
**Improvement of Visual Appearance and Landscape Treatment
for Man-made Slopes and Retaining Walls**

Introduction

From time to time, the public complains about the adverse visual impact of slopes covered with shotcrete or chunam. Other than unpleasantness, this type of man-made slopes are much more heat-reflective than the vegetated ones. Vegetation, apart from serving the important landscape function, works against the greenhouse effect through absorption of carbon dioxide and helps to mitigate the “urban heat island” effect.

2. To improve the built environment, it is important to make engineered slopes as natural as possible, to blend them in with the surroundings and to minimize their visual impact. There is, therefore, a need to minimize the use of shotcrete and chunam and to promulgate technical guidelines and good practice in landscape treatment and bio-engineering.

3. This Practice Note provides advice and technical guidelines to promote good practice in landscape treatment and bio-engineering for man-made slopes and retaining walls. The Building Authority strongly recommends authorized persons and registered structural engineers to follow these guidelines and procedures in forming new slopes or retaining walls, and in upgrading and maintaining of existing ones.

Landscape Input in Formation, Upgrading and Maintenance of Slopes and Retaining Walls

4. In the formation, upgrading and maintenance of slopes and retaining walls, due consideration should be given to incorporate landscape measures to improve the visual appearance of these features. Landscape treatment should be provided, wherever possible, to all newly formed or newly upgraded slopes and the use of shotcrete or chunam on slopes should only be considered as a last resort. Guidance on the use of shotcrete and chunam, landscape treatment and bio-engineering in slope works as depicted in Appendix A should be followed.

5. It should be borne in mind that large slopes are not only costly to construct and maintain, it may also be difficult to blend them in with the environment. Such slopes should, wherever possible, be avoided or reduced in size by replanning the layout of the development, or by the use of structural support such as retaining structures provided that they are not too massive or visually obtrusive.

6. In designing and executing upgrading or maintenance works for slopes and retaining walls, endeavours should be made to preserve and protect any existing healthy trees. To ensure the continuing healthy growth of the trees, due care should be taken to avoid any damage/weakening of the crown, trunk or root system during the works. If the slope has to be covered by shotcrete or chunam, tree rings of sufficient size should be provided to allow adequate supply of air and water to reach the tree roots. The slope works should also include, where necessary, structural supports to prevent trees from falling over due to their own-weight or in combination with other external forces such as strong wind. The structural support should not be visually obtrusive and measures should be incorporated to make it blend with the environment if needed.

7. Unhealthy or decaying trees may fall causing injuries or deaths to persons and damage to property if not properly trimmed or removed. It is advisable that the AP should arrange a suitably experienced person to conduct a thorough inspection of vegetation growth of the slope concerned, paying particular attention to any unhealthy or decaying tree which may pose a danger to the public if it falls. Remedial works should be carried out to remove any potential danger as necessary. APs are advised to submit an inspection report to the BA for record prior to the submission of a certificate for completion of site formation works.

8. Tree felling or transplanting should only be considered as the last resort in the event that there is a genuine safety concern and there is no practical solution to retain the tree in a healthy state. Property owners may have a responsibility in certain land grant conditions and under legislation to ensure that no trees are unnecessarily felled without the Government's prior approval. Reference should be made to Practice Note to Authorized Persons and Registered Structural Engineers 267 and Lands Administration Office Practice Note for Authorized Persons, Surveyors and Registered Structural Engineers No. 8/2002 in this regard.

9. Apart from landscape design, proper maintenance is also important. Maintenance requirements for landscape treatment measures should be specified in the slope maintenance manual. Where necessary, specialist advice should be sought on the planting, maintenance and protection of vegetation on slopes to ensure its continued healthy growth.

Technical Guidance

10. The Geotechnical Manual for Slopes (2nd Edition) contains general information on the use of grass, shrubs and trees on slopes. More detailed technical guidance on good practice for the aesthetic design of slopes and retaining walls, and on relevant principles of landscape design and implementation can be found in GEO Publication No. 1/2000 "Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls". GEO Retaining Walls (Particularly for Roadside Slopes) into Their Surroundings" also presents detailed guidance on the aesthetic design of man-made slopes and retaining

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walls, particularly roadside slopes. These publications are available from the Government Publications Centre. The Layman's Guide to Landscape Treatment of Slopes and Retaining Walls intended for the use of the general public is also available for free from the District Offices.

11. New design guidelines will be issued by the Geotechnical Engineering Office (GEO) of the Civil Engineering Department from time to time as a result of continuing research and development and should be adopted to supplement the above technical guidance. Designers should obtain specialist landscape advice where necessary.



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Slopes and Retaining Walls - Landscape Treatment

**Guidance on the Use of Shotcrete and Chunam, Landscape Treatment,
and Bio-engineering in Slope Works**

A. Guidance on the Use of Shotcrete and Chunam

1. The use of shotcrete or chunam on slopes should only be considered as a last resort and only after other techniques have been explored and found not practicable. If used, shotcrete or chunam should be avoided over the bottom 3m of a slope, as this is the area most visible to passers-by. Where the use of shotcrete or chunam is unavoidable, measures, such as toe wall planters, planter boxes, tree pits, creeper holes on the slope surface and colour/pigments added to the shotcrete, should be implemented to improve the visual appearance of the slope for blending in with the surroundings. In addition, tree rings of sufficient size should be provided on the shotcrete or chunam surface to cater for the continued healthy growth of trees present on the slope.

2. In general, shotcrete or chunam should not be used on soil cut slopes of consequence-to-life Category 3 as defined in PNAP 234. As part of future upgrading or maintenance programmes, designers should consider replacing existing shotcrete or chunam on Category 3 soil cut slopes with a vegetated surface cover. Existing shotcrete or chunam on slopes of other consequence-to-life categories should also be replaced where acceptable on slope safety grounds. Failing this, shotcrete or chunam with suitable landscape treatment measures should be considered. Stone pitching which is aesthetically more pleasant can be used as an alternative to shotcrete or chunam.

3. Generally, shotcrete or chunam should not be used to cover fresh to moderately decomposed (Grade I – III) rock where the joints are tight and of average spacing greater than 60mm. Application of shotcrete or chunam may be warranted on more closely-jointed (i.e. joint spacing < 60mm) rock, rock containing joints with open apertures or rock which deteriorates quickly when exposed to weather, but the need should be confirmed by a suitably experienced geotechnical engineer/engineering geologist. Weepholes should be provided at appropriate locations based on a site assessment of the locations of discontinuities and seepage in the rock mass (see guidance in Figure 5.4 of the Geotechnical Manual for Slopes (2nd Edition)).

4. Where a rock face is highly fractured or has closely spaced joints, and needs restraint, wire mesh should be considered and used where possible as it is less visually obtrusive than shotcrete. Large concrete buttresses and dentition areas on rock slopes should be provided with a suitable surface finish to reduce their visual impact. The use of masonry facing may be considered in order to blend in with the natural rock face. For large areas with a uniform surface finish, a design to break the monotony should be considered.

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B. Guidance on Landscape Treatment and Bio-engineering

5. The Geotechnical Manual for Slopes (2nd Edition) contains general guidance on the use of grass, shrubs and trees on slopes. It covers hydroseeding, which is generally applicable to establishing a vegetation cover on all types of soil slopes (i.e. soil cut slopes and fill slopes).
6. GEO Publication No. 1/2000 "Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls" gives detailed guidance on the subject. The design process and techniques described in the document are applicable to the construction of new slopes and upgrading of existing slopes, as well as slope maintenance and improvement works.
7. GEO Report No. 116 "Review of Effective Methods of Integrating Man-made Slopes and Retaining Walls (Particularly for Roadside Slopes) into Their Surroundings" presents guidance on the aesthetic design of man-made slopes, particularly roadside slopes. The guidance is based on the findings of a review of local and international practice in the reduction of visual impact of slopes, as well as accepted good landscape practice.
8. In common with other slope works, soft landscape works should be as maintenance-free as possible. Plant species that demand a lot of trimming/pruning or dry season watering should be avoided. Use of native species particularly for those give seasonal flowering effect should be considered.
9. It is essential to provide a bio-degradable protective fabric to a slope face after hydroseeding is completed, irrespective of slope gradient. The temporary fabric serves to reduce raindrop impact and erosion while the grass is establishing.
10. Proper maintenance of vegetation and other landscape treatment measures are important. Due consideration should be given to aspects such as providing protection or positive support, or removal if necessary, of existing trees on slopes during maintenance. Where necessary, specialist advice should be sought on the planting, maintenance and protection of the vegetation to ensure its continuing healthy growth. It must be pointed out that approval from the relevant Authority should be obtained prior to any removal of existing trees.

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