

Technical Bulletin

Broad Based Dips

BROAD BASED DIP (BBD) – An intentional reverse grade built into a roadway that diverts flow from the road surface and the uphill ditch across the road to a discharge area.

PURPOSE

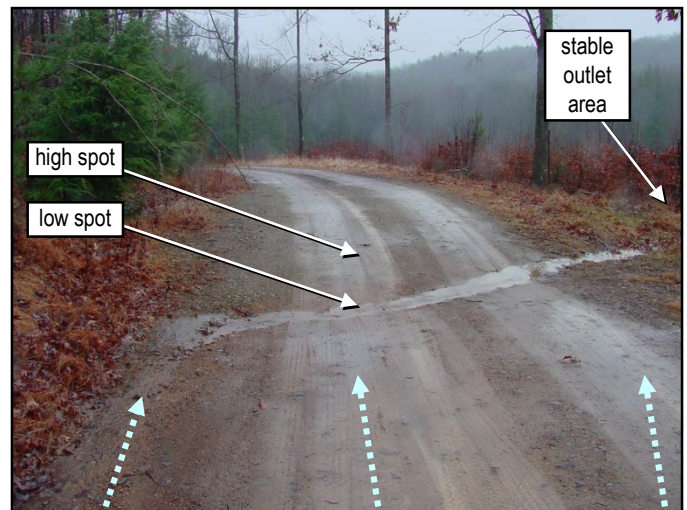
Broad based dips collect flowing water from the road surface and ditches and direct it across the road to a stable outlet. In certain situations, *broad based dips* can be used in place of crosspipes, to convey water from the uphill ditch across the road to an outlet. A *Broad based dip* can prevent accelerated aggregate loss and sediment generation by stopping drainage from flowing a long distance in wheel tracks or ruts.

BENEFITS

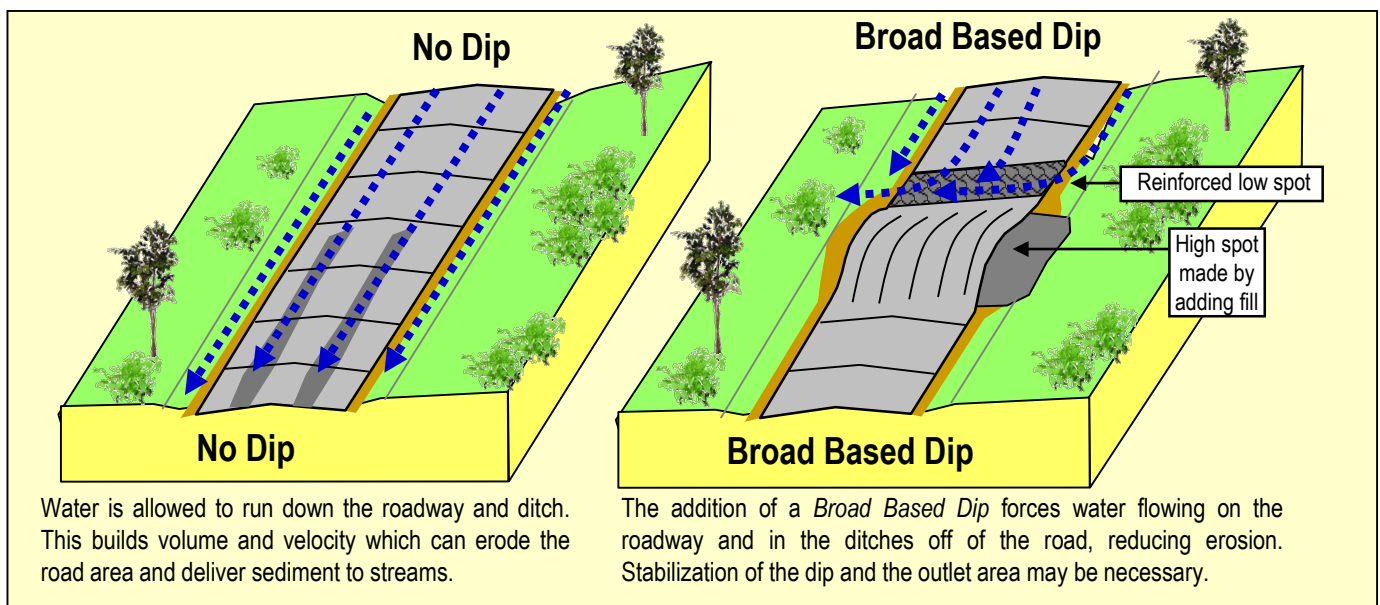
- Prevents erosion caused by concentrated water flowing on road.
- Serves as an outlet for drainage from the uphill side of the road, reducing erosion and potential stream pollution from long ditch runs.
- Cheap, easy, and effective on low volume roads.

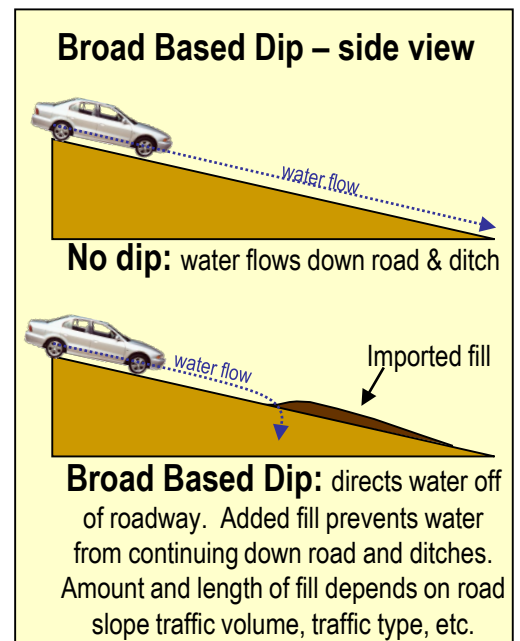
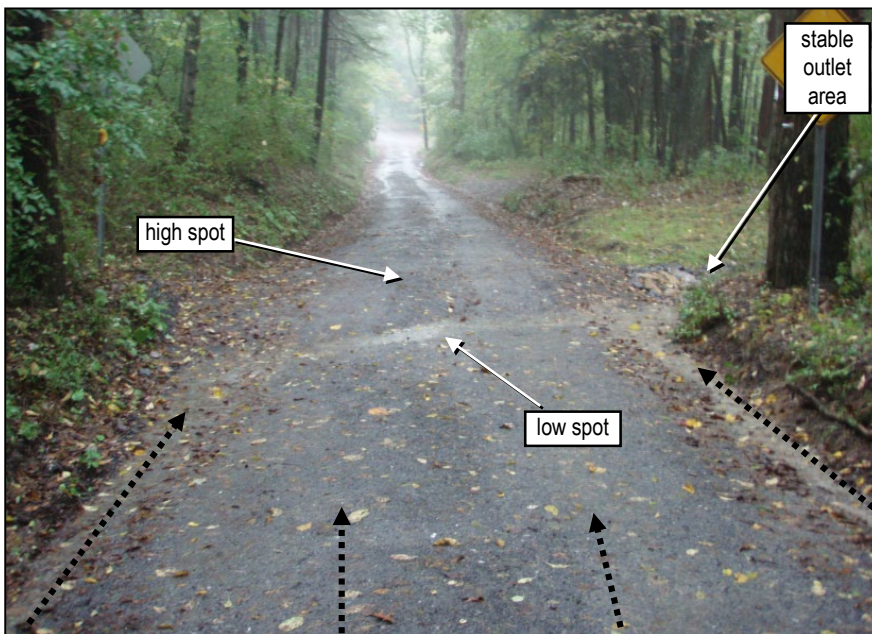
CONSIDERATIONS

- Use discretion when considering *broad based dips*. BBDs are only appropriate for use on low traffic roads. Roads with high vehicle traffic and oversized loads may not be appropriate for *broad based dips*.
- *Broad based dips* may not be appropriate on roads with a slope of greater than 10%.
- Depending on site conditions, it may be necessary to reinforce the bottom of the dip and dip outlet to prevent erosion.
- *Broad based dips* are not “mini fords,” and are not intended to accommodate continually flowing water such as springs or streams.



This *broad based dip* is located on a forest access road that is only open to the public for hunting season. This low-use road is an ideal location to use *broad based dips* instead of crosspipes to reduce long term maintenance. This simple and effective drainage practice is a good fit in this situation.





A *broad based dip* is pictured here during a rainstorm. Notice how gradual the dip would be to vehicles, yet how effectively road and ditch flow is directed across the road. Without the dip, road and ditch drainage would continue to build erosive force downslope.

CONSTRUCTION CONSIDERATIONS

- **SPACING:** Multiple *broad based dips* can be used in sequence, similar to crosspipes, to drain a long stretch of road. Spacing for *broad based dips* depends on site-specific conditions including road slope, upslope drainage, soil type, and available outlets.
- **SIZE & SHAPE:** Size determination for *broad based dips* will vary depending on road slope and anticipated traffic. BBDs on flat roads may be relatively small, with slight elevation changes and short fill transitions. Whereas dips installed on steeper sections of road will need to be higher and will require longer approaches to ease the transition into and out of the structure. Be sure to take anticipated traffic into account. The abrupt dip pictured on the front of this document is on a private access road. The BBD pictured above is on a public road and has much smoother transitions to accommodate cars and commercial vehicles. A relatively wide channel in the dip bottom is recommended to spread flow and to ease vehicle transitions. The upslope end of the dip should be tied into the uphill bank to insure water does not bypass the structure and continue to flow down the ditch.
- **ANGLE:** *Broad based dips* should be angled across the road at approximately 20-40 degrees and not placed perpendicular to the road like a speed bump. The angle will facilitate the flow of water across the road. A dip placed straight across the road is more likely to fail and causes more erosion, since it forces water to turn at a right angle to cross the roadway.
- **SLOPE:** Similar to a crosspipe, the bottom of a *broad based dip* should have a continuous elevation drop towards the outlet end. The slope is usually dictated by the grade of the road and the angle of the dip.
- **DIP REINFORCEMENT:** Because a *broad based dip* is designed to carry concentrated flow on the surface of the road, reinforcement of the dip bottom is recommended, especially on steeper slopes. Hard stone and even geo-synthetic materials can be used to reinforce the bottom of the dip to resist erosion.
- **OUTLET REINFORCEMENT:** Because *broad based dips* discharge concentrated flow like a crosspipe, the outlet area must be stable. When possible, outlet dips into a vegetated buffer areas. Depending on the flow volume and velocity, additional stabilization methods, such as rock armoring, may be required.
- **MAINTENANCE:** A properly constructed *broad based dip* will function with minimal maintenance. Mark BBDs as you would other drainage features and take care not to remove them during future maintenance.

Broad based dips are a cheap and effective means of drainage control on low volume public roads. In addition, BBDs help control run-on flow from farm lanes, camp roads, and other access roads that intersect the public road. Remember to always discharge dips to a stable outlet away from streams.

Grade Breaks are also effective road surface drainage structures and are covered in a separate technical bulletin.