

MINUTES OF MEETING
ON SEVENTH JOINT COORDINATION COMMITTEE FOR
PROJECT FOR CONTROL AND MITIGATION OF SLOPE DISASTERS
IN THE CENTRAL DISTRICT IN REPUBLIC OF HONDURAS

The Seventh Joint Coordination Committee (hereinafter referred to as “JCC”) was held with the participation of the Japan International Cooperation Agency (hereinafter referred to as “JICA”), JICA Expert Team (hereinafter referred to as “JET”), the Municipal Government of the Central District (hereinafter referred to as “AMDC”), Secretary of State in the Offices of Risk Management and National Contingencies (hereinafter referred to as “COPECO”), and the National Autonomous University of Honduras (hereinafter referred to as “UNAH”) for the Project for Control and Mitigation of Slope Disasters in the Central District in Republic of Honduras (hereinafter referred to as “the Project”)

As a result of discussions at this Joint Coordination Committee, all parties agreed to the matters described on the attached sheets.

Tegucigalpa, October 11th, 2023

桑野 健

Dr. KUWANO Takeshi
Team Leader
The Expert Team
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Mr. SHINO Katsuhiko
Chief Representative
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Mr. Jorge ALDANA
Mayor
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Mr. Dario GARCIA
Minister
Secretary of State in the Offices of Risk
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Dr. Marco Tulio MEDINA
Vice Rector in International Affairs
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THE ATTACHMED DOCUMENTS

I. Agreements Regarding Project Progress and Plans

Following the explanation of the Project progress from March to September 2023 and the coming six (6) months' plan, the JCC deliberated on the agreements and issues described below.

Considerations on impacts of landslide phenomena on Colonias Guillen and Nueva Santa Rosa

The JCC acknowledges that due to the events aroused in the Guillen colony, a product of the activation of the landslide block adjacent to the landslide blocks object of the project research in the Nueva Santa Rosa colony, during the year 2022, and for which, both the activities of Output I and II, were affected or altered, and therefore, it is estimated that they should be re-evaluated from the perspective of the need for adjustments.

(1) Output 1 (Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened)

The countermeasure plans for the two (2) large-scale landslide risk sites, Jose Angel Ulloa and El Eden, have been proposed as prospective projects for the AMDC. It is recommended that the AMDC considers aid projects in the future based on these countermeasure plans.

All the activities related to Output 1 have not been completed in its entirety, due to the activation of the landslide blocks in La Guillen neighborhood, which transcend to affect the Nueva Santa Rosa neighborhood. The Working Group 1 (hereinafter referred to as "WG# (number)"), composed of the Integrated Municipal Risk Unit, Risk Evaluation Management, and the Municipal Emergency Committee in the AMDC, with the support from JET, will continue with the pending research and analysis of the landslide phenomenon, both for Nueva Santa Rosa and La Guillén. To this end, AMDC, COPECO and UNAH with the participation of JICA, will establish collaborative actions for the management of technical resources to carry out the additional research processes arising from the analysis is, being able to integrate the equipment, technologies and other aspects that are required and with which these agencies have.

(2) Output 2 (Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced)

The detailed design of countermeasure works for Villa Nueva and that of emergency

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countermeasure works for Nueva Santa Rosa and La Guillen have been completed. The emergency countermeasure works have been proposed as a set of mitigation works whose main purpose is to reduce the activity and speed of evolution of the phenomenon, while the definitive stabilization works are being defined. However, due to the recent heavy rains in 2023, the effects of these on the evolution of the phenomenon and the behavior of the mitigation measures implemented, the need to re-evaluate the study carried out before the rains and to carry out countermeasure works in the area in order to ensure the response to the phenomenon is identified.

As a result of the progress made in this component, in the coming period, the supervision of countermeasure works in Villa Nueva, as well as the emergency countermeasure works in Nueva Santa Rosa and La Guillen, followed by the design of permanent countermeasure works, for the stabilization of the landslide phenomenon. In this sense, due to the complexity of the case, its evolution, the commitment of lives and property, and other aspects related to the expertise of the JET in this type of case, the development of these activities will be carried out by WG2 engineers with technical support from JET, integrated by the technical areas of the AMDC linked to the design and execution process of the institution's disaster risk reduction works.

(3) Output 3 (Capacity to develop hazard and risk maps is enhanced)

Hazard maps and risk maps for landslides and slope failure/rockfall in the pilot areas have been finalized by using GIS. These maps have been delivered to the AMDC for future integration into "Sistema de Estudios Territoriales".

(4) Output 4 (Capacity to regulate land use for slope disasters is enhanced)

The land use regulations and the regulation maps have been finalized and officially submitted to the Municipal Corporation.

All the activities related to Output 3 and Output 4 have been completed. AMDC, COPECO, and UNAH are continuously expected to utilize the knowledge and experience acquired from these activities to achieve the Action Plans described in the next section.

II. Special notes of the Project

(1) Extension of the Project period

As a result of the discussion between AMDC and JICA, and because the project has been implemented with the inclusion of the case of landslide in neighborhood Nueva Santa Rosa, with

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investigations during the years 2020, 2021, 2022 and are maintained during 2023, although the conditions of activity due to landslide are maintained and worsened with the activation of the continuous block located in the neighborhood La Guillen , both instances have planned to extend the period of the Project until December 2025. It is noted that because the 2022 large-scale landslide that occurred in La Guillen, adjacent to Nueva Santa Rosa, also required further consideration of emergency work at La Guillen and a subsequent amendment for the countermeasure plans and designs of Nueva Santa Rosa.

From the above, the parties additionally agree that they will have the technical support of JET dispatched by JICA, as a body that will provide technical assistance for the design of the measures and other interventions considered in the case studies and intervention processes in the colonies of Guillen and Nueva Santa Rosa. Both sides confirmed the importance to enhance the implementation members, being AMDC, through the Mayor, will lead the selection process, in addition to the technical staff who have been trained in the field of Integrated Disaster Risk Management (IDRM) and Climate Change Adaptation (CCA) in the municipality, as well as with the Working Groups of AMDC, COPECO and UNAH, which are currently participating in the project..

(2) Amendment to the Record of Discussion of the Project

The Amendment to the Record of Discussions (hereinafter referred to as "R/D"), outlining the discussions regarding the extension of the Project period, is drafted. The amendment of the R/D undergoes review by AMDC, COPECO, UNAH, and JICA and will be signed as the final version accordingly.

(3) Action Plan from 2024 onwards

In accordance with the extension of the Project period, an Action Plan has been developed by AMDC, COPECO, and UNAH, which must be known to the Municipal Corporation to ensure the inclusion of aspects related to special regulations for personnel deployment and procurement and budget allocation when these have already been defined and require their approval. This Action Plan describes the responsibilities of AMDC, COPECO, and UNAH, who are tasked with achieving the objectives by themselves from 2024 onwards, it also incorporates the advisory support of JET during the extended project period within the framework agreed on the Record of Discussion.

It has been unanimously agreed upon that AMDC, COPECO, and UNAH will allocate the necessary human resources, and AMDC will make maximum effort to get the Municipal

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Corporation to approve the necessary budget. If necessary, resources can be arranged with other collaborating partners. The above, to ensure the successful execution of the activities in the Action Plan. Detailed information regarding the timeline for implementation is found in the Annex.

[Output 1 (Investigation and Analysis) & Output 2 (Countermeasure Works)]

Objective 1: Maintaining the effectiveness and functionality of countermeasure works constructed. (On-going)

- Landslide measurement using devices in Campo Cielo and Nueva Santa Rosa. (AMDC)
- Maintenance of structural measures in Campo Cielo, Fuerzas Unidas and Villa Nueva. (AMDC)
- Conducting lectures and study sessions on investigation & analysis and countermeasure works for external organizations and within AMDC. (COPECO, UNAH, AMDC)

Objective 2: Completing countermeasure works in Nueva Santa Rosa and La Guillen supported by JET. (On-going)

- Investigation including boring and installation of new measurement devices, as well as analysis, design, resource management and/or budget allocation, and construction works in Nueva Santa Rosa and La Guillen. (AMDC, UNAH)

Objective 3: Implementing countermeasures in other high-priority sites. (Next step)

- Selecting high-priority sites for countermeasure works other than the constructed pilot sites in the Project within the Tegucigalpa area, such as Jose Angel Ulloa, Villa Delmi, and Suazo Cordova. (AMDC, UNAH)
- Selecting high-priority sites for countermeasure works in others municipalities of the country. (Other municipalities with COPECO, UNAH)
- Geological/geophysical surveys, installation of monitoring devices, and analysis in Jose Angel Ulloa Landslide, identified as one of the highest-priority sites for future countermeasure works, along with budget allocation. geological survey and instrumentation of the sites are considered. (AMDC, UNAH)
- Investigation and analysis for countermeasure works in the selected high-priority sites. (UNAH, AMDC)
- Investigation and analysis for countermeasure works in other municipalities high-priority. (Other municipalities with COPECO)
- Design, construction, and budget allocation for countermeasure works in the selected high-priority sites. (AMDC)

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- Design, construction, and budget allocation for countermeasure works in other municipalities. (Other municipalities with COPECO)
- Maintenance and monitoring for countermeasure works in the selected high-priority sites. (AMDC)
- Maintenance and monitoring for countermeasure works in other municipalities. (Other municipalities with COPECO)

[Output 3 (Hazard Map & Risk Map) & Output 4 (Land Use Regulation)]

Objective 1: Maintaining information latest and socializing the knowledge. (On-going)

- Monitoring the updates and publication status of hazard maps and the risk maps in SIMET including study areas for regulation or already regulated areas. (AMDC)
- Conducting lectures and study sessions on hazard mapping and risk mapping for external municipalities and within AMDC. (AMDC, UNAH, COPECO)

Objective 2: Implementing the regulations on pilot regions by each classification. (On-going)

- Raising resident awareness and providing relocation recommendations in the regulated regions under the scheme that the AMDC considers most effective and with the greatest impact. (AMDC)
- Sensitizing residents in the understanding of the regulation through socialization activities including distributing regulation maps and the installation of signboards in neighborhoods. (AMDC)
- Identification and preparedness the land for the relocation of families, including candidate selection and preparation procedures. (AMDC)
- Conducting lectures and study sessions on land use regulations for external organizations and within AMDC. (AMDC, UNAH, COPECO)

Objective 3: Creating hazard and risk maps for priority area. (Next step)

- Selecting priority areas for hazard mapping and risk mapping within the Tegucigalpa area. (AMDC, UNAH)
- Selecting priority areas for hazard mapping and risk mapping in other municipalities in the country. (Other municipalities with COPECO, UNAH)
- Hazard evaluation for the selected area within the Tegucigalpa area. (AMDC)
- Hazard evaluation for the selected area and other municipalities in the country. (Other municipalities with COPECO)
- Risk analysis for the selected area. (UNAH, Other municipalities)

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- Hazard mapping and risk mapping for the selected area. (AMDC)
- Hazard mapping and risk mapping for other municipalities (Other municipalities with COPECO)

Objective 4: Implementing the regulations on selected regions based on the risk map. (Next step)

Objective 5: Sharing the knowledge to other municipalities. (Next step)

- Selecting regions for implementing land use regulations on the risk map areas within the Tegucigalpa area (AMDC, UNAH) and other municipalities in the country. (COPECO, UNAH)
- Implementing land use regulations within the Tegucigalpa area (AMDC, UNAH) and other municipalities in the country. (Other municipalities with COPECO, UNAH)

(4) Others

It was reconfirmed as JICA requirement, to ensure the success of the extended project, special attention should be given to the following items:

- ✓ The attendance of the authorized decision-making representatives of AMDC, COPECO and UNAH at crucial meetings (such as the JCC) is recommended, as it leads to more efficient discussions, which ultimately enable the implementation of more effective countermeasures for slope disasters.
- ✓ To ensure the necessary budget, including personnel expenses, it is important to prepare necessary documents and submit them to Municipal Corporation in a timely manner, and to follow-up the status of its approval. If necessary, financial resources may be arranged with other cooperating actors and strategic partners of the municipality to complete the results.
- ✓ Delays on implementation of countermeasures increase the risk of landslide. In order to maintain a streamlined project timeline, all internal organizational procedures such as procurement procedures, shall be put prioritized and be promptly executed.
- ✓ It is critical to realize smooth and collaborative communication among AMDC, COPECO, UNAH and JET throughout the Project, and to have a willingness to seek technical support from JET without undue adherence to proprietary methods. Sharing essential information including a draft design and cost estimation and having frank discussion with JET, enable them to diagnose a problem properly and make an effective suggestion in a timely manner. Leveraging JET's technical expertise enhances the Project's success.

Annex-1: List of members who attended the Joint Coordination Committee

Annex-2: Schedules in the Action Plan from 2024 onwards

Annex-3: Project Design Matrix ver.5 and Plan of Operation ver.5

Annex-4: Monitoring sheet ver.7

Annex-5: Second Amendment to the Record of Discussions (Draft)



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List of members who attended the Joint Coordination Committee

Annex-1

<HONDURAS SIDE >

Municipal Government of the Central District (AMDC)

Silvia Sosa (Alderman, Municipal Corporation)
Aurelio Lagos (Alderman, Municipal Corporation)
Ingrid Flores (Director, Integrated Municipal Risk Unit)
Roberto Granados (Risk Officer, Integrated Municipal Risk Unit)
Edgardo Ordoñez (Deputy Manager, Municipal Development Institute)
Julio Quiñonez (Project Executing Unit)
María Fernanda Flores (Project Executing Unit)

Secretary of State in the Offices of Risk Management and National Contingencies (COPECO)

Benedicto Santos (Vice Secretary, General Secretariat)
Jorge Miguel Aguilar (Director, Seismology Department)

National Autonomous University of Honduras (UNAH)

Marco Tulio Medina (Vice Rector, International Affairs)
Amy Chahin (Assistant, International Cooperation Directorate)
Laura Salgado (Technical Project Liaison, Faculty of Engineering)

<JAPANESE SIDE>

JICA Headquarters *Online

KUBOYAMA Keita (Officer, Disaster Risk Reduction Group, Global Environment Department)

JICA Honduras Office

SHINO Katsuhiko (Chief Representative)
SAITO Mizuka (Head of Technical and Financial Cooperation)
Cinthia Rodríguez (Program Officer)

JICA Expert Team

KUWANO Takeshi (Team Leader /Slope Disaster Risk Analysis)
UZAWA Kosuke (Project Coordinator) *Online
Alejandro Flores (Technical Project Assistant)
Vilma Mejía (Project Assistant)

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1. Creación de mapas de amenaza y riesgo para las zonas prioritarias

Resultado 3 (mapa de amenaza y mapa de riesgo)/Output 3 (hazard map & risk map)	2024												2025												2026											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Seguimiento de las actualizaciones y estado de publicación de los mapas de amenazas y de los mapas de riesgos en SIMET/ Monitoring the updates and publication status of hazard maps and the risk maps in SIMET.	AMDC-UMGIR												AMDC-UMGIR												AMDC-UMGIR											
Realización de charlas y sesiones de estudio sobre mapeo de amenazas y mapeo de riesgos para municipios externos y dentro de la AMDC /Conducting lectures and study sessions on hazard mapping and risk mapping for external municipalities and within AMDC	COPECO, UNAH, AMDC-UMGIR												COPECO, UNAH, AMDC-UMGIR												COPECO, UNAH, AMDC-UMGIR											
Selección de áreas para mapeo de amenazas y mapeo de riesgos dentro del área de Tegucigalpa y otros municipios del país / Selecting areas for hazard mapping and risk mapping within the Tegucigalpa area and other municipalities in the country	AMDC-UMGIR, UNAH, COPECO												AMDC-UMGIR, UNAH, COPECO												AMDC-UMGIR, UNAH, COPECO											
Evaluación de peligros para el área seleccionada dentro del área de Tegucigalpa y otros municipios del país / Hazard evaluation for the selected area within the Tegucigalpa area and other municipalities in the country	AMDC-UMGIR, COPECO												AMDC-UMGIR, COPECO												AMDC-UMGIR, COPECO											
Análisis de riesgo para la zona seleccionada / Risk analysis for the selected area	UNAH, COPECO												UNAH, COPECO												UNAH, COPECO											
Mapeo de amenazas y mapeo de riesgos para el área seleccionada / Hazard mapping and risk mapping for the selected area	AMDC, COPECO												AMDC, COPECO												AMDC, COPECO											

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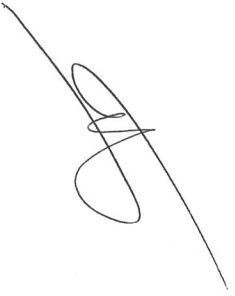
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1. Mantener la eficacia y funcionalidad de las obras de contramedidas construidas
2. Finalización de las obras de contramedidas en Nueva Santa Rosa y La Guillen
3. Ejecución de contramedidas en otros lugares de alta prioridad

Resultado 1&2 investigaciones y análisis detallados, medidas estructurales	Responsable	2024												2025												2026											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Medición de deslizamientos de tierra mediante dispositivos./Landslide measurement using devices	AMDC-CODEM	[Green bar]																																			
Mantenimiento de medidas estructurales/Maintenance of structural measures	AMDC-CODEM	[Green bar]																																			
Realización de conferencias y sesiones de estudio sobre regulaciones de uso de la tierra para organizaciones externas y dentro de AMDC./Conducting lectures and study sessions on land use regulations for external organizations and within AMDC	COPECO, UNAH, AMDC	[Green bar]																																			
Investigación, análisis, diseño, asignación presupuestaria y construcción en Nueva Santa Rosa y La Guillén/ Investigation, analysis, design, budget allocation, and construction in Nueva Santa Rosa and La Guillen	AMDC, UNAH	[Green bar]																																			
Seleccionar sitios de alta prioridad/ Selecting high-priority sites	AMDC-UMGIR, UNAH, COPECO	[Blue bar]																																			
Estudios geológicos/geofísicos, instalación de dispositivos de monitoreo y análisis en José Ángel Ulloa./ Geological/geophysical surveys, installation of monitoring devices, and analysis in Jose Angel Ulloa	AMDC, UNAH	[Blue bar]																																			
Investigación y análisis para trabajos de contramedida./ Investigation and analysis for countermeasure works	UNAH, AMDC, COPECO	[Blue bar]																																			
Diseño, construcción y asignación presupuestaria de obras de contramedida./ Design, construction, and budget allocation for countermeasure works	AMDC, COPECO	[Blue bar]																																			
Mantenimiento y seguimiento de obras de contramedida/ Maintenance and monitoring for countermeasure works	AMDC, COPECO	[Blue bar]																																			

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...del municipio con otros municipios

...en el municipio de...

Project Design Matrix (PDM)

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District¹
 Project Period: From February 2019 to December 2025 (about 6 years and 10 months)
 Zone Identified for the Project (Project Target Area): The Central District
 Counterpart: The Central District Municipal Government (AMDC), National Disaster Prevention Committee (COPECO), National Autonomous University of Honduras (UNAH)

Date: October 11, 2023
 Version: 5.0

Definition of slope disasters in the Project: landslide, slope failure, and rock fall

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
<p>Overall Goal</p> <p>Necessary actions for control and mitigation for slope disaster risks in the Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District (the Action Plan)²</p> <p>Project Purpose</p> <p>Capacity to manage slope disasters in the Central District is improved</p>	<ul style="list-style-type: none"> Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan. 2 countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within 3 years after the project completion. The newly created land use regulation for special regime zones in Central District based on the Action Plan. 	<ul style="list-style-type: none"> Statistical data managed by AMDC List of implemented countermeasure projects for slope disasters risks Land use regulation for special regime zones for slope disasters risks issued by AMDC 	<ul style="list-style-type: none"> The level of importance given to control and mitigation of slope disaster risks by AMDC and the Government of Honduras stays high. AMDC has access to the equipment and tools owned by UNAH.
<p>Outputs</p> <p>1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened</p> <p>2. Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced</p> <p>3. Capacity to develop hazard</p>	<p>1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC. *3</p> <p>2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.</p>	<ul style="list-style-type: none"> Pilot project review report(s) (including an evaluation of completed construction projects by counterparts) prepared by JICA experts Document on "Action Plan for Risk Reduction for Slope Disasters in the Central District" 	<ul style="list-style-type: none"> The key counterparts are assigned during the project period AMDC has access to the equipment and tools owned by UNAH. In the pilot site and its surroundings, significant disasters with large-scale topographical alterations does NOT happen during the period from the survey until the countermeasure construction. *3
<p>1-1 Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced.</p> <p>1-2 A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared.</p> <p>2-1. 4 structural measures for small/medium size slope disaster risks are constructed. *3</p> <p>2-2 A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared.</p>	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites JICA project monitoring report Manual for investigation and analyzing small/medium size slope disaster risk sites Project designs of 4 structural measures for small/medium size slopes JICA project monitoring report 4 structural measures at pilot sites Manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk 	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory Map and the 	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory

¹ Slope disaster means disasters caused by phenomena of slope movements in Spanish.

² The Action Plan includes 1) project priorities of area selected by the Project and 2) the AMDC's plan to disseminate the outcomes of the Project.


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and risk maps is enhanced	Multi-hazard Map are created. 3-2 A manual for hazard and risk mapping is prepared.	Map and the Multi-hazard Map • Manual for hazard and risk mapping
4. Capacity to regulate land use for slope disasters is enhanced.	4-1. A draft land use regulation for slope disaster risk area for pilot special regime zones is created. 4-2. Land use regulation maps for slope disasters for pilot special regime zones are created.	• A draft land use regulation for slope disasters for pilot special regime zones • Land use regulation map for slope disasters for pilot special regime zones

Activities	Input (under consideration)	Pre-condition
<p>1.1. Identify and select pilot sites (2 small/medium-size landslides, 2 small/medium-size slope failures/rock falls, 2 large-size landslides) to implement structural measures on slope disasters.</p> <p>1.2. Prepare Work Plan for the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.3. Investigate the topographic conditions of the 4 small/medium-size slope disaster risk sites (generating geo spatial information for the terrain elevation model).</p> <p>1.4. Investigate the geophysical (elastic wave exploration, electrical exploration, and others) and mechanical (laboratory test and others) characteristics of the 4 small/medium-size slope disaster risk sites.</p> <p>1.5. Analyze and interpret the data from the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.6. Evaluate the vulnerability of the 4 small/medium-size slope disaster risks sites, including their surrounding areas.</p> <p>1.7. Define risk and characterize the risk zones of the 4 small/medium-size slope disaster risk sites.</p> <p>1.8. Prepare the conceptual proposals of design and inputs required for the structural measures in the Output 2 for the 4 small/medium-size slope disaster risk sites.</p> <p>1.9. Systematize the mechanism and the procedure applied in the characterization process of the 4 pilot small/medium-size slope disaster risk sites.</p> <p>1.10. Prepare project concepts of the 2 large-sized slope disaster risk sites selected in activity 1.1 for future projects.</p> <p>1.11. Prepare a manual for investigating and analyzing small/medium size slope disasters risk sites based on activities 1.1 – 1.9.</p> <p>1.12. Provide training course, seminar, or/and conference to share the manual produced by the Project.</p> <p>1.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p> <p>2.1. Design structural measure works at the 4 small/medium-size slope disaster risk sites based on the data provided by the Output 1.</p> <p>2.2. Organize applicability of structural measure methods for different slope disasters.</p> <p>2.3. Conduct the environmental impact/social assessment.</p> <p>2.4. Assign budget items for the investment for 2 small/medium structural measures conducted by AMDC</p> <p>2.5. Develop bidding documents (technical specification, calculation reports, cost estimation, and estimation of material needed and budget).</p> <p>2.6. Conduct bidding and award process</p> <p>2.7. Make contracts with subcontractors selected in the procurement process to implement the structural measure works.</p> <p>2.8. Implement and supervise structural measure works.</p> <p>2.9. Prepare a monitoring and maintenance plan.</p> <p>2.10. Conduct monitoring and maintenance of the structural measure works.</p> <p>2.11. Prepare a manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk sites based on activities 2.1 – 2.10.</p> <p>2.12. Provide training course, seminar, or/and conference to share the manual and experience produced by the Project</p> <p>2.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Japanese Side</u></p> <ol style="list-style-type: none"> Experts Team leader <p>2) Geological investigation and analysis</p> <ol style="list-style-type: none"> Topographic survey Structural measures Slope disaster hazard evaluation GIS mapping Land use regulation Coordinator <p>2. Training in Japan</p> <ul style="list-style-type: none"> Training on Slope Disaster Risk Reduction <p>3. Procurement of Equipment</p> <ul style="list-style-type: none"> Digital Terrain Model <p><u>Input: Honduras Side</u></p> <ol style="list-style-type: none"> Counterpart Personnel: <ul style="list-style-type: none"> Project Director (Mayor of AMDC) Project Manager (Coordinator of UMGIR) WG members for Output 1 WG members for Output 2 WG members for Output 3 WG members for Output 4 Working Space and Facilities for JICA Experts at: <ul style="list-style-type: none"> UMGIR 	<p>Working members are assigned.</p>

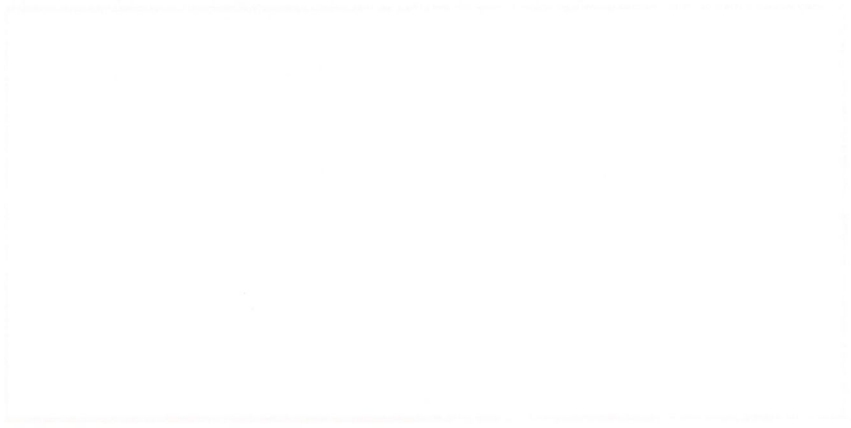
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	Issues and Countermeasures
<p>3.1. Review slope disaster risk related maps and related information</p> <p>3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map</p> <p>3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.</p> <p>3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.</p> <p>3.5. Collect the existing geo-spatial data in the pilot area.</p> <p>3.6. Analyze the geo-spatial data in the pilot area.</p> <p>3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.</p> <p>3.8. Define the level of slope disaster hazard and risks in the pilot area.</p> <p>3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.</p> <p>3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 – 3.9.</p> <p>3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.</p> <p>3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p> <p>4.1. Review the current approach and information on the land use regulation</p> <p>4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.</p> <p>4.3. Select pilot special regime zones to develop a proposal of land use regulation.</p> <p>4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.</p> <p>4.5. Elaborate draft regulations for land use on the pilot special regime zones.</p> <p>4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.</p> <p>4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District</p> <p>4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 – 4.6.</p> <p>4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.</p> <p>4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<ul style="list-style-type: none"> • UNAH <p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects

*3: A large-scale landslide disaster occurred in La Guillen, adjacent to Nueva Santa Rosa, one of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work in La Guillen and subsequent amendments to the countermeasure plans and designs for Nueva Santa Rosa. The Important Assumption "Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period" has been invalidated.




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TO JICA HONDURAS OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District

Version of the Sheet: Ver.7.0 (Term: March 2023 – September 2023)

Name: Kuwano Takeshi

Title: Team leader

Submission Date: October 11, 2023

I. Summary

1 Progress		
1-1 Progress of Inputs		
Inputs	Plan as of February 2019	Actual as of September 2023
Japanese Side Experts	Total PM: 54.80 PM 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Slope disaster hazard evaluation 6) GIS mapping 7) Land use regulation 8) Coordinator	63.18 PM (97.82 % of Total PM) 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Construction Planning/Bid Supervision 6) Construction Supervision 7) Slope disaster hazard evaluation 8) GIS mapping 9) Land use regulation 10) Coordinator
Japanese Side Training (Japan, Third Countries)	• Training on Slope Disaster Risk Reduction	• Training on Slope Disaster Risk Reduction
Procurement of Equipment	• Digital Terrain Model	• Digital Terrain Model
Honduras Side	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects

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1-2 Progress of Activities

Progress of activities is indicated in Monitoring Sheet Form 3-2 (PDM) and Form 3-3 (PO).

1-3 Achievement of Output

Output/indicators	Achievement (%)		Major results
	Plan	Actual	
Output 1: Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.			
Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced.	100	100	The report was completed.
A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared.	100	100	The manual was completed.
Output 2: Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.			
4 structural measures for small/medium size slope disaster risks are constructed.	80	80	The structural measure in Villa Nueva is under construction. As for La Guillen and Nueva Santa Rosa, the emergency countermeasure works have been completed. Investigation will be started, followed by the design.
A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared.	90	90	The manual is being prepared.
Output 3: Capacity to develop hazard and risk maps is enhanced.			
The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created.	100	100	The maps were completed.
A manual for hazard and risk mapping is prepared.	100	100	The manual was completed.
Output 4: Capacity to regulate land use for slope disasters is enhanced.			
A draft land use regulation for slope disaster risk area for pilot special regime zones is created.	100	100	The land use regulation was completed.
Land use regulation maps for slope disasters for pilot special regime zones are created.	100	100	The land use regulation maps were completed.

1-4 Achievement of the Project Purpose

Project purpose/indicators	Achieve	Situation
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	ment (%)	
Project purpose: Capacity to manage slope disasters in the Central District is improved.		
1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.	40	The structural measure in Villa Nueva is under construction. As for La Guillen and Nueva Santa Rosa, the emergency countermeasure works have been completed. Investigation will be started, followed by the design.
2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.	100	Action Plan for each Output and the Integrated Action Plan were completed.

1-5 Changes of Risks and Actions for Mitigation

A landslide disaster happened in September 2022 in La Guillen next to Nueva Santa Rosa which is a pilot site for the Project. The disaster affected Nueva Santa Rosa as well as La Guillen. Since it was necessary to consider the impact of the landslide in La Guillen for the countermeasures in Nueva Santa Rosa, these countermeasure plans and designs were significantly changed.

1-6 Progress of Actions undertaken by JICA

JICA Expert Team provides technical advice for the AMDC's activity in La Guillen and Nueva Santa Rosa until December 2025 by extension of the Project period.

1-7 Progress of Actions undertaken by Gov. of Honduras

AMDC proposed a new schedule for 2023 to 2025 to complete the countermeasure works by December 2025 in La Guillen. According to the new schedule, AMDC implements investigation, emergency works and permanent countermeasure works.

1-8 Progress of Environmental and Social Considerations (if applicable)

None.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

None.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None.

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2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

Due to La Guillen disaster, the countermeasure plans must be changed for Nueva Santa Rosa. The countermeasure works will be completed by December 2025 in La Guillen and Nueva Santa Rosa according to the new plan prepared by AMDC.

2-2 Cause

A landslide disaster happened in September 2022 in La Guillen.

2-3 Action to be taken

AMDC proposed a new schedule for 2023 to 2025 to complete the countermeasure works by December 2025 in La Guillen.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Honduras, etc.)

AMDC implements investigation, emergency works and permanent countermeasure works by AMDC's own budget and human resources.

JICA Expert Team provides technical advice for the AMDC's activity in La Guillen and Nueva Santa Rosa until December 2025 by extension of the Project period.

3 Modification of the Project Implementation Plan

3-1 PO

The Project period is modified "from February 2019 to December 2023 (about 4 years and 10 months)" to "from February 2019 to December 2025 (about 6 years and 10 months)."

3-2 Other modifications on detailed implementation plan

None.

4 Preparation of Gov. of Honduras toward after completion of the Project

None.

II. Project Monitoring Sheet I & II as Attached

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Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District¹

Implementing Agency: The Central District Municipal Government (AMDC), National Disaster Prevention Committee (COPECO), National Autonomous University of Honduras (UNAH)

Project Period: 2019 to 2025 (about 6 years and 10 months)

Project Site: The Central District

Version: 7.0

Dated: October 11, 2023

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption	Achievement	Remarks
<p>Overall Goal</p> <p>Necessary actions for control and mitigation for slope disaster risks in the -Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District (the Action Plan)².</p> <p>Project Purpose</p> <p>Capacity to manage slope disasters in the Central District is improved.</p>	<ul style="list-style-type: none"> Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan. 2 countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within 3 years after the project completion. The newly created land use regulation for special regime zones in Central District based on the Action Plan. 	<ul style="list-style-type: none"> Statistical data managed by AMDC List of implemented countermeasure projects for slope disasters risks Land use regulation for special regime zones for slope disasters risks issued by AMDC 		(future activity)	
<p>1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.³</p> <p>2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.</p>	<p>1. Pilot project review report(s) (including an evaluation of completed construction projects by counterparts) prepared by JICA experts</p> <p>2. Document on "Action Plan for Risk Reduction for Slope Disasters in the Central District"</p>	<ul style="list-style-type: none"> The level of importance given to control and mitigation of slope disaster risks by AMDC and the Government of Honduras stays high AMDC has access to the equipment and tools owned by UNAH. 	<p>The structural measure in Villa Nueva is under construction.</p> <p>As for La Guillen and Nueva Santa Rosa, the emergency countermeasure works have been completed. Investigation will be started, followed by the design.</p> <p>Action Plan for each Output and the Integrated Action Plan were completed.</p>		

¹ Slope disaster means disasters caused by phenomena of slope movements in Spanish.

² The Action Plan includes 1) project priorities of area selected by the Project and 2) the AMDC's plan to disseminate the outcomes of the Project.

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Outputs							
1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced. A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared. 	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites JICA project monitoring report Manual for investigation and analyzing small/medium size slope disaster risk sites 	<ul style="list-style-type: none"> The key counterparts are assigned during the project period AMDC has access to the equipment and tools owned by UNAH. 	The report was completed.			
2. Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.	<ul style="list-style-type: none"> 4 structural measures for small/medium size slope disaster risks are constructed. *3 A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared. 	<ul style="list-style-type: none"> Project designs of 4 structural measures for small/medium size slopes JICA project monitoring report 4 structural measures at pilot sites Manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk 	<ul style="list-style-type: none"> In the pilot site and its surroundings, significant disasters with large-scale topographical alterations does NOT happen during the period from the survey until the countermeasure construction. *3 	The structural measure in Villa Nueva is under construction.			
3. Capacity to develop hazard and risk maps is enhanced	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created. A manual for hazard and risk mapping is prepared. 	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map Manual for hazard and risk mapping 	<ul style="list-style-type: none"> As for La Guillen and Nueva Santa Rosa, the emergency countermeasure works have been completed. Investigation will be started, followed by the design. 	The maps were completed.			
4. Capacity to regulate land use for slope disasters is enhanced.	<ul style="list-style-type: none"> A draft land use regulation for slope disaster risk area for pilot special regime zones is created. Land use regulation maps for slope disasters for pilot special regime zones are created. 	<ul style="list-style-type: none"> A draft land use regulation for slope disasters for pilot special regime zones Land use regulation map for slope disasters for pilot special regime zones 	<ul style="list-style-type: none"> The land use regulation was completed. 	The land use regulation was completed.			
				The land use regulation maps were completed.			

Activities		Input		Pre-condition		
1.1. Identify and select pilot sites (2 small/medium-size landslides, 2 small/medium-size slope failures/rock falls, 2 large-size landslides) to implement structural measures on slope disasters.		1. Experts	Input: Japanese Side	Working members are assigned.		
1.2. Prepare Work Plan for the investigation of the 4 small/medium-size slope disaster risk sites.		1) Team leader				
1.3. Investigate the topographic conditions of the 4 small/medium-size slope disaster risk sites (generating geo spatial information for the terrain elevation model).		2) Geological investigation and analysis				
1.4. Investigate the geophysical (elastic wave exploration, electrical exploration, and others) and mechanical (laboratory test and others) characteristics of the 4 small/medium-size slope disaster risk sites.		3) Topographic survey				
1.5. Analyze and interpret the data from the investigation of the 4 small/medium-size slope disaster risk sites.		4) Structural measures				
1.6. Evaluate the vulnerability of the 4 small/medium-size slope disaster risk sites, including their surrounding areas.		5) Slope disaster hazard evaluation				

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<p>1.7. Define risk and characterize the risk zones of the 4 small/medium-size slope disaster risk sites.</p> <p>1.8. Prepare the conceptual proposals of design and inputs required for the structural measures in the Output 2 for the 4 small/medium-size slope disaster risk sites.</p> <p>1.9. Systematize the mechanism and the procedure applied in the characterization process of the 4 pilot small/medium-size slope disaster risk sites.</p> <p>1.10. Prepare project concepts of the 2 large-sized slope disaster risk sites selected in activity 1.1 for future projects.</p> <p>1.11. Prepare a manual for investigating and analyzing small/medium size slope disasters risk sites based on activities 1.1 – 1.9.</p> <p>1.12. Provide training course, seminar, or/and conference to share the manual produced by the Project.</p> <p>1.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p> <p>2.1. Design structural measure works at the 4 small/medium-size slope disaster risk sites based on the data provided by the Output 1.</p> <p>2.2. Organize applicability of structural measure methods for different slope disasters.</p> <p>2.3. Conduct the environmental impact/social assessment.</p> <p>2.4. Assign budget items for the investment for 2 small/medium structural measures conducted by AMDC</p> <p>2.5. Develop bidding documents (technical specification, calculation reports, cost estimation, and estimation of material needed and budget).</p> <p>2.6. Conduct bidding and award process</p> <p>2.7. Make contracts with subcontractors selected in the procurement process to implement the structural measure works.</p> <p>2.8. Implement and supervise structural measure works.</p> <p>2.9. Prepare a monitoring and maintenance plan.</p> <p>2.10. Conduct monitoring and maintenance of the structural measure works.</p> <p>2.11. Prepare a manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk sites based on activities 2.1 – 2.10.</p> <p>2.12. Provide training course, seminar, or/and conference to share the manual and experience produced by the Project</p> <p>2.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p> <p>3.1. Review slope disaster risk related maps and related information</p> <p>3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map</p> <p>3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.</p> <p>3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.</p> <p>3.5. Collect the existing geo-spatial data in the pilot area.</p> <p>3.6. Analyze the geo-spatial data in the pilot area.</p> <p>3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.</p> <p>3.8. Define the level of slope disaster hazard and risks in the pilot area.</p> <p>3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.</p> <p>3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 – 3.9.</p> <p>3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.</p> <p>3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p> <p>4.1. Review the current approach and information on the land use regulation</p> <p>4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.</p>	<p>6) GIS mapping</p> <p>7) Land use regulation</p> <p>8) Coordinator</p> <p>2. Training in Japan</p> <ul style="list-style-type: none"> • Training on Slope Disaster Risk Reduction <p>3. Procurement of Equipment</p> <ul style="list-style-type: none"> • Digital Terrain Model <p><u>Input: Honduras Side</u></p> <p>1. Counterpart Personnel:</p> <ul style="list-style-type: none"> • Project Director (Mayor of AMDC) • Project Manager (Coordinator of UMGIR) • WG members for Output 1 • WG members for Output 2 • WG members for Output 3 • WG members for Output 4 <p>2. Working Space and Facilities for JICA Experts at:</p> <ul style="list-style-type: none"> • UMGIR • UNAH <p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects 	<p><u>Issues and Countermeasures</u></p>
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		<p>4.3. Select pilot special regime zones to develop a proposal of land use regulation.</p> <p>4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.</p> <p>4.5. Elaborate draft regulations for land use on the pilot special regime zones.</p> <p>4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.</p> <p>4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District</p> <p>4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 – 4.6.</p> <p>4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.</p> <p>4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>
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*3: A large-scale landslide disaster occurred in La Guillen, adjacent to Nueva Santa Rosa, one of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work in La Guillen and subsequent amendments to the countermeasure plans and designs for Nueva Santa Rosa. The Important Assumption "Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period" has been invalidated.

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MINUTES OF MEETING
ON SECOND AMENDMENT TO THE RECORD OF DISCUSSIONS
FOR
PROJECT FOR CONTROL AND MITIGATION OF SLOPE DISASTERS
IN THE CENTRAL DISTRICT IN REPUBLIC OF HONDURAS

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA Expert Team (hereinafter referred to as "JET"), the Municipal Government of the Central District (hereinafter referred to as "AMDC"), Secretary of State in the Offices of Risk Management and National Contingencies (hereinafter referred to as "COPECO") and the National Autonomous University of Honduras (hereinafter referred to as UNAH) hereby agree that the first amendment to the Record of Discussions (hereinafter referred to as "R/D") for the Project for Control and Mitigation of Slope Disasters in the Central District in Republic of Honduras (hereinafter referred to as "the Project") signed on September 30th, 2021 will be amended as attached.

Tegucigalpa, XXXXX XX, 2023

Mr. SHINO Katsuhiko

Chief Representative

Japan International Cooperation Agency (JICA)
Honduras Office

Mr. Jorge ALDANA

Mayor

Municipal Government of the Central District
(AMDC)



Mr. Dario GARCIA

Minister

Secretary of State in the Offices of Risk
Management and National Contingencies
(COPECO)

Dr. Marco Tulio MEDINA

Vice Rector in International Affairs

National Autonomous University of Honduras
(UNAH)

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SECOND AMENDMENT TO THE RECORD OF DISCUSSION

In September 2022, a huge landslide disaster occurred in La Guillen, adjacent to Nueva Santa Rosa, which serves as a pilot site for the Project. This disaster had a profound impact on both Nueva Santa Rosa and La Guillen. Given the need to account for the landslide's effects in La Guillen when planning countermeasures for Nueva Santa Rosa, significant changes were made to the countermeasure plans and designs.

AMDC proposed a revised schedule for the period from 2023 to 2025 to complete the countermeasure works in La Guillen by December 2025. According to this new schedule, AMDC will undertake investigations, emergency works, and permanent countermeasure works. JET will provide technical guidance to support AMDC's activities in La Guillen and Nueva Santa Rosa until December 2025, through an extension of the Project period.

As agreed during the seventh Joint Coordination Committee meeting on October 11, 2023, to align with the Project Purpose and each output, the first amendment to the R/D for the Project, attached as Annex 1, will be modified as follows.

1. Period of the Project (Modification in PDM and PO)

Before	Amended Version
From February 2019 to December 2023 (about 4 years and 10 months)	From February 2019 to <u>December 2025</u> (about <u>6 years and 10 months</u>)

Reason: AMDC's countermeasure works in La Guillen and Nueva Santa Rosa receive technical support from JET.

All the other articles of the original R/D shall remain unchanged.

Annex 1: First amendment to the Record of Discussion for the Project (signed on September 30th, 2021)

Annex 2: Record of Discussion for the Project (signed on November 27th, 2018)

Annex 3: Project Design Matrix version 5.0 (Draft) (dated on XXXX, 2023)

Annex 4: Plan of Operation version 5.0 (Draft) (dated on XXXX, 2023)

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MEETING MINUTES
IN THE EIGHTH JOINT COORDINATION COMMITTEE FOR THE
HILLSIDE DISASTER CONTROL AND MITIGATION PROJECT
IN THE CENTRAL DISTRICT OF THE REPUBLIC OF HONDURAS

The Eighth Joint Coordination Committee (hereinafter referred to as "CCC") was held with the participation of the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the JICA Team of Experts (hereinafter referred to as "EEJ"), the Municipal Mayor's Office of the Central District (hereinafter referred to as "AMDC"), the Secretary of State in the National Risk Management and Contingencies Offices (hereinafter referred to as "COPECO") and the National Autonomous University of Honduras (hereinafter referred to as "UNAH") for the Project for the Control and Mitigation of Disasters on Slopes in the Central District of the Republic of Honduras (hereinafter referred to as "the Project")

As a result of the discussions of this Joint Coordination Committee, all parties agree on the contents of the attached sheets.

Tegucigalpa, March 27, 2025

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Dr. KUWANO Takeshi
Team Leader
JICA Team of Experts
Japan International Cooperation Agency


明屋篤典

Sr. KADOYA Atsunori
Resident Representative
Honduras Office
Japan International Cooperation Agency


Mr. Jorge ALDANA

Mayor
Municipal Mayor's Office of the Central District




Sr. José Jorge FORTIN
Vice Admiral Secretary
Secretary of State in the Offices of Risk Management and National Contingencies


Mr. Javier LOPEZ
Vice-Rector for International Relations
National Autonomous University of Honduras



RECTORIA DE RELACIONES INTERNACIONALES

ATTACHMENTS

I. Agreements on the Progress and the Project Plans.

Following the explanation of the progress of the Project from October 2023 to March 2025 and the plan for the next seven (7) months until the completion of the Project, the CCC deliberated on the agreements and issues described below.

<Common understanding on the design of AMDC countermeasure works>

Under the structure of the Project, it is AMDC's responsibility to implement the countermeasures works for the landslide in Nueva Santa Rosa and La Guillén, as well as the slope failure and rockfall in Villa Nueva, using the knowledge transferred by the EEJ through the pilot activities in Campo Cielo and Fuerzas Unidas.

For Nueva Santa Rosa and La Guillén, the detailed design of the original countermeasures works was completed in June 2024, in collaboration between AMDC and EEJ. The EEJ had advised the AMDC to start construction from November 2024 to ensure the completion of critical parts of the works before the rainy season in May 2025. Nonetheless, AMDC expressed its intention to build an additional retaining wall as part of the countermeasures, which required further geological surveys and revision of the designs. The studies in question, as well as the design, were evaluated, in an area affected by landslides located very close to the countermeasures works initially planned. As a result, although the design initiative has been carried out, AMDC decided not to implement the additional retaining wall beyond the originally proposed countermeasure works, and ultimately chose to proceed only with the original countermeasure works. AMDC explained that construction of the original countermeasure is scheduled to begin in April 2025.

For Villa Nueva, from a safety standpoint, EEJ advised AMDC to start construction from November 2023 based on the detailed design of the original countermeasures works, which was completed in June 2023 thanks to the collaboration between AMDC and EEJ. EEJ also recommended that the removal of the most critical unstable rock masses be completed before the rainy season in May 2024. However, due to the delay in the recruitment and relocation procedures for residents, the actual start of the works was significantly delayed until April 2024. As a result, the removal of the most critical unstable rock massifs was postponed until the rainy season, and on June 29, 2024, a slope collapse occurred due to continuous rainfall, with part of the collapsed rocks and soil falling on the road. Under this situation, it is necessary to carry out a geological study and stability analysis of the collapsed slope, which still has the potential to collapse, in order to determine the appropriate



combination and design of the mitigation works based on engineering analysis. . Therefore, the AMDC took into account the observations made by the EEJ and submitted a request to the UNAH for the support in carrying out an engineering analysis including soil tests in order to achieve the objectives of the project based on a technical analysis. AMDC committed to conduct a manual geological survey with the support of UNAH no later than April 4, 2025. Revised construction of the countermeasure following the hillside failure is scheduled to begin in April 2025.

(1) Outcome 1 (Capacities are strengthened to conduct detailed research and analysis to identify and characterize hillside disaster phenomena)

(a): La Guillén and Nueva Santa Rosa

Following the activation of landslide blocks at the La Guillén and Nueva Santa Rosa sites in 2022, AMDC has been operating a regular monitoring system for landslide activity. Although small displacements have been detected in relation to rainfall, no serious damage has been reported. EEJ has advised the AMDC to continuously monitor the site and, if accelerated deformations were observed, inform residents and prepare for evacuation. AMDC and EEJ reconfirmed that they would continue to hold regular online meetings on landslide monitoring to review and exchange views, and discuss the future course of action. AMDC agreed to verify the need for the additional work in light of the concern expressed.

(b): Villa Nueva

Due to slope instability, AMDC, UNAH, and the EEJ agreed that UNAH would voluntarily conduct a manual geological survey with the support of AMDC and EEJ, rather than conducting a drilling survey that could increase the risk of further slope collapse. EEJ verifies the result of the stability analysis based on the geological survey.

EEJ and JICA have expressed concern about the risk of construction accidents in the rainy season, and strongly recommended that construction work not be carried out during the rainy season.

(2) Outcome 2 (Capacities are strengthened for the design, construction, supervision and maintenance of structural disaster risk response measures on small/medium-scale slopes)

(a) Relocation

AMDC explained that the relocation process and the construction of new Villa Solidaridad residential lots are currently underway.

(b) Monitoring



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The monitoring and maintenance manual was completed in March 2025. Based on the manual, the AMDC is expected to establish a monitoring and maintenance plan for the four (4) pilot sites built under the Project by September 2025.

(c) Supervision

AMDC and the EEJ confirmed that the original countermeasures devised through the collaboration between the EEJ and AMDC should be monitored by AMDC with the support of the EEJ. However, EEJ and JICA reiterated that EEJ would support supervision until October 2025, when activities in Honduras are closed, as EEJ will have fully achieved its target of technical transfer for supervision. Starting in October 2025, AMDC will bring the technology-based oversight and knowledge it has gained from the EEJ.

II. Special Notes of the Project

(1) Modification to Project Design Matrix

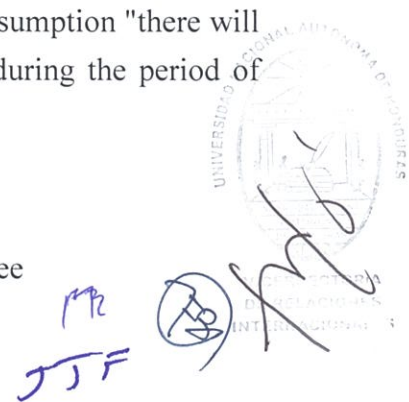
It is proposed to amend the project design matrix (hereinafter referred to as "PDM"), which outlines the discussions regarding the exemption of defects and the achievement of the project objectives. The following sentences are added to the MIP footnote:

"In September 2022, a large-scale landslide occurred in La Guillén, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for the structural measures financed and built by the AMDC. The Project period has been extended by two years, to December 2025, due to the need for further evaluation of the emergency works and the consequent modifications to the countermeasure plans and designs for both pilot sites. Even in the event that the structural measures at both pilot sites are not completed within the project period, the Project Objective and Outcome 2 are interpreted to have sufficiently achieved the Objectively Verifiable Indicators by carrying out the technical transfer related to the monitoring and maintenance of the structural measures, as well as the formulation of the relevant plans. The Important assumption "there will be NO significant disasters involving large-scale topographical alterations during the period of study and construction" has been invalidated."

Addendum-1: List of members who attended the Joint Coordination Committee

Appendix-2: Project Design Matrix see.6

Appendix-3: Monitoring Sheet see. 10



<HONDURAS>

Municipal Mayor's Office of the Central District (AMDC)

Jorge Aldana (Mayor)

Rosa Irene Villela (Manager, Legal Services)

Adolfo Lagos (Manager, Construction Control)

Darwin Martínez (Manager, Risk Assessment) Ingrid Flores (Coordinator, Municipal Risk Integral Unit) Roberto Granados (Risk Officer, Municipal Risk Integral Unit)

Mariela Suazo (Risk Analyst, Municipal Risk Integral Unit)

Claudia Turcios (Assistant, Directorate of Territorial Planning)

Secretary of State in the National Risk and Contingency Management Offices (COPECO)

Wilmer Edgardo López (Director, Directorate of Prevention Management)

National Autonomous University of Honduras (UNAH)

Javier López Padilla (Vice-Rector, Vice-Rector for International Affairs)

Bryan Larios (Dean, Faculty of Sciences)

Lidia Torres Bernhard (Researcher, Institute of Earth Sciences)

<JAPAN>

JICA Honduras

KADOYA Atsunori (Resident Representative) SAITO Mizuka (Chief of Technical and Financial Cooperation)

YOKOO Koji (Head of Administration)

Cinthia Rodríguez (Program Officer)

JICA Team of Experts

KUWANO Takeshi (Team Leader/Slope Disaster Risk Analysis)

Alejandro Flores (Technical Project Assistant)

Vilma Mejía (Project Assistant)

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TO JICA HONDURAS OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District

Version of the Sheet: Ver.10.0 (Term: October 2024 – March 2025)

Name: Kuwano Takeshi

Title: Team leader

Submission Date: March 31, 2025

I. Summary

1 Progress

1-1 Progress of Inputs

Inputs	Plan as of February 2019	Actual as of March 2025
Japanese Side Experts	Total PM: 54.80 PM 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Slope disaster hazard evaluation 6) GIS mapping 7) Land use regulation 8) Coordinator	<u>71.75 PM (91.73 % of Total PM: 78.22)</u> 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Construction Planning/Bid Supervision 6) Construction Supervision 7) Slope disaster hazard evaluation 8) GIS mapping 9) Land use regulation 10) Coordinator
Japanese Side Training (Japan, Third Countries)	• Training on Slope Disaster Risk Reduction	• Training on Slope Disaster Risk Reduction
Procurement of Equipment	• Digital Terrain Model	• Digital Terrain Model
Honduras Side	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects



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1-2 Progress of Activities

Progress of activities is indicated in Monitoring Sheet Form 3-2 (PDM) and Form 3-3 (PO).

1-3 Achievement of Output

Output/indicators	Achievement (%)		Major results
	Plan	Actual	
Output 1: Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.			
Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced.	100	100	The report was completed.
A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared.	100	100	The manual was completed.
Output 2: Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.			
4 structural measures for small/medium size slope disaster risks are constructed.	95	89	<p>As for La Guillen and Nueva Santa Rosa, JET had advised AMDC to commence construction in November 2024 to ensure the completion of high risk parts of the works before the rainy season, by May 2025. However, AMDC wanted to implement additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024. The additional retaining wall was cancelled. The original countermeasure construction is scheduled to commence in April 2025.</p> <p>For Villa Nueva, JET had advised AMDC to commence construction in November 2023 that the removal of the highest risk unstable rock masses be completed before the rainy season, by May 2024. However, the actual commencement of construction was significantly delayed until April 2024. Consequently, the removal of the unstable rock masses postponed into the rainy season, and on June 29, 2024, a slope failure occurred due to continuous rainfall. Under this situation, AMDC is conducting a geological survey with support from UNAH for revised countermeasure works. The revised countermeasure construction after the slope failure is scheduled to commence in April 2025.</p> <p>As a result, the original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, will not be completed</p>



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			by December 2025, the end of the Project (JICA has extended the Project for two (2) years). JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer for supervision.
A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared.	95	95	The manual in the maintenance section is under preparation. It will be prepared in April 2025.
Output 3: Capacity to develop hazard and risk maps is enhanced.			
The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created.	100	100	The maps were completed.
A manual for hazard and risk mapping is prepared.	100	100	The manual was completed.
Output 4: Capacity to regulate land use for slope disasters is enhanced.			
A draft land use regulation for slope disaster risk area for pilot special regime zones is created.	100	100	The land use regulation was completed.
Land use regulation maps for slope disasters for pilot special regime zones are created.	100	100	The land use regulation maps were completed.

1-4 Achievement of the Project Purpose

Project purpose/indicators	Achievement (%)	Situation
Project purpose: Capacity to manage slope disasters in the Central District is improved.		
1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.	60	The original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, will not be completed by December 2025, the end of the Project (JICA has extended the Project for two (2) years). JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer for supervision.
2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.	100	Action Plan for each Output and the Integrated Action Plan were completed.

1-5 Changes of Risks and Actions for Mitigation

None.



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1-6 Progress of Actions undertaken by JICA

None.

1-7 Progress of Actions undertaken by Gov. of Honduras

None.

1-8 Progress of Environmental and Social Considerations (if applicable)

None.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

None.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

The original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, is scheduled to commence in April 2025 and will not be completed by December 2025, the end of the Project though JICA has extended the Project for two (2) years.

2-2 Cause

As for La Guillen and Nueva Santa Rosa, JET had advised AMDC to commence construction in November 2024 to ensure the completion of high-risk parts of the works before the rainy season, by May 2025. However, AMDC wanted to implement additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024.

For Villa Nueva, JET had advised AMDC to commence construction in November 2023 that the removal of the highest risk unstable rock masses be completed before the rainy season, by May 2024. However, the actual commencement of construction was significantly delayed until April 2024. Consequently, the removal of the unstable rock masses postponed into the rainy season, and on June 29, 2024, a slope failure occurred due to continuous rainfall. Under this situation, AMDC is conducting a geological survey with support from UNAH for revised countermeasure works.



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2-3 Action to be taken

JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer for supervision.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Honduras, etc.)

1) JET continuously provide technical support, including supervision assistance until October 2025, to ensure a smooth implementation process, as outlined below.

- Advise on the procedures and schedules, ensuring that the highest risk works of collapse should not be carried out during the rainy season but should be completed during the dry season.
- Provide technical advice and documents summarizing the tasks, schedule, technical considerations for the supervision related to the construction of the remaining countermeasure works, and the plans for post-construction maintenance and monitoring.

2) After October 2025, AMDC will take full responsibility for supervision based on the technology and knowledge it has acquired from JET.

3 Modification of the Project Implementation Plan

3-1 PO

None.

3-2 Other modifications on detailed implementation plan

None.

4 Preparation of Gov. of Honduras toward after completion of the Project

None.

II. Project Monitoring Sheet I & II as Attached

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Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District¹

Implementing Agency: The Central District Municipal Government (AMDC), National Disaster Prevention Committee (COPECO), National Autonomous University of Honduras (UNAH)

Project Period: 2019 to 2025 (about 6 years and 10 months)

Project Site: The Central District


Version: 10.0
Dated: March 31, 2025

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Necessary actions for control and mitigation for slope disaster risks in the -Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District (the Action Plan) ² .	<ul style="list-style-type: none"> Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan. 2 countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within 3 years after the project completion. The newly created land use regulation for special regime zones in Central District based on the Action Plan. 	<ul style="list-style-type: none"> Statistical data managed by AMDC List of implemented countermeasure projects for slope disasters risks Land use regulation for special regime zones for slope disasters risks issued by AMDC 		(future activity)	
Project Purpose					
Capacity to manage slope disasters in the Central District is improved.	1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.* ³	1. Pilot project review report(s) (including an evaluation of completed construction projects by counterparts) prepared by JICA experts	<ul style="list-style-type: none"> The level of importance given to control and mitigation of slope disaster risks by AMDC and the Government of Honduras stays high. AMDC has access to the equipment and tools owned by UNAH. 	The original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, will not be completed by December 2025, the end of the Project (JICA has extended the Project for two (2) years). JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer	

¹ Slope disaster means disasters caused by phenomena of slope movements in Spanish.

² The Action Plan includes 1) project priorities of area selected by the Project and 2) the AMDC's plan to disseminate the outcomes of the Project.

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				for supervision. Footnote *3 is added into the PDM.	
	2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.	2. Document on "Action Plan for Risk Reduction for Slope Disasters in the Central District"		Action Plan and Operational Plan were completed.	
Outputs					
1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced. A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared. 	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites JICA project monitoring report Manual for investigation and analyzing small/medium size slope disaster risk sites 	<ul style="list-style-type: none"> The key counterparts are assigned during the project period AMDC has access to the equipment and tools owned by UNAH. 	The report was completed.	
2. Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.	<ul style="list-style-type: none"> 4 structural measures for small/medium size slope disaster risks are constructed. *3 	<ul style="list-style-type: none"> Project designs of 4 structural measures for small/medium size slopes JICA project monitoring report 4 structural measures at pilot sites Manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk 	<ul style="list-style-type: none"> In the pilot site and its surroundings, significant disasters with large-scale topographical alterations does NOT happen during the period from the survey until the countermeasure construction. *3 	<p>As for La Guillen and Nueva Santa Rosa, JET had advised AMDC to commence construction in November 2024 to ensure the completion of high risk parts of the works before the rainy season, by May 2025. However, AMDC <u>wanted to</u> implements additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024. The additional retaining wall will be verified after the completion of the original works was cancelled. The original countermeasure construction is scheduled to commence in April 2025.</p> <p>For Villa Nueva, JET had advised AMDC to commence construction in November 2023 that the removal of the highest risk unstable rock masses be completed before the rainy season, by May 2024. However, the actual commencement of construction was significantly delayed until April 2024. Consequently, the removal of the unstable rock masses postponed into the rainy season, and on June 29, 2024, a slope</p>	



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	<ul style="list-style-type: none"> A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared. 			<p>failure occurred due to continuous rainfall. Under this situation, AMDC is conducting geological survey with support from UNAH for revised countermeasure works. The revised countermeasure construction after the slope failure is scheduled to commence in April 2025.</p> <p>As a result, the original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, will not be completed by December 2025, the end of the Project (JICA has extended the Project for two (2) years). JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer for supervision. Footnote *3 is added into the PDM.</p>	
3. Capacity to develop hazard and risk maps is enhanced	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created. A manual for hazard and risk mapping is prepared. 	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map Manual for hazard and risk mapping 		<p>The maps were completed.</p>	
4. Capacity to regulate land use for slope disasters is enhanced.	<ul style="list-style-type: none"> A draft land use regulation for slope disaster risk area for pilot special regime zones is created. Land use regulation maps for slope disasters for pilot special regime zones are created. 	<ul style="list-style-type: none"> A draft land use regulation for slope disasters for pilot special regime zones Land use regulation map for slope disasters for pilot special regime zones 		<p>The land use regulation was completed.</p> <p>The land use regulation maps were completed.</p>	

Activities	Input	Pre-condition
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<p>1.1. Identify and select pilot sites (2 small/medium-size landslides, 2 small/medium-size slope failures/rock falls, 2 large-size landslides) to implement structural measures on slope disasters.</p> <p>1.2. Prepare Work Plan for the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.3. Investigate the topographic conditions of the 4 small/medium-size slope disaster risk sites (generating geo spatial information for the terrain elevation model).</p> <p>1.4. Investigate the geophysical (elastic wave exploration, electrical exploration, and others) and mechanical (laboratory test and others) characteristics of the 4 small/medium-size slope disaster risk sites.</p> <p>1.5. Analyze and interpret the data from the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.6. Evaluate the vulnerability of the 4 small/medium-size slope disaster risks sites, including their surrounding areas.</p> <p>1.7. Define risk and characterize the risk zones of the 4 small/medium-size slope disaster risk sites.</p> <p>1.8. Prepare the conceptual proposals of design and inputs required for the structural measures in the Output 2 for the 4 small/medium-size slope disaster risk sites.</p> <p>1.9. Systematize the mechanism and the procedure applied in the characterization process of the 4 pilot small/medium-size slope disaster risk sites.</p> <p>1.10. Prepare project concepts of the 2 large-sized slope disaster risk sites selected in activity 1.1 for future projects.</p> <p>1.11. Prepare a manual for investigating and analyzing small/medium size slope disasters risk sites based on activities 1.1 – 1.9.</p> <p>1.12. Provide training course, seminar, or/and conference to share the manual produced by the Project.</p> <p>1.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Japanese Side</u></p> <p>1. Experts</p> <ol style="list-style-type: none"> 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Slope disaster hazard evaluation 6) GIS mapping 7) Land use regulation 8) Coordinator <p>2. Training in Japan</p> <ul style="list-style-type: none"> • Training on Slope Disaster Risk Reduction <p>3. Procurement of Equipment</p> <ul style="list-style-type: none"> • Digital Terrain Model 	<p>Working members are assigned.</p>
<p>2.1. Design structural measure works at the 4 small/medium-size slope disaster risk sites based on the data provided by the Output 1.</p> <p>2.2. Organize applicability of structural measure methods for different slope disasters.</p> <p>2.3. Conduct the environmental impact/social assessment.</p> <p>2.4. Assign budget items for the investment for 2 small/medium structural measures conducted by AMDC</p> <p>2.5. Develop bidding documents (technical specification, calculation reports, cost estimation, and estimation of material needed and budget).</p> <p>2.6. Conduct bidding and award process</p> <p>2.7. Make contracts with subcontractors selected in the procurement process to implement the structural measure works.</p> <p>2.8. Implement and supervise structural measure works.</p> <p>2.9. Prepare a monitoring and maintenance plan.</p> <p>2.10. Conduct monitoring and maintenance of the structural measure works.</p> <p>2.11. Prepare a manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk sites based on activities 2.1 – 2.10.</p> <p>2.12. Provide training course, seminar, or/and conference to share the manual and experience produced by the Project</p> <p>2.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Honduras Side</u></p> <p>1. Counterpart Personnel:</p> <ul style="list-style-type: none"> • Project Director (Mayor of AMDC) • Project Manager (Coordinator of UMGIR) • WG members for Output 1 • WG members for Output 2 • WG members for Output 3 • WG members for Output 4 <p>2. Working Space and Facilities for JICA Experts at:</p> <ul style="list-style-type: none"> • UMGIR • UNAH <p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects 	<p><u>Issues and Countermeasures</u></p>
<p>3.1. Review slope disaster risk related maps and related information</p> <p>3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map</p> <p>3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.</p> <p>3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.</p> <p>3.5. Collect the existing geo-spatial data in the pilot area.</p> <p>3.6. Analyze the geo-spatial data in the pilot area.</p>	<p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects 	<p><u>Issues and Countermeasures</u></p>

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<p>3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.</p> <p>3.8. Define the level of slope disaster hazard and risks in the pilot area.</p> <p>3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.</p> <p>3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 – 3.9.</p> <p>3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.</p> <p>3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>		
<p>4.1. Review the current approach and information on the land use regulation</p> <p>4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.</p> <p>4.3. Select pilot special regime zones to develop a proposal of land use regulation.</p> <p>4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.</p> <p>4.5. Elaborate draft regulations for land use on the pilot special regime zones.</p> <p>4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.</p> <p>4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District</p> <p>4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 – 4.6.</p> <p>4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.</p> <p>4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>		

*3: Large-scale landslide disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. Even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that the Project Objective and Output 2 have sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans. The Important Assumption "Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period" has been invalidated.

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MINUTES OF MEETING
ON NINTH AND FINAL JOINT COORDINATION COMMITTEE FOR
PROJECT FOR CONTROL AND MITIGATION OF SLOPE DISASTERS
IN THE CENTRAL DISTRICT IN REPUBLIC OF HONDURAS

The Ninth and Final Joint Coordination Committee (hereinafter referred to as “JCC”) was held with the participation of the Japan International Cooperation Agency (hereinafter referred to as “JICA”), JICA Expert Team (hereinafter referred to as “JET”), the Municipal Government of the Central District (hereinafter referred to as “AMDC”), Secretary of State in the Offices of Risk Management and National Contingencies (hereinafter referred to as “COPECO”), and the National Autonomous University of Honduras (hereinafter referred to as “UNAH”) for the Project for Control and Mitigation of Slope Disasters in the Central District in Republic of Honduras (hereinafter referred to as “the Project”)

As a result of discussions at this Joint Coordination Committee, all parties agreed to the matters described on the attached sheets.

Tegucigalpa, XX XX, 2025

Dr. KUWANO Takeshi

Team Leader
The Expert Team
Japan International Cooperation Agency

Mr. Jorge ALDANA

Mayor
Municipal Government of the Central District

Mr. KADOYA Atsunori

Chief Representative
Japan International Cooperation Agency
Honduras Office

Mr. Jose Jorge FORTIN

Vice Admiral Minister
Secretary of State in the Offices of Risk
Management and National Contingencies

Dr. Javier LOPEZ

Vice Rector in International Affairs
National Autonomous University of Honduras

THE ATTACHMED DOCUMENTS

I. Agreements Regarding Project Progress

<Common Understanding on AMDC's Construction for Countermeasure Works>

Large-scale slope disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. The Important Assumption in the Project Design Matrix (hereinafter referred to as "PDM") "Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period" has been invalidated.

All the parties agreed at the 8th JCC held in March 2025 and signed the minutes, confirming that the essential purpose of the Project is to enhance the understanding of the AMDC, COPECO and UNAH on slope disaster risk reduction against landslides, slope failures, and rockfalls through the process of (i) monitoring, (ii) analysis and diagnosis, and (iii) countermeasure planning. Through the activities implemented under Outputs 1 and 2, the AMDC, COPECO and UNAH have acquired these technical skills in slope disaster management, and therefore it can be concluded that the fundamental purpose of the Project has been achieved. Furthermore, it was recognized that even in case that the structural measures in both pilot sites are not completed within the Project period, it is interpreted that the Project Objective and Output 2 in the PDM have sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans.

Under the structure of the Project, AMDC is responsible for implementing the countermeasure works for the landslide in Nueva Santa Rosa and La Guillen, as well as the slope failure and rockfall in Villa Nueva, utilizing the knowledge transferred from JET through the pilot activities in Campo Cielo and Fuerzas Unidas. In doing so, AMDC is required to carry out the works with due consideration for safety, avoiding the rainy season considering the extremely high risks associated with construction during that period.

However, more importantly, there are a variety of countermeasures to reducing slope disaster risk and the Honduran side understand that there are more rooms to be improved for a better slope

disaster risk reduction.

Following the explanation of the Project progress from March 2025 to September 2025.

(1) Output 1 (Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened)

(a): Nueva Santa Rosa and La Guillén

The design of the countermeasure works was completed in 2024, and no new geological investigations have been carried out. AMDC continues to conduct regular monitoring. Since many of the buried monitoring instruments were damaged due to the activation of the landslide, simplified manual monitoring has been introduced as a substitute.

The monitoring results are reviewed in monthly online meetings between AMDC and JET, during which the movement of the landslide is analyzed and evaluated. These results have confirmed a correlation between landslide activity, rainfall, and fluctuations in the groundwater level, indicating that landslide activity in the area is still ongoing.

(b): Villa Nueva

To carry out a technical verification of AMDC's design, JET requested the analysis data used in the geological investigation report. In response, AMDC, with support from the Faculty of Engineering at UNAH, carried out laboratory tests on geological samples and conducted the verification based on the test results for the design work in Villa Nueva.

This allowed JET to conduct a stability evaluation, which concluded that the likelihood of a slope failure of the same scale as the previous disaster is currently quite low. At the same time, weathering of the slope has produced soil material and visible open cracks, meaning that the possibility of shallow failures cannot be ruled out. Accordingly, JET proposed removing unstable surface soil masses, noting that the removal of small rock fragments would be feasible.

(c): Campo Cielo

Three years have passed since the completion of the countermeasure works. During this period, monthly monitoring was carried out, which confirmed that the groundwater level had decreased to the planned level, and no landslide activity has been observed for three years.

Based on these results, the monitoring frequency was revised to twice a year (before and after the rainy season). However, additional monitoring will be conducted as needed in the event of heavy rainfall, such as during hurricanes.

(d): Fuerzas Unidas

Three years have passed since the completion of the countermeasure works. During this period, no rockfall damage has occurred. The effectiveness of the countermeasures has been maintained as AMDC continues to carry out regular maintenance activities such as cleaning and repairs.

(2) Output 2 (Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced)

(a): Nueva Santa Rosa and La Guillén

Although the design of the countermeasure works was completed in June 2024, with collaborating between AMDC and JET, the initial construction order was issued only on September 16, 2025. The reasons for this delay are as follows.

JET had advised AMDC to commence construction from November 2024 to ensure the completion of critical parts of the works before the rainy season, by May 2025. However, AMDC expressed intention to additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024. The studies mentioned, as well as the design, were evaluated, revealing high costs for the additional countermeasure works at the site. These costs are not included in the budget. Additionally, AMDC evaluated the need for this additional retaining wall in a landslide-affected area located very close to the originally planned countermeasure works. As a result, although the design initiative has been undertaken, AMDC decided not to implement the additional retaining wall beyond the originally proposed countermeasure works and ultimately chose to proceed with only the original countermeasures works.

(b): Villa Nueva

The original construction work commenced in April 2024; however, due to the occurrence of a large-scale slope disaster in June 2024 due to the rainy season, the work was suspended, and a revised design became necessary. The revised design was proposal prepared by AMDC. JET carried out a technical verification of AMDC's design and provided technical advice including recommendations for improvement to AMDC in April 2025. The initial construction order was issued on September 16, 2025, AMDC, together with the local consultant and contractor, began revising the design to incorporate and implement the proposed recommendations.

(c): Common Items

After October 2025, AMDC will perform the supervision based on the technology and knowledge acquired from JET. To support AMDC in managing future works independently, JET and AMDC prepared a construction supervision plan outlining key points to be considered and provided guidance to AMDC. Based on this plan, AMDC held discussions with the contractor and consultant and formulated the construction plan. In addition, JET and AMDC have developed monitoring and maintenance plans for the pilot sites of the Project—Campo Cielo, Fuerzas Unidas, Nueva Santa Rosa & La Guillen, and Villa Nueva. A monitoring and maintenance manual was also prepared to facilitate technology transfer. Furthermore, a technical seminar was conducted to support the implementation of these plans.

II. Project Evaluation and Action Plan

(1) Project Evaluation

In the Project, four Outputs transferred to AMDC, UNAH, and COPECO, with the Objectively Verifiable Indicators for each Output as stipulated in the PDM, are presented below. As indicated, the technology transfer for each Output has been sufficiently achieved.

Output 1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.

[Objectively Verifiable Indicator]

1-1 Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced: Achieved.

1-2 A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared: Achieved.

Output 2. Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.

[Objectively Verifiable Indicator]

2-1. Four structural measures for small/medium size slope disaster risks are constructed: Achieved.

* At the 8th JCC in March 2025, all parties agreed, confirming that AMDC, COPECO, and UNAH have gained essential skills in slope disaster management, and thus the fundamental purpose of the Project has been achieved. It was also confirmed that even if the structural measures are not completed within the Project period, Output 2 have met the indicators through technical transfer and planning.

2-2 A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared: Achieved.

Output 3. Capacity to develop hazard and risk maps is enhanced.

[Objectively Verifiable Indicator]

3-1. The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created: Achieved.

3-2 A manual for hazard and risk mapping is prepared: Achieved.

Output 4. Capacity to regulate land use for slope disasters is enhanced.

[Objectively Verifiable Indicator]

4-1. A draft land use regulation for slope disaster risk area for pilot special regime zones is created: Achieved.

4-2. Land use regulation maps for slope disasters for pilot special regime zones are created: Achieved.

The Project Purpose, with the Objectively Verifiable Indicators as stipulated in the PDM, is presented below. Based on the degree of achievement and the actual results of the technology transfer of the aforementioned four outputs, the Project Purpose has also been sufficiently achieved.

Project Purpose: Capacity to manage slope disasters in the Central District is improved.

[Objectively Verifiable Indicator]

1. Two pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC: Achieved.

* At the 8th JCC in March 2025, all parties agreed, confirming that AMDC, COPECO, and UNAH have gained essential skills in slope disaster management, and thus the fundamental purpose of the Project has been achieved. It was also confirmed that even if the structural measures are not completed within the Project period, the Project Objective have met the indicators through technical transfer and planning.

2. “Action Plan for Risk Reduction for Slope Disasters in the Central District” is created: Achieved.

(2) Construction Completion Actions for AMDC’s Pilot Sites: Nueva Santa Rosa (La Guillén) and Villa Nueva

(a): Nueva Santa Rosa and La Guillén

✓ Completion of early relocation and implementation of the relocation.

- ✓ Implementation of the countermeasure works based on the construction procedures proposed in the construction supervision plan prepared by JET and AMDC, which run in parallel with the resident relocation process.
- ✓ Close information sharing and collaboration with the department responsible for managing the resident relocation process during the execution of the countermeasure works.
- ✓ Continuous monitoring throughout the construction period, including groundwater level measurements, inclinometers in boreholes, and simple surface observations. Removed observation wells should be reinstalled at locations not affected by construction. After completion of the construction, monitoring will continue to confirm that the groundwater level has lowered to the target level.

(b): Villa Nueva

- ✓ Revised design for the technical verification report prepared by JET, as necessary.
- ✓ Preparation and execution of the construction supervision plan for the countermeasure works based on the revised design.
- ✓ Coordination and collaboration with the national road construction currently underway in the lower section of the construction site.
- ✓ Continuous monitoring throughout the construction period, Visual monitoring before and after heavy rainfall.

(3) Actions to Accomplish the Overall Goal in the Project

In the Project, the Overall Goal and their indicators, which are expected to be achieved within 3 years after the Project completion, are established as follows. To achieve the goal, activities to be jointly carried out by AMDC, COPECO, and UNAH in collaboration are proposed.

Overall Goal: Necessary actions for control and mitigation for slope disaster risks in the Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District.

[Objectively Verifiable Indicator]

1. Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan.
2. Two countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within three years after the Project completion.
3. The newly created land use regulation for special regime zones in Central District based on the Action Plan.

(a): Selecting high-priority sites for countermeasure works other than the constructed pilot sites in the Project, by AMDC supported with UNAH.

In addition to the Suazo Cordova Landslide, where AMDC has already completed a geological investigation and is carrying out monitoring such as two sets of borehole inclinometers and groundwater level meters since June 2024, and the Reparto Arriba Landslide, where borehole investigations and installation of monitoring instruments such as three sets of borehole inclinometers and groundwater level meters are currently underway since September 2025, the Cerro Grande Landslide along the national road, the San Juan Rock Slope, and the Jose Angel Ulloa Landslide are also considered high-risk sites, in Reparto, where the installation of monitoring instruments is about to begin, as well as in Altos de Loarque.

(b): Geological/geophysical surveys, installation of monitoring devices, and analysis in the selected high-priority sites for future countermeasure works, by AMDC supported with UNAH.

Monitoring in the Suazo Córdoba, Reparto Arriba, Cerro Grande, and José Angel Ulloa landslides should be continued and expanded, with the results to be analyzed and evaluated for the planning of appropriate countermeasures.

(c): Design for countermeasure works by AMDC supported with UNAH, The AMDC prioritizes the high-priority sites selected for subsequent constructions.

The countermeasure design technology transferred through the Project is being disseminated within AMDC, enabling independent design implementation by AMDC supported with UNAH. Regarding landslides, it is urgent for AMDC to be able to independently carry out the design of horizontal drainage boring. To achieve this, it is important that AMDC engineers who have received technical transfer under the Project take the lead in applying design training to the various landslide sites indicated in above mentioned at the (a) paragraph, while transferring knowledge to other AMDC engineers through repeated training sessions. It is also highly recommended to leverage the expertise and experience of the private design companies and the private geological survey companies that were jointly involved in conducting horizontal drainage borings for the Project. In addition, the design and supervision manuals, as well as the construction supervision plan provided through the Project, are being utilized.

(d): Implementation of land use regulations in newly established special regime zones: AMDC for the Central District and COPECO for nationwide coverage

The special regime zones are determined based on the hazard maps developed under Output 3; therefore, it is first necessary to expand and refine these hazard maps in the Central District

and in regional cities at risk of slope disasters. Land use regulations are then established according to the hazard levels identified in the maps. At this stage, AMDC and COPECO engineers who have received technical transfer under the Project should serve as instructors to conduct training for AMDC and COPECO engineers to enhance understanding of the regulations and strengthen operational capacity, to promote understanding among residents inside and outside the regulated zones through regular information-sharing and consultation sessions, and to prepare relocation support plans and develop relocation sites to assist residents in high-hazard areas. Furthermore, after the regulations are enforced, it will be necessary to establish a monitoring system for the regulated zones.

Annex-1: List of members who attended the Joint Coordination Committee

Annex-2: Project Design Matrix ver.6

Annex-3: Monitoring sheet ver.11

Annex-4: Statement of Notification of Intentions

<HONDURAS SIDE >

Municipal Government of the Central District (AMDC)

Jorge Aldana (Mayor)

Rosa Irene Villela (Manager, Legal Services)

Adolfo Lagos (Manager, Construction Control)

Darwin Martínez (Manager, Risk Assessment)

Ingrid Flores (Coordinator, Integrated Municipal Risk Unit)

Roberto Granados (Risk Officer, Integrated Municipal Risk Unit)

Mariela Suazo (Risk Analyzer, Integrated Municipal Risk Unit)

Claudia Turcios (Assistant, Land use Regulation Directorate)

Secretary of State in the Offices of Risk Management and National Contingencies (COPECO)

Wilmer Edgardo López (Chief, Prevention Management)

National Autonomous University of Honduras (UNAH)

Javier López Padilla (Vice-Rector, Vice-Rectorate for International Affairs)

Bryan Larios (Dean, Science Faculty)

Lidia Torres Bernhard (Searcher, Institute of Earth Sciences)

<JAPANESE SIDE>

JICA Honduras Office

KADOYA Atsunori (Chief Representative)

YOKOO Koji (Head of Technical and Financial Cooperation)

Cinthia Rodríguez (Program Officer)

JICA Expert Team

KUWANO Takeshi (Team Leader /Slope Disaster Risk Analysis)

Vilma Mejía (Project Assistant)

Project Design Matrix (PDM)

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District¹

Project Period: From February 2019 to December 2025 (about 6 years and 10 months)

Zone Identified for the Project (Project Target Area): The Central District

Counterpart The Central District Municipal Government (AMDC), National Disaster Prevention Committee (COPECO), National Autonomous University of Honduras (UNAH)

Date: March 26, 2025

Version: 6.0

Definition of slope disasters in the Project: landslide, slope failure, and rock fall

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal			
Necessary actions for control and mitigation for slope disaster risks in the -Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District (the Action Plan) ²	<ul style="list-style-type: none"> Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan. 2 countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within 3 years after the project completion. The newly created land use regulation for special regime zones in Central District based on the Action Plan. 	<ul style="list-style-type: none"> Statistical data managed by AMDC List of implemented countermeasure projects for slope disasters risks Land use regulation for special regime zones for slope disasters risks issued by AMDC 	
Project Purpose			
Capacity to manage slope disasters in the Central District is improved	<ol style="list-style-type: none"> 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC. *3 "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created. 	<ul style="list-style-type: none"> Pilot project review report(s) (including an evaluation of completed construction projects by counterparts) prepared by JICA experts Document on "Action Plan for Risk Reduction for Slope Disasters in the Central District" 	<ul style="list-style-type: none"> The level of importance given to control and mitigation of slope disaster risks by AMDC and the Government of Honduras stays high. AMDC has access to the equipment and tools owned by UNAH.
Outputs			
1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened	<ol style="list-style-type: none"> 1-1 Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced. 1-2 A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared. 	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites JICA project monitoring report Manual for investigation and analyzing small/medium size slope disaster risk sites 	<ul style="list-style-type: none"> The key counterparts are assigned during the project period AMDC has access to the equipment and tools owned by UNAH. In the pilot site and its surroundings, significant disasters with large-scale topographical alterations does NOT happen during the period from the survey until the countermeasure construction. *3
2. Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced	<ol style="list-style-type: none"> 2-1. 4 structural measures for small/medium size slope disaster risks are constructed. *3 2-2 A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared. 	<ul style="list-style-type: none"> Project designs of 4 structural measures for small/medium size slopes JICA project monitoring report 4 structural measures at pilot sites Manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk 	
3. Capacity to develop hazard	3-1. The updated Slope Disaster Hazard Inventory Map and the	<ul style="list-style-type: none"> The updated Slope Disaster Hazard Inventory 	

¹ Slope disaster means disasters caused by phenomena of slope movements in Spanish.

² The Action Plan includes 1) project priorities of area selected by the Project and 2) the AMDC's plan to disseminate the outcomes of the Project.

and risk maps is enhanced	Multi-hazard Map are created. 3-2 A manual for hazard and risk mapping is prepared.	Map and the Multi-hazard Map • Manual for hazard and risk mapping	
4. Capacity to regulate land use for slope disasters is enhanced.	4-1. A draft land use regulation for slope disaster risk area for pilot special regime zones is created. 4-2. Land use regulation maps for slope disasters for pilot special regime zones are created.	• A draft land use regulation for slope disasters for pilot special regime zones • Land use regulation map for slope disasters for pilot special regime zones	

Activities	Input (under consideration)	Pre-condition
<p>1.1. Identify and select pilot sites (2 small/medium-size landslides, 2 small/medium-size slope failures/rock falls, 2 large-size landslides) to implement structural measures on slope disasters.</p> <p>1.2. Prepare Work Plan for the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.3. Investigate the topographic conditions of the 4 small/medium-size slope disaster risk sites (generating geo spatial information for the terrain elevation model).</p> <p>1.4. Investigate the geophysical (elastic wave exploration, electrical exploration, and others) and mechanical (laboratory test and others) characteristics of the 4 small/medium-size slope disaster risk sites.</p> <p>1.5. Analyze and interpret the data from the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.6. Evaluate the vulnerability of the 4 small/medium-size slope disaster risks sites, including their surrounding areas.</p> <p>1.7. Define risk and characterize the risk zones of the 4 small/medium-size slope disaster risk sites.</p> <p>1.8. Prepare the conceptual proposals of design and inputs required for the structural measures in the Output 2 for the 4 small/medium-size slope disaster risk sites.</p> <p>1.9. Systematize the mechanism and the procedure applied in the characterization process of the 4 pilot small/medium-size slope disaster risk sites.</p> <p>1.10. Prepare project concepts of the 2 large-sized slope disaster risk sites selected in activity 1.1 for future projects.</p> <p>1.11. Prepare a manual for investigating and analyzing small/medium size slope disasters risk sites based on activities 1.1 – 1.9.</p> <p>1.12. Provide training course, seminar, or/and conference to share the manual produced by the Project.</p> <p>1.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Japanese Side</u></p> <ol style="list-style-type: none"> 1. Experts <ul style="list-style-type: none"> 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Slope disaster hazard evaluation 6) GIS mapping 7) Land use regulation 8) Coordinator 2. Training in Japan <ul style="list-style-type: none"> • Training on Slope Disaster Risk Reduction 3. Procurement of Equipment <ul style="list-style-type: none"> • Digital Terrain Model 	Working members are assigned.
<p>2.1. Design structural measure works at the 4 small/medium-size slope disaster risk sites based on the data provided by the Output 1.</p> <p>2.2. Organize applicability of structural measure methods for different slope disasters.</p> <p>2.3. Conduct the environmental impact/social assessment.</p> <p>2.4. Assign budget items for the investment for 2 small/medium structural measures conducted by AMDC</p> <p>2.5. Develop bidding documents (technical specification, calculation reports, cost estimation, and estimation of material needed and budget).</p> <p>2.6. Conduct bidding and award process</p> <p>2.7. Make contracts with subcontractors selected in the procurement process to implement the structural measure works.</p> <p>2.8. Implement and supervise structural measure works.</p> <p>2.9. Prepare a monitoring and maintenance plan.</p> <p>2.10. Conduct monitoring and maintenance of the structural measure works.</p> <p>2.11. Prepare a manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk sites based on activities 2.1 – 2.10.</p> <p>2.12. Provide training course, seminar, or/and conference to share the manual and experience produced by the Project</p> <p>2.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Honduras Side</u></p> <ol style="list-style-type: none"> 1. Counterpart Personnel: <ul style="list-style-type: none"> • Project Director (Mayor of AMDC) • Project Manager (Coordinator of UMGIR) • WG members for Output 1 • WG members for Output 2 • WG members for Output 3 • WG members for Output 4 2. Working Space and Facilities for JICA Experts at: <ul style="list-style-type: none"> • UMGIR 	

<p>3.1. Review slope disaster risk related maps and related information</p> <p>3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map</p> <p>3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.</p> <p>3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.</p> <p>3.5. Collect the existing geo-spatial data in the pilot area.</p> <p>3.6. Analyze the geo-spatial data in the pilot area.</p> <p>3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.</p> <p>3.8. Define the level of slope disaster hazard and risks in the pilot area.</p> <p>3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.</p> <p>3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 – 3.9.</p> <p>3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.</p> <p>3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<ul style="list-style-type: none"> • UNAH <p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects 	<p><u>Issues and Countermeasures</u></p>
<p>4.1. Review the current approach and information on the land use regulation</p> <p>4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.</p> <p>4.3. Select pilot special regime zones to develop a proposal of land use regulation.</p> <p>4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.</p> <p>4.5. Elaborate draft regulations for land use on the pilot special regime zones.</p> <p>4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.</p> <p>4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District</p> <p>4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 – 4.6.</p> <p>4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.</p> <p>4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>		

*3: Large-scale landslide disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. Even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that the Project Objective and Output 2 have sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans. The Important Assumption “Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period” has been invalidated.

TO JICA HONDURAS OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District**Version of the Sheet: Ver.11.0 (Term: March 2025 – October 2025)****Name: Kuwano Takeshi****Title: Team leader****Submission Date: October 14, 2025**

I. Summary

1 Progress		
1-1 Progress of Inputs		
Inputs	Plan as of February 2019	Actual as of <u>October 2025</u>
Japanese Side Experts	Total PM: 54.80 PM 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Slope disaster hazard evaluation 6) GIS mapping 7) Land use regulation 8) Coordinator	78.22 PM (100 % of Total PM: 78.22) 1) Team leader 2) Geological investigation and analysis 3) Topographic survey 4) Structural measures 5) Construction Planning/Bid Supervision 6) Construction Supervision 7) Slope disaster hazard evaluation 8) GIS mapping 9) Land use regulation 10) Coordinator
Japanese Side Training (Japan, Third Countries)	• Training on Slope Disaster Risk Reduction	• Training on Slope Disaster Risk Reduction
Procurement of Equipment	• Digital Terrain Model	• Digital Terrain Model
Honduras Side	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects	(1) Counterpart Personnel: 1) Project Director (Mayor of AMDC) 2) Project Manager (Coordinator of UMGIR) 3) WG members for Output 1 4) WG members for Output 2 5) WG members for Output 3 6) WG members for Output 4 (2) Working Space and Facilities for JICA Experts at: • UMGIR • UNAH (3) Project Cost: • Local operation cost • Construction of 2 pilot projects

<p>1-2 Progress of Activities</p> <p>Progress of activities is indicated in Monitoring Sheet Form 3-2 (PDM) and Form 3-3 (PO).</p>			
<p>1-3 Achievement of Output</p>			
Output/indicators	Achievement (%)		Major results
	Plan	Actual	
<p>Output 1: Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.</p>			
Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced.	100	100	The report was completed.
A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared.	100	100	The manual was completed.
<p>Output 2: Capacity to design, construct, supervise, and maintain structural measures for small/medium size slope disaster risk is enhanced.</p>			
4 structural measures for small/medium size slope disaster risks are constructed.	100	100	<p>Large-scale slope disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. The Important Assumption in the PDM has been invalidated. All the parties agreed at the 8th JCC held in March 2025 and signed the minutes, confirming that the essential purpose of the Project is to enhance the understanding of the AMDC, COPECO and UNAH on slope disaster risk reduction against landslides, slope failures, and rockfalls through the process of (i) monitoring, (ii) analysis and diagnosis, and (iii) countermeasure planning. Through the activities implemented under Outputs 1 and 2, the AMDC, COPECO and UNAH have acquired these technical skills in slope disaster management, and therefore it can be concluded that the fundamental purpose of the Project has been achieved. Furthermore, it was recognized that even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that the Project Objective in the PDM has sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and</p>

PM Form 3-1 Monitoring Sheet Summary

			maintenance of structural measures, as well as formulating relevant plans.
A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared.	100	100	The manual was completed.
Output 3: Capacity to develop hazard and risk maps is enhanced.			
The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created.	100	100	The maps were completed.
A manual for hazard and risk mapping is prepared.	100	100	The manual was completed.
Output 4: Capacity to regulate land use for slope disasters is enhanced.			
A draft land use regulation for slope disaster risk area for pilot special regime zones is created.	100	100	The land use regulation was completed.
Land use regulation maps for slope disasters for pilot special regime zones are created.	100	100	The land use regulation maps were completed.
1-4 Achievement of the Project Purpose			
Project purpose/indicators	Achievement (%)	Situation	
Project purpose: Capacity to manage slope disasters in the Central District is improved.			
1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.	100	As mentioned in the Output 2 above, the essential purpose of the Project is to enhance the understanding of the AMDC, COPEO and UNAH on slope disaster risk reduction against landslides, slope failures, and rockfalls through the process of (i) monitoring, (ii) analysis and diagnosis, and (iii) countermeasure planning. Through the activities implemented under Outputs 1 and 2, the AMDC, COPECO and UNAH have acquired these technical skills in slope disaster management, and therefore it can be concluded that the fundamental purpose of the Project has been achieved. Furthermore, it was recognized that even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that Output 2 in the PDM has sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans.	
2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.	100	Action Plan for each Output and the Integrated Action Plan were completed.	

1-5 Changes of Risks and Actions for Mitigation

None.

1-6 Progress of Actions undertaken by JICA

None.

1-7 Progress of Actions undertaken by Gov. of Honduras

None.

1-8 Progress of Environmental and Social Considerations (if applicable)

None.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

None.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

The countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, was commenced in October 2025 and will not be completed by December 2025, the end of the Project though JICA has extended the Project for two (2) years.

2-2 Cause

As for La Guillen and Nueva Santa Rosa, JET had advised AMDC to commence construction in November 2024 to ensure the completion of high-risk parts of the works before the rainy season, by May 2025. However, AMDC wanted to implement additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024.

For Villa Nueva, JET had advised AMDC to commence construction in November 2023 that the removal of the highest risk unstable rock masses be completed before the rainy season, by May 2024. However, the actual commencement of construction was significantly delayed until April

2024. Consequently, the removal of the unstable rock masses postponed into the rainy season, and on June 29, 2024, a slope failure occurred due to continuous rainfall.

2-3 Action to be taken

After October 2025, AMDC will perform the supervision for the construction works based on the technology and knowledge acquired from JET. To support AMDC in managing future works independently, JET and AMDC prepared a construction supervision plan outlining key points to be considered and provided guidance to AMDC. Based on this plan, AMDC held discussions with the contractor and consultant and formulated the construction plan. In addition, JET and AMDC have develop monitoring and maintenance plans for the pilot sites of the Project—Campo Cielo, Fuerzas Unidas, Nueva Santa Rosa & La Guillen, and Villa Nueva. A monitoring and maintenance manual was also prepared to facilitate technology transfer.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Honduras, etc.)

AMDC is responsible for promptly implementing the countermeasure works for the landslide in Nueva Santa Rosa and La Guillen, as well as the slope failure and rockfall in Villa Nueva, utilizing the knowledge transferred from JET through the pilot activities in Campo Cielo and Fuerzas Unidas. In doing so, AMDC is required to carry out the works with due consideration for safety, avoiding the rainy season in light of the extremely high risks associated with construction during that period.

3 Modification of the Project Implementation Plan

3-1 PO

None.

3-2 Other modifications on detailed implementation plan

None.

4 Preparation of Gov. of Honduras toward after completion of the Project

None.

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Control and Mitigation of Slope Disasters in the Central District¹

Implementing Agency: The Central District Municipal Government (AMDC), National Disaster Prevention Committee (COPECO), National Autonomous University of Honduras (UNAH)

Project Period: 2019 to 2025 (about 6 years and 10 months)

Project Site: The Central District

Version: 11.0
Dated: October 14, 2025

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Necessary actions for control and mitigation for slope disaster risks in the -Central District will be undertaken based on the Action Plan for Risk Reduction for Slope Disasters in the Central District (the Action Plan) ² .	<ul style="list-style-type: none"> Number of people living under slope disaster risks is reduced by implementing countermeasures based on the Action Plan. 2 countermeasures for slope disasters risks in accordance with the Action Plan are undertaken within 3 years after the project completion. The newly created land use regulation for special regime zones in Central District based on the Action Plan. 	<ul style="list-style-type: none"> Statistical data managed by AMDC List of implemented countermeasure projects for slope disasters risks Land use regulation for special regime zones for slope disasters risks issued by AMDC 		(future activity)	
Project Purpose					
Capacity to manage slope disasters in the Central District is improved.	1. 2 pilot structural measures for small/medium size slope disasters are financed and constructed by AMDC.* ³	1. Pilot project review report(s) (including an evaluation of completed construction projects by counterparts) prepared by JICA experts	<ul style="list-style-type: none"> The level of importance given to control and mitigation of slope disaster risks by AMDC and the Government of Honduras stays high. AMDC has access to the equipment and tools owned by UNAH. 	Large-scale slope disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. The Important Assumption in the	

¹ Slope disaster means disasters caused by phenomena of slope movements in Spanish.

² The Action Plan includes 1) project priorities of area selected by the Project and 2) the AMDC's plan to disseminate the outcomes of the Project.

				<p>PDM has been invalidated. *3</p> <p>All the parties agreed at the 8th JCC held in March 2025 and signed the minutes, confirming that the essential purpose of the Project is to enhance the understanding of the AMDC, COPECO and UNAH on slope disaster risk reduction against landslides, slope failures, and rockfalls through the process of (i) monitoring, (ii) analysis and diagnosis, and (iii) countermeasure planning. Through the activities implemented under Outputs 1 and 2, the AMDC, COPECO and UNAH have acquired these technical skills in slope disaster management, and therefore it can be concluded that the fundamental purpose of the Project has been achieved. Furthermore, it was recognized that even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that the Project Objective in the PDM has sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans.</p>	
	2. "Action Plan for Risk Reduction for Slope Disasters in the Central District" is created.	2. Document on "Action Plan for Risk Reduction for Slope Disasters in the Central District"		Action Plan and Operational Plan were completed.	
Outputs					
1. Capacity to conduct detailed investigation and analysis to identify and characterize slope disaster phenomena is strengthened.	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites is produced. A manual for investigating and analyzing small/medium size slope disaster risk sites is prepared. 	<ul style="list-style-type: none"> Report on detailed investigation and analysis to identify slope disaster risks of pilot sites JICA project monitoring report Manual for investigation and analyzing small/medium size slope disaster risk sites 	<ul style="list-style-type: none"> The key counterparts are assigned during the project period AMDC has access to the equipment and tools owned by UNAH. 	<p>The report was completed.</p> <p>The manual was completed.</p>	
2. Capacity to design, construct, supervise, and	<ul style="list-style-type: none"> 4 structural measures for small/medium size slope disaster risks are constructed. *3 	<ul style="list-style-type: none"> Project designs of 4 structural measures for small/medium size slopes 	<ul style="list-style-type: none"> In the pilot site and its surroundings, significant disasters 	<p>As mentioned in the Project Objective above, the essential purpose of the Project is to enhance the understanding of the AMDC,</p>	

maintain structural measures for small/medium size slope disaster risk is enhanced.		<ul style="list-style-type: none"> • JICA project monitoring report • 4 structural measures at pilot sites • Manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk 	with large-scale topographical alterations does NOT happen during the period from the survey until the countermeasure construction. *3	<p>COPECO and UNAH on slope disaster risk reduction against landslides, slope failures, and rockfalls through the process of (i) monitoring, (ii) analysis and diagnosis, and (iii) countermeasure planning. Through the activities implemented under Outputs 1 and 2, the AMDC, COPECO and UNAH have acquired these technical skills in slope disaster management, and therefore it can be concluded that the fundamental purpose of the Project has been achieved. Furthermore, it was recognized that even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that Output 2 in the PDM has sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans.</p>	
	<ul style="list-style-type: none"> • A manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risks is prepared. 				
3. Capacity to develop hazard and risk maps is enhanced	<ul style="list-style-type: none"> • The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map are created. 	<ul style="list-style-type: none"> • The updated Slope Disaster Hazard Inventory Map and the Multi-hazard Map • Manual for hazard and risk mapping 			
	<ul style="list-style-type: none"> • A manual for hazard and risk mapping is prepared. 				
4. Capacity to regulate land use for slope disasters is enhanced.	<ul style="list-style-type: none"> • A draft land use regulation for slope disaster risk area for pilot special regime zones is created. 	<ul style="list-style-type: none"> • A draft land use regulation for slope disasters for pilot special regime zones • Land use regulation map for slope disasters for pilot special regime zones 			
	<ul style="list-style-type: none"> • Land use regulation maps for slope disasters for pilot special regime zones are created. 				

Activities	Input	Pre-condition
1.1. Identify and select pilot sites (2 small/medium-size landslides, 2 small/medium-size slope failures/rock falls, 2 large-size landslides) to implement structural measures on slope disasters.	<u>Input: Japanese Side</u> 1. Experts 1) Team leader 2) Geological investigation and	Working members are assigned.
1.2. Prepare Work Plan for the investigation of the 4 small/medium-size slope disaster risk sites.		
1.3. Investigate the topographic conditions of the 4 small/medium-size slope disaster risk sites (generating geo spatial		

<p>information for the terrain elevation model).</p> <p>1.4. Investigate the geophysical (elastic wave exploration, electrical exploration, and others) and mechanical (laboratory test and others) characteristics of the 4 small/medium-size slope disaster risk sites.</p> <p>1.5. Analyze and interpret the data from the investigation of the 4 small/medium-size slope disaster risk sites.</p> <p>1.6. Evaluate the vulnerability of the 4 small/medium-size slope disaster risks sites, including their surrounding areas.</p> <p>1.7. Define risk and characterize the risk zones of the 4 small/medium-size slope disaster risk sites.</p> <p>1.8. Prepare the conceptual proposals of design and inputs required for the structural measures in the Output 2 for the 4 small/medium-size slope disaster risk sites.</p> <p>1.9. Systematize the mechanism and the procedure applied in the characterization process of the 4 pilot small/medium-size slope disaster risk sites.</p> <p>1.10. Prepare project concepts of the 2 large-sized slope disaster risk sites selected in activity 1.1 for future projects.</p> <p>1.11. Prepare a manual for investigating and analyzing small/medium size slope disasters risk sites based on activities 1.1 – 1.9.</p> <p>1.12. Provide training course, seminar, or/and conference to share the manual produced by the Project.</p> <p>1.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p>analysis</p> <p>3) Topographic survey</p> <p>4) Structural measures</p> <p>5) Slope disaster hazard evaluation</p> <p>6) GIS mapping</p> <p>7) Land use regulation</p> <p>8) Coordinator</p> <p>2. Training in Japan</p> <ul style="list-style-type: none"> • Training on Slope Disaster Risk Reduction <p>3. Procurement of Equipment</p> <ul style="list-style-type: none"> • Digital Terrain Model 	
<p>2.1. Design structural measure works at the 4 small/medium-size slope disaster risk sites based on the data provided by the Output 1.</p> <p>2.2. Organize applicability of structural measure methods for different slope disasters.</p> <p>2.3. Conduct the environmental impact/social assessment.</p> <p>2.4. Assign budget items for the investment for 2 small/medium structural measures conducted by AMDC</p> <p>2.5. Develop bidding documents (technical specification, calculation reports, cost estimation, and estimation of material needed and budget).</p> <p>2.6. Conduct bidding and award process</p> <p>2.7. Make contracts with subcontractors selected in the procurement process to implement the structural measure works.</p> <p>2.8. Implement and supervise structural measure works.</p> <p>2.9. Prepare a monitoring and maintenance plan.</p> <p>2.10. Conduct monitoring and maintenance of the structural measure works.</p> <p>2.11. Prepare a manual for designing, procuring, constructing, and maintaining small/medium size slope disaster risk sites based on activities 2.1 – 2.10.</p> <p>2.12. Provide training course, seminar, or/and conference to share the manual and experience produced by the Project</p> <p>2.13. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>	<p><u>Input: Honduras Side</u></p> <p>1. Counterpart Personnel:</p> <ul style="list-style-type: none"> • Project Director (Mayor of AMDC) • Project Manager (Coordinator of UMGIR) • WG members for Output 1 • WG members for Output 2 • WG members for Output 3 • WG members for Output 4 <p>2. Working Space and Facilities for JICA Experts at:</p> <ul style="list-style-type: none"> • UMGIR • UNAH <p>3. Project Cost:</p> <ul style="list-style-type: none"> • Local operation cost • Construction of 2 pilot projects 	
<p>3.1. Review slope disaster risk related maps and related information</p> <p>3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map</p> <p>3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.</p> <p>3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.</p> <p>3.5. Collect the existing geo-spatial data in the pilot area.</p> <p>3.6. Analyze the geo-spatial data in the pilot area.</p> <p>3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.</p> <p>3.8. Define the level of slope disaster hazard and risks in the pilot area.</p> <p>3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.</p>		<p><u>Issues and Countermeasures</u></p>

<p>3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 – 3.9.</p> <p>3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.</p> <p>3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>		
<p>4.1. Review the current approach and information on the land use regulation</p> <p>4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.</p> <p>4.3. Select pilot special regime zones to develop a proposal of land use regulation.</p> <p>4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.</p> <p>4.5. Elaborate draft regulations for land use on the pilot special regime zones.</p> <p>4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.</p> <p>4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District</p> <p>4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 – 4.6.</p> <p>4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.</p> <p>4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas</p>		

*3: Large-scale landslide disaster occurred in September 2022 in La Guillen, adjacent to Nueva Santa Rosa, and in June 2024 in Villa Nueva, both of the two pilot sites for structural measures financed and constructed by AMDC. The Project period has been extended by two years until December 2025 due to the need for further assessment of emergency work and subsequent amendments to the countermeasure plans and designs for both pilot sites. Even in case that the structural measures in both pilot sites are not completed within the project period, it is interpreted that the Project Objective and Output 2 have sufficiently achieved the Objectively Verifiable Indicators by carrying out technical transfer related to supervision and maintenance of structural measures, as well as formulating relevant plans. The Important Assumption “Significant disasters involving large-scale topographical alterations will NOT occur during the survey and construction period” has been invalidated.

Output 3:																																																															
3.1. Review slope disaster risk related maps and related information	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.2. Identify and select a pilot area to update the Slope Disaster Risk Hazard Inventory Map and the Multi-Hazard Map	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.3. Prepare check sheets for simple hazard/risk evaluation at field visits and organize the simple hazard/risk evaluation method.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.4. Investigate the slope disaster conditions at field visits with the check sheets in the pilot area.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.5. Collect the existing geo-spatial data in the pilot area.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.6. Analyze the geo-spatial data in the pilot area.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.7. Interpret the results of the field visits in activity 3.4 and the geo-spatial data analysis in activity 3.6.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.8. Define the level of slope disaster hazard and risks in the pilot area.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.9. Update the Slope Disaster Risk Hazard Inventory Map and Multi-Hazard Map in the pilot area for integrating SIMET based on the prioritization in activity 3.8.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.10. Prepare a manual for hazard and risk mapping based on activities 3.1 - 3.9.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.11. Provide training course, seminar, or/and conference to share the hazard map produced by the Project.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	
3.12. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas.	Plan	[Yellow bar]																																																												Completed.	
	Actual	[Brown bar]																																																												Completed.	

Output 4:																																																															
4.1. Review the current approach and information on the land use regulation	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.2. Define scope of work for land use regulation of special regime zones for slope disaster risks.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.3. Select pilot special regime zones to develop a proposal of land use regulation.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.4. Prepare technical materials based on Output 3 for explanation of land use regulation of the pilot special regime zones.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.5. Elaborate draft regulations for land use on the pilot special regime zones.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.6. Prepare land use regulation map indicating the zoning for the regulation on the pilot special regime zones.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.7. Submit the draft regulations and the draft land use regulation map to the Municipal Corporation of the Central District	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.8. Prepare a manual for land use regulation of slopes disaster based on activities 4.1 - 4.6.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.9. Provide training course, seminar, or/and conference to share the draft/approved regulation produced by the Project.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	
4.10. Prepare the Action Plan for Risk Reduction for Slope Disasters in prioritized areas.	Plan	[Blue bar]																																																												Completed.	
	Actual	[Dark blue bar]																																																												Completed.	

Monitoring Plan		2019												2020												2021												2022												2023												2024												2025												Issue	Solution
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
Monitoring																																																																																							
Joint Coordinating Committee	Plan	[Grey bar]																																																																																					
	Actual	[Red bar]																																																																																					
Submission of Monitoring Sheet	Plan	[Red bar]																																																																																					
	Actual	[Red bar]																																																																																					
Reports/Documents																																																																																							
Work Plan	Plan	[Red bar]																																																																																					
	Actual	[Red bar]																																																																																					
Progress Report	Plan	[Red bar]																																																																																					
	Actual	[Red bar]																																																																																					
Final Report	Plan	[Red bar]																																																																																					
	Actual	[Red bar]																																																																																					

The final JCC meeting is held in October 14, 2025.

Draft final report was submitted on October 2025.

Final report will be submitted on December 2025.

**STATEMENT OF NOTIFICATION OF INTENTIONS ON EIGHTH JOINT
COORDINATION COMMITTEE FOR
PROJECT FOR CONTROL AND MITIGATION OF SLOPE DISASTERS
IN THE CENTRAL DISTRICT IN REPUBLIC OF HONDURAS**

The Eighth Joint Coordination Committee (hereinafter referred to as “JCC”) was held with the participation of the Japan International Cooperation Agency (hereinafter referred to as “JICA”), JICA Expert Team (hereinafter referred to as “JET”), the Municipal Government of the Central District (hereinafter referred to as “AMDC”), Secretary of State in the Offices of Risk Management and National Contingencies (hereinafter referred to as “COPECO”), and the National Autonomous University of Honduras (hereinafter referred to as “UNAH”) for the Project for Control and Mitigation of Slope Disasters in the Central District in Republic of Honduras (hereinafter referred to as “the Project”) on March 27th, 2025

As a result of discussions on the countermeasure works in the pilot sites and the waiver of defects at this Joint Coordination Committee, AMDC, JICA and JET described the matters on the attached sheets in this statement of notification of intentions, which summarizes the situation as of March 2025.

Dr. KUWANO Takeshi

Team Leader

The Expert Team

Japan International Cooperation Agency

Mr. Jorge ALDANA

Mayor

Municipality of Central District

Mr. KADOYA Atsunori

Chief Representative

Japan International Cooperation Agency

Honduras Office

<Intention/Willings on AMDC's Design for Countermeasure Works>

In the Project, the four (4) pilot sites selected were Campo Cielo, Fuerzas Unidas, Nueva Santa Rosa (La Guillen), and Villa Nueva. It was agreed that JICA would be responsible for the survey, design, and construction of Campo Cielo and Fuerzas Unidas, while AMDC would be responsible for the those of Nueva Santa Rosa (La Guillen) and Villa Nueva. For the pilot sites managed by JICA, Campo Cielo and Fuerzas Unidas, the countermeasure works were completed as scheduled, and these sites are stable with no landslides. However, due to the reasons mentioned below, the original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, managed by AMDC, have not yet started as of March 2025.

For Nueva Santa Rosa and La Guillen, the detailed design of the original countermeasure works was completed in June 2024, with collaborating between AMDC and JET. JET had advised AMDC to commence construction since November 2024 to ensure the completion of critical parts of the works before the rainy season, by May 2025. However, AMDC expressed intention to implement additional retaining wall as a part of countermeasures, which required further geological surveys and revision of designs. Consequently, the construction could not commence in November 2024. The studies mentioned, as well as the design, were evaluated, revealing high costs for the additional countermeasure works at the site. These costs are not included in the budget. Additionally, AMDC evaluated the need for this additional retaining wall in a landslide-affected area located very close to the originally planned countermeasure works. As a result, although the design initiative has been undertaken, AMDC decided not to implement the additional retaining wall beyond the originally proposed countermeasure works, and ultimately chose to proceed with only the original countermeasures works. AMDC explained that the original countermeasure construction is scheduled to commence in April 2025.

For Villa Nueva, from a safety perspective, JET advised AMDC to commence construction since November 2023 based on the detailed design of the original countermeasure works, which was completed in June 2023 through collaboration between AMDC and JET. Additionally, JET recommended that the removal of the most critical unstable rock masses be completed before the rainy season, by May 2024. However, due to the delay of procurement procedures and resident relocation, and to contract amendments the actual commencement of construction was significantly delayed until April 2024. Consequently, the removal of the most critical unstable rock masses postponed into the rainy season, and on June 29, 2024, a slope failure occurred due to continuous rainfall, with part of the collapsed rocks and soil falling onto the road. Under this situation, it is necessary to conduct a geological survey and stability analysis of the collapsed slope, that still has potential to collapse, to identify the appropriate combination and layout of the countermeasure

works based on engineering analysis, not empirical rules. It is essential to follow such a procedure in a technical way, and this is an important part of the technology transfer in the Project. Therefore, AMDC took into account the observations made by JET and submitted a request to UNAH for support in conducting an engineering analysis, including soil tests, with the purpose of achieving the project objectives based on technical analysis. AMDC committed to conduct a manual geological survey with a support from UNAH by April 4, 2025. The revised countermeasure construction after the slope failure is scheduled to commence in April 2025.

< Waiver of Defects >

As a result, the original countermeasure works for Nueva Santa Rosa (La Guillen) and Villa Nueva, which are managed by AMDC, will not be completed by December 2025, the end of the Project (JICA has extended the Project for two (2) years). JET will support the supervision for the construction until October 2025 including the rainy season, which marks the closure of activities in Honduras, as JET will have fully achieved its project objective for technical transfer for supervision. The reason for the delay of the construction is that, despite the fact that the detailed design for the original countermeasure works designed by JET and AMDC on both sites was sufficiently provided to AMDC in advance, the original countermeasure works have not yet started but the commitment to complete these works is maintained. It is therefore JICA and JET bear no defects for the delay in the original countermeasure works designed by JET and AMDC in these two (2) sites, nor for the fact that the original countermeasure works will not be completed within the project period.

This waiver of defects is justified because JICA and JET fulfilled their responsibilities by providing AMDC with a sufficiently detailed design for the original countermeasure works well in advance to allow for completion within the project period. Additionally, JET will have fully achieved its project objective of technical transfer in investigation, analysis, design, supervision, and maintenance for countermeasure works related to slope disasters in Honduras. The delay in construction is due to factors beyond JICA and JET's control, as AMDC did not commence construction despite having received the necessary technical inputs. Furthermore, JET has continuously provided technical support, including supervision assistance until October 2025, to ensure a smooth implementation process, as outlined below.

- Advise on the procedures and schedules, ensuring that the most critical works at risk of collapse should not be carried out during the rainy season but should be completed during the dry season.
- Provide technical advice and documents summarizing the tasks, schedule, technical considerations for the supervision related to the construction of the remaining countermeasure

works, and the plans for post-construction maintenance and monitoring. Technical transfer seminars related to these contents will be held.

Action Plan and Operation Plan



**ACTION PLAN FOR RISK
REDUCTION
BY SLOPE DISASTERS IN THE
CENTRAL DISTRICT**

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ACRONYMS AND ABBREVIATIONS.

ABREVIATION	OFFICIAL NAME IN SPANISH	TRANSLATION IN ENGLISH
AMDC:	Alcaldía Municipal del Distrito Central	Municipality of the Central District
Art:	Artículo	Article
CAH:	Colegio de Arquitectos de Honduras	Association of Architects of Honduras
CICH:	Colegio de Ingenieros Civiles de Honduras	Association of Civil Engineers of Honduras
CEPAL:	Comisión Económica para América Latina	Economic Commission for Latin America
COPECO:	Comisión Permanente de Contingencia	Secretary of State in the National Risk and Contingency Management Offices
CODEM:	Comité de Emergencias Municipal	Municipal Emergency Committee
CODEL:	Comité de Emergencias Local	Local Emergency Committee
COMUDE:	Comité Municipal de Datos Espaciales	Municipal Committee of Spatial Data
DAYF:	Dirección de Administración y Finanzas	Administration and Finance Directorate
DC:	Distrito Central	Central District
DCyS:	Dirección de Control y Seguimiento	Control and Follow up Directorate
DOT:	Dirección de Ordenamiento Territorial	Territorial Planning Directorate
DGCDH:	Dirección de Gestión Comunitaria y Desarrollo Humano	Directorate for Community Management and Human Development
DMJ:	Departamento Municipal de Justicia	Municipal Department of Justice
ENEE:	Empresa Nacional de Energía Eléctrica	National Electric Power Company
IHCIT:	Instituto Hondureño de Ciencias de la Tierra	Honduran Institute of Earth Sciences
GER:	Gerencia de Evaluación de Riesgo	Risk Assessment Management

GLA:	Gerencia de Licitaciones y Adquisiciones	Bidding and Procurement Management
GOC:	Gerencia de obras Civiles	Civil works management
GMU:	Gerencia de Movilidad Urbana	Urban Mobility Management
GAC:	Gerencia de Atención al Cliente	Customer Service Management
GCC:	Gerencia de Control de la Construcción	Construction Control Management
GCH:	Gerencia de Centro Histórico	Management of Historical Centre
GVH:	Gerencia de Vivienda y Hábitat	Housing and Habitat Management
GSL:	Gerencia de Servicios Legales	Legal Services Management
IP:	Instituto de la Propiedad	Institute of Property
ISR:	Impuesto Sobre la Renta	Income tax
JICA:	Agencia de Cooperación Internacional del Japón	Japan International Cooperation Agency
LCE:	Ley de Contratación del Estado	State Contracting Law of Honduras
L:	Lempiras	Lempiras (currency)
POA:	Plan Operativo Anual	Annual operative plan
PMGIR:	Política Municipal de Gestión Integral del Riesgo	Municipal Policy for Integral Risk Management
RRRD:	Reglamento para la Reducción de Riesgos a Desastres	Regulation for Disaster Risk Reduction
SIT:	Secretaria de Infraestructura y Transporte	Secretary of Infrastructure and Transport
SIG:	Sistema de Información Geográfica	Geographic Information System
SIMET:	Sistema de Información Municipal de Estudios Territoriales	Municipal Information System for Territorial Studies
SINAGER:	Sistema Nacional de Gestión del Riesgo	National Risk Management System
TdRs:	Términos de Referencia	Terms of reference
UMGIR:	Unidad Municipal de Gestión Integral de Riesgo	Municipal Unit for Integral Risk Management

UNAH:	Universidad Nacional Autónoma de Honduras	National Autonomous University of Honduras
UMPEG:	Unidad Municipal de Planificación Estratégica y Gestión	Municipal Strategic Planning and Management Unit
UMAPS:	Unidad Municipal de Agua Potable y Saneamiento	Municipal Drinking Water and Sanitation Unit
UGA:	Unidad de Gestión Ambiental	Environmental Management Unit

1 SUMMARY OF THE ACTION PLAN.

1.1 Introduction

The Action Plan for Slope Disaster Risk Reduction is an essential tool to contribute to the integral development of the communities of the Municipality of the Central District.

The Action Plan represents an opportunity for the Central District to analyze its level of risk; assess its capacity to respond to these risks, both preventive and corrective; and employ a comprehensive planning methodology within the overall framework of local government. The Plan in question and the methodology used in its development are therefore key inputs for assertive planning, making it possible to strengthen both technicians and the community affected by the problem at the municipal level.

Given the vulnerability of the Central District, it is important to make good use of this document because it contains key information for the proper management of the different stages of risk management and its management.

The main purpose of the document presented is to provide recommendations for the sustainability of the projects carried out by JICA, as well as the replicability of these in different communities of the DC.

This document contains four chapters, of which the first chapter refers to the unified flow chart and the condensed project implementation matrix of the four results, the second chapter refers to the four project implementation guidelines that were developed, in addition to the publication of results in chapter three and concludes with the achievements achieved over the years as a Central District.

1.2 Goals.

- To generate guidelines for the implementation of projects to strengthen technical capacities for research and analysis related to natural disasters and their consequences in the Central District.
- To develop the foundations for replicability of these experiences in other DC communities.
- To generate project implementation guidelines to strengthen technical capacities to design, develop construction, monitor and maintain structural measures that mitigate risk in the communities of the Central District.
- To generate project implementation guidelines to strengthen technical capacities to develop risk maps.
- To generate guidelines for the implementation of projects to strengthen technical capacities to regulate the territory of the Central District that is in a situation of risk.
- To promote the communication of each of the processes both with the competent authorities and with the population that will benefit from the work to be carried out.

1.3 Responsibility Diagram and Matrix.

Below, the activity flow diagram is shown which graphically shows the steps or processes to follow to achieve each of the results that make up the action plan, facilitating a quick understanding of each activity and its relationship, it also presents the matrix of responsibilities of the four lines of results that make up it, involving government actors, academia actors and civil society actors. It represents the roles and responsibilities of the different team members and makes it possible to quickly identify to whom we should report, communicate and request something at a specific time, ensuring that the plan is carried out efficiently.

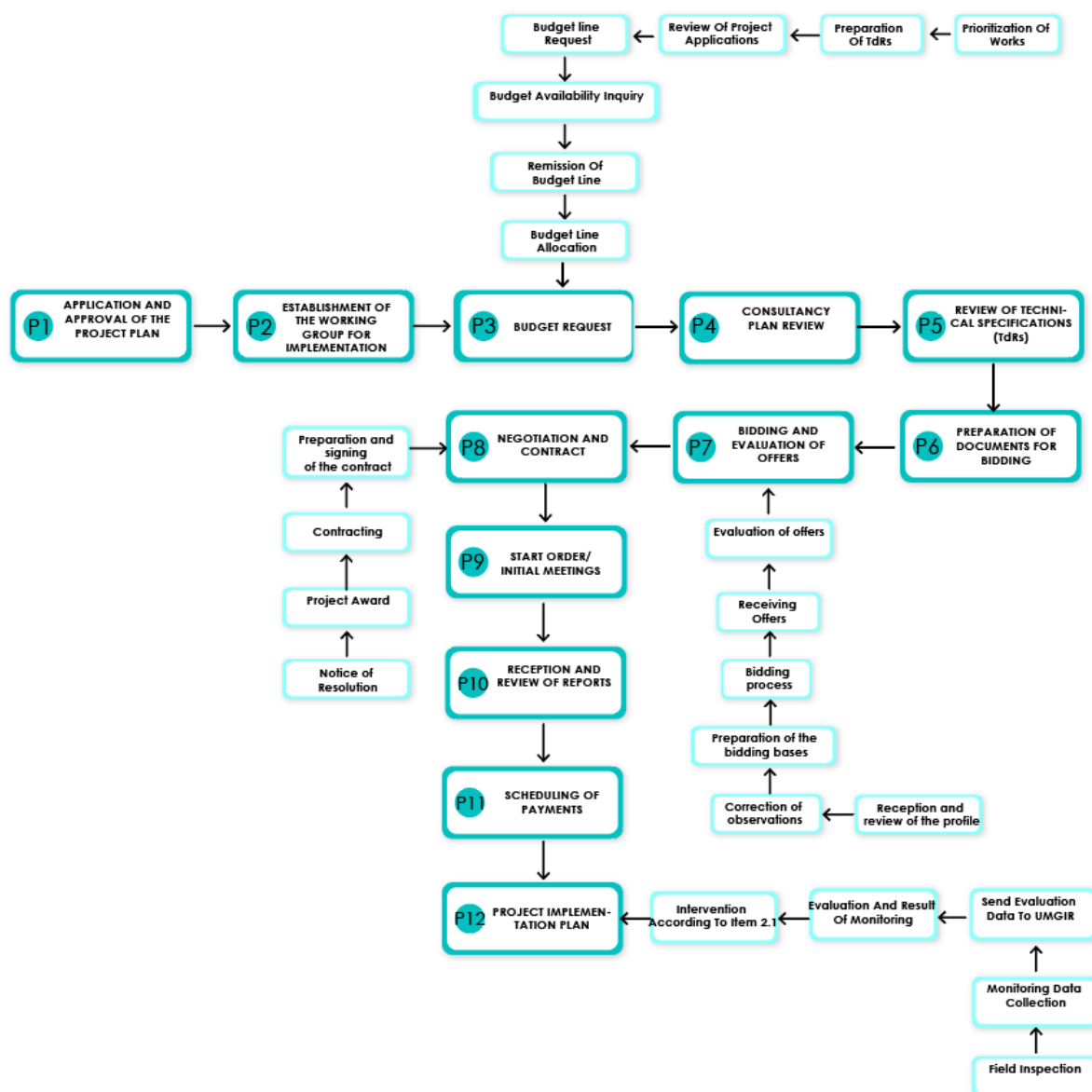


Figure 1.- Flow of activities of the Guideline of Output 1. (Source: JET)

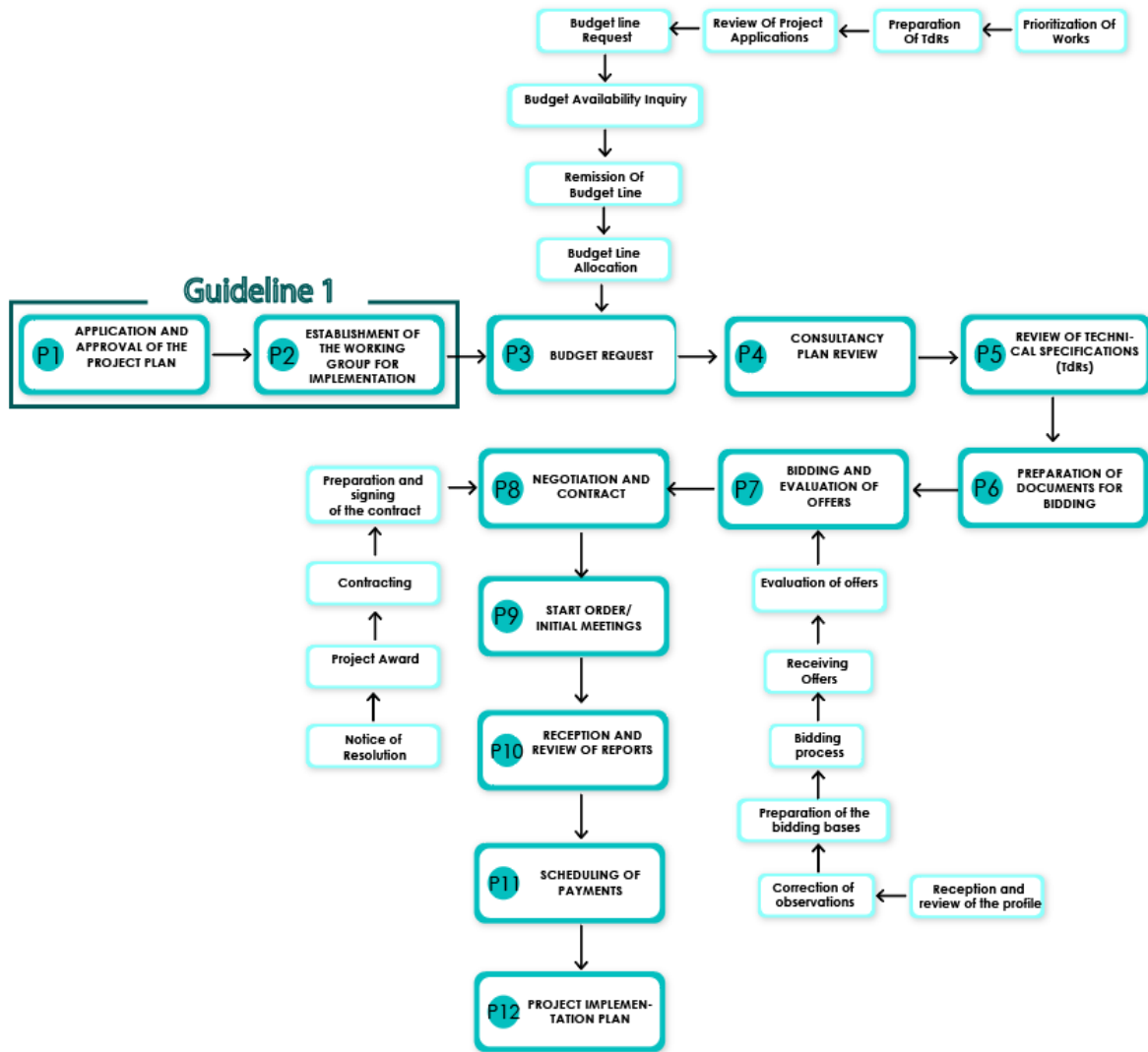


Figure 2.- Flow of activities of the Guideline of Output 2. (Source: JET)

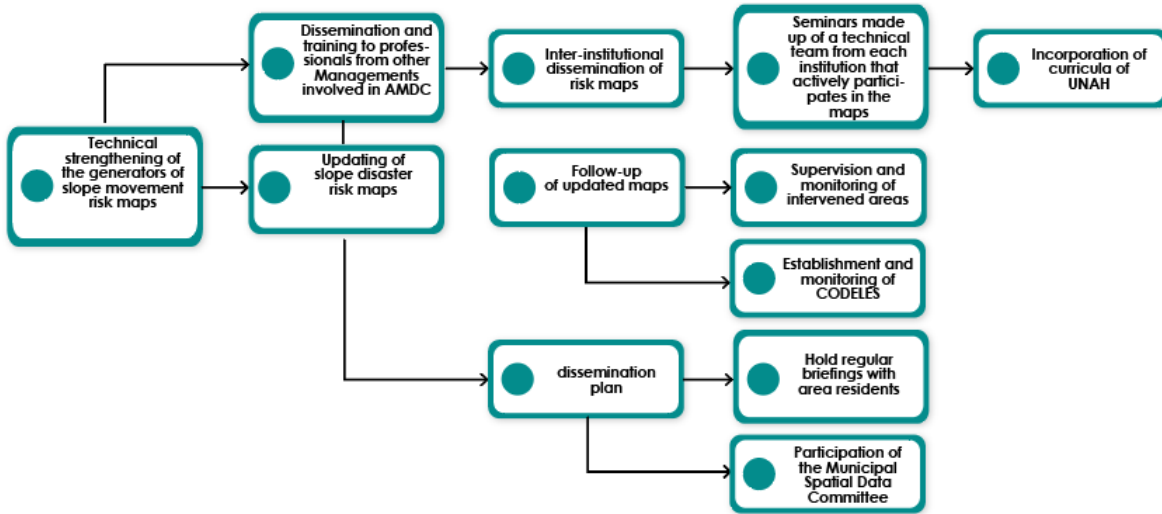


Figure 31.- Flow of activities of the Guideline of Output 3. (Source: JET)

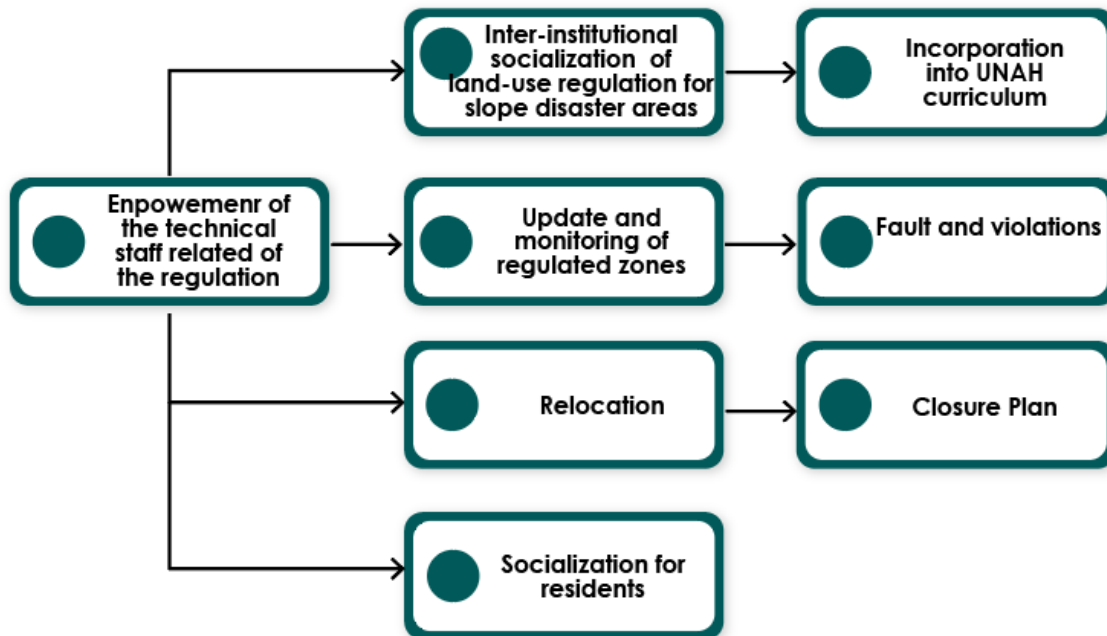


Figure 2.- Flow of activities of the Guideline of Output 4. (Source: JET)

Table 11.- General matrix of responsibilities. (Source: JET)

RESPONSIBLE MATRIX									
GUIDELINE	ITEM	GUIDELINES	ITEM	ACTIVITY	FREQUENCY	COORDINATOR	IN CHARGE	COMMUNITY ACTORS	INSTITUTIONAL ACTORS
GUIDELINE OUTPUT 01	1.1.1.1	Monitoring and evaluation of the existing slope disaster pilot de ladera			Every 6 months	UMGIR	UMGIR/ Technical Engineer	CODELES Community (Trust board, Directors board and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, CODEM, UMGIR and DOT
	1.1.1.2	Assessment of the current status of areas under hazard.	1.1.1.2.1	Method of Priority Assessment	Every 6 months		UMGIR/ Technical Engineer	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, CODEM, UMGIR and DOT
	1.1.1.3	Project Plan.	1.1.1.3.1	Preparation of the Project Plan (Stage of Investigation and analysis)	Yearly		UMGIR/ Head of Unit	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, UMGIR, CODEM and DOT
			1.1.1.3.2	Application and Approval of the Project Plan	Yearly				
	1.1.1.4	Establishment of the Working Group for the Implementation of Disaster Preparedness on Slopes	1.1.1.4.1	Formation of the Coordinating Team	Yearly		UMGIR/ Head of Unit	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, CODEM, UMGIR and DOT
	1.1.1.5	Securing a budget for studies	1.1.1.5.1	Make the study plan.	Yearly		UMGIR/ Head of Unit	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: GER, UMGIR, DAYF and DOT
			1.1.1.5.2	Budget request for studies.	Yearly				
	1.1.1.6	Contracting	1.1.1.6.1	Revision of the consultancy plan.	Yearly		GLA/ Head of Unit	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, UMGIR, DCyS, GLA, DAYF and DOT
			1.1.1.6.2	Revision of Technical Specifications.	Yearly		UMGIR/ Technical Engineer		
			1.1.1.6.3	Preparation of Documents for Tender.	Yearly		GLA/ Head of Unit		
			1.1.1.6.4	Bidding and evaluation of offers					
			1.1.1.6.5	Negotiation and contract					
	1.1.1.7	Contract Management	1.1.1.7.1	Start Order/ Inicial Meetings	Monthly		UMGIR/ Head of Unit	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, UMGIR, DCyS, GLA, DAYF and DOT
			1.1.1.7.2	Receipt and review of reports	Monthly		DAYF/ analysts		
			1.1.1.7.3	Programming of payments	Due to work progress				
	1.1.2	Plan of Implementation of the Slope Disaster Prevention	1.1.2.1	Survey Results and analysis of contractors			UMGIR/ Technical Engineer	CODELES, Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, CODEM, UMGIR, DCyS, GOC and DOT
			1.1.2.2	Perform the monitoring and analyze the results of the monitoring (in case of landslides)					
			1.1.2.3	Countermeasures policy (Draft)					

GUIDELINE OUTPUT 02	1.2.1.1	Project Plan.	1.2.1.1.1	Preparation of the Project Plan	Yearly	CIVIL WORKS MANAGEMENT	GOC/Chief Design Unit UMGIR/Chief Design Unit	-- CODELES, Community (Trustees Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: UMPEG, GER, UMGIR, DCyS, GOC and DOT
	1.2.1.2	Budget request	1.2.1.2.1	For Designing	Yearly		GOC/Manager	--	AMDC: UMGIR, DCyS, GOC and DAyF
			1.2.1.2.2	For construction, supervision and maintenance for major works.	Yearly		DCyS/Manager	--	
			1.2.1.2.3	For construction, supervision and maintenance for minor works.	Yearly		DCyS/Manager	--	
	1.2.1.3	Contracting	1.2.1.3.1	Cost Estimation	According to project to tender		GOC/Chief Formulation Unit	--	AMDC: Bidding and Procurement Management (GLA) and DAyF
			1.2.1.3.2	Selection of Contractors			GLA/Manager	--	
			1.2.1.3.3	Review of the Consulting Plan and contractor plan			GLA/Tenders Unit	--	
			1.2.1.3.4	Review of Technical Specifications			GLA/Tenders Unit	--	
			1.2.1.3.5	Preparation of documents for bidding			GLA/Tenders Unit	--	
			1.2.1.3.6	Bidding and evaluation of offers			GLA/Manager	--	
			1.2.1.3.7	Negotiation and Contract			GLA/Manager	--	
	1.2.1.4	Project Management	1.2.1.4.1	Start order/ Initial Meetings	According to project to tender		GOC/Chief Design Unit	--	AMDC: UMGIR, DCyS and DOT
			1.2.1.4.2	Reception and review of reports			DCyS/Head of Unit	--	
			1.2.1.4.3	Payment schedule			DAyF/Accounting department	--	
	1.2.1.5	Maintenance	1.2.1.5.1	Monitoring	Biannual		CODEM/Site Chief	According to project to tender	COPECO UNAH AMDC: CyS, UMPEG, GER and DOT
GUIDELINE OUTPUT 03	1.3.1.1	Technical strengthening of the generators of slope movement risk maps	1.3.1.1.1	Dissemination and training of professionals from other Managements involved in AMDC with focus on the map application	Yearly	UMGIR	UMGIR	--	COPECO UNAH AMDC: DMJ, GCC, GER, UMGIR, UMAPS, GAC, CATASTRO, DGCDH, DMJ, CODEM, UGA, GCH, GMU, GVH
	1.3.1.2	Inter-institutional dissemination of risk maps	1.3.1.2.1	Seminars made up of a technical team from each institution that actively participates in the	biannual		UMGIR	--	college careers of UNAH: Architecture Civil Engineering Faculty of Legal Sciences Faculty of Space Sciences
			1.3.1.2.2	Incorporation of curricula of UNAH	quarterly		GER	--	Honduran Institute of Earth Sciences CICH, CAH, IP ENEE, SIT Mi Ambiente fire Department, Police AMDC: GCC, GER, UMGIR, CATASTRO
	1.3.1.3	Updating of slope disaster risk maps	1.3.1.3.1	Updating and improvement of site evaluation tools for the generation of hazard, vulnerability and risk maps	Yearly		GER	--	COPECO UNAH AMDC: GER, UMGIR and DOT
	1.3.1.4	Follow-up of updated maps	1.3.1.4.1	Supervision and monitoring of intervened areas	biannual		GER	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: CODEM, CATASTRO, GVH, DGCDH, UMGIR, UMPEG, GER, and DOT
			1.3.1.4.2	Establishment and monitoring of CODELES	Yearly		CODEM	--	
	1.3.1.5	Dissemination Plan	1.3.1.5.1	Hold regular briefings with area residents	quarterly		CODEM	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: CODEM, CATASTRO, GVH, DGCDH, UMGIR, UMPEG, GER, and DOT
			1.3.1.5.2	Participation of the Municipal Spatial Data Committee	quarterly		COMUDE	--	

GUIDELINE OUTPUT 04	1.4.1.1	Technical Strengthening of the applicators of the regulation		Yearly	DOT	AMDC:DOT , GCC and GSL	-	COPECO UNAH AMDC: DMJ, GER, UMGIR, UMAPS, GAC, CATASTRO, DGCDH, DMJ, CODEM, UGA, GCH, GMU, GVH	
	1.4.1.2	Inter-institutional socialization of new Regulations	1.4.1.2.1	Seminars made up of a technical team from each institution that actively participates in regulation		Yearly	AMDC:UMGIR and DOT	-	COPECO UNAH Private universities CICH, CAH, IP, ENEE, SIT, Mi Ambiente, Fire Department, Police AMDC:GSL
			1.4.1.2.2	Incorporation of curricula of UNAH		quarterly	AMDC:UMGIR and DOT	-	ANH: Faculty of Architecture, Civil Engineering, Faculty of Legal Sciences, Faculty of Space Sciences, IHCIT AMDC:UMGIR and GCC
	1.4.1.3	Updating and Monitoring of Regulated Areas		Yearly		AMDC: DOT	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	UNAH COPECO AMDC: UMGIR, GER and GCC	
	1.4.1.4	Fouls and infractions	1.4.1.4.1	Formation of links in the Managements responsible for monitoring the legalization of the work		Yearly	AMDC: GCC	-	COPECO UNAH AMDC: GCC, DMJ, CATASTRO, GSL, Corporación Municipal, DGCDH and CODEM
			1.4.1.4.2	Create ordinances to reinforce the regulation		Yearly	AMDC: GSL		
	1.4.1.5	Relocation	1.4.1.5.1	Establishment and implementation of the Relocation Assistance Plan for each risk area		Yearly	AMDC: DOT	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: CODEM, CATASTRO, GSL, DGCDH, UMGIR,UMPEG, GVH and GER
			1.4.1.5.2	Resettlement ground preparation		Yearly	DOT		
			1.4.1.5.3	Inclusion of the national government as support in relocations		Yearly	DOT		
	1.4.1.6	Socialization to residents	1.4.1.6.1	Hold regular briefings with area residents		quarterly	AMDC:DGCDH	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: CODEM and DOT
	1.4.1.7	Closing plan	1.4.1.7.1	Risk areas attended		Yearly	AMDC: DOT and GER	CODELES Community (Trust Board, Boards of Directors and/or Water Board)	COPECO UNAH AMDC: CATASTRO, GSL, DGCDH, GOC, DOT y GCC
			1.4.1.7.2	Administration in favor of the AMDC as a public utility of uninhabitable properties in the relocation process		Yearly	AMDC: CADASTRAL		
			1.4.1.7.3	Budget request for the transformation project		Yearly	AMDC: DOT		
			1.4.1.7.4	Project execution		Yearly	AMDC: GOC		

2 PROJECT EXECUTION GUIDELINES

The procedures for carrying out each of the activities included in the four results of the Project for the Control and Mitigation of Slope Disasters of the Central District and the responsible departments are described below:

2.1 OUTPUT 01: STRENGTHENING OF CAPACITY TO DETAILED INVESTIGATIONS AND ANALYSIS TO IDENTIFY AND CHARACTERIZE DISASTER PHENOMENA IN SLOPE.

The procedures for carrying out surveys and analyzes in slope disaster risk areas selected by AMDC and the responsible departments are described below.

2.1.1 Monitoring and evaluation of the existing slope disaster pilot area.

The candidate sites were evaluated in each aspect depending on the current condition of the site and based on the total score obtained, based on the points sites were selected as priority.

Once all the structural works have been executed in the pilot sites, it is necessary to implement a series of periodic evaluations of the current state of each of the intervened areas to ensure sustainability over time.

Goal:

To collect and analyze data and information systematically in order to detect signs of change in relation to the baseline obtained from the entire process. It must be understood the evaluation is not only the measurement of the success of the work carried out, but also analyzes any type of change in the intervention, whether negative or positive.

Disaster risk areas on the slopes of the DC, including existing areas where countermeasures have been implemented, will be inspected and the level of risk and urgency of each site will be assessed. Based on the results, the implementation of countermeasure work is prioritized and the areas subject to countermeasure work are selected.

Department/Organization responsible for the activity:

Table 2. Responsibility Matrix for Monitoring and Evaluation of Areas under Study.

MONITORING AND EVALUATION OF THE EXISTING PILOT AREA OF SLOPE DISASTER.			
Role	Unit/Institution		Responsibility
Direct Responsible	UMGIR	Unit Manager and Technicians	Coordination, monitoring and conclusion of the Activity
Direct support	GER	Prevention Officer GER	Technical Evaluation and Inspection Results
	CODEM	Surveillance Team	Technical support in the process and management with the community
partners	CODELES	Certified Members	Provide information about the site
	UNAH	IHCIT	Scientific Advice
		Faculty of Engineering	Technical advice
	COPECO	Specialized technical staff	Technical advice

A mapping of actors is appreciated where the institutions that should be in the process are identified, these are divided into three categories:

- Academy: UNAH which must establish which department is involved in this process described above.
- Civil Society: two stakeholders were mapped; the community at large through the board of trustees, board of directors or other organization that has the colony/neighborhood and that is representative of their part; and the CODELES, which are responsible for ensuring the care of the community in issues of risk.
- Government: COPECO as the central government, which must propose a department that is involved in the whole process and the AMDC as the administrative body of the municipality of DC.

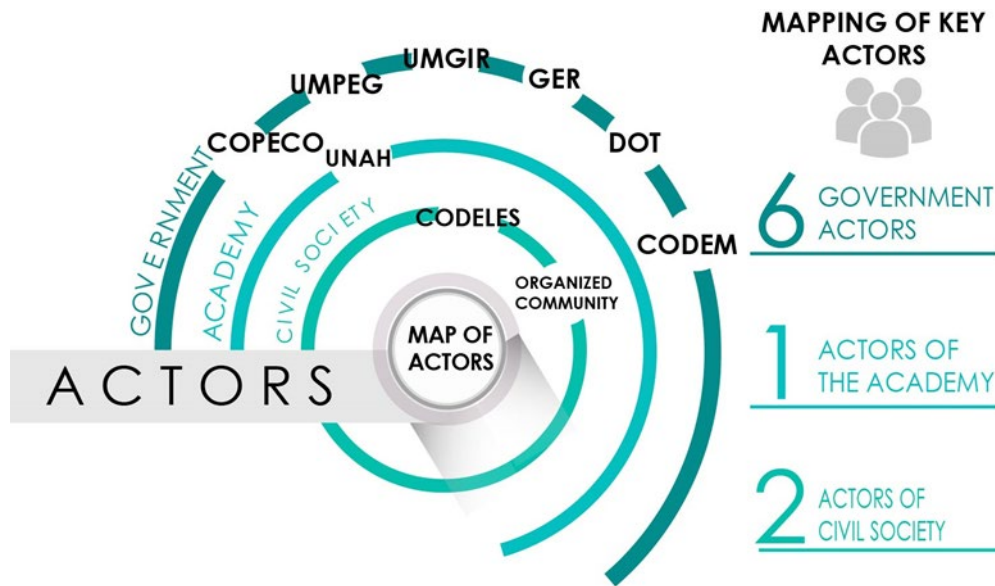


Figure 5.- Mapping of Actors (Source: JET)

Time of execution:

Site inspections shall be carried out each April of the year preceding the year in which the countermeasure works are to be carried out. If an inspection is requested outside this time due to external accelerating events, it will be carried out on a case-by-case basis.

2.1.2 Assessment of the current status of areas under hazard.

To implement a monitoring and evaluation system with the aim of collecting and analyzing data and information in order to detect signs of change in relation to a baseline, which in this case are the analyses previously carried out for each pilot area.

Inspection team:

UMGIR assign the member of the inspection team from the relevant departments and request the supporting organization to send the member for the inspection.

Implementation procedure:

UMGIR coordinate the following points:

- Determination of slope disaster risk areas to execute the inspection.
- Arrangement of the inspection team.
- Timetable of implementation.

Site inspection for slope disaster risk areas will be performed by the site inspection team.

The inspection team shall compile the result of the inspection using the inspection sheet immediately after the inspection. The inspection sheet form is attached in the Annex.

For the process to be sustainable it is important to consider the following procedure depending on the case, which is described below.

These assessments should follow the following steps:

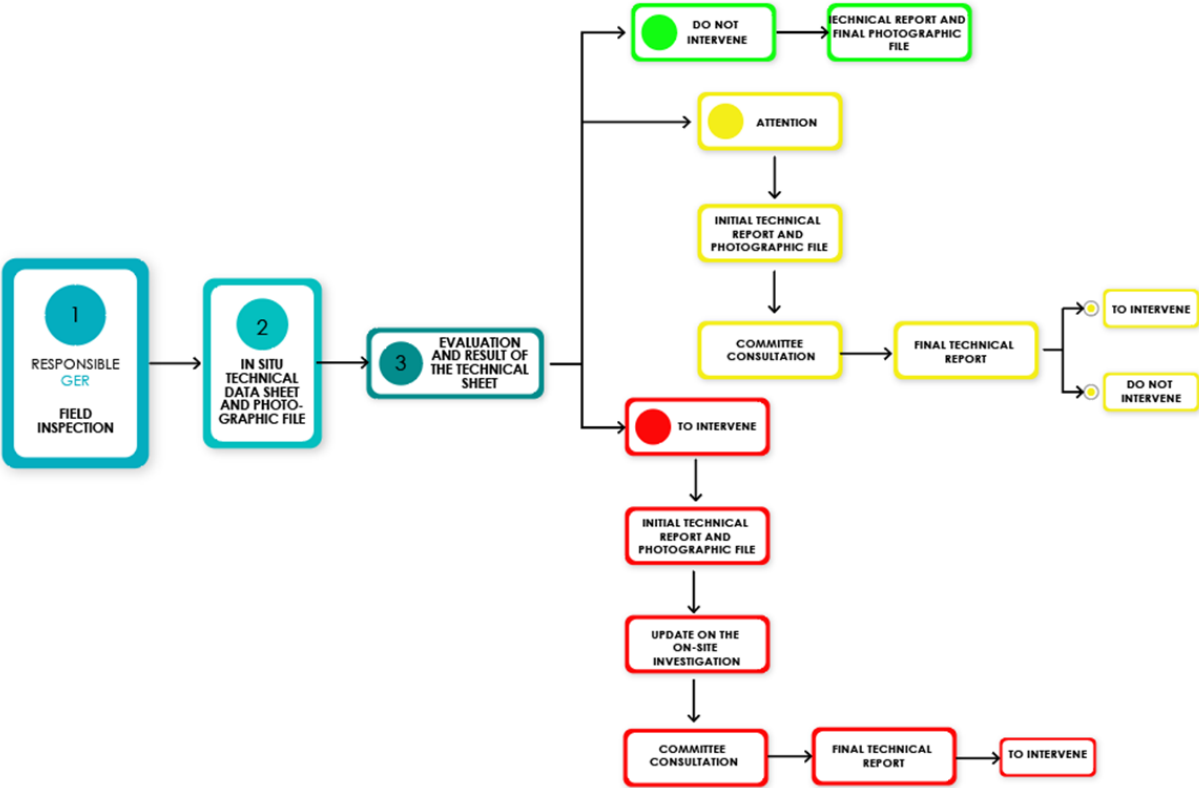


Figure 6.- Steps for monitoring and evaluating the current status. (Source: JET)

Table 3.- Procedural Matrix of Monitoring and Evaluation. (Source: JET)

MONITORING AND EVALUATION PROCEDURE			
N°	STEP	ACTIVITY	SUB-ACTIVITY
1	FIELD INSPECTIONS	In conjunction with the technical area, the community and the CODELES, visits will be made with a minimum frequency of six (6) months to intervention areas or in the event of an accelerating event caused by natural agents such as earthquakes, rainfall, increased groundwater level, soil erosion, undermining of rivers or by human activities, this with the aim of finding evidence or signs on the site that allows identifying any significant change in the area. It is imperative that all those involved in the process are present at the time of the inspection to generate a better evaluation of the site.	
2	IN SITU TECHNICAL DATA SHEET AND PHOTOGRAPHIC FILE	In order to keep a timeline of the project, it will first be necessary to make a photographic file of each of the intervened areas with their respective geolocation; in addition, at the time of making the field visits, a technical file must be filled out with a series of questions that guide the technician to know the current status of each area. There must be a field in the file where a brief interview is conducted with the inhabitants of the area, since they are the ones who see first-hand the events that take place in that area.	
3	EVALUATION AND RESULT OF THE TECHNICAL SHEET	Once the evaluation sheet has been filled out, it will be necessary to carry out the desktop evaluation to obtain the final result of the current state of the intervened area. The use of traffic lights is recommended, to take into account in the last step in the decision-making of the actions to be carried out (Green: In good condition-Do not intervene, Yellow: Intermediate state-attention and Red: Bad state-urgent intervention) . Once the evaluation sheet has been analyzed, the results obtained in the technical visit will be evidenced by means of a technical report, incorporating the photographic file and the data obtained from it.	GER
4	ACTIONS TO PERFORM		1. GREEN TRAFFIC LIGHT: This color indicates the good state and function of the structural measure and its positive reference for the assessment, so it does not need any intervention by the monitoring team, just to submit a technical report of current good state and a photographic file.
		Once the technical report and the results of the traffic lights have been made, it is important to take priority actions on each of the findings found on the site. For each traffic light color there will be an action, the following describes what must be done depending on the case:	2. YELLOW TRAFFIC LIGHT: this color indicates the need for a more in-depth evaluation given the little information that was obtained during the visit, with the aim of knowing how the structural work is functioning, which is why it will sometimes require evaluation in situ of an expert on the subject, who will be part of the committee that has been formed for the intervened neighborhood, to conclude with the evaluation and proceed to intervene if it were the case. In the same way, it is necessary for the technical team to prepare a report explaining everything that happened and evidencing the photographic file.
			3. RED TRAFFIC LIGHT: indicative color that denotes a work that must be intervened and from which it is necessary to obtain more information to solve the problem raised at that time, through comparative studies between the initial investigation and analysis stage and the new ones. studies carried out in the area, it will be determined if there is a factor of change with respect to the initial situation and with the help of the committee made up of experts on the subject (municipal technicians, COPECO or academics from the UNAH) a decision must be reached. conclusion and therefore a solution to the problem treated.

Once each of the traffic lights carried out during the visit has been evaluated and the agent causing the damage to the structural work has been found, it will be necessary to evaluate which corrective actions are priority to intervene and solve the work; for this it will be necessary to use a methodology for evaluating priorities described below.

2.1.2.1 Method of Priority Assessment

Once the site has been evaluated and monitored, resulting in the technical report describing the state of the structural work, the measures corresponding to each situation will be implemented according to prioritization; that is, in case of need of intervention it must be implemented with the help of the method of prioritization of each of the actions that will solve the problem raised.

UMGIR shall set the meeting for the selection of the target area to which countermeasures shall be applied. UMGIR assign the member of the assessment team from the related departments and ask the supporting organization to send the member for inspection. The member will be the person who joined the site inspection.

Assessment team:

Below is a graph showing the influence of the actors who should be involved in the whole process:

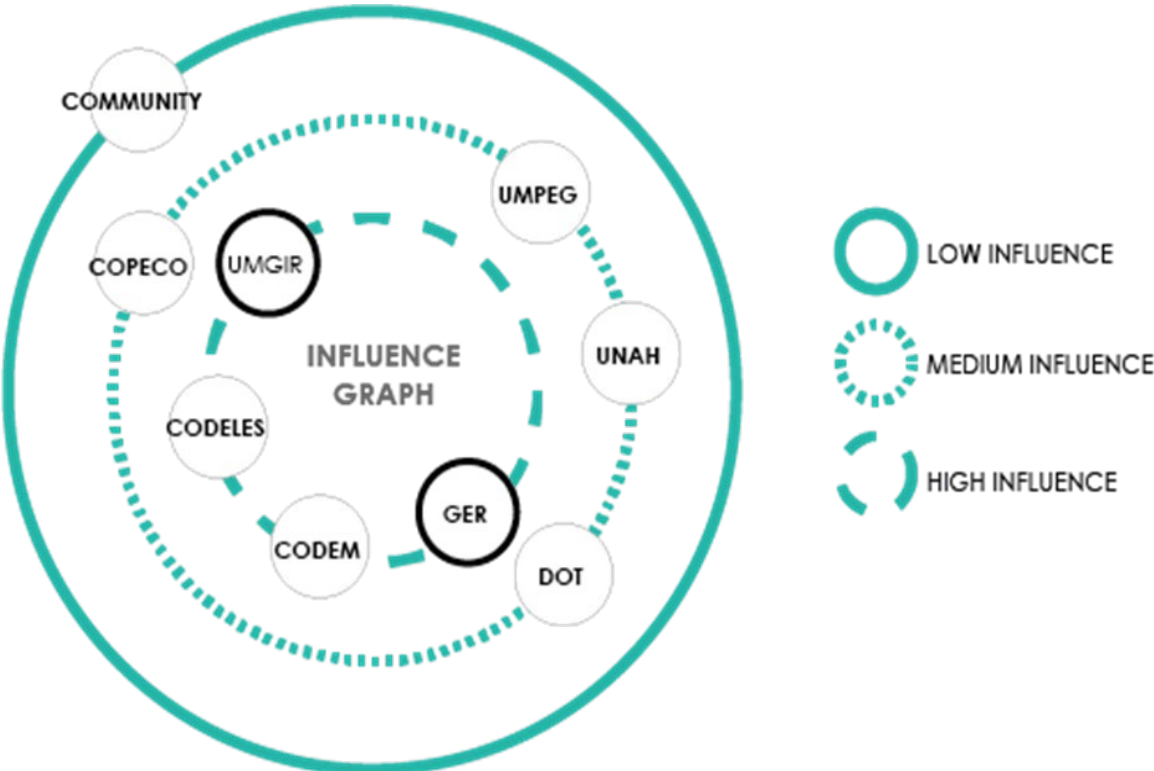


Figure 7.- Influence graph, evaluation stage. (Source: JET)

Method of priority assessment:

The prioritization of actions to be performed at the moment of intervention at a site is recommended based on the matrix shown below, which breaks down the important points to be evaluated to make decisions for immediate intervention. The criteria will be evaluated according to a specific weight per qualification (low, medium and high) which will have their rating of 1-3 respectively and in turn will be weighted to obtain the points depending on their importance:

Table 4.- Priority assessment matrix. (Source: JET)

PRIORIZATION OF ACTIONS					
N°	Criteria	%	ACTION 1		
			Classification	Qualification	Score
1	NEED OF THE TERRITORY	20%	Low	1	0.20
			Medium	2	0.40
			High	3	0.60
2	POLITICAL FEASIBILITY	10%	Low	1	0.10
			Medium	2	0.20
			High	3	0.30
3	SOCIAL IMPACT	15%	Low	1	0.15
			Medium	2	0.30
			High	3	0.45
4	ENVIRONMENTAL IMPACT/CLIMATE CHANGE	20%	Low	1	0.20
			Medium	2	0.40
			High	3	0.60
5	VIABILITY	10%	Low	1	0.10
			Medium	2	0.20
			High	3	0.30
6	INFLUENCE ON PLANNING	15%	Low	1	0.15
			Medium	2	0.30
			High	3	0.45
7	RESOURCES FOR FORMULATION	10%	Low	1	0.10
			Medium	2	0.20
			High	3	0.30
TOTAL		100%			

1. NEED OF THE TERRITORY: refers to how important will be the work of intervention for the community.
2. POLITICAL FEASIBILITY: refers to the possibility that the action to be carried out is sustainable on a continuous basis and that this will be supported by government entities for as long as necessary.
3. SOCIAL IMPACT: refers to the changes experienced by members of the community involved as a result of the development of the action and which affect human conditions in the medium or long term.
4. ENVIRONMENTAL IMPACT/CLIMATE CHANGE: refers to the variation of the environment, caused directly or indirectly by the activity carried out in the

selected area; in addition, to the effect of mitigation or adaptation to climate change caused by the action.

5. VIABILITY: refers to the availability of resources needed to meet the stated objectives and/or targets, in other words, the ability to meet the goals of a project, taking into account the resources available for their implementation.
6. INFLUENCE ON PLANNING: It will be necessary to analyze whether the community is part of an urban, risk management or other type of plan in order to evaluate the synergy of interventions to be carried out.
7. RESOURCES FOR FORMULATION: in any project it is necessary to be aware of the existence of funds for the formulation and implementation of the actions, whether municipal, national or international cooperation funds.

2.1.2.2 Policy selection for replication of pilot areas.

Apart from the priority assessment elements listed above, the results of the priority assessment may vary according to municipal or government policy. For example, there might be cases where several risk areas are implemented on a small scale, or one risk area is implemented on a large scale. In the case of large-scale risk areas, it may take several years to complete countermeasures, so the municipal policy in each case and the final selection of the area where countermeasures will be implemented must be taken into account.

If the project is replicated in other areas, it is recommended to be evaluated to determine its status and the viability of the intervention by means of defined criteria that are shown in the following matrix:

Table 5.- Site Selection Matrix. (Source: JET)

Selection of sites for project application									
No.	NAME OF APPLICATED SITE	URGENCY OF COUNTERMEASURE	CATASTRAL LEGALITY	BACKGROUND OF INTERVENTION	SIZE OF THE INTERVENTION	EXISTENCE OF CODELES	SOCIAL IMPACT OF THE WORK	ENVIRONMENTAL IMPACT/CC OF THE WORK	SECURITY OF THE SITE

To better understand each of the items shown above in the matrix is described:

1. NAME OF APPLICATED SITE: Name legally registered in the cadastral base of the AMDC, include the coordinates of the candidate site.
2. URGENCY OF COUNTERMEASURE: How necessary is the work to be carried out.
3. CATASTRAL LEGALITY: Selected sites must be legally registered with the property institute and the municipal cadastral management to strengthen the sense of belonging in the community.
4. BACKGROUND OF INTERVENTION: know the background of the site to be intervened, such as the existence of urban plans, risk control plans, among others, or if any institution is carrying out an intervention in the same location, in order to generate synergies between the different involved actors.

5. SIZE OF THE INTERVENTION: It will be analyzed according to the cost-benefit the area that will be intervened, depending on the objective of the project may be small, medium or large scale.
6. EXISTENCE OF CODELES: CODEL is a community-based organization made up of community volunteers whose responsibility is to coordinate and implement actions aimed at prevention and mitigation, preparedness, response and rehabilitation and reconstruction of emergencies and disasters in the community. Its operation is permanent and its responsibilities are related to the three phases of the emergency: before, during and after (See annex 3).
7. SOCIAL IMPACT OF THE WORK: refers to the changes experienced by the members of the community that is intervened as a result of the development of the project and that affect human conditions in the medium or long term.
8. ENVIRONMENTAL IMPACT/CLIMATE CHANGE OF THE WORK: refers to environmental change, caused directly or indirectly by the activity carried out in the selected area; in addition, to the effect of mitigation or adaptation to climate change caused by new or changing environments.
9. SECURITY OF THE SITE: to ensure that the environment is appropriate to be able to carry out the whole process it is necessary to create synergies with the community from the beginning of the process and to ensure constant involvement in everything so that the community takes ownership of the project and creates a safe environment for those involved, this synergy should be carried out through duly registered trusteeships.

These are important factors to take into account when attempting to replicate the intervention, since the implementation of this type of project involves a number of challenges of different magnitude depending on where it is going to be implemented and the result will be positive also depending on how the sites to intervene are selected given their pre-intervention conditions.

Department/Organization responsible for the activity:

This activity must be commissioned by UMGIR with the support of UNAH, COPECO and other entities of the AMDC that are responsible for the subject.

2.1.3 Project Plan

Goal:

Its purpose is to mark the steps to be followed in case of replication of intervention measures at other previously selected sites, this stage can make a difference in the success of a project. Through the matrix and given by the good or bad management of the plan at the time of its implementation. The following benefits will be realized from the implementation of this work plan:

- Resolution of potential conflicts.
- Steps to be carried out more clearly.
- In addition, the actors involved in the process will be analyzed to obtain better results, and at the same time who will be responsible for each of the stages shown in the plan.

Department/Organization responsible for the activity:

Table 6.- Roles of units in the Project Plan (Source: JET)

PROJECT PLAN/ANALYSIS AND EVALUATION			
Role	Unit/Institution		In Charge
Direct Responsible	UMGIR	Unit Manager and Technicians	Coordination, follow up and conclusion of activity
	FINANZAS	Budget Unit	Budget availability verification
Direct Support	GLA	Unit Manager and Analysts	Plan Award
	UMPEG	Unit Manager	Confirmation of Planning of Plan in POA
Partners	CODEM	Certified Members	On-site accompaniment
	UNAH	IHCIT	Scientific advice
		Engineering Faculty	Technical advice
	COPECO	Specialized technical staff	Technical advice

Time of execution:

The project plan must begin with the incorporation by the UMGIR into the Annual Operational Plan, which must be requested in April of the year preceding the year in which the plan is expected to be carried out.

2.1.3.1 Preparation of the Project Plan.

The work plan consists of five steps that set the pace of the process and will allow the project to work successfully in each of the communities where it is carried out, then each of them is shown in the following picture:

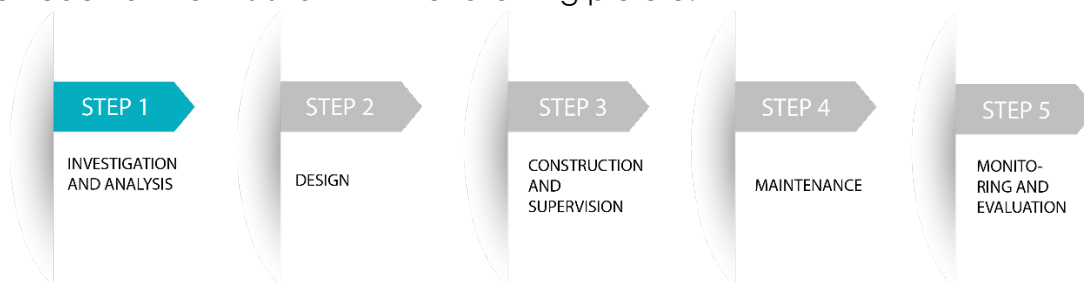


Figure 8.- Procedure for the elaboration of Project Plan. (Source: JET)

STEP 1. INVESTIGATION AND ANALYSIS: Being the initial stage and one of the most important in the whole process and the basis of the entire Project, this stage must be founded in the different studies which are carried out in the zone in order to get the majority of scientific as technical information and as consequence the solution in the design stage be a success (Annex 2).

This stage should include the involvement of the different key actors so that from the beginning of the plan they can take part and have a say in the decisions made; however, the UMGIR will be responsible for guiding this stage.

Member responsible for preparing the project plan:

Directly responsible for drawing up the project plan: UMGIR, which includes its follow-up throughout the process of drawing up and coordinating the support of the different units of AMDC, COPECO and UNAH.

2.1.3.2 *Application and Approval of the Project Plan (P1).*

The aforementioned plan must be requested by the coordinating team and approved by UMGIR since it is the municipal unit with the mandate of mainstreaming risk management. In addition, the constant involvement of UMPEG and its role in the monitoring of indicators, as well as the fulfillment of the goals and objectives of the plan are essential. Once approved, it must proceed to the implementation of the plan, they must carry out at least two (2) sessions at the stage of drawing up the plan for its revision, and one (1) final session for approval once all the corrections or modifications made by the coordinating team have been resolved.

2.1.4 Establishment of the Working Group for the Implementation of Disaster Preparedness on Slopes (P2).

This activity should be carried out by UMGIR with the support of UNAH, COPECO and other AMDC entities responsible for the issue.

Objective for establishing the working group

To implement this plan, it is necessary to set up working teams with those responsible for implementation, who will be responsible for defining, carrying out and developing the timetable for each activity.

That is why it intends to set up a coordinating team that handles all the processes in the different colonies/neighborhoods and different committees, as well as intervened colonies/neighborhoods in the DC, to manage each project on time and based on the needs of each community.

Procedure for nominating and approving members of the working group

2.1.4.1 *Formation of the Coordination Team.*

A coordinating team will be set up for the implementation of this plan of action to monitor and evaluate the progress made over time as a result of the implementation

of this plan of action, and to provide a response, if necessary, when evaluating a situation that occurs in the intervention works.

The composition of the Coordinating Team is recommended to be developed under a technical support and coordination agreement between the AMDC, COPECO and UNAH. It will be composed of a representative of each institution mentioned above.

Representatives of the above-mentioned institutions should be chosen on the basis of the following criteria:

- Be over 25 years old
- Work in the institution you intend to represent.
- The representative should have time to participate in the workshops and meetings to which he/she would be invited, as his/her participation will be binding for achieving the project objective.
- It must have the necessary experience to generate technical criteria for the procedures carried out.
- To be a professional of a career in order to the project (Civil engineer, architect or similar career).

The diagram that the coordinating team should have is shown below:



Figure 9.- Diagram of the coordinating team. (Source: JET)

Procedure for selecting external partnerships

If the intervention of an entity external to those mentioned above is necessary, AMDC will be the one designated to carry out the pertinent link by means of a letter signed by the Municipal Mayor and addressed to the institution with which it is required to formalize the alliance for support in the processes that are required. The following steps must be followed to manage the necessary strategic alliances:



Figure 10.- Process for formalizing external partnerships. (Source: JET).

Table 7.- Description of steps to formalize alliances (Source: JET)

ALLIANCES CREATION PROCEDURE			
Nº	STEP	ACTIVITY	ALLIED INSTITUTION
1	ALLIANCES ANALYSIS	The coordinating team will be in charge of analyzing which external entity should be involved in the process, either because of its degree of influence or because of its experience in the matter. These entities may belong to the following categories: Academia (in case of needing the experience or influence of an institution other than the UNAH), civil society (It must be linked to an association duly constituted as such, or a community group such as patronage, water board or board of directors or some private institution that has due importance in the case to be dealt with), in addition, other central government entities that are necessary in the process may be involved.	DOT
2	PREPARATION OF OFFICIAL LETTER	DOT will be in charge of making the official letter that will be sent to the entity which wants to generate the alliance, specifying the objective of the inclusion, the estimated time that will be required and the designation of responsibilities that will be obtained once the alliance is accepted.	DOT
3	OFFICIAL SIGNATURE	Once the official letter has been prepared, the mayor signs it to strengthen its institutional validity.	MAJOR
4	DELIVERY OF OFFICIAL	Once the official letter has been signed, it is sent to the institution/association designated as a strategic alliance and addressed to the legal representative of said entity.	DOT
5	ALLIANCE ACCEPTANCE	The institution/entity to which the official letter was sent to be part of the process must send a response letter accepting the alliance and committing to be part of the meetings that are designated to be held during the process in which it will be part of the process. part.	ALLIED INSTITUTION

2.1.5 Securing a budget for studies (P3).

The entry of the budget within the POA must be made taking into account the budget ceilings for this type of action and it will be necessary to update it every year, taking as a reference the results obtained as a result of the monitoring of the execution of the POA executed the previous year. This will allow determining new courses of action that allow the achievement of the expected results. This budget, once entered into the POA, must have a monitoring system which consists of

evidencing the physical and financial execution based on the interventions carried out and the results obtained, which must be carried out by the UMPEG.

Goal:

In order to establish a budget for the different studies that must be carried out in the areas to be intervened, an amount will be established that must be reviewed each year in the POA of the unit that carries out the study.

Department/Organization responsible for the activity:

This activity should be entrusted to UMGIR with the support of UNAH, COPECO and other AMDC entities that are responsible for this issue.

2.1.5.1 Make the study plans

This stage must have the involvement of the different key actors so that from the beginning of the project they can take part, having a voice and a vote in the decisions carried out; however, UMGIR will be responsible for guiding the studies in constant support of UNAH and its team of experts.

The person responsible for carrying out the investigation and analysis of the sites to be intervened will be UMGIR with the constant support of UNAH and its team of specialists.

Department/Organization responsible for the activity:

UMGIR will be responsible for conducting the investigation and analysis of the sites to be addressed, with the continued support of UNAH and its team of specialists.

2.1.5.2 Budget request for studies

Below is the procedure to follow to allocate the budget for the studies to be carried out:

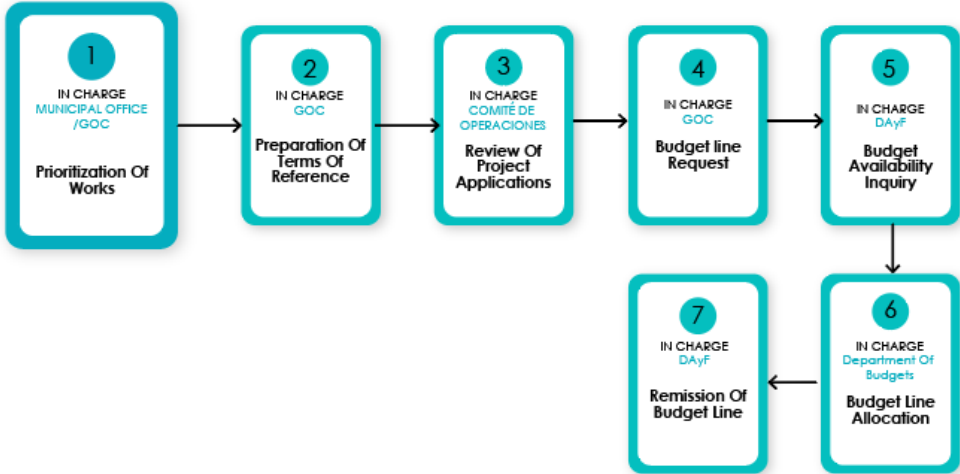


Figure 11.- Procedure for budget allocation. (Source: JET)

1. PRIORITIZATION OF WORKS: The Municipal Mayor, Civil Works Management, and/or other Units within the AMDC, identify construction needs at different points in the Central District.

2. PREPARATION OF REFERENCE TERMS: Once the priorities of projects to be implemented have been defined, and according to the order of arrival, the project code is entered into the Infrastructure Program, the "Control of Applications", and the technical staff are assigned to and follow up the respective projects.

Technical staff prepares the terms of reference (TdRs) for the hiring of consulting firms and sends the request for approval to the Operations Committee, which is composed of the Director of Finance and Administration, Director of Spatial Planning and Director of Control and Follow-up.

3. REVIEW OF PROJECT APPLICATIONS: They review the applications received for new projects, orders to change them, as well as the addenda, if everything is correct they accept the application and approve the application, otherwise they reject it and return it with the respective comments.

Send request to the requesting area.

4. REQUEST FOR BUDGET LINE: Makes an application memorandum addressed to the Directorate of Finance and Administration, requesting the budget line and enclosing the application approved by the committee.

5. CONSULTATION OF BUDGET AVAILABILITY: Forwards the request for budgetary availability to the Budget Division through a memorandum of referral.

6. BUDGET LINE ASSIGNATION: Check that the budget request memorandum has the approval of the Director of Finance and Administration and that the budget request has the signature of the Director of Territorial Planning.

Inquiry about availability in the requested budget line.

There is availability

Print and sign the budget item and send it to the Directorate of Territorial Planning.

Lack of availability

Rejects the request and returns with the explanations of the case to the Directorate of Finance and Administration, who in turn returns to the Directorate of Territorial Planning.

7. REMISSION OF BUDGET LINE: Sends the budget item to the requesting unit by Official Letter.

2.1.6 Contracting.¹

GLA carries out the contracting process for public or private works and services in strict compliance with the policies, guidelines and directives established in the State Contracting Law.

Goal

To develop a tendering process for works or procurement of goods and services that meet the requirements and expectations, following the mandate of the laws that are associated with the tendering process.

¹ MANUAL DE PROCESOS Y PROCEDIMIENTOS INTEGRADOS DIRECCIÓN GENERAL DE ADQUISICIONES

2.1.6.1 *Revision of the consultancy plan (P4).*

In order to contract consultancy services for the conduct of studies of all kinds, it is necessary to follow the respective procedures according to the State Contracting Law and the procedures established by the municipality.

Department/Organization responsible for the activity:

This activity should be commissioned by GLA with the support of UMGIR.

2.1.6.2 *Revision of Technical Specifications (P5).*

It will be necessary to revise the technical specifications previously drawn up for the intended procurement, which will be contained in a document called "Terms of Reference" or TdRs.

The TdRs specify the characteristics that the service is intended to have, through the precise identification of the activities that make it up, the technical characteristics of these activities and the procedures that the contractor is expected to use, as well as the expected end result of each detailed activity.

UMGIR will be responsible for preparing the terms of reference when required and subsequently moving to the GLA for review and approval.

2.1.6.3 *Preparation of Documents for Tender (P6).*

GLA will be responsible for preparing the documentation required for the tendering process to be carried out by AMDC.

These documents are called "tender documents" which set out the works, goods or services which are the subject of the invitation to tender, the instructions to tenderers for preparing their tenders, the requirements to be met by the tenderers, the basis for the procedure leading to the award and conclusion of the contract, the time limits for each stage of the tender and the criteria for evaluating the tenders. Shall also include the general and special conditions of the contract and any other requirements deemed relevant.

2.1.6.4 *Bidding and evaluation of offers (P7).*

Goal:

To obtain services according to an initial request from the different AMDC units and at the best cost/benefit conditions. In addition to evaluating the performance of contracted services.

It involves the selection of contractors for public works or for the supply of goods or services; it involves a public invitation to interested parties or a direct invitation to certain qualified tenderers, who meet the requirements of the LCE and its Regulations, submit their tenders in writing to the contracting authority which decides on the award of the contract in accordance with the criteria laid down in the LCE.

Department/Organization responsible for the activity:

The tender for the contracting of services will be carried out by GLA which is responsible for AMDC to carry out the tendering processes.

Tendering and evaluation procedure

Below, the procedure and those responsible for its execution to carry out the tendering process according to the type of service you want to contract are shown:

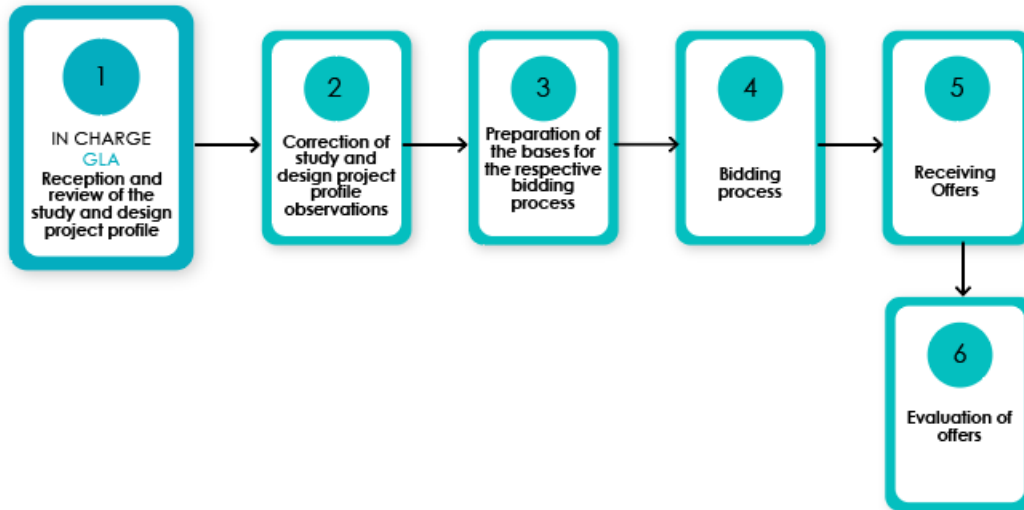


Figure 12.- Bidding process and evaluation of bids. (Source: JET)

The procedure shown in the figure above is described, information obtained from the Manual of Procedures of the Civil Works Management, Study Procedure and Design of Works:

1. RECEPTION AND REVIEW OF THE DRAFT STUDY PROJECT PROFILE: Upon receipt of the profile, the GLA reviews the document and makes any comments that, in its opinion, are necessary for the project to meet the requirements of the State Contracting Law.
Comments on the document are sent via e-mail and/or memorandum to GOC so that technical staff can correct any necessary corrections or adjustments to the document.
2. CORRECTION OF OBSERVATIONS TO THE STUDY PROJECT PROFILE: If there are any comments on the correction or adjustment document in accordance with the state contracting law, the technical staff of GOC makes the necessary adjustments and the profile is sent again via memorandum and/or email.
3. PREPARATION OF THE BASES FOR THE RESPECTIVE BIDDING PROCESS: Once tenders have the profile rectified by UMGIR, having verified their existence in the investment plan, the tender process is carried out in accordance with the provisions of the state contracting law of Honduras.
4. TENDERING PROCESS: During the respective bidding process, there is a question-and-answer period where if GLA considers that UMGIR should clarify or amend something to the terms of reference, it refers the bidders' queries and these are reviewed by the technical staff of the UMGIR within the time established by law.

5. RECEIVING OFFERS: Technical and economic bids from all interested parties participating in the tendering process are acknowledged through a public event. The existence of:
 - *Technical offer in sealed envelope*
 - *Economic offer in sealed envelope*
 - *Guarantee of maintenance of supply.*
6. EVALUATION OF OFFERS: After knowing the lowest value offered, the technical offer is evaluated, if it meets all the requirements established in the terms of reference in terms of experience in the type of projects to be designed and its methodology meets the criteria of AMDC, the breakdown of the economic offer is reviewed. If the coordination considers it necessary to carry out a price negotiation with the offeror, the latter is invited to a negotiation process to agree on a value that satisfies the interests of the AMDC, this process is explained below in the next item.

2.1.6.5 *Negotiation and contract (P8).*

Once the analysis and evaluation of the different offers that were submitted to the bidding process launched, the award resolution is issued.

Tenders shall be awarded within the period of validity of the tenders, by reasoned decision of the competent body, in this case GLA of AMDC. The award shall be made to the tenderer who, meeting the conditions for participation, including economic and financial solvency and technical or professional suitability, submits the lowest price tender or, where the contract documents so determine, the tender which is the lowest price, which is considered the most economical or advantageous as a result of an objective assessment of the price and other factors provided for in the Law (Art. 51.52, LCE; 139 RLCE).²

Department/Organization responsible for the activity:

The tender for the contracting of services will be carried out by GLA which is responsible for AMDC to carry out the tendering processes.

Procedimiento para la etapa de negociación y contratación

Below, the procedure and those responsible for its implementation are shown to carry out the negotiation and contracting process according to the type of service to be contracted:

² Manual de Contratación de ONCAE

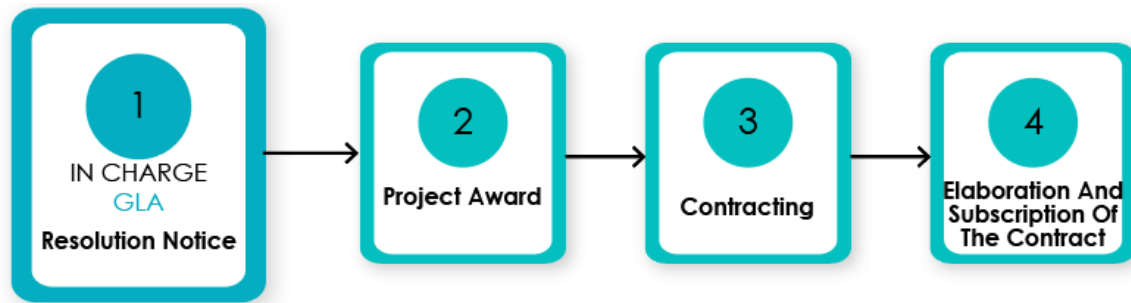


Figure 13.- Procedure for the negotiation and contracting phase. (Source: JET)

1. **NOTIFICATION OF RESOLUTION:** The tenderers shall be notified of the decision and the result shall be recorded in the file.
The publication shall include at least the following information:
 - El nombre de la entidad;
 - Una descripción de los servicios incluidos en el contrato;
 - El nombre del contratista al cual se adjudicó el contrato;
 - El valor de la adjudicación (Art. 142 RLCE)
2. **AWARD OF THE PROJECT:** Once the price has been negotiated and GLA has verified that the bidder meets the legal requirements, GLA verifies that the project is included in the current investment plan and thus asks the Finance Department for the respective budget line to guarantee the financial availability to be able to contract these services.
Once DAYF through the budget department issues the respective budget line, GLA sends the Municipal Mayor for signature the contract already signed by the bidder to whom the project is awarded.
3. **CONTRACTING:** once the above steps have been completed and additional documentation specified in the specifications will be required to proceed with the process.
4. **DEVELOPMENT AND SUBSCRIPTION OF THE CONTRACT:** AMDC shall draw up the contract, which shall be subject to the provisions of the Award Resolution, as well as the terms of the contract and the tender selected, which shall be signed by the parties within the stipulated time.

2.1.7 Contract Management.

2.1.7.1 Initial Meetings (P9).

A meeting will be held to initiate the hiring, it will function as an introductory presentation between the parties involved in the entire process that will be carried out and the clarification of the scope required for the contracted consultancy.

Once the contract has been signed The Contractor shall be obliged to commence the contracted works upon receipt of the commencement order which shall be issued by AMDC within fifteen (15) calendar days of the date of delivery of the advance on account of the total price, if so agreed, provided that the other requirements provided for in Article 68 of LCE (art. 63, 68 72).

Department/Organization responsible for the activity:

This activity should be commissioned by the UMGIR with the support of the AMDC entities responsible for the subject.

2.1.7.2 Receipt and review of reports (P10).

Through its duly selected staff, AMDC will oversee the proper execution of the contract and the timely delivery of products. Written orders of supervisors shall be carried out by the Contractor, provided that they comply with the provisions of the LCE, its Regulations or the contract documents. (ART. 82 LCE; ART. 2215, 216,217,218,219 RLCE).

Follow-up meetings should be held at least every fifteen (15) days to make the respective product reviews UMGIR will be responsible for ensuring that these reviews are carried out in the best way, ensuring that the end result is what is desired and agreed according to the TdRs and needs to be met.

Department/Organization responsible for the activity:

This activity should be commissioned by DAYF with the support of AMDC entities responsible for the subject.

2.1.7.3 Programming of payments (P11).

The final step will be to assess the degree of satisfaction in meeting the need that was intended to be met, i.e. to consider whether it has been possible to meet the needs with the efficiency and effectiveness that we anticipated according to the initial planning. It will also allow us to identify unmet needs. From the assessment of recruitment management we will then be able to document the lessons learned and put them into action for the next occasion.

Department/Organization responsible for the activity:

This activity should be commissioned by DAYF with the support of AMDC entities responsible for the subject.

2.1.8 Plan of Implementation of the Slope Disaster Prevention Project (P12).

This plan will be the tool for prevention and preparedness to face emergency situations due to slope disasters. But this must be made known to the municipal authorities and the population at large in order to raise collective awareness among the inhabitants of the areas at risk. Commitments from both sides should be made to reduce risks and develop a better-lived and safer community from natural and man-made threats.

2.1.8.1 Survey Results and analysis of contractors

Based on the results of the survey and analysis, prepared by the contractor, the urgency of the target area, the scale of the appropriate countermeasure work and the feasibility of implementing the work will be discussed.

UMGIR, as the organizer, shall convene the related departments of AMDC (DOT, GER and CODEM) and related organizations such as UNAH and COPECO to carry out the meeting to review the results of the surveys and the analysis carried out by

the contractor. The participation of UNAH (IHCIT and Faculty of Engineering) is mandatory, especially since verification and technical evaluation are required. Once these products have been reviewed and comments made, the final report is drawn up by the contractor.

2.1.8.2 *Perform the monitoring and analyze the results of the monitoring (in case of landslides)*

When the type of hazard on the target slope is a landslide, monitoring shall be performed to observe the movement of the landslide using instrumentation, taking into account the indications in item 2.1.

Responsible for this activity shall be CODEM, which shall measure the monitoring equipment placed on the site. CODEM will collect the results of the monitoring and share them with UMGIR and other relevant areas of AMDC, UNAH and COPECO within an appropriate period of time.

The analysis and evaluation based on the results of the monitoring will be prepared by UMGIR with the collaboration of UNAH. In addition, it will carry out the management of landslides based on the results of the monitoring, this will be the starting point for the decision making of the actions to be carried out according to their urgency. Slide monitoring should continue after survey and analysis work as a continuous and periodic process.

The procedure to be followed should be as follows:

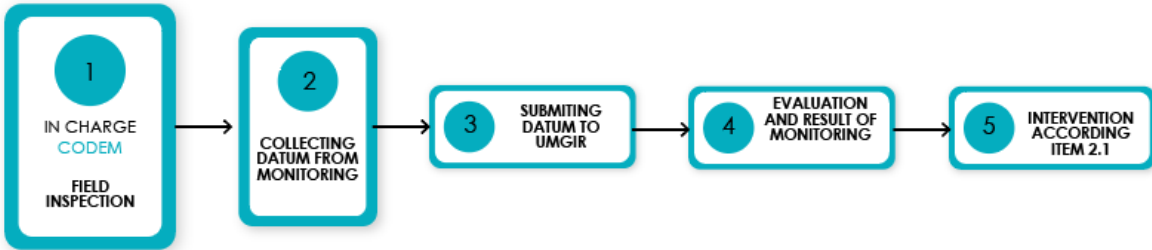


Figure 14.- Process of monitoring and analyzing the results of monitoring (Source: JET)

2.1.8.3 *Countermeasures policy (Draft)*

Based on the verification of the survey results and the results of the monitoring, the budget plan and the feasible implementation period for implementing the countermeasures will be discussed. This study group will be held once a year, coordinated by UMGIR. In addition to UMGIR, GER, GOC, DOT and other relevant AMDC departments participate in the study group (see Table #7 Condensed Responsible Matrix). UNAH, COPECO and CODEM will be invited to participate as advisers, if necessary.

Based on the results of this study, the project will proceed to the design and construction phase of countermeasures works.

2.2 OUTPUT 02: STRENGTHENING OF CAPACITY FOR THE DESIGN, CONSTRUCTION, OVERVISION AND MAINTENANCE OF STRUCTURAL MEASURES FOR SLOPE DISASTER RISKS OF SMALL/MEDIAN SCALE.

The procedures for carrying out design, construction, supervision and maintenance in the hillside disaster risk areas selected by AMDC and the responsible departments are described below.

The plan should be reviewed and updated every five (5) years taking into account the overlapping change of government so as not to lose the continuity of those responsible.

The following describes the procedures for the realization of the project plan (Stage 2-5) to be implemented in the disaster risk areas of the slopes selected by AMDC and the responsible departments.

2.2.1 Project Plan.

It is important to note that before elaborating the project plan, it must go through a preparatory phase where the objective of the project is analyzed, those involved in developing it both on the part of AMDC and on the part of the community that must be involved in the whole process.

Goal:

Its purpose is to mark the steps to be followed in case of replication of intervention measures at other previously selected sites, this stage can make a difference in the success of a project. Through the matrix and given by the good or bad management of the plan at the time of its implementation. The following benefits will be realized from the implementation of this work plan:

- Resolution of potential conflicts.
- Clarified steps to be taken.
- In addition, the actors involved in the process will be analyzed to obtain better results, and at the same time who will be responsible for each of the stages shown in the plan.

Department/Organization responsible for the activity:

AMDC will be in charge of the process of elaborating and implementing the Project Plan in which, according to its work experience, the following entities should be involved: DOT, UMPEG, GER, CODEM, DCyS and GOC; however, for the Investigation and Analysis phase, UMGIR will be directly responsible for the activity with the support of the above-mentioned managers/directorates/units.

The activity will be constantly supported by UNAH, under the department that they consider competent for the support that will be provided to AMDC.

Time of execution:

The project plan has five phases that will last depending on the size of the intervention to be undertaken and the type of tendering process to be undertaken. The Investigation and analysis phase may last more than a year since studies will have to be carried out during the rainy seasons depending on the type of work to be carried out. The design work will be carried out within a period determined by

the size of the project, the construction and supervision will depend on the type of project that has been designed, this may be a major or minor work and depending on its size the execution time will be decided, the maintenance phase will be carried out for the first time six (6) months after the completion of the project (12) months, the monitoring and evaluation should be carried out on a regular basis every six months. It will be the Coordinating Team (UNAH, COPECO and AMDC) through their respective representatives who will review and approve the project plan and each of its phases to be subsequently developed and implemented in the areas to be intervened. These must carry out at least two (2) sessions during the preparation of the plan for its revision, and one (1) final session for approval once all the corrections or modifications made by the coordinating team.

2.2.1.1 Preparation of the Project Plan.

The work plan consists of five steps that set the pace of the process and will allow the project to function successfully in each of the communities where it is carried out. It should be noted that step one (Investigation and Analysis) is part of Output 1, which is why it is explained in the Action Plan of the Output. The following figure shows the complete process of the Project Plan:

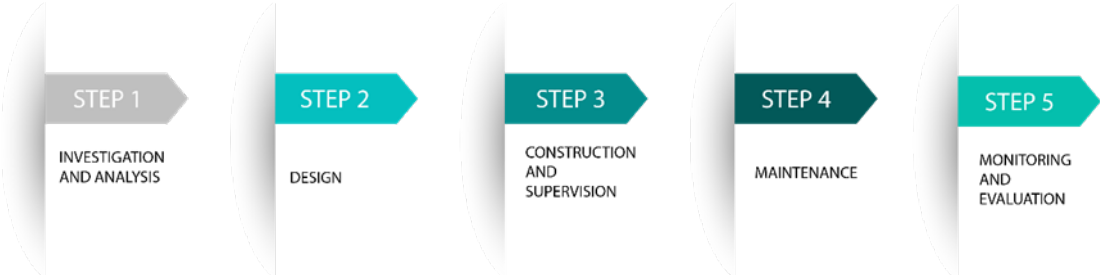


Figure 35.- Procedure for establishing a Project Plan. (Source: JET)

The next steps are described below:

STEP 2. DESIGN: The effective execution of an intervention work will depend largely on the results of the investigation stage and to a large extent on its design. This step will be carried out based on the results of the previous stage and in order to solve the problem exposed, effective and feasible solutions will be proposed in all aspects (economic, social and environmental) See annex 4.

Member responsible for preparing the project plan:

This phase must involve the different key actors so that they can participate and have a say in the decisions carried out; however, the GOC will be responsible for guiding this phase 2 of design, with the constant support of UNAH and its team of experts.

The following image shows an influence graph³, which represents the capacity of the institution, person or organization to persuade others, influencing their decisions and expectations; taking into account certain criteria such as being a financial,

³ "Informe del taller de mapa de actores del proyecto de Corredor de buses Eléctricos y bicicletas-Eje 8 Sur-, Ciudad de México, México, elaborado por C40 Cities Finance Facility (CFF)".

legal or social mobilization resource, in other words, an actor may not have the necessary financial resources, but may have the capacity to exert pressure for decision-making in a given sector of the territory. As long as there is more influence on a key actor, their expectations will be higher.

Those involved in the process are classified into three levels of territorial influence: high, medium and low. Based on the previous categorization, the following criteria were taken to develop the classification of each of the actors in the process:

- Government: Consideration was given to the various activities carried out by the different centralized and decentralized government institutions that are part of the interest group, according to the different stages of the plan.
- Academy: In order to consider the degree of mobilization of the population in this category, it mainly considered the contributions they have made in terms of research and information generation, the degree to which the university is linked to solving community problems, the relevance of the academic offer to the reality of the territory, the existence of institutes, observatories or research groups, and the specific geographical areas where the research projects are carried out and/or linkage, in addition to taking into account the number of students enrolled.
- Civil Society: In order to consider the level of mobilization of the population in the category of civil society, the different types of internal organizations of the colonies, villages and neighborhoods of the DC were considered, such as the Safe Barrio, formal patronage, water boards and boards of directors.

For the development of this process, certain guidelines were followed, such as:

- Selection of the form of representation.

The form of representation of the actors corresponds to the onion-type graph, through which it was possible to visualize the 3 categories already established for territorial actors: Academy, Government and Civil Society.

- Placement of actors

For the placement of the actors, the same symbol (circle) was used to represent the actors directly influencing the project. The type of line represents the degree of influence of the actor with respect to the project objective. The segmented line represents a high degree of influence, the dotted line represents the medium degree of influence, and the continuous line represents the low degree of influence.

Below is a graph showing the influence of the actors who should be involved in the whole process:

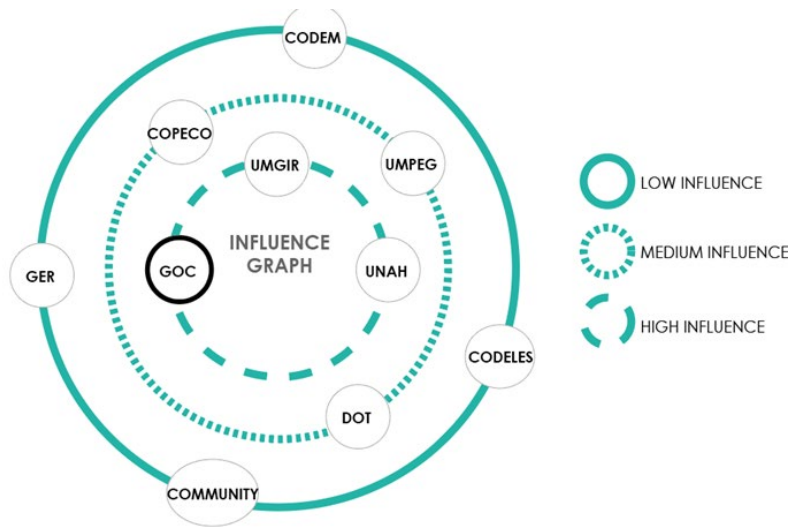


Figure 46.- Influence graph, Design stage. (Source: JET)

GOC will be responsible for carrying out the design of the intervention works, with the support of the delegated committee and its team of specialists. This management must ensure that this design is incorporated into the annual POA, in order to secure the budget for carrying out the designed work. Once the design has been carried out by the specialists who are part of those involved, it will be necessary to proceed with the next step, which is explained in the next section.

- STEP 3. CONSTRUCTION AND SUPERVISION: The implementation of this stage involves the implementation of the design proposal that was carried out in the previous step and includes the organization and structure of the project executing team, the operation of the design and the assignment of tasks, deadlines and responsibilities for each objective, products or results and activities committed, among others to carry out all the design intervention works in full. Some recommendations to be taken into account during the construction phase of the project are set out below:
- To ensure that project logistics take into account local human resources to meet project demands by identifying and assessing their capacities.
 - To develop weekly, monthly or annual work plans (schedule of activities) depending on the size of the work
 - To prepare contingency plans for health or natural emergencies.
 - To generate strategic alliances between the actors involved.
 - To establish appropriate responsibility mechanisms within the members of the community, taking into account that the entities in charge of ensuring safety in the event of natural disasters are the CODELES team of the community duly trained and equipped by AMDC.
 - To clarify roles and responsibilities between of the project executor, its work team, the supervisory team and the project participants.
 - To establish process supervision mechanisms by a third party.

Member responsible for preparing the project plan:

This phase must involve the different key actors so that they can participate and have a say in the decisions made; however, DCyS will be responsible for guiding this phase 3 of construction and supervision, with the constant support of the other stakeholders and their team of experts.

The following image shows an influence graph⁴, which represents the capacity of the institution, person or organization to persuade others, influencing their decisions and expectations; taking into account some criteria such as being a financial, legal or social mobilization resource; that is, an actor might not have the necessary financial resources, but might have the capacity to exert pressure for decision-making in a given sector of the territory.

For the placement of the actors, the same symbol (circle) was used to represent the actors directly influencing the project. The type of line represents the degree of influence of the actor with respect to the project objective. The segmented line represents a high degree of influence, the dotted line represents the medium degree of influence, and the continuous line represents the low degree of influence.

Below is a graph showing the influence of the actors who should be involved in the whole process:

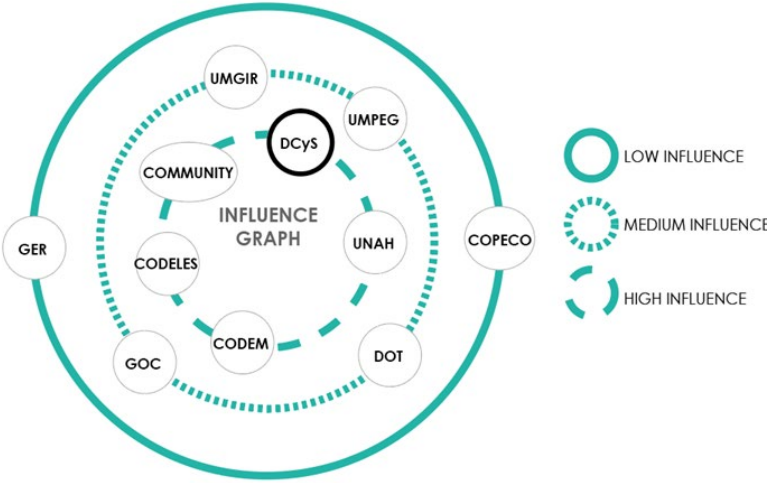


Figure 57.-.- Influence chart, construction phase and monitoring. (Source: JET)

The person responsible for carrying out the construction of the intervention works will be through the hiring of a construction company and another supervising company to oversee the process, with the support of DCyS and UMPEG, the delegated committee and its team of specialists. This entity must ensure that this work is included in the annual POA, in order to secure the budget for carrying it out. Once the construction has been carried out by the specialists who are part of those involved, it will be necessary to proceed with the next step, which is explained in the following section.

4 "Informe del taller de mapa de actores del proyecto de Corredor de buses Eléctricos y bicicletas-Eje 8 Sur-, Ciudad de México, México, elaborado por C40 Cities Finance Facility (CFF)".

STEP 4. **MANTENANCE:** This stage refers to the set of preventive tasks that must be carried out with some frequency in an intervention in order to meet the previously defined objectives and also increase the useful life of the built work as much as possible. The frequency can be set based on the experience of the technicians in charge of ensuring its maintenance. It is recommended that said follow-up frequency be periodic, that is, indicating the time that must elapse between interventions and may coincide with the monitoring and evaluation dates that must be carried out every six (6) months.

Member responsible for preparing the project plan:

This stage must involve the different key actors so that they can participate and have a say in the decisions carried out; however, DCyS will be responsible for guiding this stage 4, which will maintain the constant support of the other stakeholders and its team of experts.

The following image shows an influence graph ⁵, which represents the capacity of the institution, person or organization to persuade others, influencing their decisions and expectations; taking into account certain criteria such as being a financial, legal or social mobilization resource, in other words, an actor may not have the necessary financial resources, but may have the capacity to exert pressure for decision-making in a given sector of the territory.

For the placement of the actors, the same symbol (circle) was used to represent the actors directly influencing the project. The type of line represents the degree of influence of the actor with respect to the project objective. The segmented line represents a high degree of influence, the dotted line represents the medium degree of influence, and the continuous line represents the low degree of influence. Below is a graph showing the influence of the actors who should be involved in the whole process:

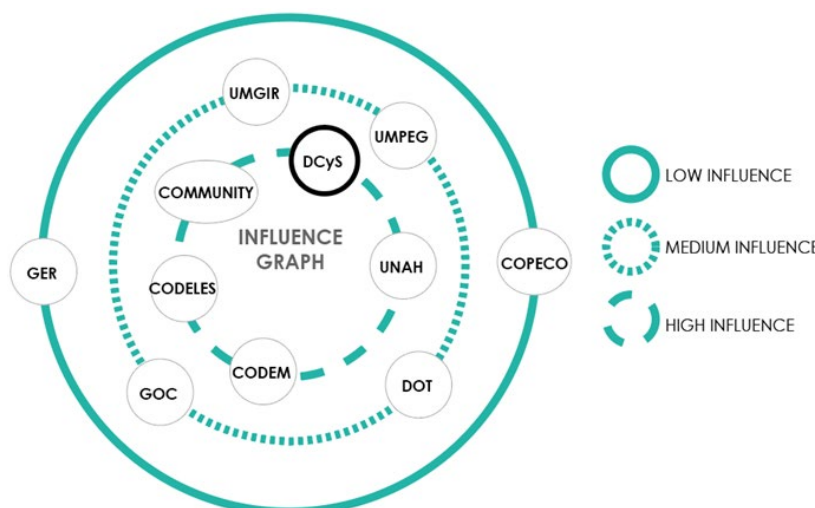


Figure 68.- Influence chart, maintenance stage. (Source: JET)

⁵ "Informe del taller de mapa de actores del proyecto de Corredor de buses Eléctricos y bicicletas-Eje 8 Sur-, Ciudad de México, México, elaborado por C40 Cities Finance Facility (CFF)".

DCyS will be responsible for maintaining the intervention works, with the support of the delegated committee and its team of specialists. Once the maintenance has been carried out by the specialists who are part of those involved, it is necessary to proceed to the next step, which is explained in the next section. This directorate must ensure that this process is incorporated into the annual OPA, in order to secure the budget for carrying it out.

STEP 5. MONITORING AND ASSESSMENT: as part of the project plan, it is intended to ensure continuous monitoring and evaluation to generate better results, as well as identifying good practices that allow continuous improvement, in this and other risk management processes. This is an essential component of the successful management of any type of intervention. Monitoring the process of collecting and analyzing data and information on a systematic basis in order to detect signs of change from the baseline obtained in step one (1) of the entire process. Instead, the evaluation refers to the process of reviewing the data collected from monitoring to understand how much difference the intervention has made and what lessons can be learned and replicated at other sites with similar characteristics. It must be understood that the evaluation is not only the measure of the success of the work carried out but also the analysis of any kind of change in the intervention, whether negative or positive.

Member responsible for preparing the project plan:

This stage must involve the different key actors so that they can participate and have a say in the decisions carried out; however, CODEM will be responsible for guiding this stage 5 of monitoring and evaluation in constant support of the other stakeholders and their team of experts.

The following image shows an influence graph⁶, which represents the capacity of the institution, person or organization to persuade others, influencing their decisions and expectations; taking into account certain criteria such as being a financial, legal or social mobilization resource, in other words, an actor may not have the necessary financial resources, but may have the capacity to exert pressure for decision-making in a given sector of the territory.

For the placement of the actors, the same symbol (circle) was used to represent the actors directly influencing the project. The type of line represents the degree of influence of the actor with respect to the project objective. The segmented line represents a high degree of influence, the dotted line represents the medium degree of influence, and the continuous line represents the low degree of influence. Below is a graph showing the influence of the actors who should be involved in the whole process:

⁶ "Informe del taller de mapa de actores del proyecto de Corredor de buses Eléctricos y bicicletas-Eje 8 Sur-, Ciudad de México, México, elaborado por C40 Cities Finance Facility (CFF)".

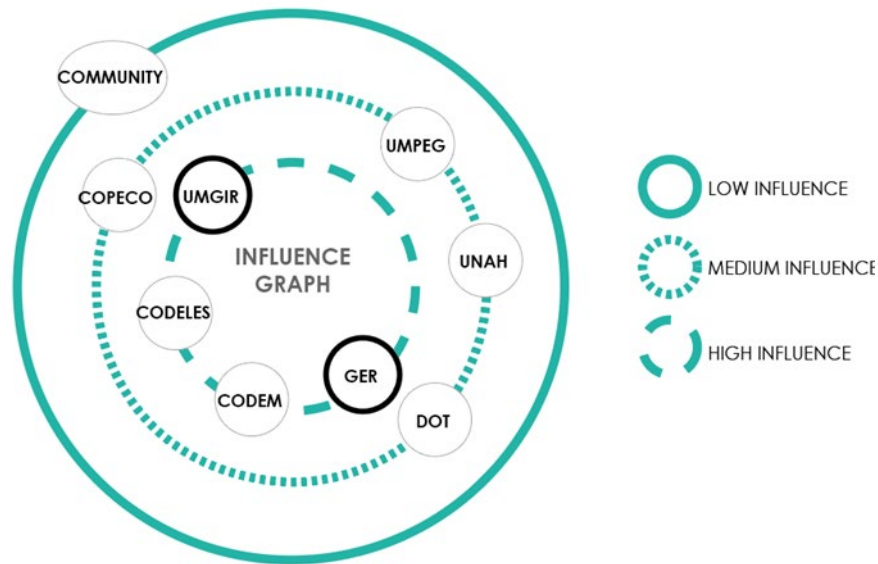


Figure 79.- Influence chart, monitoring and assessment stage. (Source: JET)

CODEM with the support of DCyS will be responsible for carrying out the monitoring and evaluation of the intervention works, with the support of the delegated committee and its team of specialists. Once the maintenance has been carried out by the specialists who are part of those involved, it is necessary to proceed to the next step, which is explained in the next section. Monitoring and evaluation is intended to be carried out through the following mechanisms, for this purpose the indicators of compliance and the deadlines described above will be used as a reference.

- Committee of experts consisting of representatives of COPECO, AMDC, UNAH and CODELES of the sites that will be intervened.
- Internal reports on the implementation of the Plan's actions by the different municipal administrations involved in the process. Quarterly reports are proposed.
- Six-monthly monitoring report generated by GER at the time of carrying out the assessments of each site involved.

Actors involved in the process of activity development

All those involved in the process should be aware of the activities to get better results from the site, then the key actors identified for this process of the Project Plan are shown; in addition, there is a chart mapping the actors that identify the institutions that should be involved in the process, these are divided into three categories. (Academy, Civil Society and Government), on the part of the academy there is the UNAH which will have to establish which department will be involved in the process described above. As part of civil society, two stakeholders were mapped: the community at large through the board of trustees, board of directors or other organization that has the colony/neighborhood and is representative of its part, and the CODELES, which are responsible for ensuring the care of the community in issues of risk, for which they must always be involved, and as part of the government there

is COPECO as the central government, which must propose a department that is involved in the whole process and AMDC as the administrative body of the municipality of DC through the different managers/units/directorates according to the process. In this particular case of the Project Plan, the following entities must be involved: In this particular case of the Project Plan, the following entities must be involved: DOT, UMPEG, GER, DCyS, CODEM and GOC:

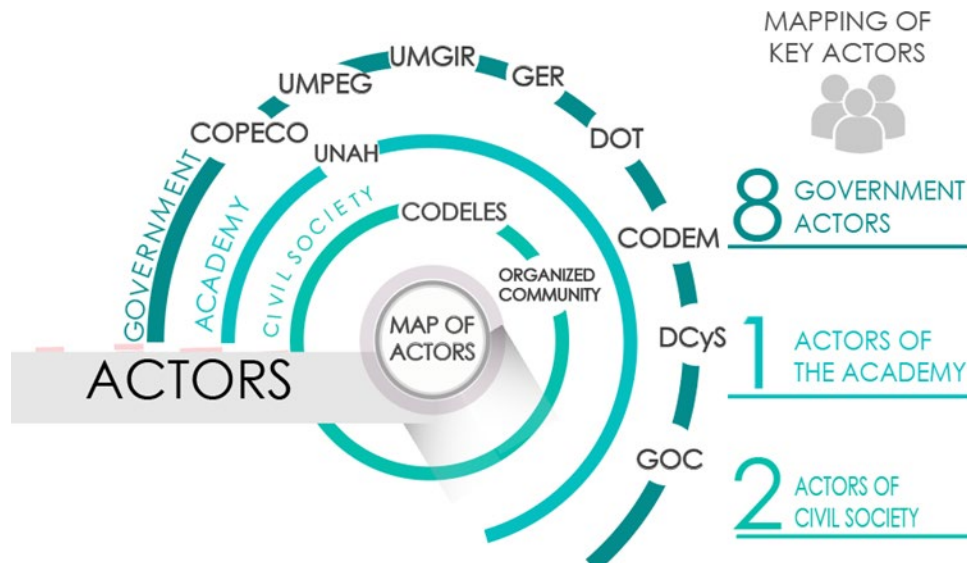


Figure 20.- Mapping of Actors for the project plan (Source: JET)

The responsibilities of the institutions involved in the process described above are set out below, in order to have a better control of the activity:

Table 8.- Matrix of actors involved and their responsibilities. (Source: JET)

ACTORS INVOLVED AND ITS RESPONSIBILITIES		
CATEGORY	INSTITUTION	RESPONSIBILITIES
ACADEMY	UNAH	Technical support in the process
CENTRAL GOVERNMENT	COPECO	Technical support in the process
LOCAL GOVERNMENT	DOT	Technical support in the process of the
	UMPEG	Technical support in the process
	UMGIR	Preparation of the monitoring and evaluation stage of the Project Plan.
	GER	Technical support in the process
	DCyS	Preparation of the construction stage, supervision and maintenance of the Project Plan.
	GOC	Elaboration of the design stage of the Project Plan.
	CODEM	Technical support in the process and management with the community
CIVIL SOCIETY	CODELES	Community observers
	COMMUNITY	

2.2.2 Budget request (P3).

The entry of each of the stages of the plan into the POA should be made taking into account the budgetary ceilings for that type of work specifically. The budget for each of the phases to be carried out must be updated annually, taking as a reference the results obtained as a result of the monitoring of the implementation of the POA carried out the previous year. This planning makes it possible to identify new courses of action to achieve the expected results from the results-oriented strategic planning approach. Once this budget has been entered into the POA, it must have a monitoring system which consists in demonstrating the physical and financial implementation based on the interventions carried out and the results obtained.

Goal:

In order to establish a budget for the different phases to be carried out, an amount shall be established which shall be reviewed annually in the POA of the unit carrying out the phase.

Department/Organization responsible for the activity:

This activity will be developed by GOC, which is the management responsible for leading this entire process to its formulation.

2.2.2.1 For Designing.

Every design project has a procedure for requesting a budget, the following picture shows the procedure to be followed for requesting a budget at the design stage:

The procedure to be followed for the allocation of the budget for the studies to be carried out is shown below:

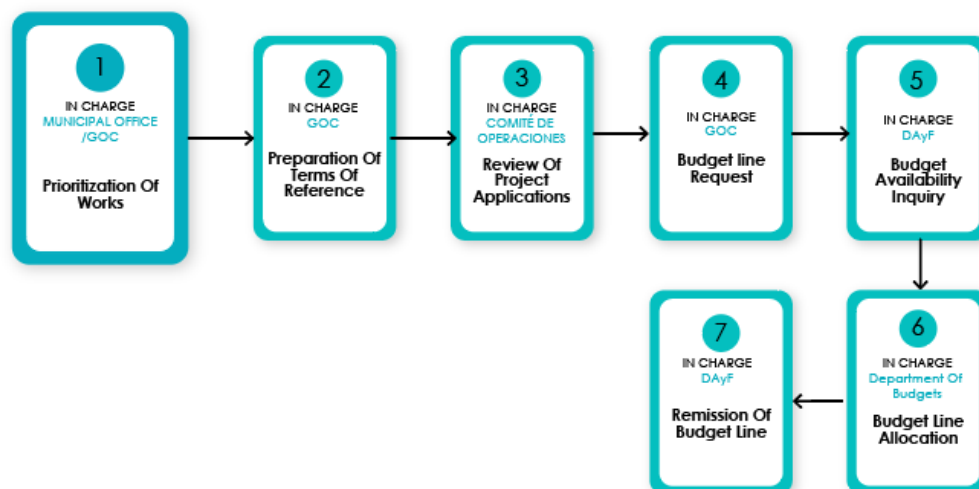


Figure 218.- Procedure for budget allocation. (Source: JET)

1. **PRIORITIZATION OF WORKS:** The Municipal Mayor, Civil Works Management, and/or other Units within AMDC, identify construction needs at different points in the Central District.
2. **PREPARATION OF REFERENCE TERMS:** Once the priorities of projects to be implemented have been defined, and according to the order of arrival, the project code is entered into the Infrastructure Program, the "Control of Applications", and the technical staff are assigned to and follow up the respective projects.
 Technical staff prepares the terms of reference (TdR) for the hiring of consulting firms and sends the request for approval to the Operations Committee, which is composed of the Director of Finance and Administration, Director of Spatial Planning and Director of Control and Follow-up.
3. **REVIEW OF PROJECT APPLICATIONS:** They review the applications received for new projects, orders to change them, as well as the addenda, if everything is correct they accept the application and approve the application, otherwise they reject it and return it with the respective comments.
 Send request to the requesting area.
4. **BUDGET LINE REQUEST:** Makes an application memorandum addressed to the Directorate of Finance and Administration, requesting the budget line and enclosing the application approved by the committee
5. **BUDGET AVAILABILITY INQUIRY:** Forwards the request for budgetary availability to the Budget Division through a memorandum of referral.
6. **BUDGET LINE ALLOCATION:** Check that the budget request memorandum has the approval of the Director of Finance and Administration and that

the budget request has the signature of the Director of Territorial Planning. Inquiry about availability in the requested budget line.

There is availability: Print and sign the budget item and send it to the Directorate of Territorial Planning.

Lack of availability: Rejects the request and returns with the explanations of the case to the Directorate of Finance and Administration, who in turn returns to the Directorate of Territorial Planning.

7. REMISSION OF BUDGET LINE: Sends the budget item to the requesting unit by Official Letter.

2.2.2.2 For construction, supervision and maintenance for major works.

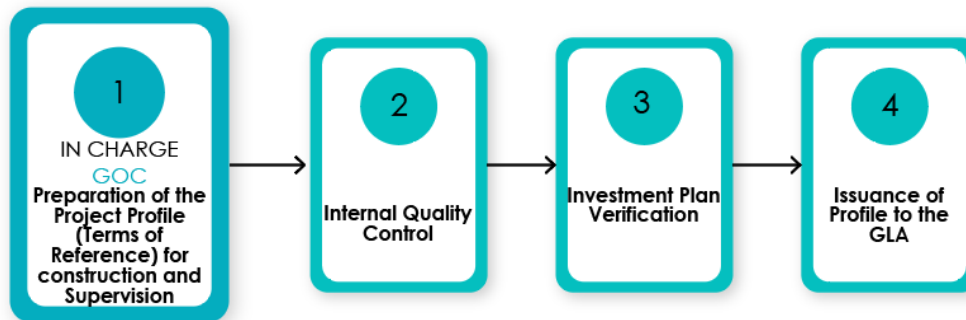


Figure 22.- Budget request process for construction and major construction supervision (Source: JET)

The procedure shown in the previous figure is described below, information obtained from the Manual of Procedures of the Civil Works Management, Study Procedure and Design of Major Works (Annex 5):

1. PREPARATION OF THE PROJECT PROFILE (REFERENCE TERMS) FOR CONSTRUCTION AND SUPERVISION: With the complete designs delivered by the consultant responsible for the project, AMDC prioritizes the implementation of new projects and gives the guidance to GOC to proceed with the formulation of the project profile for a specific solution (See Annex 6).
2. INTERNAL QUALITY CONTROL: Once you have the profile of the project, an internal quality control is carried out, this will serve to verify that it includes the requirements requested by GLA, based on the Contracting Law of the State of Honduras.
3. INVESTMENT PLAN VERIFICATION: Having the project profile ready, GOC financial manager verifies that the construction and supervision of the project is included in the investment plan, which will be sent to the GLA.
4. INSSUANCE OF PROFILE TO GLA: Once the profile is ready and GOC has the authorization to submit the document. It is sent to GLA in physical form and on CD via a memorandum, indicating the name of the project, code, method of contracting and any information that clarifies the purpose of the project.

2.2.2.3 For construction, supervision and maintenance for minor works.

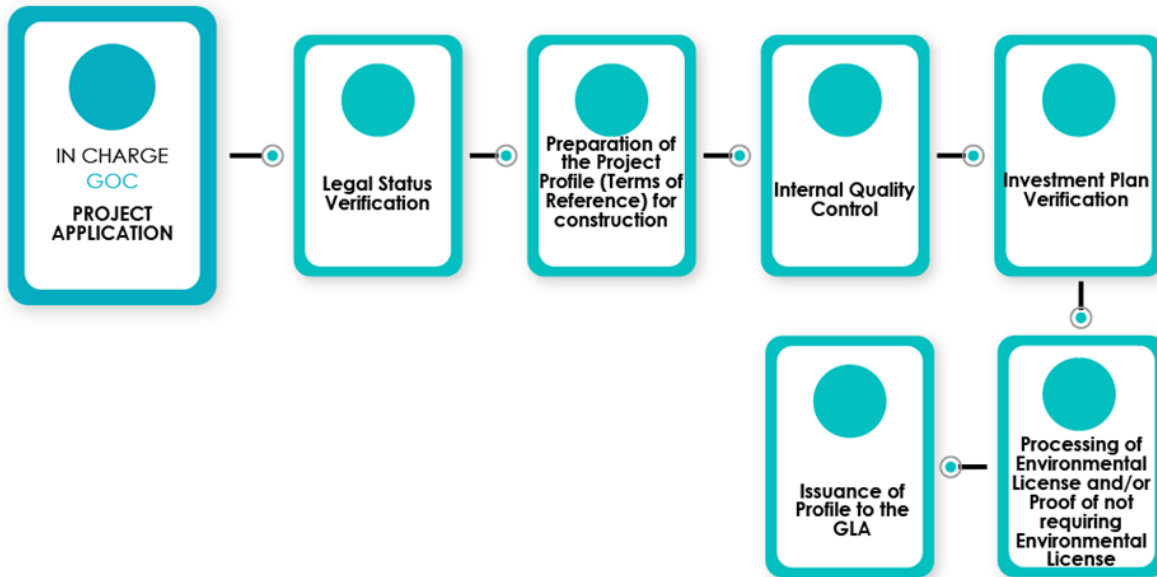


Figure 23.- Budget request process for construction and minor construction supervision. (Source: JET)

The procedure shown in the previous figure is described below, information obtained from the Manual of Procedures of the Civil Works Management, Study Procedure and Design of Minor Works:

1. **PROJECT APPLICATION:** The Board of Trustees, water boards, neighborhood boards, taxpayers in general, send an application addressed to the Municipal Mayor and is taken to the offices of the Municipal Office and / or copy to GOC. It details the requirements in terms of site needs in the different neighborhoods, settlements, villages and hamlets of the Central District (Annex 7). The request includes a description of the needs, photos of the site, location and name of the site, signature of the beneficiaries of the project, there are different projects that fall under this category of minor works which are broken down in it.
2. **LEGAL STATUS VERIFICATION:** Upon having authorization to formulate the project, GOC makes a request for proof of public thoroughfare by means of a memorandum to the Cadastral Management to verify that the site where the work is proposed is on a public thoroughfare or municipal property (green area).
3. **PREPARATION OF THE PROJECT PROFILE (REFERENCE TERMS) FOR CONSTRUCTION:** Upon receipt of the project application, GOC technical staff conducts a field visit to assess the needs expressed in the project application.
After the field assessment, the scope of the project that can be implemented on the site is defined, reviewed and prioritized by AMDC for the implementation of new projects and instructed GOC to proceed with the formulation of the project profile for a specific solution. (See Annex 8).

4. INTERNAL QUALITY CONTROL: Once you have the profile of the project, an internal quality control is carried out, this will serve to verify that it includes the requirements requested by GLA, based on the state contracting law of Honduras.
5. INVESTMENT PLAN VERIFICATION: Having ready the profile of the project, the financial manager of GOC verifies that it is included in the investment plan the construction of the project that will be sent to GLA.
6. PROCESSING OF ENVIRONMENTAL LICENSE AND/OR PROOF OF NOT REQUIRING ENVIRONMENTAL LICENSE (See Annex 4): Knowing the exact location, the basic budget of the project, construction plans and an estimate of the beneficiaries of the same, GOC proceeds to ask UGA for the respective environmental license procedure, which is why it proceeds to submit and formally apply to MIAMBIENTE for such a license. GOC proceeds to apply to UGA for the respective environmental license procedure, which is why UGA analyzes the information sent and determines that it is sufficient to issue a confirmation that an environmental license is not required.
7. INSSUANCE OF PROFILE TO GLA: Once you have the profile ready and GOC has the authorization to submit the document. It is sent to GLA in physical form and on CD via memorandum, indicating the name of the project, code, method of contracting and any information that clarifies the purpose of the project.

2.2.3 Contracting.⁷

Goal:

To purchase a service based on a written agreement called a contract between the AMDC and the suppliers/suppliers defining the conditions and requirements, both technical and economic, of the service to be supplied by means of the Terms of Reference made by the competent entity within AMDC.

Department/Organization responsible for the activity:

This activity will be developed by GLA, which is the management responsible for leading this entire process up to its award.

Implementation procedure:

Contracts shall be awarded on the basis of the award criteria set out in the notification for tenders issued by AMDC in one of these two ways:

- Offer with the lowest price of all regular and compliant offers.
- At the quality-value for money.

The award criteria must meet the following requirements:

- They must be linked to the subject-matter of the contract.

⁷ MANUAL DE PROCESOS Y PROCEDIMIENTOS INTEGRADOS DIRECCIÓN GENERAL DE ADQUISICIONES

- They shall be formulated objectively, with full respect for the principles of procurement and shall not confer unlimited freedom of decision on the contracting authority.
- They must ensure that tenders can be evaluated under conditions of effective competition.

The types of contracts are as follows:

1. **DIRECT CONTRACTING:** these are considered those whose estimated value is equal to or less than 250,000.00 HNL.

Purchases of lesser amount, up to 50,000.00 HNL, will be acquired directly from suppliers or service providers, Purchase Order against invoice. Purchases over 50,000.00 HNL and lower than 250,000.00 HNL may be made by direct contracting based on a single offer and Purchase Order issued to the supplier. These direct purchases, for an amount equal to or less than 250,000.00 HNL, They may not have a duration of more than one year or be subject to extension.

2. **DIRECT CONTRACTING BY EXCEPTION:** The procedure of direct contracting by exception is of exceptional use, since it is an exception to the principles of competition and advertising, for this reason this procedure is not included among those of ordinary use. It is therefore of limited and restrictive use and will only be used in exceptional cases. This procurement procedure, which is an exception to the general procedure, will only be used in the following cases:

- Where the works, supplies or services can only be entrusted to a particular supplier for one of the following reasons: the absence of competition for technical reasons; or the protection of exclusive rights, including intellectual and industrial property rights. The absence of competition for technical reasons and the protection of exclusive rights, including intellectual and industrial property rights, shall only apply where there is no reasonable alternative or substitute and where the absence of competition does not result from a restrictive configuration of the requirements and criteria for the award of the contract.
- Where, for imperative reasons of urgency, due to events which the contracting authority could not foresee and for which it is not responsible, the time limits imposed by the procedures referred to in this manual cannot be complied with.
- When the nature or special characteristics of some supplies justify it, for example, when the execution of the contract is reserved exclusively to the holders of patents or licenses that regulate their use.
- When a tender is declared void because no offer deserves to be selected from a qualitative and financial point of view, in which case, after canceling the tender, the contracting authority may enter into negotiations with the bidders it prefers among those who have participated in the tender, if they meet the selection criteria, and provided that the initial conditions of the contract are not substantially modified and the principle of fair competition is respected. If no offer was received, or if none of the bidders meet the selection criteria, direct contracting may not be authorized by exception.
- When a new contract must be concluded due to the early termination of an ongoing contract.

In all cases, a report must be prepared justifying the way in which the negotiations have been carried out and the reasons for the subsequent decision to award the contract. This report must be included in the contract file and must be approved by the contracting authority. As well as the proper issuance of the Purchase Order to the supplier of the good or service.

3. **PRICE COMPARATIVE CONTRACTION:** Shortened procedure used only for purchases of common supplies with standard specifications, this procurement procedure may not exceed the amount of 400,000.00 HNL. This procedure is based on the comparison of prices offered by at least three (3) potential suppliers. The award of these contracts will be awarded by the contracting authority to the offer with the lowest price among all the regular and compliant offers.

By its very nature, lowest-price procurement, suppliers will not be informed in the price comparison of the base budget, i.e. the maximum expenditure that may be incurred by the contracting authority under the contract, including value added tax.

The selection of the successful tenderer must always be based on the lowest price, which means that the technical specifications (minimum requirements) must be sufficiently detailed to make it impossible to assess other aspects other than price. The applicant who identifies the need shall send a requisition request, who, together with the head of the Directorate for Administration and Finance, shall be responsible for managing the procedure and documenting the file.

4. **SIMPLIFIED PROCEDURE:** The procedure used for intermediate value purchases consists of a restricted invitation to a minimum of three bidders subject to requirements (deadlines, conditions, technical specifications) under which they submit their proposals and which AMDC will then award on the basis of the award criteria corresponding to the nature of the subject matter of the contract (services, supplies or works).

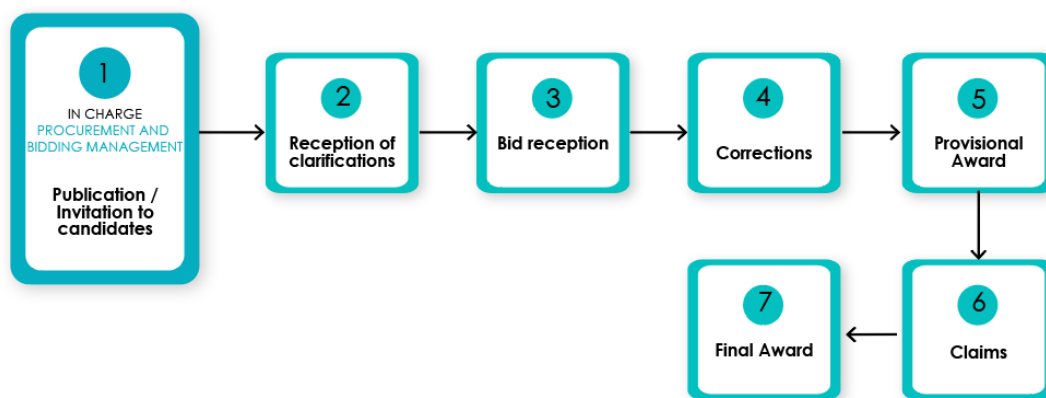


Figure 24.- Simplified contracting process (Source: JET).

This procedure may be carried out in the following ways:

- Restricted invitation (minimum three guests) without advertising (until 500,000.00 HND).
- Invitation (minimum three guests) with advertising (from 500,000.00 HND).

5. **FRAMEWORK CONTRACT:** Contract used for the supply of goods or services of recurring need and for extended periods, based on an auto-renewal purchase order. A framework contract is an agreement concluded between the contracting authority and one or more economic operators laying down the conditions governing specific contracts to be awarded over a specified period of time.

The framework contract may be used only for service and supply contracts, as an alternative in simplified and tendering procedures. The framework contract may not be used where the estimated value exceeds 4.000.000 of lempiras. Framework contracts shall be awarded on the basis of a call for tender or a simplified procedure, usually involving a request for proposals to provide a good or service for an extended period of time and price maintenance.

The duration of such contracts may not exceed four years, save in exceptional cases duly justified, in particular by the subject-matter of the framework contract. The solicitation documents and the contract shall, to the extent possible and in a non-binding manner, include a minimum and a maximum quantity of goods or services to be procured during the term of the contract. For the purposes of calculating the estimated value, for framework agreements, the maximum estimated value of the set of contracts foreseen during the total duration of the framework agreement will be taken into account, excluding Value Added Tax.

6. **CONTRACTION BY TENDER:** In the case of contracts with a value greater than 1,000,000.00 HNL, OEI will publish an advertisement on its website in the "Contracting Area" and in any other additional media it deems appropriate with the aim of increasing its dissemination. The publication shall include the "Terms of Reference" or "Terms of Reference" as appropriate, which shall contain at least the following information:

- Background
- Description of the subject matter of the contract with its essential characteristics or technical specifications.
- Budget on the basis of tendering.
- Deadlines governing the notification for tenders: for the submission of tenders, for requesting clarifications to the tender documents, for dealing with remedies at the request of the AMDC, for communicating the award and for the submission of complaints, among others. Those periods shall be sufficient to guarantee the principles of competition, equality and non-discrimination.
- Documentation to be submitted by bidders, form and modalities of submission of tenders.
- Selection and award criteria
- Procedure in the event of a tie.
- Duration and extensions of contract
- Place and term of delivery or execution of the good or service.
- Guarantees that must be constituted, if applicable, by the bidders or the successful bidder.
- Way to pay.
- Legal regime of the contract and competent jurisdiction.
- Any other condition considered necessary for the correct execution of the contract.

For the award of these contracts, AMDC must obtain at least one valid offer that deserves to be selected from the qualitative or economic point of view.

The process carried out for hiring a professional or a company will be the same for all stages of the project plan (design, construction, supervision, maintenance, etc.), only the amount of the process must be taken into account for decide what type of contracting of the aforementioned will be carried out.

2.2.3.1 *Cost Estimation.*

Refers to the process of forecasting the financial and other resources necessary to complete a project within a defined scope and criteria.

An initial cost estimate will be able to determine if a project is green light and if the project moves forward, the estimate can be a factor in defining the scope of the project. A cost estimate is a sum of all the costs involved in successfully completing a project, from start to finish (project duration). These costs can be classified into two main categories: direct costs and indirect costs.

- Direct costs are generally classified as those directly associated with a single area (such as a department or a project). In project management, direct costs are expenses billed exclusively to a specific project. They can include project team salaries, resource costs to produce physical products, fuel for equipment, and money spent to address project-specific risks.
- Indirect costs, on the other hand, cannot be tied to a specific cost center and instead are incurred on multiple projects simultaneously, sometimes in varying amounts. In project management, quality control, security costs, and utilities are generally classified as indirect costs, as they are shared across a number of projects and are not billed directly to any one project.⁸

Some of the criteria to be taken into account should be the following depending on the type of contract that is made:

2.2.3.1.1 For the design (including design of renovation and repair work for maintenance).

The cost estimate of the design will depend on the magnitude of the design.

In addition, in this case only the direct costs and the human resource that will be in charge of carrying out the design of the intervention work should be taken into account (Annex 10).

2.2.3.1.2 For construction (including design of renovation and repair work for maintenance.)

Construction costs encompass two main cost categories:

1. At the time of construction and development of the project: aspects such as:
 - Acquisition of land: this aspect must be taken into account when the work is designed covering privately owned land, however, it must be prioritized that the designs be carried out on public property.
 - Construction materials: taking into account the design, it will be possible to have an estimate of both the amount of materials and their cost.

⁸ <https://es.smartsheet.com/ultimate-guide-project-cost-estimating>

- Fluctuations in the price of materials: the increase in the price of materials must be taken into account when the project lasts more than three months.
 - Equipment: Another important aspect is the rental of construction equipment that the executing company does not have.
 - Human resource: this must include all non-specialized labor that will be used at the time of execution of the work, as well as the team of professionals that will supervise the correct execution of the design.
2. Those incurred in the operations and maintenance of the work throughout its life cycle: includes the costs of maintenance and repair, the costs of renting land and public services, and the cost of operations and the employment of maintenance personnel operations.

In addition to these categories, it should be taken into account to estimate the costs of contingencies or unforeseen events that may occur in the project. Since construction projects are often large-scale and take place over long periods, proper contingency planning is vital.

2.2.3.2 Selection of Contractors.⁹

Contractors will be excluded from the selection processes if they do not meet the criteria described below. These must be clear and non-discriminatory in order to assess whether the contractor has sufficient financial, economic, technical and professional capacity to perform the tasks of the contract. These criteria are described in the following paragraph:

- VERIFICATION OF THE ECONOMIC CAPACITY OF THE CONTRACTORS: The purpose of this criterion is to examine whether the contractor will in fact not be financially dependent on the contracting authority (in this case AMDC) in the event of awarding the contract to it and whether it has sufficient financial stability to cope with the proposed contract. Financial and economic standing may be evidenced by one or more of the following documents, for example:
 - Appropriate bank statements;
 - Declaration on annual turnover referring to the year with the highest turnover of the last three years. Turnover shall be at least one and a half times the estimated value of the contract where its duration does not exceed one year, and at least one and a half times the average annual value of the contract where its duration is more than one year. The annual turnover shall be credited by means of its annual accounts submitted to the Revenue Administration Service (Annual Declaration). Sole proprietors not registered with the Revenue Administration Service will certify their annual turnover by means of their inventory books and annual accounts certified by the SAR.
 - Proof of the existence of insurance against civil liability for professional risks for an amount equal to or greater than that required in the contract notice or the invitation to take part in the procedure. Evidence of this requirement shall be provided by means of a certificate issued by the insurer, stating the amounts and risks insured and the date of expiry of the insurance, and by

⁹ Procedimiento de compras y contrataciones oei honduras
http://h1.honducompras.gob.hn/Procesos/MANUAL_CONTRATACION_ONCAE_GPR_Julio2015.pdf

- means of a binding undertaking to take out, extend or renew the insurance, where appropriate.
- Solvency ratio (current assets/current liabilities) for the last year for which closed accounts are available must be at least equal to 1. The economic and financial solvency required must be proportionate to the object of the contract.
 - VERIFICATION THE TECHNICAL AND PROFESSIONAL CAPACITY OF CONTRACTOR: The purpose of this criterion is to examine whether the contractor actually has sufficient staff and experience to handle the proposed contract. The applicant's technical and professional capacity may be evidenced by one or more of the following documents, for example:
 - Academic and professional titles of the entrepreneur and the directors of the company and, in particular, of the person in charge or persons in charge of the execution of the contract, as well as of the technicians directly in charge of it, provided that they are not evaluated as an award criterion;
 - List of the main services and supplies provided in the last three years. The corresponding certificates issued or endorsed by the entity that contracted or acquired the services or supplies will be presented as evidence of good performance; The accreditation of the technical or professional solvency will be carried out through the list of the main services carried out in the last three years, of the same or similar nature as those that constitute the object of the contract, whose accumulated annual amount in the year of greatest execution is equal or greater than 70 percent of the average annuity of the contract.
 - List of works carried out in the last five years, with indication of amounts, dates and location. The list of most important works must be accompanied by appropriate certificates of good performance issued by the entity which acquired the works, indicating whether they have been carried out professionally and whether they have been carried out correctly;
 - Description of technical equipment, tools and equipment used in the performance of a service or works contract.

The process for selecting a contractor will be the same for all phases of the project plan (design, construction, supervision, maintenance, etc.), only the amount of the process should be taken into account in deciding which type of procurement to be undertaken.

2.2.3.3 *Revision of the consultancy plan and Contractor plan (P4).*

To hire consulting services to carry out studies of all kinds or contractors to carry out infrastructure works, it is necessary to follow the respective procedures according to the Contracting Law of Honduras and the procedures established by the municipality.

2.2.3.4 *Revision of Technical Specifications (P5).*

It will be necessary to revise the technical specifications previously drawn up for the intended procurement, which will be contained in a document called "Terms of Reference." or TdRs.

The TdRs specify the characteristics that the service is intended to have, through the precise identification of the activities that make it up, the technical characteristics of these activities and the procedures that the contractor is expected to use, as well as the expected end result of each detailed activity.

UMGIR will be responsible for preparing the terms of reference when required and subsequently moving to GLA for review and approval.

2.2.3.5 *Preparation of Documents for Tendering (P6).*

GLA will be in charge of preparing the documentation required for the bidding process that will be carried out by AMDC.

These documents are called "condition documents" where the works, goods or services that are the object of the tender are broken down, the instructions to the bidders to prepare their offers, the requirements that they must meet, the bases of the procedure until the award and formalization of the contract, the terms of each of its stages and the criteria for evaluating the offers; They will also include the general and special conditions of the contract and any other requirement that is considered important.

2.2.3.6 *Bidding and evaluation of tenders (P7).*

Goal:

Obtain services according to an initial request by the different AMDC units and in the best cost/benefit conditions. In addition to evaluating the execution of the contracted services.

It involves the selection of contractors for public works or supplies of goods or services; and consists of the public invitation to interested parties or direct invitation to certain qualified bidders, who meet the requirements set forth in the LCE and its Regulations, so that, subject to the condition documents, they submit their offers in writing to the body responsible for the contracting and that it decides the award of the contract according to the criteria set forth in the LCE.

Department/Organization responsible for the activity:

The tender for the contracting of services will be carried out by GLA, which is responsible for carrying out the bidding processes on the part of AMDC.

Tendering and evaluation procedure

The procedure and those responsible for its execution are shown below to carry out the bidding process according to the type of service to be contracted:

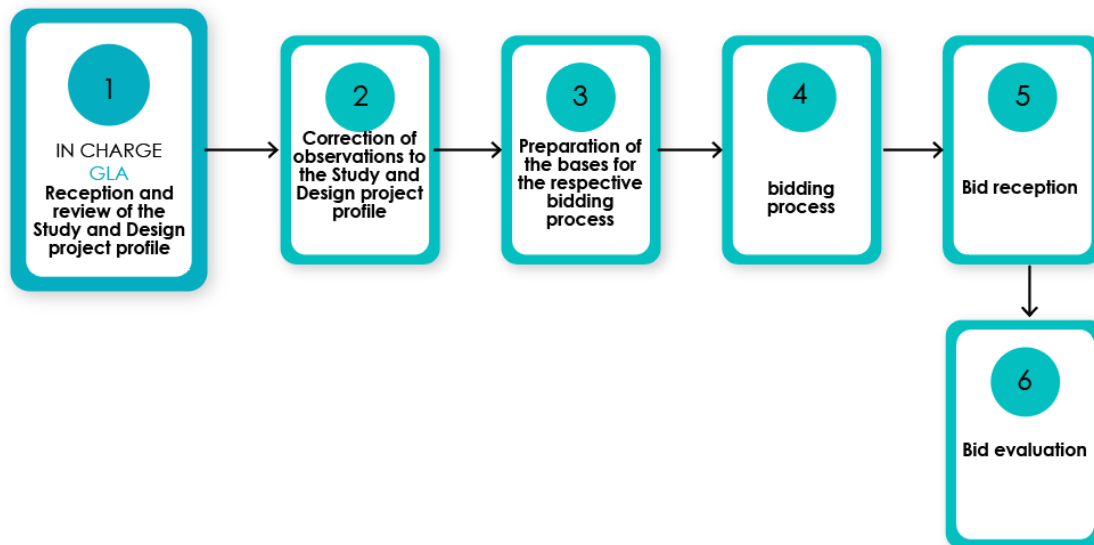


Figure 25.- Process of bidding for designing. (Source: JET)

Next, the procedure shown in the previous figure is described, information obtained from the Manual of Procedures of the Civil Works Management, Procedure for the Study and Design of Works:

1. RECEPTION AND REVIEW OF THE STUDY AND DESIGN PROJECT PROFILE: Upon receipt of the profile, GLA reviews the document and makes any observations that, based on its experience, are necessary for the project to meet the requirements of the State Contracting Law.
If there are any comments on the document, these are sent via email and/or memorandum to GOC so that the technical staff can correct any necessary correction or adjustment to the document.
2. CORRECTION OF OBSERVATIONS TO THE STUDY AND DESIGN PROJECT PROFILE: If there are observations to the correction or adjustment document in accordance with the state contracting law, the technical staff of the GOC makes the necessary adjustments and the profile is sent again via memorandum and/or mail electronic.
3. PREPARATION OF THE BASES FOR THE RESPECTIVE BIDDING PROCESS: Once the bidding has the profile corrected by GOC, having verified its existence in the investment plan, the bidding process is carried out in accordance with the provisions of the state contracting law of Honduras.
4. BIDDING PROCESS: During the respective bidding process there is a time for questions and answers where if GLA considers that UMGR should clarify or amend something to the terms of reference, it sends the queries of the bidders and these are reviewed by the technical staff of UMGR in the time established based on law.
5. BID RECEPTION: By means of a public act, the technical and economic offers of all the interested parties that participated in the bidding process are considered received. Verify the existence of:
 - Technical offer in sealed envelop
 - Economical offer in sealed envelop

-Fulfillment Guarantee of offer.

6. **BID EVALUATION:** After knowing the lowest value offered, the technical offer is evaluated, if it meets all the requirements established in the terms of reference in terms of experience in the type of projects to be designed and its methodology meets the AMDC criteria. , the breakdown of the economic offer is reviewed. If the coordination considers it necessary to carry out a price negotiation with the bidder, it is invited to a negotiation process to agree on a value that satisfies the interests of the AMDC, this process is explained below in the next item.

2.2.3.7 Negotiation and contract.

Once the analysis and evaluation of the different offers that were submitted to the bidding process launched, the award resolution is issued.

The tenders will be awarded within the period of validity of the offers, through a reasoned resolution issued by the competent body, in this case GLA of AMDC, the award will be made to the bidder that meets the participation requirements, including its economic and financial solvency and its technical or professional suitability, present the offer with the lowest price or, when the specifications so determine, the one that is considered most economical or advantageous as a result of the objective evaluation of the price and the other factors provided for in the Law (Art. 51.52, LCE; 139 RLCE).¹⁰

Department/Organization responsible for the activity:

The tender for the contracting of services will be carried out by GLA, which is responsible for carrying out the bidding processes on the part of AMDC.

Procedure for the negotiation and contracting phase

The procedure and those responsible for its execution are shown below to carry out the negotiation and contracting process according to the type of service to be contracted:

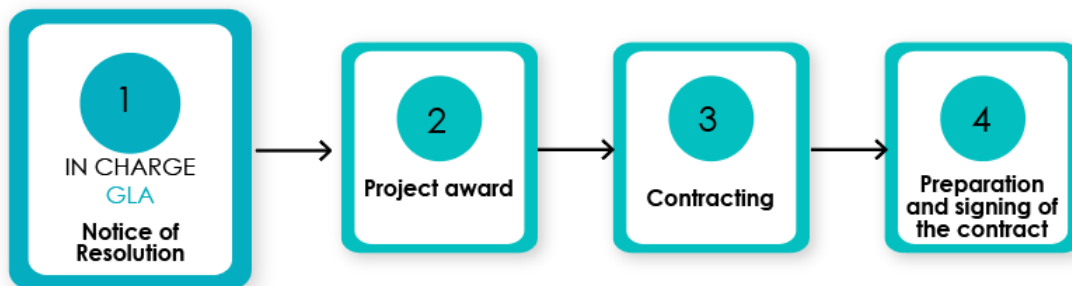


Figure 26.- Negotiation Process (Source: JET)

1. **NOTICE OF RESOLUTION:** This will be notified to the bidders, leaving a record of the result of the same in the file.
The publication must include at least the following information:
Name of the entity;

¹⁰ Manual de Contratación de ONCAE

- A description of included services in the contract;
The name of the contractor to whom the contract was awarded;
The value of the award (Art. 142 RLCE)
2. PROJECT AWARD: Upon having a negotiated price and having verified GLA that the bidder meets the requirements of the law, it proceeds to verify that the project is included in the current investment plan and thus request the Finance Directorate for the respective budget item that guarantee the financial availability to be able to contract these services.
Once DAYF, through the budget department, issues the respective budget item, GLA sends the contract already signed by the bidder to whom the project was awarded to be signed by the Municipal Mayor.
 3. CONTRACTING: Once the previous steps have been carried out and to proceed with the process, additional documentation indicated in the condition documents will be required.
 4. PREPARATION AND SIGNING OF THE CONTRACT: AMDC will prepare the contract, which must be subject to the provisions of the Award Resolution, as well as the provisions of the condition documents regarding the contract and the selected offer, this must be signed by the parties in the stipulated time.

2.2.4 Contract Management.

2.2.4.1 Initial Meetings.

A meeting will be held to start the contracting, this will function as an introductory presentation between the parties involved in the entire process that will be carried out and the clarification of the scope required for the contracted consultancy. The person in charge of directing the meetings and calling them must be UMGIR with its team of specialists.

Once the contract has been signed The Contractor shall be obliged to commence the contracted works upon receipt of the order to commence which shall be issued by the AMDC within fifteen (15) calendar days of the date of delivery of the advance on account of the full price, if so agreed, provided that the other requirements provided for in Article 68 of LCE (art. 63, 68, 72) are met.

The process carried out for the management of contracts will be the same for all phases of the project plan (design, construction, supervision, maintenance, etc.), only the amount of the process will have to be taken into account to decide which type of contract will be carried out.

2.2.4.2 Receipt and review of reports.

Through its duly selected personnel, UMGIR will supervise the correct execution of the contract and delivery of products in a timely manner. Written orders of supervisors shall be carried out by the Contractor provided that they are in accordance with the provisions of LCE, its Regulations or the contractual documents. (ART. 82 LCE; ART. 2215, 216, 217, 218, 219 RLCE).

Follow-up meetings should be held at least every fifteen (15) days to make the respective product reviews and UMGIR will be responsible for ensuring that these reviews are carried out in the best way, ensuring that the end result is what is desired and agreed according to the TdRs and needs to be met.

2.2.4.3 Programming of payments.

The final step will be to assess the degree of satisfaction in meeting the need that was intended to be met, i.e. to consider whether it has been possible to meet the needs with the efficiency and effectiveness anticipated in the initial planning. It will also allow us to identify unmet needs. From the assessment of recruitment management we will then be able to document the lessons learned and put them into action for the next occasion.

The total payment of the Consultant shall not exceed the total cost of the Contract and shall be an amount comprising the full costs of staff and the sub-consultant, as well as the costs of printing documents, communications, travel, accommodation and the like, and all other costs incurred by the Consultant in providing the services. In addition, payments will be made in national currency, unless otherwise stated in the TdRs submitted since the beginning of the process.

The person in charge must be DAYF with his team of specialists.

2.2.4.3.1 For the design (including design of renovation and repair work for maintenance).

Payments shall be made by the Contractor within forty-five (45) days from the date on which the Consultant submits the payment request and the request has been accepted by the Contractor, upon submission of the products specified in the TdRs. Payments may be made as follows (Annex 11):

- 15% for the presentation of the Work Plan and Initial Report (Preliminary Design Report) once approved by AMDC through the representation of UMGIR.
- 20% for the presentation of the Characterization report, once approved by AMDC through the representation of UMGIR.
- 20% for the presentation of the Preliminary Design report, once approved by AMDC through the representation of UMGIR.
- 35% for the presentation and delivery of the Final Design Report to UMGIR (Final Report without notification of the validation / Partial Acceptance of the product).
- 10% for delivery of the validation notification of the Final Design by GOC and DCyS to UMGIR.

From each payment, 12.5% will be withheld specifically on the value of the portion corresponding to the Fees included in each payment, retentions that will be returned when the Settlement agreement is issued to the consultancy. It is understood that, if the Consulting Firm accredits making "Payments on Account", no withholdings will be made for income tax purposes ISR.

All payments before they are made must be approved by the corresponding reports in advance by DOT.

2.2.4.3.2 For construction (including design of renovation and repair work for maintenance.)

Payments shall be made by the Contractor within forty-five (45) days of the date on which the request for payment is submitted by the Consultant and accepted by the Contractor. Payments may be made as follows:

- An advance payment of 15% to start the necessary preliminary works.
- Payments according to the presentation and approval of work estimates.
- Last payment of 10% at the end of the work and according to the final estimate presented and approved by DCyS.

From each payment, 12.5% will be withheld specifically on the value of the portion corresponding to the Fees included in each payment, withholdings that will be returned when the Settlement is issued to the consultancy.

2.2.5 Maintenance.

2.2.5.1 *Monitoring.*

Once all the structural works have been executed in the intervened sites, it is necessary to implement a series of periodic evaluations of the current state of each of the areas to ensure sustainability over time.

Goal:

Collect and analyze data and information on a systematic basis to detect signs of change relative to the baseline obtained from the entire process. It must be understood that the evaluation is not only the measure of the success of the work carried out but also the analysis of any kind of change in the intervention, whether negative or positive.

Areas at risk of slope disasters in DC, including existing areas where countermeasure works have been applied, are surveyed and will be assessed for current status. Based on the results, the application of maintenance work is prioritized, which must be carried out if necessary.

Department/Organization responsible for the activity:

Table 9.- Responsibility matrix for monitoring and evaluation of intervened areas.

MONITORING AND EVALUATION OF INTERVENED AREAS			
Role	Unit/Institution		In Charge
Direct Responsible	UMGIR	Manager of Unit and Technicians	Coordination, follow-up and completion of the Activity
Direct Support	GER	Prevention Officer GER	Technical Evaluation and Inspection Results
	CODEM	Monitoring Team	Technical support in the process and management with the community
Partners	CODELES	Certified Members	Provide information about the site
	UNAH	IHCIT	Scientific advice
		Engineering Faculty	Technical advice
	COPECO	Specialized technical staff	Technical advice

The following is a mapping of actors identifying the institutions that should be involved in the process. These are divided into three categories:

- Academy: UNAH which should establish which department will be involved in this process described above.
- Civil society: two of the community at large were mapped through the board of trustees, board of directors or other organization that has the colony/neighborhood and that is representative of their part, and the CODELES, which are responsible for ensuring the care of the community in issues of risk.
- Government: COPECO as the central government, which should propose a department that is involved in the whole process and the AMDC as the administrative body of the DC municipality.

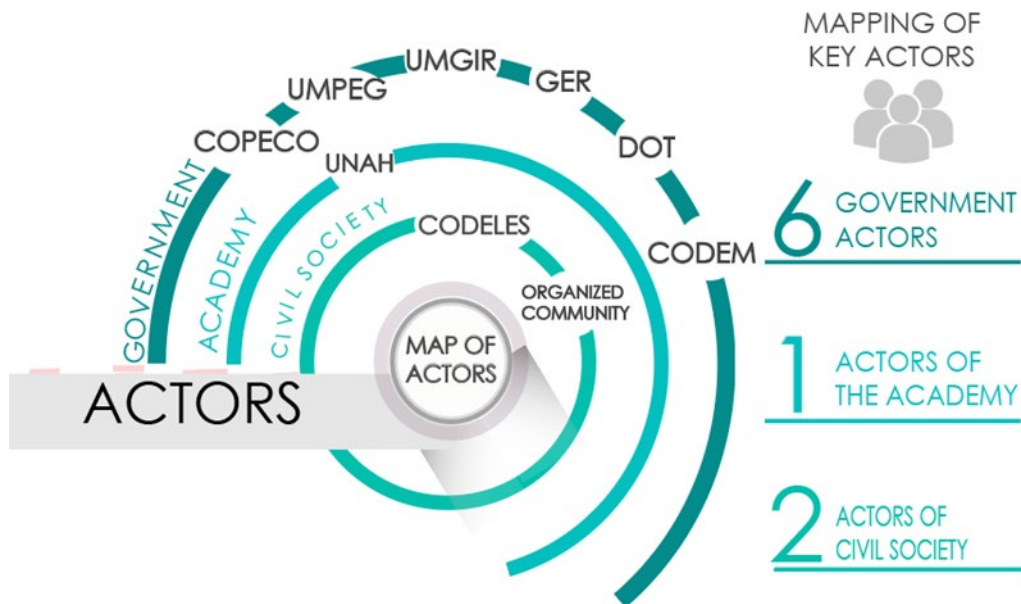


Figure 27.- Mapping of actors (Source: JET)

Time of execution:

Site inspections shall be carried out every February of the year preceding the year in which the maintenance work is scheduled to be carried out. This shall be done before the rainy season beginning in May of each year. If an inspection is requested outside this time due to external accelerating events, it will be carried out on a case-by-case basis.

2.2.5.1.1 Condition of facilities.

The CODEL team will be the first in charge of ensuring the monitoring of the facilities that are in the intervened area, they must carry out periodic inspections in the treated areas to know their status.

A monitoring and evaluation system should be implemented in order to collect and analyze data and information in order to detect signs of change in relation to a baseline, which in this case are the analyzes previously carried out in each pilot area.

Inspection Team:

CODEM will assign the inspection team member and request the supporting organization to send the member for inspection.

Implementation procedure:

CODEM will coordinate the following points:

- Determination of the areas of risk of slope disasters to carry out the inspection.
- Arrangement of the inspection team.
- Execution schedule.

The site inspection for hillside disaster risk areas will be executed by the on-site inspection team.

The inspection team will compile the result and record it in a report for subsequent decision making.

2.3 OUTPUT 03: STRENGTHENING CAPACITIES TO DEVELOP HAZARD AND RISK MAPS.

Risk maps are cartographic representations that make it possible to visualize the distribution of certain disaster risks in a specific territory, in this case the areas where intervention will be undertaken. These arise from the combination of hazard maps and vulnerability maps, each of which is already the result of specific indices and indicators.



Figure 28.- Risk chart. (Source: Manual for the elaboration of risk maps)

GER is the unit commissioned by AMDC to carry out assessments of sites at risk. The same management generates a technical report with all the details of the site, including the generation of current situation maps based on studies carried out by JICA in previous years. Another AMDC area responsible for carrying out risk maps is UMGR, which produces them with the aim of characterizing risk in different areas of the capital.

These entities are responsible for generating and managing risk maps.

2.3.1 Technical strengthening of the generators of slope movement risk maps.

The implementation of maps, whether new or updated, must involve a training component for the technicians who will be responsible for ensuring faithful compliance with this requirement. With the aim of strengthening the technical capacities of the GER staff, who are responsible for drawing up the maps of the different areas of the city.

These trainings should be given once a year due to updates of the scope of application in case it is extended or when new GER professionals who need to be trained in this topic enter.

For the generation of maps in disaster risk areas on slopes, it is essential to strengthen technical capacities for the correct elaboration and understanding of these maps. GER and UMGR are the bodies responsible for drawing up these maps. All technical staff designated for this purpose should be trained, using a methodology of "case

study¹¹", so that staff was able to understand and apply the entire procedure for drawing up risk maps for affected areas.

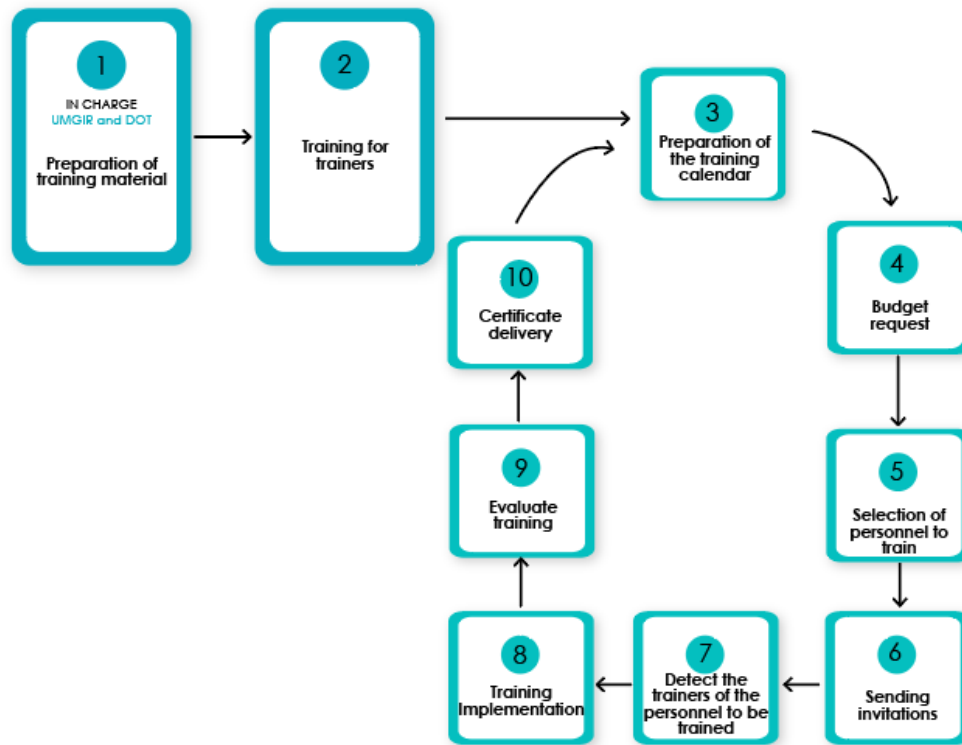
The training will be the responsibility of UMGIR, as the technical office responsible for disaster risk management in AMDC, with the support of DOT due to the link that exists in terms of territorial planning and with the support of UNAH specialists, who will be able to ensure that the methodology used meets the pedagogical requirements of the case. The following is a breakdown of the main activities to be carried out in order to conduct the training in the best possible manner and with success.

Table 10.- Training process (Source: JET)

TRAINING PROCESS															
ITEM	ACTIVITIES	IN CHARGE	YEAR 1						YEAR 2						
			6	7	8	9	10	11	12	1	2	3	4	5	6
1	Preparation of training material	UMGIR and DOT	■	■	■	■	■	■	■						
2	Training for trainers	UMGIR and DOT									■	■	■		
3	Preparation of the training calendar	UMGIR and DOT	■	■	■										
4	Budget request	UMGIR	■	■	■	■									
5	Selection of personnel to train	UMGIR								■	■				
6	sending invitations	UMGIR												■	
7	Detect the capabilities of the personnel to be trained	UMGIR													■
8	Training Implementation	UMGIR													■
9	To evaluate training	UMGIR													■

¹¹ Sistema Tecnológico de Monterrey

Figure



Process for training (Source: JET))

- STEP 1. PREPARATION OF TRAINING MATERIAL: It is here that everything relating to the training to be given will be designed and prepared; where the concept of the workshop, including its objectives, contents and methodology, is drawn up. In addition, detail the steps of the event, highlighting the schedules, techniques and activities, materials, responsibilities and resources needed such as presentations, teaching materials, examples and case studies, etc.
- STEP 2. TRAINING FOR TRAINERS: the professionals who will be responsible for training the other technical staff should be trained in order to transmit in a better way all the knowledge necessary for the understanding of the subject. Trainers will be trained by professionals who developed the mapping methodology first-hand with UNAH.
- STEP 3. PREPARATION OF THE TRAINING CALENDAR: Organizing the times of the training will allow you to make the most of each moment and theme. This calendar should be done in conjunction with the UNAH since they are the experts on the subject.
In addition to the implementation schedule (which should include dates and times), it is important that you specify what will be the content, the training techniques, the target audience and all the resources and materials required to carry it out.
- STEP 4. BUDGET REQUEST: The entry of this activity into the OPA should be made taking into account the budgetary ceilings for this type of activity. There is

a need for an annual update of the budget for each of the trainings to be conducted, based on the results achieved in the previous year.

STEP 5. SELECTION OF PERSONNEL TO TRAIN: A mapping will be made of technicians who must be trained according to their assignments and positions in order to be able to implement what they have learned in their daily work.

STEP 6. SENDING INVITATIONS: one month before the start of the training, invitations should be sent formally by means of a memorandum to the technicians selected in the previous step.

In order to have the desired attendance, a follow-up system must be created by those responsible, this can be by phone, mail or text message, in addition to making the reminder one week before the event to complete the follow-up.

STEP 7. TO DETECT THE TRAINERS OF THE PERSONNEL TO BE TRAINED: An initial assessment is needed to determine the current state of knowledge regarding risk mapping. The trainer should apply a short evaluation to determine the level of knowledge about risk management and its mapping. Once the evaluation has been reviewed, the trainer will be able to understand how to conduct the workshop and how to delve into the topic.

STEP 8. TRAINING IMPLEMENTATION: Technical staff of GER and UMGIR will be trained using the "Case Study" methodology, in order to enable the professionals who generate the maps to face real situations and to be able to make decisions, evaluate actions, and make informed judgments for decision-making. The usefulness of the case study method is to bring the technician closer to real-life conditions, in order to prepare him by developing latent talents of vision, authority, communication and leadership, to enable him to engage in civilized confrontation of agile and effective communication, to process rational and objective information and to make decisions under uncertain conditions regarding the generation of maps; and not only learning by memory the procedures for their elaboration. In this sense, this methodology has the following characteristics:

- Allows the application of proven theoretical and technical concepts in real life.
- Helps the participant develop both problem-solving and decision-making skills.
- Requires active participation and encourages the development of communication facilities.
- They can replicate situations of crisis, risk or uncertainty, which are typical of real life.
- They contribute to a practical and pragmatic approach to a wide range of situations.

For all these reasons, case studies are considered to be one of the most effective methodologies for this type of training.

STEP 9. TO EVALUATE TRAINING: It refers to the evaluation of the effectiveness of the training for the technicians, since it is important to evaluate whether

the workshop carried out has worked or not. To clearly understand the main objective, the trainer should ask himself the following questions: Has this training covered the needs/gaps that the person had before receiving it? Has it fulfilled the objective that was expected of it? In order to be able to answer these questions, the first thing that must be clearly identified are the training needs (which come out of the initial assessment) and the objective, that is, the purpose for which this training is going to be carried out, in this case the understanding of the generation of mapping by GER and UMGIR.

Finally, by means of measurement indicators, it will be possible to determine the level of strengthening achieved by the unit that was trained, comparing the initial assessment with the final assessment applied to the trained technicians.

STEP 10. CERTIFICATE DELIVERY: upon completion of the training, a certificate attesting to the participation of each person who has attended the training shall be issued. This will describe the name of the training, the date, the hours of the training and must be signed by the Mayor of DC and the Rector of UNAH.

2.3.1.1 Dissemination and training of professionals from other Managements involved in the AMDC with a focus on the application of the map.

Although GER and UMGIR are responsible for drawing up risk maps, there are other managers in addition to these that must be aware of their interpretation in order to intervene according to their competencies when appropriate. Within these are; DOT, GMU; UMAPS, GAC, Cadastral office, UGA, GCH, GVH, DGCDH, CODEM and DMJ among others.

These managers must be fully aware of the usefulness of risk maps of these special areas for any procedure carried out there. Below is a chart of actors mapping that shows the managers that should be involved in the process explained in the previous paragraphs:

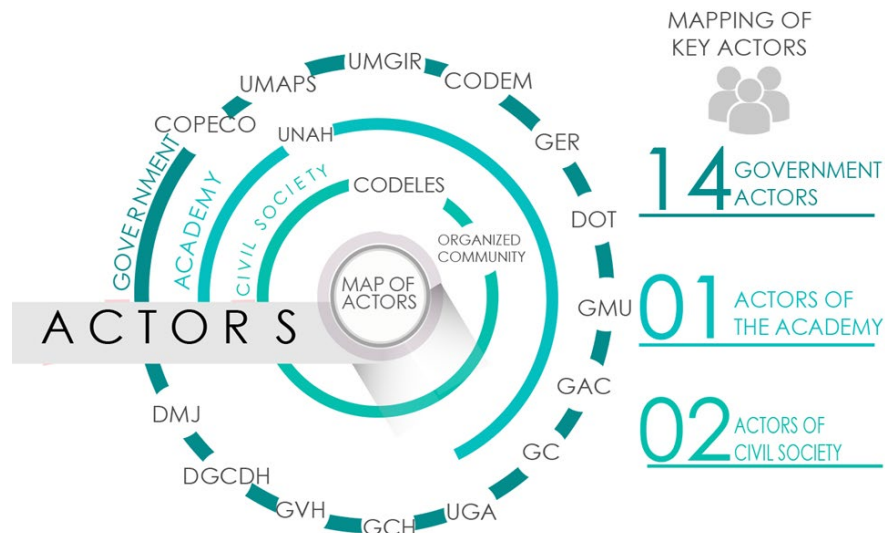


Figure 30- Mapping of actors for the training process. (Source: JET)

Through training, the other managers/units/directorates will be trained so that they have full knowledge of the interpretation of the maps generated by GER or UMGIR, using the methodology of item 2.1 for better training.

2.3.2 Inter-institutional dissemination of risk maps.

There are institutions outside the AMDC that must be aware of the elaboration and/or interpretation of the maps so that they have full knowledge of the process. This group should be made up of relevant institutions with membership and land use, such as:

- COPECO
- UNAH (Careers related to the theme).
- Private Universities (Careers related to the theme).
- professional associations (CICH and CAH)
- Property Institute (IP)
- Electric Power Company (ENEE)
- Secretary of Infrastructure and Transportation (SIT)
- Mi Ambiente
- Fire department
- Police
- And any other institution that deals with construction and/or risk issues.

Below is a stakeholder mapping graph showing the institutions that should be involved in the process explained in the previous paragraphs:

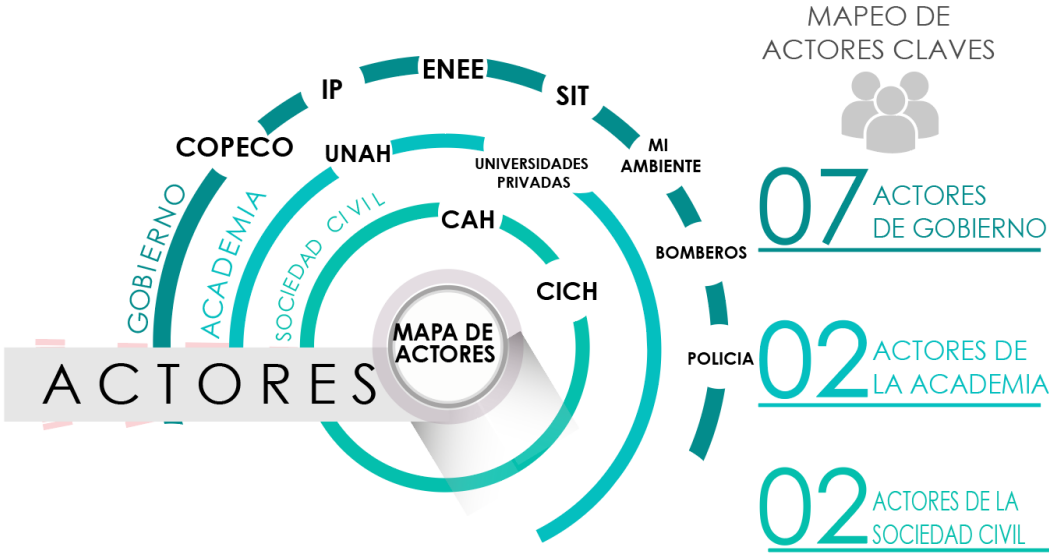


Figure 31.- Mapping of actors for the socialization process. (Source: JET)

It is important to highlight that in all socialization or dissemination of said process, AMDC must be responsible through **UMGIR** and **DOT** with the collaboration at all times of the UNAH.

Said socialization must be given once a year for COPECO professionals, Professional Associations and any other institution that deals with construction and/or risk issues, and in the case of universities it must be socialized every six (6) months due to the transition that is generated with the students annually.

2.3.2.1 *Seminars made up of a technical team from each institution that actively participates in the maps.*

In order to promote the elaboration and/or interpretation of the maps from this project, seminars should be carried out with the aforementioned institutions. It is recommended to use the "Master Class¹²" methodology, also called master class. This consists of the transmission of information (or knowledge) by the facilitator to the listener in a unidirectional way, in this case being the possible professional listeners in construction and risk management.

The seminars will be the responsibility of UMGIR with the support of the specialists that UNAH has since the latter are the ones who will be able to ensure that the methodologies used comply with the pedagogical requirements of the case; however, the logistics of said activity must be in charge of the Communications Management of the AMDC. The main activities that must be carried out to carry out the training in the best possible way and with successful results are described below.

Table 11.- Process for conducting seminars. Source: JET)

PROCESO DE SEMINARIO															
ITEM	ACTIVIDADES	RESPONSABLE	AÑO 1						AÑO 2						
			6	7	8	9	10	11	12	1	2	3	4	5	6
1	Preparación del material para el seminario	UMGIR y DOT	■	■	■	■	■	■	■						
2	Capacitación para los seminaristas	UMGIR y DOT									■	■	■		
3	Elaboración del calendario de seminarios	UMGIR y DOT	■	■	■										
4	Solicitud de presupuesto	UMGIR	■	■	■	■									
5	Selección de personal a capacitar	UMGIR							■	■					
6	Envío de invitaciones	UMGIR											■		
7	Detectar las capacidades del personal a socializar	UMGIR												■	
8	Implementación del seminario	UMGIR												■	
9	Evaluar el seminario	UMGIR												■	

12 Universidad Central, Bogotá Colombia.

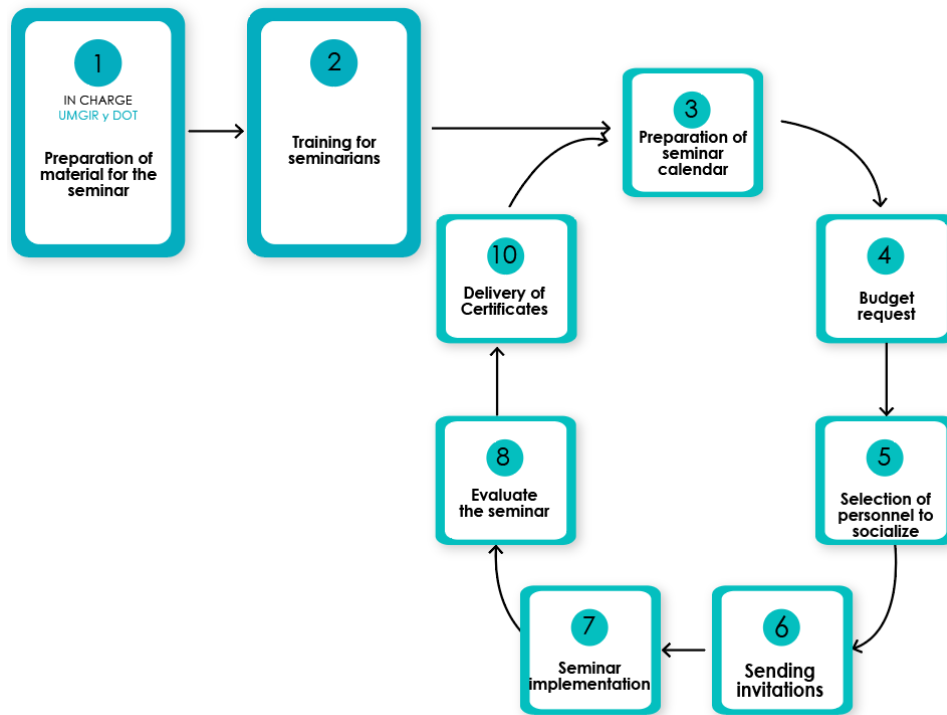


Figure 32- Process for conducting seminars. (Source: JET)

- STEP 1. **PREPARATION OF MATERIAL FOR THE SEMINAR:** It is here that everything relating to the seminar to be given will be designed and prepared; the concept of the seminar, including its objectives, contents and methodology, is elaborated. In addition, detail the steps of the event, highlighting the schedules, techniques and activities, materials, responsibilities and resources needed such as presentations, teaching materials, examples and case studies, etc.
- STEP 2. **TRAINING FOR SEMINARIANS:** the professionals who will be in charge of implementing the seminar should be trained to the rest of the technical staff in order to transmit in a better way all the knowledge necessary for the understanding of the subject. Trainers will be trained by professionals who developed the mapping methodology first-hand with UNAH.
- STEP 3. **PREPARATION OF SEMINAR CALENDAR:** Organizing the timing of the seminars will make it possible to make the most of each moment and theme. This timetable should be done jointly with UNAH, since they are the experts on the subject.
In addition to the implementation schedule (which must include dates and times), it is important to specify what will be the content, the training techniques, the internal audience it is intended for and all the resources and materials required to carry it out.
- STEP 4. **BUDGET REQUEST:** The entry of this activity into the OPA should be made taking into account the budgetary ceilings for this type of activity. There is a need for an annual update of the budget for each of the trainings to be conducted, based on the results achieved in the previous year.

- STEP 5. SELECTION OF PERSONNEL TO SOCIALIZE: A mapping will be made of people who should be socialized according to their positions, in order to be able to implement what they have learned in their daily work.
- STEP 6. SENDING INVITATIONS: one month before the start of the seminar, invitations must be sent in a formal way by means of a memorandum. If they are technicians of the WDCA and if they are external actors, these will be sent to those selected in the previous step.
In order to have the desired attendance, a follow-up system must be created by those responsible, this can be by phone, mail or text message, in addition to making the reminder one week before the event to complete the follow-up.
- STEP 7. SEMINAR IMPLEMENTATION: Using the methodology of "master class" will socialize with the professionals of each institution mentioned in the item 2.2. This is a very versatile methodology as it can be used to work with both a large and a small group. This methodology consists of the oral presentation of contents by the facilitator to the entire group of professionals. This intervention by the facilitator may range from describing, demonstrating procedures, formulas for drawing up maps and interpreting them. The oral speech must be accompanied by audio-visual resources that illustrate, accompany and complement the message. Sometimes, it may also be supported by drawing up diagrams, notes and notes on the blackboard so that the listeners can grasp the message in the best possible way.
- STEP 8. TO EVALUATE THE SEMINAR: It refers to the evaluation of the effectiveness of the seminar given to the professionals, this will only be an evaluation to understand how far the original goal was achieved and, if necessary, to reinforce certain aspects of the seminar or to resolve doubts that have remained among the participants of the seminar. This assessment will be carried out by means of a survey to find out how much the participant has learned and in case of any doubt or point was not fully understood it should be reinforced.
- STEP 9. DELIVERY OF CERTIFICATES: at the conclusion of the seminar, a certificate attesting to the participation of each person who has attended the seminar shall be issued. This will describe the name of the seminar, the date, the hours of the seminar and must be signed by the Mayor of DC and the Rector of UNAH.

2.3.2.2 *Incorporation of the UNAH curricula.*

UNAH will be responsible for ensuring that the mapping methodology is incorporated into the curriculum of the courses for which it is responsible, specifically the courses of architecture, civil engineering and the Faculty of Law, since it is the future professionals who will have to interpret these maps to apply them in their designs and constructions, in addition to the Faculty of Space Sciences and IHCIT. This incorporation may be by means of workshop, master classes or the technique that the scholar deemed appropriate to impart the class to the students.

If the workshops are given in the Faculty of Architecture, they can be given twice a year, taking into account that it has two academic periods considered "semesters" which have a calendar of the first period between January-June and the second period from July-December. On the other hand, the rest of the faculties have an academic period called "Trimester" which has a calendar of the first period from January-April, the second period from May-August and the third period from September-December.

The workshops will be the responsibility of UMGIR, with the support of the specialists that UNAH has, since the latter are the ones who will be able to ensure that the methodologies used meet the pedagogical requirements of the case for each of the different careers to which they are assigned will teach the theme. Below is a breakdown of the main activities that must be carried out to carry out the talks in the best possible way and with successful results:

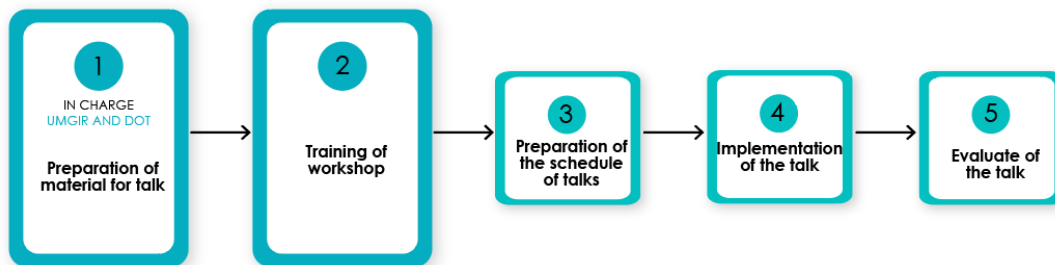


Figure 33- Process for conducting Workshops. (Source: JET)

- STEP 1. **PREPARATION OF THE WORKSHOP MATERIAL:** It is here that everything related to the workshop will be designed and prepared to be given in the different courses that are responsible for knowing how to generate risk maps; the concept of the talk is elaborated, including the objectives, contents and methodology of the talk. In addition, detail the steps of the event, highlighting schedules, techniques and activities, materials, responsibilities and resources needed such as presentations, teaching materials, examples and case studies, etc.
- STEP 2. **TRAINING FOR THE WORKSHOP SPEAKER:** the professionals who will be in charge of giving the workshop to the students should be trained with the aim of transmitting in a better way all the knowledge necessary for the understanding of the subject. Those responsible for training the practitioners delivering the talk will be those who developed the maps first-hand in conjunction with UNAH.
- STEP 3. **PREPARATION OF WORKSHOP SCHEDULE:** Organizing the workshop times will allow you to make the most of each moment and theme. This schedule should be done jointly with UNAH, as they are the experts on the subject and will depend on the scheduling of academic periods.
- STEP 4. **IMPLEMENTATION OF WORKSHOP:** Using the methodology of "master class" will socialize with the students of each course mentioned above. This is a very versatile methodology as it can be used to work with both a large and a small group. This consists of an oral presentation of contents by the facilitator to the whole group. This intervention by the facilitator may range from describing, demonstrating procedures, formulas for making

the maps and interpreting them. The oral speech must be accompanied by audio-visual resources that illustrate, accompany and complement the message. Sometimes, it may also be supported by drawing up diagrams, notes and notes on the blackboard so that the listeners can grasp the message in the best possible way.

STEP 5. EVALUATION THE WORKSHOP: It refers to the evaluation of the effectiveness of the workshop given to the students, this will only be an evaluation to understand how much was achieved with the goal initially proposed and, if necessary, to reinforce certain aspects of the talk or to resolve doubts that have remained in the listeners. This assessment will be carried out by means of a survey to find out how much the participant has learned and in case of any doubt or point was not fully understood it should be reinforced.

2.3.3 Updating of slope disaster risk maps.

A risk map is, above all, an essential analysis tool that, among other uses, allows to identify areas of greater or lesser risk faced with different hazards, as a key factor when determining the areas to intervene with a given infrastructure investment in general, both public and private. It is a fundamental resource when it comes to preventing future risk situations by adapting the management of the territory to the restrictive conditions for its occupation. That is why updating these maps on a regular basis is of great importance, being a key factor in making their implementation effective as a planning tool. In this sense, the use of tools such as Geographic Information Systems (GIS) is highly effective because of their versatility to incorporate new information as it is generated and updated.

It is imperative that everyone involved in the process is aware of all activities in order to obtain better results from the update, below is a mapping graph of actors where the institutions that should be in the process of updating the regulation are identified, these are divided into three categories (academy and government), on the part of the academy there is the UNAH the which should establish which department will be involved in this process described above, and as part of the government is COPECO as the central government, which should propose a department that is involved in the entire process and AMDC as the administrative entity of the municipality of DC.

This stage must have the involvement of the different key actors so that from the beginning of the project they can take part having a voice and vote in the decisions made; The Coordinating Team will be in charge of ensuring the constant updating of the maps, which must be reviewed every five years to see if it still works within the scope of application, however, **UMGIR** is responsible for updating the maps as the entity entrusted by the AMDC. See annex 12 on the graph of influence of the actors that must be involved in the process.

To update the maps, it must be taken into account that due to the effects of climate change, the areas at risk may increase if no intervention is made in any way or decrease as long as the AMDC carries out structural measures to improve specific areas of risk.

To perform the update and monitoring in the best way, the following steps are presented:

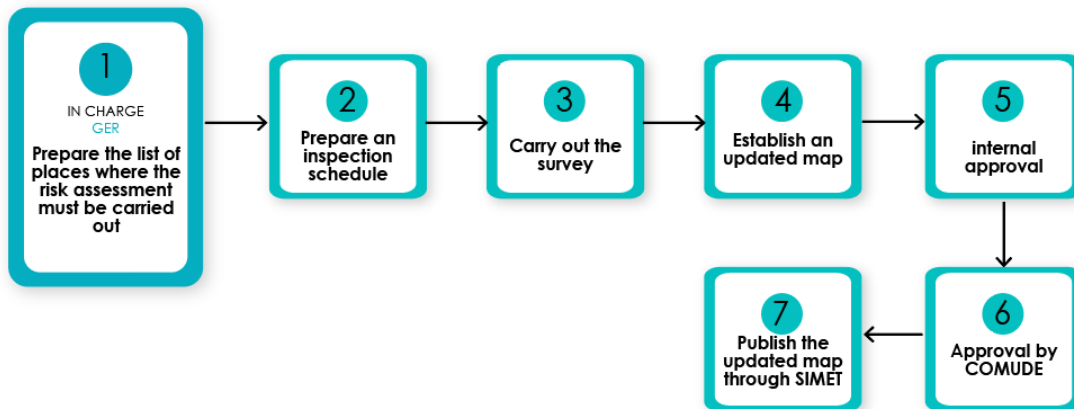


Figure 34.- Process of updating risk maps. (Source: JET)

- STEP 1. TO PREPARE THE LIST OF PLACES WHERE THE RISK ASSESSMENT MUST BE CARRIED OUT: These must be the places that have been previously intervened with some structural measure to mitigate the risk of the existing population.
- STEP 2. TO PREPARE AN INSPECTION SCHEDULE: For a better help in terms of the general scheduling of GER, which should be in charge of ensuring the constant monitoring of said sites, it is recommended the establishment of a calendar where each of the sites to be visited is described with the objective by which the inspection is carried out, this calendar may vary when they encounter a triggering event such as: hurricanes, earthquakes or other natural factors.
- STEP 3. TO CARRY OUT THE SURVEY: as described in item 2.4.1, said evaluation of the intervened site must be implemented.
- STEP 4. SETTING UP AN UPDATED MAPPING: once the inspection and evaluation of the site has been carried out, the maps must be updated in case the sites have undergone any change in their current state.
- STEP 5. INTERNAL APPROVAL: this upgrade will need to go through DOT and UMGIR approval.
- STEP 6. APPROVAL BY COMUDE: once DOT and UMGIR approve the updated maps, they must go to COMUDE for approval and publication in the GISCLOUD.
- STEP 7. TO PUBLISH THE UPDATED MAP THROUGH SIMET: This update must be published through portals such as SIMET, with the aim of general dissemination of the situation in each of the intervened areas.

2.3.3.1 Updating and improvement of site evaluation tools for the generation of hazard, vulnerability and risk maps.

Given the spatial-temporal variability of threats and vulnerability factors, updating the risk map is also a key factor in making it effective as a planning tool. In this sense, the use of tools such as Geographic Information Systems (GIS) is highly effective

because of their versatility to incorporate new information as it is generated and updated.

The tools to be used at the time of risk assessment at sites should be constantly and as far as possible improved to produce better results and prevent damage and loss of material and human class. GER and UMGIR, being the entities in charge of ensuring the evaluation of these sites, should request support from experts on the subject, either within AMDC or outside with its partners of AMDC.

2.3.4 Follow-up of updated maps.

2.3.4.1 Supervision and monitoring of intervened areas.

Once all the structural works in the intervened areas have been executed, it is necessary to implement a series of periodic evaluations of the current state of each of the areas to ensure sustainability over time.

These evaluations must follow the following steps:

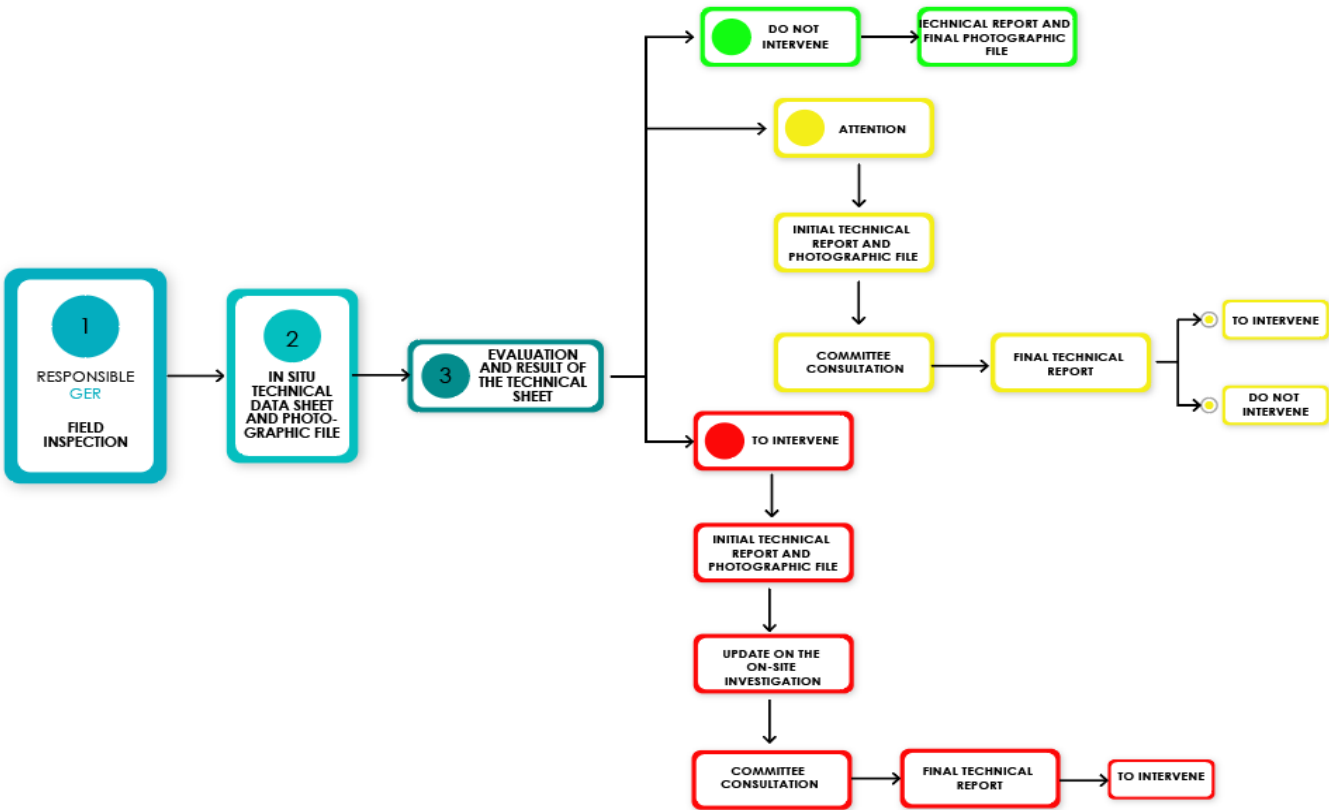


Figure 359.- Procedure for supervision and monitoring. (Source: JET)

STEP 1. FIELD INSPECTION: In conjunction with the technical department, the community and the CODELES, visits will be made at least six (6) months to the intervention areas or in the event of an accelerating event caused by natural agents such as earthquakes, rainfall, rising groundwater levels, soil

- erosion, erosion of rivers or human activities, all with the aim of finding evidence or on-site signs to identify any significant changes in the area. It is imperative that all those involved in the process be present at the time of the inspection to generate a better assessment of the site.
- STEP 2. **IN SITU TECHNICAL DATA SHEET AND PHOTOGRAPHIC:** To keep a timeline of the project, it will first be necessary to make a photographic file of each of the intervened areas with their respective geo-location; In addition, when making field visits, a technical sheet must be filled out with a series of questions that guide the technician to know the current status of each area.
In the form there must be a field where a short interview is conducted with the inhabitants of the area, since they are the ones who see first-hand the events happening in the area.
- STEP 3. **EVALUATION AND RESULT OF THE TECHNICAL SHEET:** Once the form is filled out, it will be necessary to carry out the desktop evaluation to obtain the final result of the current state of the intervened area. The use of traffic lights is recommended, to take into account in the last step for decision-making of the actions to be carried out (Green: In good condition-Do not intervene, Yellow: Intermediate status-attention and Red: Bad status-urgent intervention). Once the field file has been analyzed, the results obtained in the technical visit will be evidenced by means of a technical report, incorporating the photographic file and the data obtained from it.
- STEP 4. **ACTION TO CONDUCT:** Once the technical report and the results of the traffic lights have been completed, it is important to take priority actions on each of the findings found on the site.

For each traffic light color there will be an action, below is a description of what must be done as the case may be:

1. **GREEN TRAFFIC LIGHT:** this colour indicates the good condition and functioning of the structural work and its positive reference for the evaluation, so it does not require any intervention on the part of the monitoring team other than to record in a technical report the current good condition and the photographic file.
2. **YELLOW TRAFFIC LIGHT:** this colour indicates the need for a more in-depth evaluation given the little information obtained during the visit, with the aim of finding out how the structural work is functioning. Therefore, it will sometimes require the on-site evaluation of an expert on the subject, who will be part of the committee that has been formed for the colony/neighborhood involved, to conclude with the evaluation and proceed to intervene if as the case may be. In the same way, it is necessary for the technical team to make a report explaining everything that happened and highlighting the photographic file.
3. **RED TRAFFIC LIGHT:** An indicative colour denoting a work that needs to be worked on and from which it is necessary to obtain more information to solve the problem posed at that time, by means of comparative studies between the initial research and analysis stage and the new studies carried out in the area, it will be determined whether there is a factor of

change with respect to the initial situation and with the help of a committee made up of experts on the subject (municipal technicians). COPECO or academics from UNAH) a conclusion must be reached and therefore a solution to the problem dealt with.

Once each of the traffic lights carried out by means of the visit has been evaluated and the agent that causes the damage to the structural work has been found, we will proceed to evaluate which corrective actions are priority in order to intervene and solve the work.

2.3.4.2 Establishment and monitoring of CODELES.

Since the CODELES are responsible for ensuring the safety of communities in the face of risks, it must be ensured that the neighborhood or colony in which the intervention is carried out has a duly sworn, trained group with the necessary equipment to implement it in the event of an emergency. In the absence of a CODELES team, it must be formed through the Municipal Emergency Committee of the AMDC so that the intervention achieves its objective.

The process of formation of CODEL ¹³ consists of the selection of members for coordination and four commissions:

1. Monitoring and Communications,
2. First Response Brigade,
3. Shelters and Humanitarian Aid
4. Damage Assessment and Needs Analysis.

CODEL is made up of at least 9 persons: (1) coordinator and (2) persons per commission. If the community wants to include more people, they can be added to the commissions or support staff. The CODEL training and certification process has been established in 4 steps:

¹³ Guía para el Proceso de Formación y Certificación de Comités de Emergencia Local, del Municipio del Distrito Central, Honduras 2019



Figure 36- Steps for the formation of CODELES. (Source: JET)

- STEP 1. **FORMATION:** is to establish the basic operating structure of CODEL through a participatory community process. Volunteers and willing to help their community should be selected and the internal structure of the CODEL.
- STEP 2. **CERTIFICATION:** includes three levels of certification: basic level, intermediate level and advanced level. This is where the seminar under item 2.2.1 should be included to train the CODELES of the colonies/neighborhood to understand and be able to read the maps prepared by AMDC.
- STEP 3. **SWEARING IN:** symbolic event by which CODEL members are publicly recognised once the certification process has been completed
- STEP 4. **EQUIPMENT:** minimum equipment to respond to emergency events.

2.3.5 Dissemination Plan.

In order to establish a proper relationship with the people living in the areas at risk. The socialization strategy has the following objective:

- Generate understanding by residents and organizations involved of the danger of slope disasters and their ability to implement appropriate measures on their own initiative.

It is important that the authorities responsible for producing the maps continuously provide feedback to the population, as part of the success is the continuous communication and participation of the affected community. To carry it out, the following must be done:

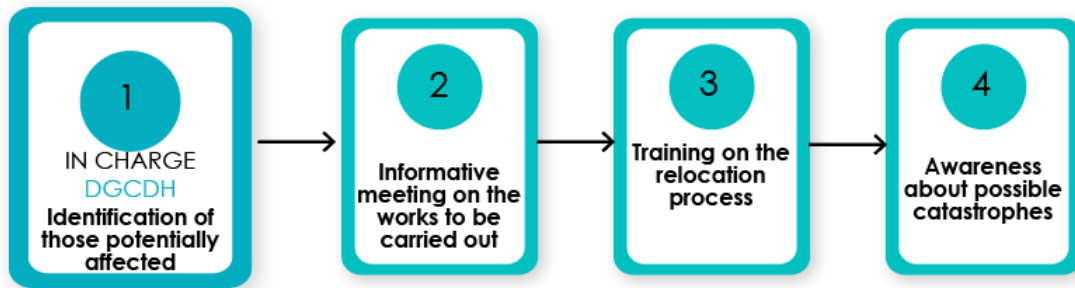


Figure37- Socialization process. (Source: JET)

- STEP 1. To identify and characterize those possibly affected, based on the basic information sheets, in order to have a socio-cultural and educational profile of the affected people.
- STEP 2. To report on the works (dimensions, benefits, impacts and timing of execution and characteristics of the companies).
- STEP 3. To train with pedagogically adapted materials for adult education, on the population resettlement process, its benefits and potential impacts.
- STEP 4. To raise awareness among the population in the face of a potential catastrophe, their role as those affected and that of the government as the entity responsible for ensuring their protection.

It is important to highlight that in all socialization, AMDC must be responsible through **UMGIR and DOT** with the collaboration of UNAH at all times, in addition to the constant involvement of DGCDH and CODEM.

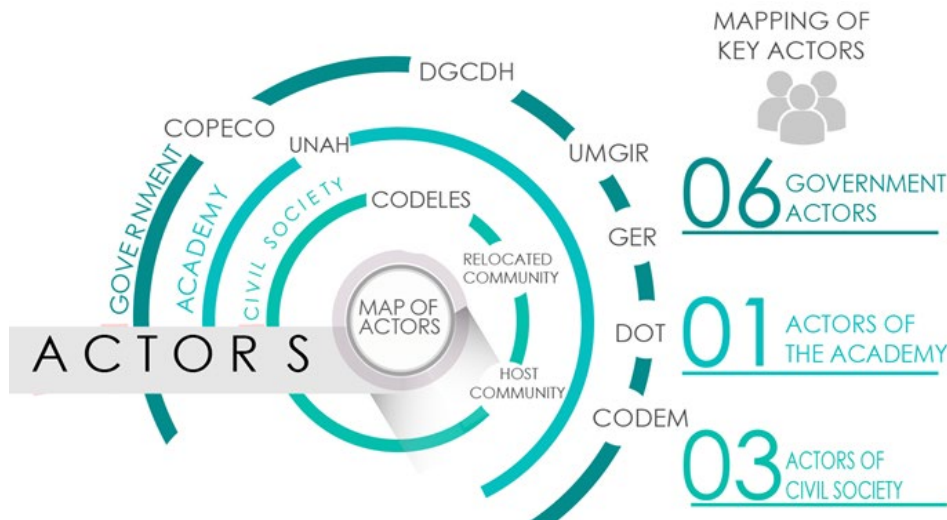


Figure 38.- Mapping of actors involved in Socialization. (Source: JET)

This socialization must be given once a year for the inhabitants of the communities concerned.

2.3.5.1 *Hold regular briefings with area residents.*

Since in a collective resettlement people will move to the same location and have to rebuild their community in the new environment, the most appropriate reporting mechanism is community meetings because they allow:

- To present in detail all the information related to each component of the resettlement program.
- Explanation of the content of the regulation to the entire intervened community.
- To answer the questions, doubts and concerns that people have and that arise during the presentation of the topics.
- To make concerted decisions about actions that must be carried out.
- To agree on the responsibilities of each of the parties.

These meetings should be held with the entire community, both the one to be relocated and the one remaining on the site for reasons of not being in a high-risk immitigable situation. The objective of these meetings should be both informative and to raise awareness among the people who are surrounding the high-risk area. On the other hand, the fact of debating the issues openly and publicly guarantees transparency and avoids the perception of giving preferential treatment to some people or different messages. If the number of population is large, several meetings should be held by sectors, so that the entire population has the opportunity to participate in them and receive the information directly.

In addition to the community meetings, the local offices, web pages or emails that have been established in the previous phases, must continue to function under the agreements previously established with the community.

Information at the implementation stage also becomes a form of psychological support, because people feel cared for and supported during the process. Therefore, in addition to the local offices, the social workers assigned by DGCDH must plan regular visits to the families in order to ascertain their situation and provide them with the information they need to prepare for their relocation.

Mechanisms for consulting host populations on population resettlement need to be defined in cases where there are communities close to the selected land. Since information is currently available on the availability of social services in the area and the diagnosis of access routes and transport systems, among other things, it is also possible to inform these communities of the infrastructure that will be built or extended in the area to meet the demands of both the resettled population and themselves, and of the improvements that will be made to these services. Consideration should also be given to signing agreements with the receiving communities on the acceptance of resettlement in the area and the benefits they will receive in terms of service delivery and other services that have been identified. Some of the activities required to carry out the meeting with residents of the regulated areas include the following:

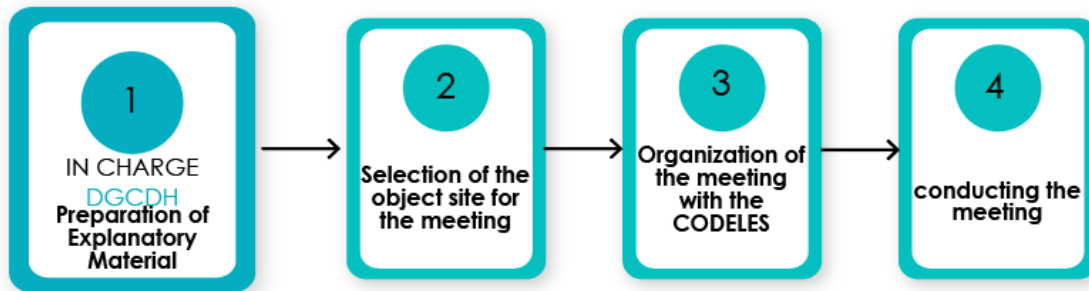


Figure 39.- Briefing process. (Source: JET)

- STEP 1. PREPARATION OF EXPLANATORY MATERIAL: this can be by means of a presentation elaborated in Power Point and projected by means of a data show for better understanding by the community. It must explain the details of the relocation, the reasons for the relocation, the current situation of the colony/neighborhood in general, showing by means of maps the areas that are at risk and any other information of interest to the inhabitants who will be relocated and those who remain around.
- STEP 2. SELECTION OF THE OBJECT SITE FOR THE MEETING: A place should be found to hold the meeting where all the involved of the community can be, this could be: an educational institution, a church, a community center, among others. The appropriate conditions will be taken into account to gather people such as the availability of chairs, electricity, audiovisual system and good ventilation.
- STEP 3. ORGANIZATION OF THE MEETING WITH THE CODELES: the meeting will be convened by the AMDC through the CODEM, these addressing the CODELES of the community that must be informed; the CODELES, in turn, must inform the community in general through their internal communication system. The call must be made at least two weeks before the proposed day and a confirmation must be made to have a clear list of participants.
- STEP 4. CONDUCTING THE MEETING: Once the material that will be presented has been prepared and the participants have been summoned, the meeting is held, allowing the free expression of the participants at all times.

2.3.5.2 Participation of the Municipal Spatial Data Committee (COMUDE).

This committee is responsible for making official use of the map portal of the AMDC (<https://amdc.giscloud.com/>) all the information that can be mapped of the Central District.

In order for this committee to approve the information provided by all management/units/directorates, it must go through the following process:

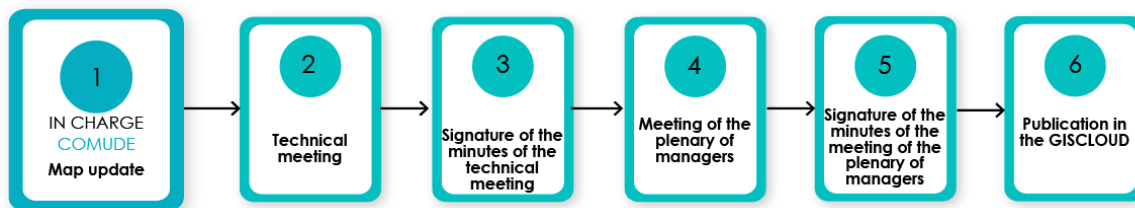


Figure 40.- Process of COMUDE. (Source: JET)

- STEP 1. MAP UPDATE: each of the managers responsible for generating and managing information in the AMDC, prepare the maps for review and approval.
- STEP 2. TECHNICAL MEETING: The maps generated are reviewed and approved by a technical team which meets once a month. These professionals verify that the information is from reliable and verified sources and that it is reflected in the best way on the maps.
- STEP 3. SIGNATURE OF THE MINUTES OF THE TECHNICAL MEETING: at the end of the meeting, after having discussed each of the points to be dealt with, the minutes are signed, reflecting the maps that have been approved to move on to the next stage of approval.
- STEP 4. MEETING OF THE PLENARY OF MANAGERS: As a last filter, a meeting is held every three months where the managers of each of the departments responsible for generating and managing information in the AMDC meet to verify the maps that must be published on the public portal of the city hall.
- STEP 5. SIGNATURE OF THE MINUTES OF THE MEETING OF THE PLENARY OF MANAGERS: at the end of the meeting, once each of the points to be treated has been discussed, the minutes are signed in which are reflected the maps that have been approved for publication.
- STEP 6. PUBLICATION IN THE GISCLOUD: approved maps are published on the AMDC map portal so that they can be used by the public.

2.4 OUTPUT 04: IMPROVEMENT OF CAPACITIES TO REGULATE LAND USE THE RISK AREAS FOR SLOPE DISASTERS.

During the JICA Project named as "Project for Control and Mitigation of Slope Disasters in the Central District in Republic of Honduras", a new regulation "Land-use regulation for slope disaster areas" has been proposed. This new regulation has a purpose to protect the human life and property in the zones prone to the slope disasters and regulate some development activities in these zones. This Action Plan serves to summarize the projects and activities to be conducted by AMDC and other organizations in order for the regulation to be applied properly and sustainably in Honduras.

2.4.1 Technical Strengthening of Regulatory Enforcers.

All regulations, whether newly drafted or updated, must include a training component for the technicians who will be in charge of ensuring faithful compliance with the regulation. With the objective of strengthening the technical capacities of the AMDC staff, both those directly involved in the application of the regulation and those who are not part of this group, but who are part of the other management/units/directorates that are responsible for being informed of the existence of new regulation "Land-use regulation for slope disaster areas".

These trainings should be held once a year due to updates of the scope of application in case it is extended or when new professionals join the AMDC and need to be trained in this area for its application.

In addition to the generation of the Land-use regulation for slope disaster areas, it is essential to strengthen technical capacities for the correct application of the regulation, and since the GCC is in charge of ensuring compliance with the regulation, all technical personnel designated for this purpose should be trained. It is proposed that a "Case Study" methodology be used for this purpose, so that the personnel can understand, comprehend and apply all the regulations developed in the document.

The training will be the responsibility of the DOT, through the **GCC** and the support of the specialists from UNAH, since the latter are the ones who will be able to ensure that the methodology used meets the pedagogical requirements of the case. The following is a breakdown of the main activities to be carried out in order to best achieve the training objectives.

Table 12.- Flow for the implementation of training to GCC (Source: JET)

ITEM	ACTIVITY	RESPONSIBILITY	YEAR 1						YEAR 2						
			6	7	8	9	10	11	12	1	2	3	4	5	6
1	Preparation of training materials	DOT, GCC and GSL	■	■	■	■	■	■	■						
2	Training for trainers	DOT, GCC and GSL								■	■	■			
3	Development of the training schedule	DOT, GCC and GSL	■	■	■										
4	Budget Request	DOT	■	■	■	■									
5	Selection of personnel to be trained	DOT							■	■					
6	Sending invitations	DOT										■			
7	Detecting staff capabilities	GCC											■		
8	Implementation of training	GSL and GCC												■	
9	Evaluation of training	GCC													■

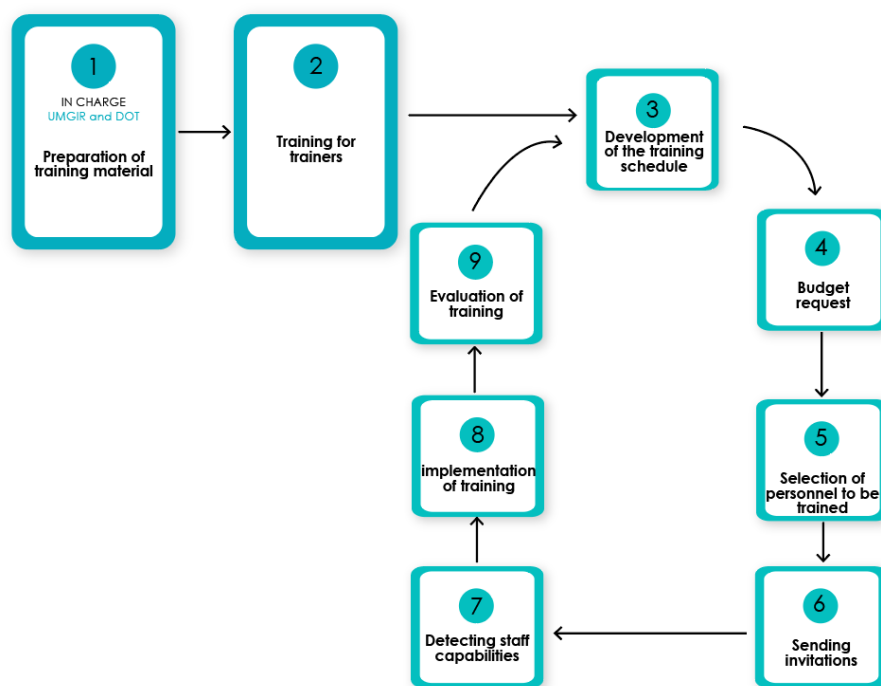


Figure 41- Steps of the training to GCC (Source: JET)

- STEP 1. PREPARATION OF TRAINING MATERIALS: In this STEP, the materials for trainings will be designed and prepared; this is where the concept of the training is elaborated, as well as the objectives, contents and methodology of the workshop. In addition, it is also necessary to define detail the each following step, schedules, techniques and activities, materials, responsibilities and necessary resources such as presentations, didactic material, examples and case studies, etc.
- STEP 2. TRAINING FOR TRAINERS: The professionals who will be in charge of training shall be trained with the objective to transmit in a better way all the knowledge necessary for the understanding of the topic. Those in charge of training of trainers will be the professionals who elaborated first-hand the methodology of the maps together with the UNAH.
- STEP 3. DEVELOPMENT OF THE TRAINING SCHEDULE: Training schedule is prepared to make moment and topic to be used to the maximum. The schedule should be drawn up in conjunction with the UNAH, as they are the experts on the subject.
In addition to the establishment of schedule (which should include dates and times), it is important to clarify the content, training techniques, target, and all the resources and materials to be used.
- STEP 4. BUDGET REQUEST: The entry of the trainings within the POA should be done by taking into account the budget ceilings for this type of activities. It is necessary to update annually the budget for each of the trainings to be carried out, taking as a reference the results obtained in the previous year.

- STEP 5. SELECTION OF PERSONNEL TO BE TRAINED: A selection of technicians to be trained will be carried out according to their assignments and positions in order to implement what they have learnt in their daily work.
- STEP 6. SENDING INVITATIONS: One month before the training, invitations should be sent formally by memorandum to the technicians selected in the previous step.
In order to have the desired attendance, a follow-up to the invitation should be generated by those responsible, which it would be via phone call, email or text message, as well as a reminder a week before the event.
- STEP 7. DETECTING STAFF CAPABILITIES: An initial assessment to the training participants is necessary to determine their current knowledge regarding the subject to be covered in the training. The trainer should apply a short assessment of no more than five (5) questions to determine the level of knowledge about risk management, land use and regulations. Once the assessment has been reviewed, the trainer will be able to determine how to conduct the workshop and how much more in-depth the topic should be.
- STEP 8. IMPLEMENTATION OF TRAINING: The training is implemented for the selected personnel by using the "Case Study" methodology. Through the training, they are able to be confronted with real situations and make decisions, evaluate actions, and know the application of the regulation in its entirety. At the end of the training, a certificate should be issued to certify the participation of each person who has attended the training.
- STEP 9. EVALUATION OF TRAINING: This refers to the evaluation on the effectiveness of the training for the technicians, as it is important to evaluate whether the workshop has been useful or not. To clarify the achievement of the training, the trainer should ask himself/herself the following questions:
Has this training covered the needs/shortcomings that the person had before the training, and has it fulfilled the expected objective?
In order to answer these questions, the first thing that must be clearly identified is the training needs and the objective (which come out of the initial assessment on Step 7), i.e. the purpose for which the training is to be carried out, in this case the understanding of the application of the regulation by the GCC.

Finally, through the evaluation, it will be possible to know the level of strengthening obtained by the unit that was trained, making a comparison between the initial assessment and the final assessment applied to the trained technicians.

Although the GCC is responsible for applying the regulation, there are also other departments that must be aware of the regulation in order to conduct appropriate intervention according to their competences, including: the DOT, GMU, UMAPS, GAC, Catastro, UGA, GCH, GVH, DGCDH, CODEM, DMJ, among others.

These management units must be fully aware of the regulations that are applied and any procedures to be carried out in the DC. Below is actors mapping chart showing the managements that must be involved in the process explained in the previous paragraphs:

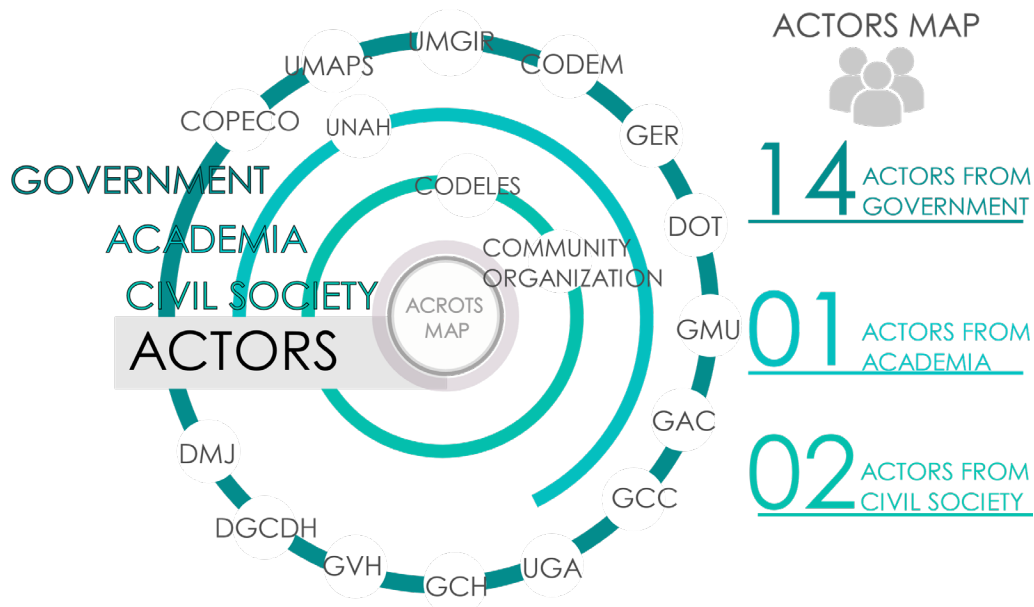


Figure 42.- Actor map for the training (Source: JET)

2.4.2 Inter-institutional socialization of Land-use regulation for slope disaster areas.

There are some institutions outside the AMDC that should be aware of the Land-use regulation for slope disaster areas so that they have full knowledge of countermeasure works for slope disasters and community activities as stakeholders. These include the following:

- COPECO
- UNAH
- Private universities
- Professional colleges (such as CICH and CAH)
- Instituto de la Propiedad (IP)
- Empresa de Energía Eléctrica (ENEE)
- Secretaria de Infraestructura y Transporte (SIT)
- Mi Ambiente
- Firefighter
- Police and
- Other institution related to construction and/or risk issues.

Below is an actor mapping chart showing the institutions:

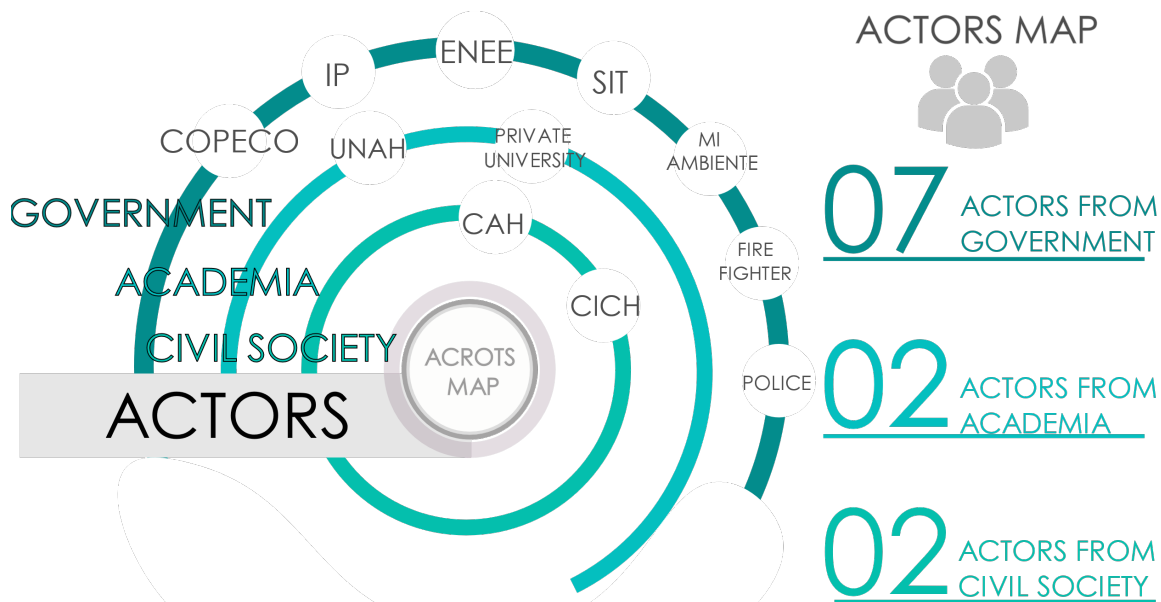


Figure 43.- Actor map for the socialization (Source: JET)

It is important to highlight that the entities responsible for any socialization or dissemination of the regulation are the **GSL and DOT** of the AMDC. The departments are also responsible for ensuring faithful compliance with the regulation, with the collaboration of the UNAH.

This socialization should be given once a year to the professionals of relevant institutions shown above, and in the case of universities it should be socialized every six (6) months due to the transition that is generated with the students every year.

2.4.2.1 Seminars made up of technical teams from each institution actively involved in regulation

In order to promote the Land-use regulation for slope disaster areas, seminars should be held with the aforementioned institutions. It is recommended to use the "Master Class" methodology which consists of the transmission of information (or knowledge) by the facilitator to the listener in a unidirectional way. In this case, the listeners are supposed to be the professionals on construction coming from each institution.

The seminars will be conducted under the responsibility of DOT, with the **GSL** and the support of the UNAH's specialists. Since the latter are the ones who will ensure that the methodologies meet the pedagogical requirements of the case. The following is a breakdown of the main activities that must be carried out in order to carry out the seminars in the best possible way and with successful results.

Table 13.- Process for the implementation of the seminar (Source: JET)

ITEM	ACTIVITY	RESPONSABILITY	YEAR 1						YEAR 2						
			6	7	8	9	10	11	12	1	2	3	4	5	6
1	Preparation of seminar material	UMGIR and DOT	█	█	█	█	█	█	█						
2	Training for seminar speaker	UMGIR and DOT									█	█	█		
3	Establishment of the seminar schedule	UMGIR and DOT	█	█	█										
4	Budget request	UMGIR	█	█	█	█									
5	Sending Invitations	UMGIR												█	
6	Implementation of seminar	UMGIR												█	
7	Evaluation of seminar:	UMGIR												█	

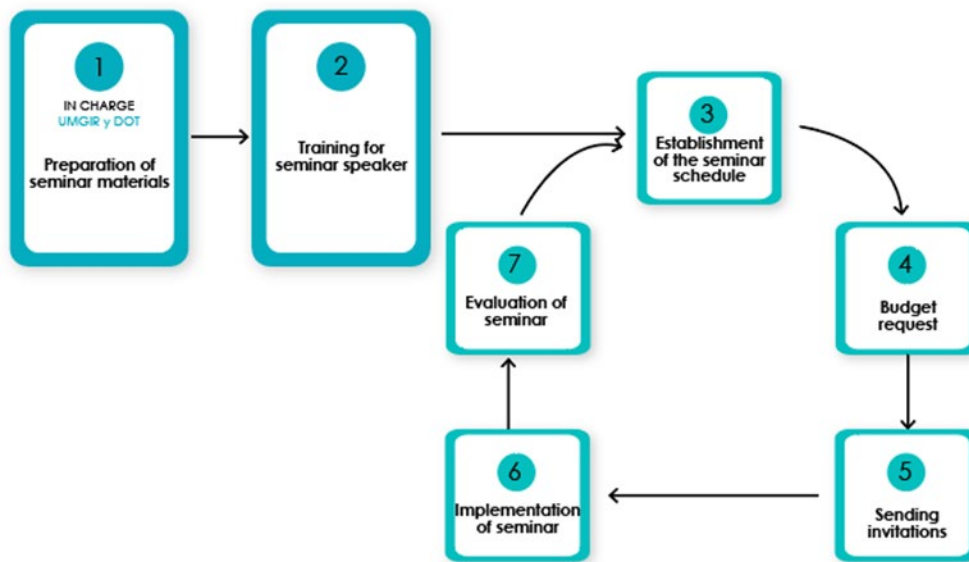


Figure 4410.- Steps for the implementation of the seminars (Source: JET))

STEP 1. PREPARATION OF SEMINAR MATERIAL: This is where everything related to the seminar to be given will be designed and prepared; the concept of the seminar is elaborated, including the objectives, contents and methodology of the seminar. In addition, detail the steps of the event, highlighting the schedules, techniques and activities, materials, responsibilities and necessary resources such as presentations, didactic material, examples and case studies, etc.

- STEP 2. TRAINING FOR SEMINAR SPEAKER: This Step is the same as the Step 2 mentioned in the Case Study methodology in 2.1 Technical Strengthening of Regulatory Enforcers.
- STEP 3. ESTABLISHMENT OF THE SEMINAR SCHEDULE: This Step is the same as the Step mentioned in the Case Study methodology in 2.1 Technical Strengthening of Regulatory Enforcers.
- STEP 4. BUDGET REQUEST: This Step is the same as the Step 4 mentioned in the Case Study methodology in 2.1 Technical Strengthening of Regulatory Enforcers.
- STEP 5. SENDING INVITATIONS: One month prior to the seminar, official letters to inform the relevant institutions of the seminar outline and invite them to the event. Based on the letters, each organization select the participants. The follow-up of the invitation should be also conducted as mentioned in the Step 6 mentioned in the Case Study methodology in 2.1 Technical Strengthening of Regulatory Enforcers.
- STEP 6. IMPLEMENTATION OF SEMINAR: Using the "Master Class" methodology, socialization will take place with the professionals of each institution mentioned in item 2.2. At the end of the training, a certificate should be issued to certify the participation of each person who has attended the training.
- STEP 7. EVALUATION OF SEMINAR: This refers to the evaluation of the effectiveness of the seminar given to the professionals. The purpose is to know how well the seminar listeners understand the seminar contents and, if necessary, to reinforce certain aspects of the seminar or resolve doubts that have remained in the seminar's listeners. This evaluation will be carried out by means of a survey or questionnaire.

2.4.2.2 *Incorporation into UNAH curriculum*

UNAH will be responsible for ensuring that the Land-use regulation for slope disaster areas is incorporated into the curriculum of the faculties that are responsible for dealing with this issue, specifically the Faculties of Architecture, Civil Engineering and the Faculty of Legal Sciences, since they are the future professionals who will have to interpret the maps to apply them in their designs and constructions, as well as the Faculty of Space Science and IHCIT. This incorporation may be by means of workshops, master classes or the technique that the academic considers appropriate to teach the class to the students.

If the workshops are given in the Faculty of Architecture, they can be given twice a year, taking into account that it has two academic periods considered "semesters" which have a calendar of the first period between January-June and the second period from July-December. On the other hand, the rest of the faculties have an academic period called "Trimester" which has a calendar of the first period from January-April, the second period from May-August and the third period from September-December.

The workshops will be conducted under the responsibility of DOT, with the GCC and the support of the specialists from UNAH. The following is a breakdown of the main

activities necessary for carrying out the workshops in the best possible way and with successful results:

Table 24.- Process for the implementation of lectures (Source: JET)

ITEM	ACTIVITY	RESPONSABILITY	YEAR 1											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Preparation of the workshop	UNAH, UMGIR and DOT	█	█	█	█	█	█	█	█	█	█	█	█
2	Training for workshop speaker	UNAH, UMGIR and DOT	█	█	█	█	█	█	█	█	█	█	█	█
3	Elaboration of workshop (Faculty of Civil Engineering and Architecture)	UNAH, UMGIR and DOT	█	█					█	█				
4	Implementation of workshop (Faculty of Civil Engineering and Architecture)	UNAH			█	█					█	█		
5	Evaluation of workshop (Faculty of Civil Engineering and Architecture)	UNAH and UMGIR					█	█					█	█
6	Elaboration of workshop (Other faculties)	UNAH, UMGIR and DOT	█	█					█	█				
7	Implementation of workshop (Other faculties)	UNAH			█	█					█	█		
8	Evaluation of workshop (Other faculties)	UNAH and UMGIR					█	█					█	█

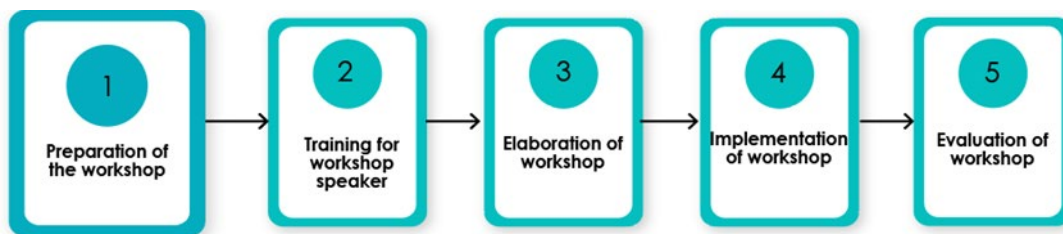


Figure 4511.- Steps for the implementation of lectures (Source: JET)

- STEP 1. PREPARATION OF THE WORKSHOP MATERIAL: In this STEP, everything related to the workshop to be given in the different faculties that are responsible for knowing the regulation will be designed and prepared; the concept of the workshop will be elaborated, including the objectives, contents and methodology of the same.
- STEP 2. TRAINING FOR WORKSHOP SPEAKER: The professionals who will be in charge of giving the workshops must be trained in order to transmit in a better way all the knowledge necessary for the understanding of the topic. Those in charge of the workshops will be the ones who elaborated the regulation first hand in conjunction with the UNAH.

- STEP 3. ELABORATION OF WORKSHOP SCHEDULE: Organizing the times schedule will allow to take advantage of each moment and topic to the maximum. This calendar should be made in conjunction with the UNAH since they are the experts on the subject and it will depend on the calendar of the academic periods.
- STEP 4. IMPLEMENTATION OF WORKSHOP: The workshops are given to the students by using the "Master Class" methodology.
- STEP 5. EVALUATION OF WORKSHOP: For this step, the same methodology of the evaluation is applied as Step7 "Seminars made up of technical teams from each institution actively involved in regulation".

2.4.3 Update and monitoring of regulated zones

DOT is responsible for modifying and changing the contents of Articles in the regulation, updating the regulation map as well as for monitoring the regulated zones, since the department is in charge of updating the regulations pertaining to the construction sector, zoning and land use in the Central District on behalf of the AMDC. See Annex 13 for the graph of influence of the actors that should be involved in the process.

It will be necessary to monitor and evaluate periodically the zones where the Land-use regulation for slope disaster zones is applied in order to know the implementation status.

The information will be obtained through two (2) channels: a survey of the population living in or around the area and through the management of data on construction permits which GCC has and the risk data which UMGIR and GER have. This information should answer the following questions:

1. Have natural fault activations been detected at the site where the regulation was implemented?
Constant monitoring should be carried out in order to evaluate whether the applied measure has the desired effect after the event.
2. Has any slope movement been detected at the regulated zones?
Constant monitoring should be carried out in order to evaluate if another type of intervention is necessary.
3. Percentage of constructions with construction permits versus executed illegally.

GCC must keep a record of the constructions executed in the regulated zones in order to control the constructions conducted with permission, and must also make constant visits, at least once a month to the sites in order to understand the illegal constructions.

Subsequently, once a year, a statistical analysis of the incidences of the regulated zones must be performed, comparing the constructions with construction permits and ones conducted illegally. As to the result of illegal constructions, the respective sanctions must be applied. If the percentage of illegal construction in the regulated zones is higher than 30%, a socialization of the regulation and the sanction must be carried out.

- Affectations by human factors: As part of the monitoring of the regulated zones, aspects such as the change in type of land use and the building density that has been constructed must be evaluated in order to be able to make decisions regarding the modification of the regulation.

Table 15.- Proceso de actualización de zonas reguladas (Elaboración: Propia)

ITEM	ACTIVITIES	RESPONSABILITY	YEAR 1												YEAR 2		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Establishment of the list on the places of hazard and risk evaluations	DOT	█	█	█	█	█	█	█	█	█	█	█				
2	Establishment of evaluation schedule	DOT	█	█	█	█	█	█	█	█	█	█	█				
3	Implementation of the evaluations	GER and DOT		█	█	█	█	█	█	█	█	█	█				
4	Establishment of the updated regulation map	GER and DOT			█	█	█	█	█	█	█	█	█				
5	Internal approval	UMGIR and DOT										█	█				
6	Approval by COMUDE	UMGIR and COMUDE											█	█			
7	Publish the updated regulation map through SIMET	UMGIR and COMUDE													█	█	

In order to carry out the updating the regulated areas in the best way, the following steps are presented:

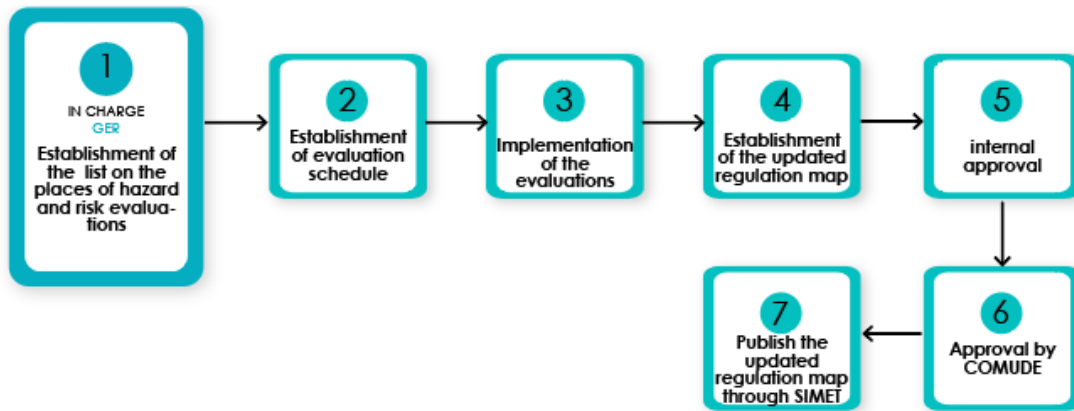


Figure 126.- Steps for updating the regulation (Source: JET)

STEP 1. ESTABLISHMENT OF THE LIST SHOWING PLACES ON THE PLACES OF HAZARD AND RISK EVALUATIONS: These areas where the land use regulation for slope disaster area as well as ones where the countermeasure works are conducted shall be listed up in order to add and modify the classification of the regulated zones.

- STEP 2. ESTABLISHMENT OF EVALUATION SCHEDULE: To better assist in the general scheduling of the GER, which should be responsible for ensuring the constant monitoring of regulated zones, it is recommended to establish a calendar describing each of the sites to be visited with the purpose for which the inspection is performed.
- STEP 3. IMPLEMENTATION OF THE EVALUATIONS: As described in Annex 15, this evaluation of the site should be implemented.
- STEP 4. ESTABLISHMENT OF THE UPDATED REGULATION MAP: Once the evaluation is completed, the evaluated areas shall be designated as regulated zones and draft of the updated regulation map shall be established.
- STEP 5. INTERNAL APPROVAL: This update must be approved by DOT and UMGIR.
- STEP 6. APPROVAL BY COMUDE: Once the DOT and UMGIR approve the updated map, it must be submitted to COMUDE for approval and publication in GISCLOUD.
- STEP 7. PUBLISH THE UPDATED REGULATION MAP THROUGH SIMET: The update map should be published to the nationwide through SIMET, with the objective of general disclosure of the situation of each of the intervened areas.

2.4.4 Fault and violations

In the process of monitoring and evaluation of the zones regulated by the land use regulation for slope disaster area, it must be ensured that the regulation is faithfully complied with. If they are not complied with, a correction process must be carried out. Some of the situations that may be considered as faults are the following:

- Failure to execute works in accordance with the authorized plans.
- Occupying a building without previously obtaining a Construction Compliance Certificate.
- Failure in complying with orders to repair or demolish unsafe or dangerous buildings.
- Depositing construction debris and/or placing construction machinery on public roads without complying with the provisions of the GCC.
- Changing the use of a building without the corresponding permit issued by the GCC.

In the event that constructions that do not comply with the parameters described in the Zoning, Works and Land Use Regulation of the Central District are conducted, sanctions will be applied. The following classes are distinguished:

- **WARNING:** A warning message issued by the authorized personnel from GCC by means of a report, without the need for prior notification. In case of recurrence in the same work, a higher penalty shall be applied.
- **FINES:** in the cases foreseen by the legislation in force and its processing and application shall be under the jurisdiction of the DMJ and/or the GCC who shall apply the respective economic sanction.
- **DISQUALIFICATION OF THE SIGNATURE OF THE OWNER, PROFESSIONAL, DEVELOPER OR PERSON RESPONSIBLE TO THE MUNICIPALITY FOR CERTAIN PERIODS:** In cases of minor offenses in the opinion of the GCC, and technical or administrative provisions of the regulations are violated, this type of penalty

is applied. It is applied by the GCC by means of a disposition that will be notified to the owner, professional or responsible.

- **WORK STOP:** This sanction is applied at the moment the infraction is observed. It will be lifted once the correction works are conducted according to the request form the GCC.

2.4.4.1 Formation of liaisons in the Management Departments responsible for following up on the legalization of the work

The faults and infractions to the provisions of the land use regulation for slope disaster areas will be sanctioned by the GCC and the DMJ in accordance with the provisions of the Police and Social Coexistence Law.

In order to proceed with the legalization of a work, the following procedure must be followed:

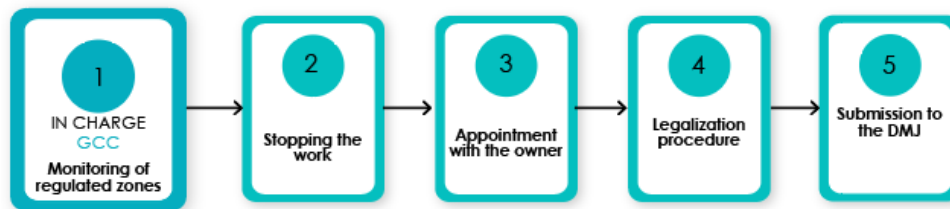


Figure 137.- Steps for the legalization (Source: JET)

- STEP 1. **MONITORING OF REGULATED ZONES:** Through regular inspection visits, the GCC monitors the regulated zones in order to understand the status of the constructions located in such zones. In case of finding a building under construction and without the proper permit, a warning will be issued to the owner or builder.
- STEP 2. **STOPPING THE WORK:** At the time of the inspection and detection that the construction incurs in a fault, the work must be stopped and the sign indicating the stoppage of the work must be placed, the owner will have 2 weeks to correct the fault.
- STEP 3. **APPOINTMENT WITH THE OWNER:** The GCC will make an appointment with the owner or builder to carry out the appropriate process for the legalization of the work.
- STEP 4. **LEGALIZATION PROCEDURE:** The owner or builder must go to the GCC offices to solve the fault in the work. Once GCC verifies that the problems are solved, a document will be issued notifying that he/she is authorized to continue the construction works.
- STEP 5. **SUBMISSION TO THE DMJ:** Once the document is issued by the GCC, the owner or builder must submit it to the DMJ for verification and approval of the continuity on the work.

The Step1 shall be carried out by GCC throughout the year, without specifying the specific time of year. And the other steps shall be conducted depending on the first step.

2.4.4.2 *Creating ordinances to reinforce regulation*

Ordinances are normative documents through which the Municipal Corporation expresses guidelines of its interest, whose application and compliance is mandatory. These ordinances arise as a support of the regulations in force at the time.

Ordinances seek to regulate very precise aspects depending on the economic, political, technical and social environment that surrounds the community. For example, an ordinance can support aspects regarding offenses and/or sanctions, some type of economic amnesty or other aspects that support the regulation elaborated and approved.

2.4.5 Relocation

This refers to houses that must be displaced from their current location and resettled in different areas due to the risk in which they are located. This activity also includes the insertion of these households into active population dynamics and having all the basic and dignified habitability standards. It is important to avoid malfunctioning in resettlement issues practiced over the years such as, the mechanism where families are moved to areas away from the social dynamics that consolidate their identity and independence as citizens sometimes causes social and territorial uprooting as a negative effect, and that the return of these families to the risk zones from where they were resettled. This implies that it will be necessary to analyze new resettlement mechanisms that take into account the needs and participation of the population to be relocated.

To carry out this process, the AMDC will assign the **DOT** and the **DGCDH**, who will perform all the urban analysis to provide a suitable site and the **GVH** with the support of the **DGCDH** and the **CODEM**.

Important factors to consider when designing relocation processes include:

- The existence of a well-defined and appropriate legal framework, based on human rights law, to govern the relocation process;
- The extent to which the needs of the affected populations and the impact of the planned relocations on them are taken into account, and the manner in which the affected populations are consulted in the process;
- If the relocation adversely affects the affected community, the municipality or central government should pay compensation for the negative impact suffered.
- The complexity of land tenure issues in terms of vacant areas, land acquisition, relocation sites, etc.
- The importance of adequate monitoring, evaluation and accountability mechanisms at all stages of the process.

The application of the above will guarantee a successful relocation process that promotes the integral development of the people to be resettled.

2.4.5.1 Establishment and implementation of the Relocation Assistance Plan for each risk zone

Given that in the DC there is neither a resettlement law nor a plan that allows for a healthy process of household relocation, it is necessary to generate a relocation assistance plan for the relocation of housing located in at-risk areas.

The entry of each of the stages of the plan within the POA should be made taking into account the budget ceilings for that specific type of action. The budget for each of the stages to be carried out must be updated annually, taking as a reference the results obtained as a result of monitoring the execution of the POA implemented the previous year. This planning makes it possible to determine new courses of action to achieve the expected results from the results-oriented strategic planning approach. Once this budget has been included in the POA, it must have a monitoring system that consists of showing the physical and financial execution in terms of the interventions carried out and the results obtained.

For the implementation of this plan, a series of actors are established who are responsible for the planning and execution of the population resettlement process. Below is a figure of influence for this activity, showing those involved and their degree of power in risk and construction issues. Also, the person directly responsible for the relocation assistance plan is highlighted with a black dotted circle:

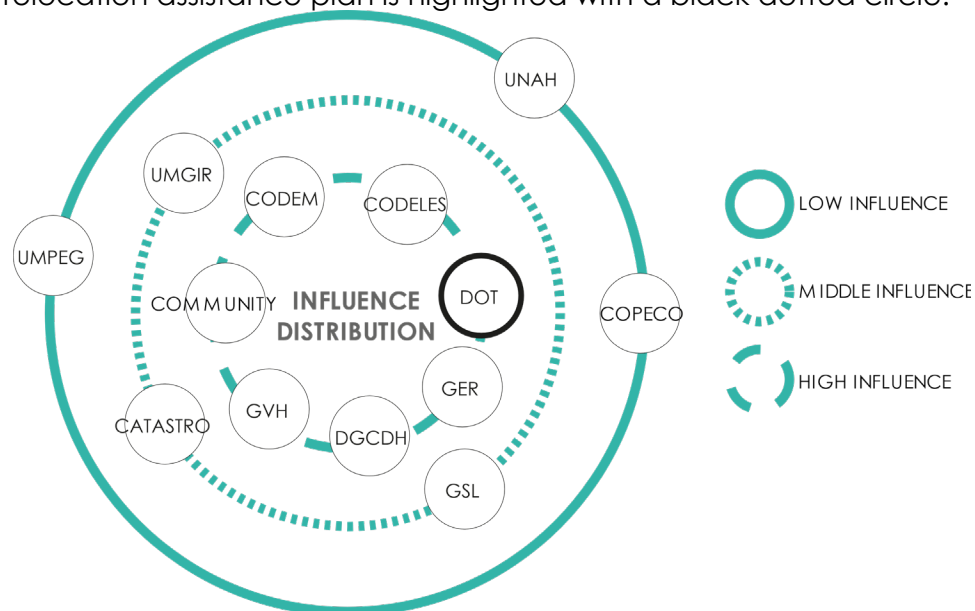


Figure 48.- Distribution of the influence for the Relocation Plan (Source: JET)

2.4.5.1.1 Overview of relocation plans in risk areas

Each of the components in Annex 16 are part of the initial research that the plan to be implemented in the different communities must contain, being necessary to carry out the specific research of each population to be relocated.

Table 36.- Process for implementation of the relocation project (Source: JET)

ITEM	ACTIVITY	SUBACTIVITY	RESPONSABILITY	YEAR 1												YEAR 2											
				1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	PREPARATION	Elaboration of risk assessment report	DOT	█	█																						
		Elaboration of the community profile		█	█																						
2	DIAGNOSTIC	Integration of the information	DOT	█	█																						
		Elaboration of the problem tree				█	█																				
3	FORMULATION	Definition of the tree of objectives, indicators and goals	DOT			█	█																				
		Design of relocation strategy				█	█																				
4	VALIDATION AND APPROVAL	Review of the content of the plan	DOT				█	█																			
		Approval of the plan					█	█																			
		Dissemination of the plan	DGCDH and CODEM					█	█																		
5	Selection of the plans to be implemented next year	DOT and CODEM					█	█	█																		
6	Budget request for the selected plans	DOT							█	█	█																
7	Implementation of the selected plans	DOT											█	█	█	█	█	█	█	█	█	█	█				
8	Evaluation of the implemented plans	DOT																					█				

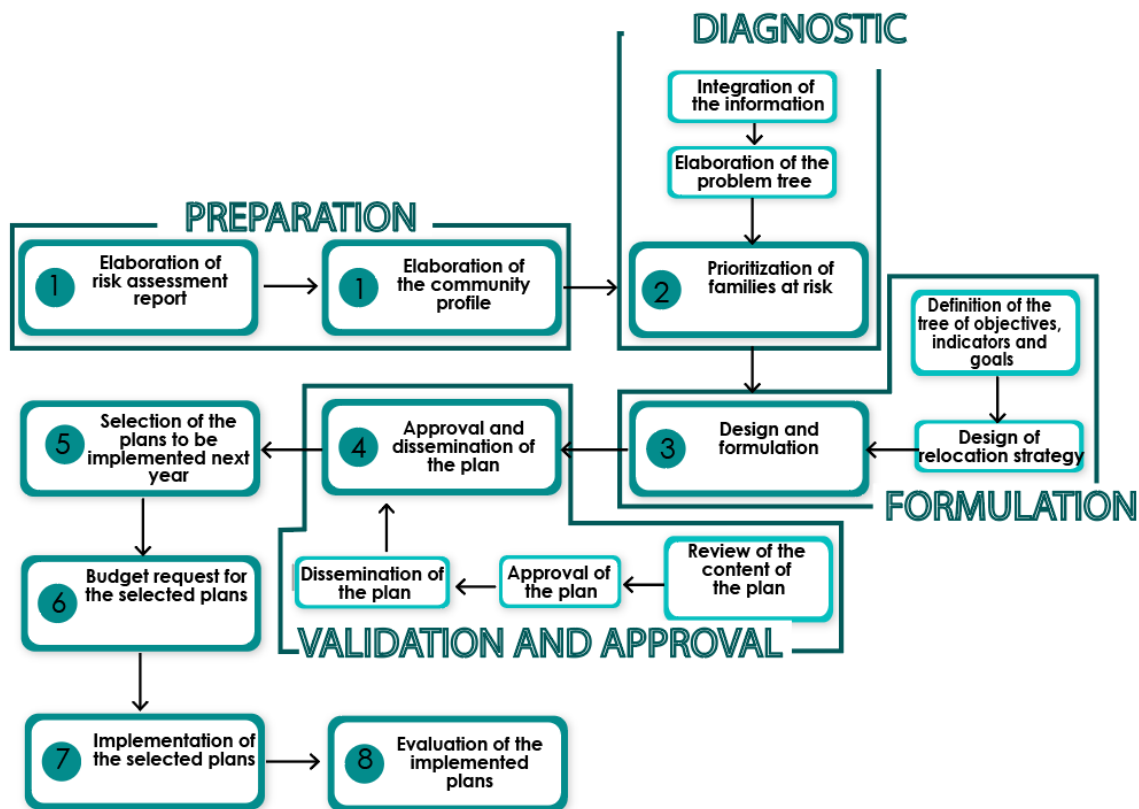


Figure 49.- Process for the implementation of relocation (Source: JET)

The relocation process should be based on existing protocols at the country level. In addition, the institutional synergies that the AMDC has with other institutions, both governmental and from other sectors, should be taken into account or established in order to know available supports from them at the implementation of the plan. It should be also taken into account that this process is a voluntary decision that is proposed as a last alternative to families at risk.

In order for the relocation to have a healthy process in all senses and to be a successful project, it is recommended to carry out at least the following stages:

- STEP 1. **PREPARATION:** It will be the responsibility of the DOT to lead this process together with the GER, UMGIR, UMPEG and other management departments that are responsible for the subject matter, and will also be supported by the committee assigned to that community, which is made up of the coordinating team (COPECO, UNAH and AMDC) and community representatives from CODEL to the patronage. This step will consist of two (2) sections, which are explained below:
1. **ELABORATION OF RISK ASSESSMENT REPORT:** The GER establishes the risk assessment based on the existing data and the evaluation sheet slope disaster prone areas. In the report, the risk related to the slope disaster and the significant reasons why the relocation is necessary shall be described.
 2. **ELABORATION OF THE COMMUNITY PROFILE:** The CODEL and the coordinated team (COPECO, UNAH, and AMDC) shall obtain the

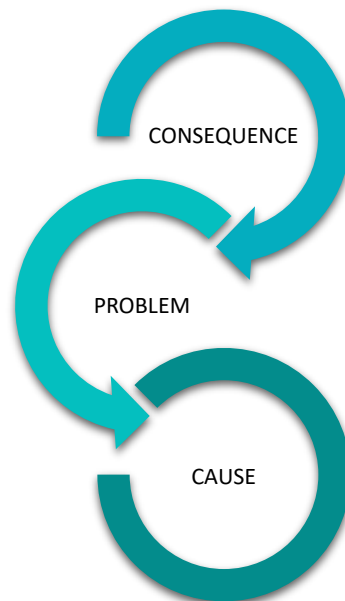
information on the community through interviews and on-site investigations of the neighborhoods. This information will be from both the affected community and the host community where they intend to relocate. The following information about the community should be available:

Table 47.- Elements incorporated in the community profile (Source: JET)

ELEMENTS		DATE
GEOLOCATION		
GENERAL INFORMATION	LAND USE	
	CLIMATE	
	MOBILITY	
	DEMOGRAPHIC DEVELOPMENT	
	EXISTING POPULATION	
	COMMUNITY ORGANIZATION	
VIALITIES		
EMPLOYMENT		
ECONOMICALLY ACTIVE POPULATION		
DINAMICAS ECONÓMICAS		
EDUCATION		
HEALTH AND COMMUNITY SERVICES		
POPULATION TO BE RELOCATED		

- STEP 2. DIAGNOSTIC: The **DOT** is in charge of this step. It consists of reviewing, comparing and consolidating the information available in the base documents previously elaborated such as the GER Assessment Report and any other document containing community information, with the qualitative and quantitative information on the affected area and the host area.
1. INTEGRATION OF THE INFORMATION: All the information such as legal situation, community profile, past studies carried out by GER as well as risk assessment report about the affected and host communities.
 2. ELABORATION OF THE PROBLEM TREE: based on the gathered information, a comprehensive situational diagnosis will be developed. The "problem tree", is effective to identify and qualitatively integrate the cause-and-effect relationship in the problems of the affected and host communities. The understanding on the cause-and-effect relationship on the communities serves as the basic idea for establishment of the resettlement proposal. An example of the problem tree is shown below.

The problems in the process of estimating, preventing and reducing disaster risk should be identified.



It refers to the negative effects obtained as a result of the problem posed.

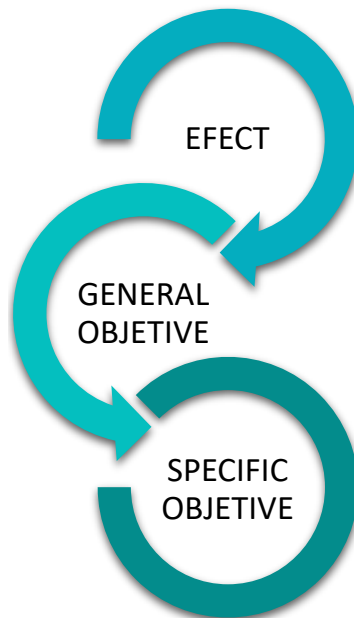
It refers to the factors that are causing the problem to be dealt with.

Figure 50.- Problem tree (Source: JET)

- STEP 3. FORMULATION: The **DOT** will be responsible for this step, which consists of identifying the actions and/or activities that will generate the desired results. An inventory of the activities to be implemented will be made.
1. DEFINITION OF THE TREE OF OBJECTIVES, INDICATORS AND GOALS: To design and prioritize the objectives, the technique called "Tree of Objectives¹⁴", should be used. The tree of objectives is prepared based on the "Problem Tree", for which the negative conditions should be converted into positive ones. This process allows a planning oriented to the treatment or solution of a problem. In addition, it describes the future situation of the community, obtains the purpose of each intervention and at the same time the prioritization of each action to be implemented will be obtained.

¹⁴ There should be an evident correspondence between the central problem and the general objective, which seeks to overcome and/or mitigate it and the direct causes of the central problem with the specific objectives that also have an impact with the same purpose.

It refers to the action taken to solve the problem previously stated, this should not be detailed or mention the means to do so. Because this will be broken down in the design strategy.



It refers to the positive consequences obtained as a result of the problem-solving action.

It refers to the different activities to be carried out in order to fulfill the general objective in the best way.

Figure 51.- - Tree of objective (Source: JET)

2. DESIGN OF RELOCATION STRATEGY: This should contain three preparations as shown below:
 - a. Preparation of the investment program: this stage consists of establishing the mechanisms to promote financial sources as well as the raising and allocation of budget for the execution of relocation projects. The following table shows the management of financing information obtained for the relocation:

Table 58.- Financing matrix (Source: Guía Plan de Reasentamiento)

PROGRAM/ PROJECT	INVESTMENT	INVESTMENT PROJECTS AND THEIR SOURCES OF FINANCING FINANCIAL SOURCES			
		MUNICIPAL RESOURCE	CENTRAL GOVERNMENT RESOURCE	EXTERNAL COOPERATION	OTHER

- b. Preparation of the relocation plan: the relocation plan should be gradual and concerted, prepared by taking into account the priority actions to be carried out to promote sustainable development.
 - c. Preparation of monitoring and evaluation plan: Monitoring and evaluation is applied mainly to the financial strategy and the implementation of the Relocation Plan, in order to record possible deviations in the execution of activities and projects, proposing corrective measures in order to achieve the programmed goals and objectives.

The GVH and the DGCDH will be in charge of overseeing compliance with the plan, i.e., monitoring the progress and compliance with the plan.

- STEP 4. **VALIDATION AND APPROVAL:** The purpose of this step is to verify and approve the technical quality and feasibility of all the components involved in the plan, both in terms of content and scope. It will also be made official by the corresponding authorities in the AMDC and, as a last point, the socialization of the plan with both the authorities and the community, which must be involved in the whole process of the plan. To carry out this process it will be necessary to comply with the following items:



Figure 52.- Steps for validation and approval (Source: JET)

1. **REVIEW OF THE CONTENT OF THE PLAN:** The plan should be reviewed by the coordinating team (COPECO, UNAH, AMDC with their respective managements) for any technical, economic or social aspect that should be modified.
 2. **APPROVAL OF THE PLAN:** The DOT submit the plan to the municipal corporation who will approve.
 3. **DISSEMINATION OF THE PLAN:** Once approved it must be published on the AMDC website, and must be disseminated to all public and private entities that have been involved in the entire relocation process.
- STEP 5. **SELECTION OF THE PLANS TO BE IMPLEMENTED NEXT YEAR:** Depending on the financial situation, the number of the plans to be implemented during the next year is limited. DOT and CODEM will select the plans to be implemented in next financial year according to the necessary budget, risk level etc.
- STEP 6. **BUDGET REQUEST FOR THE SELECTED PLANS:** DOT prepares necessary documents and requests the budget for the plans to be implemented next year.
- STEP 7. **IMPLEMENTATION OF THE SELECTED PLANS:** Once the budget is approved in Municipal Corporation, DOT shall start the budget allocation and implement the project according to the plan. DOT shall be the responsibility for the implementation of activities such as informative meeting to the local residents, bidding procedure and other activities related to the implementation of the project.
- STEP 8. **EVALUATION OF THE IMPLEMENTED PLANS:** Once the project has been done, DOT immediately evaluates the project outputs.

Table 19.- Process for establishment of relocation plan (Source: JET)

ITEM	ACTIVIDADES	SUBACTIVIDADES	RESPONSABLE	AÑO 1												AÑO 2											
				1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	PREPARATION	ELABORATION OF RISK ASSESSMENT REPORT	DOT and CODEM	█	█																						
		ELABORATION OF THE COMMUNITY PROFILE		█	█																						
2	DIAGNOSTIC	INTEGRATION OF THE INFORMATION	DOT	█	█																						
		ELABORATION OF THE PROBLEM TREE				█																					
3	FORMULATION	DEFINITION OF THE TREE OF OBJECTIVES, INDICATORS AND GOALS	DOT			█																					
		DESIGN OF RELOCATION STRATEGY				█	█																				
4	VALIDATION AND APPROVAL	REVIEW OF THE CONTENT OF THE PLAN	DOT				█																				
		APPROVAL OF THE PLAN					█																				
		DISSEMINATION OF THE PLAN	DGCDH and CODEM					█																			
5	SELECTION OF THE PLANS TO BE IMPLEMENTED NEXT YEAR		DOT and CODEM					█	█																		
6	BUDGET REQUEST FOR THE SELECTED PLANS		DOT							█	█	█															
7	IMPLEMENTATION OF THE SELECTED PLANS		DOT											█	█	█	█	█	█	█	█	█	█	█			
8	EVALUATION OF THE IMPLEMENTED PLANS		DOT																					█			

2.4.5.2 Preparation of the resettlement site

Resettlement entails changes in the population distribution of the host territory, by influencing the implications for land use planning, pressure on natural resources and the demand for public and social services. As a result, it may affect other human groups, such as the communities from which the population is transferred and those that receive the resettled population. The analysis of the host territory must be exhaustive in order to understand the different impacts that the relocation brings to the host area.

The relocation must meet certain criteria that are critical to the success of the process. Therefore, they should be established in order to serve as a guide in the land selection process. Among these criteria are:

Table 20.- Criteria to select the resettlement sites (Source: JET)

Item	Criteria	Description
1	Existence of plans	
2	Risk	
3	Land legality	
4	Soil quality	
5	Current occupation	
6	Centers for the provision of social services	
7	Public services	
8	Value of land	
9	Compatibility between the host and resettled populations	

The detailed descriptions of each criteria are shown in the Annex 17.

Taking into account the criteria above, the AMDC entities such as DOT and Cadastre, who has knowledge on the entire territorial situation in legal aspects and in terms of land use planning are responsible for finding the resettlement areas. The participatory mechanisms with the local population can be also effective. The visits to the candidate sites and workshops to jointly analyze the advantages and disadvantages of each of the candidate sites.

When it is not possible to find a site with the adequate size to house all the families to be resettled, several must be selected, which implies the formulation of additional criteria to determine the families and social units to be moved to each site, which should be a task of the DGCDH.

2.4.5.3 Inclusion of the national government to support relocations

The role of the central government, based on adequate participation and coordination between the public and private sectors, is crucial for the implementation of the relocation process in the reception area integrated with the host community. The change of use of the unoccupied area will be established in accordance with current regulations. The Housing Relocation Assistance Plan, due to its systemic approach to disaster risk prevention and reduction, is the technical instrument that allows for its orderly and efficient viability at the local level.

The formulation and execution of the plan is the responsibility of the municipality of the DC with the direct participation of the inhabitants to be relocated, with the

technical and economic assistance of the entities specialized in the matter at the national level, being the Ministry of the Interior and Justice one of the entities that provides advice in the aspects of its competence, as well as the actions of coordination and inter-institutional articulation at the national level.

2.4.6 Socialization for residents.

In order to establish an adequate relationship with the people living in the affected areas. The socialization strategy has the following objective:

- For the resident to understand the land-use regulation for slope disaster area and hazard and risk of slope disasters
- For the resident to recognize the necessity to become able to implement appropriate measures on their own initiative.

It is worth to mention that the responsible for all socialization among the AMDC's entities are the DGCDH in conjunction with CODEM, who are directly involved with the population. In addition to the entities responsible for leading the process, there are others that must be involved for it to be successful, as shown below:

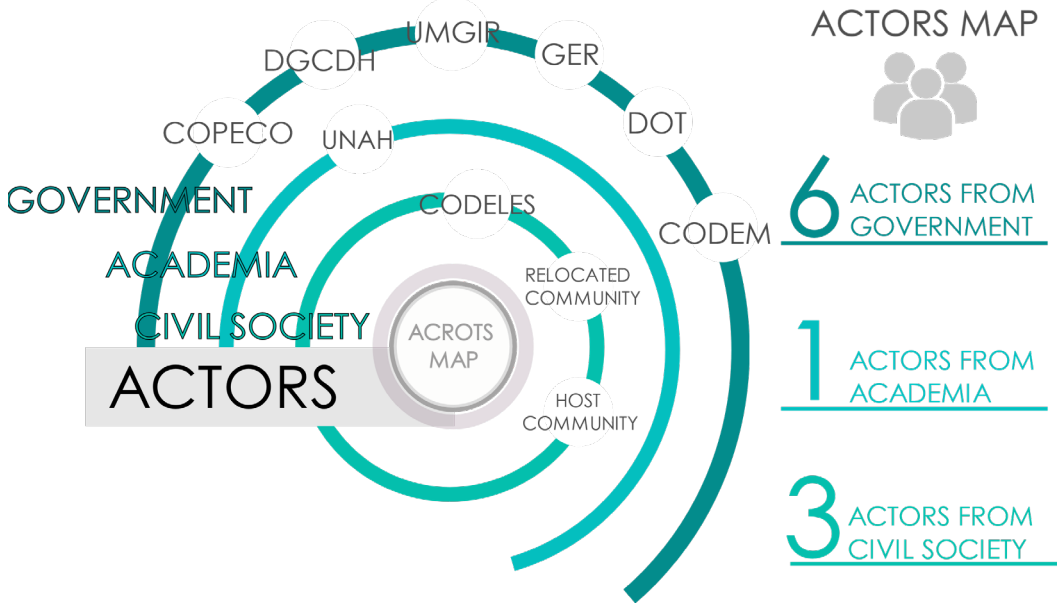


Figure 53.- Distribution of the actors related to the socialization (Source: JET)

2.4.6.1 Periodic informational meetings with residents in the regulated areas.

The most appropriate method for the socialization of the local residents is informational community meetings containing the following points:

- Basic information on the regulation content
- Actions to be taken by the residents according to the regulation
- Detail all information on resettlement program.
- Q&A session in order to clarify all doubts and concerns that residents have
- Agree on the responsibilities of each party.

These meetings should be held with the entire community, inviting both those who will relocate and those who choose to stay in the site. The objective of these

meetings should be both informative and awareness-raising for the people surrounding the risk area.

On the other hand, open discussion ensures transparency and avoids the perception of giving preferential treatment to some people or different messages. In case that the large number of people are involved in the meeting, several meetings should be held by sector, so that the entire population has the opportunity to participate and receive the information directly.

In addition to community meetings, local offices, web pages or e-mails that have been established in previous phases should continue to operate under the agreements previously established with the community.

Information at the implementation stage also becomes a form of psychological support, because people feel cared for and supported during the process. Therefore, in addition to the attention in the local offices, the assigned DGCDH social professionals should plan in their activities periodic visits to the families, to learn about their situation and provide them with the necessary information on the regulation

Some of the activities required to conduct the meeting with residents in the regulated areas are as follows:

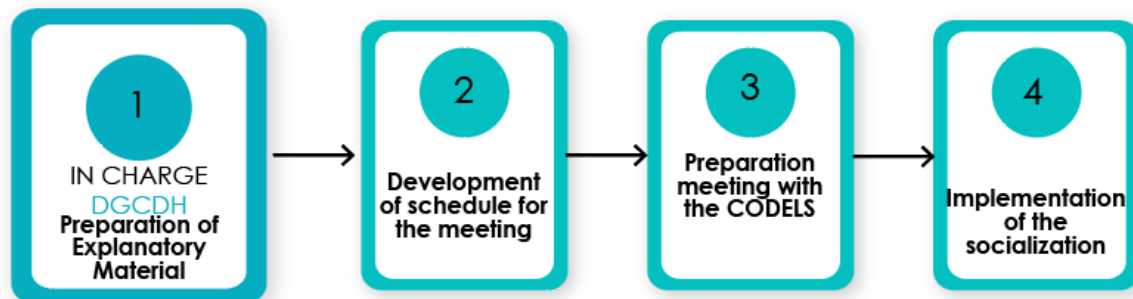



Figure 5414.- Steps for the informative meeting (Source: JET)

- STEP 1. **PREPARATION OF EXPLANATION MATERIALS:** The materials can be prepared by the Power Point presentation so that it can be projected during the meeting, which enables participants to understand well. It should explain the details of the regulation contents, the relocation, the current situation of the neighborhood in general. Showing regulation map help participants understand the location of regulated zones and any other information of interest.
- STEP 2. **DEVELOPMENT OF SCHEDULE FOR THE MEETING:** Based on the regulation category, AMDC especially DGCDH should prioritize the site where the meeting and make a schedule for the approximate meeting for the next year. After making the approximate schedule, DGCDH shall fix the schedule and arrange the meeting date, time and location, under the support with CODEL. A venue for the meeting should have enough capacity to receive all the stakeholders of the community. This could be: educational institutions, churches, community centers, among others. It will take into account the appropriate conditions to gather people such as the availability of chairs, electricity, audiovisual system and good ventilation.

- 
- STEP 3. PREPARATION MEETING WITH THE CODEL: A preparation meeting will be held among DGCDH CODEM, and CODEL in order to confirm the preparation status on the socialization. After this meeting, CODEL shall inform the community about the socialization through their internal communication system. The call should be made at least two weeks before the proposed date.
- STEP 4. IMPLEMENTATION OF THE SOCIALIZATION: once all the preparations have been done, the meeting is held. The meeting serves for the participants to express themselves freely at all times.

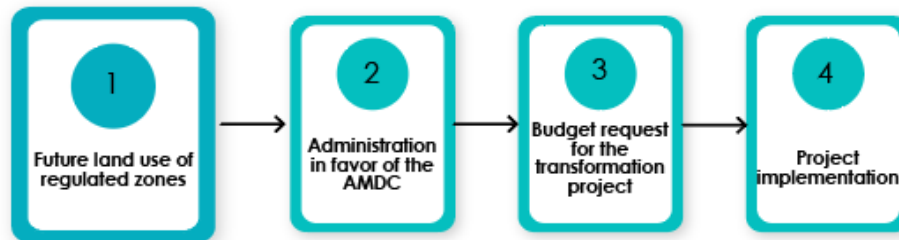


Figure 55.- Steps for implementation of the closure plan (Source: JET))

- STEP 1. **FUTURE LAND USE OF REGULATED ZONES:** The probability of new inhabitants moving into the vacated areas is very high if the people who live there are simply relocated. In order to avoid the residents occupying these areas again, these areas shall be used for some other purpose a part from residential areas. The type of use shall be as far as possible what the surrounding communities can benefit from the new use. The subsequent use of the reclaimed land validates the risk reduction plan. To achieve these objectives, it is necessary for the entity responsible for risk management to define the potential uses that the vacated area may have once the population residing there is relocated, as well as the rehabilitation works required for the defined uses. If there are several potential uses, the communities and stakeholders can be consulted to select the one that meet the interests and needs. It is also necessary to define the entities or authorities that will be in charge of the control and maintenance of the areas after they are recovered and adapted for the new uses.
- STEP 2. **ADMINISTRATION IN FAVOR OF THE AMDC:** A determining point in the resettlement process is that the property rights of the land to be relocated are legally transferred to the AMDC by means of public deeds duly registered in the IP and updated in the cadastral base of the AMDC. Since for this process, it is recommended to generate a kind of exchange of the property in the risk zone for the property in the resettlement. The change will help the AMDC to control, recover and maintain the vacated area at risk, preventing new settlements and occupations that put human lives at risk. The Cadastre, GSL and DGCDH will be involved in this process, and the Cadastre being responsible for coordinating the process. In order to carry out this legal procedure, it will be necessary to follow the following procedure:
1. **TOPOGRAPHIC SURVEY:** In order to determine the area of the land, buildings and their characteristics, it is necessary to carry out topographic surveys of the properties, which are carried out by technicians of the Cadastre. These technicians must prepare a report describing the physical characteristics of the properties at risk, the properties built and everything on them, as well as a plan of each property it contains.

2. **CADASTRAL EVALUATION:** In order to proceed with the cadastral valuation, it will be necessary that the topographic survey and the technical report go through the respective reviews of the manager of Cadastre. It is important that a representative of the family (of legal age) be present at the time of the valuation.

At the time of appraisal, consideration should be given to the devaluation applied due to the risk situation, but also to the commercial value of the real estate according to its area, characteristics and construction materials for a use other than housing.

3. **DEEDING AND REGISTRATION OF PROPERTY IN RISK ZONE TO THE AMDC:** Based on the analysis performed, the Cadastre and the GSL should be assigned to jointly take charge of the control and recovery of the risk zone so that the deeds of the properties in the risk zone are made out in the name of the AMDC. In this way, legal power is granted to recover and rehabilitate the zone and to assign uses that do not expose people to the risk of disaster.

Once this STEP is completed, the AMDC may assign the best use for the land at risk in order to prevent new inhabitants from occupying such land and to designate it as "public space" for community use within the permitted uses according to the opinion of the GER and approval of the AMDC.

- STEP 3. **BUDGET REQUEST FOR THE TRANSFORMATION PROJECT:** For the execution of the transformation project and its respective activities, the necessary human, physical and financial resources must be estimated. The activities to be carried out directly by the AMDC, those to be contracted and those to be executed by other entities through inter-institutional agreements or by the community itself must be defined.

Regarding the financial aspect, the DOT should proceed to enter each of the stages of the plan within the POA, taking into account the budget ceilings for this type of work specifically. Once this budget has been included in the POA, it must have a monitoring system that consists of showing the physical and financial execution in terms of the interventions carried out and the results obtained.

- STEP 4. **PROJECT IMPLEMENTATION:** Once the budget for the implementation of the transformation has been approved, the DOT will proceed to design the assigned use, which will then be submitted to the GOC to be formulated and implemented either by the AMDC or by an externally contracted entity.

This process should be participatory in its entirety from the beginning in the design stage to its culmination in the execution and maintenance of the same to generate appropriation of the space by the inhabitants that surround it.

3 PUBLICATION OF RESULTS

3.1 Target population to report

As reflected in the Sendai Framework, exposure to people and property has increased more intensely and rapidly than vulnerability has decreased in all countries, which inevitably increases risks and creates new ones. Given that Central District is one of the most vulnerable cities in the America, the target population should cover 100 per cent of communities within risk zones.

Therefore, the spaces for socializing the results obtained will be shared with neighbors, community leaders, representatives of water boards, board of trustees and CODELES of the communities at risk of disasters in the DC, as well as the municipal authorities, which will allow to inform about the risk, clarify doubts and collective concerns about the problem, the process and other aspects related to the risk of disasters. It is important to take into account that the publication of results must be adapted to the target population, the following section describes the communication channels that the AMDC can use to disseminate the results obtained.

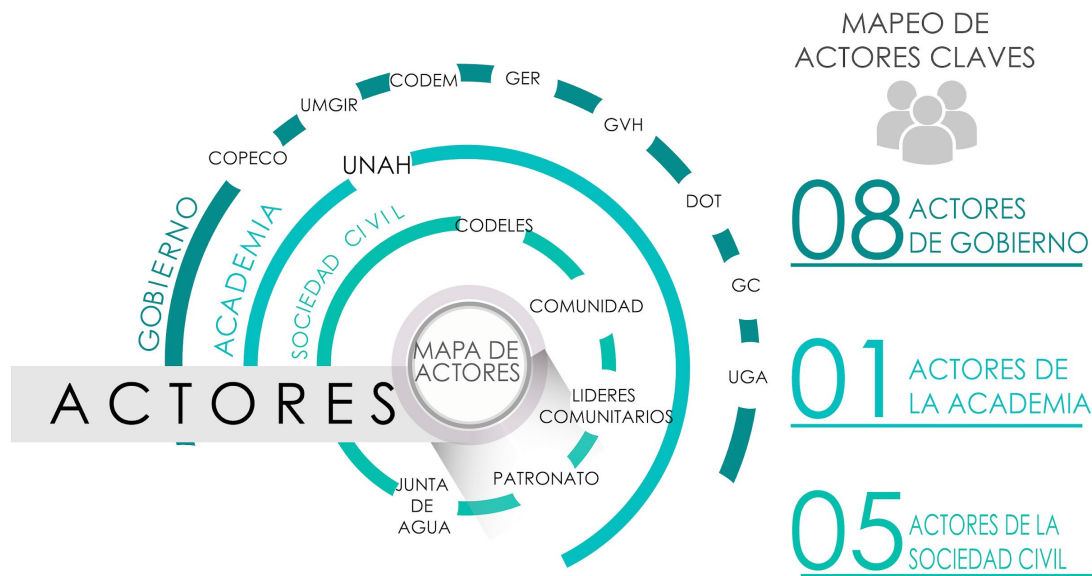


Figure 56.- Mapping of actors for the publication of results. (Source: JET)

3.2 Channels of communication

These channels may vary depending on the target population, since not everyone uses the same means to find out what happened both in their community and in DC in general, the disclosure must be clear, prudent, timely and suitable for correct data on the incidence of development and the effects caused by a disaster as this facilitates the public's understanding of the magnitude of an event, and helps decision makers.

The following dissemination channels can be used to communicate the results:

1. Publication on the AMDC website¹⁵: The City Hall has as one of its strategies, to communicate the projects carried out, either with national, municipal or external cooperation funds; this with the aim of generating a kind of social oversight by the residents with access to the platform.

Below is an example of the publication of results from one of the programs currently financing projects for risk mitigation in DC:

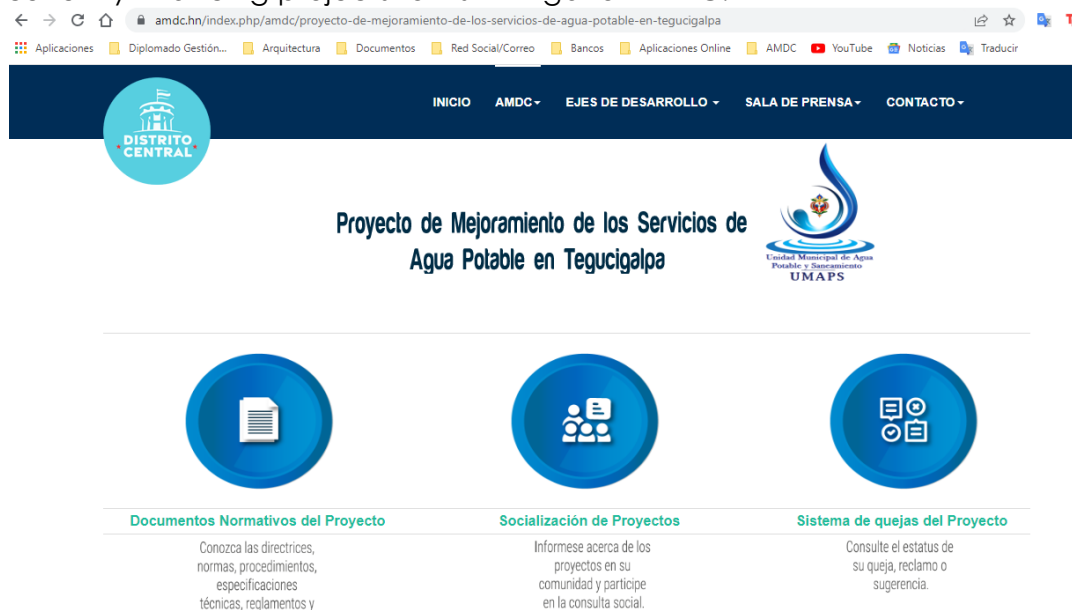


Figure 57.- Example of publication of the results of the UMAPS project in the AMDC. (Source: AMDC)

2. Publication on the AMDC geo-portal/portal de mapas¹⁶ : being a very useful tool, AMDC geo-spatially publishes its projects that have an active status so that residents know the current situation of the same, can make their queries or comments to the regard.

Below an example of the publication of results from one of the programs currently financing projects for risk mitigation in DC:

¹⁵ <https://www.amdc.hn/index.php>

¹⁶ <https://amdc.giscloud.com/>

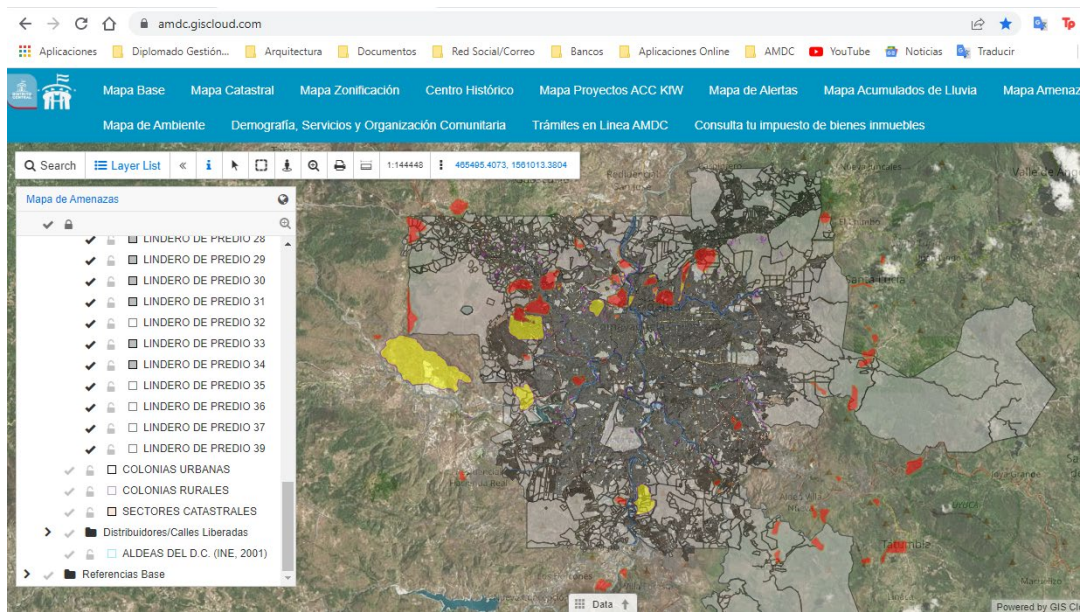


Figure 58 Example of publication of the Multihazards map on the AMDC geoportal. (Source: AMDC)

3. Publication on the COPECO website: part of the central government's strategies is to communicate the projects carried out, either with national funds or external cooperation; this with the aim of generating a kind of social oversight by the residents with access to the platform.

Below is an example of the news publication on the COPECO website:

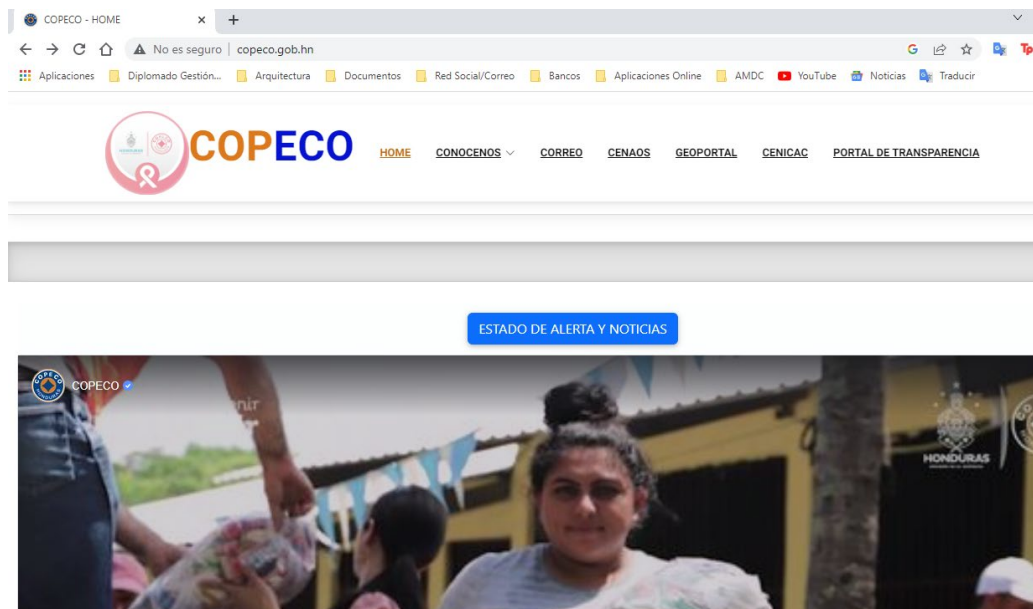


Figure 59.- Example of publication of COPECO results (Source: COPECO)

4. Publication on the IHCIT-UNAH website: UNAH has various portals belonging to its faculties, institutes and careers where the different news of products, research, partnerships or results of projects carried out independently or in collaboration with other entities are presented.

Below is an example of news posting on the website IHCIT-UNAH:

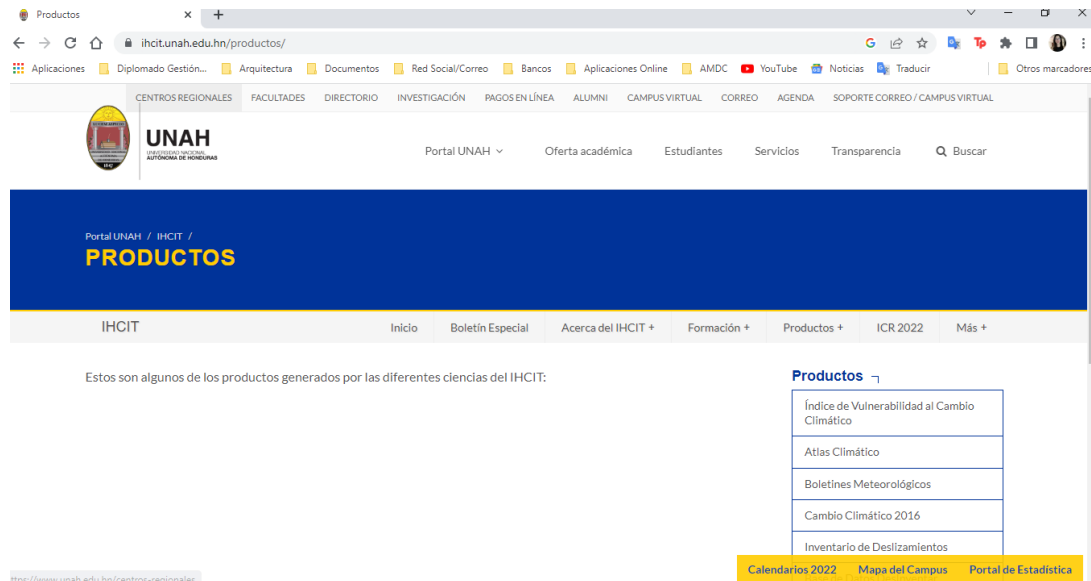


Figure 60.- Example of publication of IHCIT-UNAH results (Source: UNAH)

The most appropriate method to inform the residents of the place are the informative community meetings that contain the following points:

- Basic information about the project.
- Actions to be carried out by the residents according to the type of project.
- Detailing all the information about the project to be carried out.
- Question and answer session to clarify all the doubts and concerns that residents have.
- Agreeing on the responsibilities of each of the parties.
- These meetings should be held with the entire community where the project will take place. The objective of these meetings should be both informative and awareness-raising towards the people who are surrounding the risk area.

On the other hand, discussing issues openly and publicly ensures transparency and avoids the perception of giving preferential treatment to certain people or different messages. If the population is large, several sectoral meetings should be held so that the entire population has the opportunity to participate and receive information directly.

Socialization should be complemented with informative material on the scope of the project and provide a contact telephone number to respond to concerns or doubts about the project.

Some of the activities required to carry out the meeting with the residents of the communities are as follows:

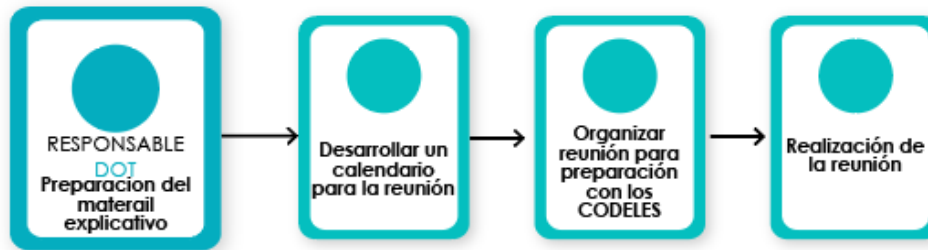


Figure 61.- Briefing process. (Source: JET)

- STEP 1. PREPARATION OF EXPLANATORY MATERIAL: this may be by means of a presentation elaborated in power point and projected by means of a data show for better understanding by the community. It must explain the details of the project, the objectives of the project, and the current situation of the colony/neighborhood in general, showing by means of maps the areas that are at risk and any other information of interest to the inhabitants who will be benefited and those close to the project.
- STEP 2. DEVELOP A SCHEDULE FOR THE MEETING: Based on the range of risk, AMDC especially UMGIR, should prioritize the site where the meeting will be held and make an approximate schedule for next year's meeting. After making the approximate schedule, set the schedule and agree on the date, time and place of the meeting, with the support of the CODELES. A place should be found to hold the meeting where the residents of the community can be, this could be: an educational institution, a church, a community center, among others. Consideration will be given to appropriate conditions for gathering people, such as the availability of chairs, electricity, audio-visual system and good ventilation.
- STEP 3. ORGANIZATION OF THE MEETING FOR PREPARATION WITH CODELES: a preparatory meeting will be held between UMGIR, CODEM, and CODEL(s) to confirm the state of preparedness of the socialization. The call must be made at least two weeks before the proposed day.
- STEP 4. CONDUCT OF THE MEETING: once the material that will be presented and summoned to the participants is prepared, the meeting is held, allowing the free expression of the participants at all times.

The meetings should be held periodically depending on the magnitude of the project to be socialized.

4 ACHIEVEMENTS RELATED TO SLOPE DISASTER RISK REDUCTION

4.1 AMDC achievements.

Throughout the time in AMDC and with the support of different cooperators, mainly JICA, achievements have been obtained related to the reduction of disaster risk on slopes in the municipality of the Central District, which are broken down according to the assigned category, below:

4.1.1 Budget

Table 22.- Detail of Budget assigned by AMDC.

YEAR	LOCATION	ACTIVITY	BUDGET
2011	Colonia Obrera	Tender for the construction of gabions	--
2019	Colonia Obrera and la Flor No. 1	Study and design of landslide control works	L 1,928,111.00
2019	Colonias Villanueva sector No. 5, Divino Paraíso and Miramesí.	Study and design of works for Landslide Control	L 1,948,373.05
2019	Colonias Altos de los Pinos Sector el Cerro, Colonia Nueva providencia, aldea Nueva Suyapa, Villanueva Sector No. 8	Study and design of works for Landslide Control	L 1,824,753.10
2022	Colonia Suazo Córdoba and Col. Guillen	Evacuation	L 3,459,250.00
2022-2023	Colonia Suazo Córdoba	Emergency works for landslide	L2,500,000.00
OUTLOOK FOR FUTURE BUDGET ALLOCATION			
2023	Colonia Villa Nueva	Countermeasure works to mitigate the Slope failure	L 10,200,000.00
2023	Col. Guillen and Nueva Santa Rosa	Temporary Mitigation Works	L 3,200,000.00
2023	Villa Delmi	Countermeasure works	L 1,500,000.00
2023	Col. Guillen	relocation	L 130,000,325.00

- Tender for the construction of gabions in the neighborhood Obrera in 2011, where the following main activities were carried out:
Supply and installation of MIRAFL 180N geotextile gabions over an area of 1,231 m² (3 rolls of 3.8 mx 108 ml), rectangular masonry gutter E=25 W=40 P=60 over a length of 100 meters.
- Investment of L 1,928,111.00 to carry out Study and design of landslide control works in the neighborhood Obrera and la Flor No. 1:
In which activities were carried out to study vulnerability and estimate probable losses, final characterization of the landslide hazard for each of the sites and conceptual definition of the best solutions to address them (Characterization Report containing the conceptual measures of solution); finally, the designs of the Works for the Control of Slides in neighborhoods Obrera and La Flor No.1, all of the Metropolitan Area of the Central District

including structural designs with their respective calculation record and construction details.

- Investment of L 1,948,373.05 for the Contract Study and design of the works for the control of landslides in the neighbourhoods Villanueva sector No. 5, Divino Paraíso and Miramesí.

In which activities were carried out to study vulnerability and estimate probable losses, final characterization of the landslide hazard for each of the sites and conceptual definition of the best solutions to address them (Characterization report containing conceptual measures of solution); finally the designs of the Works for the Control of Landslides in the neighborhoods of Divino Paraíso and Miramesi, all of the Metropolitan Area of the Central District including structural designs with their respective calculation record and construction details.

- Contract for the Study and Design of Works for the Control of Landslides in the Neighborhoods Altos de los Pinos Sector el Cerro, Colonia Nueva providencia, aldea Nueva Suyapa, Villanueva Sector No. 8

In which activities were carried out vulnerability study and estimation of probable losses, final characterization of the landslide hazard for each of the sites and conceptual definition of the best solutions to address them (Characterization report containing conceptual measures of solution); finally the designs of the Works for the Control of Landslides in the neighborhoods mentioned, all of the Metropolitan Area of the Central District including structural designs with their respective calculation record and construction details.

- Due to the rainfall recorded in the municipality of the Central District during the months of August and September 2022 that manifested activities of slope movements in the settlements Nueva Santa Rosa-Guillén and Roberto Suazo Córdoba; people were evacuated from said area, where a daily human resource of approximately 275 people intervened, distributed in the technical, logistical, security and design areas; In addition, a budget of L. 3,459,250.00 to provide evacuees which was used to prepare daily food, in addition to delivering supplies of unprepared food, personal hygiene packages, mattresses and baby kit.
- As emergency measures contemplated in Colonia Suazo Cordova due to a sliding block that has a sliding plane, there are perforations for drainage and perforations with a diameter of 90mm and a length of 300 meters, as well as the installation of 3.50 m³ of gabions of 1.50 *1*0.50m and 50 meters of flexible drainage pipe with a diameter of 300 m.
- Investment of L 10,200,000.00 for the execution and works of countermeasures at Col. Nueva Santa Rosa in 2023: in the coming year AMDC will carry out studies to implement countermeasures to mitigate the risk as part of AMDC's commitments under JICA project.
- Investment of L 3,200,000.00 for temporary mitigation works in the Guillen and Nueva Santa Rosa neighborhoods in 2023: in the coming year AMDC will carry out temporary works to reduce the landslides caused by the 2022 rains in these areas, which accelerated the existing landslides, for which an amount has already been considered for intervention in these areas.

- Countermeasure works are being considered for the year 2023 at Villa Delmi because a cliff more than 5 m high has been identified at the head of the landslide and the body of the landslide at the head has been shaken, Also at the base of the landslide there is a clear uplift and the left side of the landslide has an open topography and there has been a landslide that collapses near the foot of the landslide, such works could consist of channels and drains for the control of surface water; horizontal drainages, drainage Wells for Groundwater Control; Earthwork at the top of the landslide; Reconstruction of the slope (in the whole area) carry out Retention Works as Anchorage and for erosion control in the lower part of the slide the construction of channels and retaining walls.
- Due to the collapse of Col. Guillén in 2022, the Villa Solidaridad project has been planned for next year, which in its first phase would benefit 180 families out of the more than 400 who lost their homes.
In addition, the municipal common land itself, with the support of Convivencia and FHIS (Central Government), is planning the second phase of the project, with the aim of reaching the rest of the affected families who do not manage to benefit in the first phase.

4.1.2 Organization

Table 23.- Detail of organisation AMDC

YEAR	ACTIVITY	INITIAL STAFF	CURRENT STAFF
2011	Restructuring Municipal Emergency Committee (CODEM)	62	110
2014	Certification of establishment of UMGIR	03	22
2014	Creation of the Risk Assessment Management (GER)	06	14
2017	Establishment of the Municipal Spatial Data Committee (COMUDE)	20	34

- Restructuring Municipal Emergency Committee (CODEM) in 2011: is responsible for coordinating all actions aimed at preventing, responding to and recovering from emergencies or disasters occurring within the municipal territory, focusing more on these actions following the entry into force of the SINAGER law.
- Certification of establishment of UMGIR in 2014: under agreement No. 55, contained in protocol No. 17 dated 8 October of 2014; this is the municipal unit formed within the framework of SINAGER, to ensure the development of a social process integrated with human activities, aimed at preventing, mitigating, reducing and permanently controlling the risk of disasters; addressing climate change in a territorial context; and aiming at sustainable and inclusive human, environmental and economic development.

- Creation of the Risk Assessment Management (GER) in 2014: By Municipal Agreement No. 055 contained in Act No. 017 of October 8, 2014. Its function is to carry out the risk assessment and issue the respective risk report, in order to prevent and minimize the generation of potential damage to human life and property. In addition to the creation of the Municipal Ordinance for issuing risk assessments "building a resilient city".
- Establishment of the Municipal Spatial Data Committee (COMUDE), in 2017.
- Entity attached to the Municipal Office, on a permanent basis, whose purpose is to administer and coordinate the development, exchange, review, validation, formalization, use of data and spatial information services at all levels of AMDC.

4.1.3 Technology and Knowledge.

Table 24.- Detail of Technology and knowledge applied in AMDC

YEAR	ITEM	PURPOSE	ORGANIZATION
2011	Institutionalization of the Multi-Hazard Map (Floods and Slope Movement) of the Municipality of DC	Collect information from the Study on Flood Control and Slope Disaster Prevention in the Tegucigalpa Metropolitan Area of the Republic of Honduras	AMDC Technical advice and financing: JICA Collaboration: CAH, COPECO, IHCIT-UNAH, CIUR, COSUDE, PNUD
2011	Emergency plan of the "El Edén" neighborhood	With the aim of training and persuading residents who are at risk.	AMDC
2015	Flood study developed by the Inter-American Development Bank within the framework of the Emerging and Sustainable Cities Initiative (ICES)	The study was carried out as a complement to the Action Plan, whose main motivation is to contribute to a comprehensive and inclusive vision of the capital of Honduras	AMDC Technical advice and financing: BID
2016	Generation of the technical manual "Orange Book"	The purpose of the manual is to provide a tool that brings together the regulations in force in the Municipality of the Central District necessary for the planning, design and implementation of urban projects that define our territory.	AMDC GOAL USAID
2017	Regulations for Disaster Risk Reduction in the DC	Establish municipal regulations aimed at reducing the risk of disasters within the geography of	AMDC

		the municipality of the DC; in accordance with the main principles of Disaster Risk Reduction, adaptation to climate change and territorial planning.	
2017	Action plan for disaster risk reduction and resilience	Provide local authorities with a tool to develop capacity to prepare for and respond to potential disaster events, as well as to adapt to the effects of a changing climate, and recover from its impacts more effectively and efficiently.	AMDC UNISDR
2017	Creation of the geo portal amdc.giscloud.com	identify disaster risks that are directly linked to urban footprint growth scenarios	AMDC JICA PNUD BID
2018	Municipal Policy for Integral Risk Management	Implement risk-reduction measures that, in turn, help to consolidate a culture of prevention among the population.	AMDC
2018	Training in the Software Winlink 2000	This program allows first-response institutions and those working during emergencies to send information over radio waves, in the HF high frequency bands, when telephone and digital communications fail or there is an interruption of the electrical flow.	AMDC COSUDE
2018-2021	Master plans for disaster risk reduction	The Neighborhood Perspective is defined as a strategy based on a geographical approach that simultaneously responds to the multisectoral needs of the population	AMDC GOAL USAID
2019-2021	Diploma in Urban Territorial Management, Edition 1 and 2	With the aim of training municipal technicians on issues of land use planning and risk management.	AMDC GOAL UNAH
2020	Update of the Multi-hazard Map of the Municipality of the Central District	Update the information of the generated maps.	AMDC KFW

2021	Training of municipal technicians from DC, Ojojona and AMDC	The purpose of these courses is to promote the joint implementation of research, development and innovation projects, the training of personnel and the dissemination of knowledge in the field of urban planning and disaster risk reduction.	AMDC GOAL UNAH
2022	Advice on disaster issues	Elaborate the risk map of the neighborhoods of Guillen and Santa Rosa to support the disaster that occurred in the rainy months of 2022	AMDC UNAH COPECO JICA
-	Officialization and publication on the geo portal of the slope movement hazard map in the area of the El Reparto, El Edén, Nueva Santa Rosa and Canaán.	Elaborate the risk map of El Reparto, El Eden, Nueva Santa Rosa and Canaan colonies.	AMDC JICA

- Institutionalization of the Multi-hazard Map (Floods and Slope Movement) of the Municipality of DC. Funded by the United Nations Development Programme in 2011 and made official by the Municipal Corporation through the RRRD in 2017: This map was prepared by compiling information from the Study on Flood Control and Landslide Prevention in the Metropolitan Area of Tegucigalpa, Republic of Honduras, funded by JICA. The method of slope movement density and geomorphic analysis were applied. For each of the main geologies emerging in the study area, the inventory of slope movements was superimposed with spatial variables grouped into ranges.

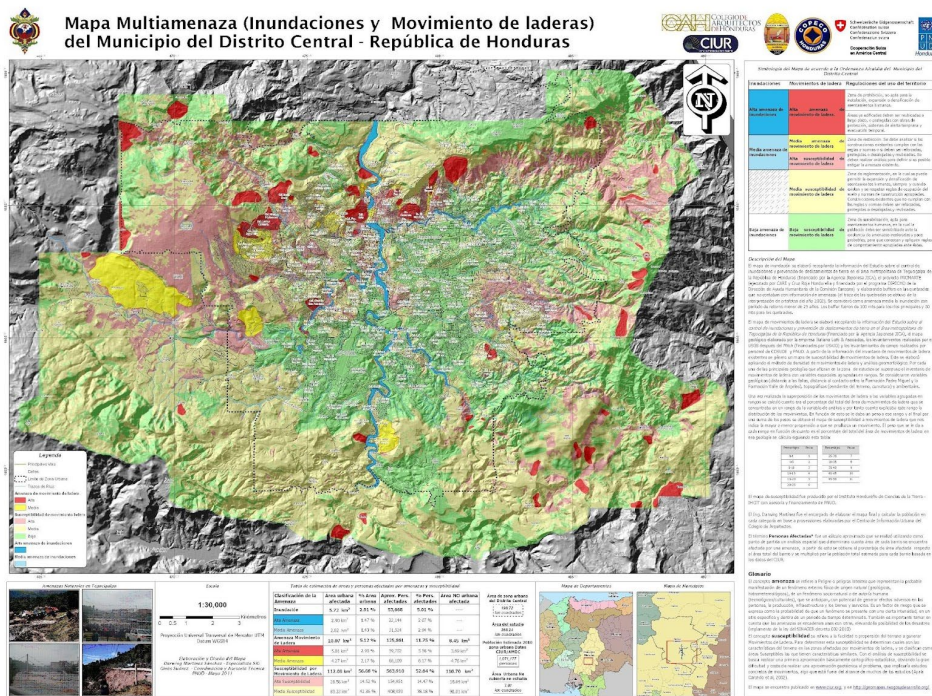


Figure 62.- Multi-hazard Map. (Source: AMDC)

- Elaboration of the “El Edén” neighborhood emergency plan and its respective simulation exercise: these activities were carried out in 2011 and were part of the “Reducing Risks from Landslides and Earthquakes in Tegucigalpa” project. Residents were trained with special techniques so that they can save lives and help others if they get caught in the rubble.



Figure 63.- Simulation performed. (Source: Newspaper Tiempo)

- Flood study carried out by the Inter-American Development Bank within the framework of the Emerging and Sustainable Cities Initiative (ICES), through the Engineering and Construction and Assembly Management Consultancy and the Institute of Environmental Hydraulics of the University of Cantabria in

2015: The study was carried out as a complement to the Action Plan, whose main motivation is to contribute to a comprehensive and inclusive vision of the capital of Honduras. For this reason, it addresses the two cities that together, and as a single entity, officially constitute the administrative headquarters of the government of Honduras: Tegucigalpa and Comayagüela, in the Municipality of the Central District (MDC). This document is the result of a synergistic effort between the Mayor of the Central District Municipality (AMDC) and the Emerging and Sustainable Cities Initiative (ICES) of the Inter-American Development Bank (IDB) to support them in their sustainable growth.

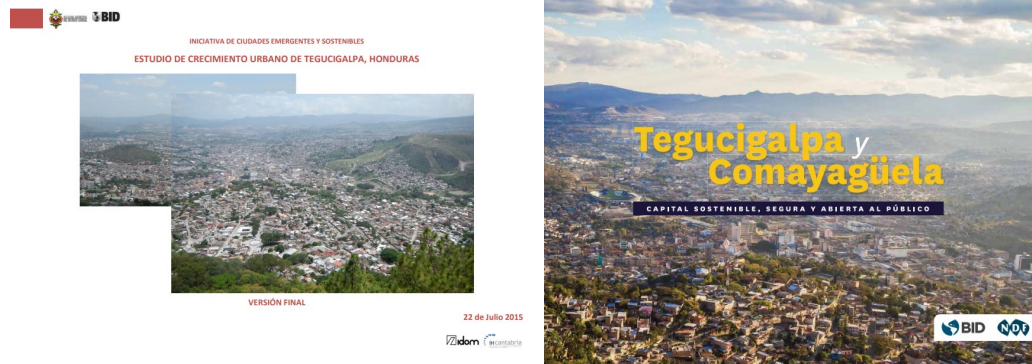


Figure 64.- Urban Growth Study and Plan of Action of Tegucigalpa-Comayagüela, Honduras
(Source: BID)

- Generation of the technical manual “Orange Book” with the support of GOAL International in 2016 2016: The purpose of the manual is to provide a tool that brings together regulations in force in the Municipality of the Central District necessary for the planning, design and execution of urban projects that define our territory. The handbook includes general indications of the main aspects that are part of the implementation of an urbanization, such as general considerations for the selection of a safe site, general considerations for the configuration of the urbanization, the road system, the definition of the drinking water supply system, sewerage system, storm water drainage system, electricity grid and street lighting, and solid waste management.

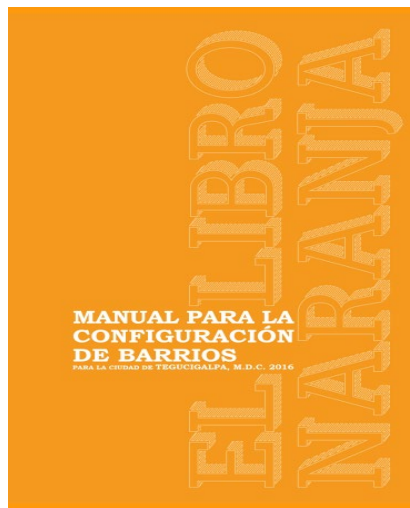


Figure 65.- Cover of Orange Book, Edition 1. (Source: AMDC)

- Regulations for Disaster Risk Reduction in the DC (RDRR), year 2017: This regulation is mandatory for all natural or legal persons, whether public or private, engaged in different processes of development and use of the territory, mainly through construction or operation processes, or in any area of their social action, and where risk assessments defined by both the municipality and/or the central government are required, as well as in other legal instruments relating to disaster risk management, prior to obtaining licenses, permits or any other administrative act issued by the AMDC, which shall be applied to urban development projects, new and existing buildings and any real estate, regardless of their use; as well as business operations licensing processes, which are located in a risk zone.

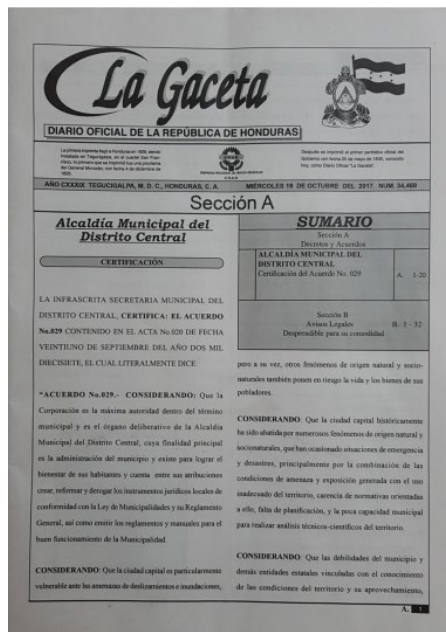


Figure 66.- Publication of regulations. (Source: AMDC)

- Creation of the Action Plan for Disaster Risk Reduction and Resilience: At the end of 2017, the municipality, in consortium with UNISDR, through the DEVCO Initiative, began to carry out a process of diagnosis and design of initiatives towards resilience. AMDC took on the challenge of increasing political commitment to build resilience at the local level, assessing their resilience to disasters, and formulating and implementing a Local Action Plan for Disaster Risk Reduction and Resilience, in a changing climate.



Figure 67.- Home page of the Local Action Plan for Disaster Risk Reduction and Resilience.

- Creation of the geo portal amdc.giscloud.com, As a result of the various studies carried out by UNDP, JICA and others carried out by the IDB, which identify that the risks of disasters are directly linked to the scenarios of growth of the urban footprint, AMDC has resolved the need to generate actions aimed at addressing this issue. The map is constantly updated with layers of various themes such as: zoning, risk, location of shelters, satellite image, demographic and geological data, among others.

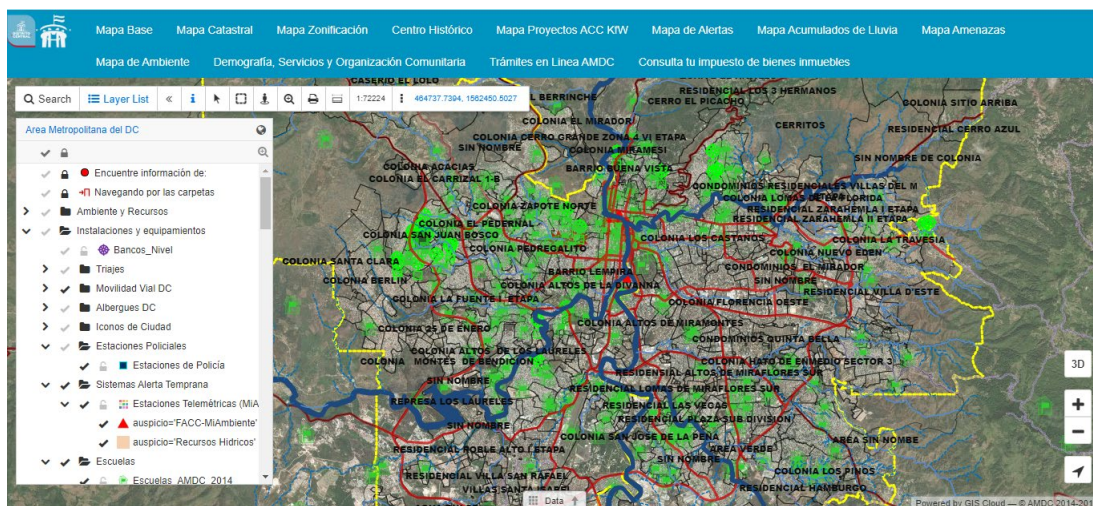


Figure 68.- Geo-portal of AMDC (Source: <https://amdc.giscloud.com/>)

- Municipal Policy for Integral Risk Management (PMGIR) in 2018:

This policy aims to reduce disaster risks in the Central District by generating and consolidating knowledge, in addition to strengthening governance and governability for disaster risk management and adaptation to climate change in the Central District Municipality, generating municipal competencies for financial risk management, so that investments in non-structural structural measures that are prioritized and necessary to increase urban and rural resilience are developed.

- Training by Swiss Cooperation on Winlink 2000 Software in 2018: This software is a system for transferring digital messages between radio amateurs from all over the world, which offers classic email and exchange of attachments such as maps, geographical configuration and weather charts. This program allows first responders and emergency service providers to send information over radio waves, in the HF high frequency bands, when telephone and digital communications fail or there is an interruption of power.
- Disaster risk reduction plans were developed through the Resilient Neighborhoods Project in Los Pinos, Villanueva Norte and Sur, José Ángel Ulloa, La Berlín and Alto de Los Pinos neighborhoods: Developed within the framework of the Project “Making a Neighborhood Approach to Urban Disaster Risk Reduction Operational in Three High-Risk Colonies in Tegucigalpa”, funded by the United States Agency for International Development (USAID/OFDA), developed by GOAL International in agreement with the Municipality of the Central District.



Figure 69.- Master Plans for Disaster Risk Reduction. (Source: GOAL)

- Update of the Multi-threat Map of the Municipality of the Central District (Input Generation)
Development of the following inputs: a. Digital Terrain Elevation Model adjusted; b. Mapping of Terrain Slopes; c. Mapping of Geology at local scale (Includes geomorphology and surface geology); d. Mapping of landslides according to the work of geology, geomorphology and strata of other

studies analysed (mentioned above) e. 60 m of geotechnical drilling at sites where a greater depth of analysis is required due to its complexity. f. Hydrological model in the HEC-HMS software of the required areas of interest; g. Hydraulic model in the HEC-RAS 2D software of the required areas of interest; h. Flood mapping adjusted for the return periods of 2, 5, 10, 25, 50 and 100 years; 4. Printed and digital maps: Flood map integrated with previous and requested studies, and geology and geomorphology maps updated by the consultancy.

- Training of municipal technicians by GOAL-honduras in risk management and territorial planning: Through the Diploma in Urban Territorial Management taught by FACES-UNAH in two editions, in 2019 and 2021, were involved technician of the units as, DOT, GCC and Catastro.
- Training of municipal technicians from DC, Ojojona and AMHON in 2021: UNAH, through the Faculty of Space Sciences (FACES) and the Department of Geographic Information Science and Technology (DCTIG), within the framework of the collaboration agreement signed between UNAH-GOAL International, provided training courses for technical staff of the Municipality of the Central District, Municipality of Ojojona and the Association of Municipalities of Honduras. The purpose of these courses is to promote the joint implementation of research, development and innovation projects, the training of personnel and the dissemination of knowledge in the field of urban planning and disaster risk reduction. This training consisted of 3 courses which were developed over a period of 3 weeks divided into 3 modules each with virtual and practical classes each week, the trainings were:
 - Course on Geographic Information Systems with a focus on informal settlement planning and disaster risks.
 - Course of Multipurpose Cadastral
 - Course on Direct Measurement Equipment Management.

The courses aim to strengthen the basic skills of selected technical staff from the Municipalities of the Metropolitan Area of Valle de Sula (ZMVS) and Central District, Municipality of Ojojona and the Association of Municipalities of Honduras.



Figure 70.- Training of municipal technicians. (Source: UNAH)

- Advice from JICA on disaster issues:
In addition to the advice given to AMDC, COPECO and UNAH technicians, a risk map of the neighborhoods of Guillen and Santa Rosa was prepared to support the disaster that occurred during the rainy months of 2022. Through the Action Plans offered by JICA, it was possible to obtain funding to implement the Project: Community Based Disaster Risk Management in Berrinche and El Reparto (Component "Soft"), which was able to strengthen the communities, community leaders, schools and institutes of both sites and thus support the component of control and mitigation works at these sites (Component "Hard"). After these trainings in Japan and the implementation of the Community Based Disaster Risk Management Program in Berrinche and Reparto, financing was obtained with Taiwan through PADF to intervene in the 4 sectors of the La Canaán neighborhood by implementing another capacity building program. In addition, accompanied by a socioeconomic analysis of the neighborhood, scientific studies of groundwater and site effect, the design and construction of small and medium-sized works to control and mitigate landslides and floods were achieved.



Figure 71.- Training by JICA experts. (Source: El Herald)

- Officialization and publication on the geo portal amdc.giscloud.com, of the threat map of landslides in the area of the El Reparto, El Edén, Nueva Santa Rosa and Canaán colonies:
Information from the Study on Flood Control and Landslide Prevention in the areas of interest was collected for inclusion in the AMDC Portal and thus form part of the published database.

4.1.4 Plan of Government.

1. Establishment of the "Slope Disaster Action Plan" in AMDC.

Its objective is to carry out the necessary actions for the control and mitigation of the risks of hillside disasters in the municipality of the Central District, based on the "Plan of Action for the Reduction of the Risk of Slope Disasters in the Central District" through which the capacity to deal with slope disasters in the municipality of the Central District will be improved.

The document provides policy and administrative recommendations for the sustainability of projects carried out jointly with JICA, as well as their replicability in different DC communities.

4.1.5 Human Resource

1. Recruitment of specialists and establishment of a project formulation team for the "Urban Adaptation to Climate Change in Central America – Honduras Component" Programme of the KfW bank. Three formulators are currently working on this project.
2. AMDC staff and UNAH teachers and researchers trained in the following subjects:

- Analysis of susceptibility to mass movements and their characterization.
 - Design and construction of control measures of medium and low magnitude.
 - Geographic information systems in satellite image processing and vectorization of information obtained in the field.
 - Application of analysis sheets of landslides and rockfall.
 - Elaboration of regulations and regulations in territorial planning associated with mass movements.
 - Landslide Control, evaluation of landslides.
3. Strengthening of synergies between AMDC and UNAH through offices of understanding on integrated disaster risk management, climate change and territorial planning.

4.1.6 Equipment and Facilities

Table 25.- breakdown of equipment and facilities into AMDC

ACTIVITY	PURPOSE	FUNDS
Procurement of disaster risk assessment equipment	Monitoring and maintenance of CD risk areas	JICA/KFW
Piping installation services for inclinometers and piezometers and soil testing at Nueva Santa Rosa and Campo Cielo	Monitoring and maintenance in neighborhoods classified as high risk for slope disaster	
Aerial flight for the generation of aerial photographs of the Municipality of the Central District	With the aim of improving thematic maps in the capital.	JICA
Contracts for micro-enterprises	Surveillance and security in disaster prevention and mitigation projects.	MUNICIPAL

- Acquisition of equipment for disaster risk assessment: procurement of instrumentation, drilling, installation of equipment, personal training of CODEM, CODELES and purchase of equipment for first response in colonies at risk of disaster:

Table 26.- breakdown of AMDC equipment used in projects

LOCATION	EQUIPMENT	FUNDS	PURPOSE
Colonia José Ángel Ulloa	<ul style="list-style-type: none"> • 4 vibrating string piezometers • 2 hand-held piezometers • 3 inclinometers 	KFW	Monitoring of colonies located in risk areas

Colonia Guillen	<ul style="list-style-type: none"> • 3 hand-held piezometers • 3 i inclinometers 		
Colonia Canaán	<ul style="list-style-type: none"> • 4 piezometers • 3 inclinometers 		
Colonia La Obrera	<ul style="list-style-type: none"> • 3 piezometers • 3 inclinometers 		
Colonia La Flor #1	<ul style="list-style-type: none"> • 4 piezometers • 2 inclinometers 		
Colonia La Cabaña	<ul style="list-style-type: none"> • 4 piezometers • 2 inclinometers 		
Nueva Santa Rosa and Campo Cielo	<ul style="list-style-type: none"> • 3 inclinometers. • 3 piezometers • 4 oxygen sensors. • 3 data logger. • 31 Community rain gauges. • 1 Portable GPS • 1 generating plant. • 5 trained persons. • 1 maintenance manual. • 12 community emergency sirens. 	JICA/AMDC	Monitoring of neighborhoods located in risk areas

- Contract services for the installation of pipes for inclinometers and piezometers and soil tests in Nueva Santa Rosa and Campo Cielo. Where it included the following activities:

In Nueva Santa Rosa: 43 meters of drilling, 22 meters of installation of inclinometric pipe ABS with internal diameter of 40mm plus couplings, installation of piping PVC perforated from 20mm to 30mm of diameter for piezometer and construction of 7 protective boxes 1.5 x 1.5m.

In Campo Cielo: 15m of drilling without extraction of cores, 15m of installation of inclinometric ABS pipe with internal diameter of 40mm plus couplings and construction of 1 protective box 1.5 x 1.5m.

- Aerial flight for the generation of aerial photographs of the Municipality of the Central District: these have served not only for the development of the JICA Projects on landslides, but have also been useful for improving thematic maps in the capital, for example: to run different models such is the case of a Machine Learning for slides developed by IHCIT with other international partners.

- Microenterprise contracts: CODEM requested permanent monitoring and security services for disaster prevention and mitigation projects of the landslides in El Berrinche and Reparto (L 70,000.00 c/u), which included private security personnel accompanied by municipal police, cleaning of canals, cleaning of infiltration wells and cleaning of weeds on the project site.

4.1.7 Projects

Table 27.- breakdown of projects in AMDC

LOCATION	ACTIVITY	FUNDS
Colonia Fuerzas Unidas and Arnulfo Cantarero López	Runoff control works	KFW
Colonia Berlín	Relocation of families from risk areas	GOAL
Colonias: José Ángel Ulloa, Villa Nueva S. 7b, Los Pinos Generación 2000, Flor del Campo Nueva Providencia, Berlín, Los Alpes, 28 de Marzo, Japón, La Obrera 1 de diciembre, Altos de la Cabaña	Partial development plans in thirteen (13) neighborhoods of the Capital	KFW

- Runoff control works at the Fuerzas Unidas and Arnulfo Cantarero López through the program “Urban Adaptation to Climate Change in Central America – Honduras Component” of the KfW bank: These works were carried out because its location is in a risk zone situation that must be controlled according to the report issued by the GER in 2018.

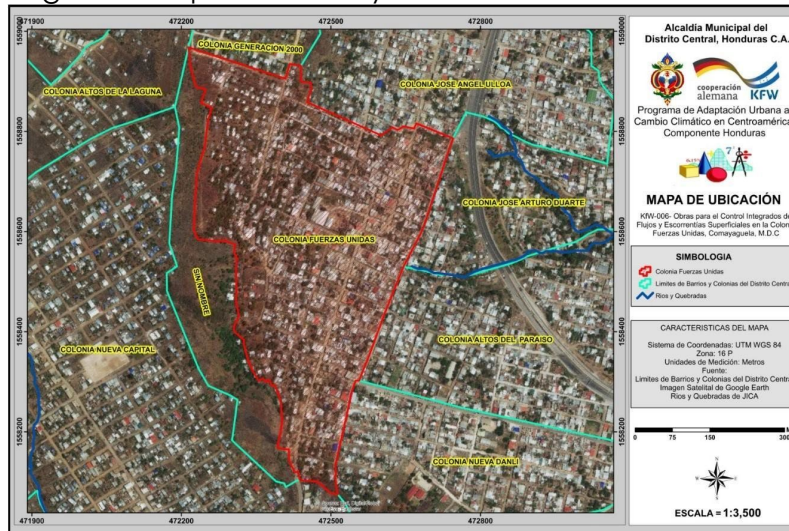


Figure 72.- Map of the location of the project. (Source: UMGIR)

- Elaboration of partial development plans in thirteen (13) neighborhoods of the Capital through the projects of the “Urban Adaptation to Climate Change in Central America – Honduras Component” program of KfW bank: These partial plans of the intervention areas are instruments for regulating the conservation and improvement measures planned for the areas selected through the Site Selection Methodology; and they represent the guiding instrument for spatial planning at a specific level, since they form part of the set of specific rules for the purpose of specifying zoning and regulating the uses, uses and reserves of land located in their area of application.

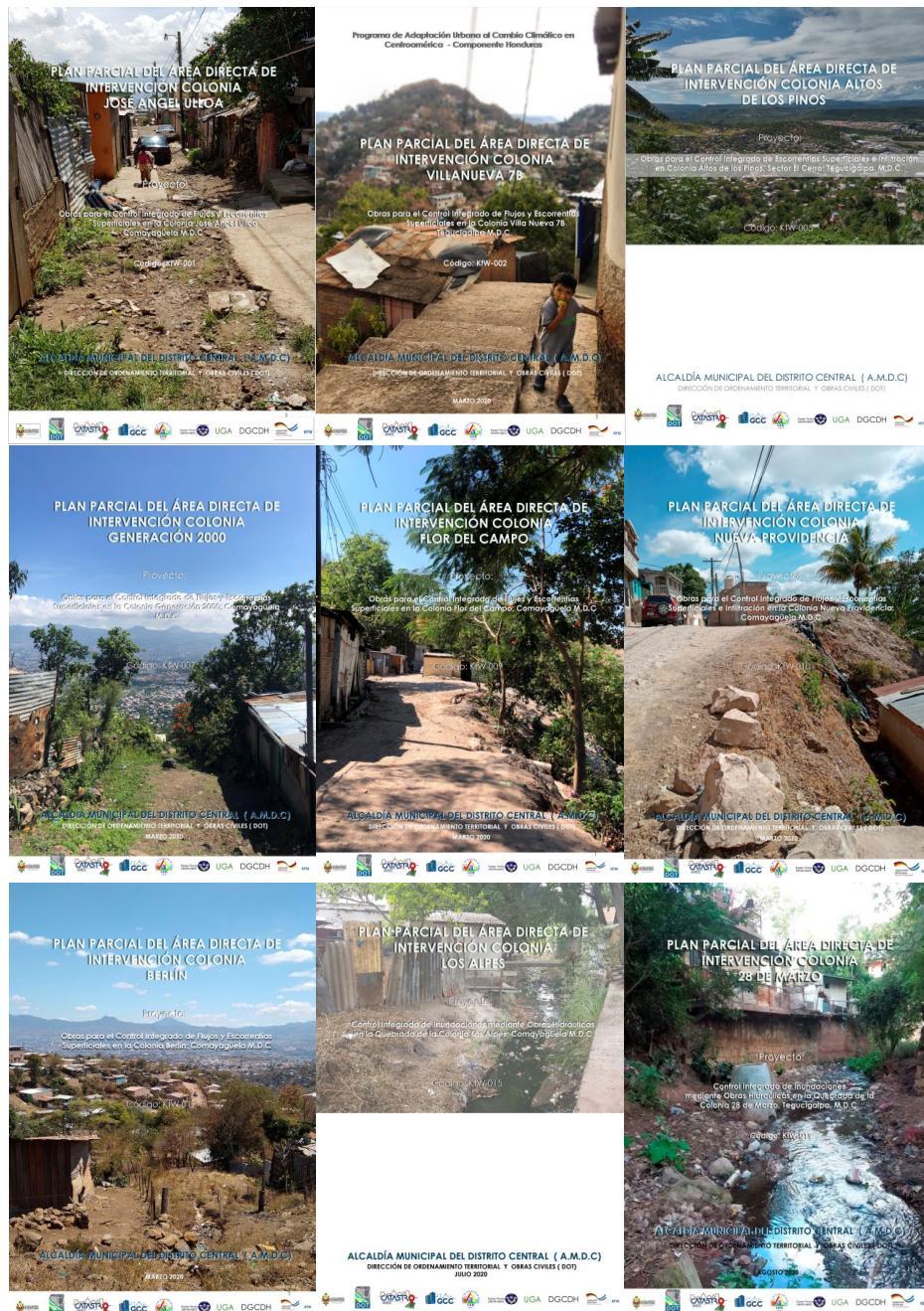


Figure 73.- Partial plans prepared by the DOT in 2021. (Source: DOT)

- Relocation of families from risk areas: The project was carried out with a neighbourhood approach to urban disaster risk reduction in three high-risk neighbourhoods, La José Ángel Ulloa, José Arturo Duarte and Nueva Providencia. The project included the construction of various works, including ditches, cobblestones, bleachers, clean-up campaigns, training the population on risk management and early warning, and the relocation of families whose homes were built in a safe area in the Berlin neighbourhood.

4.2 COPECO achievements

Over time, COPECO has achieved achievements related to the reduction of the risk of disasters on hillsides in the municipality of the Central District, which are broken down according to the category assigned, as follows:

4.2.1 Technology and Knowledge.

Table 28.- Matrix of technology and knowledge applied in COPECO

YEAR	NAME	PURPOSE	ORGANIZATION
2011	Manual for site risk assessment and constructed risk assessment	It serves as a guide and will be applied by personnel certified by COPECO as risk evaluators and supervised by qualified and certified prevention officers under a Risk Management strategy developed by the institution.	COPECO Technical assistance and financing: COSUDE y PNUD
2014	Organization and training of CODED, CODEM, CODELES Y CODECES	To strengthen the different emergency committees in the country.	COPECO
2014	Technological space functioning with the required requirements	Improving workspaces for better results in the prevention of natural disasters	COPECO
2014	Strengthening inter-repeater communications at the national level	Improved communications between COPECO offices nationwide	COPECO
2014	Diagnosis of the inclusion of risk management in the Honduran Construction Code.	Reducing the vulnerability of existing structures and avoiding the construction of new risks	COPECO
2014	Vulnerability study and mitigation proposal	Characterize existing risk in the departments	COPECO
2015	Construction of the Hazard and Response Map at the National Level	For monitoring and control of areas through satellite technology equipment, map algebra and mobile data collection	COPECO, IHCIT-UNAH, SANAA, AMDC, INE, COSUDE, ICF, CIDES, CEPRENAC
2015	Training of 20 municipalities of the Sula Valley Region in disaster risk management	It seeks to reduce vulnerability through the development of participatory and inclusive planning processes, as well as the	World Bank Mundial COPECO

		implementation of mitigation measures.	
2015	Risk management training of people	Strengthen risk awareness in the different communities.	World Bank
2015	Capacity Building for the Mainstreaming of Risk Management Project	Strengthen risk knowledge	COSUDE
2016	Regional workshop to update the processes of the regional mutual aid mechanism for disaster relief	Update the processes of the regional mechanism for mutual aid in the event of disasters.	COSUDE COPECO
2016	Launching of regional project CEPREDENAC-USAID/OFDA	Strengthening Institutional Capacities for Integrated Disaster Risk Management and Climate Change Adaptation in the Central American Region	COPECO USAID
2016	Regional meeting on integrated disaster risk management and institutionalization of the gender approach	Exchange of experiences among regional countries	COPECO USAID
2017	Central American Meeting on Addressing Disaster Risk in Urban Contexts	Analyze the opportunities and challenges of urbanization, reinforce regional commitment and define the key elements for the definition of a Central American Strategic Framework for Disaster Risk Reduction in Urban Contexts	COPECO USAID SICA CEPREDENAC
2020	Development of territorial planning and characterization for local risk management	Geo portal is a tool that allows collaboration and coordination of the work of the different institutions within the National Risk Management System (SINAGER)	COPECO UNAH

- Manual for site risk assessment and constructed risk assessment in 2011: This will allow the standardization of criteria and methodologies for risk assessment in Honduras, which has been validated for more than two years. Through this manual and its dissemination to the relevant entities in the country, it complies with article 24 of the SINAGER Act, which states that “prevention officers shall use technical data sheets to assess the risk of the site (in any type of infrastructure) and the built environment” (specifically buildings).

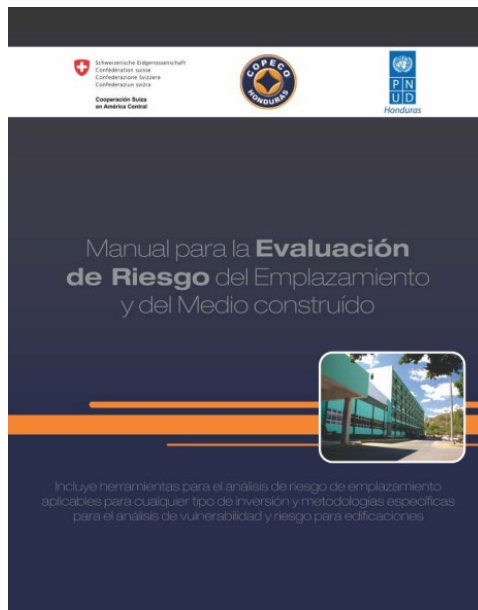


Figure 74.- Manual prepared by COPECO. (Source: COPECO)

- Organization and training of CODED, CODEM, CODELES Y CODECES, was strengthened by means of training courses developed by COPECO, with a total of 405 distributed as follows:
 - 5 for Departmental Emergency Committees
 - 86 for Municipal Emergency Committees
 - 301 for Local Emergency Committees
 - 13 for School Emergency Committees.
- Technological space functioning with the required requirements: Work spaces were improved to obtain better results in the prevention of natural disasters with the installation of IPS, false floors, air conditioners, environment sensors, automated fire extinguishers, creating a modern data center.
- Strengthening inter-repeater communications at the national level: through the installation of radio links to strengthen communications, generating direct communication between COPECO central and regional I, regional II, regional IV and regional VI.
- Diagnosis of the inclusion of risk management in the Honduran Construction Code, in order to reduce the vulnerability of existing structures and avoid building new ones, COPECO has joined efforts to incorporate this issue in construction in general, benefiting more than 8 million Hondurans.
- Vulnerability study and mitigation proposal for Department of Valle, Municipality of la Libertad-Comayagua, Santa Rosa de Copán and Belén-Ocotepeque, having as a main objective to characterize the existing risk in the following departments.
- Construction of the Hazard and Response Map at the National Level: For monitoring and control of areas through satellite technology equipment, map algebra and mobile data collection. Under the coordination of COPECO, with the participation of first response institutions, National Autonomous University of Honduras (UNAH), National Institute of Statistics

(INE), Honduran Institute of Earth Sciences (IHCIT), Institute of Forest Conservation (ICF), National Geographic Institute, SANAA, Secretariat of Education, Municipal Mayor's Office AMDC, Executive Directorate of the National Plan, members of the Inter-agency Committee of Spatial Data (CIDES); with financing from COSUDE in the framework of the Project: COSUDE/PCGIR of CEPREDENAC: "Promotion and Harmonization of the Central American Policy for Disaster Risk Management".



Figure 75 training on the map to implement (Source: COPECO)

- Training of 20 municipalities of the Sula Valley Region in disaster risk management: As part of knowledge management for risk management by 2015, 60% of the Digital Elevation Models of Terrain had been prepared through aerial photography for the 20 municipalities in the Sula Valley area, which in turn were trained in risk issues.
- Risk management training of people: COPECO's National Research and Training Center for Contingency Response (CENICAC) carried out 59 training sessions for the benefit of more than 6 thousand people. In addition, 31 trainings in Educational Centers and 8 simulations in different sectors of the country, with the support of COPECO's projects and international partner organizations. In addition, more than 3,800 copies of the popular version of the SINAGER Law were distributed in the Sula Valley, with the support of the Risk Management Project (PGRD) financed by the World Bank.



Figure 76.- people who were trained (Source: COPECO)

- Capacity Building for the Mainstreaming of Risk Management Project: Approval of the Capacity Building Project for the Mainstreaming of Risk Management in the Municipal Development Process in Western Honduras, in the amount of \$ 350,000.00, agreement signed on July 20, 2015, at the offices

of COSUDE, Tegucigalpa, Honduras. (10 municipalities in the western part of the country will benefit.)



Figure 77.- Different trainings carried out (Source: COPECO)

- Regional workshop to update the processes of the regional mutual aid mechanism for disaster relief (MECREG-SICA): During the working week, the country teams present developed the work schedule for conducting the First Regional Simulation within the framework of the regional mechanism. The Workshop was held under the auspices of the Swiss Cooperation in Central America within the framework of the project "Promotion and Harmonization of the Central American Policy for Integral Disaster Risk Management (PCGIR)", from April 04 to 8, 2016, at the facilities of the Central American Regional Academy for Search and Rescue (AC-BYR), based in the Republic of Costa Rica.



Figure 78.- Team trained through the workshop. (Source: COPECO)

- Launching of regional project CEPREDENAC- USAID/OFDA: The project will be implemented in the countries of the Central American Region Costa Rica, El Salvador, Guatemala, Honduras and Panama, during 2016 and 2017, with the objective of contributing to the consolidation and improvement of the competitiveness of the Governing Bodies and National Systems of Integral Disaster Risk Management and Civil Protection, at a territorial and multisectoral level, for the benefit of the population of the countries of the Region, through two components:

- a. Continuous and sustainable development of risk management authorities in Central American countries.
- b. Consolidation of regional institutions for Integrated Disaster Risk Management for recent support to Central American countries.



Figure 79.- Launch of the project. (Source: COPECO)

- Central American Meeting on Addressing Disaster Risk in Urban Contexts: for the next 20 years, organized the "Central American Meeting on Addressing Disaster Risk in Urban Contexts" - (Challenges and Commitments Towards a New Urban Agenda and Disaster Risk Reduction in Central America), promoting concepts and guidelines for making cities more inclusive, safe, resilient and sustainable in Central America. It was attended by 55 officials, representatives of the National Integrated Disaster Risk Management Systems of the countries of the Central American region with responsibility for promoting risk reduction and urban development processes, including NGO partners, multilateral agencies, specialized secretariats, the Red Cross Movement and the United Nations system.



Figure 80.- Participants of the Central American meeting. (Source: COPECO)

- Regional meeting on integrated disaster risk management and institutionalization of the gender approach: As part of the development of the meeting, regional, national and methodological presentations were made on gender mainstreaming actions in Integrated Disaster Risk Management (GIRD), with the main themes of gender mainstreaming:
 - Sendai Framework for Disaster Risk Reduction (MSRRD 2015-2030) and the Central American Policy for Integral Disaster Risk Management (PCGIR),

Global Commitments and Guidelines for Gender Approach in Central America.

- Regional Policy on Gender Equality and Equity (PRIEG), contents relating to GIRD and complementarity with international frameworks.
- Actions and processes for gender mainstreaming in GIRD at the national level in Central America.
- Conceptual frameworks and methodologies for institutionalizing the gender approach in support of the actions of the governing bodies that are members of the CEPREDENAC.



Figure 81.- Participants of the meeting. (Source: COPECO)

- Development of territorial planning and characterization for local risk management: The Geo portal shows in the map viewer, the graphical information – numerical (static and dynamic), studies, and plans obtained in the process of characterization and territorial planning and socialized in the institutionalization of risk management carried out by PGRD – COPECO in the period 2015 – 2018. It supports decision-making on territorial intervention, helping to reduce vulnerability. Likewise, the Geo portal is a tool that allows collaboration and coordination of the work of the different institutions framed in the National Risk Management System. (SINAGER).



Figure 82.- Map on the COPECO website. (Source: COPECO)

4.2.2 Plan of Government

Table 29.- Government plan aimed at reducing the risk of disasters on slopes.

YEAR	NAME	PURPOSE	ORGANIZATION
2009	Establishment of SINAGER	Regulate, among other things, the issue of the organization and implementation of the risk management policy in the country	COPECO
2013	State Policy for Integral Risk Management in Honduras	The policy is the guiding framework for Honduran society for the comprehensive management of disaster risk arising from natural hazards, the effects of climate change and anthropogenic action, linking political, territorial and financial management in order to reduce vulnerability, foster resilience and contribute to human development processes and sustainable development in Honduras.	COPECO PNUD
2014-2019	National Integral Risk Management Plan	It is the operational instrument of the State Policy, an integral part of the sustainable development of Honduras, which records the harmonized strategies, regulations and institutional actions of SINAGER actors, which contribute, over a specified period of five years, to disaster	COPECO MITIGAR

		risk reduction for human and territorial security.	
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- Establishment of SINAGER in 2009: Decree No. 151-2009 of 26 December 2009, approved the National Risk Management System Act (SINAGER), which regulates, inter alia, the organization and implementation of risk management policy in the country.
- State Policy for Integral Risk Management in Honduras: The State Policy provides the guiding framework for comprehensive risk management in Honduras for the short, medium and long term, based on coordinated action by State institutions at the central (executive) and local (298 municipalities) levels and by all the organizations that form part of the National Risk Management System (SINAGER) and are governed by the Act of the same name.



Figure 83.- Cover of the official document of the Policy.

- National Plan for Integral Risk Management: Developed for a period of five years from 2014 to 2019. It originates from the State Policy for Integral Risk Management (PEGIRH), as a mechanism for its operational implementation. The PEGIRH was approved by PCM051-2013, as a systematic and continuous process of actions by the different government administrations, in line with the Law on the Vision of the Country and Plan of the Nation up to 2038.

Sistema Nacional de Gestión de Riesgos SINAGER (SINAGER)
 Comisión Nacional de Contingencias COPECO
 Secretario Ejecutivo del SINAGER

PLAN NACIONAL DE GESTIÓN INTEGRAL DE RIESGOS
 - P N G I R H -
 Período 2014-2019

Consultora Patricia Bourdeth Flores
 MITIGAR – COPECO

Tegucigalpa, Honduras, Diciembre del 2014



Figure 84.- Cover of the official document of the Plan. (Source: COPECO)

4.2.3 Equipment and facilities

Table 30.- Equipment and facilities in COPECO

ACTIVITY	PURPOSE	FUNDS
Acquisition of minor equipment and tools.	Strengthening the capacity to respond to situations of risk and/or threat to the population.	Banco Mundial
Construction of the Risk Management Training Centre	Create a space where it is appropriate to receive trainings and workshops.	BID

- Acquisition of minor equipment and tools like: GPS, rescue equipment, stretchers, chainsaws, portable electric generators, shovels, picks, rescue backpacks, clothing, tent, first aid kits, lighting towers, kitchen kit, blankets, mattresses, among other implements that were delivered to CODELES and CODEM of the municipalities of Valle de Sula.
- Construction of the Risk Management Training Centre: To operate in the facilities of COPECO, with financing of more than 22 million lempiras from the Inter-American Development Bank (IDB) through the Mitigar project of COPECO.



Figure 85. COPECO Training Centre. (Source: COPECO)

4.2.4 Monitoring and maintenance

Table 31.- Monitoring and maintenance activities in COPECO

ACTIVITY	PURPOSE	FUNDS
Execution of the second phase of the Project for the Modernization of the Environmental Observation and Civil Protection Equipment	For the supply of early warning equipment and systems and emergency care	España
Early Warning Systems (SAT) in Honduras	Provide the necessary tools for monitoring the Hydrometeorological Forecast Center (CPH)	Nacional, UNESCO-CEPRENAC
Monitoring and advice of sites at risk in the country	Cover the need to monitor hazards that compromise the assets of the people and the lives of Hondurans	Nacional
Emergency care drills for landslides carried out in 2014	Train citizens who are at risk in some areas of the country.	Nacional

- COPECO invested 600 million in early warning and emergency response equipment (2013); the funds were approved by the government for the implementation of the second phase of the Project for the Modernization of the Environmental Observation and Civil Protection Equipment by COPECO, in which approximately 660 million lempiras were invested for the provision of equipment and systems for early warning and emergency response. The first phase of the project was carried out with the support of Spain, which donated some 500 million lempiras to Honduras for this purpose; this second phase includes: the supply and implementation of technological systems for

monitoring environmental conditions, emergency communications systems, civil works such as a COPECO Regional Centre in Tocoa, Colón and another in Roatan, Bahia Islands, as well as the expansion of the infrastructure of COPECO headquarters in Tegucigalpa; and seven Bailey Bridges (40 meters each), which will be held in reserve for emergencies.

- Early Warning Systems (SAT) in Honduras: For monitoring purposes, the PMDN also installed at the offices of the National Meteorological Service of Honduras, a ground station that allows downloading information from all Honduran telemetric hydrometeorological stations, which transmit to the NOAA GOES satellite. The installation and rehabilitation of SAT, was carried out in 2014.

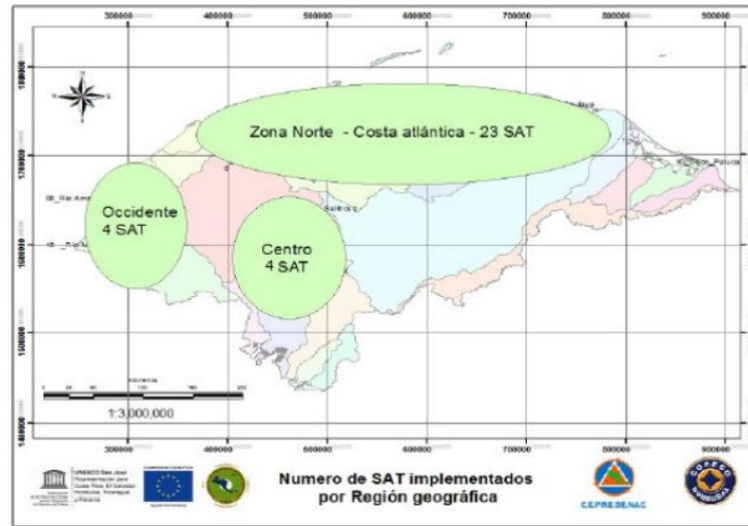


Figure 86.- SAT location map in the year 2014. (Source: COPECO)

- Monitoring and advice of risk sites in the country: the resolution was issued in housing projects such as:
 - Ciudad del Ángel, where risk analysis and vulnerability conditions were carried out.
 - Residencial Paris and Colonia José Ángel Ulloa received technical recommendations based on the risk analysis carried out by COPECO staff.
 - Structural and geological risk analysis at facilities of the Ministry of the Environment, United Nations Buildings at TGU and Museum of Villa Roy, the latter together with UNAH.
- Landslide emergency response simulations carried out in 2014: simulations were carried out in Santa Rita-Copán, Belén Gualcho-Ocotepeque, Monte la Virgen, Las Flores-Lempira. They were conducted with the communities of each of the above-mentioned locations, as well as the municipalities, CODEM and the CODELes.
- Activities carried out in 2021 by COPECO: the following table shows the activities carried out during a year in the different entities belonging to COPECO.

4.2.5 Projects

Table 32.- Projects carried out to reduce the risk of disaster on slopes in COPECO.

LOCATION	ACTIVITY	BUDGET	FUNDS
Public buildings in the Central District	Assessment of prioritized public buildings regarding to risk management		
DC	Construction of structural measures for risk reduction	L 6,680,301	Nacional
La Lima, Santa Cruz de Yojoa, El Negrito, Morazán, El Progreso y Petoa	Construction of 6 works to reduce vulnerability in these municipalities	L 21,632,250.80	World Bank
Choluteca, Valle, Francisco Morazán, El Paraíso, Comayagua, Lempira, Copán, Ocotepeque, Yoro, Atlántida, Cortés, Olancho, Colón and La Paz	37 minor mitigation works	L 190 millones	BID

Evaluation of prioritized public buildings with regard to risk management (2016): the baseline for COPECO was developed and the selection and prioritization of public facilities to be evaluated, generating a schedule for evaluation visits of prioritized buildings. Subsequently, an evaluation report was prepared and delivered to those involved.

- Through national funds, risk mitigation measures were built in neighbourhoods of the DC, equivalent to L 6,680,301.
- Construction of 6 works to reduce vulnerability in the following municipalities: La Lima, Santa Cruz de Yojoa, El Negrito, Morazán, El Progreso and Petoa, with a budget equivalent to L 21,632,250.80.
- Construction of 37 minor mitigation works between levees, boxes, bridges, ditches and relief channels in the 20 most vulnerable municipalities in the departments of Choluteca, Valle, Francisco Morazán, El Paraíso, Comayagua, Lempira, Copán, Ocotepeque, Yoro, Atlántida, Cortés, Olancho, Colón and La Paz. With the execution of 190 million national lempiras by the Inter-American Development Bank (IDB) through the Mitigar of COPECO.



Figure 87.- Some works carried out. (Source: COPECO)

4.3 UNAH Achievements

Achievements have been made over time at UNAH in the area of hillside disaster risk reduction in the municipality of the Central District, which are broken down by category as follows:

4.3.1 Organization

1. Establishment of the Honduran Institute of Earth Sciences: it was created as part of the fourth reform of the National Autonomous University of Honduras in July 2007. Since then, its mission has focused on the production of climate information and risk management, particularly on threats and vulnerability at the national level, as well as capacity-building and formal and informal academic training, supporting territorial planning processes in accordance with the National Plan approved by the Government of the Republic.
2. Strengthening of curricula/syllabus for the creation and implementation of the Degree in Earth Sciences and Geology within the Faculty of Science of UNAH: The Faculty of Science of UNAH opened this degree, this considering that the country needs specialized personnel in subjects related to science and is important to develop curricula within the academy.

4.3.2 Technology and Knowledge.

Table 33.- Matrix of Technology and Knowledge in UNAH

YEAR	NAME	PURPOSE	ORGANIZATION
2012	Development of disaster risk and risk management indicators	To improve disaster risk understanding and risk management performance	UNAH IDEA-Univ. from Colombia Technical advice and financing: BID
2012	First published climate and risk management atlas of the country	To serve as a tool to support the country's technical and scientific knowledge by strengthening institutional capacities in the preparation of studies and	UNAH Technical advice and financing:

		research that they carry out at the national and international levels	IHCIT-UNAH, COSUDE, PNUD
2016	II Central American and Caribbean Congress of Slope Movements	Strengthening of institutional capacities, not only of UNAH, but also of other public institutions in the Central District, and all those related to slope movement events	IHCIT-UNAH
-	Inventory of DC landslides	Based on the results obtained, it was proposed to divide the territory into affected regions or areas, each with similar characteristics from the point of view of slope stability, and the most interesting results and prospects are discussed with the sole aim of saving lives	IHCIT-UNAH
-	Belonging to the International Landslide Consortium ICL	Allowing partnerships with various experts to exchange experiences around the theme of landslides at a global level	UNAH

- Establishment in 2012 for Development of disaster risk and risk management indicators: In order to improve the understanding of disaster risk and the performance of risk management, the Institute of Environmental Studies (IDEA) of the National University of Colombia, based in Manizales, developed a transparent, representative and robust Indicator System, easy to understand by public policy makers, relatively easy to update regularly and allowing for cross-country comparisons. In Honduras, as part of technical cooperation, the necessary tools were developed for the implementation of the loan operation, which focused on preventing and mitigating the risk of natural disasters in the country. In order to determine the effectiveness and impact of this operation, the impact indicators, results and expected outputs were defined.



**Indicadores de Riesgo de
Desastre y de Gestión de
Riesgos**
Programa para América Latina
y el Caribe
HONDURAS

**Banco
Interamericano de
Desarrollo**

División de Medio
Ambiente, Desarrollo
Rural y Gestión del
Riesgo de Desastres
(INE/RND)

NOTAS TÉCNICAS
IDB-TN-169

Abril 2012

Figure 88.- Cover of indicators report. (Source: BID)

- First published climate and risk management atlas of the country: generated by IHCIT in 2012, this atlas presents in detail the variation of the most important climatic parameters and the elements that conceptualize the theme of Risk Management, allowing to characterize the Honduran territory in all its boundaries with each of these elements represented. The aim is to promote knowledge of topics of interest in disaster risk management in the country, so the atlas was written in a simple way so that the concepts and explanations of the different maps were comprehensible to readers and serve to strengthen knowledge in this area. The methodology used for the preparation of the atlas consisted in describing the Central American region as the scene of multi-hazards, and how they affect the Honduran territory, characterizing each of them in the national territory, and considering their history of impact in the country.



UNIVERSIDAD NACIONAL AUTÓNOMA DE HONDURAS
UNAH

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IHCIT

"ATLAS
CLIMÁTICO Y DE GESTIÓN DE RIESGO DE HONDURAS"

TEGUCIGALPA, M D C

NOVIEMBRE DE 2012

Figure 89.- Cover of the atlas. (Source: UNAH News)

- Organization and development of the "II Central American and Caribbean Slope Movements Congress" in 2016: this event was developed by UNAH through the IHCIT of the Faculty of Science, Department of Civil Engineering and together with international collaborators. This congress aimed to strengthen the institutional capacities not only of UNAH, but also of other public institutions in the Central District, and all those related to events of hillside movements.



Figure 90.- photography of the event developed. (Source: UNAH)

- Creation of the DC landslides inventory: The IHCIT of the UNAH with various actors involved in the country's risk management develops in an inter-institutional way a pilot research on landslides affecting the capital city, this is an inventory of the most important landslides and mass movements.

Based on the results obtained, it was proposed to divide the territory into regions or areas affected, each with similar characteristics from the point of view of the stability of the slopes, and the most interesting results and prospects are discussed with the sole aim of saving lives.

- To be part of the International Landslide Consortium ICL: which allows to have alliances with various experts, to exchange experiences around the theme of landslides at a global level.

4.3.3 Equipment and facilities.

Table 34.- Equipment in UNAH

ACTIVITY	PURPOSE
Strengthened IHCIT Computing Laboratory	For the mapping of landslides
Strengthened IHCIT photointerpretation laboratory	Focused on the interpretation of landslide-prone configuration

1. Strengthened the IHCIT Computing Laboratory through Licensing of specialized software that can be used for landslide mapping, in addition to other GIS applications.
2. Strengthened IHCIT photo-interpretation laboratory, equipped with desktop stereoscopes of different sizes and ranges, as well as pocket stereoscopes, compasses and GPS.

5 ANNEXES

ANNEX 1. RECOMMENDED STUDIES FOR THE RESEARCH AND ANALYSIS PHASE:

For the initial phase of Research and Analysis, at least the following studies should be obtained in order to carry out the initial research in a comprehensive manner with all the data needed to solve the problem found:

Table 356.- Matrix of minimum studies to be carried out. (Source: JET)

Studies to be carried out								
No.	NAME OF SITE	GEOLOCALIZATION	TOPOGRAPHIC CONDITIONS	GEOFYSICAL CHARACTERISTICS	VULNERABILITY EVALUATION	HYDROLOGICAL CHARACTERISTICS	SOCIAL AND ORGANIZATIONAL ASPECTS	ENVIRONMENTAL ASPECTS

The following section briefly explains each of the items included in the previous matrix.

- **TOPOGRAPHIC CONDITIONS:** it is necessary to carry out a detailed survey of the land surface. This includes changes in surface and relief.
- **GEOFYSICAL CHARACTERISTICS:** is the determination of the structure and composition of the Earth, as well as the history of its past, present and future variations. Some of the studies carried out in this field are: seismology, geodynamics, and gravimetry, among others.
- **VULNERABILITY EVALUATION:** these allow the identification of the areas of greatest danger to climate-related events such as slope failures, landslides, depending on the exposure, sensitivity and adaptive capacity of the territory analyzed.
- **HYDROLOGICAL CHARACTERISTICS:** Calculation of morphometric parameters, concentration times, duration and intensity of rainfall and calculation of flows from different methodologies.
- **SOCIAL AND ORGANIZATIONAL ASPECTS:** refers to the community level of the colony/neighborhood to be intervened, like existing organization (Patronage, CODEL, or water board).
- **ENVIRONMENTAL ASPECTS:** Refers to the natural environment surrounding the intervention work, such as fauna, flora and other important aspects of the immediate ecosystem.

ANNEX 2. COMMUNITY INTERVENTION:

The following table shows the file of the projects to be assisted and their current status:

Table 36.- File of projects to be involved. (Source: JET)

Studies to be carried out								
No.	NAME OF SITE	GEOLOCALIZATION	TOPOGRAPHIC CONDITIONS	GEOPHYSICAL CHARACTERISTICS	VULNERABILITY EVALUATION	HYDROLOGICAL CHARACTERISTICS	SOCIAL AND ORGANIZATIONAL ASPECTS	ENVIRONMENTAL ASPECTS

To better understand each of the items shown above in the matrix is described:

- GEOLOCALIZATION: Refers to the geographical location of a site, by means of UTM coordinates and/or latitude and longitude.
- REASON OF THE INSPECTION: refers to the reason for the field visit, which may be by periodic inspection every six months or by an accelerating agent such as an earthquake, flood, slope movement or other that merits the visit carried out to inspect the condition of the work.
- TRAFFIC LIGHT: which refers to the color obtained in the evaluation (green, yellow or red), these have been explained in step 4 of the item 2.1.6
- INITIAL VALUE OF ANALYSIS: refers to the data obtained during the initial investigation of the work to be used as a reference to analyze the proper functioning of the work.
- CURRENT VALUE OF ANALYSIS: refers to the updating of the data obtained in the initial investigation of the intervention work to be used as a reference to analyze the proper functioning of the work.

ANNEX 3. CONFORMATION OF CODELES.

Since the CODELES are responsible for ensuring the safety of communities in the face of risks, it must be ensured that the neighborhood or colony in which the intervention is carried out has a duly sworn, trained group with the necessary equipment to implement it in the event of an emergency. In the absence of a CODELES team, it must be formed through the Municipal Emergency Committee of the AMDC so that the intervention achieves its objective.

The CODEL formation process consists of selecting members for coordination and four commissions: 1) Monitoring and Communications, 2) First Response Brigade, 3) Shelters and Humanitarian Aid and 4) Damage Assessment and Needs Analysis. CODEL is made up of at least 9 persons: (1) coordinator and (2) persons per commission. If the community wants to include more people, they can be added to the commissions or support staff. The CODEL training and certification process has been established in 4 steps:

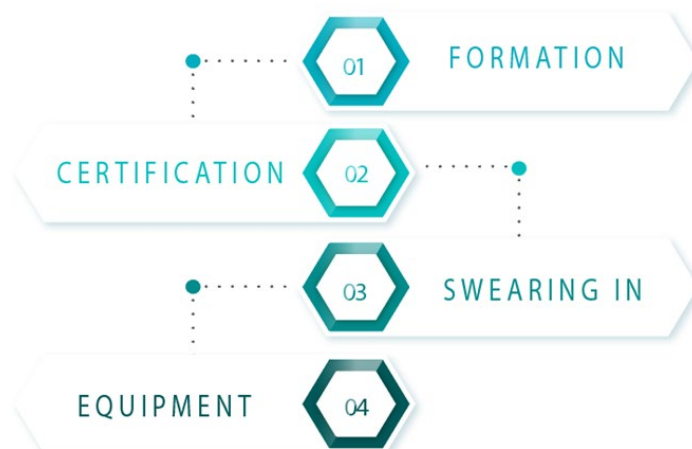


Figure 91.- Steps for forming CODELES. (Source: JET)

Table 37.- Explanation of steps for forming CODELES. (Source: JET)

PROCEDURE FOR THE CONFORMATION OF CODEL			
Nº	STEP	ACTIVITY	IN CHARGE
1	FORMATION	It consists of establishing the basic operating structure of CODEL through a participatory process of the community.	CODEM
2	CERTIFICATION	It includes three levels of certification: basic level, intermediate level and advanced level.	
3	SWEARING IN	Symbolic event by which CODEL members are publicly recognized once the certification process has been completed	
4	EQUIPMENT	Provision of minimum equipment to respond to emergency events.	

ANNEX 4. ELEMENTS TO TAKE INTO ACCOUNT FOR THE DESIGN STEP:

In the design stage is where the elements of the following matrix must be captured:

Table 38.- Matrix of design elements. (Source: JET)

Design elements									
No.	THE OBJECTIVE OF THE INTERVENTION	SCOPE	PROBLEM TO SOLVE	BENEFICIARY	COST OF THE WORK	CAUSES	STRATEGY	EXPECTED RESULTS	IN CHARGE

The following section briefly explains each of the items that were included in the previous matrix.

- OBJECTIVE OF THE INTERVENTION: Refers to the reason of being of the intervention to be carried out.
- SCOPE: has as its purpose the concrete determination of the goal to be achieved during the development of the project in question, the completion of which will lead to the successful completion of the project.

- PROBLEM WHICH IS TRIED TO FIX: What is intended to be improved with the intervention to be carried out?
- BENEFICIARIOS: refers to the number of people benefiting from the project and/or assets to be protected.
- WORLD COST: refers to the final budget that will have the intense activities of participation to carry out.
- CAUSES: i.e. the analysis of the reasons behind the problems to be solved or issues that are observed in the community either natural or by man's actions.
- STRATEGY: Which short-, medium- and long-term intervention actions are intended to be carried out clearly studied and based on the research and studies carried out previously in step 1 of the project plan.
- RESULTADOS ESPERADOS: That is to say, the goals to be achieved with the realization of the structural work.
- RESPONSIBLES: refers to the person directly responsible for each of the actions to be carried out throughout the process.

ANNEX 5. INFORMATION REQUIRED FOR PROJECT PROFILE FOR CONSTRUCTION AND SUPERVISION (Major and Minor Works)

The profile include and without limitation the following:

- Name of the Project
- Project code generated in the project generation program (Different code with which the Study and Design was handled)
- Name of the formulator
- Background/Technical justification.
- Current situation
- Project Description
- Implementation time
- Financial resource
- Baseline Budget
- Cost sheets
- Photos and/or renders
- Implementation program of activities
- Technical specifications
- Construction plans
- Assessment criteria
- List of minimum equipment

ANNEX 6. ENVIRONMENTAL LICENSE PROCESSING (Contracting design):

The consultant will submit to AMDC's Environmental Management Unit (EMU) all the requirements required for the UGA to carry out the appropriate licensing process to MIAMBIENTE.

Minor works projects requiring an environmental license are:

- Paving of streets with concrete or asphalt, paving bump (the environmental license is used for the project "Rehabilitation and Improvement of Streets in Tegucigalpa and Comayagüela")

- Construction of Hydrosanitary Systems (Drinking Water, Sanitary Sewerage and Rain Sewerage))
- Maintenance of riverbed and creeks
- Community health center
- Dredging of rivers and creeks
- Works adjacent to declared basins (sub-basin of the Guacerique River, Rio del Hombre, San Jose de Rio Grande, Tatumbla River, Sabacuante River
- Protected areas declared by SINAPH: La Tigra national park, Corralitos Wildlife refuge, Bermudas Carias multiple use area.
- Any area of Environmental interest.

Minor works projects that the UGA considers do not require an environmental license are:

- pedestrian bridges
- walls
- vehicle tracks
- gutters
- fords
- Culvert bridge
- Drinking water storage tanks
- Improvement of green areas
- Municipal parks
- Multipurpose courts.
- Improvement of public buildings such as: basic centers, schools, institutes, community centers and cultural heritage buildings with an intervention area of less than 1500 m²

The consultant shall present, inter alia, the following requirements:

- Environmental Management Plan (PGA)
- Plans signed and sealed
- Budget signed and sealed
- Proof of public road issued by AMDC Cadastral Management.
- Permits for the movement of advertising elements on public roads issued by the Construction Control Management of AMDC (if any).
- Other requirements requested for the environmental license process by MIAMBIENTE.

ANNEX 7. The specification or terms of reference as appropriate shall contain at least the following information:

- Background
- Description of the subject-matter of the contract with its essential characteristics or technical specifications.
- Base budget
- Deadlines governing the call for tenders: for the submission of tenders, for requesting clarifications to the specifications or terms of reference, for dealing with remedies at the request of the AMDC, for communicating the award and for the submission of complaints, among others. These periods

shall be sufficient to guarantee the principles of competition, equality and non-discrimination.

- Documentation to be presented by the bidders, form and modalities of presentation of the offers.
 - Selection criteria and award criteria.
 - Procedure in case of a tie.
 - Duration and extensions of the contract.
 - Place and term of delivery or execution of the good or service.
 - Guarantees that must be constituted, if applicable, by the bidders or the successful bidder.
 - Way to pay.
 - Legal regime of the contract and competent jurisdiction.
- Any other condition considered necessary for the correct execution of the contract.

ANNEX 8. *BREAKINGOUT FOR MINOR WORKS:*

- Paving with Hydraulic Concrete.
- Paving with Asphalt Mix.
- Ballasted
- gutters
- Sewer bridge and fords
- Steps
- Retaining Walls
- Conduit
- Hydrosanitary Systems (Potable Water, Sanitary Sewerage and Rainwater)
- Vehicle tracks
- Construction of tanks for storage of Potable Water
- Pedestrian bridges
- Construction and/or Remodeling of Educational Centers
- Construction and/or Remodeling of Community Centers
- Construction and/or Remodeling of Parks
- Construction and/or Remodeling of public places for social and/or Recreational issues.
- Buildings with heritage value inventoried by the Historic Center Management and the Honduran Institute of Anthropology and History (IHAH).
- Health centers

ANNEX 9. *BREAKINGOUT FOR MAJOR WORKS:*

- Bridges underpass
- roundabouts
- Road Rehabilitation
- Urban mobility.

ANNEX 10. *INFORMATION FOR PAYMENT APPLICATION (Design contracting):*

- Disbursement authorization, original

- Copy budget line
- Contract Copy
- Copy Guarantee of compliance
- Product accepted, original
- original receipt
- original invoice
- Copy Start Order
- Copy Payments on Account
- Identity copy legal representative
- RTN copy, legal representative
- Solvency Copy Personal tax, legal representative
- Proof of solvency taxes: Neighborhood, ICS, and, Real estate
- Copy RTN, company
- Copy of Operating Permit
- Product receipt certificate
- Payment request

ANNEX 11. *INFORMATION FOR PAYMENT APPLICATION (Design contracting):*

- Disbursement authorization, original
- Copy budget line
- Contract Copy
- Copy Guarantee of compliance
- Product accepted, original
- original receipt
- original invoice
- Copy Start Order
- Copy Payments on Account
- Identity copy legal representative
- RTN copy, legal representative
- Solvency Copy Personal tax, legal representative
- Proof of solvency taxes: Neighborhood, ICS, and, Real estate
- Copy RTN, company
- Copy of Operating Permit
- Product receipt certificate
- Payment request

ANNEX 12. *INFORMATION FOR A REQUEST FOR PAYMENT OF RETENTIONS (Design contracting):*

- Disbursement authorization, original
- Copy budget line
- Contract Copy
- Copy Guarantee of compliance
- Product accepted, original
- original receipt
- original invoice

- Copy Start Order
- Copy Payments on Account
- Identity copy legal representative
- RTN copy, legal representative
- Solvency Copy Personal tax, legal representative
- Proof of solvency taxes: Neighborhood, ICS, and, Real estate
- Copy RTN, company
- Copy of Operating Permit
- Termination of the respective Study and Design contracted by the AMDC
- Payment request.

ANNEX 13. *INFLUENCE GRAPH FOR THE UPDATE OF REGULATED AREAS:*

The following image shows an influence graph, which represents the capacity of each institution, person or organization to persuade others, influencing their decisions and expectations; taking into account some criteria such as being financial, legal or social mobilization resources; that is, an actor may not have the necessary financial resources, but may have the capacity to exert pressure for decision-making in a given sector of the territory. As long as there is more influence on a key actor, their expectations will be higher.

Those involved in the process are classified into three levels of territorial influence: high, medium and low. Based on the previous categorization, the following criteria were taken to develop the classification of each of the actors in the process:

1. Government: Consideration was given to the various activities carried out by the different centralized and decentralized government institutions that are part of the interest group, according to the different stages of the plan.
2. Academy: To consider the degree of mobilization of the population in this category, we mainly considered the contributions they have made to the committee to which they belong with research and information generation, the degree to which the university is linked to solving community problems, relevance of the academic offer with the reality of the territory, having institutes, observatories or research groups, specific geographic areas where research projects and/or linkages are carried out, in addition to taking into account the number of students enrolled.
3. Civil Society: To consider the degree of mobilization of the population in the category of civil society, the different types of internal organizations of villages and neighborhoods of the Central District were considered, such as Barrio Seguro, formal patronages, water boards and board of directives.

For the development of this process certain guidelines were followed, such as:

- Selection of the form of representation

The form of representation of the actors corresponds to the onion-type graph, which made it possible to visualize the 3 categories already established for territorial partners: Academia, Government and Civil Society.

- Placement of the actors

For the placement of the actors, the same symbol (circle) was used to represent the actors that directly influence the project. The type of line represents the degree of influence of the actor regarding the objective of the project. The dashed line represents a high degree of influence, the dotted line represents a medium degree of influence, and the solid line represents a low degree of influence.

Below is an influence graph of the actors that should be involved in the entire process:

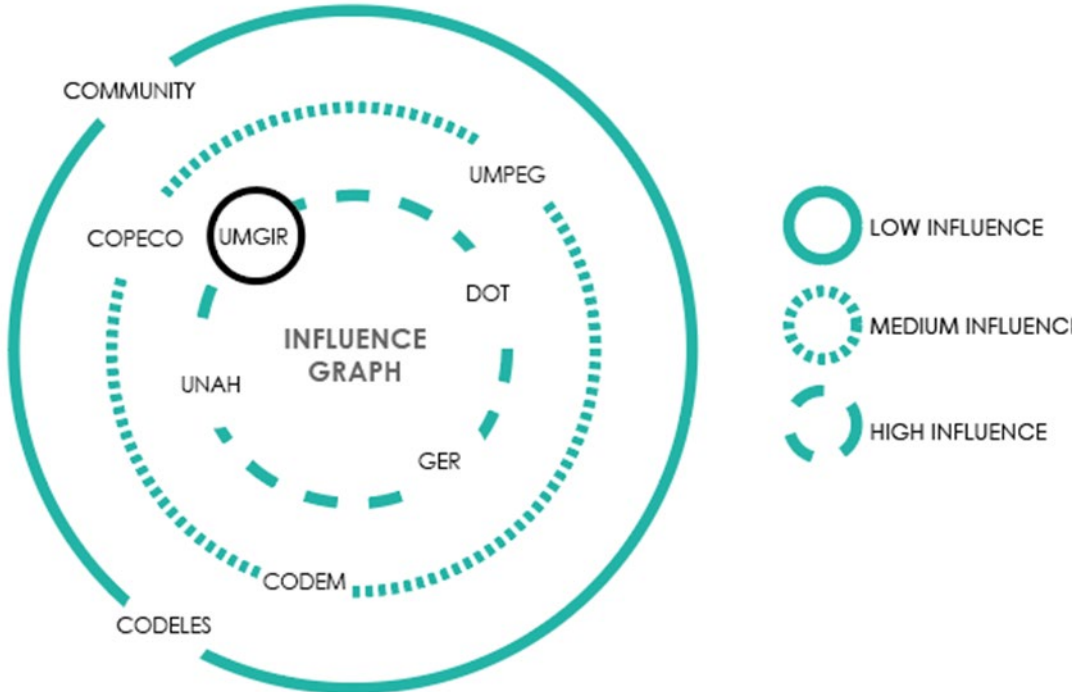


Figure 92.- Graph of influence of the actors involved in updating the regulation. (Source: JET)

ANNEX 14. Case study Methodology and Master class Methodology

[Case study Methodology]

The usefulness of this method is to bring the technicians closer to real conditions, to help them developing latent talents of vision, authority, communication and leadership, which will enable them to confront civilized, agile and effective communication, the processing of rational and objective information and decision making in conditions of uncertainty that may arise with respect to the regulation. It is not only the rote learning of the regulation. In this sense, this methodology has the following characteristics:

- To allow the application of theoretical and technical concepts tested in real life.
- To help the participant developing both problem-solving and decision-making skills.

- To require active participation and encourage the development of communication skills.
- To become able to replicate situations of criticism, risk or uncertainty, which are typical of real life.
- To contribute to a practical and pragmatic approach to diverse and varied situations.

[Master class Methodology]

This is a versatile methodology since it can be used to work with a large or small group. This methodology consists of an oral presentation of contents by the facilitator to the whole group of professionals. This intervention by the facilitator can range from the description, demonstration of procedures, formulas for the realization of the regulation and its interpretation. The oral discourse should be accompanied by audiovisual resources that illustrate, accompany and complement the message, in addition to the fact that sometimes it can also be supported by diagrams, notes and annotations on the blackboard so that the listeners can understand the message in the best way possible.

ANNEX 15. *INFLUENCE GRAPH FOR THE UPDATE OF THE REGULATED ZONES*

It is imperative that all those involved in the process are aware of all the activities to obtain better results from the update. The institutions that should be involved in the process of updating the regulation are divided into three categories (academia and government), On the UNAH takes the part of academia and should establish which department will be involved in the process described above, and on the government side is COPECO as the central government, which should propose a department that will be involved in the entire process, and the AMDC as the administrative entity of the DC municipality.

The influence graph for the updating the regulated zones represents the capacity of the institution, person or organization to persuade others, influencing their decisions and expectations. It is established by taking into account some criteria such as financial, legal or social mobilization resources. It is also probable that an actor may not have the necessary financial resources, but may have the pressure for decision-making of land use. The greater the influence of a key stakeholder, the higher his or her expectations will be.

Those involved in the graph are classified into three levels of territorial influence: high, medium and low. Based on the classification, the following criteria were used to classify each of the stakeholders in the process:

- 1. Government:** The various activities carried out by the different centralized and decentralized governmental institutions that are part of the stakeholder group were considered, according to the different stages of the plan.
- 2. Academia:** In order to consider the mobilization of the actors in this category, we mainly considered the contributions they have made in terms of the committee to which they belong with research and generation of information, degree of linkage of the university with the resolution of community problems, relevance of the academic offer with the reality of the territory, having institutes, observatories

or research groups, specific geographic areas where research and/or linkage projects are carried out, in addition to taking into account the number of students enrolled.

3. Civil Society: To consider the degree of mobilization of this category, the different types of internal organizations of community, village and neighborhood of the Central District shall be considered, such as Barrio Seguro, Patronatos, water boards and boards of directors.

Certain guidelines were followed, such as:

- **Selection of the form of representation**

The form of representation of the actors corresponds to the onion type graph, which visualizes the 3 categories already established for the territorial actors: Government, Academy and Civil Society.

- **Actors placement**

Regarding the placement of the stakeholders, the same symbol (circle) is used to represent the stakeholders that directly influence the project. The type of line represents the degree of influence of the stakeholder with respect to the project objective. The segmented line represents a high degree of influence.

Below is a graph showing the influence of the actors that should be involved in the whole process:

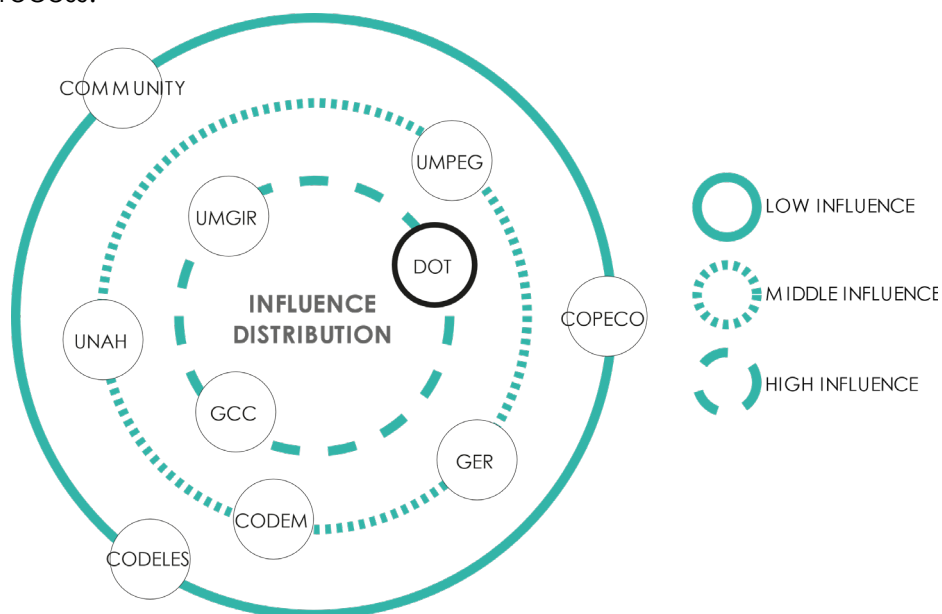


Figure 93.- Influence Graph for updating the regulated zones (Source: JET)

ANNEX 16. RISK EVALUATION IN REGULATED ZONES

In order for the process of the risk evaluation to be sustainable, it is important to take into account the following procedure, depending on the case, which is described below. These evaluations should follow the following steps:

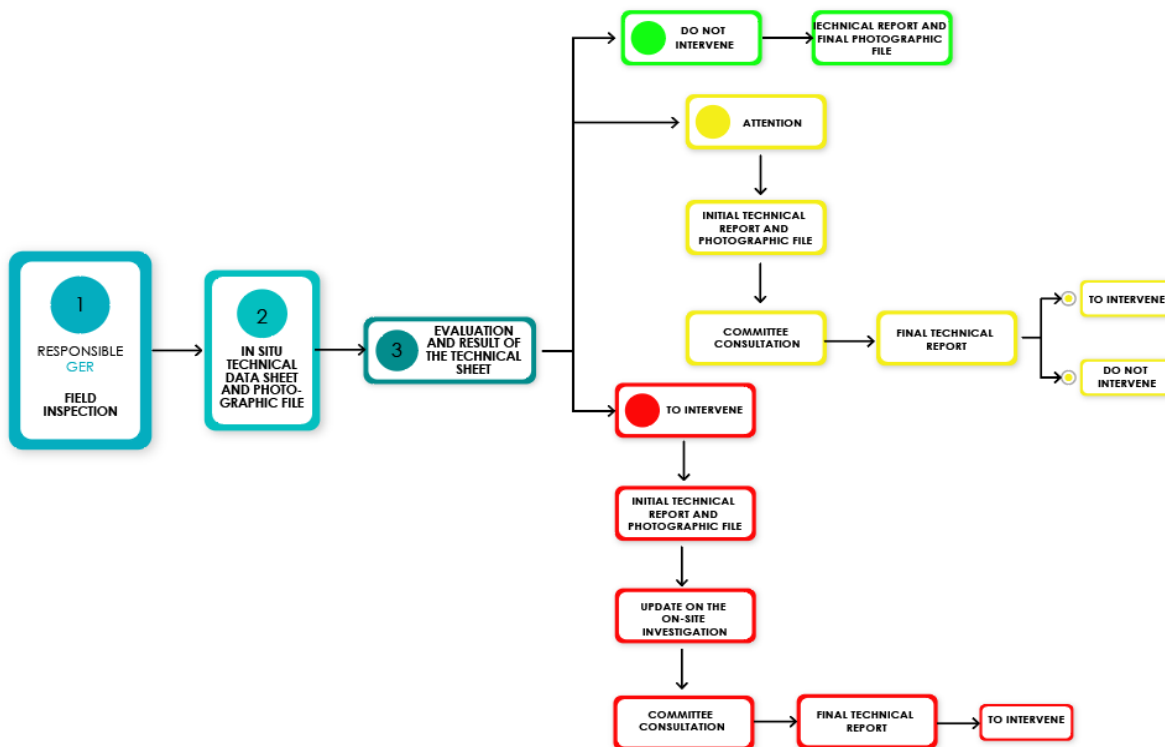


Figure 94.- Steps for the monitoring and evaluation (Source: JET)

- STEP 1. SITE INSPECTION: In conjunction with the community and CODEL of inspection sites, site visits will be made with a minimum frequency of six (6) months or in case of natural events such as earthquakes, rainfall, undermining of rivers or human activities. The purpose is to remark evidences or signs of significant changes at the site to. It is imperative that all those who are involved in the process shall be present at the time of the inspection to generate a better evaluation of the site.
- STEP 2. IN SITU TECHNICAL DATA SHEET AND PHOTOGRAPHIC RECORD: To keep a timeline, it is necessary first to make a photographic record of each of the inspection sites with their respective geolocation. In addition, at the same time, technical sheet should be fulfilled out with a series of questions that will guide the technician to know the current status of each area. The sheet should include a field where a brief interview with the inhabitants of the area should be conducted, since they are the ones who see first-hand the events that occur in the area.
- STEP 3. EVALUATION AND RESULT OF THE TECHNICAL DATA SHEET: Once the data sheet has been filled out, it will be necessary to carry out the desktop evaluation to obtain the final result of the current state of the intervened area. The use of traffic lights is recommended, to be taken into account in the last step for decision making on the actions to be taken (Green: In good condition-No intervention, Yellow: Intermediate condition-attention and Red: Bad condition-urgent intervention). Once the field record has been analyzed, the results of the technical visit will be presented in a technical

report, incorporating the photographic file and the data obtained during the visit.

Once the technical report and the results of the traffic light survey have been completed, it is important to take priority actions on each of the findings found at the site.

For each color of traffic light there will be an action, the following is a description of what should be done depending on the case:

- GREEN TRAFFIC LIGHT: this color indicates the good condition and operation of the structural work and its positive reference for the evaluation, so it does not require any intervention by the monitoring team other than to record in a technical report the current good condition and the photographic file.
- YELLOW TRAFFIC LIGHT: this color indicates the need for a deeper evaluation due to the little information obtained in the visit, with the objective of knowing how the structural work is functioning, so sometimes it will require the on-site evaluation of an expert on the subject, which will be part of the committee that has been formed for the colony/neighborhood intervened, to conclude with the evaluation and proceed to intervene if it is the case. It is also necessary for the technical team to prepare a report explaining everything that has happened and evidencing the photographic file.
- RED TRAFFIC LIGHT: indicative color that denotes a work that must be intervened and from which it is necessary to obtain more information to solve the problem posed at that time, through comparative studies between the initial research and analysis stage and new studies to be conducted in the area, it will be determined if there is a change factor with respect to the initial situation and with the help of the committee formed by experts on the subject (municipal technicians, COPECO or academics from the UNAH) should reach a conclusion and therefore a solution to the problem addressed.

ANNEX 17. *AMDC'S BASIC POLICY ON RELOCATION*

Relocation is a dynamic problem that it is difficult to establish a static plans and strategies; therefore, they must have the capacity to be rethought, taking into account the population served, its geographic location and the type of phenomenon presented. A value that must be pursued at all times, however, is to guide at all times towards an orderly, safe and sustainable zoning of the territory, contributing to reducing the vulnerability of the population and their livelihoods. To this end, the analysis of five (5) components is considered fundamental for the successful implementation of the relocation. These are described below:

- TERRITORIAL COMPONENT: For collective resettlement, it is necessary to have land on which to build housing and infrastructure for population who newly enter (in other word "relocatees"). The characteristics and location of the land is one of the key elements for the successful results of relocation. In addition, the resettle land for the relocatees and their land use, as well as the risk, vulnerability and threat situation in the natural and artificial events must be analysed. The DOT and Cadastre will carry out the analysis in order to find a suitable site which is well equipped for new life.

- **SOCIAL COMPONENT:** It is important to analyze the social compatibility of the relocated community to the host site. Aspects such as access to education and health services, community organisation and appropriation of the new habitat should be analysed. If social problems were detected in the analysis, it is necessary to conduct activities for the management of these problems. The DGCDH will carry out this analysis, through the liaisons of each community, in order to determine whether there is social compatibility between the host community and the affected community.
- **HOUSING COMPONENT:** Research on the housing or occupation status of the host site is recommended. The DOT and GVH will conduct the analysis to determine the aspects related to housing and habitability.
- **ECONOMIC COMPONENT:** The economic situation of the relocatees should be analysed, taking into account their livelihoods and the economic activities they carry out inside and/or outside the community. The DOT and DGCDH will carry out the analysis of this component in order to understand the entire population dynamics of the community.
- **ENVIRONMENTAL COMPONENT:** The environmental aspect of the host site shall be analysed to avoid any damage caused by the relocation. It will be the DOT and UGA who carry out this analysis, taking into account the environmental aspects that may be decisive for the implementation of the plan.

ANNEX 18. *CRITERIA TO BE TAKEN INTO ACCOUNT FOR THE RELOCATION*

- **PLANS:** Analyze whether the site has a land use plan, urban plan or any other plan that must be reviewed for compliance. The contents of the plans for resettlement lands must be in accordance with these plans. These plans define the type of activity that can be developed (residential, industrial, commercial, agricultural, livestock, forestry, etc.) as well as the safety conditions for human settlements, in terms of the hazards that generate risk.
- **RISK:** If there are no land use or risk management plans that determine the hazards caused by natural phenomena, the corresponding studies must be carried out in order to determine that host land does not have natural hazards that could become a risk for the population.
- **LEGALITY OF RESETTLE LAND:** The land must not have any legal problems, so that the property rights can be transferred to the resettled population. It must have the public deed of the IP and be in the cadastral registry of the AMDC.
- **SOIL QUALITY:** If the population has specific economic activities such as agriculture, livestock, etc., this criterion is also analyzed. The quality of the soils in resettle land must correspond to their economic activities.
- **TRANSPORTATION:** Existence of roads that allow for the transportation of the population and their mobility to workplaces and service centers. If it is necessary to build them, these costs should be analyzed at the time of land selection.
- **CENTERS FOR SOCIAL SERVICE:** It should be analyzed if there are schools and health centers nearby that can receive the resettled population. If this is not

the case and it is necessary to build this infrastructure, this should also be taken into account when making the land selection decision.

- PUBLIC SERVICES (nearby water, sewage and electricity networks): It is necessary to analyze whether there are nearby networks to bring services to the new settlement, and if not, to define how these services will be provided and the costs involved.
- LAND VALUE: According to the market values, price ranges can be determined for the search of the land to be acquired, in case the host site is not owned by the local government.

The activities for the acquisition of private land or the transfer of land title must be defined in detail. If the purchase of private land is necessary, an appraisal or valuation of the property must be carried out and the legal and official procedures must be followed.

- COMPATIBILITY BETWEEN ACCOMMODATION AND RESETTLED POPULATION: It is necessary to analyze the socioeconomic and cultural characteristics of the population neighboring the potential available land, in order to determine if they are compatible with the population to be resettled, or if there may be conflict generating factors. Sometimes ethnic, religious, social, social, economic or cultural aspects can trigger conflicts between population groups.

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*Manual for Investigation and Analyzing
Small/Medium Size Slope Disaster Risk Sites*

The Project for Control and Mitigation of Slope Disaster
In the Central District in Republic of Honduras

Manual for
Investigation and Analyzing Small/Medium Size
Slope Disaster Risk Sites

October 2022

Alcaldía Municipal de Distrito Central

JICA Expert Team

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Preface

This manual is a manual that describes investigation for obtaining the necessary information to study measure works for relatively small/medium-size landslide, slope failure and rockfall. The manual consists mainly following two parts.

- I Investigation Manual for Landslide Small/medium Size)
- II Investigation Manual for Slope Failure
- III Investigation Manual for Rockfall

“I Investigation Manual for Landslide (Small/medium Size)” is based on the survey conducted for the Campo Cielo landslide countermeasure works completed in 2022, and JICA Expert Team (hereinafter called “JET”) 's knowledge has been compiled as a manual.

“III Investigation Manual for Rockfall” is based on the survey conducted for rockfall countermeasure works in Fuerzas Unidas completed in 2022, and JET's knowledge has been compiled as a manual.

This manual is prepared with the following points.

1) Purpose of the Landslide Investigation

This manual is an investigation manual in order to study countermeasures against landslides, slope failure and rockfall. The landslides covered in this manual are small to medium scale which is less than about 200 m in length.

2) Measures against the Landslide

Landslide measures are stabilization measures or mitigation measures against “active” landslides. Initial landslides are out the scope of this manual.

Slope failure measures and rockfall measures are protection works for protecting residents and structures affected by the impact near the slope.

Classification and Definition of **Landslide**

There are various forms of landslides, and there are various classifications. The term landslide denotes “the movement of a mass of rock, debris or earth down a slope”. The phenomena described as landslides are not limited to either the “land” or “sliding”, and usage of the word has implied a much more extensive meaning than its component parts suggest. Ground subsidence and collapse are excluded.

The most common classification of landslide in the world may be the Vern’s Classification (1978) shown below.

Table 0.1 Vern's Classification of **Landslide** ^(JET)

Material	Types of Movement		
	Fall / Topple	Slide / Spread	Flow
Rock	Rock Fall / Toppling	Rock Slide	Rock Avalanche
Earth	Earth Fall (Slope Collapse)	Earth Slide	Earth Flow (Mudflow)
Debris	Debris Fall	Debris Slide	Debris Flow

Rock : A hard or firm mass that was intact and in its natural place before the initiation of movement
Earth : describes material in which 80% or more of the particles are smaller than 2mm, the upper limit of sand sized particles
Debris : Contains a significant proportion of coarse material; 20% to 80% of the particles are larger than 2mm, and the remainder are less than 2mm

Vern's Landslide classification has two terms: the first term describes the material type and the second term describes the type of movement as shown in Table 1. The material types are Rock, Earth and Debris, and the types of movement describe how the landslide movement is distributed through the displaced mass. The five cinematically distinct types of movement are described in the sequence fall, topple, slide, spread and flow.

Scientific classification is sometimes complicated and takes longer time to classify, since it requires knowledge and experience of geological study and natural science. Sometimes in engineering sector employs simply classification which is basically combination of the two terms in Vern's classification such as Rock fall, Rock topple, Debris slide, Debris flow Earth slide etc. In order to work out the measures against slope disasters and to design the prevention measures in Tegucigalpa, this manual recommends the engineering classification as shown in Table 2. The engineering classification which consists of four types of road disasters is based on configuration of landslides, and relation to roads.

Table 0.2 Characteristics of **Landslide** ^(JET)

Disaster Type	Movement	Topography	Material	Moisture	Size	Speed
Slope Failure	Fall, Slide	Steep / High Slope	Weathered Rock - Earth	Moist	Small - Medium (<5,000m ³)	Rapid
Rock Fall	Fall	Steep / High Slope	Rock	Dry	Very Small (< 5 m ³)	Extremely Rapid
Landslide	Slide	Gentle Slope with Characteristic Landform	Earth – Debris - Rock	Moist	Large (> 5,000m ³)	Slow
Debris Flow	Flow	Stream	Debris - Mud	Very Wet	Small (< 1,000m ³)	Rapid

Landslide: USGS defines the word of “landslide” that “Landslide is a general term used to describe the downslope movement of soil, rock, and organic materials under the effects of gravity and also the landform that results from such movement”. USGS call the landslide like Campo Cielo, “rotational landslide” or “translational landslide”. However, this manual uses the word of “landslide” for the landslide of Campo Cielo.

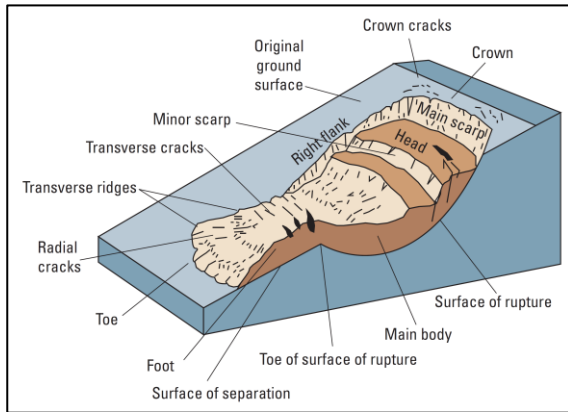


Figure 0.1 Simplified Illustration of Landslide (USGS)



Figure 0.2 Landslide (JET)

Slope Failure: This refers to failure of loose and porous soil and rocks from slope when the loose materials are filled by water during heavy rainfall or are shaken loose by earthquake. This failure type is marked as sudden with rapid movement without prior indication, generally as a result of damage, structural weakness, or lack of support. Generally, the size of failure is less than 1,000 m³ because only the loose part of the slope surface collapses. Material is mostly highly weathered rock, colluviums or debris. Depth of collapses are relatively shallow.

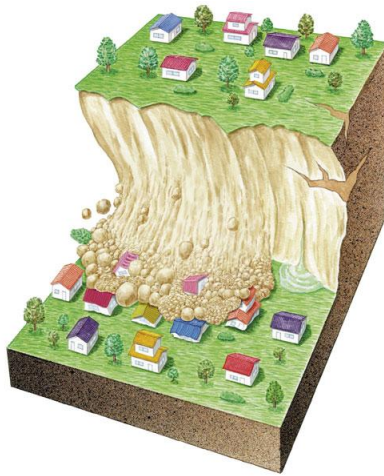


Figure 0.3 Simplified Illustration of Slope Failure

(Kanagawa Prefecture, Japan)



Figure 0.4 Slope Failure (JET)

Rockfall: Rockfalls are abrupt, downward movements of rock or earth, or both, that detach from steep slopes or cliffs. The falling material usually strikes the lower slope at angles less than the angle of fall, causing bouncing. The falling mass may break on impact, may begin rolling on steeper slopes, and may continue until the terrain flattens. Rockfall often occur along with slope failures. Therefore, it is often difficult to distinguish between slope failures and rockfalls.

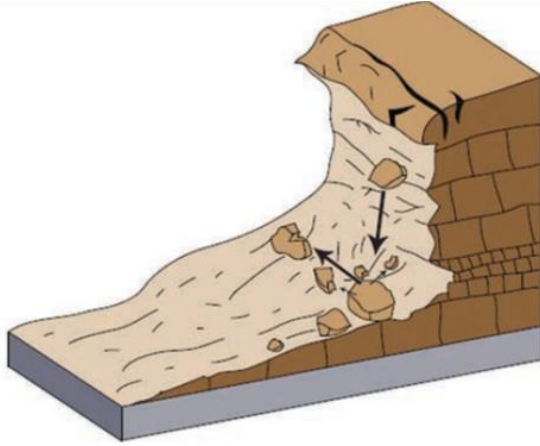


Figure 0.5 Simplified Illustration of Rockfall (USGS)



Figure 0.6 Rock Fall (JET)

Debris flow: Debris flows sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. These flows generally occur during periods of intense rain-fall or rapid snowmelt. they usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 15km/h, but can exceed 55km/h. Source area is upstream of road slope. Rapid flow of boulder, gravel, sand, silt clay mixed with a large quantity of water that is mainly generated by slope collapse and heavy rainfall. It flows down riverbed with gradient of over 20-degree gradient and stops to deposit in the riverbed with gradient of under 10 degrees. There may be streams with the possibility of debris flow around Tegucigalpa, but it is assumed that the occurrence frequency is relatively low compared to landslides and slope failures. Therefore, this manual does not cover debris flows.

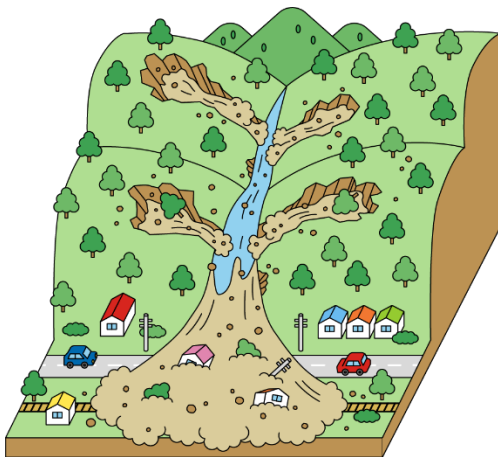


Figure 0.7 Simplified Illustration of Debris Flow

(Fukuoka Prefecture, Japan)



Figure 0.8 Debris Flow (JET)

Chapter 1. Landslide

1.1 Site Investigation and Monitoring

1.1.1 Plan

(1) Investigation and Monitoring for Stabilization Measures

This section is mentioned the investigation for planning stabilization measures against landslides.

Basically, the three items, dimension, cause and parameters are required as information for planning landslide stabilization measures. The objects of the landslide investigation are the following three objects.

Objects of Landslide Investigation

Object 1: Dimension of landslide (size, shape of surface of rupture)

Object 2: Cause of landslide

Object 3: Parameters for stability analysis

Object 1 Dimension of Landslide

The landslide shape is range (length, width) of landslide and depth of surface of rupture (slip surface).

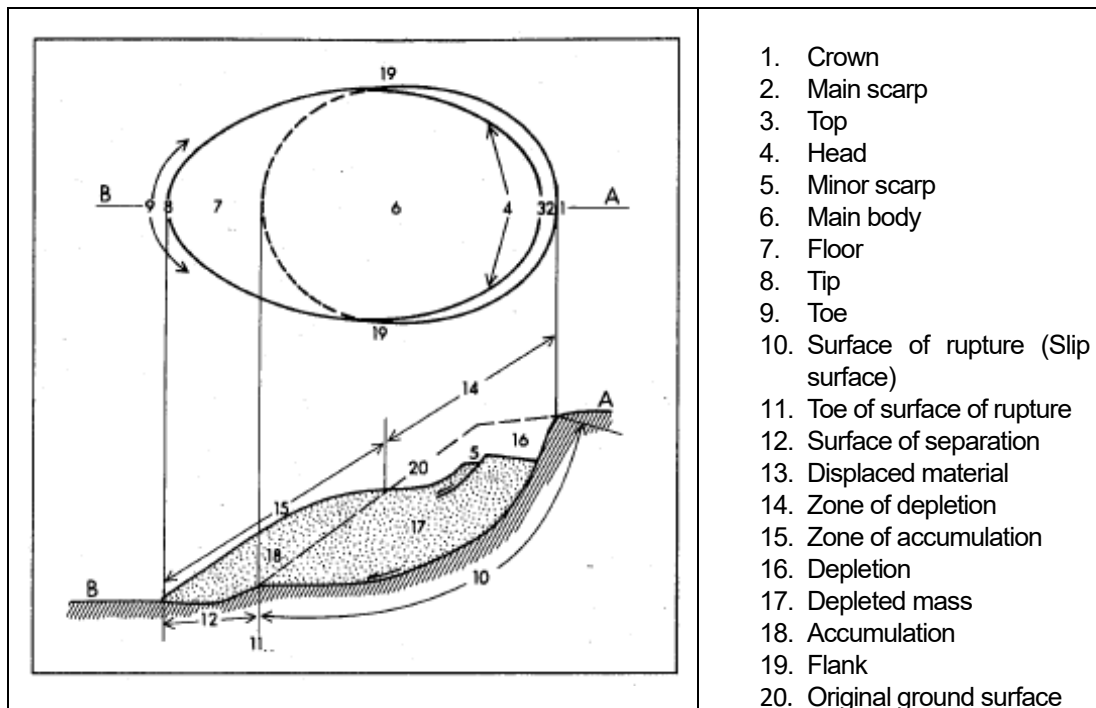


Figure 1.1 Landslide Dimensions ¹⁾

Survey to find the range of landslide

- Reconnaissance exploration

- Monitoring of observation points

Survey to find depth of the surface of rupture

- Examination of boring cores
- Monitoring of inclinometers

Object 2 Cause of Landslide (Groundwater Survey)

Causes of landslide around Tegucigalpa is following four (4) factors only.

Potential Factors make landslide activate (Cause of Landslide)

1. Rise of groundwater
2. Human activity
3. River erosion
4. Earthquake

The occurrence of landslides caused by factors 2, 3, and 4 is not often, and the cause can be easily determined by inspection. Most of the causes of landslides around Tegucigalpa are due to changes in the groundwater level. It is necessary to confirm the cause of groundwater rise, the amount of rise (range of fluctuation), and the time of rise. Rise of the groundwater is mostly due to rainfall, therefore, the groundwater survey should consist of groundwater and rainfall monitoring.

Object 3 Parameters for Stability Analysis

The parameters required for landslide stability analysis are the following three.

- Weight of mass (soil)
- Shear strength of surface of rupture (not the shear strength of the mass)
- Water pressure on the surface of rupture (nearly equal of elevation difference between groundwater level and surface of rupture)

The weight of mass can be obtained by laboratory soil tests on undisturbed sample from the landslide mass. Water pressure can be obtained by the groundwater monitoring.

The shear strength of surface of rupture must be obtained by back calculation of stability analysis, not by laboratory soil test.

Significance of Geophysical Survey in Small/Medium Size Landslide Investigation

If the landslide is relatively large (5 ha or more) and there is a clear difference in physical properties between the landslide mass and the bedrock, geophysical surveys such as seismic surveys could be useful. For

small/medium size landslides, geophysical survey is not required generally.

(2) Investigation and Monitoring for Stabilization Measures

Landslide investigations should be conducted in the following order. The order may be changed based on the site, surrounding conditions, urgency, etc.

- 1) Reconnaissance exploration : traditional walk-over survey to find landslide dimensions, cause of landslide, and to make plan of following detailed investigations. (Section I-1.2)
- 2) Topographic survey : the material that forms the basis of following investigations (Section I-1.2)
- 3) Section survey : necessary for stability analysis and planning of stabilization measure (Section I-1.2)
- 4) Observation points : to confirm the surface dimension of landslide (Section I-1.2)
- 5) Geotechnical boring : to confirm the geological profile, and to install water standpipe, inclinometer pipe etc. (Section I-1.3)
- 6) Groundwater monitoring : to find groundwater level and fluctuation (Section I-1.4)
- 7) Inclinometer monitoring : to find the surface of rupture (Section I-1.4)
- 8) Plan of stabilization measures (Chapter I-3)

(3) Emergency Measures (Initial Response)

When a new landslide occurs, the following three points should be examined first by reconnaissance exploration, interview with neighbors and old materials.

- a. Determination of landslide (find landslide or not, find stable or active)

It is common to misunderstand the imperfections of the foundations and structures of houses as landslides, or boundary of cut and fill on a road as landslides.

- b. Emergency Measures:

When the landslide is found active landslide, temporarily evacuate residents around the landslide or close a road until landslide stabilizes. Take measures that give priority to protecting the lives of residents.

- c. Permanent Measures

Measures against the landslide include various methods other than stabilization works, in some cases, relocation of residents is the best method. If construction of stabilization works is selected as a countermeasure, it will take time until the construction is completed. It may take a long time to complete the stabilization works. In the meantime, it is necessary to consider measures to protect the safety of residents.

1.1.2 Geomorphological, Geological Survey

For geomorphological, geological survey topographical surveys of small/medium size landslides,

reconnaissance exploration and topographical surveys (mapping and cross-section) should be performed.

(4) Reconnaissance Exploration

Reconnaissance exploration is conducted to formulate detailed investigation plan and an emergency plan. A general understanding of the landslide generation/movement mechanism and its effects should be made. The field reconnaissance is particularly focused on (a) estimating the landslide range and hazard area, (b) estimating cause of landslide.

a. Estimating the landslide range and hazard area by the reconnaissance exploration

First, look for deformations that appear on the ground surface, such as cracks, swells, and scarps. Then, look for deformations (destruction of walls/floors, inclination of pillars/walls, cracks, etc.) in structures such as houses on the landslides, and map their locations. Small/medium size landslides in Tegucigalpa are often located in residential areas, and it is often difficult to detect surface deformation. In that case, the distribution of sound structures without deformation could be effective information for narrowing down the range of landslides. It is effective to hear from the residents to obtain information on whether there are any anomalies in the houses and their surroundings. An example of the format used to interview with residents is shown on page I1-8.

In addition, most of the small/medium size landslides in Tegucigalpa are movement of soft material such as colluvium, debris, hardly weathered rocks. Assuming that landslides rarely occur in hard rocks, the distribution of outcrops of rocks can be judged as out of landslides. Clarification of the following points during a reconnaissance will assist in examine the extent, vulnerability, causes and stabilization works of the landslide.

- Geological properties and geological structure
- Estimating geological structure due to microtopography and large topography
- Estimating groundwater distribution
- Estimating movement patterns
- Prediction of future landslide movement
- Prediction of damage.

In some cases, the direction (x, y, z) and displacement at that point can be estimated from cracks on the ground. The direction and position of movement should be recorded (Figure I-1.2).



Figure 1.2 Measurement of Crack ^(JET)

By measuring the distance and displacement direction on both sides of the crack, the amount and direction of movement at that point can be determined^(JET)

Also, if a large-scale topographic map is available, use it as the base map for the reconnaissance. If not, use an air photo such as Google Earth. Then, after obtaining a large scale map, copy the information recorded on Google Earth onto a topographic map. When using a copy of Google earth on-site, printing the image lightly makes it easier to see the information written on-site.

b. Seek for Cause of Landslide

As mentioned in the previous section, the causes of landslides are only four. can be narrowed down to the following five points. The following points should be confirmed from the viewpoint of investigating the cause of landslides.

- i) Presence of human activity such as cut and fill or water discharge in the landslide
- ii) Existence of river erosion If the landslide is adjacent to a river
- iii) Occurrence of earthquake recently
- iv) Surface water has flowed into the landslide recently
- v) Heavy rain or long raining recently

If the above points cannot be confirmed, it is presumed that the rise of ground water is the cause of the landslide. The rise of groundwater can be confirmed with geotechnical boring and groundwater monitoring, or spring/seepage of water on ground surface.

c. Plan of detailed investigation

Topographic survey and cross sections

Observation points

Geotechnical boring including installation of inclinometer and piezometer

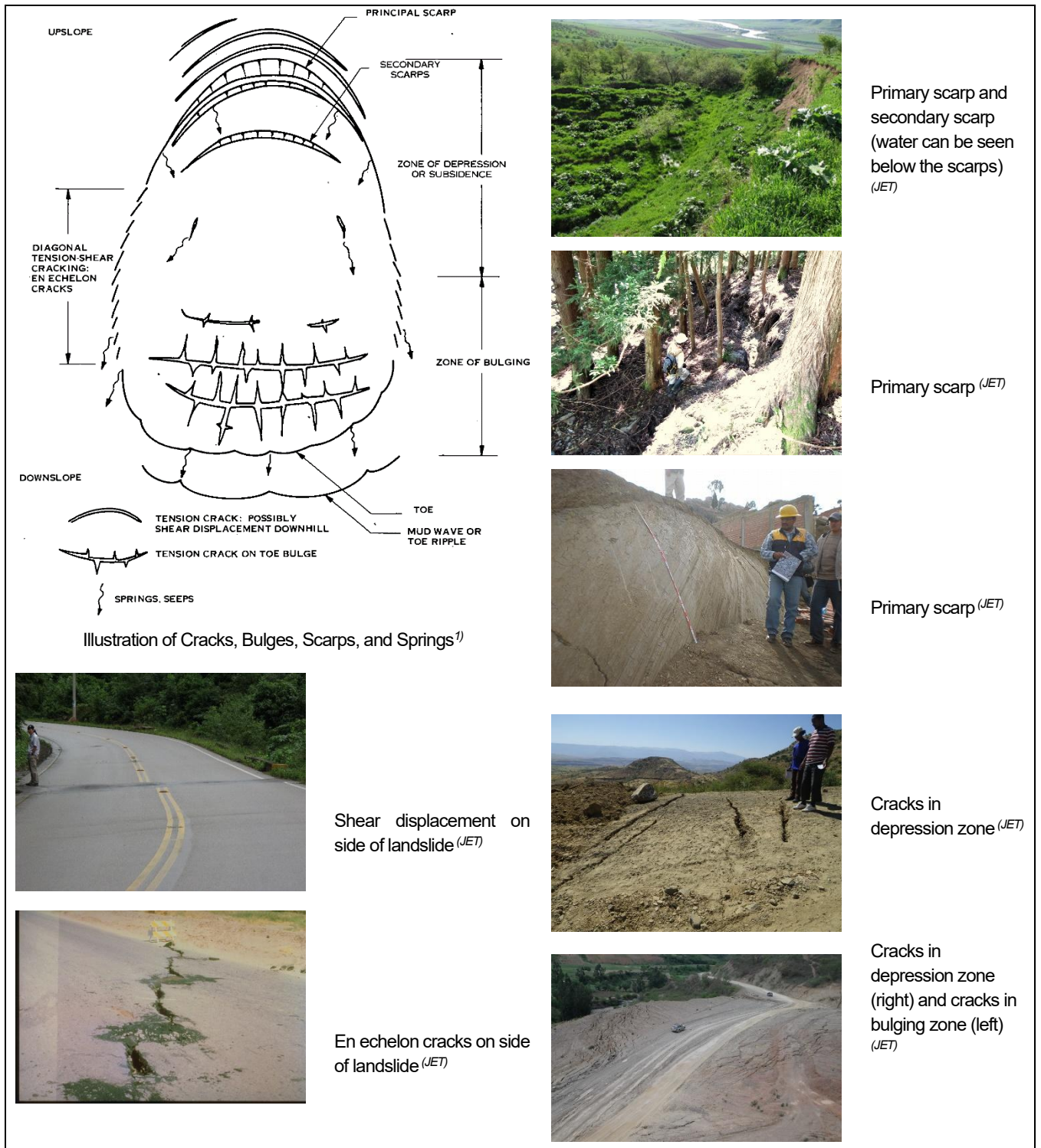


Figure 1.3 Cracks, Bulges, Scarps, and Springs around a Landslide

Example of Form of Interview Survey (JET)

Investigación – Deslizamiento El Edén
No. 3

CUESTIONARIO

Nombre: Francis Lopez

1 ¿Tiene alguna anomalía tales como grietas, deformaciones en / alrededor de su casa causadas por el deslizamiento de tierra?
 Sí, No, No sabe
This is a 50 years old house

En caso de que sí;

2 ¿Qué tipo de anomalías tiene en su casa? ¿Dónde se encuentran?
Floor damaged and cracks on the house.

3 ¿Cuándo comenzó a notar las anomalías?
2010

4 ¿Las anomalías se encuentran activas?
Yes

5 ¿Podemos observarlas?
Yes It seems that this damage was not caused by the landslide, but by the structure itself

Pregunta final;

6 ¿Ha escuchado o visto alguna otra anomalía causada por el deslizamiento de tierra en las casas vecinas?

Muchas gracias

Agencia de Cooperación Internacional del Japón (JICA)

(2) Topographic Survey

The topographic maps become the basic materials for future landslide mitigations, and were used consistently from survey plans to the mitigation plans. It should be noted that topographic maps created from aerial photographs often do not show accurate topography. In recent years, topographic maps have been created using LIDAR, and the microtopography can be easily read. For small/medium size landslides, the scale of the topographic map should be about 1/500 to 1/200. The surveyed area shall be twice the length and twice the width of the estimated landslide. If it is not possible to clarify the shape of the landslide during reconnaissance, expand the area further.

The items to be illustrated on the map are houses, roads, various structures, rivers/channels, landslides,

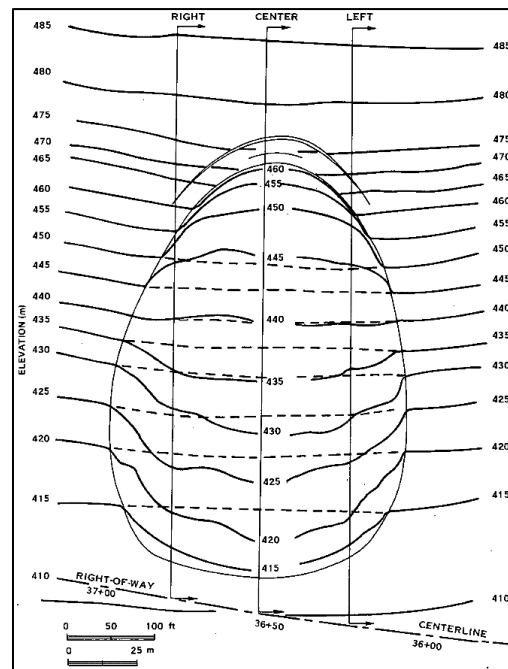
swamps, springs, wetlands, fissures, bluffs, and cultivated land. In particular, topographical information such as cracks, swells, and spring points will be useful information for landslide analysis, so instruct the surveyor to record them. In order to grasp the terrain around the target landslide and the condition of the upper slope, a wide-ranging topographic map should be prepared.

. In order to study the topography around the landslide and the condition of the upper slope, create a wide-ranging topographic map that includes old landslide in the surrounding area.

(3) Cross Section Survey

A cross section survey is an important source of landslide analysis. The section line is the basic line for determining the locations of geotechnical / geophysical explorations, groundwater exploration. The main section line can confirm the geology, geological structure, groundwater distribution, surface deformation, surface of rupture (slip surface), etc. of the landslide movement block in detail, and is set at a position and direction suitable for basic planning and basic design of measures. The main section line should be set where the surface of rupture of the landslide can be confirmed concretely, and the position and direction of the main section line shall be suitable for the basic plan and basic design of mitigations.

In reconnaissance exploration, the landslide shape and movement direction of the landslide may not be clarified. In that case, set several survey lines that are assumed to be surveyed.



Three lines are drawn, but in the case of small/medium size landslides, the center line is fine.

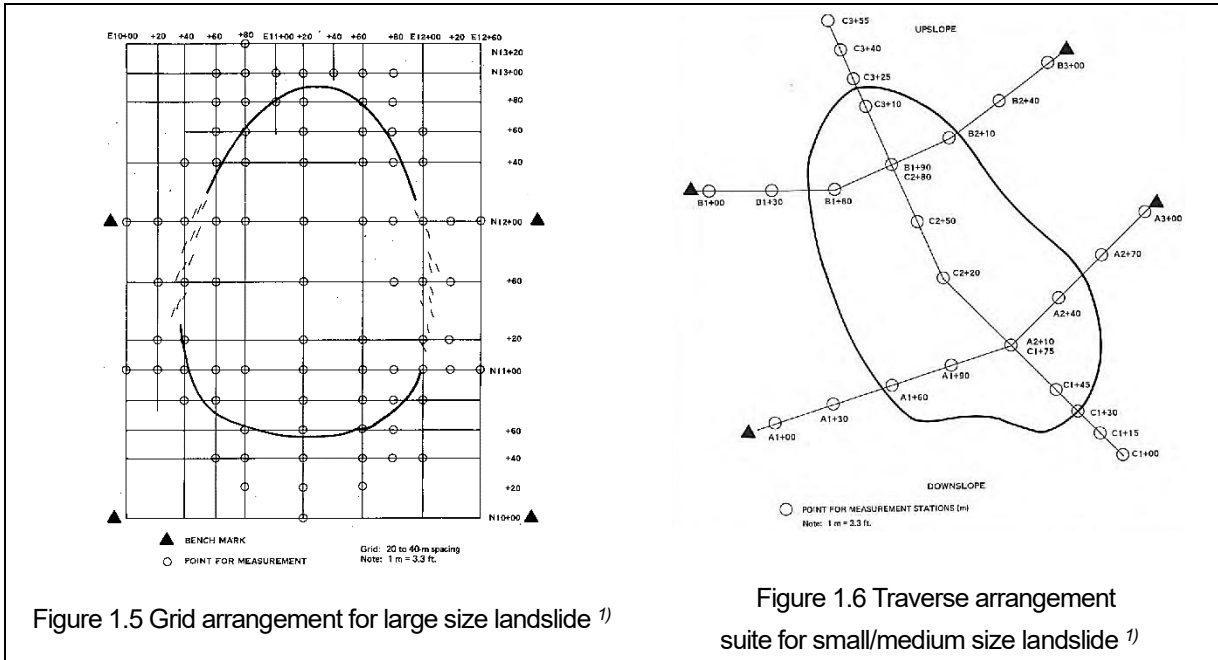
Figure 1.4 Cross Section Lines for Landslide ¹⁾

(4) Observation points

Observation points are to confirm the surface dimension of landslide.

a. Installation of points

Grid arrangement is better for large size landslide as shown in Figure 1.5. Observation traverses as shown in Figure 1.6 is suitable for the small/medium size landslide.



b. Method of observation

The continuing movement of a landslide can be measured by a system of grids or traverses across the landslide area. Typically, a series of lines more or less perpendicular to the axis of the landslide, and stakes at intervals of 15 to 30 m on the lines should be set and referenced to the control bench marks that set out of landslide area. Grids should be laid out so that the reference points are aligned with trajectories of maximum slope or apparent continuing movement.

In addition, where soil and rock weaknesses cause secondary movements that are skewed to the major landslide, intermediate points should be established. For small landslides or widely spaced areas of suspected movements, single traverse lines of reference often are used (Figure 1.7).

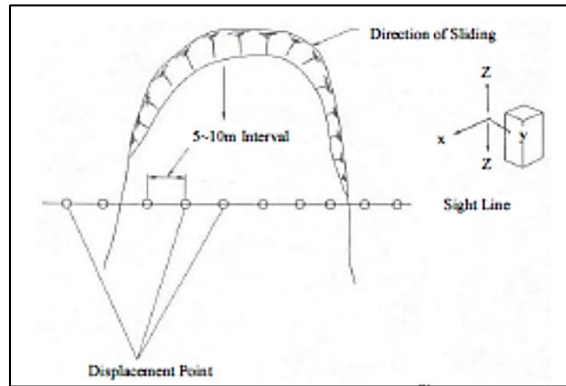


Figure 1.7 Single Traverse Line ²⁾

Line-of-sight monuments can be established with end monuments on stable ground and intermediate points on the moving mass in areas where vegetation does not obscure visibility. The monuments are established in a line and smooth or polished metal plates are fixed on top of the intermediate points. A line perpendicular to the line of sight is scribed onto each plate. A transit is located on or over one of the stable monuments and the other stable monument is used to set the horizontal angle of the instrument. Each of the intermediate points is sighted, and a line is scribed on its plate. Movement from one measurement to the next is simply measured at each plate with the aid of a machinist's rule. Appropriate location flags or markers should be placed nearby so that the staked points can be found despite severe movement. The elevation and coordinates of each point should be determined on the traverse or reference grids by periodic surveys. In areas where highly irregular topography suggests rapid differences in movement from one point to another, reference points should be spaced more closely regardless of any predetermined grid pattern. Such closely spaced stakes help to define the lateral limits of the landslide as well as the direction of movement of localized tongues within the landslide.

c. Perion and Frequency

This is particularly important in the later stages of movement because secondary movements often develop as a result of weakening of the displacing materials. Depending on the rate of movement, these grid points should be checked at intervals ranging from a few days to several months. In addition, they should be observed after periods of unusual environmental conditions, such as snowmelt, high rainfall, or marked temperature changes. In this way any relation between landslide movement and climatic changes can be established.

d. Results

Survey grid points and other critical points are plotted on the more detailed topographic map of the landslide area. Both the topography and the depicted grid points should be referenced to the same geographic reference system, whether it is an arbitrary reference convenient for the landslide site or true geographic position on the

Earth's surface. From the consecutive readings on the survey grids and traverses, the horizontal and vertical displacements of the ground surface can be determined. If the movements are large, the subsequent positions of the reference points can be plotted on the topographic map. However, if the movements are small, the successive positions of the monuments may be plotted separately to a larger scale depicting vectors of movement. The vector map may show reference- point locations and displacement vectors on a map with the landslide outline (Figures 1.8 and 1.9), or a topographic base map may be used if the information can be shown clearly. Although the initial positions of the points are shown in their proper scale relations, the displacement vectors may be plotted to a larger scale; this difference in scale should be noted. Elevations at successive dates can be entered beside the grid points.

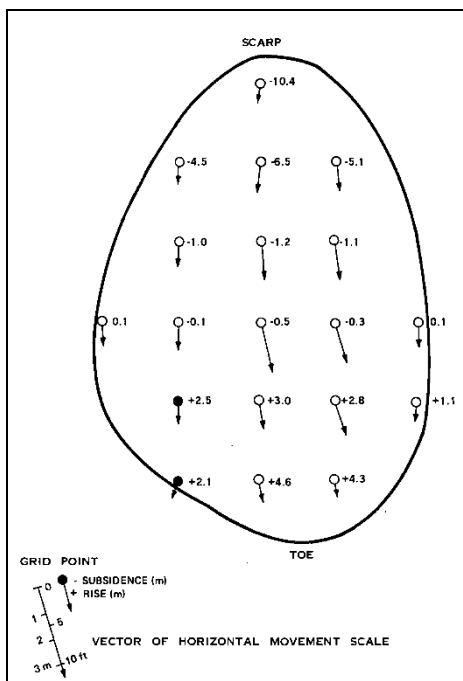


Figure 1.8 Movement Vectors Showing Displacements of Observation Points ¹⁾



Figure 1.9 Illustration of Observation Points Monitoring Results (Movement Vectors) on Jose Angel Ulloa ²⁾

1.1.3 Geotechnical Survey and Geophysical Exploration

Geotechnical boring is conducted to clarify the surface of rupture, geology, and geological structure of a landslide by collecting samples directly from the subsurface. After the boring works are completed, the following surveys may be conducted using the borehole.

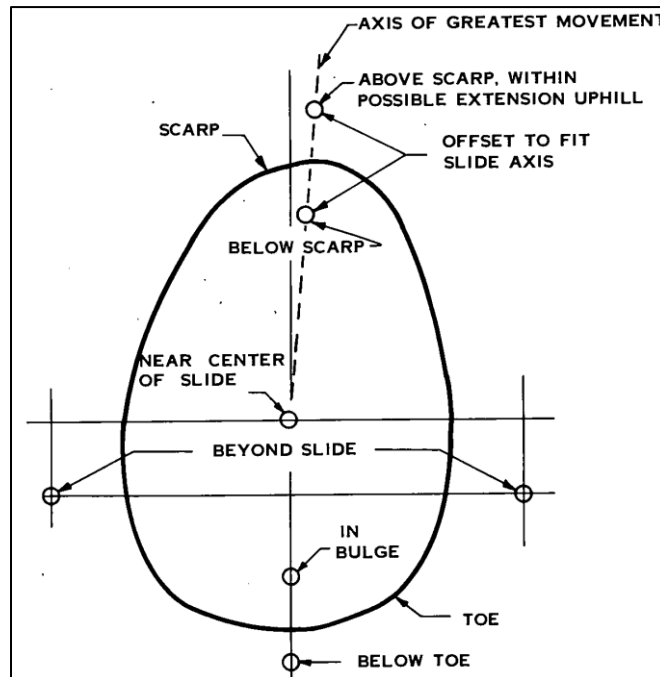
- a. Surface of rupture: inclinometer
- b. Groundwater: water standpipe, piezometer

(1) Geotechnical Boring

a. Disposition of borings

The preliminary layout, spacing, and depth of borings will depend on the prior site information. As a minimum, there should be borings near the top, middle, and bottom of a potential landslide, with as many profiles of borings as appear to be required to define the subsurface conditions. A profile of borings be developed along the centerline of the landslide and that the first boring be placed between the midpoint and the scarp or head of the landslide.

For a large size landslide, the area outside the landslide perimeter should also be explored to provide comparative data on the stable and unstable portions of the slope. Such information may also be needed to provide data on possible further expansion of the landslide or possible design of countermeasures.



When the area (scarp, toe, sides) of small/medium size landslide is clear, the borings can be omitted.

Figure 1.10 Location of Boring in Landslide ¹⁾

The length of one boring shall be long enough to confirm the bedrock. It is recommended to drill at least on boring to deep depth., as big rock fragments in the landslide body may be misidentified as the bedrock. If the depth of the surface of rupture cannot be estimated, it can be assumed that the length of boring is about 1/3 of the width of the landslide body, and adjust the length by referring to the boring results.

b. Report

Observation on boring cores, the items necessary for examining geology, soil characteristics, and surface of rupture are specified in the boring log. The main points of the boring log are;

- geological and soil observations,
- conditions at the time of drilling,
- water level during and at the end of drilling, and
- core recovery.

And the main points of the rock coring log are;

- weathering
- angles and rate of cracks
- angles of strata, laminae or schistosity

Observation of geology, soil and surface of rupture shall be conducted by experienced geologist or geotechnical engineer. Take a picture of the boring core and keep it as a record.

c. Geophysical Exploration

Surface-based geophysical exploration often provides the quickest and most economical means of obtaining general information on subsurface conditions over relatively large and rugged areas. These methods supply indirect information concerning landslide because they involve the investigation and mapping of the distribution of physical properties of earth materials, such as the speed of transmission of elastic waves or the ability to transmit electrical currents, which are not directly related to landslide processes. These geophysical techniques do not replace test borings, samples, test pits, or trenches. Rather, they supplement these more expensive subsurface exploratory methods, assist in correlation of information among widely spaced exploration locations of large size landslide, and greatly reduce the time, cost, and environmental problems associated with large-scale drilling programs. Therefore, generally for large size landslide, geophysical explorations are required.

Table 1.1 summarizes the characteristics of the most commonly used surface-based geophysical exploration methods, including

- Electrical and electromagnetic surveys,

- Seismic surveys,
- Microgravity surveys, and
- Ground-penetrating radar surveys.

Table 1.1 Surface-based Geophysical exploration¹⁾

TYPE OF SURVEY	APPLICATIONS	LIMITATIONS
Electrical and electromagnetic Electrical resistivity	Locates boundaries between clean granular and clay strata, groundwater table, and soil-rock interface	Difficult to interpret and subject to correctness of the hypothesized subsurface conditions; does not provide engineering strength properties
Electromagnetic conductivity profiling	Locates boundaries between clean granular and clay strata; groundwater table, and rock-mass, quality; offers even more rapid reconnaissance than electrical resistivity	Difficult to interpret and subject to correctness of hypothesized subsurface conditions; does not provide engineering strength properties
Seismic Seismic refraction profiling	Determines depths to strata and their characteristic seismic velocities	May be unreliable unless strata are thicker than a minimum thickness, velocities increase with depth, and boundaries are regular. Information is indirect and represents average values
Direct seismic (uphole, downhole, and crosshole surveys)	Obtains velocities for particular strata, their dynamic properties, and rock-mass quality	Data are indirect and represent averages; may be affected by mass characteristics
Microgravity	Extremely precise; locates small volumes of low-density materials utilizing very sensitive instruments	Use of expensive and sensitive instruments in rugged terrain typical of many landslides may be impractical; requires precise leveling and elevation data; results must be corrected for local topographic features; requires detailed information on topography and material variations; not recommended for most landslide investigations
Ground-penetrating radar	Provides a subsurface profile; locates buried objects (such as utility lines), boulders, and soil-bedrock interface	Has limited penetration in clay materials

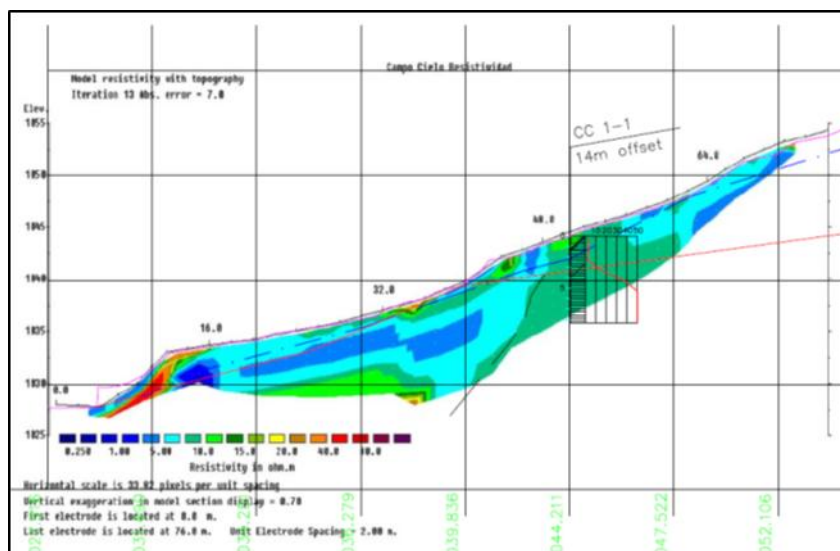


Figure 1.11 Result of Resistivity Survey at Campo Cielo (JET)

It is very difficult to find geological structures, geotechnical properties, and even the groundwater table without boring results

1.1.4 Instrumentation and Monitoring

The purpose of monitoring is to measure the activity of landslides and changes in groundwater, and to know the exact size of landslides and the cause of landslides from the results. For small/medium size landslide, the following two instrumentations are common.

Inclinometer

Groundwater Monitoring

(1) Inclinometer

a. Instrumentation

The inclinometer is an instrument that measures the normal displacement of the tube axis through which it is passed. The instrument is equipped with a sensor that measures the deviation of its axis from the vertical axis. It is used to determine the magnitude, rate, direction, depth, and type of landslide movement. This information is usually vitally important for understanding the cause, behavior, and remediation of a landslide.

The measuring equipment consists of two parts: (1) the inclinometer casing and (2) the inclinometer measuring system.

To carry out inclinometer measurements, a plastic tube (the inclinometer casing) is installed in a borehole (for ground measurements) or a void former (for measurements inside a concrete structure), and the annulus between the ground or the concrete structure and the plastic tube is filled with a cement-bentonite grout.

The inclinometer plastic tube (inclinometer casing) has four horizontal grooves along the inside, which are used as guides for the probe of inclinometer when measuring the inclinometer casing declination.

The tube in the borehole or armature should be orientated in such a way that one pair of guides is facing in the approximate direction of the expected shifts by landslide movement.

An inclinometer probe is equipped with orthogonal sensors that measure the angle that the body of the probe makes with the vertical (for vertical and inclined casings) or horizontal axis (for horizontal casings). Inclinometer probes also have sprung wheels to hold them in the center of the inclinometer casing as the survey is taking place.

In the case of installed inclinometers, the probes are equipped with sensors and inclinometers positioned at depths where the slide is expected to occur.

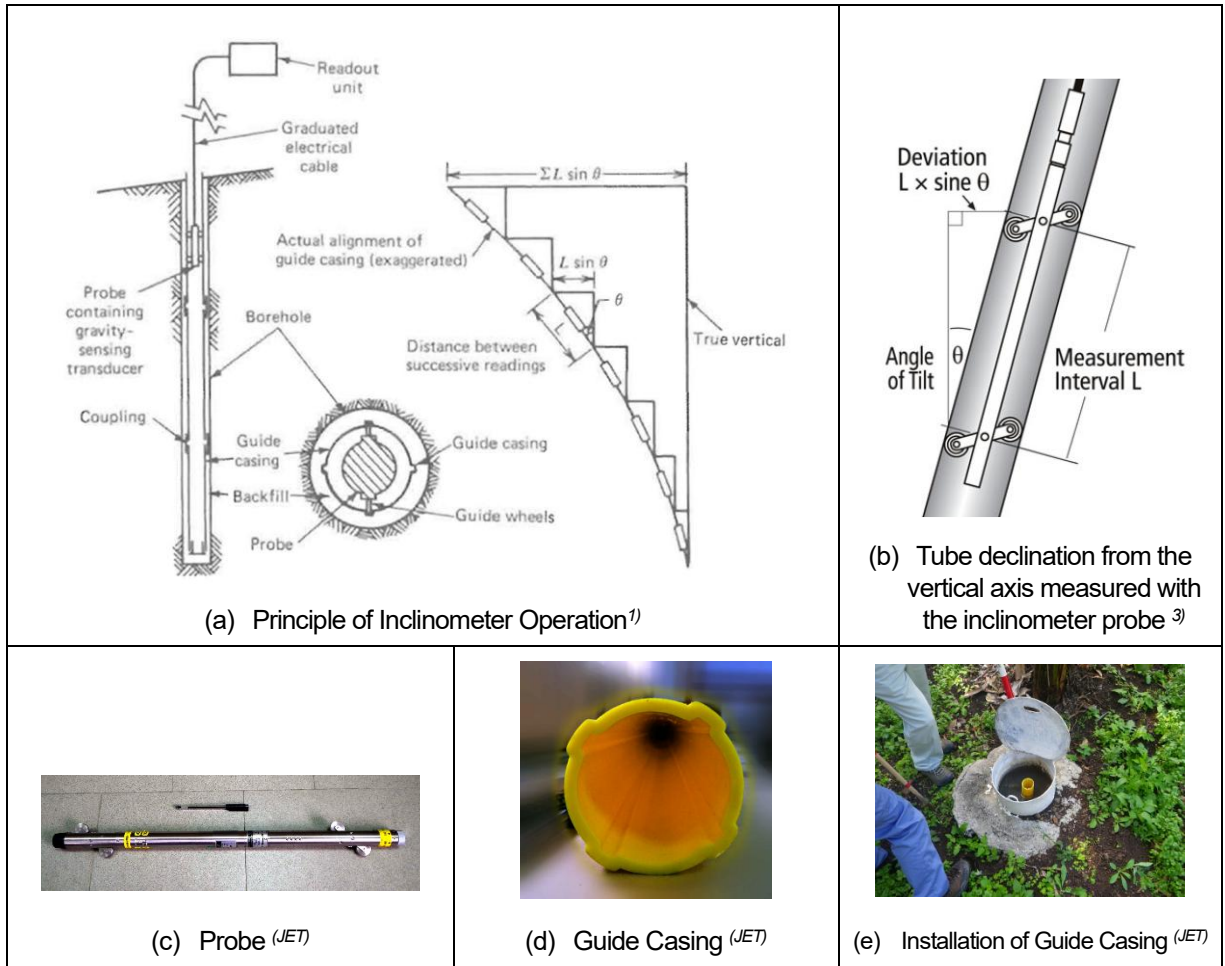


Figure 1.12 Incliner Instruments

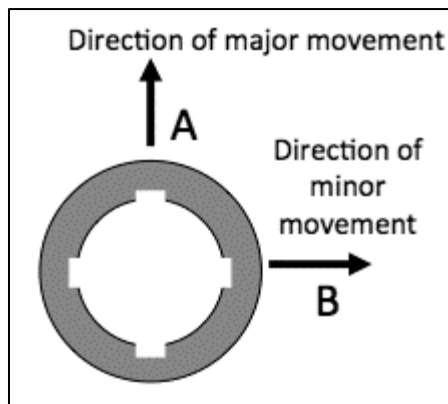


Figure 1.13 Direction of Grooves of Guide Casing⁵⁾

b. Monitoring

The inclination sensors are installed in the probes. The initial measurement is performed approximately 5-10 days after inclinometer tube installation into the ground or after the injection mixture has sufficiently hardened.

The measuring probe is lowered and it measures the inclination between two measuring points at given intervals. The measurement begins by pulling the probe from the bottom of the tube up until the first measuring mark on the cable comes into the brake. When the logger shows a stable measurement value, the operator activates the trigger for the registration (note). The probe is then retracted to the next tag, and this described procedure is repeated up to the top of the tube or the cable tag marked as the last one. By comparing the measured tube slope with previous measurements, the inclination and the displacement are determined.

During the observation, the position of the sliding surface is determined, the shifts between the measurements are examined in contrast and the deformations are observed.

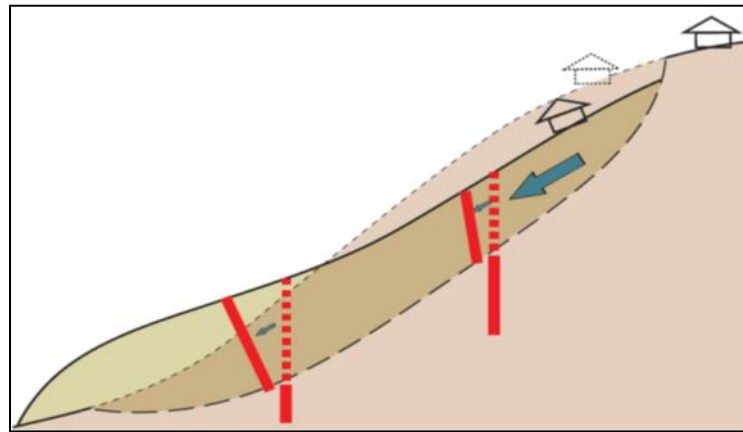


Figure 1.14 Schematic Image of Inclinometer Motoring Results ^{JET}

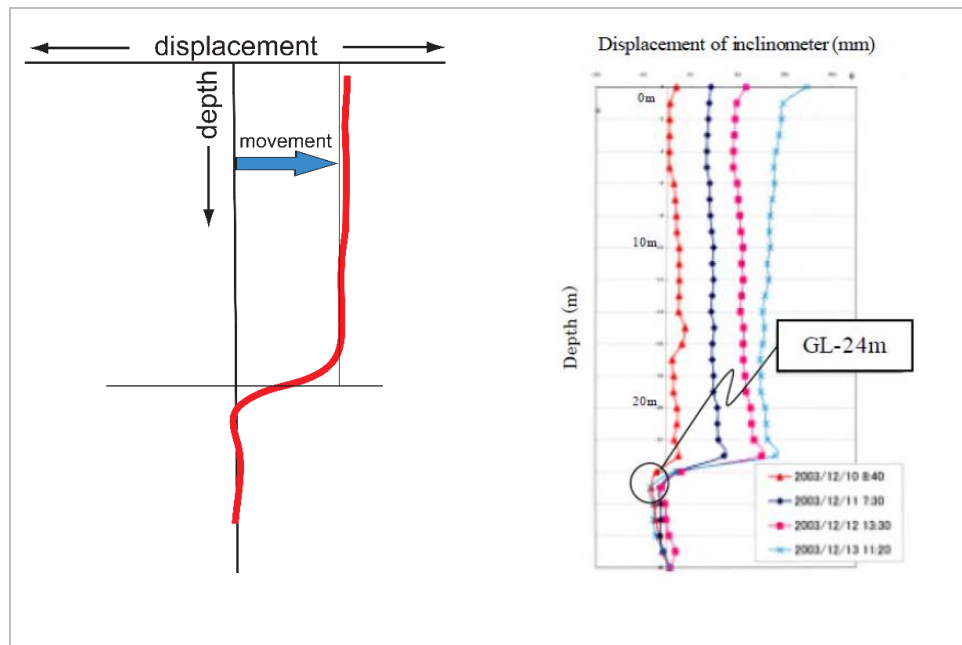


Figure 1.15 Example of inclinometer results ^{JET}

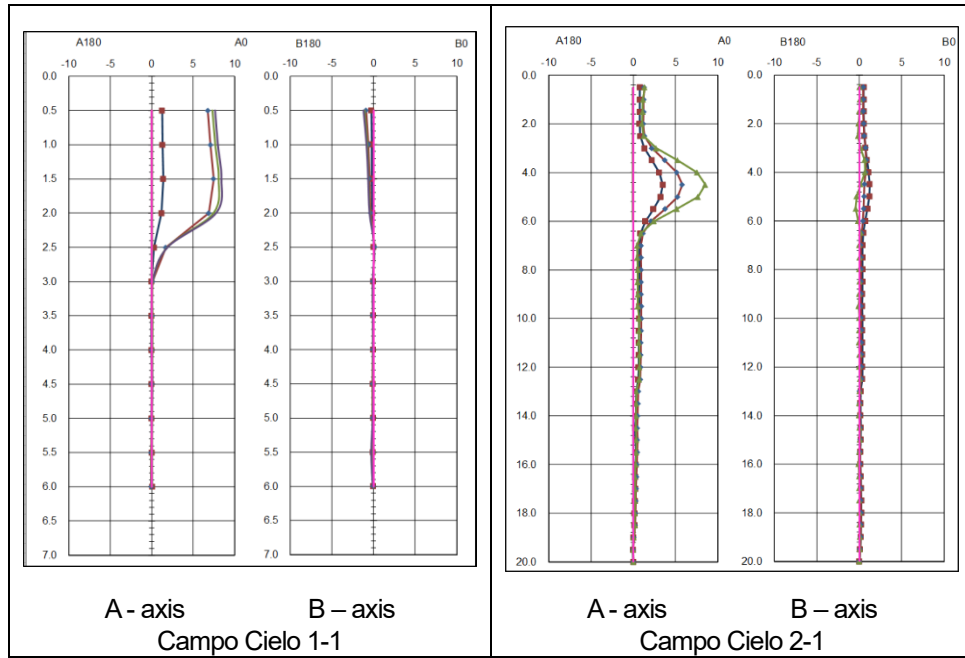


Figure 1.16 Illustration of Incliner Results Installed Correct Direction ^{JET}

In Figure 1.16, the Campo Cielo 2-1 graph shows a partially bulging shape. This is the shape often seen in inclinometers installed near the landslide head. As shown in Figure 1.17, this occurs because the slip surface has steep angle and the vertical displacement is large.

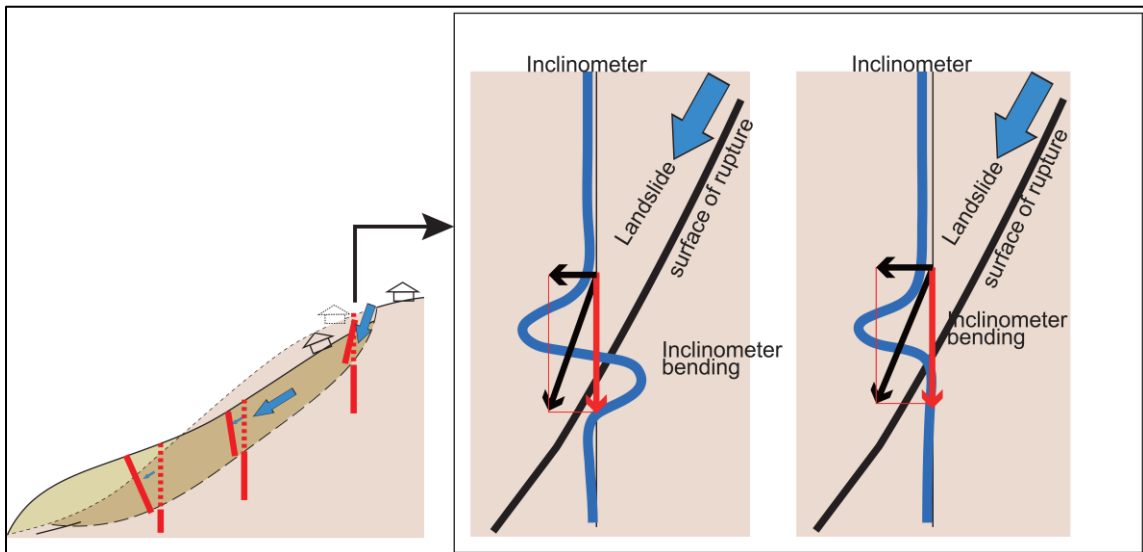


Figure 1.17 Bending of Incliner Installed at the Top of Landslide ^{JET}

c. Types of inclinometer and the measuring procedure

There are three types of borehole inclinometers:

- (a) Chain type inclinometer for continuous shift displacement (Automatic measurement)
- (b) Continuous inclinometer for continuous monitoring (Manual measurement)
- (c) Inclinometer incorporating a smaller number of inclinometer probes “chain type” in the slide area (Automatic measurement)

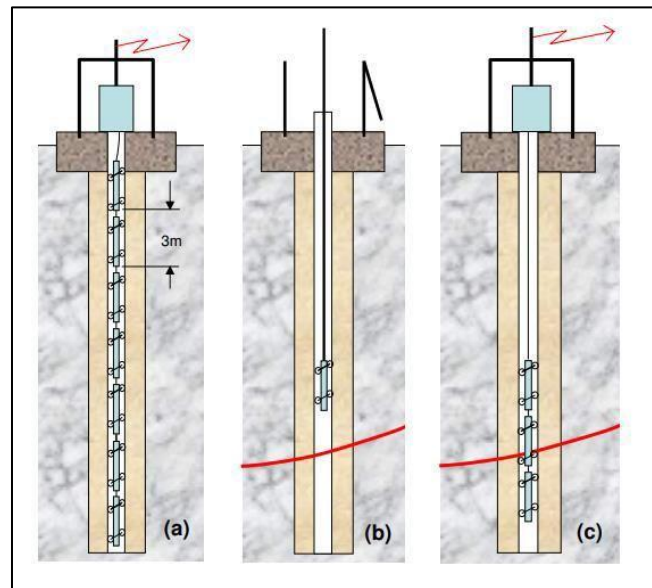


Figure 1.18 Types of borehole inclinometers ⁵⁾

The procedure of the measuring of inclinometer is as follows.

- (1) The start of the measurement (initial value measurement) should be made at least 7 to 10 days after installation of the casing when the grout has hardened.
- (2) Align the mark of the probe with the guide groove of the casing on the mountain side, lower the probe to the bottom of the casing, connect cable of probe to the data logger, turn it on, and leave the probe at the bottom position for at least 15 to 30 minutes. It is to avoid the temperature drift of the measured value due to the temperature change of the probe during the measurement because of the temperature difference between the ground surface and in the borehole.
- (3) When a probe equipped with a sensor in two directions is used, measurement the direction of landslide moving and the transverse direction are carried out at the same time.
- (4) Pull up the probe by 0.5m, align it with the depth mark, and measure the value at the depth.
- (5) Repeat (4) and measure the value at the depth to the ground surface.

- (6) Change probe direction 180° and insert into bottom of borehole. When the display of the logger become constant, start to measure.
- (7) To accurately determine the direction of landslide movement, change the direction of the probe by 90° and repeat steps (2) to (6). In this case, even if the probe is equipped with sensors in two directions, it is sufficient to measure only the main direction.

(2) Groundwater Monitoring

Groundwater levels and pore pressures in a landslide can be measured by a variety of commercially available piezometers.

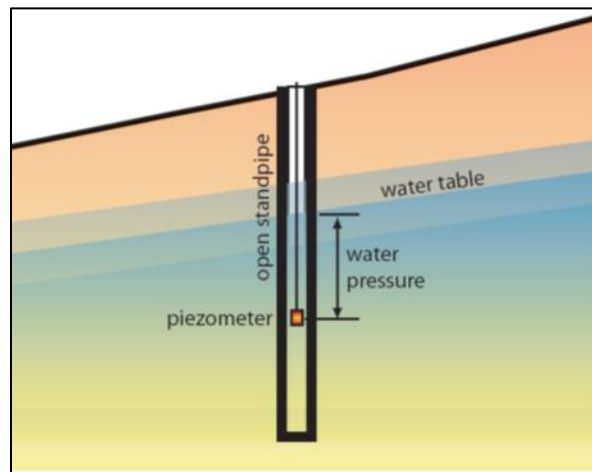


Figure 1.19 Schematic Image of Piezometer Installation (JET)

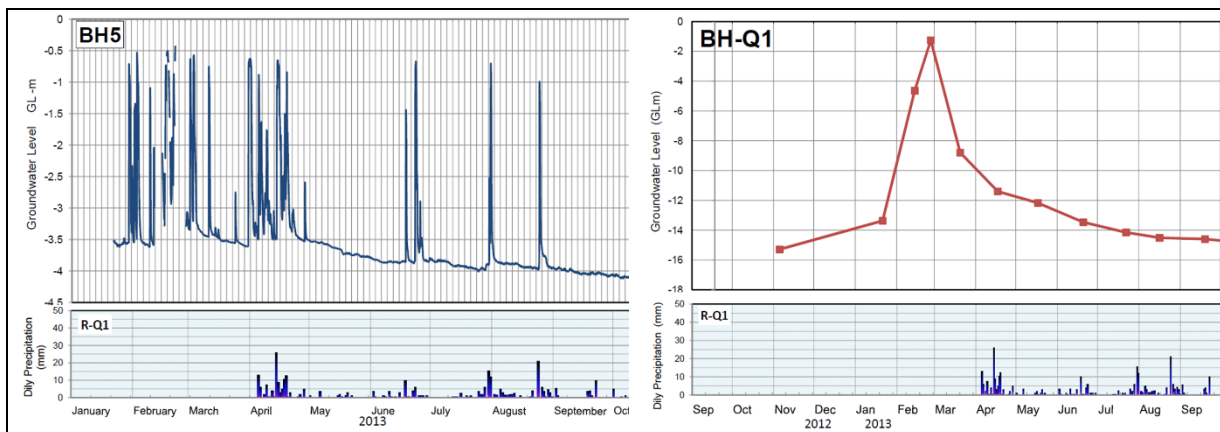


Figure 1.20 Groundwater Monitoring by Pressure Sensor Piezometer (left) and Manual Monitoring (right) (JET)

Three standard types of instrumentation are used to monitor change in the groundwater in a landslide:

- Observation Well
- Open Standpipe Piezometer

- Pressure Sensor Piezometer

a. Observation Well

Observation well is suited to measure depth to the watertable in areas with unconfined aquifers. An observation well is slotted from the bottom of the bore to above the watertable and is not sealed above the slotted section except for a collar at the surface to prevent water flowing into the borehole (Figure 1-21 (a)).

b. Casagrande Borehole Piezometer (Open Standpipe Piezometers)

Piezometers (Figure 1.21 (b)) measure the pressure (sometimes referred to as hydraulic head or piezometric head) of the groundwater over a specific portion of a confined or semi-confined aquifer. An observation well only measures depth to the watertable. Piezometers are slotted over only a short section below the watertable, within the aquifer. The borehole is sealed directly above the slotted section, usually with bentonite clay and this arrangement allows measurement of groundwater pressure at the slotted interval. Assess vertical groundwater gradients and flow directions using multiple piezometers at and across a site.

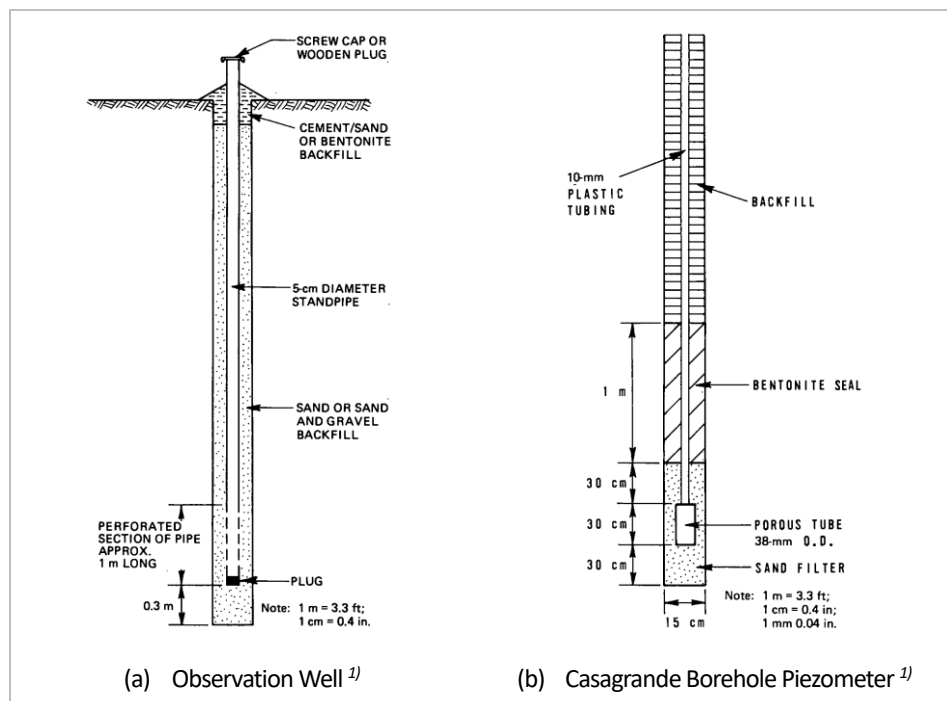


Figure 1.21 Illustration of Most Popular Open Standpipe Piezometer

c. Pressure Sensor Piezometers

Piezometers in durable casings can be buried or pushed into the ground to measure the groundwater pressure at the point of installation. The pressure gauges (transducer) can be vibrating-wire, pneumatic, or strain-gauge in operation, converting pressure into an electrical signal. These piezometers are cabled to the surface where

they can be read by data loggers or portable readout units, allowing faster or more frequent reading than is possible with open standpipe piezometers.

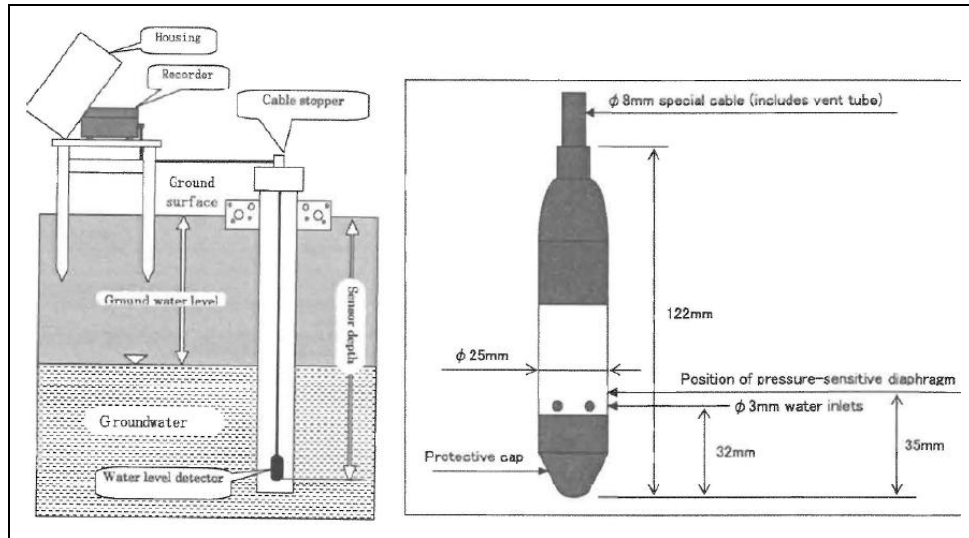


Figure 1.22 Illustration of Structure of pneumatic piezometer (JET)

Importance of Piezometer Sealing

Piezometers in landslides are commonly installed in boreholes advanced into soil or rock. The depth of the monitoring location for each piezometer is selected on the basis of the boring log and identification of materials encountered in the borehole, the estimated position of the water table, and the estimated location of the surface of rupture.

The simplest open standpipe piezometer is constructed by placing a tube within the borehole that extends to the ground surface. The monitoring portion of the piezometer installation should be pervious to allow observation of the groundwater pressure. This monitoring section may be constructed of a porous material, or the appropriate portion of the tube can be slotted or constructed from a material with a sufficiently fine screen so that free access of groundwater is permitted but movement of soil into the piezometer is prevented. The piezometer tube assembly is centered in the borehole, and a known volume of clean sand is placed around the piezometer monitoring section to create a sand filter between the soil and the piezometer sensor. Construction of an impervious barrier above the piezometer tip and sand pocket is essential. Casagrande, pneumatic, and electric sensors placed within open standpipe piezometer assemblies in boreholes can be sealed in a similar manner.

1.2 Analysis

Main objects of landslide investigation are;

- Object 1: Dimension of landslide (size, shape of surface of rupture)
- Object 2: Cause of landslide
- Object 3: Parameters for stability analysis

The analysis of the results of landslide investigation should aim to the main objects of landslide investigation.

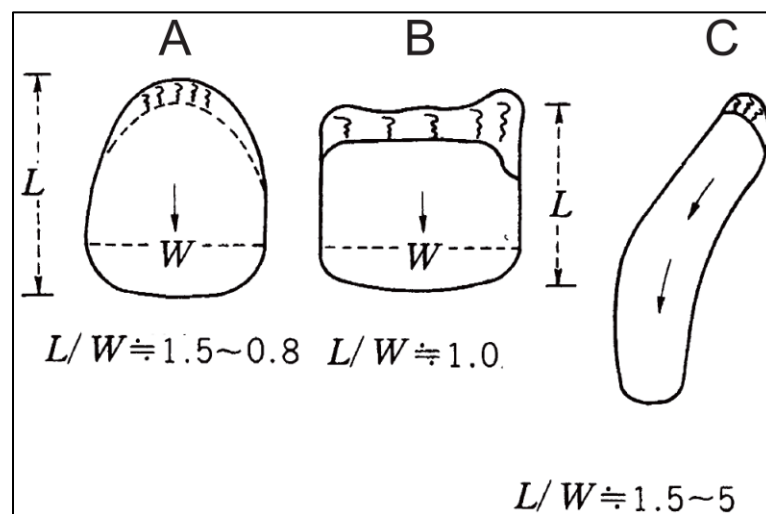
1.2.1 Dimension of Landslide

a. Area of Landslide

The area studied must be considerably larger than that comprising the suspected activity or known movement for three reasons:

- The landslide or potential landslide must be referenced to the stable area surrounding it,
- Most landslides enlarge with passage of time, and
- Many landslides are much larger than first suspected from the overt indications of activity.

As a rule of thumb, the area to be studied should be two to three times wider and longer than the area suspected. In some mountainous areas, it is necessary to investigate to the top of the slope or to some major change in lithology or slope angle. The lateral area must encompass sources of groundwater and geologic structures that affect the landslide stability. According to Ueno ⁶⁾, the rate of length of landslide (L) and width of landslide (W) is as shown in Figure 1.23.



A: Spoon Shape Landslide, B: Square Shape Landslide, C: Glacier Shape Landslide

Figure 1.23 Rete of Length and Width in Landslide ⁶⁾

As average value of L/W is $L/W = 1.24$, width of a landslide is slightly longer than length of the landslide.

b. Depth of Investigation

The depth of the surface of rupture of the landslide can be found by the inclinometer monitoring. However, the result of the inclinometer monitoring would take a while.

Longitudinal cross sections drawn along the landslide centerline may also be helpful in defining the surface of rupture. Circular or elliptical failure surfaces connecting possible toe bulges and uphill scarps can be sketched onto these cross sections, these surfaces may suggest possible maximum depths for movement. Continuous thick, hard strata within the slope may limit depths of movement.

According to Ueno (6), the rate of the depth of surface of rupture of the landslide and the width of the landslide and the length of the landslide are the following.

$$\text{Width of landslide (W) / Depth of surface of rupture (D) = 2.8 – 19.2 (average 7.4)}$$

$$\text{Length of landslide (L) / Depth of surface of rupture (D) = 3.0 – 10.7 (average 6.1)}$$

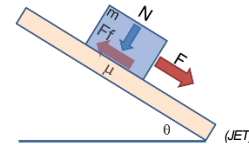
1.2.2 Cause of Landslide

a. Rise of groundwater

It seems to be the most common cause of landslides around Tegucigalpa. In other words, many of the landslides around Tegucigalpa are activated by rising groundwater. There are various causes of groundwater rise. Investigating the cause of groundwater fluctuation is one of the important purposes of surface reconnaissance.

Why does rising groundwater destabilize landslides?

The shear strength of rupture of the surface is the sum of the frictional force and the cohesive force. The frictional force is the product of the weight of an mass and the coefficient of friction. The heavier the mass, the greater the frictional force. In case that an mass becomes lighter due to buoyancy, the frictional force becomes smaller. As the groundwater rises, the landslide mass becomes lighter, so the frictional force becomes smaller and the landslide becomes more unstable. When the shear strength of the surface of rupture is only the cohesion (the friction is zero), the groundwater variations do not affect landslide stability (however, since weight of the landslide mass become heavier with weight of the groundwater, landslide stability could be changed a little).



$$F_f = \mu N = \mu mg \cos\theta$$

F_f : frictional force

μ : coefficient of friction

N : vertical force by mass ($mg \cos\theta$)

θ : slope angle

with buoyancy

$$F_{fb} = \mu (N - B) = \mu (mg - B) \cos\theta$$

B : buoyancy

hence $F_f > F_{fb}$

b. Human activity

By altering the topography and groundwater conditions, the balance between driving force and resisting force is disrupted, and landslides become more active. There are three main human activities that upset the balance of landslides;

- Cut at toe of slopes
- Embankment or overburden weight on head of landslides
- Discharge water into landslides

The landslide at “Residencial Ciudad del Angel” may be an example of landslide disaster caused by human activities.

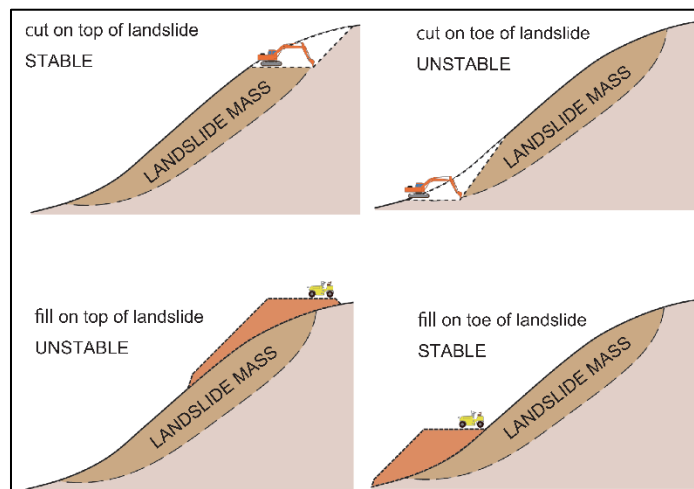


Figure 1.24 Schematic Image of Civil Works that Affects Landslide Stability ^(JET)

c. River erosion

A landslide occurs when the edge of a landslide is eroded by a river. Around Tegucigalpa, along the Rio Grande O Choluteca in the northern mountainous area may be subject to river erosion. The erosions can be found by reconnaissance exploration.

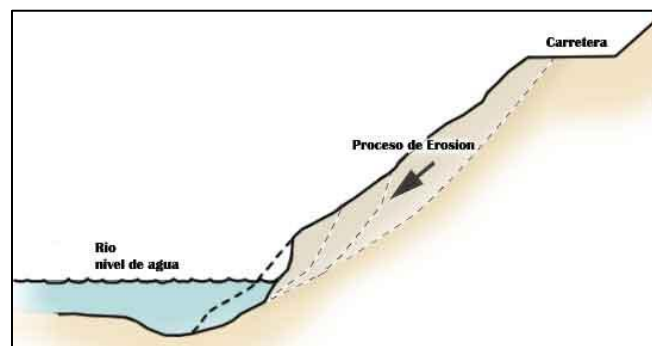


Figure 1.25 Schematic Image of River Erosion Inducing Landslide Instability ^(JET)

d. Earthquake

There have been confirmed cases of landslides triggered by seismic motion in Japan. Honduras is an earthquake-prone region, and the possibility of earthquake-induced landslides cannot be ruled out. The causes of earthquake-induced landslides can be easily identified.



Figure 1.26 Landslide Caused by Landslide *(Japanese Geotechnical Society)*

The occurrence of landslides caused by factors b, c, and d mentioned above is not often, and the cause can be easily determined by inspection. Most of the causes of landslides around Tegucigalpa are due to changes in the groundwater. It is necessary to confirm the cause of groundwater rise, the amount of rise (range of fluctuation), and the time of rise. Rise of the groundwater is mostly due to rainfall, therefore, the groundwater survey should consist of groundwater and rainfall monitoring.

1.2.3 Parameters for Stability Analysis

The parameters required for landslide stability analysis are the following three.

- Weight of mass (landslide body)
- Shear strength of surface of rupture (not the shear strength of the mass)
- Water pressure on the surface of rupture (nearly equal of elevation difference between groundwater level and surface of rupture)

(1) Weight of Mass (Landslide Body)

The weight of mass can be obtained by laboratory soil tests on undisturbed sample from the landslide mass. Water pressure can be obtained by the groundwater monitoring.

The weight of mass can be estimate by the values shown in Table 2.1. An average value of around 17.3 kN/m³ (17 – 18 kN/m³) in the Table 2.1 can be heterogeneous soil masses.

Table 1.2 Unit Weight of Wet Granular Soil *(JET based on British Standard)*

Soil Type	Unit Weight (kN/m ³)
Gravel	16.0
Well graded sand and gravel	19.0
Coarse or medium sand	16.5
Well graded sand	18.0
Fine or silty sand	17.0
average	17.3

(2) Shear Strength of the Surface of Rupture

The shear strength of surface of rupture must be obtained by back calculation of stability analysis, not by laboratory soil test.

Difficulty in obtaining the shear strength of surface of ruptures by soil laboratory test

- 1 The shear strength of the surface of rupture and the shear strength of the mass is completely different.
- 2 The surface of rupture is very uneven and the shear strength of the surface of rupture varies from place to place (Only a single rock caught in a surface of rupture could have a large impact on the shear strength of the surface of rupture).
- 3 The surface of rupture is deep and sometimes very thin, making it difficult to collect undisturbed samples of the surface of rupture.
- 4 The exact position of the surface of rupture cannot be found until obtaining the result of inclinometer monitoring.

(3) Water Pressure on the Surface of Rupture

The groundwater level, landslide activity, and precipitation (daily) are summarized in the same graph. As Figures 1.27 and 1.28 show monitoring results, both graphs should be combined into one graph.

The relation between the groundwater level and landslide activities are shown in Table 2.2.

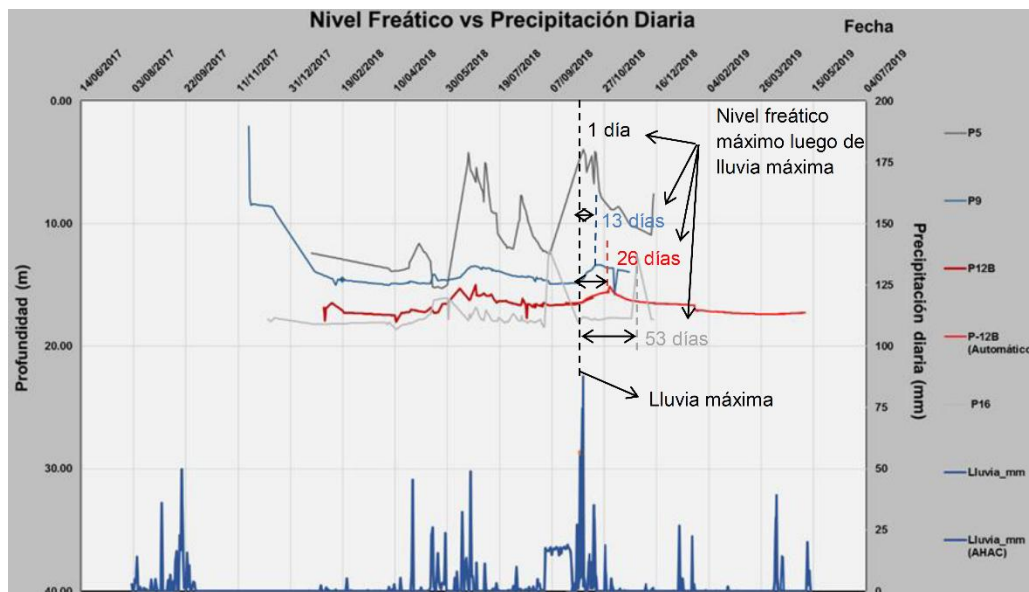


Figure 1.27 Groundwater Level Monitoring Result with Precipitation at Ulloa ⁴⁾

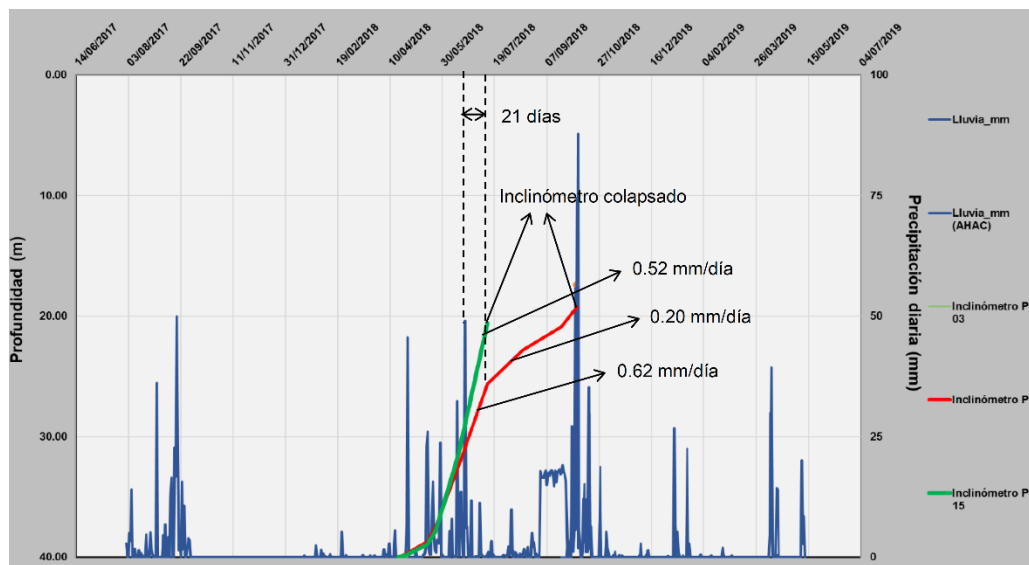


Figure 1.28 Inclímetro Monitoring Results with Precipitation at Ulla ⁴⁾

Table 1.3 Assumed Impact of Groundwater Assumed from the Results of Groundwater Monitoring ^{JET)}

Relation between Landslide Activity and Groundwater Level	Assumed Impact of Groundwater
Only when the groundwater level is rising, the landslide activate.	Rising groundwater is destabilizing landslides. There is a groundwater level that activates landslides.

	Stabilization works aim to lower the groundwater level below the level that activates landslides.
The Landslide stable even the groundwater level rises	Even the highest water level does not reach the water level (water pressure) that activates landslides. Stabilization works aim to lower the water level above the highest observed level.
The landslide active even the groundwater level is lowest	Landslides are not stable even when the groundwater is at its lowest. Mitigation works aim to lower groundwater levels at least further than the lowest observed groundwater level. Stabilization works other than the groundwater reduction works should be adopted.
No relationship between landslide activity and groundwater variations	There may be problems with the groundwater monitoring instruments (perforations of water standpipe could be choked).

1.2.4 Stability Analysis

(1) Factor of Safety

There is a factor of safety (or safety factor) as an indicator of landslide stability. The safety factor is the ratio of shear strength and shear stress, and is expressed by the following formula.

$$F = \text{Shear strength} / \text{Shear stress}$$

The safety factor and landslide activity have the following relationship.

- When landslide activity and resistance are balanced: $F = 1.00$
- When landslide is active: $F < 1.00$
- When landslide is stable: $F > 1.00$

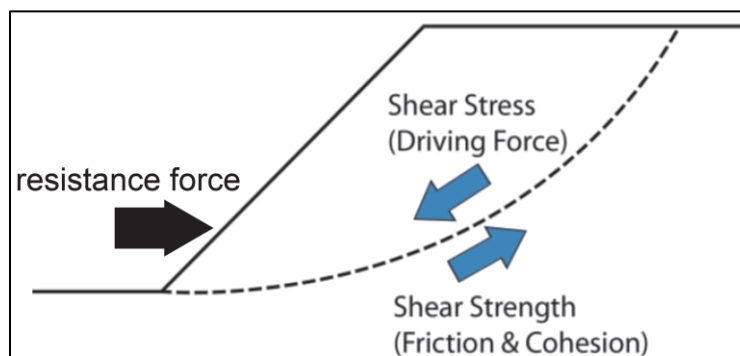


Figure 1.29 Restraint force ^{JET}

Generally, the shear stress of landslide is driving force of sliding mass induced by the gravity, and the shear strength is friction and cohesion on surface of rupture of landslide.

In Japan, the factor of safety of active landslide is assumed 0.95 to 1.00 according to actual landslide activity. In this project, factor of safety of the landslide in Campo Cielo was assumed to be 0.98.

(2) Stability Analysis

Many slope stability analysis tools use various of the methods of slices. This manual introduce one of them (modified Fellenius method). This stability analysis should be use a computer software.

In the method of slices, the Fellenius method, the sliding mass above the surface of rupture is divided into a number of slices. The forces acting on each slice are obtained by considering the mechanical (force and moment) equilibrium for the slices. Each slice is considered on its own and interactions between slices are neglected because the resultant forces are parallel to the base of each slice. This allows for a simple static equilibrium calculation, considering only soil weight, along with shear and normal stresses along the surface of rupture. Both the friction angle and cohesion can be considered for each slice.

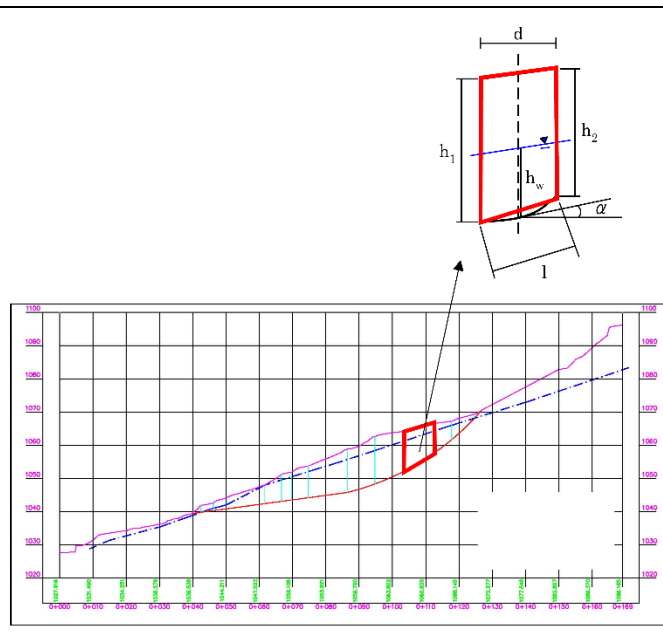
Stability Analysis (modified Fellenius method)

$F_s = \text{shear strength} / \text{shear stress}$

$$= \frac{\sum(c \cdot l + (w - u \cdot d) \cos \alpha \cdot \tan \varphi)}{\sum(w \cdot \sin \alpha)}$$

Where,

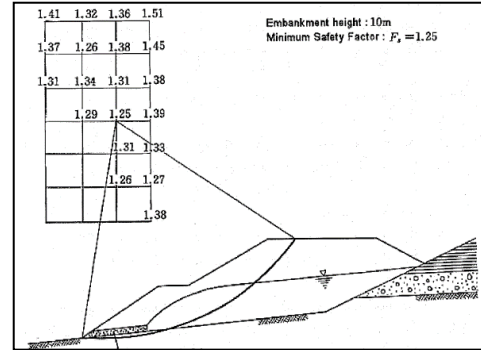
- F_s : Safety factor
- c : Cohesion (kN/m²)
- φ : Internal friction angle (degree)
- w : Weight of slice (kN)
- α : Angle of slip surface (m)
- l : Length of slip surface (m)
- u : Porewater pressure (kN/m²)
- d : Width of slice (m)



This ordinary method can be applied for the landslides which is already activate. Trial method to find minimum safety factor can not be used for stability analysis on mass movement.

Because

- sliding surface has been destined already,
- the ground with layers, discontinuities and cracks is not homogeneous,
- slip surfaces are not circle at most of mass movements



(3) Shear Strength of the Surface of Rupture

Shear Strength of the surface of rupture consists of friction and cohesion. It is very difficult to obtain exact shear strength of the surface of rupture by laboratory tests. Because,

- Shear strength of sliding surface is very different from strength of sliding mass
- Collecting the undisturbed samples from sliding surface is very difficult
- Strength of sliding surface is not homogeneous

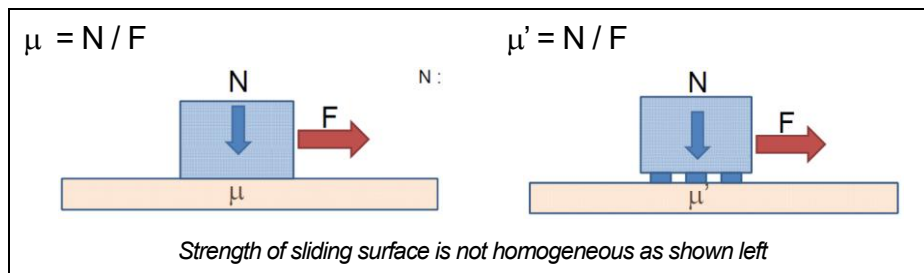


Figure 1.30 Irregularity of Strength of Sliding Surface (JET)

Back Analysis

The Shear strength can be explained as follows.

$$F_s = \text{shear strength} / \text{shear stress}$$



$$\text{shear strength} = F_s / \text{shear stress}$$

<modified Fellenius method>

$$F_s = (cl + (w - ud) \cos\alpha \tan\phi) / w \sin\alpha$$

$$cl + (w - ud) \cos\alpha \tan\phi = F_s w \sin\alpha$$

$$\text{Cohesion (c): } c = (F_s w \sin\alpha - (w - ud) \cos\alpha \tan\phi) / l$$

$$= F_s w \sin\alpha / l - (w - ud) \cos\alpha \tan\phi / l$$

w , α , l , u and d can be obtained in investigation and analysis and can be constants. Therefore, they can be assumed as follows,

$$w \sin \alpha / l = A$$

$$(w - ud) \cos \alpha / l = B$$

therefore

$$c = F_s A - B \tan \phi$$

“ c ” and “ $\tan \phi$ ” should be on the line of “ $c = F_s A - B \tan \phi$ ” as shown below.

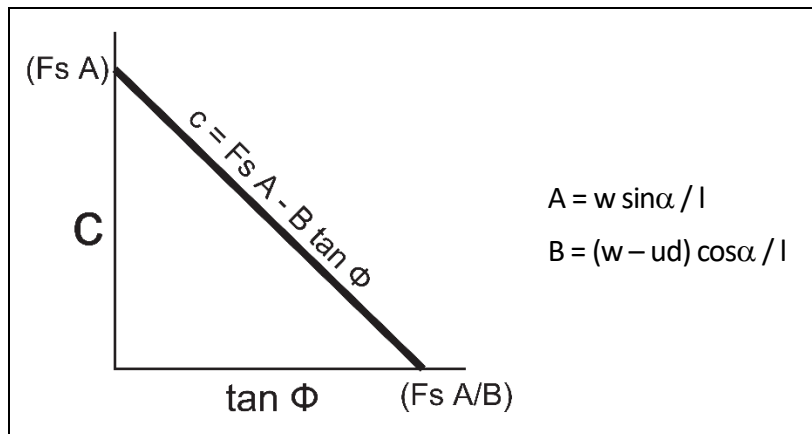


Figure 1.31 Relation between “ c ” and “ $\tan \phi$ ” ^{JET}

There are three unknowns, “ F_s ”, “ c ”, “ ϕ ”.

“ F_s ” of active landslide can be assumed 0.95 to 1.00 according to actual landslide activity.

“ c ” can be assumed according to empirical relation between the depth of surface rupture of the landslide and “ c ” as below.

$$c = D$$

c : cohesion on surface of rupture of the landslide (kN/m^2)

D : average depth of surface of rupture of the landslide (m)

1.3 Measures against Landslide

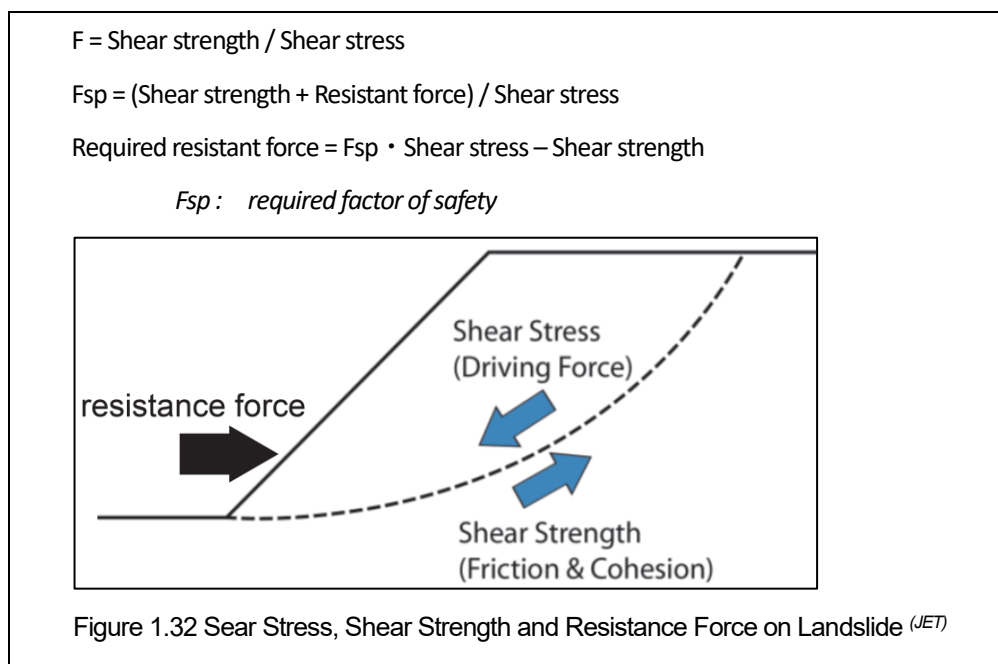
1.3.1 Basic Concept of Measures against Landslide

If there are residents living within the landslide, ensuring their safety is the top priority. It takes a considerable amount of time to complete the landslide stabilization works, which includes investigation, monitoring, design, and construction works. Therefore, the surest way to protect the people in the landslide is to relocate residents to out of the landslide.

Next step of landslide measure is to mitigate the landslide activities by stabilization works.

Basic policy of stabilization works is;

- Increase in shear strength,
- Decrease in shear stress, and
- Apply resistance force on landslide



Increase in shear strength: As can be seen from the stability formula, lowering the groundwater level reduces the buoyancy acting on the soil mass and increases the frictional force.

Decrease in shear stress: Easy way to decrease in shear stress is to cut the top of landslide, since landslide slip surface is steeper ("W sin α " is larger).

Apply resistance force on landslide: Buttress, ground anchors and piles are introduced in this manual.

1.3.2 Evacuation

Influence area of landslide is original position of the landslide area including where landslide mass reaches after it happen. The edge of the influence area can be considered as two times of the landslide length ($2L$) at a maximum as shown in Figure 3.2.

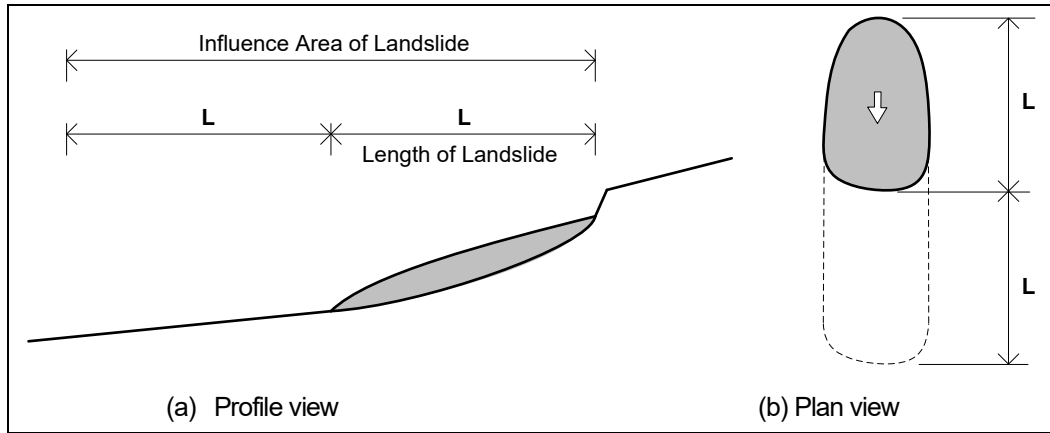


Figure 1.33 Influence area of landslide (JET)

1.3.3 Groundwater Control

Because of its high stabilization efficiency in relation to design and construction costs, drainage of surface water and groundwater is the most widely used and generally the most successful slope stabilization method. Of all possible schemes to be considered for the correction of existing or potential landslides, proper drainage is probably the single most important. Drainage will both reduce the weight of the mass tending to cause the landslide and increase the strength of the materials in the slope.

Reducing of the groundwater level has contribution to stabilization/mitigation of the landslide activity. Since rise of groundwater level is often caused by infiltration of surface water, the surface drainage system is one of the highly effective works to avoid rise of groundwater level. This work shall be considered to apply as groundwater control in the first step.



Figure 1.34 Surface Drainage System in Landslides (JET)

Horizontal gravity drain and drainage well as shown in Figures 1.35 and 1.36 can be pointed as the applicable measure works to reduce a groundwater level. These works serve to discharge a groundwater and reduce a groundwater level compulsorily due to installation of drainage pipe under the groundwater level.

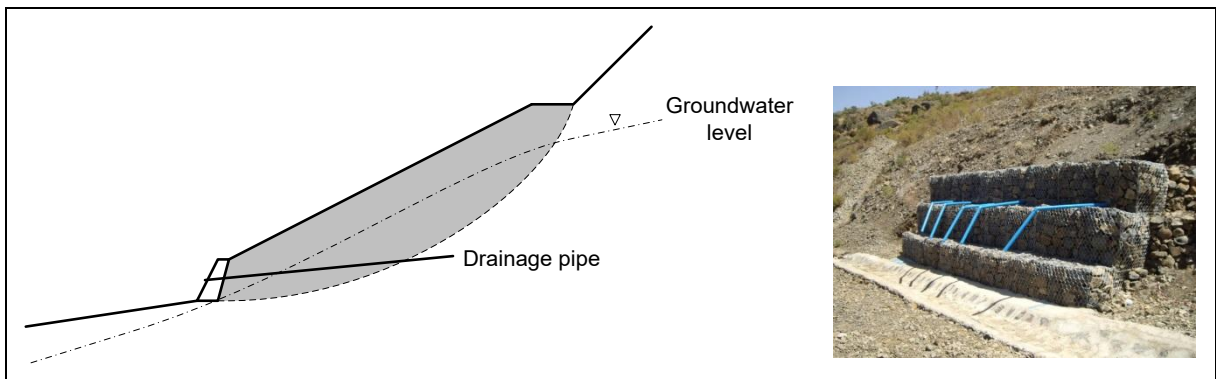
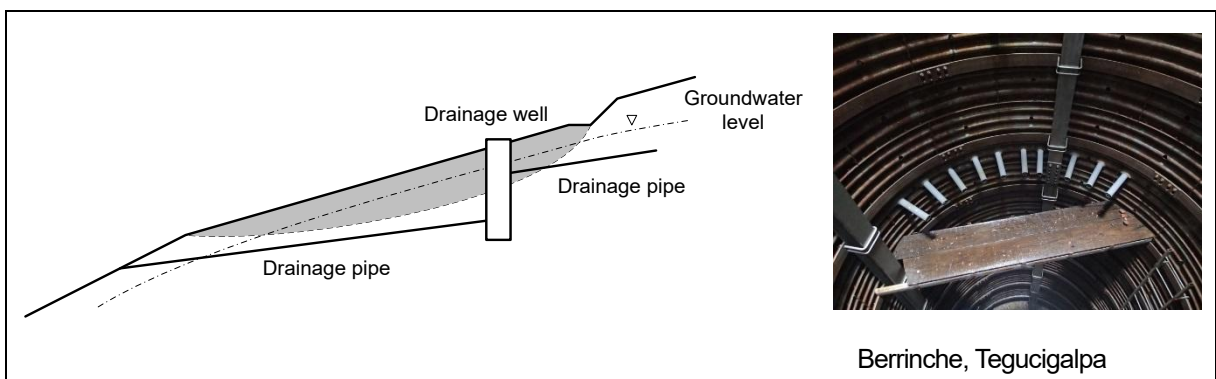


Figure 1.35 Horizontal Gravity Drains (JET)



Berrinche, Tegucigalpa

Figure 1.36 Drainage Well (JET)

1.3.4 Cut and Fill (Earth work)

In general, the shear stress is large at the head of the landslide and small at the bottom of the landslide. with reference to “shear stress = $W \sin \alpha$ ”, the shear stress is larger at the head of the landslide where α is larger, and the shear stress is smaller at the bottom of the landslide where α is smaller.

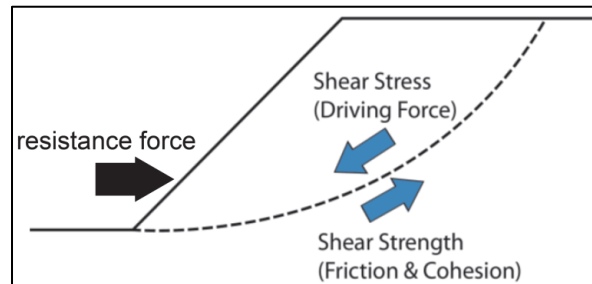


Figure 1.37 Shear Stress, Shear Strength and Resistance Force on Landslide (JET)

Cutting the landslide head can reduce the shear stress of the landslide. And, filling on the bottom of the landslide increase the resistance force.

Conversely, cutting off the lower part could destabilize the landslide, and embanking the landslide head could destabilize the landslide. These works are often the human cause of landslide.

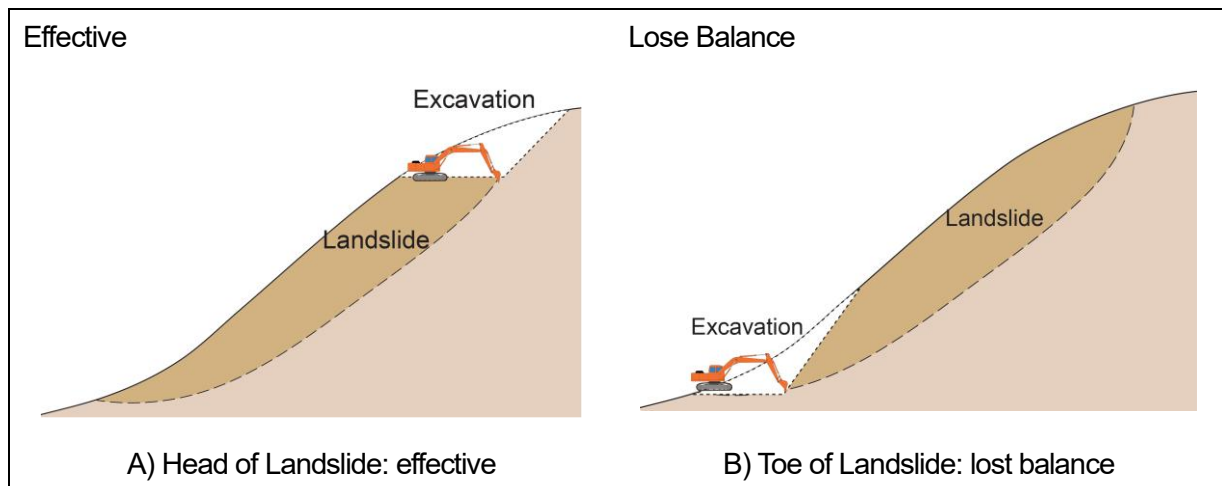


Figure 1.38 Effectiveness of removal work of head part of landslide (JET)

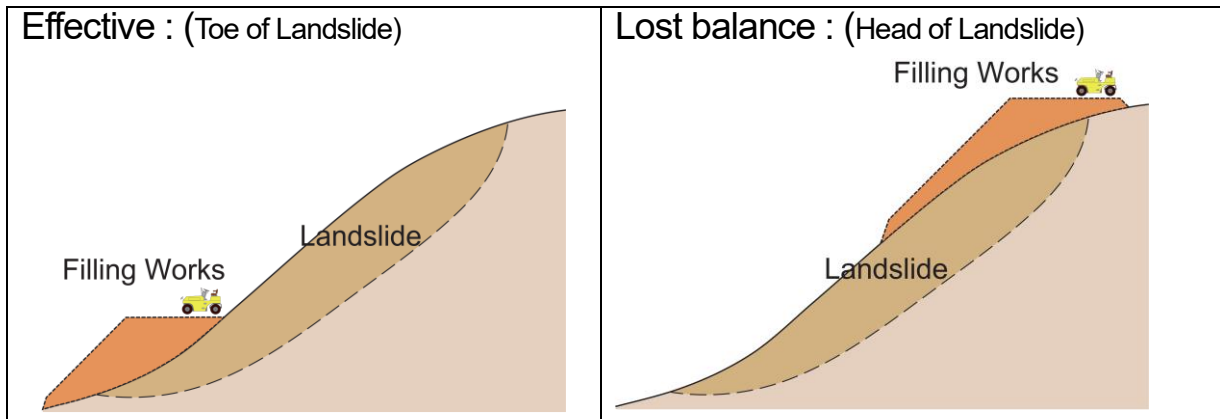
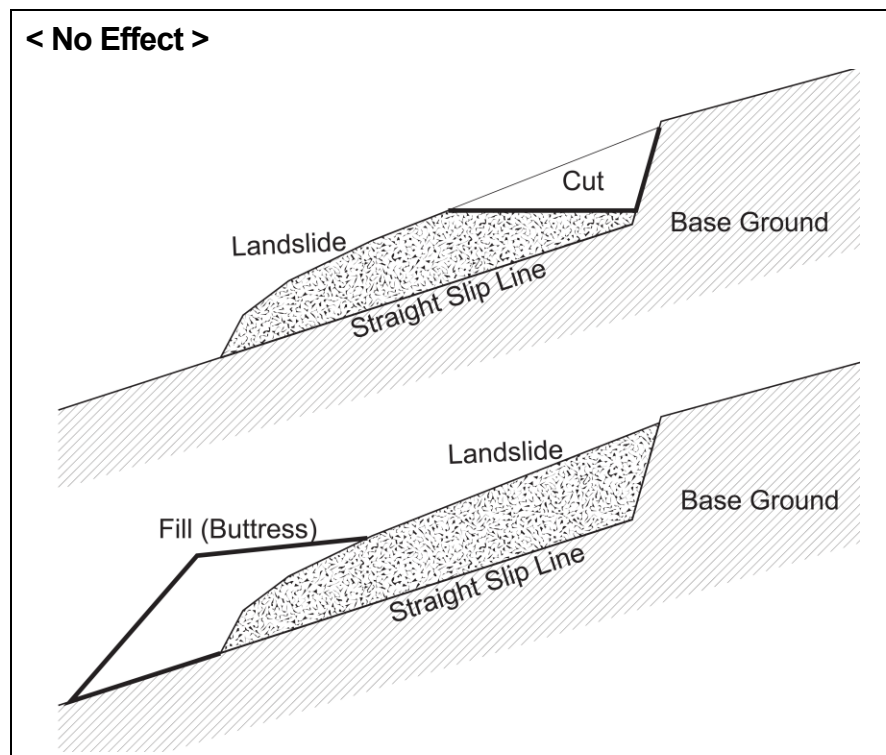


Figure 1.39 Counterweight Fill as Resistance / Restraint (JET)

Problems of Cut and Fill Works

- The Cutting risk destabilizing the slope above the landslide.
- Land must be secured below the landslide for Fill.
- As can be said for both cut and fill, cut and fill cannot be effective when the landslide slip surface is straight in the longitudinal section (Figure 1.40).



In these cases, neither cutting nor filling will have much effect in stabilizing the landslide.

Figure 1.40 Cutting and Filling Works on the Landslide with Straight Slip Surface (JET)

1.3.5 Restraint Works (Ground Anchors and Piles)

Restraint works for small / medium landslide shall be applied in case that landslide activity cannot be halted by the groundwater control or cut and fill works. In many cases, the restraint works are applied with the groundwater control.

Ones of the more effective measures for stabilizing landslides is the use of ground anchor systems and piles for increase the resisting forces by applying external restraint to a moving soil mass.

a. Ground Anchors

Ground anchors which are typically post-tensioned are made of several components, including the anchorage, the bond length, and the free stressing length. The anchorage is a system that includes an anchor head, a trumpet, and a bearing plate. Design and successful construction of ground anchor systems require knowledge and understanding of the specific application and project location as well as understanding the ground conditions and site access constraints, including overhead and underground utilities. Selection of the appropriate equipment and drilling means and methods integral to success. The applications available for a ground anchor system include retaining wall stabilization, uplift slab stabilization, slope stabilization, and concrete dam stabilization.

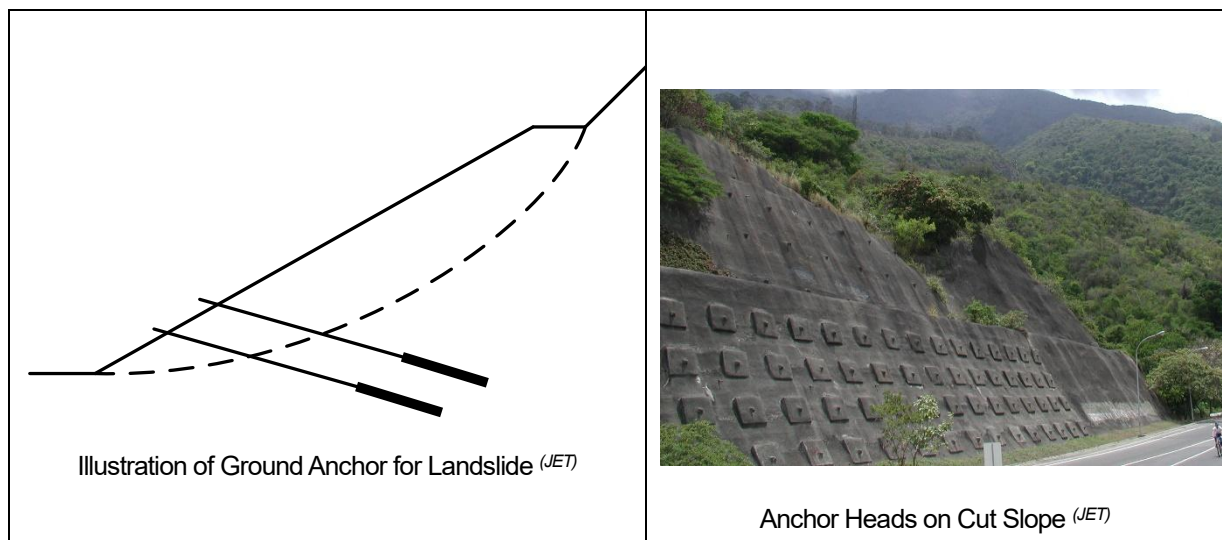


Figure 1.41 Ground Anchors for Landslide

b. Piles

The use of closely spaced vertical driven piles to stabilize landslides are quite common. Driven steel piles or concrete bored piles are used to attempt to stabilize landslides, and H-piles or timber piles are sometimes used to stabilize the small / medium size landslide.

Piles are usually driven 2/3 of their length into the ground and installed in such a way that the sheets overlap.

If the above-ground height of the sheet piles exceed the usual measure, anchors are used to tie the sheet pile faces to load bearing soil (or load bearing strata, as mentioned earlier).

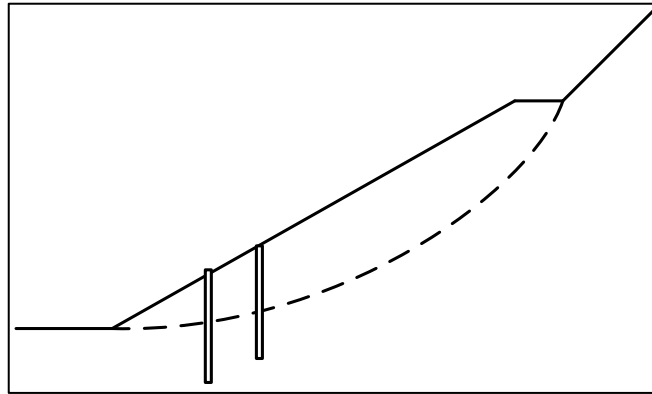


Figure 1.42 Illustration of Piles for Landslide (JET)

Reference in "I Landslide"

- 1) Transportation Research Board, National Research Council, USA (1996); Landslides – Investigation and Mitigation
 - 2) Public Works Research Institute, Japan (2007); Proposed Technical Standard of Landslide Prevention Measures
 - 3) Durham Geo Slope Indicator; Product Catalogs (<https://www.durhamgeo.com>)
 - 4) Informe Final de Proyecto "Suministro e Instalación de Instrumentos y Equipo para el Monitoreo de 6 Bloques de Deslizamiento Priorizados en Tegucigalpa"; BCIF, AMDC (2018)
 - 5) Geotech d.o.o.; <https://www.geotech.hr/en/geotech/>
 - 6) Shoji UENO (2001); Influence of Geological Factors on Configuration and Scale of Landslide, Landslides-Journal of the Japan Landslide Society Vol. 38, No. 2 (2001), September, pp. 105-114
- (JET) JICA Expert Team for the project for control and mitigation of slope disasters in the central district in Republic of Honduras

Chapter 2. Slope Failure

2.1 Realities of Slope Failure

2.1.1 Appearance

A slope failure is a phenomenon that a slope collapses abruptly due to weakened self-retainability of the earth under the influence of a rainfall or an earthquake. Because of sudden collapse of slope, many residents to escape from it if it occurs high population area, thus resulting in a higher rate of fatalities.

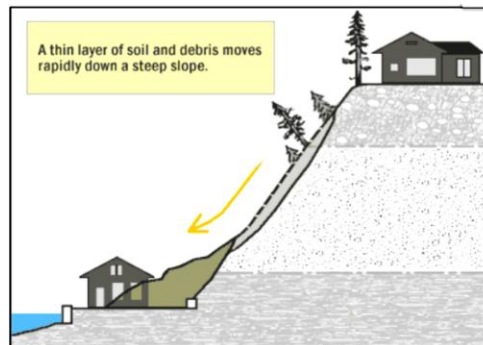


Figure 2.1 Slope Failure (<https://www.islandcountywa.gov>)

In many cases, it is difficult to distinguish between a landslide and a slope failure. Difference between landslide and slope failure is following points;

- Slope failures occur on steeper slopes
- Moving mass moves rapidly
- Surface of ruptures (slip surface) do not remain after the event of slope failure. The debris of slope failure pile up at the bottom of the slopes.
- In landslides, structures such as houses, roads and pipelines on moving masses are affected. In contrast, there are almost no structures on steep slopes, and structures below and above slopes are affected by slope failures.



Figure 2.2 Slope failures in Ethiopia (JET)

2.1.2 Location and Timing

Most of the case of Slope failure, the triggers are heavy rains or earthquakes. Since not all slopes exposed to heavy rains and earthquakes collapse, it is very difficult to predict slope failure. The slopes with the following signs are particularly critical slopes.

- a. The vegetation on the slope is partially or mostly washed away.
- b. Abnormalities such as cracks and bulges are found on the slope.
- c. There is spring water on the slope
- d. Fallen rocks and debris remain at the bottom of the slope.
- e. There have been slope failure disasters in the past. Or disasters are recurring.
- f. Geographically and geologically, the slopes as shown in Figure 2.3

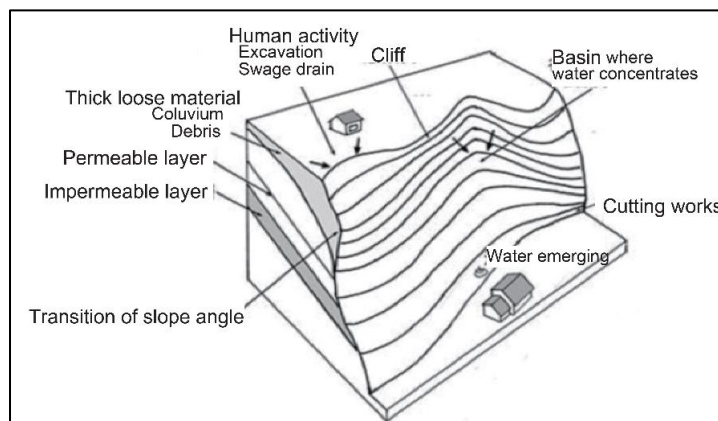


Figure 2.3 Slope Failure Prone Slope ²⁾

However, it is difficult to confirm the above phenomenon. The survey should be conducted by experienced expert.

2.2 Investigation and Analysis for Mitigation Works

The research described in this section is to obtain the information necessary to design a countermeasure work. The following two points of information are necessary for designing a countermeasure work

- slopes and surrounding terrain,
- distribution (range, depth) of soft material such as colluvium, highly weathered rocks or debris

To obtain above information, investigation works shown in Table II-2.1 could be useful.

Table 2.1 Investigation Works ^(JET)

Purpose	Investigation Works
Slopes and Surrounding Terrain	Reconnaissance Exploration
	Topographic Survey
Distribution of Soft Material	Reconnaissance Exploration
	Dynamic Cone Penetrometer, Mackintosh
	Seismic Exploration

2.2.1 Topographic Survey

The topographic maps become the basic materials for future, and are used consistently from survey plans to mitigation plans. It should be noted that topographic maps created from aerial photographs often do not show accurate topography. Topographic maps also can be created using LIDAR of which the microtopography can be easily read. The scale of the topographic map should be about 1/500 to 1/100.

a. Range of Topographic Survey

The survey shall be carried out with the same width as the slope, and the height direction is the same length as the slope on the top of the slope, and twice the length of the slope from the toe of the slope.

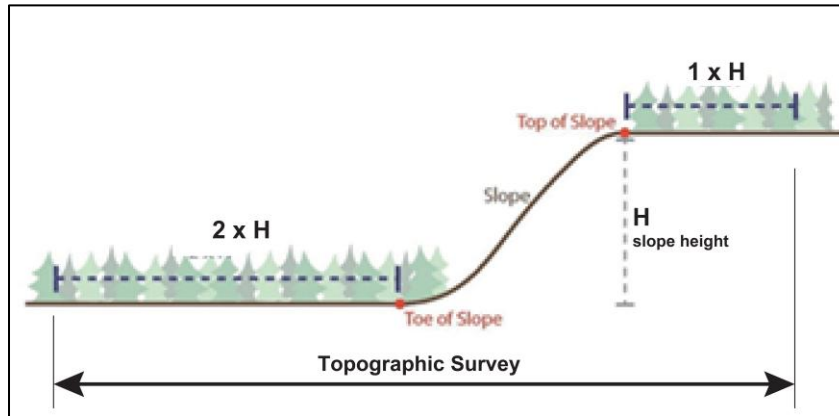


Figure 2.4 Range of Topographic Survey (JET)

b. Cross section lines

A cross section survey is an important source of slope failure analysis. The section line is the basic line for determining the locations of geotechnical / geophysical explorations and slope failure analysis. The main section line should be set where the geology, geological structure, ground surface deformation can be confirmed concretely, and the position and direction of the main section line suitable for the basic plan and basic design of mitigations.

2.2.2 Reconnaissance Exploration

The stability of slope is affected by a lot of factors such as geology, topography and water condition. Since it is difficult to predict site and timing of slope failure accurately, slope which has potential of failure shall be identified according to the past experiences. The stability of slope is well known of having close relationship with geology (material) of the slope. Therefore the statistical data is useful to estimate stable gradient of slope instead of the stability analysis for slope failures.

Slope condition, such as distribution of soil / rocks, water spring or cracks on surface, shall be examine. Slope failure risk slopes are situations in which unstable soil and rocks are distributed on steep slopes, and it is often dangerous to approach them. In that case, surveys on slopes should be avoided. If it is difficult to approach the slope, use binoculars to observe from above or below the slope, or use high-precision aerial photographs.

2.2.3 Dynamic Cone Penetrometer (DCP)

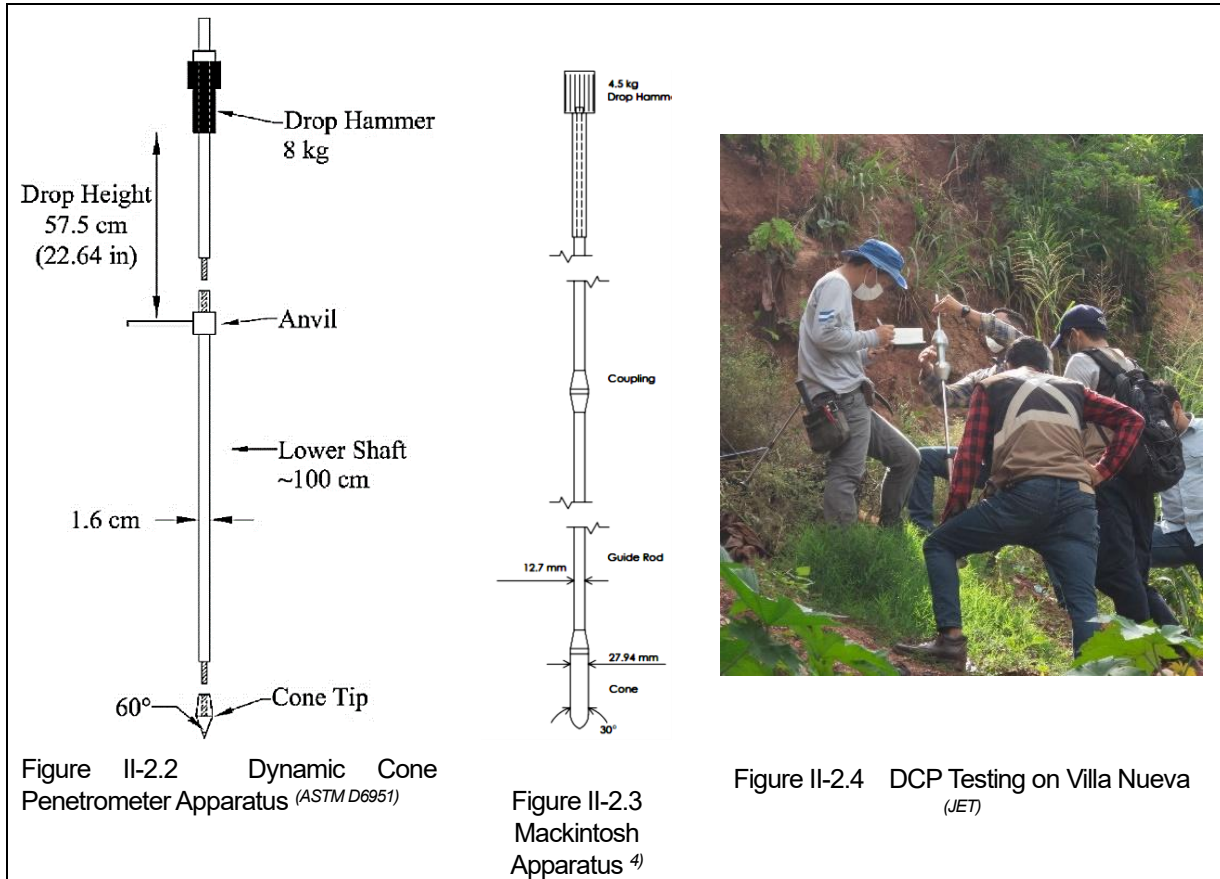
a. Apparatus

The objective of the dynamic cone penetrometer consists all probing is the same, namely to provide a profile of penetration resistance with depth, in order to give an assessment of the variability of in-situ materials on site. Probing is carried out rapidly, with simple equipment. It produces simple results, in terms of blows per unit

depth of penetration, which are generally plotted as blow-count/depth graphs.

The Mackintosh Probe is a hand operated lightweight and portable penetrometer similar to DCP. It is a considerably faster and cheaper tool than boring equipment especially when the soils under investigation are soft or loose. Can be used to a depth of 16 meters.

Considering the safety of operators, DCP and Mackintosh should not be performed on steep slopes where it is difficult for a person to stand.



ASTM; American Society for Testing and Materials

b. Arrangement of survey points

It is recommended that the survey be conducted in a grid-like pattern at an interval of 5 to 10 m by considering the scale of slope.

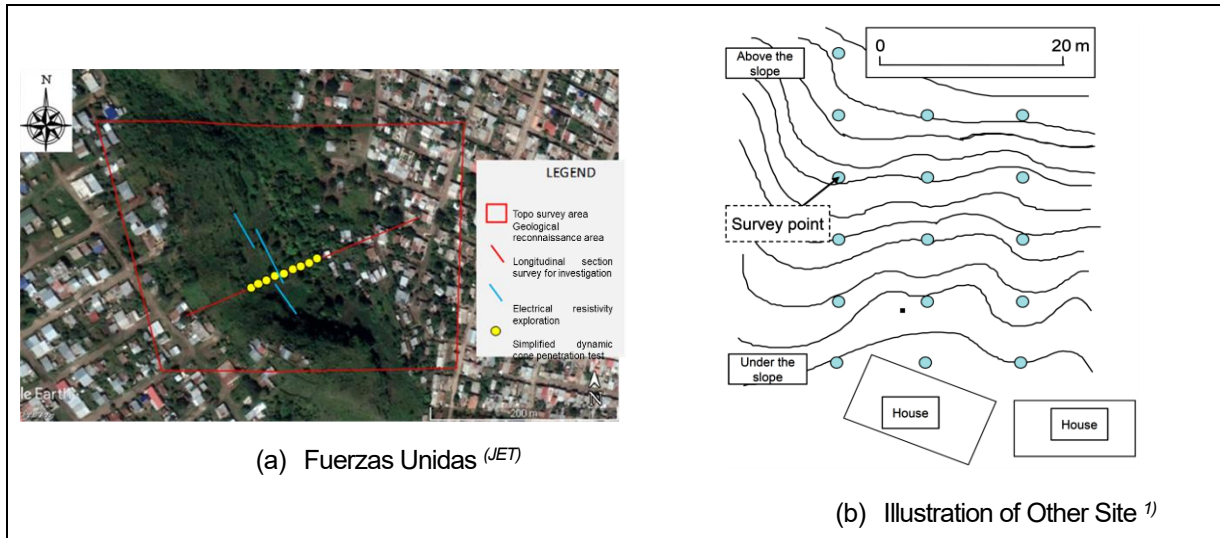


Figure 2.5 Illustration of Arrangement of Dynamic Cone Penetration Test

Check if the characteristics determined by the test result based on the soil category roughly match those of the soil structure identified in the vicinity.

When such similarity is confirmed as above, categorize the soil properties according to the soil structure identified in the vicinity. Then, identify a location where a slip plane is considered to occur and estimate the thickness of a layer that is likely to fail.

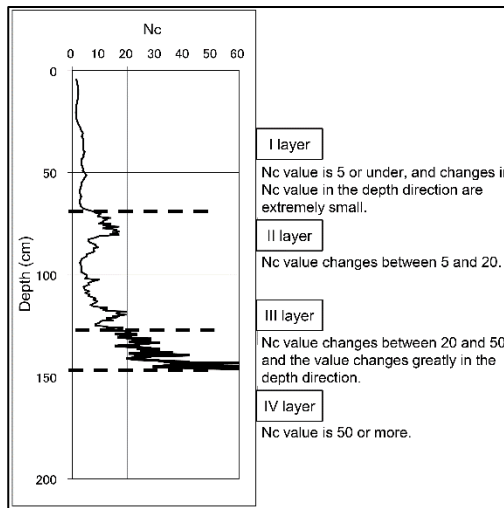


Figure 2.6 Illustration of Result of DCP ¹⁾

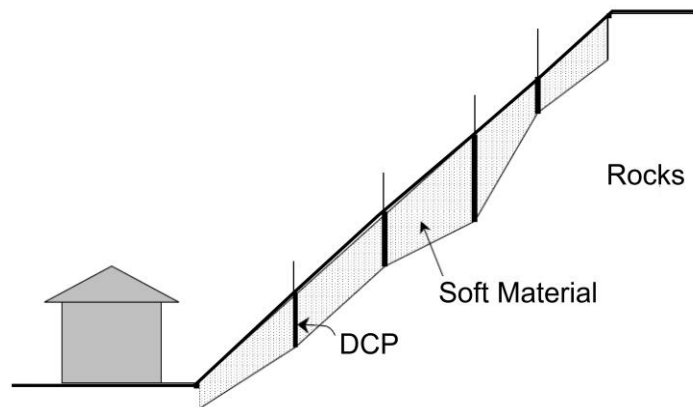


Figure 2.7 Illustration of Result of Dynamic Cone Penetrometer ²⁾

2.2.4 Geophysical Exploration

In order to know the sediment distribution on steep slopes, seismic survey is better than resistivity survey.

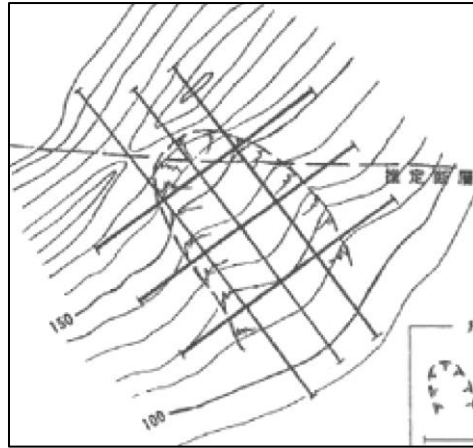


Figure 2.8 Illustration of arrangement of Seismic Survey in Large Slope Failure ³⁾

2.3 Analysis

2.3.1 Vulnerabilities

Vulnerabilities to the slope failure are steep soil slopes and steep weathered rock slopes. Japanese standard defined the vulnerabilities of slope failure as follows;

- a. Natural slopes more than 15m high, or natural slopes with angle of 30 degree or more.
- b. A lot of slope Failures are on cut slopes. Old cut slopes are often indistinguishable from natural slopes.

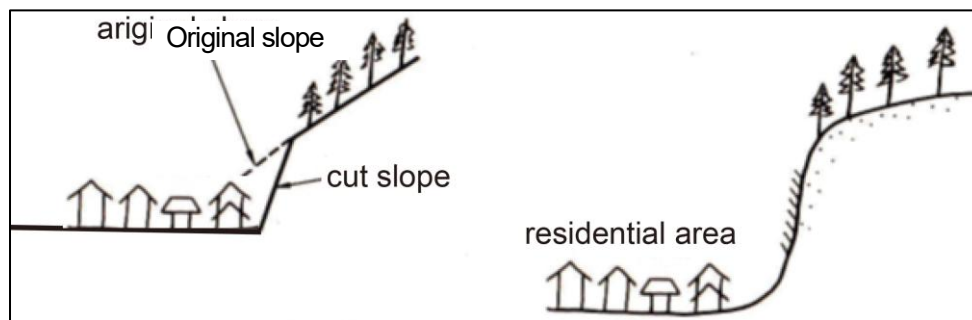


Figure 2.9 Cut Slope and Natural Slope ^(JET)

- c. If the slopes consist of following soil or rocks.
 - Soil which is easy to be eroded
 - Soil which is easy to weaken after being soaked in water
 - Rocks which is rich in cracks or fissures
 - Soft rocks which is easy to be eroded
 - Rocks which is easy to weather
 - Rocks with daylight structure
 - Soil on impermeable rocks as shown in Figure 2.10

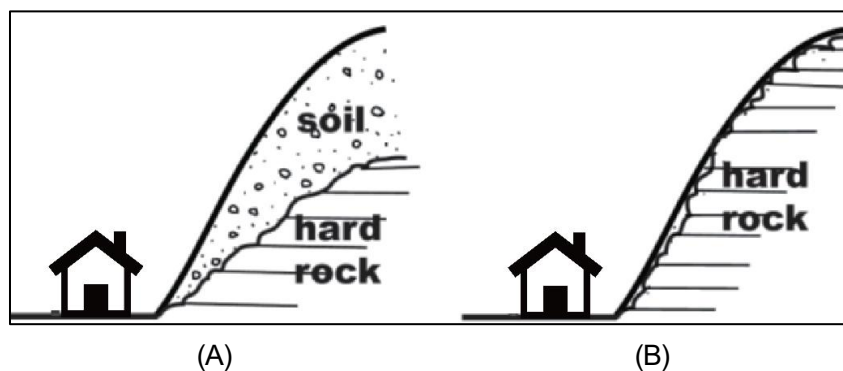


Figure 2.10 Slope with soil on hard rocks (A) is unstable than rock slope (B) ^(JET)

2.3.2 Cause of Slope Failure

The stability of slope is affected by a lot of factors such as geology, topography and water condition. Since it is difficult to predict site and timing of slope failure accurately, slope which has potential of failure shall be identified according to the past experiences. The stability of slope is well known of having close relationship with geology (material) of the slope. Therefore the statistical data is useful to estimate stable gradient of slope instead of the stability analysis for slope failures.

The trigger for slope failure is mostly precipitation and earthquake in Tegucigalpa. Cutting at lower part of steep slope also can cause for slope failure.

The Reason Why Rainfall Trigger Slope Failure

There are four mechanisms of slope failure triggered by rain fall and these are

- Water penetrates into the ground from slope surface and then effective stress (frictions) on fracture plane become small,
- Weight of soil becomes heavier with water,
- Water flowing to the surface of slope erodes slope surface, then slope can lose the balance.
- Suction in soil is very different in saturated condition and unsaturated condition, thus apparent cohesion changes very much as shown in Figure II-3.3. Grains of soil can be dispersed

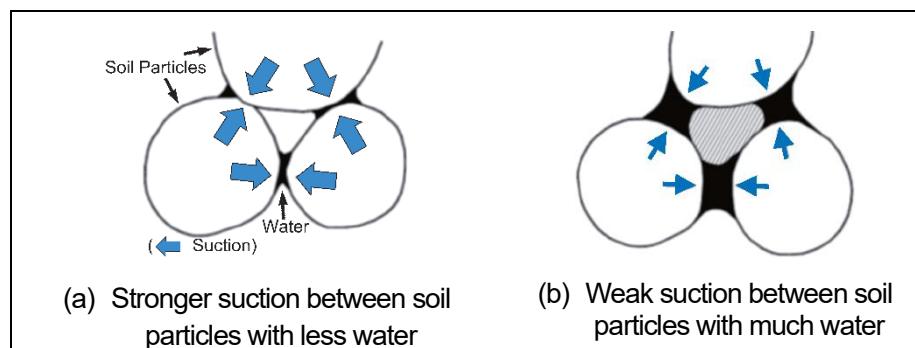
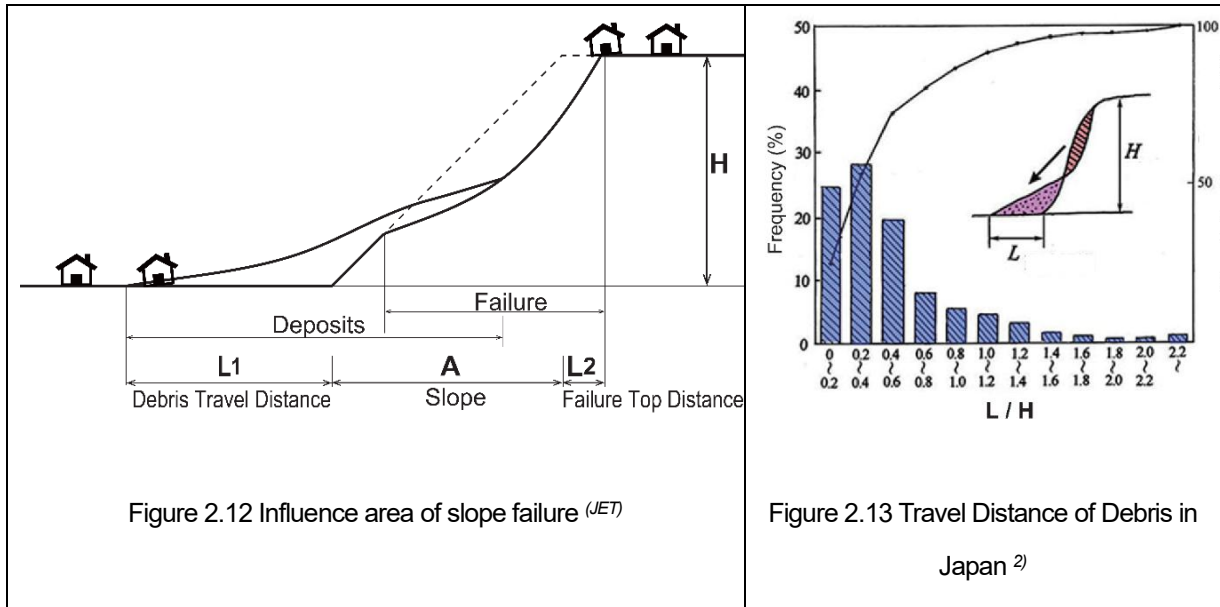


Figure 2.11 Suction between Soil Particles (JET)

2.3.3 Risk Area

The extent of the collapse and the debris travel distance are L1 and L2 respectively in the Figures 2.12 and 2.13 show debris travel distance of slope failure which is based on study in Japan. The range of travel distance of debris (L1) is particularly large up to about half the height of the slope.



With reference to and based on the past studies in Japan, the criteria that defines a landslide hazardous area includes

2.3.4 Volume of Debris

When installing a barrier as a countermeasure against slope failure, it is necessary to create a space between the slope and the barrier. This space must be large enough to accumulate deposit of debris when the slope fails.

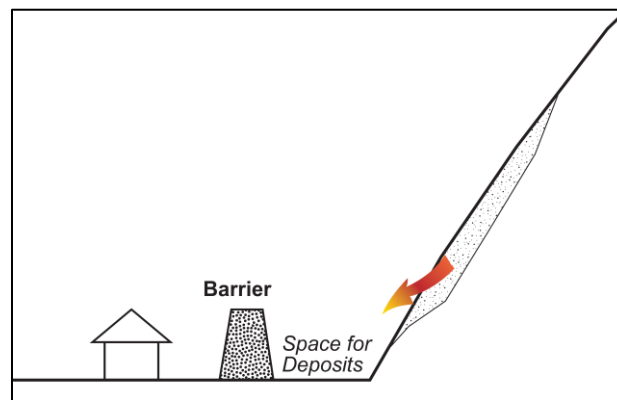


Figure 2.14 Space between Slope and Barrier (JET)

Volume of slope failure is estimated by multiplication of the height and the depth of failure part. The height is estimated from the stable gradient of slope, and the depth of failure part is estimated from thickness of loosening part such as highly weathered rock or covered soil. The volume of slope failure shall be estimated according to the reconnaissance exploration and DCP basically.

Table 2.2 shows the average shapes of slope failure obtained in Japanese studies. Although it is somewhat old information, it is useful for estimating slope failure deposit. Also, Table 2.2 shows the relationship between

slope height and deposit of slope failure. Both tables show that the amount of deposit is not very large and the space required is not large.

Table 2.2 Average Size and Volume of Slope Failure in Japan⁶⁾

	H (m)	W (m)	D (m)	V (m ³)	h / H	L / H
Average	16.6	17.6	1.6	335	0.77	0.52
Range	10 - 20	10 - 20	1.0 – 1.5	< 100	0.9 – 1.0	0.2 – 0.4

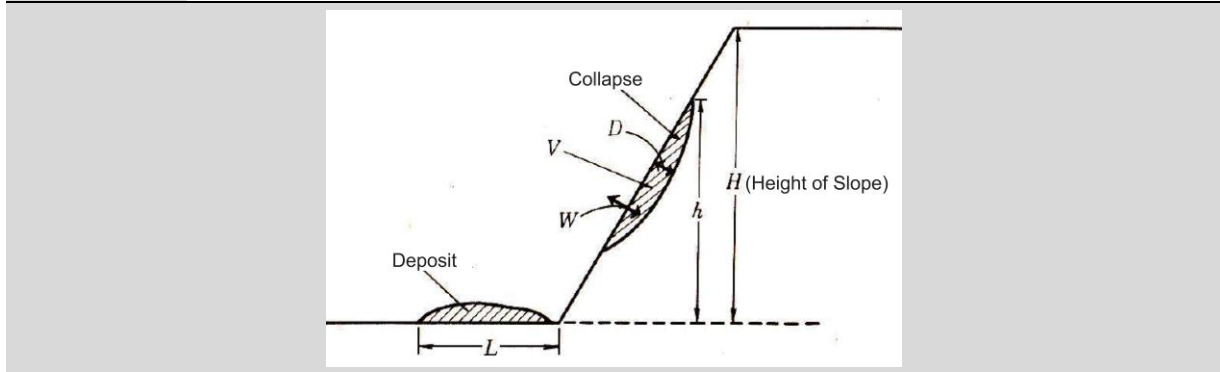


Table 2.3 Volume of Slope Failure Deposit¹⁾

Height of Slope H (m)	Volume of Deposit V (m³)	Width of Failure W (m)	Unit Quantity of Deposit Ad (m³/m)
$5 \leq H < 10$	40	14	2.86
$10 \leq H < 15$	80	17	4.71
$15 \leq H < 20$	100	19	5.16
$20 \leq H < 25$	150	21	7.14
$25 \leq H < 30$	210	24	8.75
$30 \leq H < 40$	240	25	9.60
$40 \leq H < 50$	370	29	12.76
$50 \leq H$	500	32	15.63

2.3.5 Timing

It is very difficult to predict when a slope failure will occur. As mention in “2.3.2 Cause of Slope Failure”, It is known that rainfall increases slope failure, but not all steep slopes cause slope failure. It is very difficult to predict which slope will collapse with the next rainfall. Just before slope failure, precursor phenomena such as falling pebbles, the appearance of new springs, and the appearance of cracks can be seen.

2.4 Measures against Slope Failure

2.4.1 Basic Concept for Measures against Slope Failure

When considering the measures of slope failure, consider the following order.

- 1st Step: Evacuation (Relocation) of Residents in Risk Area
- 2nd Step: Protection (Barrier) Works
- 3rd Step: Prevention works

Residents should be relocated as soon as possible to protect the lives of residents on the lower and upper parts of dangerous slopes. If it is hard for the residents to relocate, a barrier should be installed to block the residents outside of highly risk area and conservation targets on the lower part of the slope. When stabilization of the slope is required, prevention works should be installed to make slope steady.

2.4.2 Evacuation and Barrier

In terms of slope failure, surrounding area of the slope which has experience of slope failure in past has potential of further slope failure hazard as well. Therefore, the people evacuation shall be considered to be applicable preferentially if the community, and the site condition allows applying the measure.

With reference to and based on the past studies in Japan, the criteria that defines slope failure hazardous area includes land within a distance from the top of the slope equal to the height of a slope on above the slope and within a distance of the toe of the slope equal to two times the height of the slope.

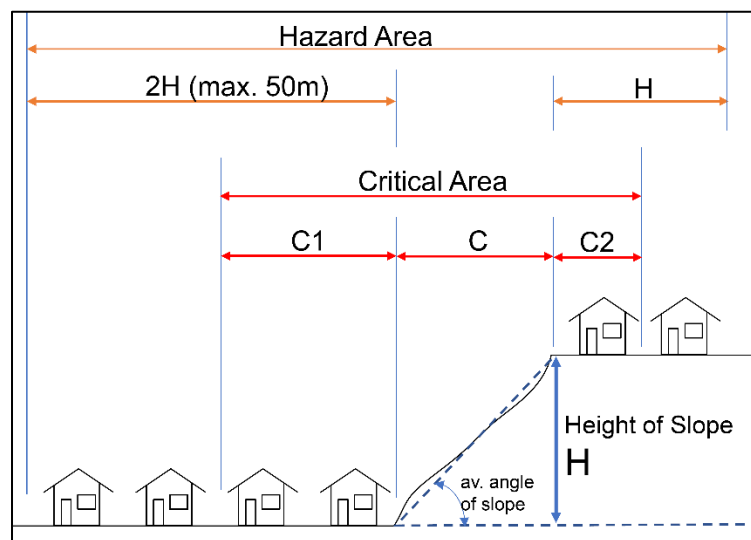


Table 2.4 Hazard Area and Critical Area of Slope Failure (JET)

Critical Areas are defined as follows.

Distance of C1 and C2	
C1 = H	without barrier
C1 = 10 m	with barrier
C2 = 10 m	

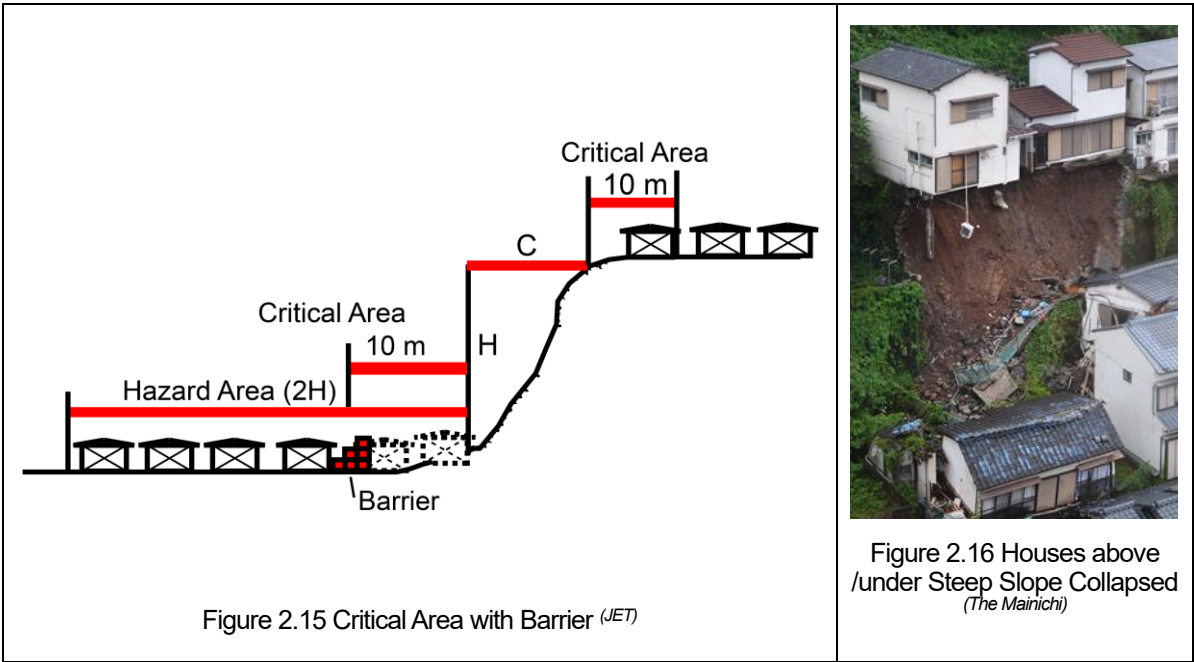


Figure 2.16 Houses above /under Steep Slope Collapsed (The Mainichi)

Houses in the Critical Area should relocate regardless of whether countermeasures are taken. This is both for the purpose of avoiding danger and for securing land for construction of the barriers.

2.4.3 Barrier (Protection Works)

Barrier walls are most suitable as measure works against the slope failures in Tegucigalpa.

Barriers are installed to protect houses in hazard areas. Between the barrier and the slope, the space and height of the barrier are required to store the collapsed deposit. The space between the barrier and the slope are discussed in “2.3.4 Volume of Debris”.

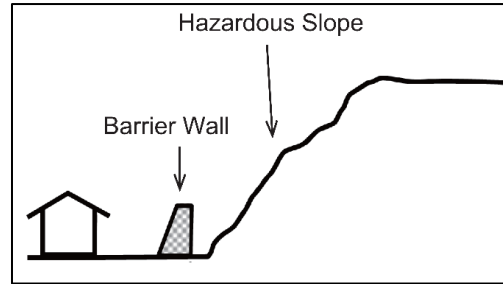
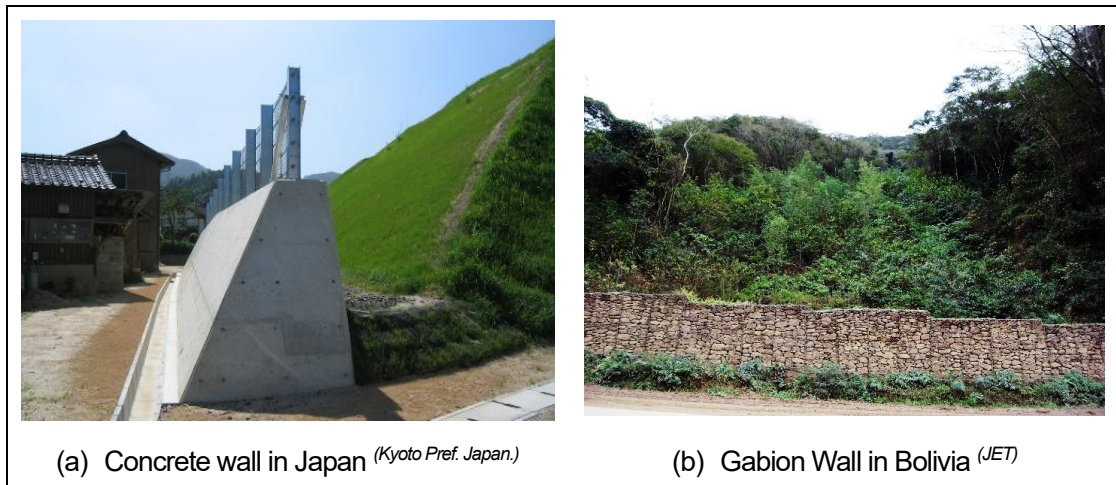


Figure 2.17 Barrier Wall and Required Information for Design (JET)



(a) Concrete wall in Japan (Kyoto Pref. Japan.)

(b) Gabion Wall in Bolivia (JET)

Figure 2.18 Barrier Walls

2.4.4 Prevention Works

There are types of prevention works against slope failure as shown in Table 2.5. Since protection works was explained in the previous section, prevention works will be explained below. However, as already mentioned, in Tegucigalpa, the Protection Works Barrier Wall is considered appropriate.

Table 2.5 Principal Measure Works against Slope Failure (JET)

	Type of Works	Works
Protection Works	Barrier	Barrier Walls
	Stabilization Works	Cutting Works
Prevention Works	Erosion Prevention Works	Drainage, Vegetation, Retaining Wall
	Slope Surface Retaining Works	Soil Nailing, Shotcrete, Crib Works

(1) Cutting Works (Stabilization Works)

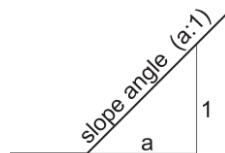
The removal work is a general measure for slope failure. It will bring the high assuredness and reasonable measure if it is selected as preferred applicable measure of works to construct.

It is to remove top soil or weathered rock layer which can be considered to be failed from the slope.

It is to excavate the slope to make suitable slope angle against material of the slope.

Table 2.6 Standard of the stable gradient of cut slopes in Japan (JET)

Geology		Height	Stable gradient
Hard rock			0.3:1 – 0.8:1
Soft rock			0.5:1 – 1.2:1
Sand	Not dense nor sorted		1.5:1 –
Sandy soil	Dense	– 5m	0.8:1 – 1.0:1
		5 – 10m	1.0:1 – 1.2:1
	Not dense	– 5m	1.0:1 – 1.2:1
		5 – 10m	1.2:1 – 1.5:1
Gravel Sandy soil with gravel	Dense or wide grain size	– 10m	0.8:1 – 1.0:1
		10 – 15m	1.0:1 – 1.2:1
	Not dense nor sorted	– 10m	1.0:1 – 1.2:1
		10 – 15m	1.2:1 – 1.5:1
Clayey soil		– 10m	0.8:1 – 1.2:1
Clayey soil with gravel		– 5m	1.0:1 – 1.2:1
		5 – 10m	1.2:1 – 1.5:1



In Japan, the above standard should be used to determine the appropriate cut slope angle, in consideration of the site conditions.

Applicability of the Removal

Removal can be applied in following conditions.

- No other landslide is going to be triggered by the removal works.
- Above the slope is gentle.
- Original slope angle is not so steep and slope height is not so high, otherwise cutting volume could be very large.

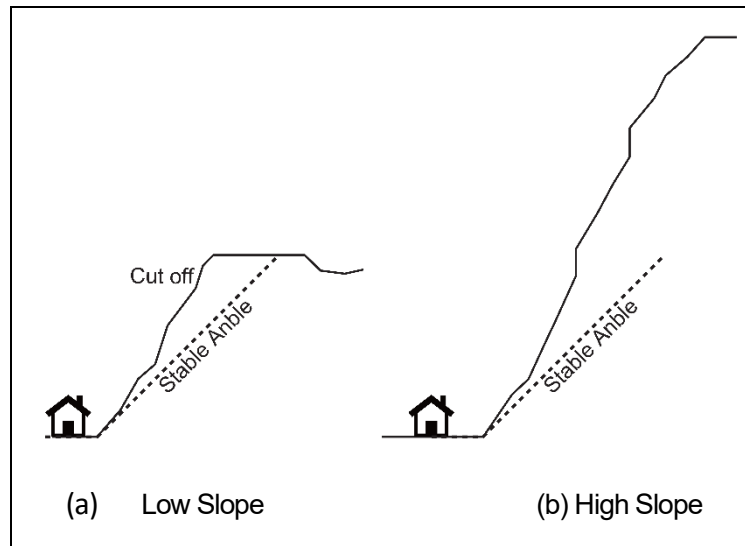


Figure 2.19 Cutting of Low Slope and High Slope (JET)

Removal Works and Required Information for Design

Slope cutting is only the way to remove the hazard of slope failure. To cut the slope, the following information are required.

- Topographical Figure (Cross Section)
- Geological (Material) condition of the slope
- Geological structure of the slope
- Hydrological condition (Spring water/seepage)

It shall be studied carefully whether the slope is not located at toe part of the landslide block before application of the removal works.

(2) Slope Erosion Prevention Works – Vegetation -

The work shall be implemented on stable slope basically. The work shall be implemented with other measure work as auxiliary measure. The type of the vegetation for the work shall be selected in consideration with environmental condition on the site.

The presence of trees has the effect of stabilizing the slope against surface failures few meters deep, it is particularly effective on steep slopes with the following mechanism.

- a. The roots of trees spread in the soil resist the shear force that tries to slide the slope by receiving the displacement of the soil layer, deforming it, and resisting pull-out due to frictional force.

- b. Roots act as reinforcing bars that prevent deformation of the soil layer, and maintain an arch structure that resists soil slippage.

However, there is a limit to the slope failure deterrence effect of vegetation, and slope failures can occur even on slopes covered with trees during heavy rainfall. In order to prevent slope erosion until vegetation takes root, it is better to use a slope protection method using wires and nets (Figure 2.20).

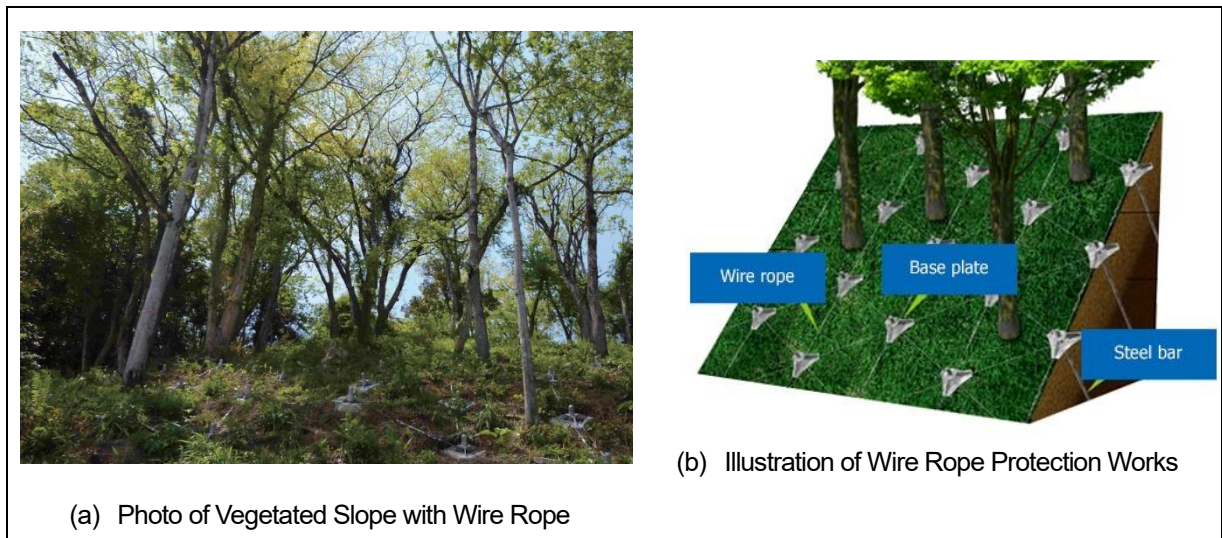


Figure 2.20 Illustration of Vegetation Works on Slope with Wire Rope ⁵⁾

In tropical regions where plants grow well, simple vegetation work like the one shown in the photo is often done, but in many cases, the plants are bleached before they take root.



Figure 2.21 Simple Vegetation Works in Malaysia

(3) Slope Surface Retaining Works

Resistance / Restraint works are to prevent occurring of slope failure by using hard structures. Necessary conditions of applicability of slope surface retaining works are the following;

- Structures to prevent the slope failure can be constructed with no problem of technical, financial and locational aspects
- There is enough space to install a structure to protect failed debris from the road
- Even if the slope collapses to a depth of several meters, the slope must not collapse significantly

Three types of slope surface retaining works, “shotcrete”, “soil nailing” and “crib works” are introduced here.

a. Shotcrete

Because shotcrete is applied pneumatically, the material is compacted against the surface to fill cracks and fissures and prevent loose material from falling. Shotcrete can therefore act both as a protective coating over the slope’s surface, but also as an ‘anchoring surface’ onto which bolts and other support systems can be fastened.

It’s important to note that very steep slopes in terrains with poor rock mass quality entail a greater risk of slope failure, and therefore a superficial layer of shotcrete will not suffice. This type of slope will require extra stabilization such as wire, mesh and fibers. Concrete spraying is typically carried out from the base of the slope upwards in order to prevent the creation of pockets of material and reduce the rebound rate during application.

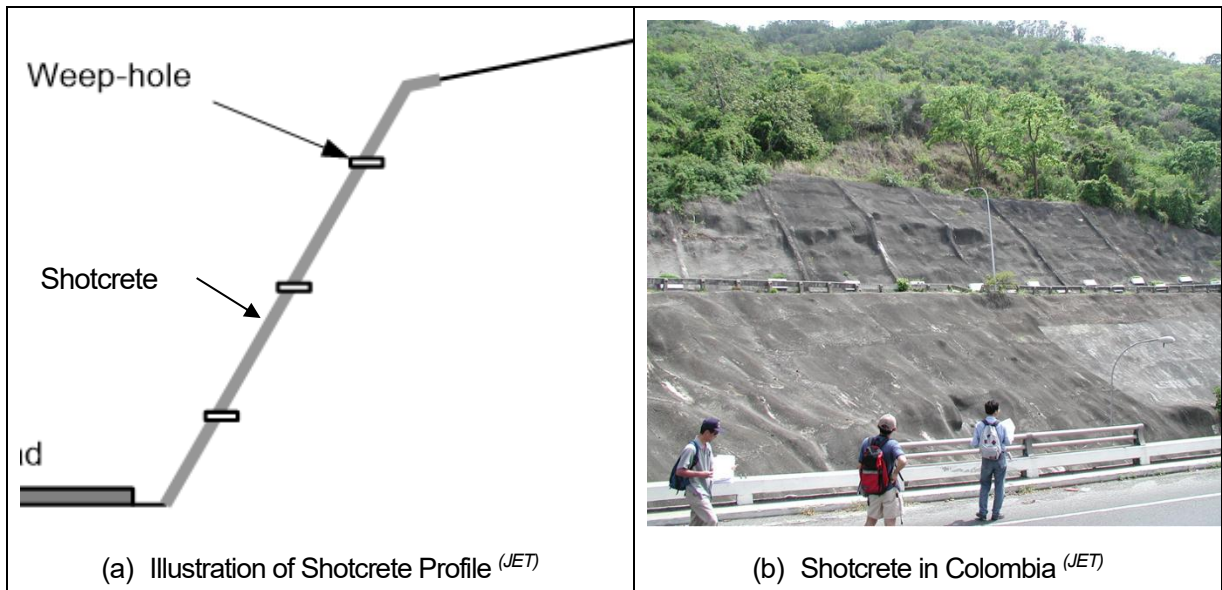


Figure 2.22 Illustrations of Shotcrete (JET)

b. Soil Nailing

Soil nailing is a remedial construction measure to treat unstable natural soil slopes or unstable man-made (fill) slopes as a construction technique that allows the safe over-steepening of new or existing soil slopes.

Bars installed using drilling techniques are usually fully grouted and installed at a slight downward inclination with bars installed at regularly spaced points across the slope face. A rigid facing (often pneumatically

applied concrete, otherwise known as shotcrete) or isolated soil nail head plates may be used at the surface.

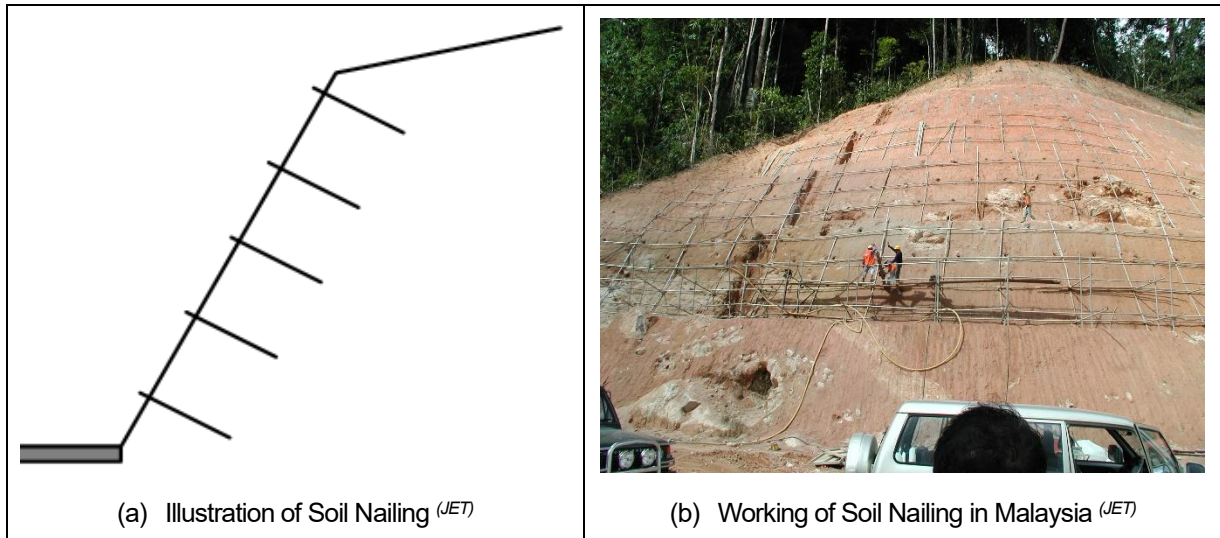


Figure 2.23 Illustrations of Soil Nailing (JET)

c. Crib Works

Shotcrete crib works are used for slopes consisting of bedrock with many cracks or slopes where the protection is urgently required. While the standard function of spray crib works is the same as those of cast-in-place concrete crib works, the good workability means that spray crib works can be applied for slopes with an uneven slope surface. Moreover, the shape of crib works can be flexibly changed in accordance with the slope conditions.

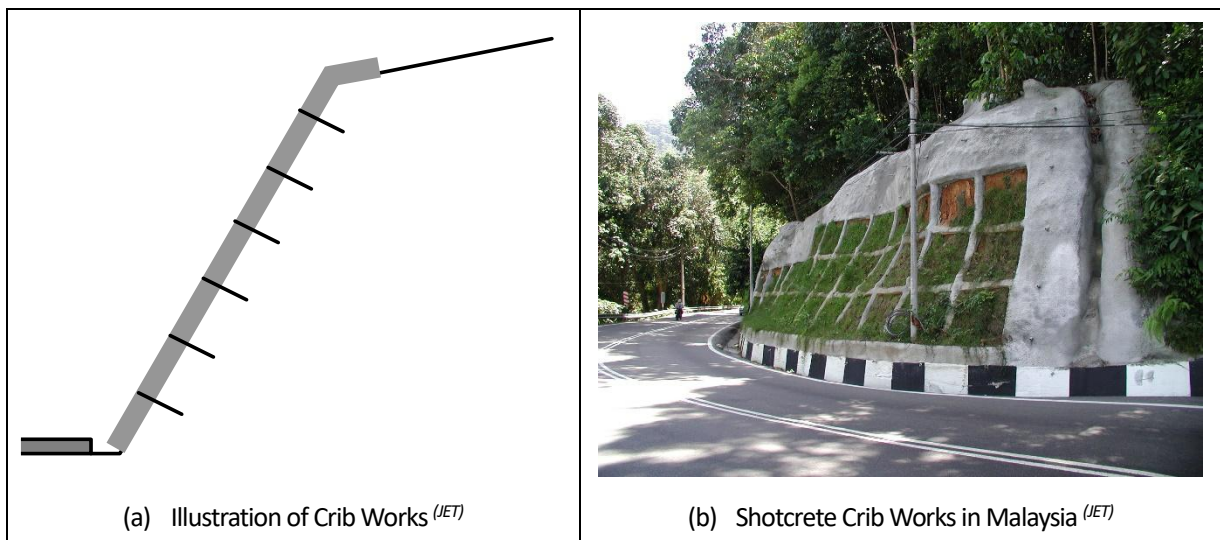


Figure 2.24 Illustrations of Crib Works (JET)

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- 1) National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism, Japan, (English)
- 2) Disaster Information Laboratory, National Research Institute for Earth Science and Disaster Resilience (NIED); https://dil.bosai.go.jp/workshop/01kouza_kiso/15houkai.html (Japanese)
- 3) JASDiM “Japan Association for Slope Disaster Management”
- 4) Syahril Azim Bin Saiful Bahri (2015); Nautica Gauge Mackintosh Prove
- 5) Non-Frame Method Study Group; <http://www.non-frame.com/index.html> (Japanese)
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(JET) JICA Expert Team for the project for control and mitigation of slope disasters in the central district in Republic of Honduras

Chapter 3. Rockfall

3.1 Realities of Rockfall

3.1.1 Appearance

Rockfall is a fragment of rock detached by sliding, toppling, or falling that falls along the vertical or sub-vertical cliff, progressing downward by bouncing and flying along ballistic trajectories or by rolling on talus or debris slopes. Alternatively, "rockfall is a natural downward motion of the detached block or series of blocks with small volume involving falling bouncing, rolling, and sliding".

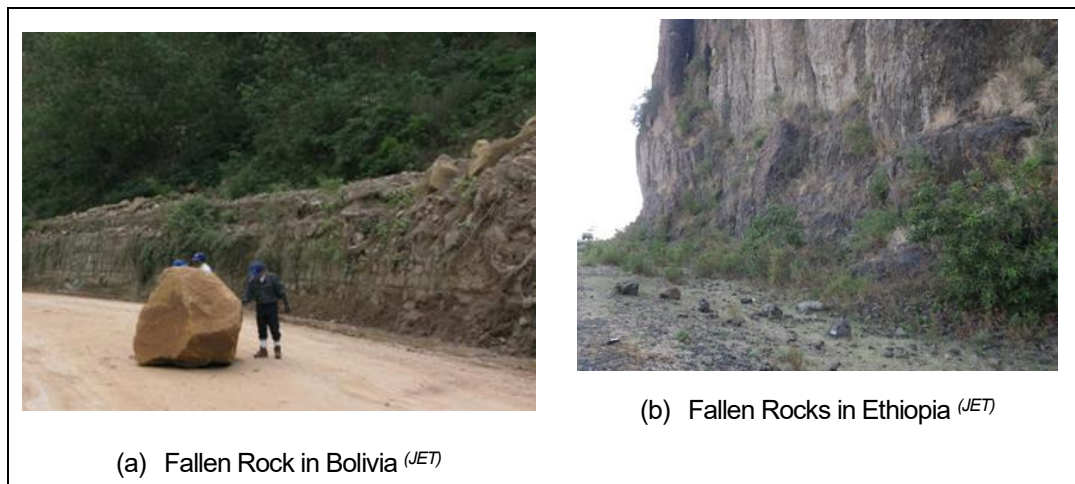


Figure 3.1 Rockfall

Favorable weak geological formation and climate are the principal causal mechanisms of rockfall, factors that include intact condition of the rock mass, discontinuities within the rock mass, weathering susceptibility, ground and surface water, freeze-thaw, root-wedging, and external stresses. A tree may be blown by the wind, which causes pressure at the root level and loosens rocks and can trigger a fall. The pieces of rock collect at the bottom creating a talus or scree. Rocks falling from the cliff may dislodge other rocks and serve to create another mass wasting process, for example an avalanche.

A cliff that has favorable geology to rockfall may be said to be incompetent. One that is not favorable to rockfall, which is better consolidated, may be said to be competent.

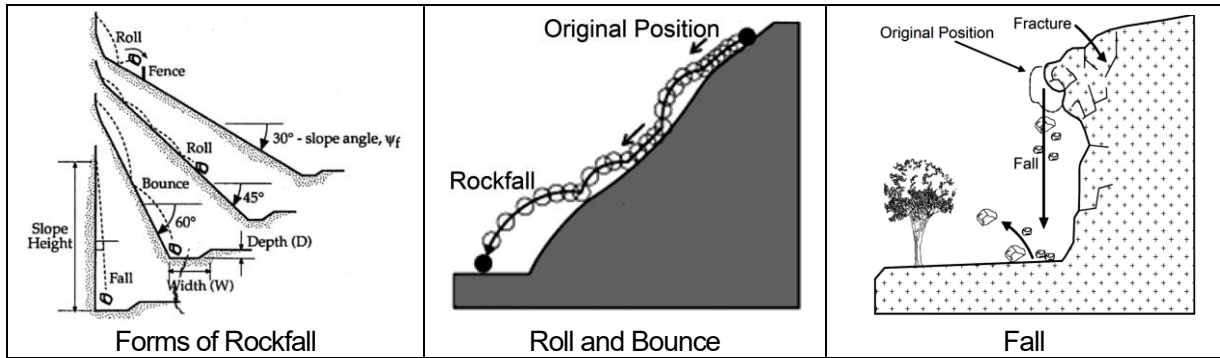


Figure 3.2 Rockfall – Fall, Bounce, Roll - ¹⁾

3.1.2 Vulnerabilities and Triggers of Rockfall

(1) Rockfall Vulnerabilities

Japanese standard defined the vulnerabilities of slope failure as follows

- A slope with stones or rock fragments on the surface
- A slope consists of rocks which is rich in cracks or fissures
- A slope consists of soft rocks which is easy to be eroded
- A slope consists of rocks which is easy to weather
- A slope consists of rocks with daylight structure

Slopes mentioned above are natural or cut slopes more than 15m high or natural slopes with angle of 30 degree. Figure 3.3 shows illustration of unstable rocks on slopes. (a) is colluvium on a slope, (b) and (c) are gravel layer, conglomerate, tuff breccia or terrace deposits, (d) is weathered massive rocks such as granite, (e) is fissured hard rocks, (f) is alternation of hard layer and soft layer. and weathered (b) are sometimes collapsed with fine material. That is similar to phenomenon of slope failure.

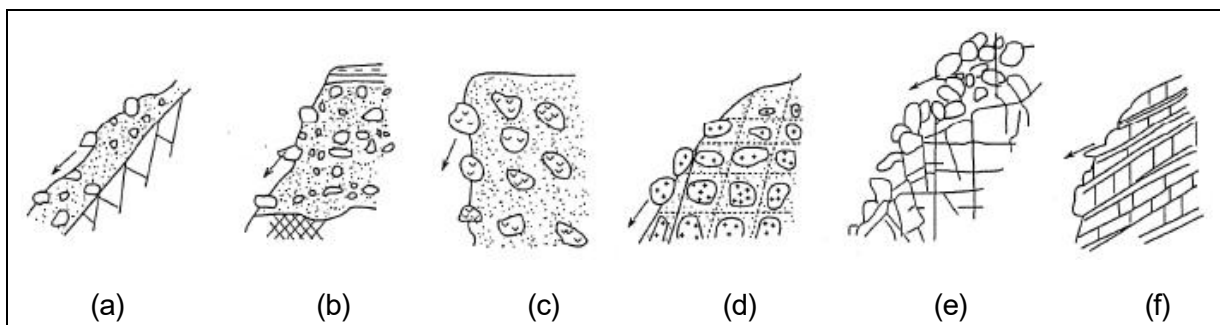


Figure 3.3 Unstable rocks on slopes ¹⁾

(2) Triggers

Triggers for rockfall are different on different occasions or different from location to location; therefore, no

single reason can be accounted as trigger for rockfall. This means there is no a single universally accepted reason why rocks fall is activated. However, the most popular causes are the followings,

- Rain fall: progress of vulnerability of the ground by the rainfall water
- Strong wind: vibration of trees by wind makes crack wider and rock detached
- Vegetation: roots of vegetables make cracks wider and rock detached
- Human activities: Disturbance of the ground by tread of humans
- Animals: Disturbance of the ground by tread of animals
- Heavy vehicle = vibration by heavy vehicle
- Landslide = deformation of the slope by landslide

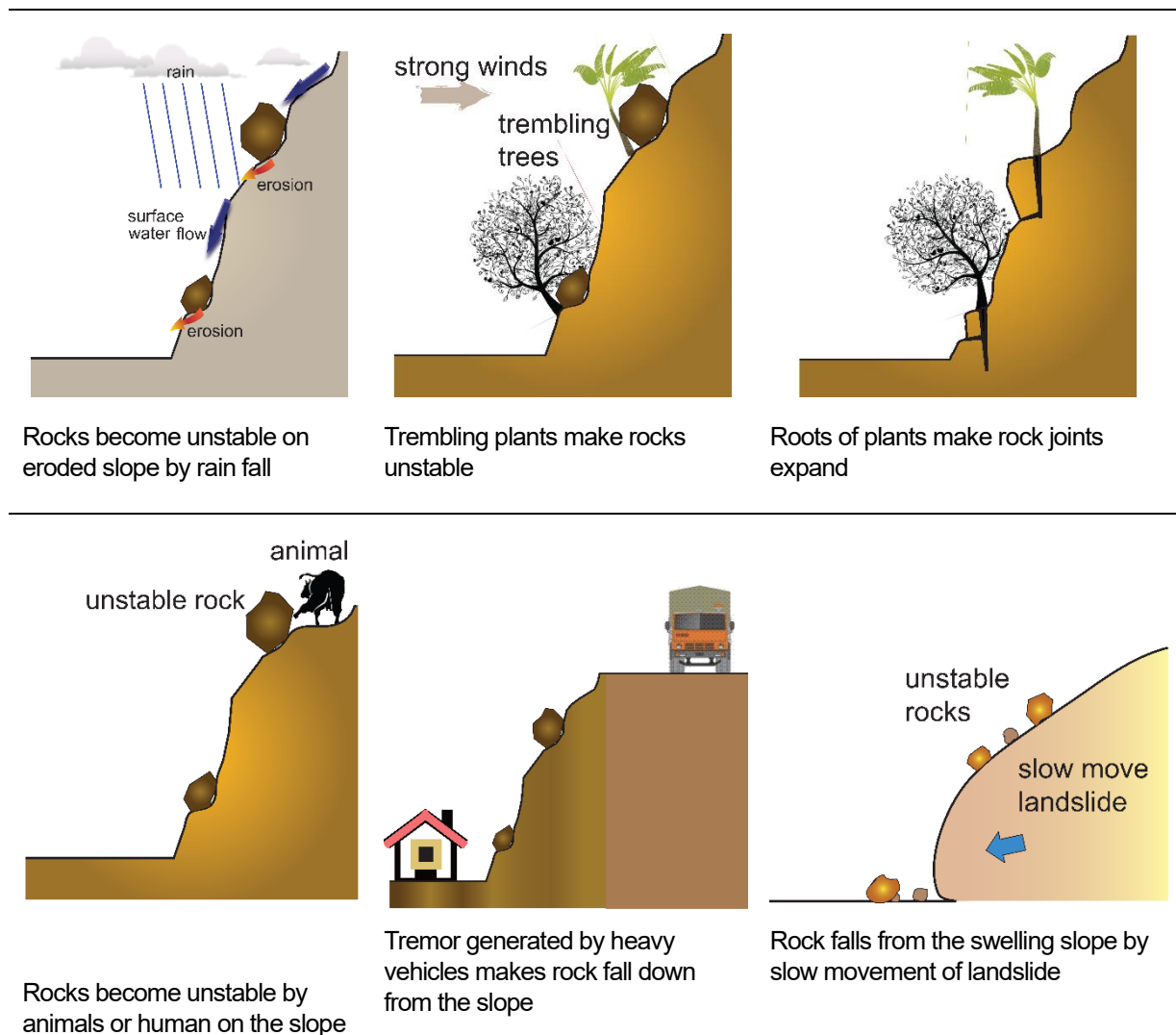


Figure 3.4 Triggers of rockfall (JET)

3.2 Measures against Rockfall

3.2.1 Basic Concept for Measures against Rockfall

The concept of the measures against rockfall is very similar to the concept of the measures against slope failures. When considering the measures of rockfall, consider the following order.

1st Step: Evacuation (Relocation) of Residents in Risk Area

2nd Step: Protection (Barrier) Works

3rd Step: Prevention works

Residents should be relocated as soon as possible to protect the lives of residents on the lower and upper parts of dangerous slopes. If it is hard for the residents to relocate, a barrier should be installed to block the residents outside of highly risk area and conservation targets on the lower part of the slope. When stabilization of the slope is required, prevention works should be installed to make slope steady.

3.2.2 Evacuation

In terms of rockfall, surrounding area of the slope which has experience of rockfall in past has potential of further rockfall hazard as well. Therefore, the people evacuation shall be considered to be applicable preferentially if the community, and the site condition allows applying the measure. With reference to and based on the past studies in Japan, The distance a falling rock reaches from the toe of the slope is the same height as the rock's original position (Figure 3.5).

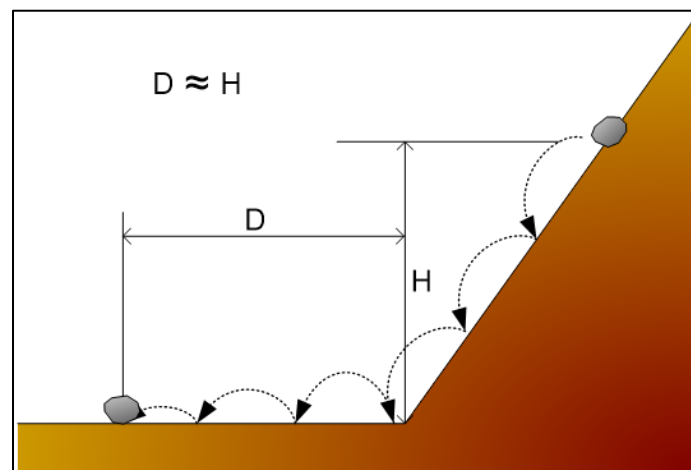


Figure 3.5 Influence area (D) of rockfall (JET)

The criteria that defines rockfall hazardous area includes land within a distance of the toe of the slope equal to two times the height of the slope (Figure 3.6). Houses in the Critical Area should relocate regardless of whether countermeasures are taken. This is both for the purpose of avoiding danger and for securing land for construction of the barriers (Figure 3.7). Hazard Area and Critical Area are shown in Figures 3.6 and 3.7 are same as slope failure.

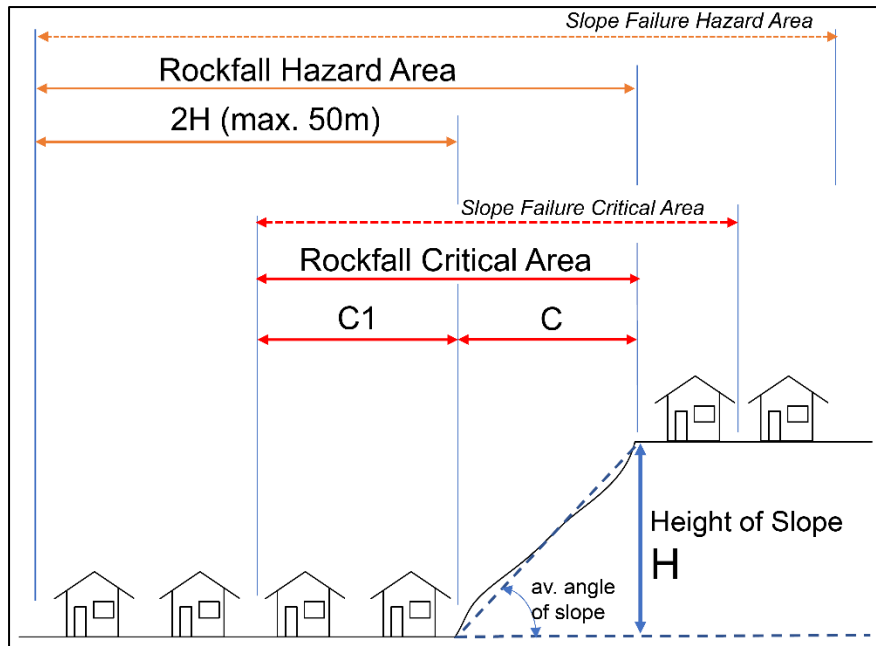


Figure 3.6 Hazard Area and Critical Area of Rockfall (JET)

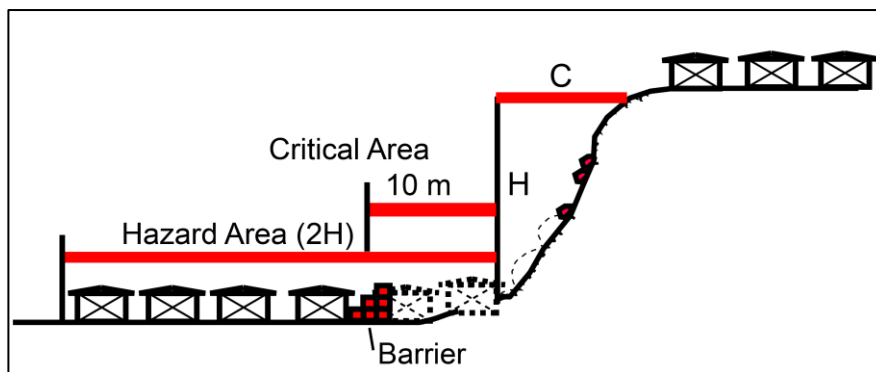


Figure 3.7 Critical Area with Barrier (JET)

3.2.3 Prevention Works

There are types of prevention works against rockfall as shown in Table 3.1.

Table 3.1 Principal Measure Works against Rockfall (JET)

	Type of Works	Works
Protection Works	Barrier	Barrier Wall, Barrier Net
Prevention Works	Removal Works	Remove Unstable Rocks, Cutting Works
	Restraint Works	Rock Net, Wire Net
	Slope Surface Retaining Works	Rock Bolt, Footing, Shotcrete, Crib Works

(1) Barrier (Protection Works)

Barrier walls could be most suitable as measure works against the rockfall in Tegucigalpa. Since this work is implemented by the construction of structure, maintenance is required after the installation / construction. Barriers are installed to protect houses in hazard areas. Between the barrier and the slope, the space and height of the barrier are required to store the fallen rocks. Generally, jumping height of falling rock is equal or less than 2m. Therefore, the height of the wall shall be more than 2m line in parallel with slope angle.

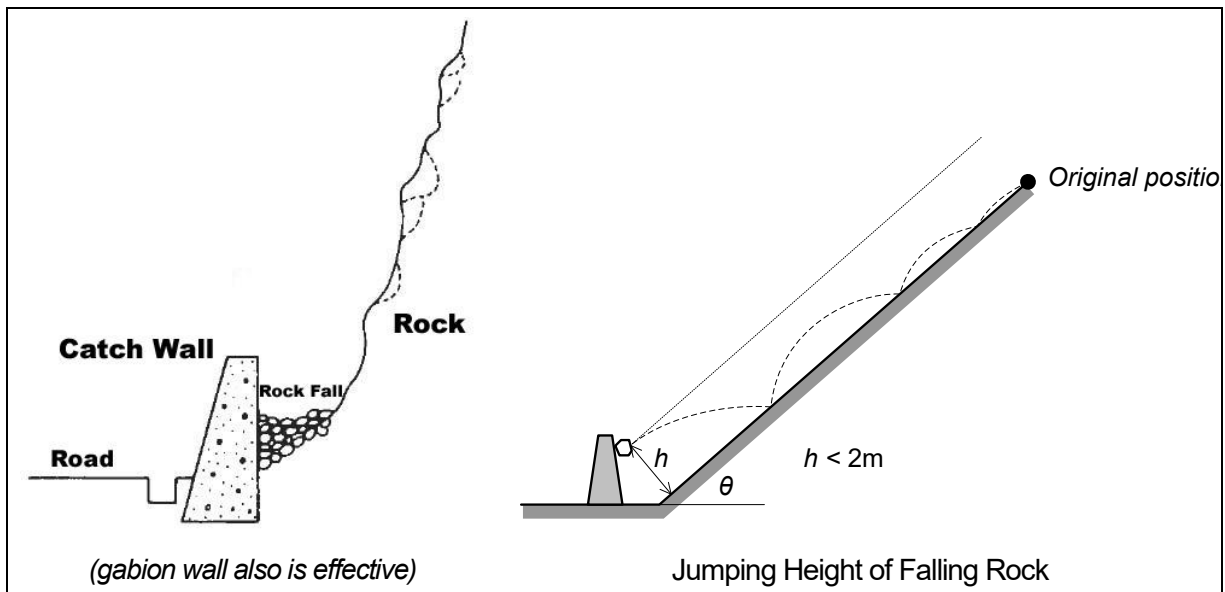


Figure 3.8 Barrier against rockfall (JET)

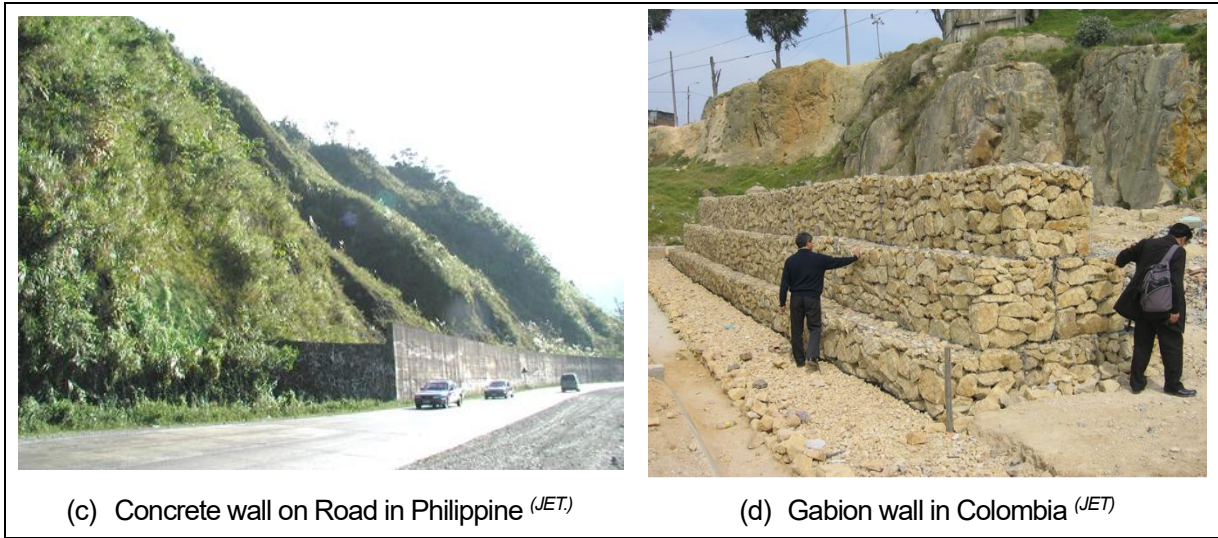


Figure 3.9 Barrier Walls

Rock falls down talus slopes tend to roll and stay close to the slope surface. In these conditions a lightweight chain-link fence placed either on the slope or along the outside edge of the ditch will decelerate or catch the rock. The position of the fence depends on the size of the blocks and the height of the fall.

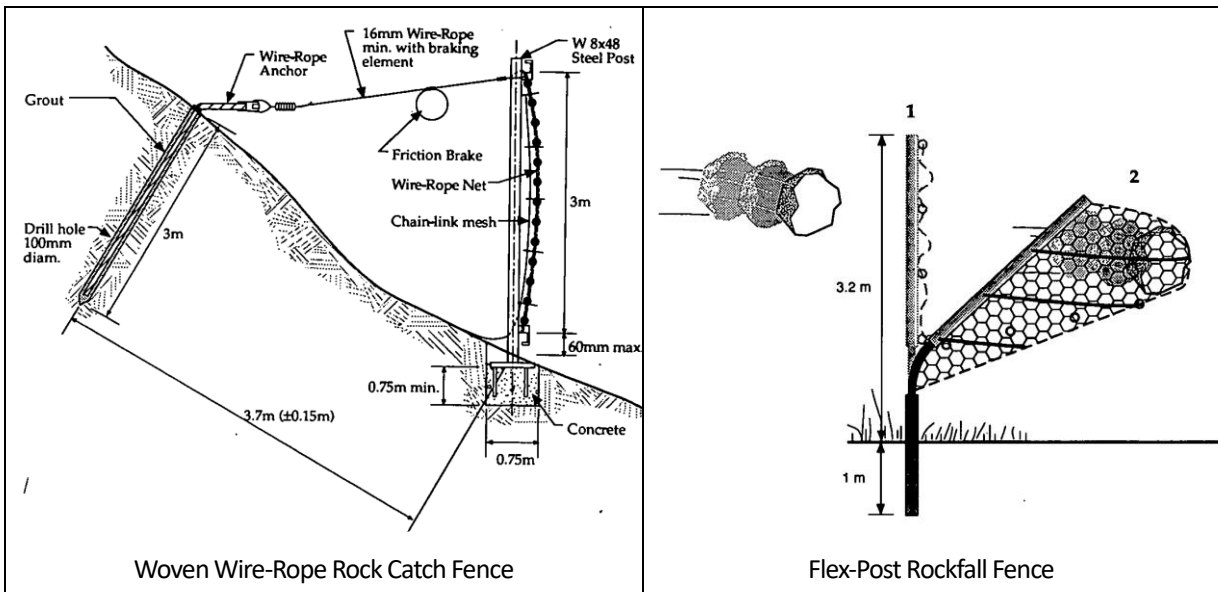


Figure 3.10 Rockfall Barrier other than Barrier Wall ¹⁾

(2) Removal Works (Prevention Works)

The removal work could be the most useful measure against rockfall. It shall be considered whether the work is applicable preferentially. Conditions for applicability of removal works are;

- Target unstable rock can be identified individually and is available number to remove;

- There is gentle / flat space above the slope in case to remove slope part to make gentle angle with unstable rock; and
- The work does not affect stability of surrounding slope or area.

Type of work for the Removal measure and required information/data for design of the works are shown in Table 3.2. The slope is often in unstable condition due to disturbance by the activities after the removal works. It is recommended to apply surface treatment work on the slope surface by shotcrete work of the vegetation work. Rock removal can be carried out by manual or using heavy machinery. In case of large scale rock removal work, it shall be broken by heavy machinery or blasting. Basically, blasting shall not be applied if there is slope which has hazard of landslide or slope failure on/around the site.

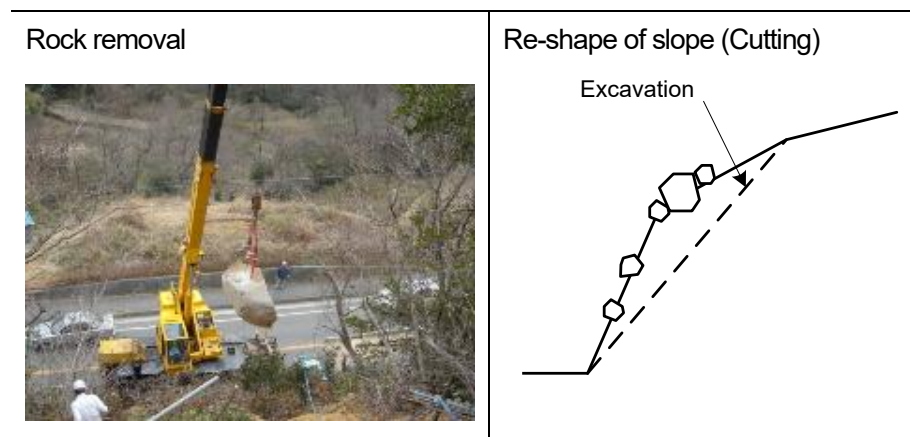


Figure 3.11 Removal Works (JET)

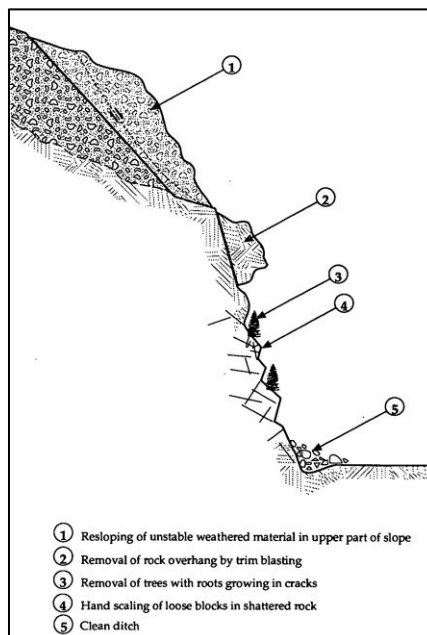


Figure 3.12 Removal Works on Hard Rock Cliff ¹⁾

(3) Restraint Works (Prevention Works)

Major works of restraint works are rock net and wire rope.

The rock net consists of high tensile net, such as high tensile strength steel wire mesh. The wire rope consists of high tensile rope, wire rope or ring net. Generally high tensile net mainly provides active protective (rock covering). wire ropes mainly provide passive protective (rockfall blocking). The rock net and wire rope are widely used in rockfall prevention and slopes stabilization. Generally, the rock net and wire rope are fastened to the slope tightly by the anchors and spike plates through prestressed tension. Then the boundary rope, sewing rope and connection clips will reinforce the rock net for solid and firm. When the rockfall comes, the large stones or debris will be blocked by the rock net and reduce the attack to the ground. Wire ropes using as passive rockfall prevention system, the steel post should be installed well with the foundation firstly, the wires will be fastened to the steel post and ground by anchors, it works together with buffering ring, and creating complete protection to the area.

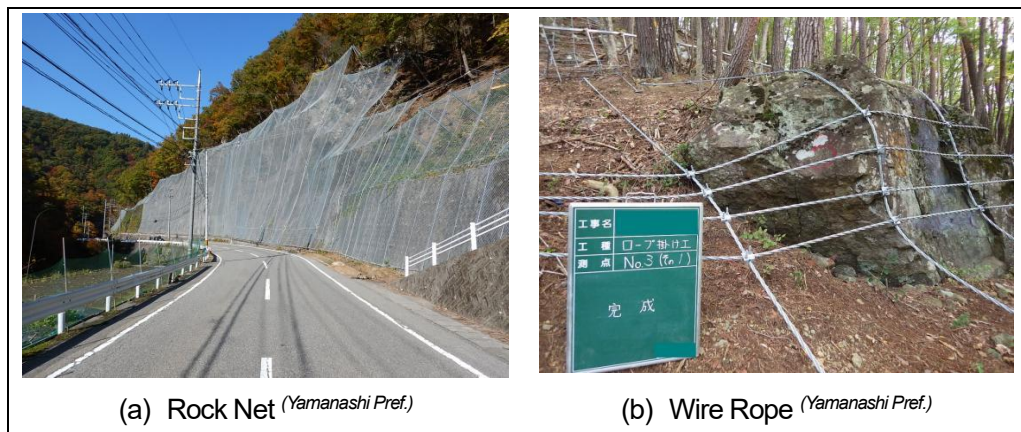


Figure 3.13 Examples of Restraint Works

(4) Slope Surface Retaining Works (Prevention Works)

It is to restrain rock failure by structure. It is to avoid by structure so that fallen rock not to reach to road. Condition for applicability of resistance works are;

- Unstable rocks can be identified clearly.
- It is feasible in terms of technical, financial and locational aspects to construct of the structure to restraint rock failure.
- There is enough space to install a structure to protect the road from falling rocks.

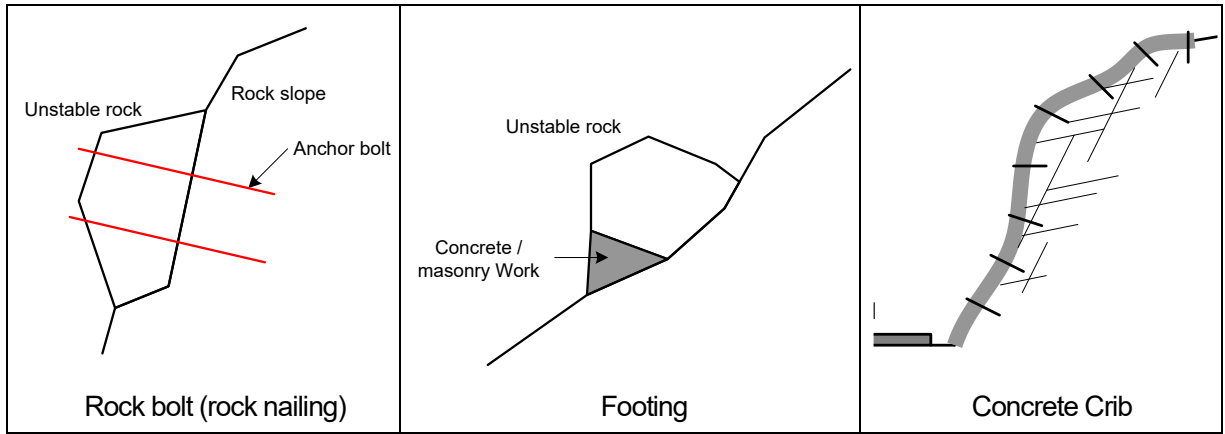


Figure 3.14 Type of Resistance / Restraint Measures

3.3 Investigation and Analysis for Mitigation Works

3.3.1 Investigation

The purpose of investigation is to determine the range of rockfall risk area and create rockfall modeling.

(1) Topographic Survey

The topographic maps become the basic materials for future, and are used consistently from survey plans to mitigation plans. It should be noted that topographic maps created from aerial photographs often do not show accurate topography. Topographic maps also can be created using LIDAR of which the microtopography can be easily read. The scale of the topographic map should be about 1/500 to 1/100.

a. Range of Topographic Survey

The survey shall be carried out with the same width as the slope, and the height direction is the same length as the slope on the top of the slope, and twice the length of the slope from the toe of the slope.

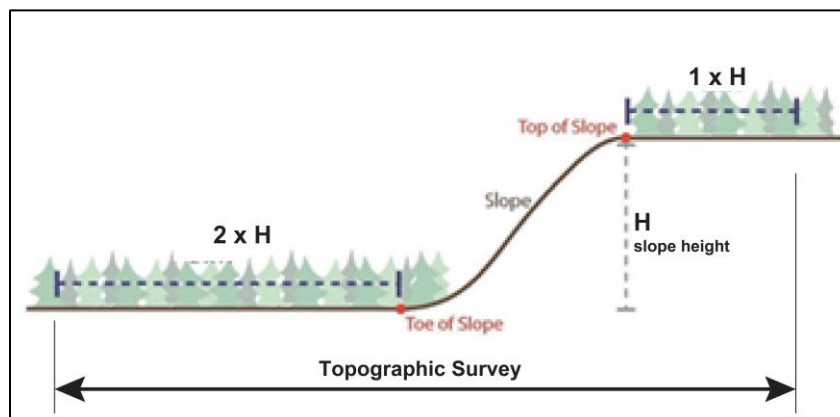


Figure 3.15 Range of Topographic Survey (JET)

b. Cross Section

A cross section survey is an important source of rockfall analysis. The section line is the basic line for determining the locations of geotechnical / geophysical explorations and rockfall analysis. The main section line should be set where the geology, geological structure, unstable rocks can be confirmed concretely, and the position and direction of the main section line suitable for the basic plan and basic design of mitigations. If the major unstable rocks are found several places, set several survey lines.

(2) Sight Reconnaissance

Location and size of unstable rock shall be confirmed by the site reconnaissance. Check points of the site reconnaissance are size, location (height and area), crack condition (opening and freshness), material of rock,

hardness, angle of slope, spring water / seepage, fallen rocks, vegetation on the slope, and so on. Additionally, records of past rockfall also will help to identify area of rockfall. There is a case that geological condition affects stability of rock. Through the observation and measurement with hammer and clinometers on the outcropping, the geological information of the slopes is obtained. In most cases, it is better to climb to the upper part of the slope and make the observations. The main items to be observed are shown below in Table 3.2.

Table 3.2 Geological information required for design ^(JET)

Geological structure	Stratum condition	Distribution condition of the stratum, boundary, strike and dip
	Cracks	Dimension of fault crushing belt, joints
Rock Properties	Rock formation and lithology	Type and strength of rock
	Weathering and deterioration	Degree of weathering and deterioration
Soil Properties	Type and component	Components of gravel and sands
	Situation of the deposits	Agglomeration degree, thickness, spring water

If slope is very steep or if unstable rocks remain on the slope, keep away from the slope and use a binocular and a camera to inspect the slope.







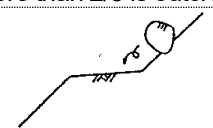
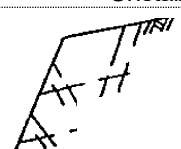
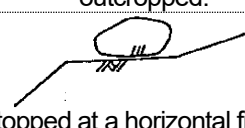
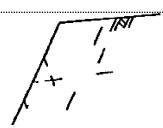
Evaluation of Stability of Rockfall

Stability evaluation is conducted for detached rocks or isolated rocks during the field reconnaissance (Table 3.3 and 3.4). Based on the evaluation results, the necessity and priority of countermeasure works are determined.

Table 3.3 Criterion of rock stability on a slope ^(JET)

Evaluation	Surface soil layer	Fallen rock or detached rock
Unstable	<ul style="list-style-type: none"> - The surface soil layer is thick (thicker than 50 cm); - Deformation occurred in the layer, or erosion occurred. 	<ul style="list-style-type: none"> - More than 2/3 of the diameter outcropping from the ground; - Completely isolated, which is moved by manpower easily.
Slightly unstable	<ul style="list-style-type: none"> - Although the layer is thick, deformation or erosion are not confirmed from the slope surface; - The surface soil layer is thick, but the possibility for moving and erosion exists. 	<ul style="list-style-type: none"> - The above phenomena rarely occurred; - Degree of the outcropping is small; - Slightly isolated and difficult to be moved by manpower.
Stable	<ul style="list-style-type: none"> - Only thin surface soil layer or no surface soil; - No deformation even in the vegetation. 	<ul style="list-style-type: none"> - No isolated rock or detached rock; - If there are isolated or detached rocks, they are in stable conditions.

Table 3.4 Examples of stability evaluation in field investigation ²⁾

State of stability	Fallen rock	Detached rock	Stability
1	 Stopped by tree.	 Completely detached.	Rockfall occurs in near future.
2	 Stopped at a steep cliff, or completely outcropped.	 Erosion is occurring at the lower part.	Although it is difficult to predict the failure time, rockfall occurs in this site.
3	 The lower slope is gentle, or more than 2/3 is outcropped.	 Unstable topography.	The possibility for rockfall is high.
4	 The lower slope is near horizontal, or 2/3 - 1/2 is outcropped.	 Intensive cracks.	The possibility for rockfall exists.
5	 Stopped at a horizontal field or less than half is outcropped.	 Almost sound.	There is no possibility for rockfall.

3.3.2 Analysis

(1) Rockfall Modeling

Figure 3.16 shows an example of the output from rock fall analysis. The larger plot shows the path of a single falling rock, which lands and comes to rest on the outer slope of the ditch. The inset shows the distribution for 100 rock falls with bounce heights at each 1.7-m horizontal interval measured from the top of the slope. Similar histograms can be obtained for the bounce height and rock velocity at the analysis point (in the example, this point is located at a 21.6-m horizontal distance from the top of the slope). The input for the program includes definitions of the slope and ditch geometry, irregularity (roughness) of the face, attenuation characteristics of the slope materials, and the size and shape of the block. The degree of variation in the shape of the ground surface is modeled by randomly varying the surface roughness in relation to the block size between fixed limits for each of a large number of runs. The results of analyses such as those shown in Figure 3.17, together with geological data on block sizes and shapes, can be used to estimate the dimensions of a ditch or its optimum position and the required height and strength of a fence or barrier. In some cases it may also be necessary to verify the design by constructing a test structure. In the following sections, types of ditches, fences, and barriers and the conditions in which they can be used are described.

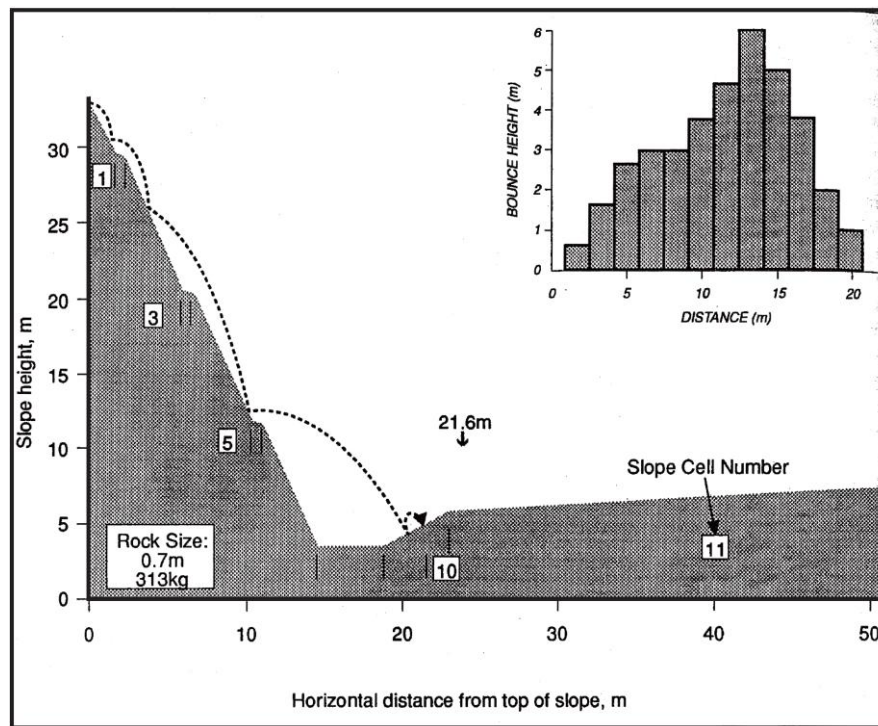


Figure 3.16 Example of rockfall simulation ¹⁾

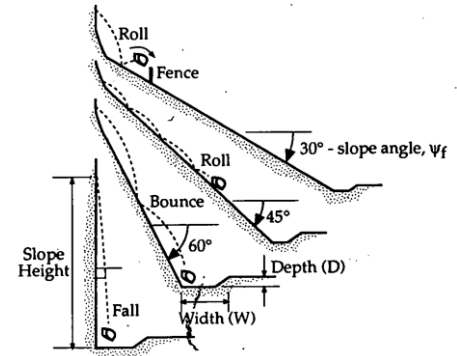
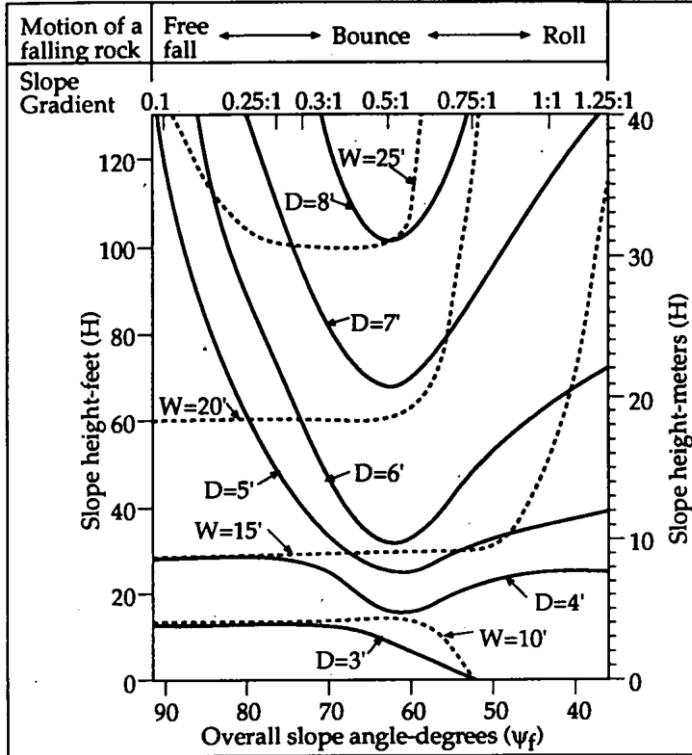


Figure 3.17 ¹⁾
 Design chart to determine required width and depth of rock catch ditches in relation to height and face angle of slope

(2) Influence Area and Energy of Rockfall

Rockfall simulation can be carried out to estimate the influence area and energy of falling rock if unstable rock is identified. For the simulation, detail and accurate cross section is required.

The formula below is the basic formula to obtain falling energy of a rock.

$$E = mgh$$

$$\therefore E = \frac{1}{2} \cdot m \cdot v^2$$

$$\therefore v^2 = 2 \cdot g \cdot h$$

E : impact energy of rock at road surface

m : mass of the rock

g : gravity

h : height of original position

v : velocity of the rock

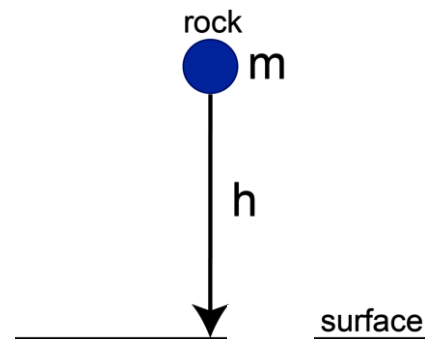


Figure 3.18 Energy of falling rock (JET)

Recently, rockfall simulation is popular to predict the impact energy of rock and impact position of the fallen rock. To do the simulation, exact topographical map and exact position of rock are necessary.

Decision of the Area to be applied the countermeasure work

The scope of the countermeasure work may need to take into account not only the local conditions but also the budget and construction period of the project. Therefore, it was decided to select areas of higher priority. The following describes the method used to determine the priority of the scope of application of countermeasure works at Fuerzas Unidas.

Although rock slopes are a source of falling rocks, the hazard of falling rock hazards differs depending on the location, such as the degree of slope instability and the presence or absence of conservation targets (residences). The target rock slope was divided into nine sections based on topography, and the rockfall hazard in each section was evaluated. There are no particular rules for this sectional classification, and engineers can classify the sections according to conditions that are easy for them to evaluate. The scope of application of countermeasure works is prioritized based on this rockfall hazard. The hazard assessment was based on three items: looseness of the rock slope, history of rockfall, and presence or absence of conservation targets (houses).

■ Looseness of the rock slope

The rock slopes include sections with crack openings, sections without crack openings, and sections with no cracks. The degree of slope loosening was evaluated by the relative number of rock masses regulated by the measured opening cracks to assess the degree of instability of each section.

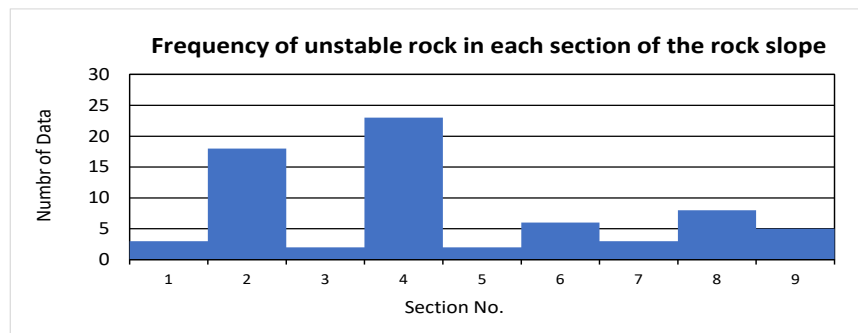


Figure 3.19 Frequency of unstable rock on each slope section

■ History of rockfall

The source and stop locations of the rockfalls that caused damage to the houses, as estimated by interviews with residents and field surveys, were confirmed in the field. These rockfalls are presumed to have originated from Sections 2, 4, and 5. The CODEM field survey at the time of the rockfalls confirmed that the rockfalls from Sections 4 and 5 were the result of the collapse of a collapsed rock mass within the collapsed soil layer. The rock mass was located on the sediment layer, and it is considered that the sediment under the foot of the rock mass was

unstable due to scouring by surface water, which led to the collapse. Based on these results, sections 2, 4, and 5 were evaluated as having a history of rockfall.

■ Presence or absence of conservation targets

Sections with houses or other conservation targets below the rock slope were rated as high priority for application of countermeasure works. As a result, except for Section 1 and Section 9, the target slope sections are considered to be affected by rockfall hazards if there are houses directly under the slopes and rockfall occurs from the slopes.

The results of the evaluation of the three aforementioned items are used for priority analysis (Table 3.5). The vertical axis of the matrix is the conservation target (house) and the history of falling rocks, and the horizontal axis is the degree of instability.

The priority rank in each slope section is determined from the combination of the results of the three aforementioned evaluation items. The priority ranks are divided into three categories, with rank 1 sections rated as having a relatively high priority rank and rank 3 sections rated as having a relatively low priority rank.

Table 3.5 Evaluation Matrix for Priority of Rockfall Countermeasure

House	History	Instability		
		High	Med.	Low
Y	Y	I	I	II
	N	I	II	II
N	Y	II	II	II
	N	III	III	III

LEGEND

Y: Yes

N: No

<Risk rank>

Rank I: High Risk

Rank II: Medium Risk

Rank III: Low Risk

Table 3.6 Result of Priority Evaluation to apply the countermeasure work in Fuerzas Unidas

Section	Instability	History	Conservation object (house)	Risk Rand
1	Low	N	N	III
2	High	Y	Y	I
3	Low	N	Y	III
4	High	Y	Y	I
5	Low	Y	Y	II
6	Medium	N	Y	II
7	Low	N	Y	III
8	Medium	N	Y	II
9	Medium	N	N	III

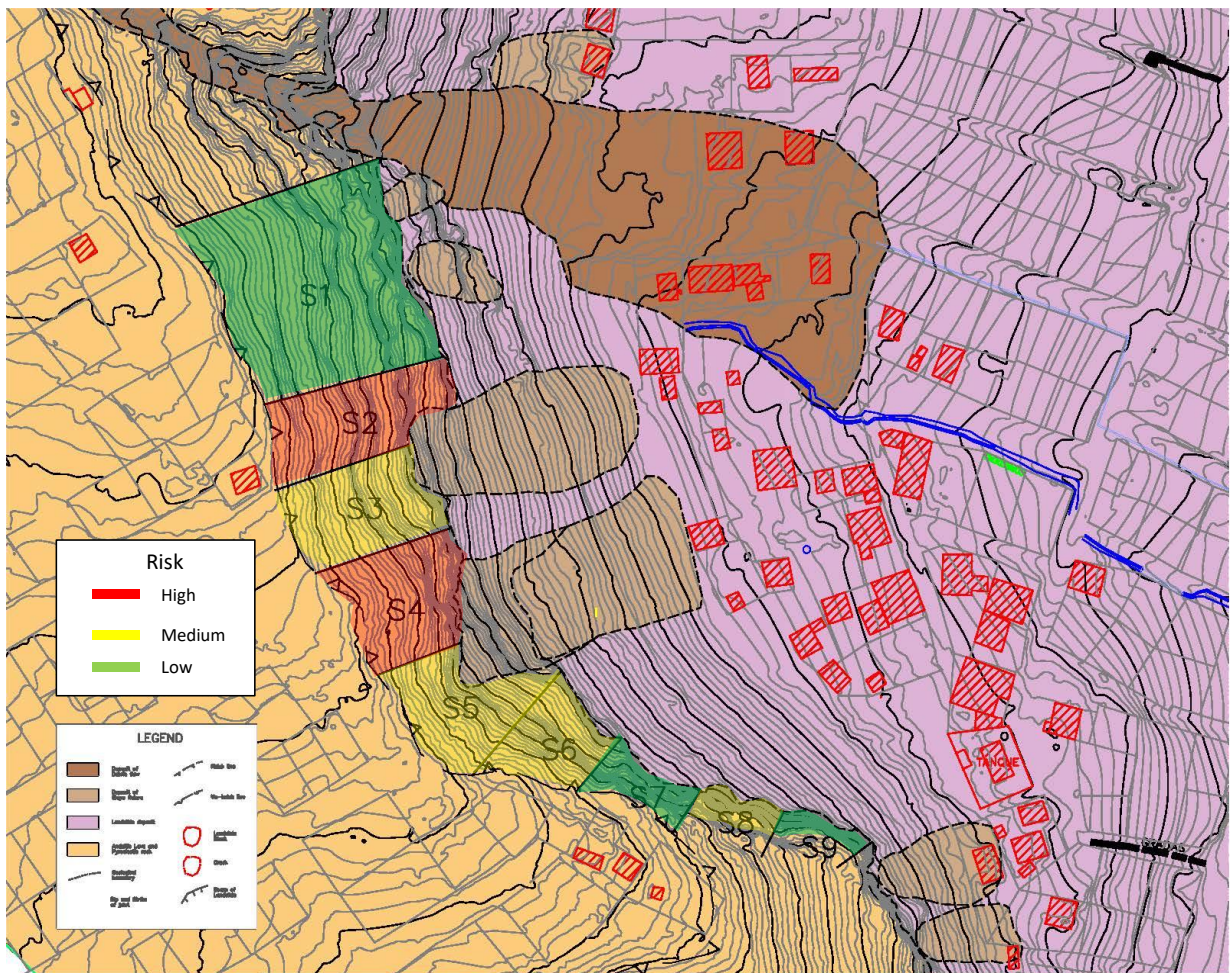


Figure 3.20 Result of Priority Evaluation to apply the countermeasure work in Fuerzas Unidas

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- 1) Transportation Research Board, National Research Council, USA (1996); Landslides – Investigation and Mitigation
- 2) National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism, Japan, (English)

(JET) JICA Expert Team for the project for control and mitigation of slope disasters in the central district in Republic of Honduras

Chapter 4. Risk Analysis

4.1 Risk Management against Landslide* Disaster

In general, the activities to prevent accidents and risks are called “risk management” and the activities that follow the occurrence of accidents or crisis situations are called “crisis management”. In the case of landslide* disaster prevention, emphasis should be placed on “risk management”. However, there are many landslide* risk, and moreover, it takes time and cost to implement mitigation works at one risk place. Every country is in a situation where “risk management” is not well implemented. Therefore, the concept of “non-structural measure” such as “evacuation” or “early warning” was born to protect only human life with priority against natural disasters.

Naturally, it is essential to take measures to protect social infrastructure such as life, property and social infrastructure.

Selection of Risk Places (Priority)

Risks are generally expressed as described below:

$$R=C_i \times P_i$$

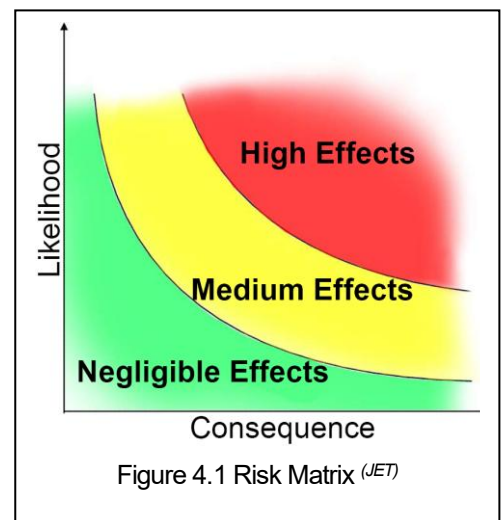
Where:

C_i : Magnitude of disaster (impact and size of the classification)

P_i : Probability of occurrence (there are cases of both quantitative and qualitative knowledge)

This is an important concept when considering disaster prevention. When using this definition, it is important not to judge a risk solely on the risk value obtained as a result of this multiplication. The risks of "low probability due to high magnitude of disaster" and "high probability due to low magnitude of disaster" are differentiated in their management. In many cases, if the risk value is the same, the risk of low probability with a high magnitude of disaster is recognized as the risk of greater importance.

Likewise, the risk matrix like the one in the diagram is an effective methodology to express the risk in an easy way to understand. The red area with high probability and high magnitude of disaster is called high effect area and it is an area where risks should be reduced. The area of high probability and small magnitude (small accidents, everyday disasters, etc.) and the area of high magnitude and low probability (large natural disasters, war, etc.) are called insignificant effects. Commonly, in the risks of the last 2 areas, it is judged that it is more rational to share the risk than to take



action. There are cases where the measure is taken to transfer the risk through insurance.

When considering the Tegucigalpa slope disaster, the objects of conservation are the life and property of the residents, and in some cases, social infrastructure such as roads and pipelines, and public facilities such as schools and hospitals. The scale of landslide* disasters are determined by considering these conservation targets. In particular, human lives are difficult to weigh, and cannot be determined solely by the number of affected homes. In some cases, political decisions are also necessary.

4.2 Structural Measures and Non-structural Measures

As measures before the 2 points previously indicated, in Japan the criteria of structural and non-structural measures are used. Structural measures are disaster prevention measures, where structures and/or equipment are used. Non-structural measures are methodologies to evacuate and avoid damage to life without using structures.

It is not possible to avoid the damage of people's properties with non-structural measures, although it is possible to avoid the damage of people's life and properties by taking structural measures. Therefore, it is desirable to take structural measures. However, taking structural measures for all landslide* risk places costs a great deal of time and money. The measures against the slope disasters should be taken that combine the structural with the non-structural.

Non-structural Measures in Tegucigalpa

Non-structural measures in landslide* disaster prevention management are to detect the occurrence of disasters in advance and evacuate people from dangerous slopes before disasters occur. The most desirable method is to keep people out of dangerous slopes on a daily basis, but in reality, there are houses and residents living near dangerous slopes in Tegucigalpa. This is so-called early warning, a measure that restricts the passage of people and vehicles only when the risk is imminent. The idea is that no matter what happens to houses, if there are no people in the place when a disaster occurs, people's lives can be protected. The most important thing in early warning is to know as accurately as possible when and where risks occur. Everyone knows that when there is a lot of rain, there are many landslide* disasters. Anyone can think of a way to escape from a disaster-prone area when it rains a lot. Unfortunately that simple method is by far the most effective one.

“How much rain is dangerous?”, “Where are the dangerous places?”, knowing it as accurately as possible is an important point in early warning. It is clear that there are more slope disasters during heavy rains, but not all slopes are prone to disasters, and more slopes do not. Even if a disaster does not occur due to this heavy rain, it may be possible that the disaster will occur next time. Furthermore, slope disasters may occur in situations other than rainfall, and it may be necessary to consider early warning using indicators other than rainfall. In other words,

no method of early warning is 100% certain, even though human lives are at stake. In addition to the prediction of disasters, people's response is very important.

Identifying the risk area

When signs of a disaster are identified, residents should evacuate immediately. To this end, it is helpful to know in advance which areas may be affected by disasters and to inform residents living in those areas to help ensure smooth evacuation. The following are the criteria used in Japan to determine the area potentially affected by a disaster (refer to figure below). These criteria differ for landslides and slope failure/rockfall. Tentative risk areas are estimated using this criterion on the desk, and then the researcher goes to the site and confirms the actual situation using the results of the desk study to finalize the risk areas.

The risk area for landslide site is divided into four zones: "Landslide zone", "Special warning zone", "Sediment disaster warning zone" and "other than the warning zone", and the hazard area for slope failure/rockfall site is divided into three zones: "Steep slope hazard zone", "Sediment disaster warning zone" and "other than the warning zone".

Furthermore, the risks in the event of a disaster in the risk areas are analyzed. The risk was evaluated by a combination of the hazard of slope disaster (Hazard) and the importance of facilities and infrastructure affected by the disaster (Importance). The hazard of slope disaster is judged based on the risk zoning classification standard mentioned above. In the case of a landslide area, the importance of the "landslide zone", facilities and infrastructure are judged to be higher for those with higher publicity. The importance can be evaluated based on the results of an interview survey to residence. The risk evaluation would be performed using the matrix shown below.

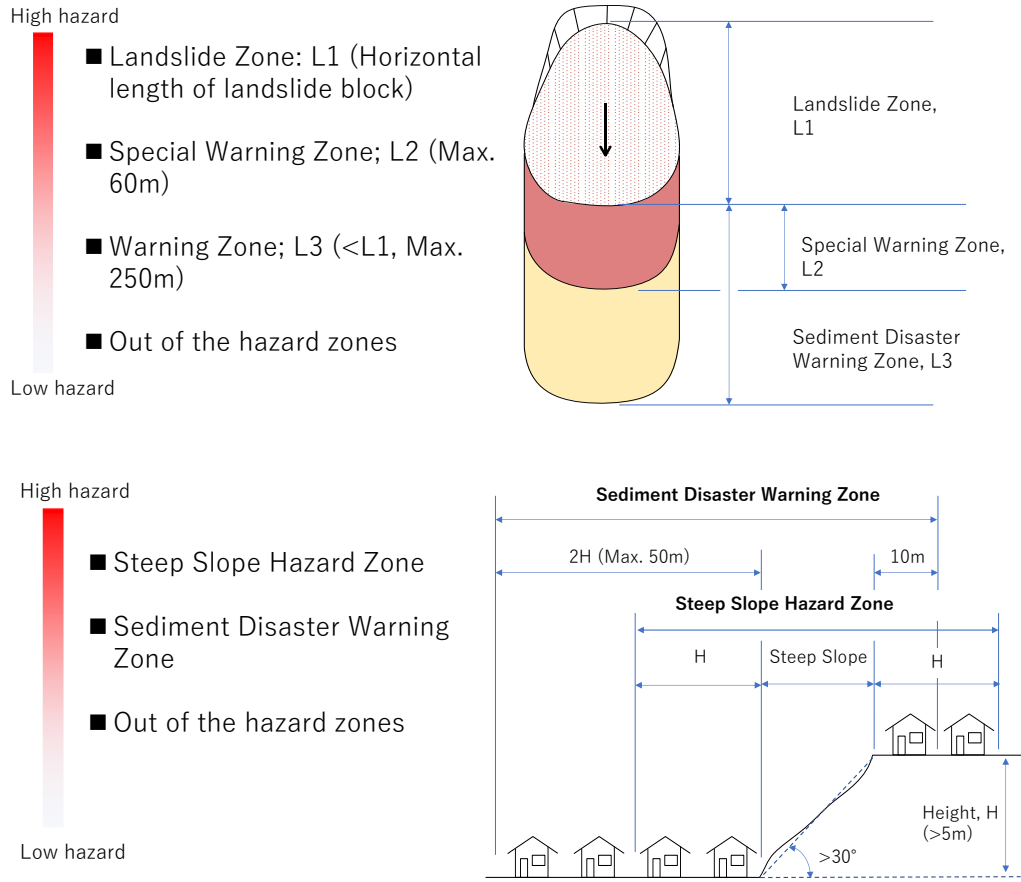


Figure 4.21 Risk zoning classification standard (for Landslide (upper), for slope failure/rockfall (lower))

<p>High</p> <p>↑</p> <p>Hazard</p> <p>↓</p> <p>Low</p>	LS+SSH zone	C3	B1	A3	A2	A1
	Landslide	C3	B2	B1	A3	A2
	Special W zone/SSH zone	C3	B3	B2	B1	A3
	LS/SSH + Warning zone	C3	C1	B3	B2	B1
	(Sediment) Warning zone	C3	C2	C1	B3	B2
	Out of hazard zone	C3	C3	C3	C3	C3
		None	Infra line	Road	House	Public facility
		Low	Importance			high

Figure 4.3 Risk evaluation matrix

People's Action

When the weather forecast predicts heavy rain, the residents in the landslide* risk area will start preparing for evacuation, and when the heavy rain warning is issued, the residents in the landslide* risk area evacuate to a predetermined safe place. Residents get information from TV, radio, etc.

Make the residents aware both landslide risk area and safe area in advance, and make them to confirm when to evacuate and where to evacuate.