River Engineering in the St. Louis District

Presented to the Changjiang (Yangtze) River Administration of Navigation Affairs

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August 12, 2019
Mississippi River Watershed

- 4th largest watershed in the world
- 1.2 million square miles
- Covers 41% of the lower 48 states
- 31 U.S. States, 2 Canadian Provinces
Mississippi River History

- Lifespan of steamboat in 1800’s was 18 months.
- Between 1810 and 1850 over 4,000 people died in steamboat accidents.
- Snags, Fire, explosions and collisions were the major causes.
1824: Congress ordered the Corps of Engineers to clear snags on the Ohio and Mississippi Rivers.
Early River Engineering Structures

1837: Lt. Robert E. Lee and 2\textsuperscript{nd} Lt. Montgomery C. Meigs arrive in St. Louis to perform work on the harbor.
Navigation and Flood Control

1872: The goal of the improvements on the Mississippi was to regularize a channel through the St. Louis harbor, sufficiently narrow and deep to accommodate the large amount of river traffic.

1879: Mississippi River Commission (MRC) created to execute a comprehensive flood control and navigation plan on the Lower Mississippi.
1939: A Nine foot navigation channel was completed on the Mississippi.

The St Louis District was responsible for the design and construction of three locks and dams. No. 24 at Clarksville, and No. 25 at Winfield in Missouri. And No. 26 in Alton Illinois.
Navigation Mission

- St. Louis District maintains 9-foot deep, 300-foot wide navigation channel on 300 miles of the Mississippi, 80 miles on lower Illinois and 36 miles on lower Kaskaskia.

- 12,000 miles of commercially active waterway system maintained by the Corps.

- St. Louis 3rd busiest port on inland waterway system, handling 110 million tons annually.
Navigation Channel Design

Develop a Reliable, Safe, and Environmentally Sustainable Navigation Channel on the Middle Mississippi River

During Low Water, 9 feet deep, 300 feet wide, with additional width in bends as required
The Inland Waterway System

- Nearly 12,000 Mile System
- 191 Lock Sites / 237 Chambers Active
- Replacement Value $125+ Billion
NOTE: The Freight Analysis Framework (FAF) is based in large part on results from the Commodity Flow Survey (CFS), last administered in 2012.

Waterways: The Most Efficient Mode of Freight Transportation

1 tow = 1,050 semis
Waterways: The Most Efficient Mode of Freight Transportation

Ton-miles Traveled per Gallon of Fuel

- Waterways: 576
- Rail: 413
- Truck: 155
Mississippi Valley Division

- St. Paul District
- Rock Island District
- St. Louis District
- Memphis District
- Vicksburg District
- New Orleans District
St. Louis District
St. Louis District: The Transition Point

Pools

Open River

Lock & Dam #24, Clarksville, MO
Tools Used for Maintaining Authorized Navigation Channel Dimensions on Open River

River Training Structures

Rock Removal

Off-Bank Revetments

Dredging
Sediment Management
July 2010
Channel Maintenance Dredging
River Contraction

Bankfull Width

Width at Low Water

Riverbed without Dike

Riverbed with Dike

+30 LWRP
• River training structures (timber pile dikes), revetments (wooden mattresses)
  • 1960’s transitioned from timber structures and revetments to rock.
  • 1990’s bendway weirs and blunt nose chevrons were introduced to the Mississippi River.
• Early 2000’s the benefits of the Regulating Works Project developments are evident with the reduction of dredging, increased reliability of the navigation channel during the low water period, and reduced accidents & groundings
Dikes (Wingdams)
Notched Dikes
Notched Dikes

1974

1998
Bendway Weirs
Chevrons
Chevrons
Bullnose
Multiple Roundpoint Structures
Multiple Roundpoint Structures
Z-Dikes
W-Dikes
W-Dikes
HSR Modeling Basic Principle
Carondelet HSR Model

- River Miles 181.0 – 165.0
- Regulating Works Program
Model Replication

2010 Prototype
Proven Design Capabilities of HSR Models

- Design and optimization of river training structures
- Thalweg realignment
- Reduction of costly, chronic dredging
- Modification of bathymetry and far-field flow patterns to improve navigation
- Environmental - i.e. Side Channels
- Demonstration & Education
Questions?