THE STAIRWAY OF WATER

When a boat travels up the Mississippi River, it climbs a set of steps. These steps are made by locks and dams. There are 29 steps that are climbed when travelling from St. Louis to Minneapolis/St. Paul. Boats get from one step to the next by using a lock.

RIVER TRIVIA

Did you know?

• From just above St. Paul, Minnesota to nearly St. Louis, Missouri, the river falls about 420 feet in a distance of 669 miles.

• The largest single bulk items moved up river are petroleum products that include gasoline, kerosene, and fuel oil, upbound from the oil fields of Texas and Louisiana.

• Coal in great quantity is also shipped upstream, mainly from the coal fields of central and southern Illinois and western Kentucky.

• Grains such as corn, wheat, oats, barley and rye are the principal downbound products.

• According to old records, one of the largest cargo's ever carried by a river steamer was that of the "Henry Frank" which arrived in New Orleans in 1881 with 9,226 bales of cotton weighing 2,390 tons, stacked so high and solid that the vessel was barely visible.

• Today a tow of 20,000 tons of freight loaded on 12 or 15 barges, with a length greater than the "Queen Elizabeth," all powered by one sturdy diesel towboat, is very common to see on the 1,500 mile trip from Baton Rouge to St. Paul.

Natural Resource Management Section
Mississippi River Project
P.O. Box 534
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THE LOCK

US Army Corps of Engineers
Rock Island District
LOCKING A TOWBOAT DOWN RIVER

TOWBOAT ENTERS LOCK

The water flows through big tunnels and then into the lock.

After the lock is filled, the upper gates are opened, and the towboat enters the lock.

After the water drains out, the lower gates are opened, and the towboat leaves the lock.

For a towboat heading up river, the locking procedure is reversed.

WHAT A LOCK LOOKS LIKE FROM THE SIDE

In the above picture, the towboat is wanting to go down river. It is on a higher step wanting to move to a lower step. How can it do this? It needs an elevator! Our elevator is called a lock.

Before the boat enters the lock, the lock is filled with water by opening the filling valves. Opening these valves is like turning on the faucet to fill your bathtub!

WHAT A LOCK LOOKS LIKE FROM THE TOP

Once inside the lock, the upper gates are closed. The emptying valves are opened.
Opening the emptying valves is like pulling the plug on a bathtub! It drains the water out of the lock, but not all of it.

TOWBOAT IS LOWERED

TOWBOAT LEAVES LOCK
Trivia:

Minneapolis/St. Paul, Rock Island, and Keokuk are the only three dams that provide their own power to operate valves and gates by hydroelectric power.

The turbine in dam #15 generates 312-kilowatt hours of electricity. It is used to supply the Visitor Center, Locks and Dam #15, and the Clock Tower with power. Some power is also sold to the Arsenal.

If you look underneath the Government Bridge, you'll notice ropes hanging down with yellow blocks attached to them. These are "last chance ropes." They are spaced at 10-foot intervals with the blocks normally located 1-1 ½ feet above the surface of the water. They are your "last chance" before going into the dam. The U. S. Army Corps of Engineers has installed these life-saving devices at its navigation dams.

For safety, there is a restricted area 600 feet above the dam and 150 feet below the dam. Due to river flow and turbulence, no vessels are allowed in that area.

We can expect the average amount of water passing through the roller dam to be:

<table>
<thead>
<tr>
<th>Season</th>
<th>Gallons/sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>418,880</td>
</tr>
<tr>
<td>Fall</td>
<td>306,680</td>
</tr>
<tr>
<td>Winter</td>
<td>209,440</td>
</tr>
<tr>
<td>Spring</td>
<td>575,960</td>
</tr>
</tbody>
</table>

Dam Facts:

- Dams are "non-navigable" because vessels cannot navigate directly over or through the dam gates; all river traffic must pass through the locks.
- Dam #15 is 1203 feet long and consists of 11 roller gates that are each 110 feet long.
- Rollers #2-10 are 26 feet in diameter and each weighs 240 tons.
- Gates #1 and #11, located at each end of the dam, are called skimmer gates. They are 21.75 feet in diameter and weigh 208 tons. They were designed to permit overflow to keep the upper pool clear of debris and aquatic vegetation. This problem never developed, so those gates no longer serve that purpose.
- There is a 4-foot breaker wall below the dam to reduce river bed erosion.
- There are 11 control houses. Each house contains operating machinery for a separate roller gate.
- From the bottom of the river to the top of each control house is 78 feet.
- Dam #15 is made up entirely of roller gates and is the largest roller dam in the world.
What is the history of the Dam?

Work on Locks and Dam 15 began in March of 1932 and was completed in May of 1934. The U.S. Army Corps of Engineers managed construction of this and other locks and dams on the Mississippi River.

Locks and Dam #15 was the first project completed on the Upper Mississippi River. It was built to control the Rock Island Rapids and provide consistent river depths. The rapids extended from Rock Island, Illinois to LeClaire, Iowa. It was considered one of the most dangerous areas on the river. Part of the rocky material creating the rapids was removed from the river and the dam submerged the rest. This improved navigation on the river. The lock began operation in August of 1933.

What is the purpose of our dam?

Dams on the upper Mississippi River hold back enough water to create a navigational pool sufficient to float vessels drafting 9 feet of water.

The dam creates a navigational pool through which boats can travel easily. The depth of the channel depends on river flow, makeup of the river bed, and flood or drought conditions.

The dam does not control flooding. A flood control dam would flood many cities and stop commercial navigation as we know it.

What is a roller gate?

A roller gate is a metal cylinder that spans the water between two concrete piers. At Locks and Dam 15, 9 of the roller gates are 110 feet long and 26 feet in diameter. The other two are about 22 feet in diameter. Why? See "Dam Facts."

Why did they choose a roller gate?

Roller gates, an idea imported from Europe, have several advantages. The strength of rollers permitted construction of long gates, longer than other types of movable gates. This allowed for an economic use of metal. The Engineers knew that longer openings would allow maximum clearances through which to pass debris, ice, and flood waters. The longer lengths also reduced the number of piers that needed to be built. The strength of the roller gate is a result of the cylindrical shape and the presence of star shaped trusses. These trusses are spaced every few feet inside the cylinder.

How does the dam work?

The dams are considered "movable" because they have gates that can be raised or lowered. Lockmasters adjust the flow of water through the gates to maintain appropriate water levels.

When lowered, a non-submersible roller gate rests directly on the dam's concrete sill, holding back the water. When raised, the roller gate allows water to flow freely beneath it.

Each roller gate can be operated independently. Operation is by means of a multiple sidearm chain mechanism, similar to an enormous bicycle chain. As an electric motor, housed within one of the piers, hauls in or plays out the chain, the gate is raised or lowered as it moves slowly along the racks.
Compare...

Cargo Capacity

- **ONE BARGE**
  - 1,500 TON
  - 52,500 BUSHELS
  - 453,600 GALLONS

- **ONE 15 BARGE TOW**
  - 22,500 TON
  - 787,500 BUSHELS
  - 6,804,000 GALLONS

- **JUMBO HOPPER CAR**
  - 100 TON
  - 3,500 BUSHELS
  - 30,240 GALLONS

- **100 CAR TRAIN**
  - 10,000 TON
  - 350,000 BUSHELS
  - 3,024,000 GALLONS

- **LARGE SEMI**
  - 26 TON
  - 910 BUSHELS
  - 7,865 GALLONS

Equivalent Units

- **ONE BARGE**
- **15 JUMBO HOPPER CARS**
- **58 LARGE SEMIS**

- **ONE 15 BARGE TOW**
- **2.25 100 CAR TRAIN**
- **870 LARGE SEMIS**

Equivalent Lengths

- **ONE 15 BARGE TOW**
  - .25 MILE

- **2.25 100 CAR TRAIN**
  - 2.75 MILES

- **870 LARGE SEMIS**
  - 11.5 MILES
  - (BUMPER TO BUMPER)