



Running alongside the Clark Fork River, Highway 200 connects the City of Missoula, East Missoula and the town of Bonner, Montana.

In 2019, the Clark Fork River experienced flooding when melted snow from nearby mountains flowed into the river. High water levels pushed dirt and rock downstream and away from the riverbank, putting the roadway in danger of sliding into the river. The Montana Department of Transportation constructed an erosion wall to save the riverbank and the road. 

WHAT IS EROSION?

Erosion occurs when natural forces such as wind, water and ice wear away or transport dirt, rock and other earthen materials. Of these forces, running water is the primary cause of soil erosion. This is because water is so abundant and powerful.

Snow builds up in the mountains over the winter months. As winter snow melts, the water flows into streams and rivers. This is called runoff. Runoff can cause streams and rivers to swell and overflow. Great amounts of water rush downstream, transporting sediment and rock away from the bank.



VISION ZERO
zero deaths - zero serious injuries
MONTANA DEPARTMENT
OF TRANSPORTATION

Presented by The Montana Department of Transportation

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HOW CAN EROSION BE PREVENTED?

There are several ways to diminish or prevent erosion. Some methods are simple, while others are more complex.

Planting trees, shrubs and other vegetation is one way to prevent and reduce soil erosion. Leaves of vegetation slow the impact of rainfall on the soil. Plant and tree roots hold the soil tightly together making it difficult for the soil to be transported away by water or wind.

Diversion is another way to prevent or decrease erosion. Water follows the path of least resistance, meaning it will flow in the direction of the fewest obstacles. By creating a diversion, the path of the water changes and moves away from the area of concern. In this case, that area is the side of Highway 200.

Another method of preventing erosion is to build a structure that can reduce the powerful effects of water. An erosion wall can be made out of several types of materials. The complexity of an erosion wall can vary from stacked rocks to a full structure made from steel beams and concrete.

ENVIRONMENTAL CONCERNs

The Old MT 200 erosion prevention wall was designed by a team of engineers to address the specific needs of the area. This erosion wall had to be strong enough to support the roadway while protecting the environment around it.

Marshall Canyon Creek flows into the Clark Fork River at the erosion site. When the highway was constructed, a fish ladder was added under the roadway to maintain the connection between the creek and the river.

A **fish ladder** allows fish to swim under or around an obstacle. The ladder is made of small pools that go up like stairs. Fish can swim up the ladder by jumping up the steps into the next pool. They keep jumping from pool to pool until they make it up the ladder into the creek.

The Old MT 200 erosion wall had to be carefully built to protect the fish ladder so trout and other fish could swim from the Clark Fork River to Marshall Canyon Creek.



Trees also had to be removed from the site and roadside landscaping was completed months before construction, at just the right time of year to protect migratory birds. Work was done in accordance with the Migratory Bird Treaty Act (MBTA) of 1918. The MBTA protects migratory birds, like orioles, mourning doves and hummingbirds, and forbids disturbing or moving their eggs and nests. Trees and shrubs could not be removed if migratory birds were nesting in them, so landscaping had to be completed before the birds returned to the area in the spring. By removing potential nesting sites before birds came back to Montana, construction could move forward without harming any nests.



BUILDING AN EROSION WALL



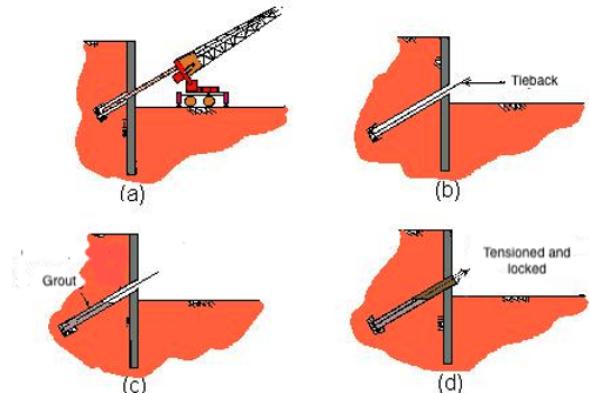
Construction on the erosion wall began with the removal of the old erosion prevention structure. Crews **excavated** the area and tore out the cement wall that had previously acted as an erosion prevention method.

Once the area was excavated, large steel beams, called **soldier pile**, were pounded deep into the ground to create the structural framework of the wall. Horizontal holes were then drilled through the steel beams and into the soil. Long braided cables were then placed into the holes and **grout** was added to hold them in place and protect them from corrosion. These long cables are known as **tiebacks** because they tie the steel beams to the soil.

Crews added the tieback supports row by row, excavating the soil away from the wall as the work moved closer to the riverbank. The Old MT 200 erosion prevention wall consists of 55 soldier pile beams, each with four rows of tieback supports.

When all of the tiebacks had been drilled, installed, grouted and tensioned, the wall was covered with wooden slats and a concrete facing was poured to create a protective shell and a decorative covering for the wall.

Large loose stones, called **riprap**, were added from midway down the wall to the bank of the river. The riprap was covered in topsoil and vegetation was planted to strengthen the riverbank against erosion and to reclaim the area for wildlife.



GLOSSARY

Erosion – The wearing away of dirt or rock by wind, water or ice.

Runoff – Melted mountain snow that flows into rivers and streams.

Engineer – A person who uses science and math to create solutions to problems and design structures.

Fish ladder – Small pools that go up like stairs allowing fish to swim under or around an obstacle.

Excavate – Digging or removing rocks and other large material.

Soldier pile – Large steel beams.

Grout – A cement-like material that holds objects in place.

Tieback – Long cables that tie steel beams to the soil.

Riprap – Large loose stones.

Name _____

EROSION ANALYSIS QUESTIONS

1. What caused the Clark Fork riverbank to erode and what impact did it have on Highway 200?

2. What is the primary cause of soil erosion and why?

3. What are three methods for preventing soil erosion?

4. Why are trees and shrubs an effective means for preventing erosion?

5. Name two environmental factors that had to be considered before or during the construction of the Old MT 200 erosion wall.

6. After reading the material, why do you think the erosion wall needed to have both vertical steel beams and horizontal supports?

7. CRITICAL THINKING:

After reading about this erosion repair project, what, if anything, do you think can be done to prevent erosion like this from occurring in other places?
