

**Cooperation Fund for the Water Sector
Pilot Demonstration Activity
Request Form**

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| Activity Title: Protection of Communities from Debrisflows in Mountain Regions | |
| Proposer (Name, Div/Dept): Junichi Yoshitani, Leader of Disaster Prevention Team, International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM), Public Works Research Institute of Japan (PWRI) Masayuki WATANABE, Coordinator for Disaster Mitigation Research, ICHARM, PWRI | |
| Request Date: November 20, 2007 | |
| Country: Philippines | Region: Site along the Highway near Baguio, Km231+600 |
| Activity Proposed Start Date: 15 March | Activity Proposed Duration: 9 months |
| Cost Estimate: US\$50,000 | |
| Implementing Organization Contact: ICHARM, Public Works Research Institute | |

1. Background and Rationale:

Flashfloods frequently results in debrisflows in mountain regions and on alluvial cones.

Disasters due to flashfloods and associated debrisflows are quite common natural phenomena in tropical and semi-tropical regions. Statistics shows that mountain regions in The Philippines are hit by sever flashfloods triggering disastrous events.

It is a well-known fact that rainfall with high intensity and mobile materials detached from steep slopes and on torrent beds are responsible for the initiation of debrisflows. The number of disasters due to flashfloods and debrisflows has been dramatically increasing over the past decades as a result of settlement expansion in rural areas, multiple use of land such as resorts, souvenir shops, and slash and burn farming on slopes, and particularly transportation roads in mountain regions. The impact of debrisflow disasters in The Philippines along with many other countries in Asia, such as Thailand and Nepal, has further increased due to the destruction of vegetation cover, which has induced large associated environmental devastation.

In addition to the causes mentioned above, it is proved that debrisflows will increasingly become a major global and regional disaster threat especially in high mountain regions due to permafrost melting triggered by global warming. This increasing trend will also became a major threat to social safety and to settlement areas along roads and on alluvial cones in valleys.

Enormous efforts have been made in an attempt to eliminate the causes of disasters due to debrisflows and reduce their devastating impact through prevention, protection and preparedness.

Nevertheless, the kinetic energy carried by flashfloods and debrisflows, once started running, is so destructive that nothing can counter to their power except massive and costly engineering structures. As a result, a lot of lives have been lost and traffic has been disrupted in mountain regions in which financial and human resources are hardly available. Due to hardships and difficulties in displacement of local people or traffic closure, prevention and protection is almost impossible. Therefore, there are no other means to prevent disasters from debrisflows except employing new low cost technologies.

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The proponent and his group developed a new, easy-to-transfer and feasible technology to cope with disasters due to debrisflows. The effectiveness of this new technology has been proven by intensive laboratory tests and field implementation in Japan.

The technology is featured by low cost, high reliability and simplicity of design and construction. In other words, the structures employing such technology are easy to build and maintain while it guarantees high safety degree from debrisflow disasters. The proposed engineering structure is composed of slightly tilted beams made of whatever materials locally available, such as iron, concrete, or wood. In countries, such as The Philippines, coconuts lumber is an appropriate construction material. The structure looks like a horizontal screen set up on torrent bed and will be referred to as Debrisflow Braker.

Debrisflows running onto the Debrisflow Braker will stop its motion due to the effect of dehydration and associated internal frictional forces, which act in the moving mass of debrisflows. Concrete examples for the effectiveness of Debrisflow Brakers have been videotaped in many sites in Japan (see the attached video).

On alluvial cones, this technology might, however, have a detrimental effect. Although debrisflow stop its motion on the Debrisflow Braker, water squeezed from the running mass of debrisflow might trigger secondary debrisflows if mobile materials, such as trees and rocks, exist on the torrent bed in lower reaches. However, this possible detrimental effect can be easily removed by combining Debrisflow Brakers built on alluvial cones with channel-bed protection works. In addition, there is no risk of secondary debrisflows if Debrisflow Brakers are set up in the immediate upper reach of paved roads running across valleys.

Making reference to the success achieved by the implementation of Debrisflow Brakers at demonstration sites in Japan and Switzerland, this technology undoubtedly offers the best, if not the only, low cost, feasible alternative to protect settlements under threat of debrisflows in rural areas and to prevent disruption of traffic passing high mountains all over the world.

2. Objectives:

The proposed demonstration activity is intended to demonstrate the following facts; firstly, the dehydration effect is the key to brake debrisflows; secondly, the dehydration effect can be achieved by setting up horizontal screens on a torrent bed; thirdly, Debrisflow Brakers are low cost and easy to build and maintain; fourthly, the technology for Debrisflow Brakers is easy to master; and fifthly, the technology is applicable to debrisflow-prone sites all over the world.

In order to conduct the demonstration activity, a debrisflow-prone site along Kenon Road, at its 260km+600m, is proposed as the appropriate site, which satisfies all the conditions mentioned in the previous section.

3. Scope and location of Work / Description of Activities:

Along and crossing the Sierra Madre Mountains in Luzon and in the further south islands, lot of human settlements as well as various livelihood activities, such as souvenir shops, have been established and larger land use expansion is taking place. The highways running in this area are also of vital importance to secure passenger services and other logistics related to the current rural economic development. The human security and social and livelihood activities in the stretches across mountain areas are however threatened by a high risk of debrisflows and associated disasters. At higher risk are sites crossing river tributaries perpendicular to roads that vulnerable to suffer from direct hits by debrisflows; for example, the settlements along the Kenon Road 231km+600m.

The proponent will conduct, in consultation with officers of the Department of Public Works and Highway of the Philippines government in charge of road management, a reconnaissance study on the risk of actual and

potential debrisflow disasters. The consultation work (reconnaissance, field survey, etc.) will focus on the number of beneficiaries, quantity of mobile materials on torrent beds, morphological and geological features which govern discharge, site conditions for the Debrisflow Braker implementation including the availability of construction materials. The above consultation work will provide the fundamental information to decide the location for the pilot demonstration site. The contract for the construction work and implementation arrangements will be made in coordination with all involved stakeholders.

4. Implementation Schedule, Institutional Management Arrangements, and Proponent Qualifications:

Implementation Schedule:

| Activities | 1 st Qtr | 2 nd Qtr | 3 rd Qtr | 4 th Qtr |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|
| Reconnaissance | ** | | | |
| Implementation arrangements | ** | | | |
| Construction works | | **** | | |
| Monitoring and maintenance | | | **** | ** |
| Report writing | | | | ** |

The construction work must be executed during the non typhoon season.

Institutional Management Arrangements: The activities consist of reconnaissance, planning, ground survey, design, implementation and supervising, and practices for monitoring and maintenance, if any.

Some parts of the activities might be undertaken directly by the Department of Public Works and Highways (DPWH).

The activity will be implemented under the aegis of DPWH.

Proponent Qualifications: The proponent had prepared the theoretical basis on which laboratory tests were conducted. Laboratory tests were followed by field demonstration in Japan by the proponent. The technology for Debrisflow Brakers has been transferred to the Department of Water Resources of the Federal Government of Switzerland.

5. Expected Results (outputs/outcomes/effects/impacts):

- Protection of human lives, livelihood activities, and economic, social and cultural assets from the threat of devastating debrisflows in the mountainous regions;
- rise of public and local community awareness to the risk from debrisflow discharge;
- rise of public and local community awareness on the importance of safety preparedness against debrisflows disasters;
- Capacity building and training of local practitioners and local implementing agencies in road management will be achieved;
- Protect roads and networks for transportation, water supply, information transmission from destruction or disruption due to debrisflow disasters;
- materials left on Debrisflows Brakers can be used as construction materials.

The long term effectiveness and sustainability of the proposed technology is assured by employing simple and low cost practices for monitoring and maintenance. Beneficiaries such as drivers and local community

members who will benefit from this project can easily monitor the volume of deposition on Debrisflow Brakers and witness the level of improvement in the region's safety.

6. Measurable Performance Indicators:

- Reduction in the number of people killed and affected by debrisflows;
- reduction in damage to assets;
- reduction in frequency of traffic closure;
- reduction in cost to remove debris after heavy rainfall and associated debrisflow discharges.

7. Stakeholders Participation:

The major stakeholder is the Department of Public Works and Highways (DPWH) of the Government of the Philippines. The Planning Service of DPWH welcomed this initiative and expressed its strong willingness to be directly involved in kind in the project by offering staff and labors. Other stakeholders in charge of planning, designing and implementation involved in disaster risk reduction can acquire technology and skills to prevent debrisflow disasters. The Ministry of Public Works and High Way will be in charge of the project after completion.

8. Scope for Replication/Use in Other Countries:

Taking into account quick unfavorable changes in meteorological and environmental conditions and financial hardships encountered, it is urgently needed to promote world-wide attention to this technology. Debrisflow Brakers are easy to adopt and replicate; therefore must be set up in potential debrisflow disaster sites to secure human lives and safety of settlements in rural areas, traffic, and networks for water supply, communication and information transmission crossing debrisflow prone areas.

9. Cost Estimate:

| <u>Inputs / Expenditure category</u> | <u>Total Costs</u> (in US\$) |
|--|---------------------------------|
| 1. <u>Reconnaissance</u> | |
| Travel | |
| 1) Airtrip: Narita ~ Manila ~ Narita | 1,500 (@750x2) |
| 2) Land trip: Manila ~ Baguio | 1,000 (@100x10) |
| 2. <u>Civil Works</u> | |
| 1) Reconnaissance..... | |
| 2) Structural design..... | 1,000 |
| 3) Cost estimation | 2,000 |
| 4) Implementation arrangements..... | 500 |
| 5) Construction work..... | 44,000 |
| 3. <u>Equipment and Supplies</u> | |
| 4. <u>Training, workshops, seminars, public campaigns</u> | |
| The theoretical basis and designing skills of the technology are illustrated by means of hydraulic simulation. | Achieved during the works above |
| 5. <u>Specialists services</u> | |
| 6. <u>Project management</u> | |
| The project is managed by the consultants headed by the proponent. The structure will be handed over to the Ministry of Public Works and High Way after completion. | |
| 7. <u>Other inputs</u> | |
| 8. <u>Contingencies (0-10% of total estimated grant fund)</u> | |
| Total PDA grant financed | 50,000 |

10. References:

1. Department of Humanitarian Affairs, United Nations (1996): MUDFLOWS, Experience and Lessons Learned from the Management of Major disasters, United Nations in New York and Geneva
2. Masayuki WATANABE (1987): Some Problems in Flood disaster Prevention in Developing Countries, J.& James, U.K.
3. Tamotsu TAKAHASHI(1991): Debris Flow, Monograph IAHR, Balkema, Rotterdam