SEACAP 21/004 Landslide Management

Mainstreaming Slope Stability Management

Theme 7 Remedial Measures:

Selection of Options

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Procedural steps

- Use of Slope and Roadside Inspections to Identify Slope Problems (Theme 4)
- Use of Slope and Roadside Assessments to Diagnose the Problems (Theme 4)
- Assess the Level of Hazard and Risk Posed by each Problem to the Operation and Stability of the Road and Adjacent Features (houses etc) and Prioritise Accordingly (Theme 5)
- Determine the Need for Engineering Geological Investigation and Carry out if Necessary (Theme 6)
- Review and Select Remedial Options

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Key Considerations in the Identification and Selection of Options:

- **Size and depth of landslide or slope failure**
- **Is the failure involving or likely to involve soil or rock, or a combination of both?**
- **What is the mechanism of failure?**
- **What is the cause of the failure?**
- **Are the remedial measures planned to result in complete or partial stabilisation?**

IT IS THE IDENTIFICATION OF THE CAUSE AND EXTENT OF SLOPE FAILURE THAT IS MOST IMPORTANT IN DETERMINING REMEDIAL MEASURES (Themes 1 and 2)

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These assessments will lead to the following management decision

Either:

- **The slope hazard is too large to be completely or even partially stabilised with any confidence**

Or:

- **An investment in remedial measures is likely to yield a significant improvement in stability**

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If the scale of the slope hazard is considered to be too large to be stabilised, then there are two main options:

- Avoid the instability, for example by realigning the road or removing an unstable slope mass (usually only possible for small volumes).
- Do nothing, or just keep the road open by regular clearance and repair operations. This can be the most cost-effective option on low traffic roads or on very large failures where continuing large scale instability is expected for several more years, and is beyond current economic justification.

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Assuming a decision is made to proceed with remedial measures then one or a combination of the following should be considered

- Slope stabilisation. The arresting of structural and mass movements within a slope. In engineering terms this means either the reduction of driving forces (e.g. excess weight at the top of a section of slope) or the increase of resistance through an external force (e.g. a retaining wall).
- Slope protection. The prevention of surface degradation on a slope. This means strengthening the surface (e.g. with a rip-rap stone covering) or reducing the energy of runoff water (e.g. by interrupting flow with a vegetation cover).
- Slope drainage. The provision of either shallow drainage to remove mainly surface water or deeper drainage to remove mainly groundwater. This strengthens the slope by increasing the internal resistance (i.e. by reducing pore water pressures).

In Lao, it is usual to find that remedial techniques commonly comprise:

i) Excavation/removal

ii) Retaining wall

iii) Surface drainage

iv) Slope protection

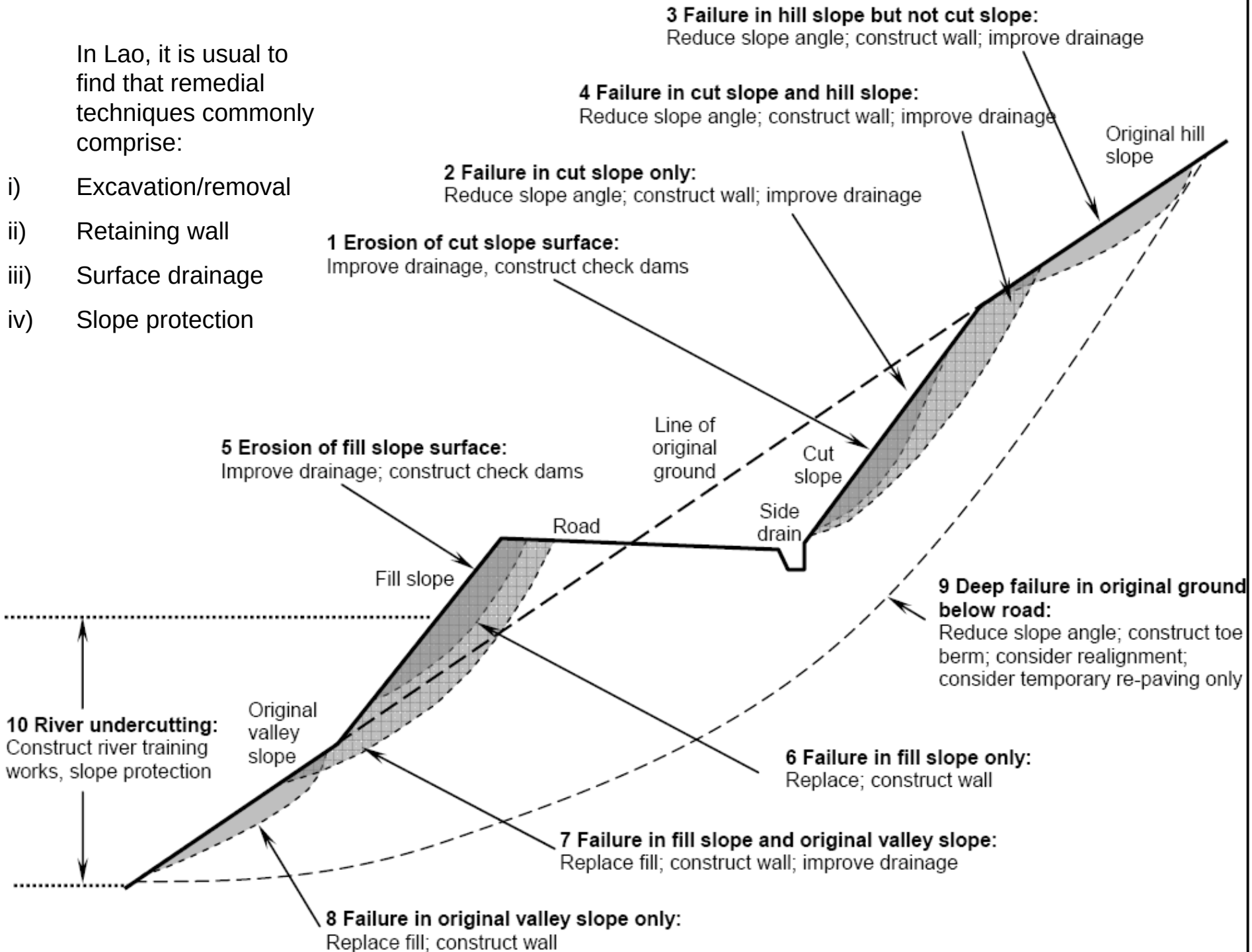
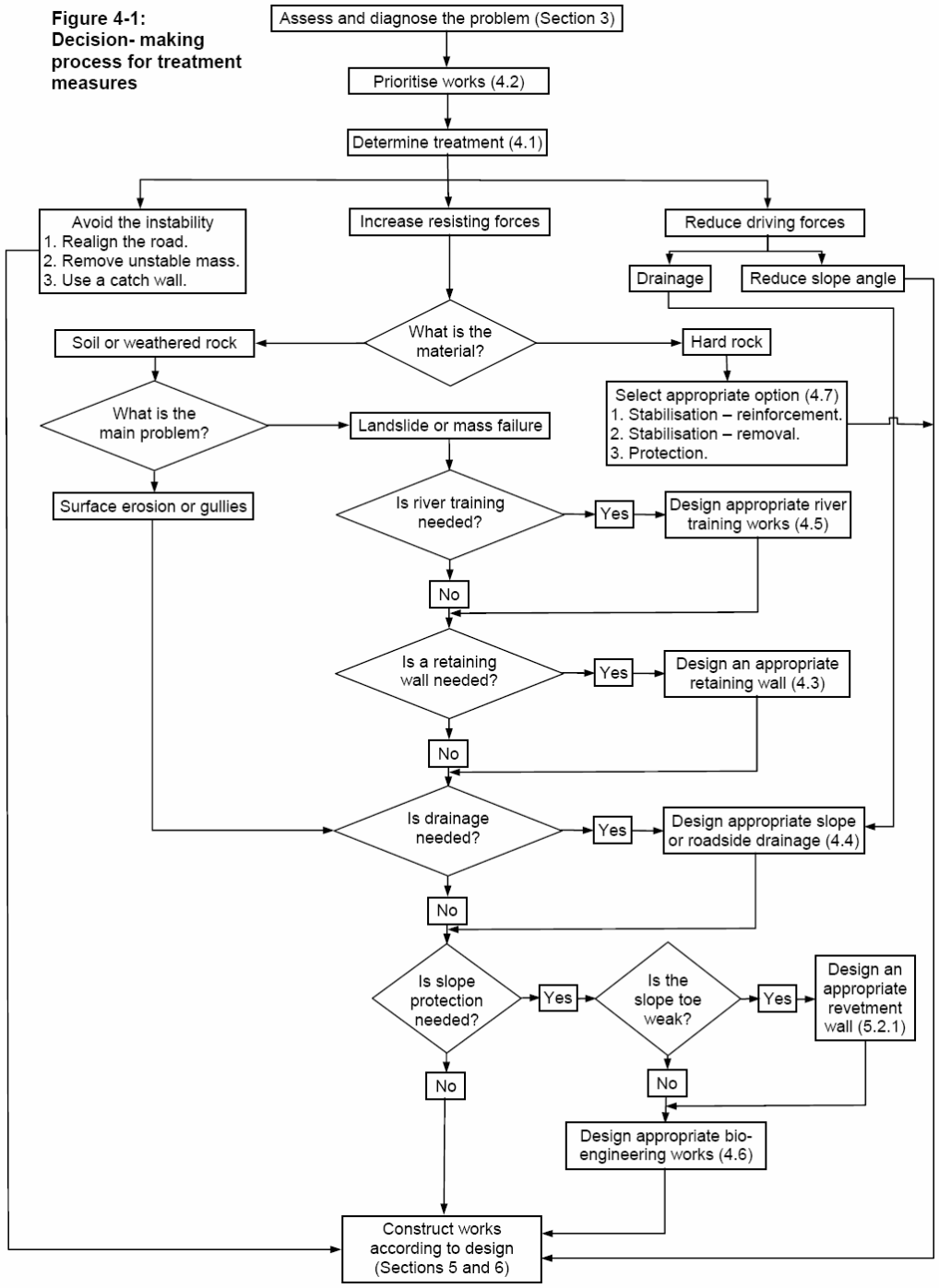


Figure 4-1: Decision- making process for treatment measures



Decision- making process for selection of remedial options