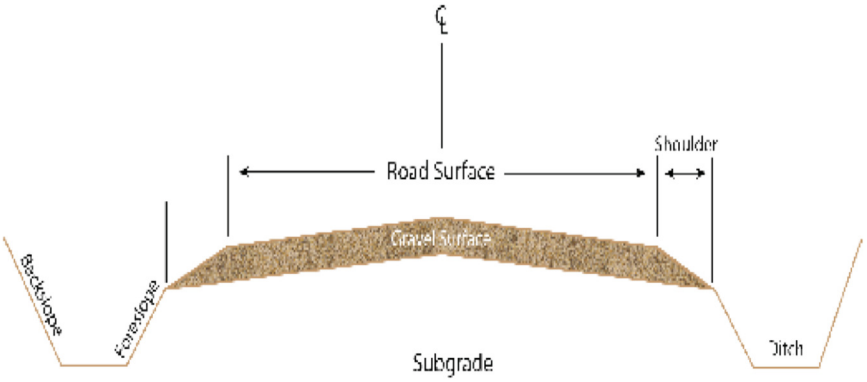
Unpaved Road Safety

For Local Roads in Colorado

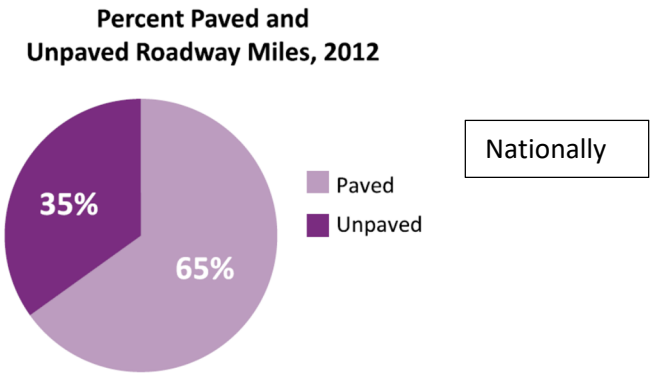
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According to the Federal Highway Administration (FHWA), in 2012 there were 1,357,430 miles of unpaved roads in the United States, accounting for almost 35 percent of the more than 4 million miles of roadway. There are 184,913 lane miles in Colorado. Of those lane miles, 105,130 lane miles are unpaved representing approximately 57% of all roadways in Colorado. Even though there are more unpaved roads in Colorado, nationally unpaved roads only account for approximately 2 percent of fatalities.



Although nationally the percentage of fatalities and serious injuries are low, in some states these roadways account for up to 20 percent of the fatalities. Local and rural road owners are responsible for a large proportion of these unpaved roads and need information on strategies to enhance the safe operations on these roadways.

Usually, most gravel roads exhibit the following characteristics:

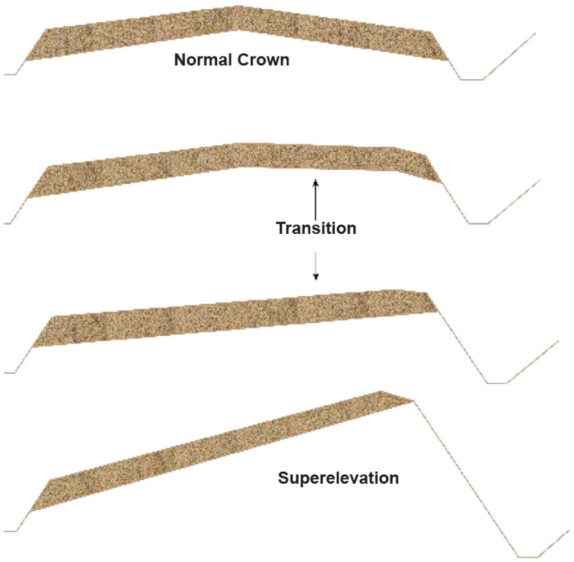
- Narrow lanes and shoulders (or no shoulders)
- Sharp horizontal and/or vertical curves
- Limited sight distances at intersections (frequently due to agriculture)
- Roadside obstacles
- Lack of clear roadside recovery area
- Minimal or non-compliant signing and delineation
- Limited passing, stopping, and horizontal sight distance
- Narrow bridges

Given the above, there are countermeasure that local road owners can do to mitigate some of the challenges.

1. Improve Sight Distance
    a. Clear vegetation at uncontrolled intersections to increase approach sight distance.
    b. Clear vegetation at horizontal and vertical curves.
    c. Mow roadway edges to improve sign visibility.
2. Strive to create a “Clear Zone”
    a. Shield, relocate, remove and/or delineate fixed objects (utility poles, agriculture fixtures, etc.) in the clear zone s; 15 to 30 feet from edge of lane.



3. Curves
    a. Strive to place proper super elevation on the curve.
        i. Can be difficult to determine without a ball bank evaluation and engineering assistance.



    b. Install advanced curve warning signs.





    c. Install chevrons at locations where roadway alignment is unclear.
        i. It is interesting to note that after an internet search including FHWA files, the authors could not find one example of a curve warning sign on a gravel road. We are sure the curves signs exist at some locations but more than likely the no traffic signs are probably more the rule and advanced signing and chevrons are the exception.

4. Have a robust Maintenance Program
    a. Provide a well graded surface with binder to reduce raveling and wash boarding.



b. Add dust retarder such as magnesium chloride. (There are many other dust retarders, this is one example).
c. Maintain a minimum 3% to 4% cross slope for drainage. No steeper than 6%. The 6% is not due to concerns for snow and ice (although it does come into play) but with too steep of slope, drivers will feel uncomfortable and drive straddling the center of the road.
d. Construct and maintain an adequate ditch section.
    i. Three most important factors in maintaining a good unpaved road is 1. Drainage, 2. Drainage, and 3. Drainage.





Roads in the same county same day after a rain. The above left picture has adequate draining and the above right picture does not.

e. Ensure culverts are maintained and draining properly.



Maintained properly



Not Maintained properly

In summary, unpaved roads in the United States, account for almost 35 percent of the more than 4 million miles of roadway. Colorado has 105,130 lane miles of unpaved county roads. Even though the overall fatal crashes account for approximately 2% of all fatal crashes nationally, counties must take advantage of safety countermeasures to reach the goal of *Vision Zero.* There are many opportunities to improve gravel roads. Colorado LTAP as well as work from other LTAP's around the country are doing a very good job of educating local gravel road owners of good maintenance practices and new technology when dealing with gravel road maintenance. However, there is a huge opportunity for safety professionals to work with local road owners on low cost safety solutions like signing and ball banking. Its important to remember, one death on any road is too many.