

# Technical Bulletin

## Surface Drainage Practices



PennState

1/2019



**Surface Drainage Practices** – Road maintenance features designed to shed water from the travelway, including crown and cross-slope, grade breaks, and broad-based dips.



**Grade Break** - A small increase in road elevation on a downhill slope, which forces surface flow off the road.



**Broad-Based Dip** - A small increase in road elevation that directs all road drainage across the road to an outlet.

**PURPOSE** – To quickly move water from the travelway. To prevent linear flow and standing water on the road. To lengthen time between grading or re-graveling and to reduce pollution.

### BENEFITS OF GOOD SURFACE DRAINAGE:

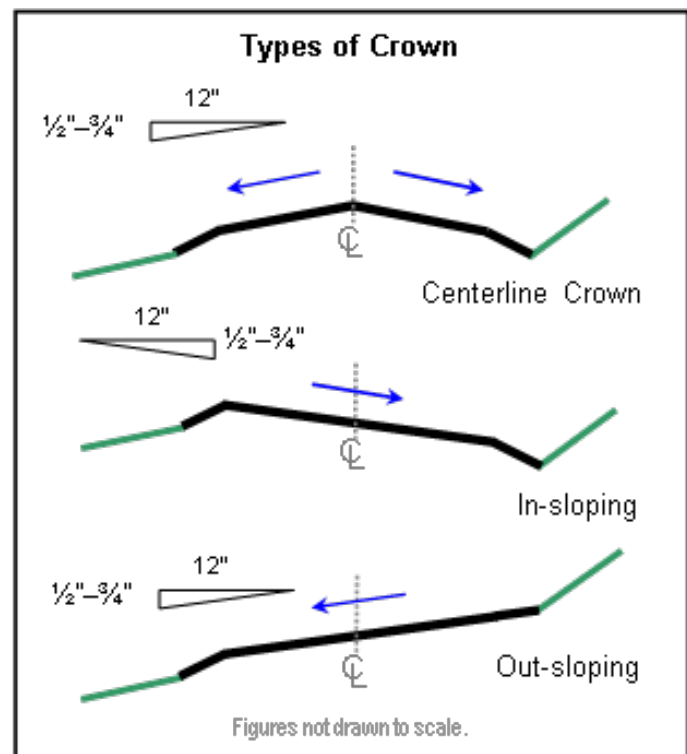
- Improves drivability and ride quality.
- Sheds water from road surface into ditches.
- Reduces surface material loss.
- Reduces base saturation, improving stability.
- Reduces long term maintenance cost and pollution of nearby surface water.

### WHERE TO USE –

- Use crown and cross-slope on all roads.
- Use Grade Breaks (GB) and Broad-Based Dips (BBD) where road grade, topography, traffic, and ability to maintain are applicable.

### CONSIDERATIONS –

- Crown and cross-slope is the road's first line of drainage defense and is a must.
- Maintenance of surface shape is necessary.
- Grade Breaks and Broad-Based Dips have slope limitations. A road can be too steep to use these practices.
- Traffic and vehicle type must be taken into account when considering a GB or BBD.
- Mark GBs and BBDs to alert grader operator.
- Center-crown, in-slope, or out-slope utilize the same 4% to 6% on unpaved roads and 2% to 4% on paved roads.



**Center Crown** – An “A” shaped high point on the road centerline to shed water to both sides of the road.



## COMMON APPLICATIONS OF SURFACE FEATURES–

### Center Crown

- Most common road shape. Splits drainage and traffic lanes.

### Inslope

- Consider when a steep downslope bank exists.

### Outslope

- Consider on low traffic/low speed roads with minimal downslope bank.
- Use to avoid concentrated drainage outlets.

### Grade Break

- On low traffic and low maintenance public roads.
- To provide cover for shallow crosspipes.
- For access roads to prevent run-on flow.

### Broad-Based Dip

- On very low traffic and low maintenance public roads where water on the road is acceptable.
- Where crosspipes or outslope are not practical.
- For access roads to prevent run-on flow.

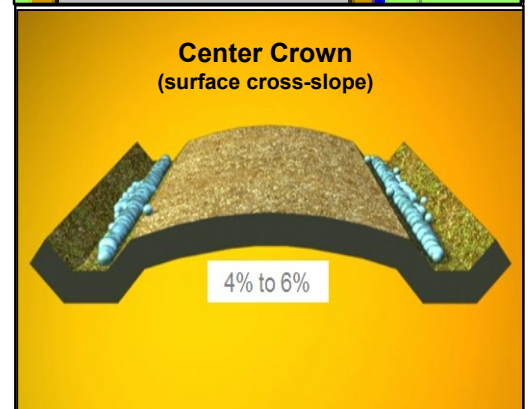
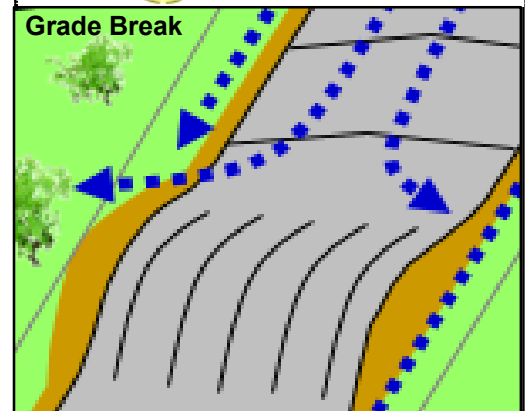
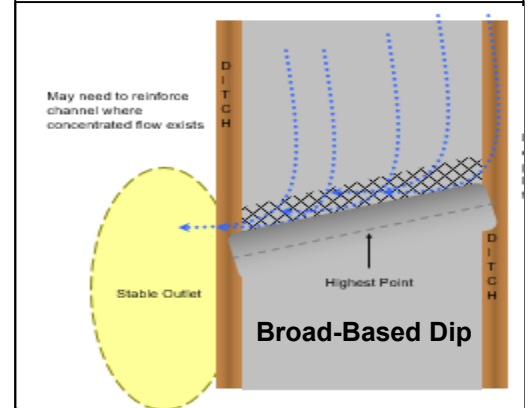
## CONSTRUCTION AND MAINTENANCE NOTES –

- Surface drainage practices vary in methods of maintenance.
- The use of a motor grader is the most common way to establish and maintain surface crown and/or cross-slope.
- Adequate material, capable of being shaped and compacted, is a must to effectively create the desired shape in the road.
- Unpaved roads need 2X-3X more crown than do paved roads.
- A paver may be employed to establish the initial crown and/or cross-slope and to replenish gravel as needed.
- Imported material (fill) is required to establish a Grade Break (GB) and a Broad-Based Dip (BBD).
- In general, Grade Breaks and Broad-Based Dips are installed using earthmoving equipment other than a motor grader.
- Construct GBs and BBDs to accommodate intended vehicles, so as not to cause ground clearance issues.
- Mark locations of Grade Breaks and Broad-Based Dips, to avoid removing them when grading or snowplowing.

## SURFACE DRAINAGE INFORMATION WORTH KNOWING –

- All practices are used to shed water from the road surface
- All practices are driven out over time and must be maintained
- All practices can be used on public roads and access roads
- All roads require crown and/or cross-slope
- Construct GBs and BBDs to create a reverse linear grade
- GBs and BBDs may calm traffic and extend surface life
- Grade breaks can be used with an associated crosspipe
- Broad-Based Dips may require a hardened flow channel
- Effective compaction extends the life of all surface features
- Roads with inslope and outslope shape suffer less surface damage during snowplowing than does a center crown road

## Common Surface Practices



Top to bottom – Sketch of broad-based dip, illustration of grade break, proper slope for center crown

