ister](width, length, depti	n, etc.)
		Topsoil, detected rock and unsteady rock		v	These is a bistory should	Lever	of disaste		4	4 1 4 -	Check				
c		Topson, detached tock and unsteady tock	stahility		the road traffic after cons	truction of	rocкs and recent mea	siope failures asures.	that were obs	stacles to					
ditio			notable spring waster		There is a history about	large fallen	rocks and	slone failures	that gets to t	he road	,				
co CO		Spring water	seepage		though there is no obstac	cle to traffic	iocks and	siope failures	i nai geis io i	ne ioau			L= 73	3.6 m. W= 145 m. D 1	m
face		1 3	none	V	There is a history about	small faller	rocks and	l slope failures	s that did not c	net to the					
Sur			bare land with minor vagetation	V	road.					,					
		Surface condition	intermediate (bare · grass · tree)		No diagotas seconda										
			mainly structure, mainly tree		ino disaster records										
			H≧50m		[Evaluation Rank]					[De	escriptio	on]			
			ਸੂ <u>30≦</u> H<50m	V	Scale of disaster	Big		Medium	Small	7	his slope	e failure	is actually cut slope	e due to the excavatio	n for N-35 and
e			<u>∎</u> 15≦H<30m		Risk	Dig		Wealdin	omai	lin	k road a aroun i	bove the	e scarp. Metasedim ed along the cut sic	entry sequence of bea	sham basement
Profi		Height (H), dip (i)	H<15m		Great risk	1		2	3	C	racked.	Three gu	Illies has marked to	wards the valley side	Erosion along
-			i≧70°		-				-	tř	nese gull	ies is en	dangering the stabl	ility of N35. Retaining	wall is partially
			ig 45°≦i<70° i<45°	V	Medium risk	1		2	3				dama	iged.	
naly	Surfac	e collapse, sin <mark>all fallen rock, gully, erosion, piping</mark> hole,	2 or more correspondences clarity certain unclarity	٧	Low risk	2		3	4						
Anor	subsid open <mark>c</mark>	ence, neaving, bending of tree root, fallen tree, crack, rack, anomaly of countermeasure	none		Organization responsible scale of the disaster	for counte	rmeasure	works accordi	ng to the	Influen disaste	ce on the r	e traffice	when potential		
I			1		-Big: Grant aid					-Great	risk: roa	d closed	for 2 days or more		
					-Medium: Major contracto	or in Pakist	an			-Mediu	m risk: ro	oad clos	ed for 1 day or less		
					-Small: Local contractor					-Low ri	sk: no ro	ad closu	ire		



Code no.	N 3 5 _ 0 1	7	Ph	oto sheet	Date	12/1/2017
Region Office			Latitude	34°56'26.6"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates	Longitude	72°52'40.3"	-	
		Road n	ame	Km]	

Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point





View of the slope failure at the middle point

Existing countermeasures / anomalies: View of Culvert outlet as counter measure and retaining wall for N-35 View of new slope failures withn the N-35-1

Code no.	Ν	3	5			0	2
Region Office							
Maintenance Unit							

[Cause	es]		
item	factor	category	Check
' of river	areas that river bed is 15°or more in watershed area	0.50km ² or more 0.15km ² - 0.50km ² less than 0.15km ²	√
Property	steepest slope of river bed	40°or more 30° - 40° less than 30°	v
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	
roperty	artificial works that cause negative effects	certain none	V
đ	new crack and/or slope failure in stream	certain none	V
	traces of large slope failure in stream	certain none	v

Coordin	indico -	Lon	gitu	de		72	° 5	2'	40	.6'	•		
Road N	lame				Km								
	[Road stru	uctur	e]										
	structure			ca	tegory o	of so	core				C	Che	ck
		10n	n or	more)							٧	
	River	5m	- 10	m									
	width	3m	- 5n	1									
		less	s tha	n 3m									
		less	s tha	n 1m	or							٧	
		No	brid	ge/b	ox culv	ert							
	Beam	1m	- 2n	1									
	height	2m	- 3n	ייייי ו									
		3m	- 5n	ייייי ו									
		5m	or n	nore									
	L										-		
	[Potencial	disa	aster	r moo	le]			С	he	ck			
	<u> </u>				-		-				1		

Damage of bridge/culvert Outflow of embankment

Debris flooding on the road

Evaluation sheet (debris flow)

Latitude

Coordinates

34° 56' 36.1"

	Date	12	/2/201
	Inspector	Yasir, Sajid,	Shafique,
[History]	category of score	e	Check
There is obstacles of recent	a history about debris fl s to the road traffic after measures.	ow that were construction	
There is though t	a history about debr here is no obstacle to	is flow traffic.	v
There is	no history of debris f	low	
Expecte	d size of disaster] (wid	Jth, length, dep	th, etc.)
	L= 1000 m, \	W=15 m, D= 2	! m

escription/comments]

A seasonal stream crosses the highway at this location. Small catachment area with debris fall/rock fall material are present on the upstream. Small landslide was also observed along the stream which contribute in the debris volume. Granite is exposed along the stream. Various boulders of granite size more than 1 m³ has also been observed. The culvert has been blocked due to debris material along this channel.

[Countermeasure]				
Type of counterm	neasure	Check		
Retaining walls has protect the road. Box made for the out flow c has blocked	been constru Culvert has a f the debris b by the debris	icted to also been ut the inlet	[Eva Risl	luation Rank] Scale o disaste Great risk
Effect of existing	none∙low moderate	V		Medium risk
countermesure	high enouah		Low risk	

Evaluation Rank]			
Scale of disaster Risk	Big	Medium	Small
Great risk	1	2	3
Medium risk	1	2	3
Low risk	2	3	4

Organization responsible for countermeasure works according to the scale of the disaster

٧

-Big: Grant aid -Medium: Major contractor in Pakistan

-Small: Local contractor Influence on the traffice when potential disaster

-Great risk: road closed for 2 days or more -Medium risk: road closed for 1 day or less -Low risk: no road closure

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Code no. N - 3 5 0 2	Photo sheet	Date 12/2/2017
Region Office	Coordinates Latitude 34° 56' 36.1"	Inspector Yasir, Sajid, Shafique, Basharat
Maintenance Unit	Longitude 72° 52' 40.6"	
	Road Name Km	
Mountain side view of the debris flow	Valley side view of the debris flow	Front view of the debris flow
The patch work on the road has been observed	Existing countermeasures / anomalies: Inlet of the culvert is chocked by the debris.	Existing countermeasures / anomalies: Culvert outlet has been constructed at the toe of the debris flow

	Code	no. N 3 5 _ 0 9	7		Evaluation sh	eet (S	Slope f	ailure/F	Rockfall)			Date	3-Dec-2	2017
Re	egion	Office				atitude	34	4°57'28.1	"			Inspector	Yasir, Sajid, Shafi	que, Bashara
Ma	ntena	nce Unit	-		Coordinates	ngitude	7	′2°53'1.8	"			I		
					Road name		Km							
ີລາເຮ	eel				Road Hame		1XIII							
Iter	n	factor	category of score	Check				[Counterm	easure]					
	t	alus slone	3 or more correspondences	V							Type of o	countermeasures		
Use	ģ	clear convex break of slope.	2 correspondences		[Disaster type]									
	e tac	eroded toe of slope,	1 correspondences		Rock fall									
C		overnang, water catchment slope	no correspondence		NOCK TAIL									
	_	succeptible to creater	marked	V	Slope failure	1			Eff	fectivenes	ss of existin	g countermeasures		Check
	s la	ess strength with water	a little marked]]		v		Potential el	ope failure are pre	evented er	nouah or i	t is defended enough	when it is generated	
		~ ~	None		[Main check o	bject]						the asteriada enough		
	÷ ŀ	nigh density of cracks and a weak layers,	marked	V	Cut slope			Potential slo	pe failure are con	siderably	prevented,	or it is considerably d	efended when it is	
	β Υ	susceptible to erosion,	a little marked		Outbiopo	•		generated.						
	- f	ast weathering	None		Natural slope	9		Potential slo	pe failure are part	tly preven	ted, or it is	partly defended when	it is generated.	v
b	c	dip slope of bedding plane	It corresponds.		- tatalal clop	-		However, it i	is not enough for	the remai	ning factors	3.		v
	Inte		None	V				There is no	countermeasure,	or there is	s not effecti	ive even if countermea	asures are not	
	. Inct	debris on impermeability bedrock	marked					performed.						
	が t	he upper part is a hard /the toe of slope is weak.	a little marked											
			None	V	[History]							[Expected size of di	saster](width, length, depth	h, etc.)
			instability	V		Leve	el of disaste	er history			Check			
		Topsoil, detached rock and unsteady rock	a little unstable		There is a history about	large falle	n rocks and	slope failures	s that were obstac	cles to	\checkmark			
_			stability		the road traffic after con	struction o	f recent me	asures.						
			notable spring waster		There is a history about	large falle	n rocks and	d slope failure	s that gets to the	road				
		Spring water	seepage		though there is no obsta	icle to traff	IC.	L= 184 m, W= 90 m, D = 3 m						
			none	V	There is a history about small fallen rocks and slope failures that did not ge road.				s that did not get	t get to the				
'			bare land with minor vagetation	v										
		Surface condition	mainly structure, mainly tree	No disaster records										
1			H≧50m	V	[Evaluation Rank]					[De	scription]			
			표 30≦H<50m 한 15≦H<30m		Scale of disaster Risk	Big		Medium	Small	Th tr	he landslic riggered d	de is located on N35 uring the road cons	5. This is an old lands truction. The landslid	slide that wa le has active
		Height (H), dip (i)	H<15m i≥70°		Great risk	1		2	3	s gu	surface ero ullies are p	osion mainly induce present on the lands	d by the rain water a slide body. On the sli	nd therefore de, detache
ੇ ਪ ਦੇ <u>45°≦ <70°</u> i<45° √					Medium risk	1		2	3	bi car	oulders ar n damage n mitigatio	re present that are p the road and traffic n measures are con	orone to slide during a . The landslide is voi ostructed to stabilize	a rainfall an d of any tre the landslin
ς Sι	rface	collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity	V	Low risk	2		3	4		, magallo			
su op	bsider en cra	nce, heaving, bending of tree root, fallen tree, crack, ack, anomaly of co <mark>untermeasure</mark>	none		Organization responsibl scale of the disaster	e for count	ermeasure	works accord	ing to the	Influenc disaster	e on the tra	affice when potential		
-			1	1	-Big: Grant aid					-Great ri	isk: road clo	osed for 2 days or mo	re	
					-Medium: Major contrac	tor in Pakis	stan			-Mediun	n risk: road	closed for 1 day or les	ss	
					-Small: Local contractor					Low ric	k: no road (



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Code no.	N 3 5 _ 0 9		Ph	oto sheet	Date	12/3/2017
Region Office		Coordinatos	Latitude	34 ^o 57'28.1"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates	Longitude	72 ^o 53'1.8"		
		Road n	ame	Km		
Full view of the landslide		View of landsl	ide on Valley sic	le:	Road condition:Cut slope	at the start point
View of the slope failure a of slope failure	at the middle point with sloping wall at the toe	Existing count measure and	ermeasures / ar retainin wall	nomalies: View of Culvert as counter	Close View of slope falur	e

Code no.	Ν	3	5			1	0	
Region Office								
Maintenance Unit								

[Cause	esj		
item	factor	category	Check
' of river	areas that river bed is 15°or more in watershed area	0.50km ² or more 0.15km ² - 0.50km ² less than 0.15km ²	v
Property	steepest slope of river bed	40°or more 30° - 40° less than 30°	V
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	v
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	v
roperty	artificial works that cause negative effects	certain none	٧
ď	new crack and/or slope failure in stream	certain none	v
	traces of large slope failure in stream	certain none	v

Evaluation sheet (debris flow)											
Coordinatos	Latitude			Latitude 34° 58' 53.					.2"		
Coordinates	Longitude			72	° 5	54'	11	.3"			
Road Name					Km						

[Road stru	ucture]	
structure	category of score	Check
	10m or more	٧
River	5m - 10m	
width	3m - 5m	
	less than 3m	
	less than 1m or	
	No bridge / box culvert	٧
Beam	1m - 2m	
height	2m - 3m	
	3m - 5m	
	5m or more	

[Potencial disaster mode]	Check	
Damage of bridge/culvert		
Outflow of embankment		
Debris flooding on the road	٧	

Inspector	Yasir, Sajid, Shafique, Basharat					
[History]						
category of score	9	Check				
There is a history about debris flo obstacles to the road traffic after of recent measures.	٧					
There is a history about debri though there is no obstacle to						
There is no history of debris fl	ow					
[Expected size of disaster] (wid	lth, length, dep	th, etc.)				
L= 1000 m, W=	23.50 m, D= 1	1-2 m				

12/4/2017

[Description/comments]

Date

A seasonal stream crosses the highway at this location. Small catachment area with debris fall/rock fall material are present on the upstream. It is a historically active debris flow with continuous flowing water. The water seeps beneath the road and through could lead to potential disaster and significant damages to the road. . Detached boulders, gravels, sand and silt was present at the toe of the DF above the road. During the rainy season it become active and often leads to damages to road and disruption of the traffic. Part of the DF is also prone to rock fall and slope failure.

[Countermeasure]

Type of countermeasure	Che	eck]			
			[Evaluation Rank]		[
Retaining walls has been co protect the road (N-	nstructed t 35)	to	Risk	Big	Medium	Sm
	,		Great risk	1	2	3
none	low		Medium risk	1	2	3
Effect of existing mode	rate	۷)
enoug	jh		Low risk	2	3	4

Organization responsible for
countermeasure works according to the scale of the disaster
-Big: Grant aid

-Medium: Major contractor in Pakistan -Small: Local contractor

Influence on the traffice when potential disaster

-Great risk: road closed for 2 days or more -Medium risk: road closed for 1 day or less -Low risk: no road closure



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Code no. N 3 5 1 0	Photo sheet	Date 12/4/2017
Region Office	Latitude 34° 58' 53.2"	Inspector Yasir, Sajid, Shafique, Basharat
Maintenance Unit	Coordinates Longitude 72° 54' 11.3"	
	Road Name Km	
Mountain side view of the debris flow	Valley side view of the debris flow	Front view of the debris flow
The crack on road has been observed	Road condition	Existing countermeasures / anomalies: Retaining wall has been constructed at the toe of the slope failure

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(Code no. N 3 5 1 4			Evaluation sl	heet (S	Slope f	ailure/l	Rockfall))			Date	12/5/2	017			
Re	gion Office	7			Latitude	35	5°00' 11.	9"				Inspector	Yasir, Sajid, Shafid	lue, Bashara			
Mair	- tenance Unit	-		Coordinates	onaitude	72	053' 53	9 "					1				
wican		_		Desderme		14	00 00.										
_				Road name		Km											
Jause	es]	enterent of score	Chock				Counterm	aggural									
		3 or more correspondences	V				Counterin	easurej		Type	of count	ermeasures					
sed	talus slope,	2 correspondences	·	Disaster type	1					.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	or obuin	Simodouroo					
ollap	eroded toe of slope , overhang,	1 correspondences	·····	[Distance ()pt		l		Retaining	wall for N-3	5 has be	een built	for road support to	owards valley side				
Ö	water catchment slope	no correspondence	·	Rock fall				0									
		marked	V		1				Effectivenes	ss of exi	isting cou	Intermeasures		Check			
	susceptible to erosion	a little marked		Slope failur	e √												
ľ	less strength with water	None	·····	Main check of	obiectl		Potential slo	ope failure are p	prevented er	nough, c	or, it is de	etended enough w	hen it is generated.				
	high density of cracks and a weak layers	marked	V	, Out days			Potential slo	pe failure are c	onsiderably	prevent	ted, or it i	s considerably de	fended when it is				
100	susceptible to erosion,	a little marked		Cut slope			generated.		,			2					
	fast weathering	None	[Natural alor	20 2		Potential slo	pe failure are p	artly preven	ited, or i	t is partly	defended when it	t is generated.				
)	din slope of bodding plane	It corresponds.		inatural slop	ve v		However, it	is not enough fo	or the remai	ning fac	tors.			v			
g		None	V			-	There is no	countermeasure	e, or there is	s not eff	ective ev	en if countermeas	sures are not				
	debris on importmospility bedrock	marked	V				performed.										
ţ	the upper part is a hard /the toe of slope is weak.	a little marked															
		None		[History]							[Expected size of dis	aster](width, length, depth	, etc.)			
		instability	V		Leve	l of disaste	er history			Check							
	Topsoil, detached rock and unsteady rock	a little unstable		There is a history about	t large falle	rocks and	slope failures	s that were obsi	tacles to								
		stability		the road traffic after construction of recent measures.													
		notable spring waster		There is a history about large fallen rocks and slope failures that gets to the use the state is an abstacle to traffic													
	Spring water	seepage	<u> </u>	though there is no obsi	acle to traff	IC.						L= 85	0 m, W= 300 m, D = 1	0 m			
_		none	ν	There is a history about	t small falle	n rocks and	d slope failure	es that did not g	et to the								
,		bare land with minor vagetation		ioau.													
	Surace condition	mainly structure, mainly tree	v	No disaster records													
		H≧50m		[Evaluation Rank]					[De	scriptio	on]						
		± 30≦H<50m ± 15≦H<30m	v	Scale of disaster Risk	Big		Medium	Small	T	his rota slone f	ational la failure	ndslide is locate	ed on N35. It is histo ainly triggered durin	rically activ			
	Height (H), dip (i)	H<15m i≧70°		Great risk	1		2	3	ear mo	thquak	e and a al rains	lso reactivated of 2010. The sli	during the torrential a	and prolon ive during			
		ਉ <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3	ra sta	iny sea able wit	asons. 7 th thick	he scarp and up vegetation. How	oper parts of the slop vever, the portion of	be is partia the landsl			
Sur	face collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk 2 3 4 close to the road is still active and rock fall and therefore posi						nd prone to frequen osing threats to the	t sliding ar oad.						
sub ope	sidence, heavin <mark>g, bending o</mark> f tree root, fallen tree, crack, in crack, anomaly of co <mark>untermeasure</mark>	none Organization responsible for countermeasure works according to the scale of the disaster					Influenc disaster	e on the	e traffice	when potential							
			· · · · · ·	-Big: Grant aid					-Great r	isk: road	d closed	for 2 days or more	9				
				-Medium: Major contra	ctor in Pakis	stan			-Mediun	n risk: ro	oad close	d for 1 day or less	6				
				-Small: Local contracto	r				-Low ris	k: no ro	ad closu	re -		-ivieuum nsk. road closure			

Code no. N 3	5 1 4		Sketch	sheet		Date	
Region Office			Latitude	35 <mark>000' 1</mark>	1.9"	Inspector	
Maintenance Unit		Coordinates -	Longitude	72 ⁰ 53' 5	3.9"		
		Road Name	N335	Km 4			
lane view					Cross sec	tional view	
Th SIMO		A					
and scorp		1					
E'S Tree							No.
A Rivel		1					
A Dushes		TITA					Y
0,0 Boulder			Ta				
4 .	(1	7 7	1			
y Drainfle	e A	X	λ	<			
	X	53 0	1				
	1 6	IVI U	N				
	105	de a	G3 1				
		10					
	1950	301.					
		LVD O					
	53		2				
	T	V Y T					
	S	ANA	P				
	410	SPI					
		10 1 6	14				1.
	1631	3 0 0					
		-A h	93				12
	P	2 4	1				- 36
	10.	0100			Scale	- 45° 28°	
	L.	BADA'A			t A	10	
Beshan-	1 M	7-35		= Dassu	1		A'
100	er i	1 1a	n		2		-
	11	A DT	51.		00		~
	0	10 5	5		~		-
	1 G		h		1		
		2ive V A Sca	ale: ← (200) m →	· L	Scale: ←	(100) m -

Region Office Maintenance Unit	Code no.	Ν	3	5	1	4	
Maintenance Unit	Region Office						
	Maintenance Unit						-

	Photo sheet											
Coordinatos		35°00'11.9"										
Coordinates	Longitude	;	72 ^o 53' 53.9"									
Road name					Km							

Date	12/5/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies



View of fallen blocks on road

	Cod	de no. N 3 5 _ 2 6	7		Evaluation she	et (S	Slope f	ailure/R	lockfall)				Date	6-Dec-2	2017
	Regio	on Office	-		Lat	itude	34	. ⁰ 02' 19.4	1"				Inspector	Yasir, Sajid, Shafi	que, Basharat
	Mainter	aance Linit	-		Coordinates	abutir	72	0 52' /0 1	2"						-
	Mainter						12	- 52 +5.0	, 						
					Road name		Km								
[Ca	auses]	factor	enterony of score	Chock				Counterme	agural						
-	Item	lactor	3 or more correspondences	V				Counterme	asurej		Type	of cour	termeasures		
hy	sed	talus slope,	2 correspondences	· · · · · · · · · · · · · · · · · · ·	[Disaster type]						Type	or oour	Remeasures		
ogra	facto	eroded toe of slope ,	1 correspondences	· • · · · · · · · · · · · · · · · · · ·		1	1								
top	ů-	overhang, water catchment slope	no correspondence	· [······]	Rock fall										
			marked	V					Eff	fectivenes	s of ex	isting co	ountermeasures		Check
	Soil	susceptible to erosion	a little marked		Slope failure										
s	0)	less strength with water	None		[Main check obj	ect]	4	Potential slo	pe failure are pre	evented en	hough,	or, it is (defended enough w	hen it is generated.	
ition	~	high density of cracks and a weak layers,	marked	V	Cut close	2	1	Potential slop	e failure are con	siderably	prevent	ted, or i	t is considerably def	ended when it is	
ondi	Sock	susceptible to erosion,	a little marked		Cut slope	N		generated.							
<u>a</u>	4	fast weathering	None		Natural slope			Potential slop	e failure are part	tly prevent	ted, or i	it is parl	tly defended when it	is generated.	2/
ogic		dip slope of bedding plane	It corresponds.		Natural Slope			However, it is	not enough for	the remair	ning fac	ctors.			v
Geol	ure	ap cope of bounding plane	None	V				There is no c	ountermeasure,	or there is	s not eff	fective e	even if countermeas	ures are not	
	ruct	debris on impermeability bedrock	marked	V				performed.							
	S	the upper part is a hard /the toe of slope is weak.	a little marked												
			None		[History]							1	[Expected size of disa	aster](width, length, depth	h, etc.)
			instability	V		Leve	el of disaste	er history			Check				
		lopsoil, detached rock and unsteady rock	a little unstable		There is a history about la	rge falle	n rocks and	slope failures	that were obstact	cles to					
ition			stability					asures.							
cod		Spring water		·	There is a history about la though there is no obstacl	arge talle e to traff	en rocks and ic	d slope failures	that gets to the	road			1 - 20	0 m W= 150 m D = 1	1 m
ace		Spring water	seepage	1				6 . 11	41 4 11 1 4 4	4 . 4			L- 20	10 m, w = 150 m, D =	1 111
Surf			bare land with minor vagetation	V	road.	mail taile	en rocks and	a slope failures	s that did hot get	to the					
		Surface condition	intermediate (bare-grass-tree)	· · · · · · · · · · · · · · · · · · ·											
			mainly structure, mainly tree	· [······]	No disaster records										
			H≧50m	V	[Evaluation Rank]					[Des	scriptio	on]			
			ਸੂ 30≦H<50m		Scale of	Div		Marthum	0	Th	ne slide	is active	rock fall and cut slop	e posing great and frequ	ent risk to road.
e			<u>9</u> 15≦H<30m		Risk	ыg		Medium	Small	Be	edrock o	of the sli	de is highly fractured	and weathered pyroxinit	te. The slide has
rofil		Height (H), dip (i)	H<15m		Great risk	1		\bigcirc	3	nang	de are v	erv steer	d gravels posing threa	60 degrees. During the	rainv season the
۵.			i≧70°		Great fisk			2	5	sli	ide is als	so prone	to debris flow compr	ising of boulders, gravel	ls, sand and silt.
			<u>ਿ</u> <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3	Ro	ock fall i	s planar sl	in nature. Water seep ide. Intersecting joints	ages is observed on the is leads to wedge failure.	right flank of the
naly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk	2		3	4						
Anor	open	rack, anomaly of countermeasure	none		Organization responsible f scale of the disaster	or count	ermeasure	works accordi	ng to the	Influence disaster	e on the	e traffic	e when potential		
					-Big: Grant aid					-Great ri	isk: roa	d close	d for 2 days or more		
					-Medium: Major contractor	in Pakis	stan			-Medium risk: road closed for 1 day or less					
					-Small: Local contractor					-Low risł	k: no ro	ad clos	ure		



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Code no.	N 3 5 _ 2 6	Photo sheet							Date	12/6/2017	
Region Office		Coordinatos	Latitude			34	1º 02' 1	19.4'	"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates	Longitude			72	<u>2</u> ° 52' 4	19.3'	II		
		Road na	ame				Km				



	Cod	te no. N 3 5 2 8]		Evaluation s	heet (S	Slope f	failure/F	Rockfall)			Date	12/7/20	017
	Regio	n Office				Latitude	35	5 ^o 02' 25.	7"			Inspector	Yasir, Sajid, Shafic	lue, Basharat
1	<i>A</i> ainten	nance Unit			Coordinates	ongitude	7	2 ^o 56' 6.8	3"					
					Road name		Km							
[Ca	usesl				riodd flaino									
	tem	factor	category of score	Check				[Counterm	easure]					
Σ	q	talus slope.	3 or more correspondences	V							Type of o	countermeasures		
rapi	tor tor	clear convex break of slope,	2 correspondences		[Disaster typ	e]	_							
20d	Solla	eroded toe of slope,	1 correspondences		Rock fall				R	etaning wa	all for slope	failures towards mount	tain side	
2	0	overnang, water catchment slope	no correspondence											
	_	susceptible to erosion	marked	V	Slope failu	re √			Et	ffectivenes	ss of existin	g countermeasures		Check
	Sol	less strength with water	a little marked			•		Potential slo	ope failure are pro	evented er	nouah. or. i	t is defended enouah w	hen it is generated.	
2			None	+	[Main check	object]	1				5 / .,.	-3	5	
	×	high density of cracks and a weak layers,	marked	V	Cut slope	• √		Potential slo	pe failure are cor	nsiderably	prevented,	or it is considerably de	fended when it is	
3	Roc	susceptible to erosion, fast weathering	a little marked		· · ·		-	generated.						<u> </u>
g			None		Natural slo	ре		Potential slo	pe failure are par	rtly preven	ted, or it is	partly defended when it	t is generated.	V
Bo		dip slope of bedding plane	It corresponds.				J	nowever, It	is not enough for	ule remai	ning lactors			
5	ture		None	v				There is no	countermeasure,	, or there is	s not effecti	ve even if countermeas	sures are not	
	truc	debris on impermeability bedrock,	niarked	v				periorneu.						
	0)	the upper part is a hard /the toe of slope is weak.	None	·	[] listen d							Eveneted size of dia	astarl(idth langth danth	ete)
-			instability	1	[HIStory]	Love	l of disast	or history			Chock	Expected size of dis	asterj(width, length, depth	, etc.)
		Tonsoil detached rock and unsteady rock		v	There is a history show	Leve	ei oi uisast		41 4		CHECK			
_		Topson, detached fock and unsteady fock	stability	+	the road traffic after co	ut large falle	n rocкs and if recent me	i siope tailures easures.	s that were obsta	icles to	\checkmark			
			notable spring waster	<u> </u>	These is a bistomy above					, ne o d				
3		Spring water	seenage	·	though there is no obstacle to traffic.							1 =9(L=900m, W= 210m, D= 1-2m	
aca			none	V	There is a history about small fallen rocks and slope failures that did not o						t get to the			
Inc			bare land with minor vagetation	V	road.				s that did not get					
		Surface condition	intermediate (bare • grass • tree)	·										
			mainly structure, mainly tree	·	No disaster records									
			H≧50m	V	[Evaluation Rank]					[De	scription1	L		
			ਸ਼ੂ 30≦H<50m		Scale of			Martinez	0	È	This is an a	ctive slope failure and	rock fall. The failure ha	s historically
Ð			15≦H<30m	1	Risk	Big		weaium	Small	affe	ected the ro	ad. The wedge shape	failure is found on the s	lide. Detache
		Height (H), dip (i)	H<15m		Great risk	4		\bigcirc	3	bo	and silt lead	gravels are nanging on Is to debris flow during	the rainy season. Redr	with the san ock is highly
L			i≧70°		Great risk			\checkmark	3	fi	ractured an	d jointed pyroxinite. Dra	ainage is developed on	the slide and
			ਉ 45°≦i<70°		Medium riek	1		2	3	act	ive weathe	ring and erosion leads	to development of gulli	es on the slic
			i<45°	V	Wiedum nak	'		2	5	Ret	aining wall	is constructed to stabili the retaining wall is	ize the slide, however, s already damaged	the right side
>	Cumfa -		2 or more correspondences clarity	V	Low risk	2		3	4				s an eady damaged.	
mai	Surface	e conapse, small fallen rock, gully, erosion, piping hole, ence, heaving, bending of tree root, fallen tree, crack	certain•unclarity	ļ	Low Hold			ž						
Alic	openc	rack, anomaly of countermeasure	none	·	Organization responsi scale of the disaster	ble for count	ermeasure	works accord	ing to the	Influenc disaster	e on the tra	affice when potential		
					-Big: Grant aid					-Great r	isk: road clo	osed for 2 days or more	e	
					-Medium: Major contra	actor in Pakis	stan			-Mediun	-Medium risk: road closed for 1 day or less			
					-Small: Local contract	or				-Low ris	k: no road o	closure		



Code no.	Ν	3	5	2	8	
Region Office						
Maintenance Unit						

Coordinates	Latitude	titude 35 ^o 02' 25.7"												
Coordinates	Longitude					72 ^o 56'	6.8'	•						
Road na	Road name					Km								

Photo sheet

Date	12/7/2017
Inspector	Yasir, Sajid, Shafique, Basharat



View of the slope failure at the middle point

Existing countermeasures / anomalies: View of shed as counter measure

Anomalies in retaining wall for N-35_28

	Coc	le no. N 3 5 2 9]		Evaluation sh	eet (S	Slope	failure/R	ockfall)			Date	12/8/2	017	
	Regio	n Office			La	atitude	35	5° 02' 34.9)"			Inspector	Yasir, Sajid, Shafi	que, Basharat	
N	lainten	ance Unit	7		Coordinates	naitude	72	²⁰ 56' 23.7							
							Km								
10-					Road name		NIII								
[Ca	lem	factor	category of score	Check				[Counterme	asural						
_			3 or more correspondences	V				loonnoimo	aouroj		Type of co	untermeasures			
aphi	or	talus slope, clear convex break of slope.	2 correspondences		[Disaster type]										
ogr	ollap fact	eroded toe of slope ,	1 correspondences			1	1		Reta	aining wall	l for N-35 p	protection towards va	lley side		
top	Ō	overhang, water catchment slope	no correspondence		Rock fall 1										
			marked	V	Slope failure				Effec	ctiveness	of existing	countermeasures		Check	
	Soil	susceptible to erosion less strength with water	a little marked		Slope failure			Potential slor	o failuro aro provi	ontod ono	uab or iti	s defended onough y	when it is generated		
st			None		[Main check of	i otentiai siop			agn, or, it i	s asienaed enough v	mon it is generated.				
ditior	×	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slope	e failure are consi	derably pr	evented, o	r it is considerably de	efended when it is		
conc	Roc	susceptible to erosion,	a little marked					generated.							
cal		าสอง พอสมายากาย	None	+	Natural slope	9		Potential slop	e failure are partly	prevented	d, or it is pa	artly defended when	it is generated.	V	
ologi		dip slope of bedding plane	It corresponds.					However, it is	not enough for the	e remainin	ng factors.				
Geo	ture		None	v				There is no co	ountermeasure, or	there is n	not effective	e even if countermea	sures are not		
	struc	debris on impermeability b <u>edrock.</u>			performed.										
	0)	the upper part is a hard /tre toe of slope is weak.	None		[Histor/]							Expected size of dis	aster](width length dent	etc.)	
			instability	V	[Filstory]	Leve	el of disast	er history		CI	heck	[Expected size of dis	sasterj(widur, rengur, depu	1, 610.)	
		Topsoil, detached rock and unsteady rock	a little unstable	· · · · ·	There is a history about large fallen rocks and slove failures that were obstacles to										
c.		·	stability		the road traffic after con	asures.		,3 10	\checkmark						
ditio			notable spring waster		There is a history about large fallen rocks and slope failures that gets to the road though there is no obstacle to traffic.										
e co		Spring water	seepage								L= 150 m, W= 90 m, D =				
rfac			none	V	There is a history about small fallen rocks and slope failures that did not get to the										
Su			bare land with minor vagetation	٧	road.										
		Surface condition	intermediate (bare-grass-tree)		No disaster records										
			mainly structure, mainly tree												
			H≧50m		[Evaluation Rank]					[Desc	cription]				
			2 30≦H<50m 9 15≤H<30m	V	Scale of disaster	Big	9	Medium	Small	The of ex	slide is ar posed pv	n active rock fall. T roxinite. The bedro	he exposed bedrock ock is highly deforme	is comprised	
ofile		Height (H), dip (i)	H<15m	+						Te	nsion cra	cks were visible or	the slide. Boulders	and gravels	
Ę.			i≧70°		Great risk	1		2	3	We	ere detacl	ned and hanging o	n the slide and there	fore posing	
			ਊ 45°≦i<70°	V	Modium risk	4		\bigcirc	3	threa failu	ats to the ire. Talus	road and traffic	intersecting joints lea de toe. No mitigation	aas to wedge measures is	
			i<45°		Wedium nsk	1		\checkmark	3	adopi	ted to sta	bilize the slide. Ho	wever, retaining wall	is constructed	
aly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity	V	Low risk	2		3	4			to protect the r	oad from sliding.		
mor	subside	ence, heavin <mark>g, bending</mark> of tree root, fallen tree, crack,	none	·	Organization responsible	e for coun	termeasure	works accordin	ing to the		on the traff	ice when notential			
Ā	openc	rack, anomaly of countermeasure		·	scale of the disaster		lenneasule	works accordin	ig to the 1	disaster		ioo when potential			
					-Big: Grant aid				-	-Great risk	c: road clos	ed for 2 days or mor	e		
					-Medium: Major contractor in Pakistan					-Medium r	isk: road c	losed for 1 day or les	s		
					-Small: Local contractor				-	-Low risk:	no road clo	osure			



Code no.	Ν	3	5	2	9	
Region Office						
Maintenance Unit						

Coordinates	Latitude	35 ^o 02' 34.9"										
Coordinates	Longitude	72 ^o 56' 23.7"										
Road na	ame				Km							

Photo sheet

Date	12/8/2017
Inspector	Yasir, Sajid, Shafique, Basharat



View of the slope failure at the middle point

Existing countermeasures / anomalies: View of shed as counter measure

View of fallen blocks on Shed

	Cod	le no. N 3 5 3 0]		Evaluation sh	eet (S	lope	ailure/	Rockfall))		Date	12/9/2	017	
F	Regio	n Office				atitude	35	^o 02' 42	.2"			Inspecto	or Yasir, Sajid, Shafi	que, Basharat	
М	ainten	ance Unit			Lo	ngitude	72	o 56' 27	.1"						
					Road name		Km								
[Cai	usesl				r toda namo										
lt	em	factor	category of score	Check				[Counterm	neasure]						
ý	p	talus slope.	3 or more correspondences	V							Type of	countermeasures			
Irapl	apse	clear convex break of slope,	2 correspondences		[Disaster type]										
boc	fac fac	eroded toe of slope,	1 correspondences		Rock fall			Retaining wall is about 07 feet high for slope protection (Mountain side) and also for N35 on valley side.							
ų	U	overnang, water catchinent slope	no correspondence			`									
	=	susceptible to erosion	marked	V	Slope failure				E	Effectivene	ess of existi	ng countermeasur	es	Check	
	So	less strength with water	a little marked					Potential slope failure are prevented enough, or, it is c				it is defended eno	ugh when it is generated.		
suc			None		[Main check ol	.									
nditic	Š	high density of cracks and a weak layers,	a little marked	v	Cut slope $$ Potential slope failure are considered						/ prevented	, or it is considera	bly detended when it is		
cor	R	fast weathering	None					Detential al	ana failuna ana na		stad as it is	nonthe dofondod w	then it is neverted	_	
gica	It corresponds.				Natural slope However, it is not enough for t						partly prevented, or it is partly defended when it is generated. for the remaining factors.				
olos	e	dip slope of bedding plane	None	V				There is no	countermeasure	or there i	is not effect	tive even if counte	rmeasures are not	_	
Ğ	nctu		marked	V				performed.		.,					
	Stri	debris on impermeability bedrock,	a little marked											- I	
		the upper part is a nard file foe of slope is weak.	None		[History]							[Expected size	of disaster](width, length, dept	h, etc.)	
			instability	V		Leve	l of disast	er history			Check				
		Topsoil, detached rock and unsteady rock	a little unstable		There is a history about large fallen rocks and slope failures that were ob										
tion			stability		the road traffic after con	nd slope failures that gets to the road					I				
codit			notable spring waster		There is a history about										
ace		Spring water	seepage	- /	though there is no obsta	С.			L= 110 m, W= 106 m, D = 1 m				1 m		
Surfa			hone	V	There is a history about small fallen rocks and slope failures that did not						get to the				
0,		Surface condition	intermediate (hare grass tree)	v											
			mainly structure, mainly tree		No disaster records										
\square			H≧50m	V	[Evaluation Rank]					[De	escription1	L			
			ਸ਼ੂ 30≦H<50m		Scale of	5		Mariliana	0	Tł	he slide is	an active rock f	all/slope failure. Gullies w	vere observed	
ø			<u>9</u> 15≦H<30m		Risk	Big		Medium	Small	on	the slide.	Talus deposits	were noted at the end of	the developed	
rofil		Height (H), dip (i)	H<15m		Great risk	1		2	3	h .	gullies. W	ledge failure is o	bserved on the slide. De	tached and	
<u>م</u>			i≧70°		Gical lisk	1		2	3	na	anging boi one to fall	during rainy sea	eis were observeu on the ason or movina cattle and	silue triat are d posing threat	
			<u>ਉ</u> 45°≦i<70° i<45°	V	Medium risk	1		2	3	to	road and	traffic. Many ve	hicle were reportedly dar	maged due to	
aly	Surface	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences · clarity	V	Low risk	2		3	4		slic	road/traffic from falling ro	ocks.		
Anom	ubside pen ci	ence, heaving, bending of tree root, fallen tree, crack, rack, anomaly of co <mark>untermeasure</mark>	none		Organization responsible scale of the disaster	e for count	ermeasure	works accore	ding to the	Influend disaste	ce on the tr r	affice when poten	tial		
<u> </u>			L		-Big: Grant aid					-Great	risk: road c	losed for 2 davs o	r more		
					-Medium: Major contract	or in Pakis	tan			-Mediu	m risk: road	l closed for 1 day	or less		
					-Small: Local contractor					-Low ris	sk: no road	closure			



Code no. N 3 5 3 0	Photo sheet	Date 12/9/2017
Region Office	Coordinates Latitude 35° 02' 42.2"	Inspector Yasir, Sajid, Shafique, Basharat
Maintenance Unit	Longitude 72° 56' 27.1"	
	Road name Km	
Full view of the landslide	View of landslide on Valley side:	Road condition:Cut slope at the start point
View of the slope failure at the middle point	Existing countermeasures / anomalies:	

	Cod	le no. N 3 5 3 1	1		Evaluation she	et (S	Slope f	ailure/Ro	ockfall)			Date	12/10/2	017	
	Regio	n Office	-		Lati	ude	. 35	0 02' 42 2"	·			Inspector	Yasir, Salid, Shafid	ue. Basharat	
			-		Coordinates	itudo	7	20 56' 22"						· ·	
N	hainter	ance Onic			Long	llude	1.	2° 30 33							
IC a	ucocl				Road name		Km								
l I	tem	factor	category of score	Check				[Countermeas	sure]						
λ	þ	talua alana	3 or more correspondences	V						Т	ype of c	ountermeasures			
grap	apse	clear convex break of slope,	2 correspondences		[Disaster type]		1								
topo	Collis	eroded too of clope ,everhang, water catchment slope	1 correspondences no correspondence		Rock fall			No countermeasures							
	_		marked	٧	Slope failure	N			Effect	tiveness o	fexistin	g countermeasures		Check	
	Soil	less strength with water	a little marked		Siope lailuite	v		Potential slope	failure are preve	nted enqui	ah or it	is defended enough v	when it is generated		
sl			None		[Main check obje	Totertial slope		nica choa	gn, or, n	is defended enough v	when it is generated.				
litior	×	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slope failure are considerably preven				or it is considerably de	efended when it is		
Sonc	Roc	susceptible to erosion,	a little marked		Oursiope			generated.							
cal c		last weathening	None		Natural slope			Potential slope	failure are partly p	prevented,	or it is p	partly defended when i	it is generated.		
logi		dip slope of bedding plane	It corresponds.					However, it is n	ot enough for the	remaining	g factors				
Geo	ture		None	v				There is no cou	intermeasure, or t	here is no	t effectiv	ve even if countermea	sures are not	V	
	truc	debris on impermeability bedrock,	marked	ν				periornied.							
	S	the upper part is a hard /the toe of slope is weak.	a little marked												
-			inote litte		[History]	1				Ch	a a la	Expected size of dis	sasterj(width, length, depth	, etc.)	
		Tanaail datashad asaly and unataady asaly	nistability	v		Leve	i oi disaste	ernistory		Che	еск				
_		Topsoli, detached fock and difsteady fock			I here is a history about large tallen rocks and slope tallures that were obstacles to										
itior.			notable spring waster		There is a history shout la	4 4									
cod		Spring water	seenade		though there is no obstacle to traffic. I = 380 m W=						80 m W= 208 m D = 2	V= 208 m. D = 2 m			
ace		Oping watch	none	V	Thore is a history about or	noll follo	n rocko ono	d alana failuraa tk	hat did not got to i	the		L= 360 m, W= 206 m, D = 2 m			
Surf			bare land with minor vagetation	v	I nere is a nistory about small fallen rocks and slope failures that did not get to the road.										
		Surface condition	intermediate (bare grass tree)												
			mainly structure, mainly tree		No disaster records										
H			H≧50m	V	[Evaluation Rank]					[Descr	iption]	L			
			ਸ਼ੂ 30≦H<50m		Scale of	D.		Mar dia ma	0	This	is a deep	seated multiple rotationa	al landslide. The main body	y of the slide is	
o			<u>15≦</u> H<30m		Risk	ВIG		wealum	Smail	consolid road is a	lated with active du	shrubs and grass. Howe	ever, the toe of the slide when the slide when the slide, detached boulders a	nich is close to the	
rofil		Height (H), dip (i)	H<15m		Great rick	4		2	3	thre	eats to the	e road and traffic. Active	erosion on the landslide de	ebris leads to	
₽			i≧70°		Great risk	'		2	5	devel affectin	opment o	of gullies. Bedrock of the d. however, no mitigation	slide is proxininite. The slip measures are built to stat	de is frequently pilize the slope or	
			ਉ 45°≦i<70° i<45°	٧	Medium risk	1		2	3	the ro agricultu	ad. On th ure purpo	ne slide body benching ar ses. Dip direction is NW	re made by the local people and dip angle is 40-50 deg	e mainly for the gress. The slide is	
naly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	٧	Low risk	2		3	4			<u></u>			
Anor	open	rack, anomaly of countermeasure	none		Organization responsible for countermeasure works according to the scale of the disaster					ifluence oi isaster	n the tra	ffice when potential			
			· · · · · · · · · · · · · · · · · · ·		-Big: Grant aid				-0	Great risk:	road clo	osed for 2 days or more	е		
					-Medium: Major contractor	in Pakis	stan		-N	Aedium ris	k: road	closed for 1 day or les	s		
					-Small: Local contractor				-L	ow risk: n	o road o	losure			


Code no.	Ν	3	5	3	1	
Region Office						
Maintenance Unit						

Coordinatoo	Latitude				3	35° 02' 4	42.2			
Coordinates	Longitude	1	72º 56' 33"							
Road na	ame		Km							

Photo sheet

Date	12/10/2017
Inspector	Yasir, Sajid, Shafique, Basharat



Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies: View of retaining wall for N-35 as counter measure



View of Large blocks fallen and talus deposit at the toe of Slaope Failure

Code no.	Ν	3	5	3	9		
Region Office							
Maintenance Unit							

Cause	esj		
item	factor	category	Check
of river	areas that river bed is 15°or more in watershed area	0.50km ² or more 0.15km ² - 0.50km ² less than 0.15km ²	V
Property	steepest slope of river bed	40°or more 30° - 40° less than 30°	v
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	v
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	√
roperty	artificial works that cause negative effects	certain none	v
Ē	new crack and/or slope failure in stream	certain none	٧
	traces of large slope failure in stream	certain none	V

Evaluat	ior	า ร	she	ee	t (de	bı	is	fl	٥v	V)		
Coordinator	Lat	titud	le			3	5°	04	' 1:	3"		
Coordinates	Loi	ngit	ude	:		72	° 5	57'	19	.6"	1	
Road Name	Ν	3	5		Km	3	9					

[Road stru	ucture]	
structure	category of score	Check
River	10m or more 5m - 10m	٧
width	3m - 5m less than 3m	
Beam height	less than 1m or No bridge / box culvert 1m - 2m 2m - 3m 3m - 5m	V
	5m or more	

[Potencial disaster mode]	Check	_
Damage of bridge/culvert		
Outflow of embankment		
Debris flooding on the road	٧	

Inspector	Yasir, Sajid, Shafique, Basha			
[History]	2	Check		
There is a history about debris flu obstacles to the road traffic after of recent measures.	ow that were construction	v v		
There is a history about debr though there is no obstacle to	is flow traffic.			
There is no history of debris fl	ow			
[Expected size of disaster] (wid	lth, length, dep	th, etc.)		
l = 1500 m W	/=13 m D= 1-	2 m		

12/11/2017

[Countermeasure]

Type of countern	Check	
Stepped and inclined constructed to protect road (N-35). Also a 2 long protection wall a bank of t	Retaining wal along the val 2 feet high and t the mouth o the stream	l has been ley side of d 15 feet f the right
Effect of existing	none · low moderate	٧
countermesure	high enough	

[Evaluation Rank]			
Scale of disaster Risk	Big	Medium	Small
Great risk	1	2	3
Medium risk	1	2	3
Low risk	2	3	4

Organization responsible for countermeasure works according to the scale of the disaster

-Big: Grant aid -Medium: Major contractor in Pakistan

-Small: Local contractor Influence on the traffice when potential

disaster -Great risk: road closed for 2 days or more

-Medium risk: road closed for 1 day or less -Low risk: no road closure

[Description/comments]

Date

This is an active DF with well develop erosion channels. The DF has huge source area. The lying debris of the DF are consists of boulders, gravels, sand and silt. The accumulated poorly sorted debris in the erosion channels are already failed and still prone to slope failure. The DF has continuous flowing water, however, the water seeps beneath the road and appears again on the valley side of the road and therefore the road is prone to a disaster. No trees are present in the source area of the DF, however, shrubs and bushes are sparsely present. Boulders are mainly of Dunite and Amphibolite. The DF is frequently affecting the road, mainly during the rading season. However, no mitigation measures are adopted to drain the water and protect the road from flowing debris. A retaining wall is constructed on the valley side of the road which is also parby damaged. Part of the source area of the DF is also prore to rock fail with detached and fragmented boulders that could also reach to the road and therefore also posing threat to road and traffic.



Code no.	Ν	_	3	5		3	9
Region Office							
Maintenance Unit							

Coordinatoo		tude	35º 04' 13"									
Coordinates		Long	jitude				72	° 57	" 19	.6"		
Road Name					Km							

Photo sheet

Date	12/11/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Mountain side view of the debris flow

Valley side view of the debris flow

Front view of the debris flow



Existing countermeasures / anomalies: Sloped Retaining wall has been constructed for Debris material







Existing countermeasures / anomalies: Retaining wall has been constructed for N-35

	Cod		1		Evaluation sh	oot (S	lone f	ailure/Rod	skfall)			Date	12/12/2	017
			-									Duto		
	Regio	n Office			Coordinates	titude	35	50457.3				Inspector	Yasir, Sajid, Shafiq	ue, Basharat
P	lainten	ance Unit			Lor	gitude	72	2°58'45.7"						
		·	-		Road name		Km							
[Ca	usesl													
	tem	factor	category of score	Check				[Countermeasu	ıre]					
≥	77	talus slone	3 or more correspondences	V				-	-	Туре	e of count	termeasures		
raph	pse(tor	clear convex break of slope,	2 correspondences		[Disaster type]									
bod	fac	eroded toe of slope ,	1 correspondences		Deals fell					There	e is no co	untermeasure		
þ	0	overhang, water catchment slope	no correspondence		NUCK Idli									
	_		marked	V	Slope failure	2			Effectiver	ness of ex	xisting co	ountermeasures		Check
	Soil	less strength with water	a little marked		Slope lailare	v		Potential slope fa	allure are prevented	lenough	or it is d	lefended enough wi	nen it is generated	
st		······································	None		[Main check ob	ect]			andre are prevented	r enlough,	01, 11 13 0	leichded chough wi	ien it is generated.	
litior	×	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slope fa	ilure are considerat	oly prever	nted, or it	is considerably def	ended when it is	
Sonc	Roc	susceptible to erosion,	a little marked		ouroiopo			generated.						
cal o		fast weathering	None		Natural slope			Potential slope fa	ilure are partly prev	ented, or	it is partly	ly defended when it	is generated.	
logi		dip slope of bedding plane	It corresponds.					However, it is not	enough for the rem	naining fa	ctors.			
Geo	ture		None	V				There is no count	ermeasure, or there	e is not el	ffective ev	ven if countermeas	ures are not	v
-	truct	debris on impermeability bedrock.	marked	V				performed.						-
	ũ	the upper part is a hard /the toe of slope is weak.	a little marked											
			None	<u> </u>	[History]						ן ז ר	[Expected size of disa	ster](width, length, depth	, etc.)
			instability	V										
		lopsoil, detached rock and unsteady rock	a little unstable		There is a history about la	arge faller	rocks and	slope failures that	were obstacles to	\checkmark				
ition			stability				recent mea	asules.		_	-			
cod		Consistent succession	notable spring waster		There is a history about 1	arge falle le to traffi	n rocks and	slope failures that	t gets to the road			1 - 40	1 m W= 02 m D = 2	
ace		Spring water	seepage	1								L= 10	54 m, w= 95 m, D = 5	m
Surf			hare land with minor vagetation	v	There is a history about a	small falle	n rocks and	I slope failures tha	t did not get to the					
•,		Surface condition	intermediate (hare+grass+tree)	· · · · · ·							-			
		Surface contailor	mainly structure mainly tree		No disaster records									
\vdash			H≥50m	v	[Evaluation Rank]				rr	Descripti	」 L ion1			
			11 <u>=</u> 0011 Ξ 30≤H<50m	⊢	Scale of					his is an acti	ive slope fail	ilure of lose debris compri	sing of boulders, gravels, san	d and silt. The scarp
			15≦H<30m	· · · · · · · · · · · · · · · · · · ·	Risk	Big		Medium S	Small	of the lar	ndslide is cle Land iointed	early visible and still prone	e to rock failure due to presen	ce of detached, f slide also cause
ofile		Height (H), dip (i)	H<15m	· · · · · · · · · · · · · · · · · · ·					de	ebris flow du	iring heavy r	rains. Shrubs and grasse	s are present on the debris h	owever, no trees are
Ē			i≧70°		Great risk	1		2	3 1	present. A oulders are	ctive erosior present on t	n and weathering on the s the loose debris that ofter	n reach to the road and there	guilles. Detached fore posing threat to
			<u></u> ਚ 45°≦i<70°		Medium risk	1		(2)	3	the road and owever, no n	d traffic. The nitigation me	e landslide is frequently af easures is constructed to	fecting the road, mainly during stabilize the slope or protect	g the rainy season, the road from flowing
Н			i<45°	√ \					a	na falling de	bris. Bed roo	ck is composed of fragme present on above a	nted and jointed Dunite. Loos nd below the road.	se talus deposits are
maly	Surface subside	e collapse, small fallen rock, gully, erosion, piping hole, ence, heaving, bending of tree root, fallen tree, crack	certain • unclarity	v	Low risk	2		3	4					
Z open open open Open open open					Organization responsible for countermeasure works according to the scale of the disaster				the Influe disas	nce on th ter	ne traffice	when potential		
					-Big: Grant aid				-Grea	-Great risk: road closed for 2 days or more				
					-Medium: Major contractor in Pakistan				-Medi	-Medium risk: road closed for 1 day or less				
					-Small: Local contractor				-Low	risk: no re	oad closu	ure		

Annexure 1 **Sketch sheet** Date 35⁰04'57.3" nspector 72°58'45.7" Cross sectional view N



Latitude

N 3 5

Code no.

Region Office

4 5

Code no.	Ν	3	5	4	5	
Region Office						
Maintenance Unit						

O	Latitude					35°04'5	7.3'				
Coordinates	Longitude	1	72 ⁰ 58'45.7"								
Road na	ame					Km					

Photo sheet

Date	12/12/2017
Inspector	Yasir, Sajid, Shafique, Basharat





Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies: No counter measures



View of fallen blocks

de no. N 3 5 5 3			Evaluation	sheet (S	lope f	ailure/F	Rockfall)			Date	12/13/2	017	
n Office				Latitude	35	^o 06' 17.	7"			Inspector	Yasir, Sajid, Shafio	que, Basharat	
nance Unit			Coordinates	Longitude	72	2 ⁰ 59' 3.6	6"				•		
			Road name		Km								
			riodd fidillo										
factor	category of score	Check				[Counterme	easure]						
talus slope,	3 or more correspondences	V							Type of co	ountermeasures			
clear convex break of slope, eroded toe of slope .	2 correspondences		[Disaster ty	pe]			Ret	aining wall	has been co	instructed for N-35 on	vallev side		
overhang, water catchment slope	no correspondence		Rock fa	ıll			1101	annig wan			valicy side.		
	marked	V	Slope fail				I	Effectivenes	ss of existing	g countermeasures		Check	
less strength with water	a little marked		Slope Iali	ule y		Potential slo	ope failure are p	prevented e	nouah. or. it	is defended enouah w	hen it is generated.		
	None		[Main chec	k object]					3 / /	5	3		
high density of cracks and a weak layers, susceptible to erosion.	marked a little marked	ν	Cut slop	be		Potential slo generated.	pe failure are co	onsiderably	prevented, o	or it is considerably de	fended when it is		
fast weathering	None		Natural al	ana 1/		Potential slo	pe failure are p	artly preven	nted, or it is p	partly defended when it	t is generated.	./	
din slope of bedding plane	It corresponds.		Indiural Si	ope v		However, it i	is not enough fo	or the remai	ining factors.			v	
	None	٧				There is no o	countermeasure	e, or there is	s not effectiv	e even if countermeas	sures are not		
debris on impermeability bedrock,	marked	V				performed.							
the upper part is a hard /the toe of slope is weak.	None		[History]							Expected size of dis	aster](width length depth	etc.)	
	instability	v	[matory]	Leve	l of disaste	er historv			Check		aotorj(maai, iongai, aopa	, 0.0.7	
Topsoil, detached rock and unsteady rock	a little unstable		There is a history ab	out large faller	rocks and	slope failures	s that were obst	acles to					
	stability		the road traffic after	construction of	recent me	asures.			N				
	notable spring waster		There is a history ab	out large falle	n rocks and	l slope failure	es that gets to th	ne road					
Spring water	seepage		though there is no ol	ostacle to traffi	с.					L= 138.4	4 m, W= 261.5 m, D =	4-5 m	
	none bare land with minor vagetation	V	There is a history ab	out small falle	n rocks and	d slope failure	es that did not g	et to the					
Surface condition	intermediate (bare arrass tree)	V	1084.										
	mainly structure, mainly tree		No disaster records										
	H≧50m	V	[Evaluation Rank]					[De	escription]	L			
	번 30≦H<50m 말 15≤H<30m		Scale o disaster	f Big		Medium	Small	This	s is a deep seate sence of grasse	d multiple rotations landslide. s, however, the left and right f	The main body of the landslide lanks of the landslide is activat	e is consolidated w ed mainly due to th	
Height (H), dip (i)	H<15m		Great rick	1		2	3	ero: pre:	sion on the slide sent in the debris	debris leads to development of s that pose threats to the road	of well-developed gullies. Hang and traffic. The slide is mainly	ing boulder are al activated during t	
	i≧70°		Greathisk			2	5	rain th	ny season and th ne road and disru	e loose debris can also leads uption of the traffic due to fallir	to debris flow. Despite the cor ng debris and rocks, not mitiga	tinuous damages tion measures are	
	냥 <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3	adi burie	constructed to protect the road	l, however, it is als cracks and open j			
	2 or more correspondences · clarity	٧	Low risk	2		3	4	are present on the slide. Falus is present on the upper and lower side of the ro thick vegetation.					
ence, heaving, bending of tree root, fallen tree, crack,	certain • unclarity none		Organization respon	sible for count	ermeasure	works accord	ding to the Influence on the traffice when potential						
rack, anomaly of countermeasure			scale of the disaster		Sinicasule			disaster	r f	nee when potential			
			-Big: Grant aid					-Great r	risk: road clo	sed for 2 days or more	9		
			-Medium: Major cont	ractor in Pakis	tan			-Mediur	n risk: road o	closed for 1 day or less	5		
	IND. IND.	In Office ance Unit factor category of score talus slope, clear convex break of slope, eroded toe of slope , overhang, water catchment slope 3 or more correspondences susceptible to erosion less strength with water 3 nore high density of cracks and a weak layers, susceptible to erosion, fast weathering marked a little marked dip slope of bedding plane It corresponds. dip slope of bedding plane None debris on impermeability bedrock, the upper part is a hard /the toe of slope is weak. marked a little marked Topsoil, detached rock and unsteady rock a little unstable stability Spring water seegage none Surface condition there grass-tree) mainly structure, mainly tree Height (H), dip (i) It 2 or more correspondences clarity certain- unclarity none e collapse, small fallen rock, gully, erosion, pipint hole, force, heaving, bending of tree root, fallen tree, crack, crack, anomaly of colentereasure 2 or more correspondences clarity certain- unclarity none	Image: Second secon	Item of fice Item of fice Item of fice Item of fice ance Unit Item of fice Item of fice Road name talus slope, eroded toe of slope, overfang, water catchment slope 3 or more correspondences V to correspondences V 2 correspondences V susceptible to erosion, fast weathering marked V V dip slope of bedding plane ittle marked V None None V debris on impermeability bedrock, the upper part is a hard /the toe of slope is weak. None V Spring water seepage V Surface condition intermediate (bare grass tree) mainty structure, mainty tree V Height (H), dip (i) g 40 States V g M25070 V V g M25070	Control Control Control ance Unit	Cathering Cathering Cathering Coordinates Latitude 35 ance Unit In Consection Index 1 Index 3 Inde	an Office or office ance Unit is of log. factor catagory of score susceptible to erosion marked issteright with water none high density of cracks and a weak layers, susceptible to erosion, tast weathining marked fast weathining None fast weathining None fast weathining none fast weathing none fast weat	A model of allogs Image of the set of allogs Image of	Initial in a college Constant in the constant of the c	Image: Control to control the stope Contro the stope Control the stope<	Image: Intermediation of the construction of the constr		



Code no.	Ν	3	5	5	3	
Region Office						
Maintenance Unit						

Coordinates	Latitude		""				
Coordinates	Longitude			72 ^o 59'	3.6'	,	
Road na	ame			Km			

Photo sheet

Date	12/13/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies: View of Retaining wall as counter measure for N-35



View of fallen blocks

	Coc	le no. N 3 5 _ 5 4	7		Evaluation she	eet (S	lope f	ailure/I	Rockfall)			Date	14-Dec-2	2017
	Regio	n Office	7		La	titude	35	^o 06' 48.	.3"	-			Inspector	Yasir, Sajid, Shafid	jue, Basharat
N	/ainter	ance Init	-		Coordinates	aitude	72	50 ' 50	7"					-	
	anter					gitude	12	- 33 33	.,						
					Road name		Km								
[Ca	uses]	factor	lastagen / of sears	Chaok				[Countorm	1						
	lem	iaciói		ULIECK			1	Counterm	leasurej		Type	of cour	atormoasuros		
hhy	sed	talus slope,	2 correspondences	·····	[Disaster type]						турс		itermeasures		
ogra	llap	eroded toe of slope ,	1 correspondences	······											
top	° _	overhang, water catchment slope	no correspondence	······	Rock fall										
			marked	V		1				Effectiven	less of ex	disting co	ountermeasures		Check
	Soil	susceptible to erosion	a little marked		Slope failure	N									
s	0,	iess sirengun with water	None	†	[Main check object]				ope failure are	prevented	enough,	or, it is	detended enough whe	en it is generated.	
ition	~	high density of cracks and a weak layers,	marked	V	Cut dana	2		Potential slo	ope failure are o	considerab	ly preven	nted, or i	it is considerably defer	nded when it is	
ondi	Rock	susceptible to erosion,	a little marked		Cut siope	v		generated.							
alo		fast weathering	None		Natural slope			Potential slo	ope failure are p	partly preve	ented, or	it is par	tly defended when it is	generated.	V
ogic		dip slope of bedding plane	It corresponds.		Natural Slope			However, it	is not enough f	for the rem	naining fac	ctors.			v
Geol	ure		None	V				There is no	countermeasur	re, or there	e is not ef	fective	even if countermeasur	res are not	
Ŭ	Inuct	debris on impermeability bedrock	marked	V				performed.							
	S	the upper part is a hard /the toe of slope is weak.	a little marked												
			None		[History]							1	[Expected size of disast	ter](width, length, depth	, etc.)
		The state of the data decide and second second second	Instability	V	Level of disaster history Check										
_		Topsoli, detached rock and unsteady rock	a little unstable	······	There is a history about large fallen rocks and slope failures that were the road traffic after construction of recent measures					stacles to	\checkmark				
itior			stability		There is a history shout d			asures.		de e une e d					
cod		Spring water	seenage	2/	though there is no obstact	arge taller le to traffic	i rocks and	siope failure	es that gets to t	ine road			I = 184	Im W= 90 m D = 3	m
ace		opining water	none	- ·	Thora is a history about	small fallor	rocke and	l clono foilure	as that did not a	not to the			2 104		
Surf			bare land with minor vagetation	V	road.		TTUCKS and	i siope ialiule	ธร แทลเ นิน ที่ปีเ ยู	yet to the					
		Surface condition	intermediate (bare • grass • tree)	·····											
			mainly structure, mainly tree	······	No disaster records										
			H≧50m	٧	[Evaluation Rank]					[[Descriptio	on]			
			ਸ਼ੂ <u></u> 30≦H<50m		Scale of disaster	Big		Medium	Small		This is a com aterial leads to	plex landsli	ide comprising of rock fall, debris	s flow and slope failure. Active	erosion on the loose
e			<u>₽</u> 15≦H<30m		Risk	Ъlg		Modum	Unian		rock on the l	left flank of	the slide has detached, fractured	and jointed boulders that are p	rone to rock fall and
Profi		Height (H), dip (i)	H<15m		Great risk	1		2	3		inerefore pos However, no	mitigation	to the road and traffic. Three road measures are constructed to stabi	us are passing through the slid- ilize the slide. A retaining wall	e at different heights. is constructed on the
			i≧70°					-	-	va	alley side of al	ll the three r	oads. Tension cracks were prese is present above and	nt on the slide and it is void of below the road.	thick vegetation. Talus
			븅 45°≦i<70°	V	Medium risk	1		2	3						
maly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk	2		3	4						
Ano	openc	rack, anomaly of countermeasure	none		Organization responsible scale of the disaster	for counte	rmeasure \	Influence on the traffice when potential disaster							
					-Big: Grant aid				-Great risk: road closed for 2 days or more						
					-Medium: Major contractor in Pakistan				-Medium risk: road closed for 1 day or less						
					-Small: Local contractor					-Low	risk: no ro	oad clos	ure		



Code no. N 3 5 _ 5 4		Pho	to sheet	Date	12/14/2017
Region Office	Coordinatos	Latitude	35º 06' 48.3"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit	Coordinates	Longitude	72 ^o 59 ' 59.7"		
	Road n	ame	Km		
Full view of the landslide	View of landsl	ide on Valley side	:	Road condition:Cut slop	be at the start point
View of the slope failure at the middle point	Existing count benching as c	ermeasures / ano ounter measure	malies: View of Retaining wall and	View of fallen blocks or	road

	Coc	de no. N 3 5 _ 5 6	7		Evaluation she	et (S	lope f	ailure/R	ockfall)			Date	15-Dec-	2017
	Reaio	on Office	-		La	titude	3	5° 06' 59"	'	,			Inspector	Yasir, Sajid, Shafid	ue, Basharat
	Jainton	aanee Unit	-		Coordinates	aitude	73	0 00' 30 8	"						
	anter					giluue	13	00 39.0	,						
10					Road name		Km								
[Ca	usesj œm	factor	category of score	Check				[Counterme	asurel						
\geq	-	telus elene	3 or more correspondences	V							Туре	e of cour	ntermeasures		
aph	or	clear convex break of slope,	2 correspondences	· · · · · · · · · · · · · · · · · · ·	[Disaster type]										
oogr	fact	eroded toe of slope,	1 correspondences		Devis fell	.1					No	o counte	ermeasures		
tol	Ö	overhang, water catchment slope	no correspondence		ROCK TAIL	N									
			marked	V	Slope failure	2				Effectivenes	ss of ex	cisting co	ountermeasures		Check
	Soil	susceptible to erosion	a little marked		Slope failure	v		Potential clor	o failura ara i	provented or	nough	or it is	defended onough w	han it is generated	
s			None		[Main check ob	ect]				provented el	nougil,	01, 11 15	derended enough w	ien it is generated.	
litior	*	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slope	e failure are c	considerably	preven	ited, or i	it is considerably def	ended when it is	
puo	Roc	susceptible to erosion,	a little marked		Outclope	v		generated.							
cal c		last weathering	None		Natural slope			Potential slop	e failure are p	partly prevent	ted, or	it is par	tly defended when it	is generated.	v
logi		dip slope of bedding plane	It corresponds.		'			However, it is	not enough f	or the remain	ining fac	ctors.			-
Ge	ture		None	V				There is no co	ountermeasur	e, or there is	s not ef	fective	even if countermeas	ures are not	
	truc	debris on impermeability bedrock,	marked	<u> </u>				performed.							
	S	the upper part is a hard /the toe of slope is weak.	a little marked	v											
			None	-1	[History]	1	- f - l ' f -	la !- 4			Ohaala	1	[Expected size of disa	ister](width, length, depth	i, etc.)
			Instability	v		Level	of disaste	er nistory			Спеск				
_		Topsoil, detached fock and unsteady fock	a iittie unstable	······	There is a history about la the road traffic after cons	arge fallen	rocks and	slope failures f	hat were obs	stacles to	\checkmark				
itior			notable spring waster		There is a history shout I			Lalana failuna	4	h a second					
000		Spring water	seenade	······	though there is no obstac	le to traffi	i rocks and c.	a slope failures	that gets to t	ne road			1=5	20m W=180m D=1-2	m
ace			none	V	Thora is a history about	mall fallo	a rocks and	d clopo failuros	that did not a	not to the		-	2.04		
Surt			bare land with minor vagetation	v	road.		TTOCKS and	a slope failures	that did hot g	Jet to the					
		Surface condition	intermediate (bare • grass • tree)	·····								-			
			mainly structure, mainly tree	· · · · · · · · · · · · · · · · · · ·	No disaster records										
\square			H≧50m		[Evaluation Rank]					[De:	escriptio	on]	L		
			ਸ਼ੂ 30≦H<50m	٧	Scale of	Die		Madium	Small	An a	active rot	tational co	omplex landslide compris	ing of slope failure, Debris	flow and rock fall.
e			15≦H<30m		Risk	ыу		wealum	Small	W traj	Veather, jo offic. Activ	ointed an ve weathe	nd fractured overhanging ering and erosion leads to	bed rock are posing threat development of gullies. De	s to the road and bris flow induced
rofil		Height (H), dip (i)	H<15m		Great risk	1		2	3	erosi	ion track	s are wel	l developed. Talus materi	al comprised on boulders,	gravels and sand is
α.			i≧70°		Great hak	1		2	5	pi howe	resent. Be ever, no n	ed rock is mitigation	s comprised of Amphiboli n measures are adopted. ?	te. Although it is posing thr This LS needs quick attentic	eats to the road, on from the concern
			<u>⊖</u> <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3	auth	horities a	is on the v	valley side a medical hosp fai	pital is built which is also p ll.	rone from the rock
maly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk	2		3	4						
Anol		rack, anomaly of countermeasure	none		Organization responsible scale of the disaster	for counte	ermeasure	works accordin	g to the	Influence disaster	ce on the	e traffic	e when potential		
					-Big: Grant aid					-Great ri	risk: roa	d close	d for 2 days or more		
					-Medium: Major contracto	r in Pakist	tan			-Medium	n risk: r	oad clos	sed for 1 day or less		
					-Small: Local contractor					-Low ris	sk: no ro	oad clos	sure		



Code no. N 3 5	_ 5 6		Photo	o sheet	Dat	te	12/15/2017
Region Office			Latitude	35 ^o 06' 59"	Ins	pector	Yasir, Sajid, Shafique, Bashara
Maintenance Unit		Coordinates	Longitude	73 ^o 00' 39.8"			
		Road	name	Km			
ull view of the landslide		View of land	slide on Valley side:		Road conditio	on:Cut slop	be at the start point

measure

View of the slope failure at the middle point



View of Overhang blocks on road

Existing countermeasures / anomalies: View of shed as counter

	Cod	de no. N 3 5 1 1 2	1		Evaluation sh	eet (S	lope f	ailure/F	Rockfall))			Date	12/16/2	2017
	Regio	n Office			La	atitude	35	o 16' 12.	3"				Inspector	Yasir, Sajid, Shafi	que, Basharat
N	/lainten	nance Unit	7		Coordinates	ngitude	73	o 13' 23.	6"						
			_		Road name	<u> </u>	Km .								
100	ussal				Road hame		KIII								
	tem	factor	category of score	Check				[Counterm	easurel						
>	_	talua alua a	3 or more correspondences					loogunouu	ououroj		Type	of cour	termeasures		
aph	or	talus slope, clear convex break of slope.	2 correspondences	V	[Disaster type]										
pogr	fact	eroded toe of slope ,	1 correspondences		Deals fall						No	counte	rmeasures		
to	Ö	overhang, water catchment slope	no correspondence		ROCK TAIL	N									
	_	susceptible to grasion	marked		Slope failure				E	Effectivenes	ss of ex	isting co	ountermeasures		Check
	Soi	less strength with water	a little marked					Potential slo	ope failure are p	prevented er	nouah	or, it is a	defended enouah wi	nen it is generated.	
su			None	V	[Main check ob	ject]					3.,		g	5	
ditio	쏭	high density of cracks and a weak layers,	marked		Cut slope			Potential slo	pe failure are co	onsiderably	preven	ted, or it	t is considerably def	ended when it is	
con	Ro	susceptible to erosion, fast weathering						generated.	<i>c</i> ::						
lical			It corresponds	v	Natural slope			Potential slo However it i	pe failure are pa is not enough fo	artly preven or the remai	ited, or i ining fac	it is part	ly defended when it	is generated.	
solog	e	dip slope of bedding plane	None	v				There is no (or there is	s not ef	foctive c	wen if countermeas	ures are not	
Ğ	Ictur		marked	-				performed.	counternicasure		3 1101 01		ven il counternicas		V
	Str	debris on impermeability bedrock,	a little marked	V				-							
		the upper part is a hard /the toe of slope is weak.	None		[History]								[Expected size of disa	ster](width, length, depth	n, etc.)
		·	instability			Leve	l of disaste	er history			Check				
		Topscil, detached rock and unsteady rock	a little unstable	V	There is a history about	arge faller	rocks and	slope failures	s that were obsta	acles to	N				
ion			stability		the road traffic after cons	struction o	f recent me	asures.			v				
codit			notable spring waster		There is a history about	large falle	n rocks and	l slope failure	s that gets to th	ie road					
ice o		Spring water	seepage		though there is no obsta	cle to traff	С.						W=	182m, L= 38.5m, D=	?
surfa			none	v	There is a history about	small falle	n rocks and	d slope failure	es that did not ge	et to the					
0)		Surface condition	intermediate (here grass tree)	• •	Toau.										
		Surace condition	mainly structure mainly tree		No disaster records										
\square			H≧50m	v	[Evaluation Rank]					[De	escriptio	onl			
			ਸ਼ੂ 30≦H<50m		Scale of	- .				A	n old r	ock fa	ll however no si	gns of fresh rock	fall. A steep
ø			15≦H<30m		Risk	Big		Medium	Small		cliff	with j	ointed, fractured	l and detached bo	, oulders.
rofil		Height (H), dip (i)	H<15m		Great risk	1		2	3	li	nterse	cting j	oints leads to w	edge. Cracks are	open. Bed
α.			i≧70°		Oreat hisk			2	5	ro	ock is	amphi	ibolite. No mitiga	ation measures a	re adopted.
			<u>ਉ</u> 45°≦i<70°	V	Medium risk	1		2	$\overline{3}$		House	es are i	located on the to	op of the ridge. A	hospital is
			i<45°					_	J	10	cateo	at the	e Valley Side of the	ne silde and there	etore needs
₹	Surface	e collapse, small fallen rock, gully, erosion, piping hole.	2 or more correspondences clarity	V	Low risk	2		3	4					c concern adirion	
шог	subside	ence, heaving, bending of tree root, fallen tree, crack,	none			for count	rmogeure	works accord	ing to the	Influence	o on th	o troffic	when potential		
A	openc	rack, anomaly of countermeasure			scale of the disaster	TOF COUNT	enneasule	WOIKS ACCOID		disaster	r	e danice	e when potential		
<u> </u>			1	•	-Big: Grant aid					-Great r	risk: roa	d closed	d for 2 days or more		
					-Medium: Major contract	or in Pakis	tan			-Mediun	n risk: r	oad clos	sed for 1 day or less		
					-Small: Local contractor					-Low ris	sk: no ro	ad clos	ure		

. oto ' 7258



Code no.	N 3 5	5		1	1 2	7	Phot	to sheet	Da	ate	12/16/2017
Region Office						0 " (Latitude	35º 16' 12.3"	Ins	spector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit						- Coordinates	Longitude	73º 13' 23.6"			
						Road n	ame	Km			
Full view of the landslide	e					View of landsl	de on Valley side:		Road condition	on:Cut slop	be at the start point
View of the slope failure	e at the middle	e point				Existing count counter measu	ermeasures / anon ure	nalies: View of retaining wall as	View of faller	n blocks	

	Coc	le no. N 3 5 _ 1 1 5	7		Evaluation she	et (S	Slope f	ailure/F	lockfall)				Date	17-Dec-	2017
	Regio	n Office	7		La	itude	35	o 13' 26.	1"				Inspector	Yasir, Sajid, Shafi	que, Basharat
N	- Aainten	ance Init	-		Coordinates	nitude	73	0 13' 25 ') "						
	anten						73	10 20.4	-						
					Road name		Km								
[Ca	uses]														
	tem	factor	category of score	Check				[Counterme	asure]	-	,				
phy	ed	talus slope,	3 or more correspondences	v	-						Type of	counter	measures		
gral	laps	clear convex break of slope, eroded too of slope	2 correspondences		[Disaster type]	1	1				Nia aa				
topc	Col	overhang, water catchment slope			Rock fall						NO CO	unterme	asures		
-			morked	1			-		E #/	ootivonooo	of oviatir		armaaauraa		Chook
	Ē	susceptible to erosion		v	Slope failure				Elle	ectiveness		ig couri	lenneasures		CHECK
	Ň	less strength with water	a illie markeu		Dia in the state	41]	Potential slo	pe failure are prev	vented enou	ugh, or, i	it is defe	ended enough w	hen it is generated.	
suo			marked	V	Liviain check obj		1	Detential -1	- failuna ana		aventa d	an 18 1 -	aanaldanahh : -!!	fandad whan it is	
nditi	к	nigh density of cracks and a weak layers, susceptible to erosion	a little marked	v	Cut slope	\checkmark		generated.	e tallure are cons	siderably pre	evented,	, or it is	considerably de	iended when it is	
col	Ř	fast weathering	None					Detential alar	o failuro ara parti	ly provented	1 or it io	portly d	ofondod whon it	tic concreted	
gica			It corresponds.		Natural slope			However, it is	s not enough for th	he remainin	g factors	paruyu S.		i o generateu.	V
oloe	e	dip slope of bedding plane	None	V			1	There is no c		or there is no	ot effect	ive ever	n if countermeas	sures are not	
Ğ	Ictur		marked	V				performed.	ountermedoure, e		01 011001				
	Str	debris on impermeability bedrock,	a little marked												1
		the upper part is a hard /the toe of slope is weak.	None		[History]							[Ex	pected size of dis	aster](width, length, depth	n, etc.)
			instability	V		Leve	el of disaste	er history		Ch	neck				
		Topscil, detached rock and unsteady rock	a little unstable		There is a history about la	rge falle	n rocks and	slope failures	that were obstacl	les to	.1				
E			stability		the road traffic after const	ruction of	f recent me	asures.			N				
oditio			notable spring waster		There is a history about 1	arge falle	en rocks and	I slope failures	that gets to the r	road					
e cc		Spring water	seepage		though there is no obstac	e to traf	ic.						L=2	30m, W=200m, D=1-2	lm
rfac			none	V	There is a history about s	mall fall	en rocks and	d slope failure	s that did not get t	to the					
Su			bare land with minor vagetation	v	road.										
		Surface condition	intermediate (bare•grass•tree)		No disaster records										
			mainly structure, mainly tree												
			H≧50m	V	[Evaluation Rank]					[Desc	ription]				
			ਸ਼ੂ 30≦H<50m		Scale of disaster	Bio		Medium	Small	An ac	ctive slop	e failure : t the rock	and rock fall. Origi	inally a rock fall, however	, talus of 16 m is Active weathering
e			ළ <u>15≦</u> H<30m		Risk					and ero	osion on t	this talus	deposits leads to	development of gullies.	On the rockfall cliff
Prof		Height (H), dip (i)	H<15m		Great risk	1		2	3	there Wedge	are many cutting is	y jointed s observe	and detached bou ed. Weathering he	Ider that poses threats to comes active during the	road and traffic.
			í≧70°					_		the roa	ad. Howe	ver, no m	itigation measures	s are constructed. A retai	ning wall is built at
			ਤੋਂ <u>45°≦।<70°</u> i<45°	V	Medium risk	1		2	3	th	e left flan	nk of the s	slide, however, it i	s also not enough to stab	ilize the slide
maly	Surface	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences · clarity certain · unclarity	٧	Low risk	2		3	4						
Ano	openc	rack, anomaly of countermeasure	none		Organization responsible scale of the disaster	for coun	ermeasure	works accordi	ng to the	Influence c disaster	on the tra	affice wl	hen potential		
l			· .		-Big: Grant aid					-Great risk	: road cl	losed fo	r 2 days or more)	
					-Medium: Major contracto	r in Paki	stan			-Medium ri	isk: road	l closed	for 1 day or less	5	
					-Small: Local contractor					-Low risk: r	no road	closure			



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Code no.	N 3 5 _ 1 1 5		Ph	oto sheet	Date	12/17/2017
Region Office		Coordinatoo	Latitude	35 ^o 13' 26.1"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates	Longitude	73 ^o 13' 25.2"		
		Road II				New Star



	Cod	le no. N 3 5 _ 1 1 6	7		Evaluation she	et (S	Slope f	ailure/F	Rockfall)				Date	18-Dec-	2017
	Regio	n Office			Lati	tude	35	° 17' 42.	9"				Inspector	Yasir, Sajid, Shafi	que, Basharat
Ν	lainten	ance Unit	-		Coordinates Long	jitude	73	° 12' 15.	5"						
<u> </u>	unnal		_		Road name		Km								
Ua I	tem	factor	category of score	Check				[Counterm	easurel						
Y	-	talua alana	3 or more correspondences	V							Туре	of count	ermeasures		
Inderigodo	Collapsed factor	clear convex break of slope, eroded toe of slope, overhand, water catchment slope	2 correspondences 1 correspondences		[Disaster type] Rock fall						Ret	aining wa	all for N-35		
-			no correspondence						F 4	ffa atiu ana a		-			Cheel
	Soil	susceptible to erosion less strength with water	a little marked	v	Slope failure	\checkmark		Potential slo	pe failure are pre	evented er	nough,	or, it is d	efended enough w	hen it is generated.	Check
2			None	-1	[Main check obje	ect]					-		_	-	
1	Rock	high density of cracks and a weak layers, susceptible to erosion,	a little marked	V	Cut slope	\checkmark		Potential slo generated.	pe failure are cor	nsiderably	prevent	ed, or it	is considerably de	tended when it is	
, girdan c	-	tast weathering	None It corresponds.		Natural slope			Potential slo However, it i	be failure are par s not enough for	rtly prevent the remain	ted, or i ning fac	t is partly tors.	y defended when it	t is generated.	V
	an	up slope of bedding plane	None	V	L	•		There is no	ountermeasure,	or there is	s not eff	ective ev	ven if countermeas	sures are not	
	Structu	debris on impermeability bedrock,	marked a little marked	V				performed.							
		the upper part is a hard /the toe of slope is weak.	None		[History]							[Expected size of dis	aster](width, length, depth	n, etc.)
			instability	V	These is a bistomy about law	Leve	l of disaste	er history	that want a bata	alaa ta	Check	Γ			
=		ropoon, doublind rook and unotoday rook	stability	······	the road traffic after constr	uction o	f recent mea	asures.	that were obstat	cies lo					
		Spring water	notable spring waster		There is a history about la though there is no obstacle	rge falle e to traff	n rocks and ic.	slope failure	s that gets to the	e road			W	=370. L= 307m. D= 7n	n
		- Frinið mann	none	V	There is a history about sr	nall falle	n rocks and	l slope failure	s that did not get	t to the					
5		Surface condition	bare land with minor vagetation intermediate (bare-grass-tree) mainly structure, mainly tree	V	road. No disaster records										
			H≧50m	V	[Evaluation Rank]					[De:	scriptic	nl L			
D			표 <u>30≦</u> H<50m 같 15≦H<30m		Scale of disaster Risk	Big		Medium	Small	Th his	ne site torical	(Chocha landslio	ang) has a histo le, which is react	ry of road blockade tivated many times.	in past. It is a Initially it wa
		Height (H), dip (i)	H<15m i≧70°		Great risk	1		2	3	rc	Geoloo	out now comp w of the	rises of some b site is characte	e in debris/talus dep oulders of size >6 m rized by presence o	osit. Deposit 3. f Kamila .lal
			<u>⊖</u> 45°≦i<70° i<45°	V	Medium risk	1		2	3	Sh	iear zo	ne on b	ackside, which r Kamila Ar	esults in intense fra nphibolite.	gmentation of
	Surface	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences · clarity certain · unclarity	V	Low risk	2		3	4					-	
2		rack, anomaly of countermeasure	none		Organization responsible for scale of the disaster	or count	ermeasure v	works accord	ng to the	Influenc disaster	e on the	e traffice	when potential		
			1	1 1	-Big: Grant aid					-Great ri	isk: roa	d closed	for 2 days or more)	
					-Medium: Major contractor	in Pakis	stan			-Medium	n risk: ro	bad close	ed for 1 day or less	6	
					-Small: Local contractor					-Low ris	k: no ro	ad closu	re		



Code no.	Ν	3	5	_	1	1	6
Region Office							
Maintenance Unit							

		Ph	oto	sh	eet								
Coordinates	Latitude				3	35º 17' 4	42.9)"					
Coordinates	Longitude	;	73º 12' 15.5"										
Road na	ame					Km							

Date	12/18/2017
Inspector	Yasir, Sajid, Shafique, Basharat



	Coc	e no. N 3 5 _ 1 1 7]		Evaluation	sheet	(SI	ope f	ailure/l	Rockfall)			Date	19-Dec-	2017
	Regio	n Office				Latitude		35	5° 18' 5.4	4"				Inspector	Yasir, Sajid, Shafi	que, Basharat
Ν	lainten	ance Unit	-		Coordinates	Longitud	le	73	0 11' 58	6"						
					Desdaras	Longhad		10								
					Road name			Km								
Ca I	usesj tem	factor	category of score	heck					[Counterm	easurel						
_	tom		3 or more correspondences	V					Counterm	easurej		Type	e of cou	Intermeasures		
	sed	talus slope, clear convex break of slope	2 correspondences		Disaster	typel						.)				
ĥ	ollap fact	eroded toe of slope ,	1 correspondences							В	enching and	d terraci	ng on t	he debris to stabilize	e the slope	
ź	ŏ	overhang, water catchment slope	no correspondence		Rock	fall										
			marked	٧	Slope fo	ailuro a	J				Effectivene	ess of ex	cisting c	countermeasures		Check
	Soil	susceptible to erosion less strength with water	a little marked		Slope la		N		Potential sl	one failure are	prevented c	nough	or it is	defended enough w	when it is generated	
2		·····	None		[Main che	ck object]			i otoritiar si		prevented e	shough,	01, 11 13	derended enough v	when it is generated.	
	×	high density of cracks and a weak layers,	marked	v	Cut slo	ope 1	J		Potential slo	pe failure are o	onsiderably	/ preven	ited, or	it is considerably de	fended when it is	
202	Roc	susceptible to erosion,	a little marked				`		generated.							
8			None		Natural	slope			Potential slo	pe failure are p	partly prever	nted, or	it is pa	rtly defended when i	t is generated.	v
ĥ		dip slope of bedding plane	It corresponds.						However, It	is not enough t	or the rema	uning tao	ctors.			
Ś	ture		None	V					There is no	countermeasur	e, or there i	is not ef	fective	even if countermeas	sures are not	
	struc	debris on impermeability bedrock,	a little marked	v					periornica.							
	0)	the upper part is a hard /the toe of slope is weak.	None		[History]									Expected size of dis	aster](width length denth	etc)
1			instability	V	[i listory]	1.6	evel	of disaste	er history			Check	1		dotorj(widel, longel, dope	, 0.0.)
		Topsoil, detached rock and unsteady rock	a little unstable	·····	There is a history a	hout large fo	allen r	ocks and	slone failure	s that were obs	tacles to					
:			stability		the road traffic after	r constructio	on of r	ecent mea	asures.		10000	V				
			notable spring waster		There is a history a	about large f	fallen	rocks and	l slope failure	es that gets to t	he road					
3		Spring water	seepage	٧	though there is no	obstacle to t	traffic.			Ū				W=	200m, L=380m, D=2-3	lm
			none		There is a history a	about small f	fallen	rocks and	d slope failure	es that did not g	get to the					
5			bare land with minor vagetation	٧	road.											
		Surface condition	intermediate (bare • grass • tree)		No disaster records	s										
			mainly structure, mainly tree													
			H≧50m	v	[Evaluation Rank]						[De	escripti	on]		10 mm	
			12 30≦H<50m		Scale	ter	Big		Medium	Small	An Ac	active de ctive eros	ebris fall sion on t	l from an old lake depo he talus leads to devel	osits. The talus cone is pre lopment of gullies. Water i	sent in the valle s flowing throug
2			≝ 15≦H<30m		Risk		-				the	talus an	d also s	eeps in the debris. Ha	nging boulder are present	in the debris. T
2		Height (H), dip (I)	H<15M		Great risk		1		2	3	dar	slide is a maging th	he road,	however, no mitigation	n measures are adopted to	o protect the roa
			1≦70 ₽ 45°≤i∠70°	1									Trer	nches are made on the	talus to stabilize the debr	is.
			i<45°	V	Medium risk		1		(2)	3						
laiy	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences · clarity certain · unclarity	V	Low risk		2		3	4						
	openc	ack, anomaly of countermeasure	none		Organization responses	nsible for co er	ounter	measure v	works accord	ling to the	Influend	ce on th r	e traffic	ce when potential		
			L L		-Big: Grant aid						-Great	risk: roa	d close	ed for 2 days or more	e	
					-Medium: Major co	ntractor in Pa	akista	an			-Mediu	m risk: r	oad clo	sed for 1 day or les	s	
					-Small: Local contr	actor					-Low ris	sk: no ro	oad clo	sure		



Code no.	Ν	3	5	_	1	1	7	
Region Office								
Maintenance Unit								

Coordinates	Latitude		35 ^o 18' 5.4"								
	Longitude		73 ^o 11' 58.6"								
Road na	Road name					Km					

Photo sheet

Date	12/19/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies: View of benching as counter measure



View of fallen blocks along slope failure

	Coc	de no. N 3 5 1 1 9	7		Evaluation sh	eet (S	Slope f	ailure/Ro	ockfall)			Date	12/20/2	017	
	Regio	on Office	1		L	atitude	35	5 ^o 18' 35.8"	'			Inspector	Yasir, Sajid, Shafic	jue, Basharat	
	Mainter	nance l Init	-		Coordinates	naitude	73	0 11' 26 8"	'						
	indian ton				Deadaran		10								
10-	أعمعا				Road name		Km								
[00	Item	factor	category of score	Check				[Countermea:	sure]						
۲	q	talus slope.	3 or more correspondences	V						Тур	e of cou	ntermeasures			
Irapl	ipse stor	clear convex break of slope,	2 correspondences		[Disaster type]		_								
boc	Colla	eroded toe of slope,	1 correspondences		Rock fall					N	o counte	ermeasures			
ţ	0	overhang, water catchinent slope	no correspondence			,	-							_	
	=	susceptible to erosion	marked		Slope failure				Effective	ness of e	xisting c	ountermeasures		Check	
	0 less strength with water		a little marked	V			l	Potential slope	e failure are prevented	l enough	, or, it is	defended enough wi	nen it is generated.		
suc			INONE	1	[Main check object]							-			
nditic	ş	high density of cracks and a weak layers,	a little marked	v	Cut slope	\checkmark		Potential slope	tailure are consideral	oly preve	nted, or	it is considerably def	ended when it is		
cor	Ro	fast weathering	Nono	·		_	-	generated.	<u>, , , , , , , , , , , , , , , , , , , </u>						
gical		Ť	It corresponds	+	Natural slope			However, it is n	namure are partly prev not enough for the ren	ented, or naining fa	it is par actors.	uy detended when it	is generated.	V	
solog	e	dip slope of bedding plane	None	v			1	There is no cou	intermeasure or ther		ffective	even if countermeas	ures are not		
õ	ctur		marked					performed.	antermeasure, or the	0 13 1101 0	neeuve	even il counternieas			
	Stru	debris on impermeability bedrock,	a little marked	V				Ľ						1	
		the upper part is a hard /the toe of slope is weak.	None		[Historv]							[Expected size of disa	ster](width, length, depth	, etc.)	
			instability	V		Leve	el of disaste	er history		Check	<				
		Topsdil, detached rock and unsteady rock	a little unstable	1	There is a history about	large falle	n rocks and	slope failures th	nat were obstacles to						
uo			stability	1	the road traffic-after construction of recent measures.					v					
oditi			notable spring waster		There is a history about	large falle	d slope failures th	hat gets to the road	bad						
ce co		Spring water	seepage		though there is no obstacle to traffic. There is a history about small fallen rocks and slope failures that did not get road.							W= 349m, L= 240m, D= 1m			
urfac			none	V											
S			bare land with minor vagetation	V											
		Surface condition	intermediate (bare · grass · tree)		No disaster records										
			mainly structure, mainly tree								Ļ				
			H≧50m	V	[Evaluation Rank]			<u> </u>	[Jescript	ion]	ion of old root foll	lithology of this site	ia Kamila	
1			50 <u>→</u> 30 <u>→</u> H < 50 m	·	Biok	Big		Medium	Small	ıt ıs li amphih	npress olite wl	ion oi oid rockiall. hich is highly iointe	Liniology at this Site d and sheared due	to closeness	
ofile		Height (H) din (i)		·	TIBK				t	o KJS. l	Jncontr	olled blasting for n	ad excavation trigg	pered this site.	
Pro			i≥70°		Great risk	1		2	3	In additi	on to it,	river is eroding the	e valley side of the i	road resulting	
			≗ 45°≦i<70°	v				\bigcirc		in ov	er steel	pening of the slope	e towards valley side	e. There is	
			i<45°	· · ·	Medium risk	1		(2)	3	reta	aınıng v counteri	vall towards valley measures for rock	side for road protec fall has been constr	ction. No ucted.	
naly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences · clarity certain · unclarity	٧	Low risk	2		3	4	-					
Anor	openc	rack, anomaly of countermeasure	none		Organization responsible scale of the disaster	e for count	ermeasure	works according	to the Influe disas	ence on ti ter	he traffic	e when potential			
					-Big: Grant aid				-Grea	at risk: ro	ad close	d for 2 days or more			
					-Medium: Major contrac	or in Pakis	stan		-Med	ium risk:	road clo	sed for 1 day or less			
					-Small: Local contractor				-Low	risk: no r	oad clos	sure			



Code no.	N 3 5 1 1 9		Phe	oto she	et		Date	12/20/2017
Region Office			Latitude		35 ^o 18' 35.8"		Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates	Longitude		73 ^o 11' 26.8"			
		Road n	name		Km			
Full view of the landslide	3	View of lands	lide on Valley sid	le:			Road condition:Cut slop	be at the start point
View of the slope failure	at the middle point	Existing coun measure	termeasures / ar	nomalies: Vi	iew of shed as counte	er	View of fallen blocks	

	Coc	e no. N 3 5 1 3 4	7		Evaluation she	et (Slo	ope fa	ailure/F	Rockfall)				Date	12/21/2	017
	Reaio	n Office	1		Lati	tude	359	23' 12.3	3" '				Inspector	Yasir. Saiid. Shafid	ue. Basharat
•	Jainton	anco Lipit	-		Coordinates	uitude	73	0 12' 2 3	- 2"						
'n	annen					, iuue	73	- 12 2.3	,						
100	ucocl				Road name	ł	Km								
[Ca	isesj iem	factor	category of score	Check				[Counterme	easure]						
Σ	p	talus slope.	3 or more correspondences	V			Γ				Туре	of cour	ntermeasures		
raph	ipse stor	clear convex break of slope,	2 correspondences		[Disaster type]										
boc	fac	eroded toe of slope,	1 correspondences		Rock fall						No	counte	ermeasures		
Ę	0	overhang, water catchinent siope	no correspondence				L								
	=	susceptible to erosion	marked	V	Slope failure		Ļ		E	Effectivene	ess of ex	isting co	ountermeasures		Check
	 Ø less strength with water 		a little marked	ļ			1	Potential slope failure are prevented enough, or, it				or, it is (defended enough w		
suc			None		[Main check object]									-	
nditic	쓧	high density of cracks and a weak layers,	a little marked	v	Cut slope	\checkmark		Potential slop	pe failure are co	onsiderably	/ preven	ted, or i	t is considerably def	ended when it is	
cor	Ъ	fast weathering	Nono	······			<i>.</i>								
gical		, , , , , , , , , , , , , , , , , , ,	It corresponds.		Natural slope	However, it is	pe railure are pa s not enough fo	aruy prever or the rema	niea, or iining fac	it is part ctors.	uy detended when it	is generated.	V		
solog	ø	dip slope of bedding plane	None	v			-	There is no c		a or there i	is not of	fective	even if countermeas	ures are not	
Ğ	ctur		marked	v	performed.										
	Stru	debris on impermeability bedrock,	a little marked				Ľ								
		the upper part is a hard /the toe of slope is weak.	None		[History]								[Expected size of disa	aster](width, length, depth	, etc.)
			instability	V	Level of disaster history Check										
		Topsoil, detached rock and unsteady rock	a little unstable	1	There is a history about la	ge fallen ro	ocks and s	slope failures	that were obst	tacles to	al				
ч			stability		the road traffic after construction of recent measures.					V					
oditi			notable spring waster		There is a history about large fallen rocks and slope failures that gets to the road										
e e		Spring water	seepage		though there is no obstacle	though there is no obstacle to traffic.							W= 264m, L= 270m, D= 1-2m		
urfac			none	V	There is a history about si	mall fallen r	rocks and	slope failure	s that did not ge	et to the					
Ñ			bare land with minor vagetation	V	road.										
		Surface condition	intermediate (bare · grass · tree) mainly structure, mainly tree		No disaster records										
			H≧50m	V	[Evaluation Rank]					[De	escriptio	on]			
e			ਤਿ <u>30≦</u> H<50m ਦ 15≦H<30m		Scale of disaster Risk	Big	Ν	Vedium	Small		Uncon Litholog	trolled gy is G	blasting for road e ranulite, which is	excavation triggered highly sheared and	this slope. fragmented
Profi		Height (H), dip (i)	H<15m		Great risk	1		2	3	S	roo cree/ta	lus/deb	oris. Due to low ini	filteration in hard roc	ks and large
			<u>ਿ</u> ਦੂ 45°≦i<70°	V	Medium risk	1		2	3		catcl	hment	area, seasonal ra	infalls result into del	bris slide.
H			i<45° 2 or more correspondences clarity	V	l ow rick	ว		3	-						
nomaly	surfac subsid	e collapse, small fallen rock, gully, erosion, piping hole, ence, heaving, bending of tree root, fallen tree, crack,	certain•unclarity none		Organization responsible f	2 or countern	measure w	vorks accordi	ing to the	Influen	ce on th	e traffic	e when potential		
A	penic	act, anomaly of countermeasure		·	scale of the disaster	e. soundin				disaste	er F	s auno	e mon potential		
					-Big: Grant aid					-Great	risk: roa	d close	d for 2 days or more		
					-Medium: Major contractor	in Pakistar	n			-Mediu	m risk: r	oad clos	sed for 1 day or less	;	
					-Small: Local contractor					-Low ris	sк: no rc	ad clos	ure		



Code no.	N 3 5 1 3 4	Photo sheet	Date	12/21/2017
Region Office		Latitude 35º 23' 12.3"	Inspector	Yasir, Sajid, Shafique, Basharat
Maintenance Unit		Coordinates Longitude 73º 12' 2.3"		
		Road name Km		
	14-261/ SIM			
Full view of the landslide	9	View of landslide on Valley side:	Road condition:Cut slop	be at the start point
View of the slope failure	e at the middle point	Existing countermeasures / anomalies: View of shed as counter measure	View of fallen blocks	

	Code no. N 3 5 1 6 2			Evaluation sh	neet (S	lope f	ailure/	Rockfall)		Date	12/22/2	2017
R	legion Office			L	atitude	35	° 27' 46	.4"			Inspector	Yasir, Sajid, Shafio	que, Basharat
Ма	aintenance Unit			Coordinates	onaitude	73	° 14' 56	9"					
inia				Desda		10							
				Road name		ĸm							
aus	ses]	entergen / of appro	Chook				Countor	1					
Tter	ini lactor	a category of score	Check				Counterm	ieasurej		Type of	countormossuros		
Por con	talus slope,	2 correspondences	v	Disastartura	1					Type of	countenneasures		
	eroded toe of slope ,	1 correspondences		[Disaster type			Perfo	orated Retaining	wall for tal	us slone ah	out 3.5m high Stepped	Retaining wall for road	N-35
° C	overhang, water catchment slope	no correspondence		Rock fall			1 0.10	, alou i totali ilig	fran for tan	ao olopo az	out oloni nigini otoppou	i totali ilg itali tot todo	
		marked	V		1				Effectivene	ess of existi	ing countermeasures		Check
	susceptible to erosion	a little marked		Slope failure √									
1		None		[Main check object]			Potential slope failure are prevented enough, or, it is defended enough when it is generated.						
	high density of cracks and	marked	V	Cut clone	1		Potential slo	ope failure are c	onsiderably	y prevented	l, or it is considerably de	efended when it is	
	· a weak layers,	a little marked			N		generated.						
	fast weathering	None		Natural clon			Potential slo	ope failure are p	artly preve	nted, or it is	s partly defended when i	it is generated.	1
	din slope of bodding plane	It corresponds.		Natural Slop	C		However, it	is not enough for	or the rema	aining factor	rs.		v
		None	V				There is no	countermeasur	e, or there	is not effec	tive even if countermea	sures are not	
	to Indebris on importmospility bodrock	marked	V				performed.						
s	the upper part is a hard /the toe of slope is w	ak. a little marked											
		None		[History]							[Expected size of dis	saster](width, length, depth	n, etc.)
		instability	V		Leve	of disaste	er history			Check			
	Topscil, detached rock and unsteady roc	a little unstable		There is a history about large fallen rocks and slope failures that were obst					stacles to 🗸				
		stability		the road traffic after con	Istruction of	recent mea	asures.						
	Spring water	notable spring waster		There is a history about though there is no obst	acle to traffi	n rocks and	slope failure	es that gets to the	he road		\A/-	165m l = 276m D= 4	Em
	Spring water	none	1					41 4 - 12-1 4 -			vv-	105III, L= 370III, D= 4-	5111
-		bare land with minor vagetation	V	road.	small falle	n rocks and	siope failure	es that did not g	jet to the				
	Surface condition	intermediate (bare grass tree)	·····										
		mainly structure, mainly tree		No disaster records									
+		H≧50m	V	[Evaluation Rank]					[De	escription]	l		
		표 30≦H<50m		Scale of	Di		Madium	Om - II	D	ue to close	eness with active Kar	mila Fault, the site is	characterize
		ਮੁੱਦੂ 15≦H<30m		Risk	Big		weaium	Small		by highly	jointed Gabbro and ta	alus deposit on slope	e. This talus
	Height (H), dip (i)	H<15m		Great risk	1		\bigcirc	3	de	eposit con	tains some boulders	ot size equal or grea	ter than thre
		i≧70°		Oreat hisk	1		$\mathbf{}$	5	"	denosit	an upsiope has result t. This deposit is high	le in accumulation of a line in the susceptible to fail in the susceptible	ire durina
		`ਚ <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3		uopoon			ino daning
SL	urface collapse, small fallen rock, gully, erosion, pip	2 or more correspondences clarit certain unclarity	y V	Low risk	2		3	4					
op	penicrack, anomaly of countermeasure			Organization responsib scale of the disaster	le for counte	ermeasure v	works accord	ding to the	Influen disaste	ce on the tr er	raffice when potential		
		L.		-Big: Grant aid					-Great	risk: road c	closed for 2 days or more	e	
				-Medium: Major contrac	tor in Pakis	tan			-Mediu	m risk: road	d closed for 1 day or les	s	
				-Small: Local contractor	r				-Low ri	sk: no road	l closure		


Code no. N 3 5 1 6 2				1 6	6 2	2				Phot	o shee	t				Date	12/22/2017
Region Office				1			1			Latitude		35º 27	46.4"			Inspector	Yasir, Sajid, Shafique, Bashara
Maintenance Unit								(Longitude 73° 14' 56.9"								
									Road na	ame		Km					
ull view of the lands	lide							\	/iew of landsl	de on Valley side:					Road	condition:Cut slo	pe at the start point

View of the slope failure at the middle point

all has not



Existing countermeasures / anomalies: View of retaining wall as counter measure for slope failure

View of fallen blocks

	Co	de no. N 3 5 2 3 6	7		Evaluation s	neet (S	Slope	failure/F	Rockfall))			Date	12/23/2	2017
	Regio	on Office				_atitude	35	5º 31' 23.	8"				Inspector	Yasir, Sajid, Shafi	que, Basharat
	Mainter	nance Unit	-		Coordinates	onaitude	73	30 39' 59	5"						
					Bood name		1 Km								
10					Road name		Km								
	iusesj Item	factor	category of score	Check				[Counterm	easurel						
~			3 or more correspondences	V				loonneim	casaroj		Type	of coun	termeasures		
aph	or	clear convex break of slope.	2 correspondences		Disaster type	9]									
ogr	ollap fact	eroded toe of slope,	1 correspondences				1			Retai	ining wall	for talus	s slope about 1m hi	gh	
ţġ	Ō	overhang, water catchment slope	no correspondence		Rock fall										
			marked	V	Slope failu	a 1				Effectivene	ess of ex	isting co	ountermeasures		Check
	Soil	less strength with water	a little marked		Slope failui	e v		Potential sk	one failure are r	nrevented (enouah	or it is d	lefended enough wi	en it is generated	
su		, , , , , , , , , , , , , , , , , , ,	None		[Main check	object]	-	. otoritiar Sit		p.ovoniou (enougn,	o, it io u	e.ondoa onougri wi	.e., it is generated.	
ditio	×	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slo	pe failure are c	onsiderabl	y preven	ted, or it	is considerably def	ended when it is	
Sond	Roc	susceptible to erosion,	a little marked				_	generated.							
cal	-		None		Natural slop	e		Potential slo	pe failure are p	partly preve	ented, or	it is partl	ly defended when it	is generated.	v
pologi		dip slope of bedding plane.	It corresponds.					However, It	is not enough to	or the rema	aining iac	tors.			
Ge	sture		None	V				There is no	countermeasur	e, or there	is not eff	lective e	ven if countermeas	ures are not	
	Struc	debris on impermeability bedrock,	a little marked	v				periornied.							
	0)	the upper part is a hard /the toe of slope is weak.	None		[History]								Expected size of disa	ster](width length denti	n etc.)
			instability	V	[instory]	Lev	el of disast	er history			Check	1		otor (tindan, torigan, dopa	1, 010.7
		Topsoil, detached rock and unsteady rock	a little unstable		There is a history abo	t large falle	n rocks and	l slone failures	that were obs	tacles to	,				
Ę			stability		the road traffic after co	nstruction of	of recent me	easures.			N				
ditic			notable spring waster		There is a history about	t large fall	en rocks an	d slope failure	s that gets to th	he road					
e co		Spring water	seepage		though there is no obs	acle to traf	fic.	•	0				W= 5	15m, L= 453m, D= 4-	5m
rfac			none	V	There is a history abou	t small fall	en rocks an	d slope failure	s that did not g	get to the					
Su			bare land with minor vagetation	V	road.										
		Surface condition	intermediate (bare • grass • tree) mainly structure, mainly tree		No disaster records										
			H≧50m	٧	[Evaluation Rank]					[D	escriptio	on]			
Ð			Image: Hold State 30≦H<50m Image: Hold State 15≦H<30m		Scale of disaster Risk	Big	9	Medium	Small	lt	t is an oi Indus R	ld lands iver in p	slide deposit (Harl bast. This deposit	oon Avalanch II), w is highly susceptibl	hich dammed le to erosion.
rofil		Height (H), dip (i)	H<15m		Great rick	1		2	3	Du	uring rai	ntall, sl	ope failure, gully	erosion and debris	tlow within this
Δ.			i≧70°		Gleat lisk	-		2	5	R	Retaining	u wall al	bout 4 feet high w	s site vuinerable. as built to minimize	the risk but it
			<u>ਿ</u> <u>45°≦i<70°</u> i<45°	V	Medium risk	1		2	3	has been damaged due to recent landslide activity.				ctivity.	
naly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	٧	Low risk	2		3 4							
Anor	open	rack, anomaly of countermeasure	none		Organization responsil scale of the disaster	le for coun	termeasure	works accord	ing to the	Influen disaste	nce on the	e traffice	when potential		
					-Big: Grant aid -Great risk: road closed for 2 days or more										
					-Medium: Major contractor in Pakistan -Medium risk: road closed for 1 day or less										
					-Small: Local contracto	r				-Low ri	isk: no ro	ad closu	ure		



106

Code no.	Ν	3	5	2	3	6	
Region Office							
Maintenance Unit							

oordinates	Latitude		3	35° 31' 2	23.8	"	
Joordinates	Longitude		7	73° 39' (59.5	"	
Road na	ame			Km			

Photo sheet

Date	12/23/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies: View of shed as counter measure



View of Multiple slope failure in the talus deposits

	Cod	de no. N 3 5 _ 2 4 4	1		Evaluation sh	eet (S	Slope f	ailure/F	Rockfall)				Date	24-Dec-	2017
	Regio	on Office	-		La	titude		35 ^o 31' 8'	'				Inspector	Yasir, Sajid, Shafi	que, Basharat
	/ainter	nance l Init	-		Coordinates	naitude	73		3"						
	haintei					Igitude	73	J° 4 4 03.							
	_				Road name		Km								
[Ca	uses]	factor	actoriany of acore	Chook				[Countorm	1						
	lem	Iactor	3 or more correspondences	Check				Counterm	easurej		Type	of count	ermessures		
aphy	sed	talus slope,	2 correspondences	·····	[Disaster type]						турс	or count	erneasures		
ogra	facto	eroded toe of slope ,	1 correspondences			1	1		No co	ountermeas	sures fo	r slope f	failure. Retaining w	all for N-35	
top	ů –	overhang, water catchment slope	no correspondence		Rock fall	\checkmark							5		
			marked		Clana failuna	2			Ef	ffectivenes	s of exi	sting cou	untermeasures		Check
	Soil	susceptible to erosion	a little marked		Slope failure	?		Dotontial alc	no foiluro oro pro	avantad an	ough (ar it in de	ofonded one ush wi	on it is generated	
sı			None	V	[Main check ob	ject]	_	Fotential sit	pe failure are pre	eventeu en	ougn, c	JI, ILIS U	elended enough wi	ien it is generated.	
litior	*	high density of cracks and a weak layers,	marked		Cut slope			Potential slo	pe failure are con	nsiderably p	prevent	ed, or it i	is considerably def	ended when it is	
conc	Roc	susceptible to erosion,	a little marked	V	Garciopo	'	-	generated.							
cal o		last weathering	None		Natural slope			Potential slo	pe failure are par	rtly prevent	ed, or i	t is partly	/ defended when it	is generated.	
ologi		dip slope of bedding plane. Jeint Planes	It corresponds.	v			J	However, it i	s not enough for	the remain	ling lac	uors.			_
Gec	cture		marked					There is no o	countermeasure,	or there is	not eff	ective ev	en it countermeas	ures are not	v
	Struc	debris on impermeability bedrock,	a little marked	V				periorneu.							
	0,	the upper part is a hard /the toe of slope is weak.	None	•	[History]							ſ	Expected size of disa	ster](width. length. dept	n. etc.)
			instability	v	[indicity]	Leve	el of disast	er history		(Check	Ĺ			.,,
		Topsdil, detached rock and unsteady rock	a little unstable		There is a history about I	arde falle	n rocks and	slope failures	that were obsta	cles to	1				
uc			stability		the road traffic after cons	truction of	f recent me	asures.			N				
oditi			notable spring waster		There is a history about	arge falle	en rocks and	d slope failure	s that gets to the	e road					
ce ci		Spring water	seepage		though there is no obstac	le to traf	ic.						W= 3	5m, L= 160m , D= 1	-2m
urfac			none	V	There is a history about	small fall	en rocks and	d slope failure	s that did not get	t to the					
ō			bare land with minor vagetation	V	road.										
		Surface condition	intermediate (bare•grass•tree)		No disaster records										
				2/	[Evaluation Bank]					[Dec	orintio				
			HE 30 <h<50m< td=""><td>v</td><td>Scale of</td><td></td><td></td><td></td><td></td><td></td><td>900 m</td><td>eters lor</td><td>na steen slone ha</td><td>vina scree/talus der</td><td>osit Boulders</td></h<50m<>	v	Scale of						900 m	eters lor	na steen slone ha	vina scree/talus der	osit Boulders
			9 15≦H<30m		Risk	Big	l	Medium	Small		of 2m ³	at toe ir	ndicates rockfall L	ipslope. Small chan	nel passing
ofile		Height (H), dip (i)	H<15m					-		thro	ough s	lope brir	nging debris mate	rial hence making th	ne gully on the
Ę			i≧70°		Great risk	1		2	3	sloj	pe. Ga	bbro of bio orug	Kohistan batholith	is exposed which is exposed which is	s crushed and
			<u>਼ੁਰੂ</u> 45°≦i<70° i<45°	V	Medium risk	1		2	3 jointed. This crushing and jointing alongwith the blasting for N3 the main triggering factors of this slope.					ig for 1935 are	
maly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk	2	2 3 4								
Anoi	open	crack, anomaly of countermeasure	none		Organization responsible scale of the disaster	for coun	ermeasure	works accord	ing to the	Influence disaster	e on the	e traffice	when potential		
· · · · ·					-Big: Grant aid			-Great risk: road closed for 2 days or more							
-Medium: Maje					-Medium: Major contracto	ctor in Pakistan -Medium risk: road closed for 1 day or less									
					-Small: Local contractor					-Low risk	a no ro	ad closu	re		

Code no. N 3 5 2 4 4	Sketch sheet	Date 19-12-2017
Region Office	Latitude 35° 31′ 8.0″	Inspector
Maintenance Unit	Longitude 73° 44' 9.3	
	Road Name N = 35 Km 2 4 4	
Plane view	Cro	oss sectional view
MA Scarp W Bed Rock W overhay A Bushes		
ion Debris	A	
W W www	the way we	
Ailas W w 1000	A Way Dassy	W35
	Scale	· 20°
		A"

Code no.	Ν	3	5	_	2	4	4	
Region Office								
Maintenance Unit								

oordinataa	Latitude			35 ^o 31	' 8"		
oorumates	Longitude		7	'3º 44' (09.3	"	
Road na	ame			Km			 Γ

Photo sheet

Date	12/24/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



View of the slope failure at the middle point



Existing countermeasures / anomalies:No Counter Measure



View of fallen blocks on road

Code no.	Ν	3	5	2	7	0		
Region Office								
Maintenance Unit								

[Cause	es]		
item	factor	category	Check
of river	areas that river bed is 15°or more in watershed area	0.50km ² or more 0.15km ² - 0.50km ² less than 0.15km ²	v
Property	steepest slope of river bed	40°or more 30° - 40° less than 30°	V
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	
Property o	artificial works that cause negative effects	certain none	v
	new crack and/or slope failure in stream	certain none	v
	traces of large slope failure in stream	certain none	√

Evaluati	or	า ร	she	ee	t (de	bı	ris	fl	٥v	v)		
Coordinatos	Lat	tituc	le		34º 28' 55.5"							
Coordinates		ngit	ude	73º 56' 03.1"								
Road Name					Km							

[Road structure]									
structure	category of score	Check							
River	10m or more 5m - 10m	٧							
width	3m - 5m less than 3m								
Beam height	less than 1m or No bridge / box culvert 1m - 2m 2m - 3m 3m - 5m	<u>√</u>							
	3m - 5m 5m or more								

[Potencial disaster mode]	Check	_
Damage of bridge/culvert		
Outflow of embankment		
Debris flooding on the road	٧	

Inspector	Yasir, Sajid,	Shatique, B	ashai
[History] category of score	e	Check	1
There is a history about debris flo obstacles to the road traffic after of recent measures.	٧		
There is a history about debr though there is no obstacle to			
There is no history of debris fl	ow		
[Expected size of disaster] (wid	lth, length, dep	th, etc.)	
L= 1300 m, W	/=25 m, D= 2-	3 m	
[Description/comments]			
	uido noor roo	d forming a	

12/25/2017

Date

Mouth of channel is very wide near road forming a fan shaped structure containing boulders of different sizes and some of size 2-3m3. Channel divides into two near the road: a) Eastern channel having culvert box b) Western Channel without protection Sides of channel are steep having overhangs.

[Countermeasure] Check Type of countermeasure Culvert with opening 1x1 m none·low moderate ٧ Effect of existing countermesure high

enough

[Evaluation Rank]											
Scale of disaster Risk	Big	Medium	Small								
Great risk	1	2	3								
Medium risk	1	2	3								
Low risk	2	3	4								

Organization responsible for countermeasure works according to the scale of the disaster

-Big: Grant aid -Medium: Major contractor in Pakistan -Small: Local contractor

Influence on the traffice when potential disaster

-Great risk: road closed for 2 days or more -Medium risk: road closed for 1 day or less -Low risk: no road closure



12/25/2017 Yasir, Sajid, Shafique, Basharat

Code no.	Ν	-	3	5	2	7	0	
Region Office								
Maintenance Unit								

Photo sheet											
Coordinatoo	Lati	tude		34º 28' 55.5"							
Coordinates	Long	jitude	•	73 ^o 56' 03.1"							
Road Name				Km							

		1	
(Carlos			
		and a	
	and the second		
			-

Mountain side view of the debris flow

Valley side view of the debris flow

Front view of the debris flow

Date

Inspector



Inlet of the culvert for the debris flow



Road condition

Existing countermeasures / anomalies: Culvert outlet view

Code no.	Ν	3	5	-	2	7	2		
Region Office									
Maintenance Unit									

[Cause	es]		
item	factor	category	Check
P	aroos that river had is 15° or	0.50km ² or more	
rive	more in watershed area	0.15km ² - 0.50km ²	
^o roperty of		less than 0.15km ²	v
		40°or more	٧
	steepest slope of river bed	30° - 40°	
		less than 30°	
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	√
roperty	artificial works that cause negative effects	certain none	v
Ē	new crack and/or slope failure in stream	certain none	v
	traces of large slope failure in stream	certain none	√

Evaluati	or	า ร	she	ee	t (de	bı	is	fl	٥v	v)		
Coordinatos	Lat	titud	le		35° 27' 38.1"							
Coordinates	Lor	_ongitude 73° 58' 9.4"										
Road Name					Km							

[Road stru	ucture]	
structure	category of score	Check
	10m or more	٧
River	5m - 10m	
width	3m - 5m	
	less than 3m	
	less than 1m or	
	No bridge / box culvert	٧
Beam	1m - 2m	
height	2m - 3m	
	3m - 5m	
	5m or more	

[Potencial disaster mode]	Check	_
Damage of bridge/culvert		
Outflow of embankment		
Debris flooding on the road	٧	

Inspector	Yasir, Sajid, Shafique, Basharat				
[History]		0			
category of score	e	Check			
There is a history about debris fluo obstacles to the road traffic after of recent measures.	ow that were construction				
There is a history about debr though there is no obstacle to	is flow traffic.	٧			
There is no history of debris fl	low				
[Expected size of disaster] (wid	dth, length, dep	th, etc.)			
L= 2000 m, W=	:11.20 m, D= ().3 m			

26-Dec-2017

[Countermeasure]

Type of countermeasure Paved drainage path towards valle		Check
Paved drainage pat	e of countermeasure drainage path towards valk of existing ermesure inone - low moderate high enough	
Effect of existing	none∙low moderate	√
countermesure	high enough	

[Evaluation Rank]			
Scale of disaster Risk	Big	Medium	Small
Great risk	1	2	3
Medium risk	1	2	3
Low risk	2	3	4

Organization responsible for countermeasure works according to the scale of the disaster

-Big: Grant aid -Medium: Major contractor in Pakistan -Small: Local contractor

Influence on the traffice when potential disaster

-Great risk: road closed for 2 days or more -Medium risk: road closed for 1 day or less -Low risk: no road closure

[Description/comments]

Date

A seasonal stream crosses the highway at this location. Two channels with large catchment area.

The 272 contains small quantity of debris as compare to 273. The 273 contains considerable amount of debris containing some boulders of size 0.5 m3, which can threaten stability of the highway. Further, valley side of channels is very steep due to river erosion. Paved drainage path on valley side is protecting from erosion on valley side.



Code no.	Ν	-	3	5		2	7	2
Region Office								
Maintenance Unit								

			••••	•···	•••					
Coordinates	Latitude 35° 27' 38.1"									
Coordinates	Lon	gitude				73	3° 5	8' 9	.4"	
Road Name				Km						

Photo sheet

Date	12/26/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Mountain side view of the debris flow

The crack on road has been observed

Valley side view of the debris flow

Front view of the debris flow



Road condition



Existing countermeasures / anomalies: Retaining wall has been constructed at the toe of the Debris Flow

Code no.	Ν	3	5	-	2	7	3		
Region Office									
Maintenance Unit									

[Cause	es]		
item	factor	category	Check
of river	areas that river bed is 15°or more in watershed area	0.50km ² or more 0.15km ² - 0.50km ² less than 0.15km ²	v
Property	steepest slope of river bed	40°or more 30° - 40° less than 30°	<u>۷</u>
	area that slope gradient is 30° or more in watershed area	0.20km ² or more 0.08km ² - 0.20km ² less than 0.08km ²	
of slope	area that meadow and shrub (less than 10m height) occupy in watershed area	0.20km ² or more 0.02km ² - 20km ² less than 0.02km ²	v
roperty	artificial works that cause negative effects	certain none	v
<u>م</u>	new crack and/or slope failure in stream	certain none	v
	traces of large slope failure in stream	certain none	√

Evaluation sheet (debris flow)												
Coordinatos	Latitude				35° 27' 33.5"							
Coordinates	Lor	ngit	ude			73	° 5	58'	11	.2"		
Road Name					Km							

[Road stru	ucture]	
structure	category of score	Check
River	10m or more 5m - 10m	٧
width	3m - 5m less than 3m	
	less than 1m or	
	No bridge / box culvert	V
Beam	1m - 2m	
height	2m - 3m	
	3m - 5m	
	5m or more	

[Potencial disaster mode]	Check	_
Damage of bridge/culvert		
Outflow of embankment		
Debris flooding on the road	٧	

Inspector Yasir, Sajid, Shafique, Basha							
[History]							
category of score	9	Check					
There is a history about debris flo obstacles to the road traffic after of recent measures.	ow that were construction						
There is a history about debri though there is no obstacle to	is flow traffic.	v					
There is no history of debris fl	low						
[Expected size of disaster] (wid	ith, length, dep	th, etc.)					
L= 1950 m, W=	:12.30 m, D= (0.6 m					
L							

27-Dec-2017

[Countermeasure]

Type of countern	Type of countermeasure						
Paved drainage pa	th towards va	lley side		[E ['] Ri			
Effect of existing countermesure	none∙low moderate high enough	√ 					

valuation Rank]			
Scale of disaster isk	Big	Medium	Small
Great risk	1	2	3
Medium risk	1	2	3
Low risk	2	3	4

Organization responsible for countermeasure works according to the scale of the disaster

-Big: Grant aid -Medium: Major contractor in Pakistan

-Small: Local contractor Influence on the traffice when potential

disaster -Great risk: road closed for 2 days or more

-Medium risk: road closed for 1 day or less -Low risk: no road closure

[Description/comments]

Date

A seasonal stream crosses the highway at this location. Small catachment area with debris fall/rock fall material are present on the upstream. Two channels with large catchment area. The 273 contains considerable amount of debris containing some boulders of size 0.5 m3, which can threaten stability of the highway. Further, valley side of channels is very steep due to river erosion. Paved drainage path on valley side is protecting from erosion on valley side.



12/27/2017 Yasir, Sajid, Shafique, Basharat

Code no.	Ν	-	3	5		2	7	3
Region Office								
Maintenance Unit								

	Photo sheet										
Coordinatoo	La	titude		35 ^o 27' 33.5"							
Coordinates	Lor	Longitude				73	° 58	3' 11	.2"		
Road Name				Km							



Mountain side view of the debris flow

Valley side view of the debris flow

Front view of the debris flow

Date

Inspector





Boulders and Blocks along the Debris flo



Existing countermeasures / anomalies: Retaining wall has been constructed at the toe of the Debris Flow

Road condition

	Coc	le no. N 3 5 _ 2 8 6	7		Evaluation sh	eet (S	Slope f	ailure/l	Rockfall)				Date	28-Dec-	2017
	Regio	n Office	-		L	atitude	35	i ^o 25' 43.	.1"				Inspector	Yasir, Sajid, Shafi	que, Basharat
Ν	lainter	ance Unit	-		Coordinates	naitude	74	0 01' 25	5"						
					Deadaran		16.00								
10-					Road name		Km								
[Ca	usesj tem	factor	category of score	Check				[Counterm	escurel						
_			3 or more correspondences	V				loonnenn	casarej		Type	e of cou	ntermeasures		
aphy	or	talus slope.	2 correspondences		[Disaster type]						71				
ogr	fact	eroded toe of slope ,	1 correspondences	·····		1					No	o counte	ermeasures		
top	Ō	overhang, water catchment slope	no correspondence	[·····]	Rock fall	N									
	_		marked	V	Slope failure				E	Effectivene	ess of ex	cisting c	ountermeasures		Check
	Soil	less strength with water	a little marked					Potential sl	ope failure are p	revented e	enouab	or it is	defended enough w	hen it is generated	
su		, , , , , , , , , , , , , , , , , , ,	None		[Main check o	oject]	1	. storitiar di	opo ranaro are pi	. e renteu t	sougn,	51, 1113	asishada shodgh v		
ditio	×	high density of cracks and a weak layers,	marked	V	Cut slope			Potential slo	ope failure are co	onsiderably	y preven	nted, or	it is considerably de	fended when it is	
conc	Roc	susceptible to erosion, fast weathering	a little marked	ļ				generated.							
ical			It corresponds	├	Natural slope	• √		Potential slo	pe failure are pa	artly prever	nted, or	it is par	tly defended when i	t is generated.	
olog	a)	dip slope of bedding plane.	None	2/				There is no			in mot of	GLOIS.			
g	ctun		marked	v				performed.	- countermeasure	e, or there	IS NOL EI	lective	even il countermeat	sures are not-	V
	Stru	debris on impermeability bedrock.	a little marked	v				'							
		the upper part is a hard /the toe of slope is weak.	None	-	[Historv]								[Expected size of dis	aster](width, length, deptl	h, etc.)
			instability	V		Leve	l of disast	er history			Check				
		Topscil, detached rock and unsteady rock	a little unstable	······	There is a history about	large falle	n rocks and	slope failure	s that were obsta	acles to	./				
ч			stability		the road traffic after cor	struction of	f recent me	asures.			N				
oditi			notable spring waster		There is a history about	large falle	n rocks and	d slope failure	es that gets to the	e road					
o eo		Spring water	seepage		though there is no obsta	cle to traff	ic.						W=	222m, L= 258m, D= 2-	-3m
urfa			none	V	There is a history about	small falle	en rocks and	d slope failure	es that did not ge	et to the					
S			bare land with minor vagetation	V	road.										
		Surface condition	intermediate (bare · grass · tree) mainly structure, mainly tree		No disaster records										
			H≧50m	V	[Evaluation Rank]					[De	escripti	on]			
e			ਬਿ <u>30≦</u> H<50m ਦ 15≦H<30m		Scale of disaster Risk	Big		Medium	Small	a	The site verage	∍ is cha joint s∣	aracterized by join pacing 1-2 meters	ted gabbro. Three jo exists leading to we	oint sets with edging failure.
Profi		Height (H), dip (i)	H<15m		Great risk	1		2	3		of the si	iore, th ite Tal	us denosit is pres	emanys is increasin ent in gully and is fli	y vumerability
			i≧70°	Ļ									road during o	or after rainfall	
				V	Medium risk	1		2	3				5		
maly	Surfac	e collapse, small fallen rock, gully, erosion, piping hole,	2 or more correspondences clarity certain unclarity	V	Low risk	2		3	4						
Ano	open	rack, anomaly of countermeasure	none		Organization responsibl scale of the disaster	e for count	ermeasure	works accord	ling to the	Influen disaste	ice on th er	e traffic	e when potential		
					-Big: Grant aid					-Great	risk: roa	ad close	d for 2 days or more	e	
					-Medium: Major contrac	tor in Pakis	stan			-Mediu	ım risk: r	road clo	sed for 1 day or les	S	
					-Small: Local contractor					-Low ri	isk: no ro	oad clos	sure		



Code no.	Ν	3	5	_	2	8	6	
Region Office								
Maintenance Unit								

Coordinatos	Latitude		35º 25' 43.1"							
Longitude					7	74º 01' 2	25.5	"		
Road na	ame					Km				

Date	12/28/2017
Inspector	Yasir, Sajid, Shafique, Basharat







Full view of the landslide

View of landslide on Valley side:

Road condition:Cut slope at the start point



Existing countermeasures / anomalies: No counter measure



View of fallen blocks along the slope failure

Photo sheet

View of the slope failure at the middle point