



# Roadmap to Stability

## Actions to Reduce the Landslide Risk in Aizawl

Landslide Policy Committee for Aizawl City

February 2014

Technical Support by:





Aizawl is in earthquake hazard zone V and highly prone to natural, man-made and earthquake induced landslides. In order to mitigate the consequences of destructive landslides, the Aizawl Municipal Corporation (AMC) formed the Landslide Policy Committee, comprising of stakeholder departments of the Government of Mizoram. Its task was to develop policies and plans to reduce losses in future earthquakes and landslides in Aizawl. ***The Roadmap to Stability*** is a plan for action that defines roles for these stakeholder departments and includes a timeline for implementation.

GeoHazards International has provided technical support to the Landslide Policy Committee, developed a science-based disaster scenario that served as a basis for the plan, and assisted in developing a detailed landslide hazard-zonation map for the city. The scenario shows the consequences of a plausible magnitude 7 earthquake, which include more than one thousand landslides triggered all at once during shaking.

### **Names of Departments**

1. Public Health Engineering Department (PHED)
2. Public Works Department (PWD)
3. Land Revenue & Settlement Department (LR&S)
4. Disaster Management & Rehabilitation Department (DM&R)
5. Mizoram Remote Sensing Application Centre (MIRSAC)
6. Geological Survey of India (GSI)
7. Mizoram University (MZU)
8. Aizawl Municipal Corporation (AMC)
9. Directorate of Geology & Mineral Resources (DG&MR)



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Policy or Action Title	Responsible Agency (Contact Person)	Actions Needed	Implementation Time		
			Short Term (1-2 years)	Medium Term (2-4 years)	Long Term (4-6 years)
<b>1. Development Controls</b>	AMC	1. Adopt rules that require a permit for all excavation or filling involving more than 10 cubic meters of soil or rock.	Development regulations Draft by AMC	Approval of draft Development Regulations by State Government	
	AMC	2. Amend the Building Regulations to require owners in designated high hazard areas submit a geologic report to AMC for review and approval before developing a building site, and that all excavations over one meter be observed periodically by a geologist to assure slope stability.			✓
	AMC , DG&MR	3. Require operators of quarries to submit a report prepared by a qualified geologist and/or geotechnical engineer for review and approval before initiating quarrying operations, and that all new and existing quarry operations be observed periodically by a geologist to assure slope stability.	Development regulations Draft by AMC	Approval of draft Dev Reg by State Govt	
	AMC	4. Require that excavated soil and rock be disposed of outside of Aizawl City or be placed and compacted in a manner that does not affect other parcel owners.	Development regulations Draft by AMC	Approval of draft Dev Reg by State Govt	
	AMC	5. AMC should have controlling authority for all developmental activities (Roads, Drainage, quarries etc.) within AMC area.		✓	



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<b>2. Surface Runoff</b>	PHED	1. Adopt and implement a five year capital outlay plan to design and construct facilities to capture and transport rain and waste water away from exposed hillslopes and ejected at locations that will not saturate potentially unstable slopes or cause adverse erosion to slopes.			✓
	PHED	2. Complete plans to construct sewerage collection and treatment facilities and to eliminate all septic tanks, leach fields and soak pits within Aizawl City.			✓
	PHED, AMC	3. Create an office within the Public Health Engineering Department to design and build, monitor and repair or improve drainage systems. (* AMC to strive to expedite this with PHED)			✓
	AMC, LR&S	4. Management of solid waste such that waste does not block natural & manmade drainage systems and enforce existing rules regarding disposal.			✓



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<b>3. Appoint Staff Geologists</b>	AMC	Hire and train a team of about five geologists to perform duties including but not limited to review geology reports submitted by owners, inspect sites prior to the issuance of permits to excavate building sites, initiate quarrying activities, place spoils materials, and periodically conduct unannounced site inspections to assure cutting and filling are done in accordance with the approved permit and that assumed conditions have not changed creating unsafe situations (conditions) and to monitor incipient landslides.	One Geologist in first 2 years.	Three Geologist staff members in four years	Five Geologist staff members in six years
<b>4. Establish a Geologic Review Board</b>	AMC	Create a Geologic Review Board, and provide administrative and technical support. The Review Board would review and evaluate geologic products such as maps, review projects carried out by other agencies that involve cutting and filling (including roads, site development for government structures, landslide remediation, etc.) and resolve disputes between geologists representing owners and AMC geologists and advise AMC.	✓		
		The Board would consist of three to five geologists and one geotechnical engineer from universities, Directorate of Geology and Mineral Resources, the Geologic Survey of India, and geologists in private practice.			
<b>5. Prepare Base and Geologic Maps</b>	MIRSAC, DG&MR, GSI	Develop a base map at a scale of 1:1000 with existing five meter resolution and 2 to 5 meter contours for Aizawl City and areas where development is proposed (Aizawl Urban Area as defined in the Master Plan: Vision 2030).	✓		



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6. Prepare Interim Geologic Maps and Landslide hazard maps	MIRSAC, DG&MR, GSI	Prepare maps at a scale of 1:8000 for the Aizawl Urban Area that indicate surface geology and structure and include existing landslides and areas prone to slides.	✓	✓	
7. Prepare Final Geologic Maps and Landslide Hazard Maps	MIRSAC, DG&MR, GSI	Prepare geologic and landslide hazard maps of Aizawl Urban Area at a scale of 1:1000; project specific maps would be at 1:500 scale.		✓	✓
8. Creation of new building sites	LR&S	Allocate house sites only after coordinating with AMC and in conformance with the Master and Zonal Plans.		✓	
9. Creation of new housing sites	DG&MR	Prepare landslide hazard maps for unallocated lands, have site-specific geological investigation of sites and access routes for roads and utilities completed and undertake (complete) measures to stabilize areas before allocating parcels.		✓	
10. Parcel Allocation	LR&S	Adopt a policy to encourage and plan for the growth of new communities in areas not threatened by landslides; and policy to require the consideration of geologic hazards before issuing Land Settlement Certificates.	✓ Corresponds with the development of Interim Maps)	✓ Corresponds with the development of Interim Maps	
11. Master Planning	AMC	Integrate new geological information into planning documents during the reviews of the Master Plan. The Master Plan is to be reviewed every five years.		✓	



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12. Landslide Remediation	DM&R, AMC	Adopt a policy to remediate unsafe areas (and landslide areas) that threaten critical utilities and roads and create a 'landslide circle' responsible for designing projects, supervising construction and maintaining improvements; Execution of this policy should be coordinated between DM&R and AMC.	Ongoing ✓		
13. Condemnation of unsafe buildings and areas	DM&R, AMC	Continue to apply existing policies that empower agencies to require evacuation and demolition of unsafe buildings and neighborhoods.	Ongoing ✓		
14. Landslide Monitoring and Early Warning	Mizoram University (MZU)	1. Initiate a program to monitor existing landslides and issue warnings to residents (meteorological & geo-technical).	✓		
		2. Develop the capacity to monitor potentially unsafe slopes and deliver early warning to those affected. This would include the authority to install, monitor and maintain sensor equipment and to issue public warnings of imminent landslide hazard.	✓		
15. Professional Licensure	AMC	Require that professional geologists and geotechnical engineers be evaluated for technical knowledge and competence and licensed to work in Aizawl	✓		
16. Data Collection	AMC	Initiate a program to collect and compile soil data and fresh borings, test results, geologic reports etc. and make them available.	✓		