

PC-32 TERRACES AND BENCHES

Refer to: ITD Standard Specifications, Section 205.
ITD Design Manual, Section 5.6.

**Definition and Purpose**

A permanent berm and channel arrangement either constructed along the face of a slope at regular intervals or constructed as a continuous series of horizontal steps on the face of a slope.

Appropriate Applications

- Reduce erosion damage by capturing or slowing down surface runoff and directing it to a stable outlet at a velocity that minimizes erosion. On long, steep slopes that have a water erosion problem or where it is anticipated that water erosion will be a problem, terraces or benches are particularly effective.
- Trap and retain sediments from the slope above, and the revegetation process on bare slopes can be enhanced. Moisture is held better than smooth slopes, and the sediment loading of surface runoff is minimized.
- May be used on new slopes to minimize erosion.
- May be suitable for slopes in soils and soft rock that can be excavated by ripping.

Limitations

- Terraces and benches should not be constructed on slopes or cuts:
 - With sandy or rocky soils, non-cohesive or highly erodible soils, or decomposing rock including moraines and other depositional materials.
 - With soft-rock laminations in thin layers oriented so that the strike is approximately parallel to the slope face and the dip approximates the staked slope line.
- Terraces and benches may cause sloughing if too much water infiltrates the soil and are effective only where suitable runoff outlets are available.
- Avoid benching, if possible, in areas where there is potential for rockfall problems.

Design Parameters

- The design of terraces and benches should be determined by an engineering survey and layout.

BMP Objectives

- | | |
|-------------------------------------|-----------------------|
| <input type="checkbox"/> | Perimeter Control |
| <input checked="" type="checkbox"/> | Slope Protection |
| <input type="checkbox"/> | Borrow and Stockpiles |
| <input checked="" type="checkbox"/> | Drainage Areas |
| <input checked="" type="checkbox"/> | Sediment Trapping |
| <input type="checkbox"/> | Stream Protection |
| <input checked="" type="checkbox"/> | Temporary Stabilizing |
| <input checked="" type="checkbox"/> | Permanent Stabilizing |

- The upper step should begin immediately below the top of the cut or fill. Continue constructing terraces or benches down to the toe of the slope.
- Terraces or benches should have approximately vertical back slopes and may vary from 2 to 4 feet vertically. The tread (level area) should be approximately horizontal but may parallel the roadway grade if it is less than 4 percent.
- Slopes 2H:1V or steeper may be stair-stepped with terraces or benches at sufficient width to retain sediment eroded from the slope above.
- The terraces and benches **must be** designed with adequate outlets, such as a grassed waterway, vegetated area, or other suitable outlet. Slope drains may be needed to convey surface runoff from the terraces or benches to the toe of the slope without causing erosion. Analysis of the local site conditions should determine the needed outlets.
- Terraces and benches may be constructed with liners to carry water to the outlet.
- Interceptor ditches may be needed at the top of the slope to prevent or reduce the surface water from running down the slope face.
- Stabilize or revegetate the slope with methods applicable to the particular site.

Construction Guidelines

- Construct terraces and benches using equipment that is capable of meeting the specifications established in the plans. Drain to a stabilized area. In cut slopes, begin terrace or bench construction at the top of the slope and work downward.
- Remove the loose material that collects at the end of terraces or benches and blend the ends of each terrace or bench into the natural ground surface. If encountering rock that is too hard to rip (within a cut), blend the terraces or benches into the rock.
- Scale the benched and terraced slopes to remove rock that may fall into the roadway ditch or onto the roadway.
- Install interceptor ditches prior to beginning the construction of the cut section.

Maintenance and Inspection

- Conduct inspections as required by the NPDES permit or contract specifications during construction.
- Periodic inspection and maintenance will be required based on post-construction site conditions.
- Make any repairs necessary to ensure the measure is operating properly.
- During the construction phase, maintenance of the terraces and benches will be the responsibility of the Contractor to ensure that these measures are properly functioning.
- Damaged benching and terracing areas shall be repaired immediately and reseeded as soon as possible. If excessive seepage or surface runoff is a problem, the seepage/runoff shall be controlled with appropriate drainage facilities.

- Prompt action shall be taken as needed to ensure proper drainage and slope stability. Rills shall be prepared and damaged areas shall be reseeded as they develop.
- Substantial maintenance of the newly planted or seeded vegetation may be required.