

水土保持國際示範區解說工法
Soil and Water Conservation
International Demonstration
Park

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1

一舉可數得 碎石袋護坡 Gravel-bag Slope Protection-Multiple purposes



將坡地土層中含有的卵、礫、碎石取出，裝填成碎石袋，除了降低農耕操作的困難，更因為碎石袋具有高透水、高機動性、材料不易流失等多元特性，可提供良好的水土保持效果。將碎石袋疊砌於邊坡坡腳以做為護坡使用時，除了可以穩固邊坡、減少土壤流失，並提高土地利用效率。

Pebbles and gravels contained in soil are extracted and packed into gravel bags. This practice helps reduce farming difficulties and also services the purposes of soil and water conservation by fully utilizing its high permeability, mobility, and material security. When stacked at hill toe to form embankments, gravel bags may strengthen slope stability, decrease soil loss as well as increase land utilization.



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Tire Slope Protection
3. 輪胎擋土牆
Tire Retaining Wall
4. 打樁編網
Staking and Weaving
5. 草皮鋪植
Turf Planting

6. 稻草蓆散蓋
Straw Mat Covering
7. 山邊溝
Hillside Ditch
8. 平台階段
Bench Terrace
9. 乾砌石護坡
Dry-stone Embankment Protection
10. 農塘
Farmpond

11. 複合材料鋪面排水溝
Composite Lining for Drainage Ditch
12. 碎石集水井
Gravel Collection Well



語音 VOICE

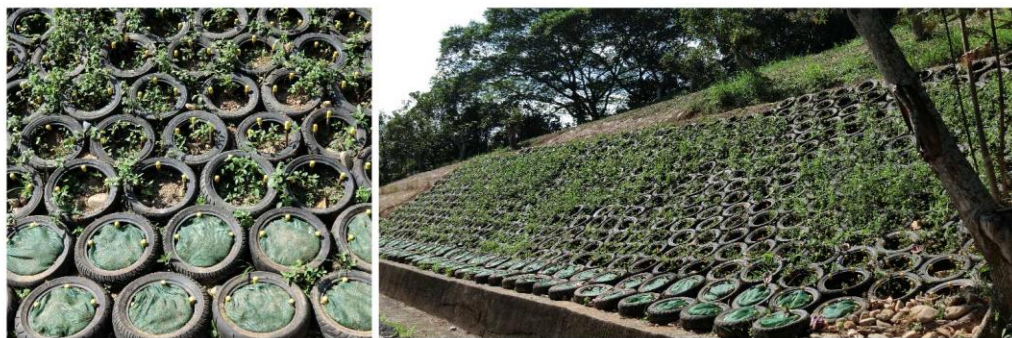


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2

廢物再生護水土 輪胎護坡

Slope Protection Using Recycle Tires – Revival of Waste Material for Soil Conservation



台灣機車數量龐大，汰換的機車輪胎是廢物再利用很好的素材。將汰換的機車輪胎以三角型拼排，緊密敷蓋在裸露坡面上，並以鋼筋固定後形成護坡。輪胎鋪面護坡容易適應地形起伏，且輪框內的空間亦可配合土壤袋客土等植生方法，改善坡地植生的生長基盤。

Motorcycles are one of the transportation tools for traveling in Taiwan. However, used motorcycle tires cause environment issue. This technique helps solve some of the environment problems by placing used tires on bare slopes to prevent soil erosion. Rebars are used to secure tires on the slope. Soil bags are then inserted into the tire cavity to facilitate vegetation growth if needed. Since tires are less difficult to work with, therefore, this technique can easily adapt to terrain changes.



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3

坡腳的守衛部隊 輪胎擋土牆

Used-tire Retaining Wall - Guardian of the Foot of the Slope



輪胎是汽、機車等交通工具所必須使用的消耗品，具有高強度、高韌性及耐久的特性。將汰換後的輪胎回收再利用，用於坡腳或溝岸保護，輪胎堆疊高度不宜超過2m。除了能提供良好的水土保持效果之外，同時也解決廢棄物處理的問題。將輪胎內紮實填土後向上堆疊所形成的擋土工法，除了可以利用自重穩固坡體，也可以調整上邊坡度，達到減少土壤沖蝕及增加坡地可利用性的效果。

Tires are the necessary consumables for cars and motorcycles. They possess the characteristics of high strength, high toughness and durability. By recycling, used tires can be used for the protection of slope toe or gully sidewalls but tiers should not be stacked more than 2 meters high. In addition to providing soil and water conservation effects, recycling used tires also solves the waste management problem. Filling the cavities of stacked used tires with soil to form retaining walls can stabilize the slope and also help adjust the slope gradient. Hence, the retraining wall thus constructed serves the purposes of reducing soil erosion as well as increasing slopeland usability.



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4

保護坡面的拒馬 打樁編柵

Staking and Wattling - Slope Protection Barrier



打樁編柵工法，是利用一般樺材、竹樺或具有自生萌芽力的萌芽樺做為材料，配合竹片、網材，在樺材間編織成柵目的在控制坡面沖蝕。施作材料以就地取材為原則，適用場域包括崩塌地、蝕溝控制、海岸防風定砂等。編柵可達到攔阻沖蝕土砂的功能，於編柵後方的空間自然淤積，也可在其中回填土壤，配合撒播或噴植方法，加速植生覆蓋。

To make this barrier, timber, bamboo, or stems with sprouting capabilities can be used as stakes; whereas, bamboo strips or any netting materials can be interlaced or woven between the stakes to form the barrier as a means of preventing soil erosion. It is best to use local available materials. Staking and wattling can be used on areas prone to collapse, and it can be used for control and on areas with coastal wind erosion. This technique helps trapping eroded sediment. Manually back-filling the area behind the staking and wattling combined with sowing or hydro-seeding helps accelerate vegetation growth.



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5

自然理想優化景觀 草皮鋪植

Turf Planting - Ideal Natural Landscaping



裸露坡面上若有完密的植生覆蓋，不僅可以減少土壤沖蝕、固結土壤，也能減少土壤水分散失、調節地溫、增加土壤養份與有機質，更有美化景觀、抑制雜草生長及方便坡地管理的效果，是一種相當理想的水土保持方法。草類覆蓋可以採用分株、扦插、種子灑播或是草皮鋪植等方式進行；其中，草皮鋪植可將培育完成的草皮掘取後移植覆蓋，可快速達到坡面保護的效果，並增加植草覆蓋的成功率。若坡面保護沒有急迫需要性，可改以種子撒播、草苗栽植的方式，如此可以降低施作成本，但需要較長的養護管理時間。

If an exposed slope is fully covered with ground vegetation, soil erosion can be minimized, soil can be strengthened, soil moisture losses can be reduced, soil temperature can be controlled, and nutrients as well as organic matters can be increased. Ground vegetation also helps beautify the landscape, retard weed growth, and facilitate slope management, which make it an ideal soil and water conservation method. Grass cover can be accomplished by suckering, cutting, sowing grass seeds, or planting turf. Among these techniques, turf-planting is the most efficient. After the turf has been excavated and transplanted, it can protect the slope effectively and improve the rate of grass cover. If there is no urgent need for slope protection, sowing or grass seeding can be used to reduce costs. However, it requires much more time to maintain.



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6

水土的自然面膜 稻草蓆敷蓋

Straw-mat Mulch-Natural Mask for Water and Soil



將稻草稈或其它作物之殘株，以層狀方式敷蓋於裸露坡面，達到減緩土壤沖蝕之目的。施作容易快速，是一種簡單有效的沖蝕控制工法。稻草稈的纖維豐富，容易保留水分，鋪設時可以提供坡面保濕、保溫的效果，亦可減少雜草入侵。當稻草蓆腐爛分解後，可提高土壤有機質含量，改善土壤肥力。除此之外，稻草蓆敷蓋亦可在種子撒播後配合使用，可避免種子因為乾燥、高溫、陽光曝曬或是鳥類啄食，影響種子發芽率。

Apply straw or crop residue to slope in layers so as to control soil erosion. A straw-mat mulch is a simple and effective erosion control method. Straw stalks are rich in fiber. Straw mat not only can preserve moisture and heat, but also inhibit weed growth. When decomposes, straw mat can increase the organic matter content in the soil, which helps improve soil fertility. In addition, straw-mat mulch can also be used after sowing to prevent grass seeds from drying out when exposing to high temperatures or being eaten by birds, which may affect seed germination.



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7

坡地農作省工基礎 山邊溝

Hillside Ditch - Fundamentals of Efficient Slopeland Farming



所謂山邊溝，是指在坡面上，每隔適當距離，沿等高方向所構築之寬淺三角形溝，同時也是建立坡地農作省工經營的基礎。除了能減短坡長，達到分段截洩逕流、防止沖蝕，增進水土保持效益的功能，也能做為等高耕作基線及田間作業道路使用，是坡地農作必須具備的基礎設施。

A hillside ditch refers to a wide but shallow triangular ditch constructed on the slope along contour line at appropriate interval. It is the foundation for efficient slopeland farming. Hillside ditch not only reduces slope length for runoff interception and prevents erosion, but also optimizes soil and water conservation benefits. Hillside ditch can also be used as the baseline for contour farming and access road, which is the essential infrastructure for slopeland farming.



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8

臺灣最傳統的農地水土保持 平台階段

Bench Terrace - Taiwan's Most Traditional Method of Soil and Water Conservation for Farmland



平台階段是在坡面上，沿等高方向，每隔適當垂直距離所構築而成的連續式水平或微斜的階段地形，是最傳統的農地水土保持工法。可達到抑制逕流、安全土地利用、保蓄土壤水分、防止土壤沖蝕的效果。連續式的階段地形能改善陡坡地區的土地利用率，是坡地農作區經常使用的水土保持設施。

Bench Terrace is a flat or slightly inclined terrace that constructed vertically along the slope contour at appropriate intervals. It is the most traditional agricultural method of soil and water conservation method for farmland in Taiwan. It serves the purposes of runoff retardation, land use management, soil moisture conservation, and erosion prevention. Consecutive terraces can improve land utilization on steep slopes, therefore, it is the common soil and water conservation technique for hill farming.



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9

水保的工藝美學 乾砌石護坡

Dry masonry Embankment- The Craft Aesthetics of Soil and Water Conservation



乾砌石駁坎源自古工藝，是人力時代手工智慧的水土保持工法。以就地取得的塊石做為素材，以六圍砌方式疊砌形成駁坎，除了具備保護坡趾之功效，並具有排水及維持表土活性的功能。由於就地取材，構造物更能融入週遭環境。砌石間的縫隙能提供動植物棲息的空間，營造出工程與生態共存的雙贏結果。

Dry masonry embankment technique originated from ancient soil and water conservation method in the era of manual labor. With rocks as base material, dry masonry embankment can be formed in hexagonal stacking format, which not only provides protection to the toe of slope but also functions as seepage drains and paths to ventilate soil. By using pebbles and rocks obtained locally, dry-stone embankment can easily integrated with the surroundings. The gaps inherent in the stacked stones act as shelter for animals and plants, a win-win for both engineering and ecology.



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10

蓄水救旱保育 農塘

Farm pond- Water Storage for Drought Conditions



農塘是指在低窪地區或水流匯集位置，以挖掘的方式形成的儲水設施，具有生態保育、灌溉救旱及微氣候調節的功能。農地水土保持之農塘不僅供養殖之用，亦提供旱季缺水之灌溉、噴灌用水，及噴灑農藥防治病蟲害之用水。

A Farm pond refers to a water storage facility formed by digging in a low-lying area or catchment area. It functions as a method of ecological conservation, irrigation and drought relief, and micro-climate regulation. Farm pond not only provides a breeding space for aquatic life, but also uses for ecological conservation, micro-climate regulation, irrigation during a drought, as well as aid in spraying pesticides to control pests and diseases during the dry season.



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11

多元材組捍衛戰 複合材料鋪面排水溝

Composite Lining Drainage Ditch - Diverse Materials As Defense



排水溝是農地排水系統中不可或缺的重要環節，主要的功用是將山邊溝、平台階段等橫向截水設施所收集之逕流，引導至下游安全位置。人造地工材料具有高強度、耐天候、抗腐蝕的特性，利用不同地工材料鋪設於排水溝面，不僅可以有效鞏固溝形、防止沖刷，且可利用其選擇多元、施作快速、替換方便的優點，讓設計者可視地形條件與排水需求選用，達到安全排水的目的。

A drainage ditch is an indispensable part of farmland drainage system. Its main function is to guide runoff collected from horizontal water intercepting facilities such as hillside ditch, bench terrace, etc., downstream to secured locations. Synthetic geotextiles possess the characteristics of great strength, sunlight-proof, and anti-corrosion. It not only secures the ditch shape, prevents abrasion, but also has the advantages of being diverse, quick-to-install, and easy-to-replace. It allows designers to adapt to terrain conditions and drainage needs.



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12

緩衝水流的小窟窿 碎石集水井

Drainage Slump - Miniature Basin for Flow Control



坡地安全排水系統乃是利用橫向截水溝與縱向排水溝的相互搭配，將坡面漫地流或是灌溉後多餘的供水集中後，排放至安全地點。由於水流匯集或有可能遇到水流流路急彎，因此必須設置集水井以做為緩衝，避免水流的強力淘刷造成排水設施損壞。因此，集水井的設計與配置，對於排水系統的安全運作尤其重要。坡地農地排水系統常利用山邊溝、土溝、草溝等做為主要的排水溝面，既使以砌石、拋石或其他材料，材料強度仍然有限。碎石袋、土包袋、砌石、磚砌、混凝土等均可作為集水井的構築材料。

Safe drainage on slopes requires the use of e horizontal intercepting ditches and longitudinal gutters to convey surface runoff or the excess water from irrigation. Drainage sumps are essential for dissipating flow energy and preventing scour. Thus the design and layout of the drainage sumps are extremely important for safe drainage. Hillside ditches, earth ditches, and grass waterways are often used for slopeland drainage. Masonry, riprap or other materials are also added to secure the ditch lifespan. However, either type of the ditch or either type of protection measure is still strength limited. Therefore, gravel bags, earth bags, masonry as well as concrete can be used as construction materials for drainage sumps.



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