WHAT LIES BENEATH? A LOOK AT THE MISSOURI RIVER USING ARCGIS BATHYMETRY

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The Maritime Administration (MARAD) was established on May 24, 1950 by Reorganization Plan No. 21 of **President Harry S. Truman** and placed within the U.S. Department of Commerce.

In 1981, MARAD was transferred to the Department of Transportation, completing the consolidation of all Federal transportation programs into one cabinet-level department.

MARAD is a US Department of Transportation agency that promotes the US maritime industry.





Marine Highway M-70

Sponsors: Ohio DOT; Illinois DOT; Kentucky Transportation Cabinet, Division of Planning; Missouri WI DOT; West Virginia DOT; Ports of Indiana; Port of MI Pittsburgh Commission Landside Route Served: Interstate-70 **Route Description:** The M-70 Route includes the Ohio, Mississippi, and Pittsburgh Missouri Rivers, and connecting commercial M-70 OH navigation channels, ports, and harbors, from Pittsburgh IN to Kansas City. It spans Pennsylvania, Ohio, Indiana, Cincinnati Illinois, and Missouri, connecting to the M-55 Route at St. Louis, MO. WV M-70 Huntington Kansas City Louisville Attributes: This Route contains major freight truck bottlenecks M-70 at numerous points, including Kansas City, KY St. Louis, Louisville, Dayton, Cincinnati, Columbus, and Pittsburgh. According to the U.S. Dept. of Transportation, long haul truck volumes are M-70 / M-55 expected to reach 25,000 per day along major segments by Paducah 2035. Similarly, rail congestion is evident in and around Kansas City, St Louis, and several points along the Route in Ohio. This Marine Highway Route has the potential to help alleviate a portion of the NC congestion from the existing landside routes, while at the same time reducing emissions, conserving energy, improving safety, and reducing highway maintenance costs. It can TN also contribute to increased economic and commercial activity in the region by removing barriers to efficient freight transportation. Background SC

In 2009 the Lower MO River from KC to STL was designated as M-70

The upper section from KC to Sioux City was added as M-20 in 2013

Background



Marine Highway M-29

Sponsors: The Port Authority of Kansas City and Missouri DOT

Supporters: Kansas DOT, the Mid-America Regional Council, St. Joseph Area Transportation Study Organization, Missouri Department of Economic Development, the Inland River Ports and Terminals Association and the Nebraska City Dock Board.

Landside Routes Served: 1-29, 1-35, 1-70, and 1-49

Route Description:

The M-29 Marine Highway Route establishes a connection between the middle section of the Missouri River in Sioux City, Iowa and the M-70 Marine Highway Route at Kansas City, Missouri.

Attributes:

Kansas City is a regional freight hub and home to the Nation's second largest rail center and third largest trucking center. The M-29 Route will provide a third transportation option for regional freight movement between Sioux City Kansas City's intermodal infrastructure and shippers in Missouri, Kansas, Iowa, Nebraska, South Dakota and Minnesota. It has the potential to contribute to a safe, cost efficient and environmentally sustainable regional transportation system.

Increasing freight transportation on the Missouri River, both north to Sioux City, Iowa and east to the Mississippi River, can serve to slow freight traffic growth on local roads, interstate highways, railroads and bridges in the surrounding counties. The M-29 Route will provide a crucial linkage to the larger M-70 Route, serving areas previously unconnected to that Route, as well as strengthening the M-70 Route itself by encouraging increased utilization. This will ease congestion between Missouri and Kansas, in other cities adjacent to the Missouri River such as Omaha, Nebraska and Sioux City, Iowa, and

M-29 throughout the Midwest region in general.

IA

Kansas City

Sai

MO

The Rivers and Harbors Act of 1945 authorized a 9-footdeep by 300-foot-wide navigation channel. To maintain the channel, the Corps constructed the Bank Stabilization and Navigation Project (BSNP) generally from Sioux City to the mouth at St. Louis, a

distance of 735 miles. John Jordan 'Buck' O'Neil Memo



Figure 1-1. Typical Arrangement of BSNP Structures on the Missouri River Background



Figure 1. Missouri River Navigation Channel





When needed dredging is used to maintain the channel



A sand dredge, a sand barge and tending towboat work the river in downtown Kansas City. photo copyright Don Wilkison, - <u>Warrior Ant Press.</u>

So, Where and When is dredging needed?

🗙 U.S. ARMY

<u>Corps Kansas City survey crews helping define restricted areas on</u> <u>the Missouri River | Article | The United States Army</u>

Corps Kansas City survey crews helping define restricted areas on the Missouri River

By James Lowe November 2, 2020

- Normally surveys are done on an as needed basis, or when Areas of Concern (AOCs) are received from the navigation industry and encountered by commercial shipping.
- In addition, channel recon inspections are performed over the 500 miles of channel from Rulo, Neb. to St. Louis.



The Kansas City District, Missouri River Area Office has two survey teams.

The survey crews use sonar to collect bathymetric surveys to determine the depth of water in the navigation channel. They're looking at areas of concern reported by the navigation community where depth less than the authorized depth of 9' in the 300-foot by 9-foot channel has been encountered by commercial shipping.

These surveys are provided on line to the public.

Background

https://www.nwk.usace.army.mil/Missions/Civil-Works/Navigation/Surveys/

Gladys West

SEADR

25' Vessel Twin 250 HP Outboards Dr. Gladys West is known for her contributions to the She is known for her contributions to mathematical modeling of the shape of the Earth, and her work on the development of satellite geodesy models, that were later incorporated into the Global Positioning System (GPS).

1-2060 KV

Prairie Engineers



HYDROGRAPHIC SURVEYING



HYDROGRAPHIC SURVEYING

YAW

Six Motions of a boat to measure & correct for

SOUAT Capt. P. Zahalka

(Cassell's Dictionary: Squat = kauern, hocken, sitzen, sich setzen)

What in fact is Squat and why is Squat relevant for shipping?

Squat is the reduction of a vessels <u>Keel-Clearance</u>, caused by the relative movement of the ship's hull through the surrounding body of water. Compared with the neutral position (1) the hull sinks deeper into the water and at the same time will trim slightly. The algebraic sum of both, sinking and trimming is called Squat (2).

Squat is not the difference of the draught readings of a vessel in her neutral position compared with the readings of a vessel making speed or laying in flowing water (current).





PITCH ROLL Heave Yaw Roll G Pitch Surge Sway

9

12



The Problem

Degradation and loss of sediment from the riverbed have caused a drop in the channel bed elevation and water surface elevation thus causing fixed objects in the river bed that were once below the authorized depth to now protrude within the authorized depth. These fixed objects (obstructions) pose a hazard to navigation during low stages.

Between 1974 to 2021 the bed has degraded between 2-8 feet with most of the degradation manifesting itself after large flood events. As part of 2019 Flood damage repairs on the BSNP, the Missouri River Navigation Obstruction Removal Project (MRNOR) is proposed to maintain the authorized navigation channel by the removal of these underwater obstructions.

this task order consists of surveying and terrain model development for nineteen (19) individual zones







PROJECT LOCATION MAP RISING CREEK BEND







HYDROGRAPHIC SURVEY LOG SHEET Survey #: Area 1	0 Sheet # of	Date: 21 - Aug - 23
Project Details: Missouri River MB Survey Area 10 at RM 136		
Fathometer Frequency: Norbit i80	Survey Crew: J.Allen & J. Langer	
Draft of Fathometer: 1.4	Survey Vessel: The Gladys West, 25' boat	
GPS Mode: Base Station Setup	Sea State:Calm	
GPS Latency:0	Avg. Speed of Sound: 4941ft/sec	
Vessel Squat : RTK	HYPACK File Information :	
Project Bench Mark:	water surface elevation at base 1204=520.44	
Bench Mark Elev and Datum:	lower 1420=519.81	
Bench Mark LAT/Y:	uppper1124=519.30	
Bench Mark LONG/X:		
Horizontal Datum : UTM Zone 15	Jefferson City 1100=6.09 1500=6.06	
Vertical Datum : NAVD88	Hermann 1100=5.64, 1500=5.52	
MLLW-NAVD88 Relationship :	100-5.01 150-5.52	
	Washington 1100=3.53 1500=3.40	
	pos ck	

Line #ame	Start Time	End Time	Tide	Speed	Heading	HDOP	File Name	Remai
1	11:15:24	11:19:00	-518.45	11.33	0.0	1.00	0001_1115.RAW	
2	11:19:38	11:24:38	-518.96	5.72	0.0	1.01	0002_1119.RAW	
3	11:24:38	11:26:40	-519.28	5.70	252.37	1.11	0002_1124.RAW	
3	11:27:54	11:28:37	-519.14	6.22	0.0	0.90	0003_1128.RAW	
5	11:30:51	11:31:39	-518.58	4.61	0.0	1.12	0004_1131.RAW	
6	11:33:53	11:34:44	-518.22	4.65	158.20	1.10	0005_1134.RAW	
76	12:26:29	12:31:46	-519.88	5.88	72.15	0.00	0016_1226.RAW	
86	12:32:57	12:40:38	-520.74	5.46	252.15	0.00	0016_1233.RAW	
94	12:41:09	12:46:01	-520.15	8.26	72.15	0.00	0014_1241.RAW	
12	12:46:52	12:56:03	-520.60	4.67	252.15	0.00	0012_1247.RAW	
10	12:56:43	13:01:43	-519.95	8.11	72.15	0.00	0010_1257.RAW	
82	13:02:31	13:11:55	-520.61	4.35	252.15	0.00	0008_1302.RAW	
63	13:12:34	13:17:14	-520.18	8.54	72.15	0.00	0006_1312.RAW	
44	13:18:12	13:28:41	-520.90	3.93	252.15	0.00	0004_1318.RAW	
25	13:29:32	13:34:48	-520.16	7.37	72.15	0.00	0002_1329.RAW	
16	13:35:52	13:46:40	-520.75	4.07	252.15	0.00	0001_1336.RAW	
17	13:47:30	13:53:55	-520.42	6.43	72.15	0.00	0001_1347.RAW	
18	13:53:55	13:54:05	-520.11	4.85	72.15	0.00	0001_1354.RAW	
19	13:55:14	14:05:39	-520.77	5.03	252.15	0.00	0001_1355.RAW	
26	14:06:53	14:11:51	-520.10	8.15	72.15	0.00	0016_1407.RAW	
21	14:13:01	14:20:25	-520.48	2.76	252.15	0.00	0001_1413.RAW	
22	14:20:48	14:26:08	-520.57	2.02	252.15	0.00	0001_1421.RAW	
23	14:26:35	14:27:18	-520.58	2.80	72.15	0.00	0001_1426.RAW	
24	14:27:26	14:32:46	-520.05	7.31	72.15	0.00	0001_1427.RAW	















READY TO ADVERTISE









READY TO ADVERTISE



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Prairie Engineers, P.C.

ELEVATION MODELS IN GIS

DEM has bare-bones elevation values referenced to a vertical datum. When you void vegetation and man-made features from elevation data, you generate a DEM

DTM's terrain-focused precision (DEM/DTM used synonymously)

DSM's representation of terrain and structures. A DSM is useful in 3D modeling for telecommunications, urban planning, and aviation.

DEMs and **DTM**s focus on ground elevation; DTMs exclude objects, while DSMs include all surface features.

Triangular Irregular Network (**TIN**) is a way to represent a 3D surface. **TIN**s provide a detailed, adaptable representation of the terrain using triangular facets RASTER

TRADITIONAL VS BATHYMETRIC TIN

Traditional TIN

Ability to create and analyze surface data represented in raster and vector datasets. Purpose: Tool for creating, modifying, and converting triangulated irregular network (TIN) datasets.

License requirement:

- Basic: Requires 3D Analyst
- Standard: Requires 3D Analyst
- Advanced: Requires 3D Analyst

ASCII to Feature Class Z to ASCII	.txt file	XY table to point	Point (shp) to TIN	TIN to Surface Contour	$\overline{}$	Surface contour to Smooth line	>
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Bathymetric TIN

Strictly preserves a shallow bias, meaning, preserves points showing local shallow areas in bathymetric terrain. The output is used to generate depth contours for navigation*

Elevation data management and visualization tool

Smooth Bathymetric TIN primarily used in nautical chart production

Availability of tool with license type:

- Basic: No
- Standard: Requires ArcGIS Bathymetry
- Advanced: Requires ArcGIS Bathymetry

Although there are ways of working around this- data display and update using a Web Map Application

BATHYMETRIC TIN

The "Depth Direction" setting determines how depth information is recorded in a Triangulated Irregular Network (TIN), which is commonly used in geographic information systems (GIS) and 3D modeling.

Here's a breakdown of the options:



Positive Down

Measured upwards from reference point Useful when depth below surface is relevant Higher number = Deeper below reference point



Positive Up

Measured upwards from reference point Capturing elevation data Higher number = Further above the reference point

Choosing between these options affects how you interpret and visualize depth data in your TIN model, influencing analyses such as volume calculations or surface modeling.





TIN



SMOOTH BATHYMETRIC TIN















Missouri House Passes HB 2352 to Propel Port Development

ong the key provisions of HB 2352 is the expansion of eligible land for

Projects

Missouri River Terminal (MRT)

This inland port will improve road access to the site, which is located where the Blue River meets the Missouri River. The funding will help attract economic and employment growth to the east side of Kansas City.

Terminal Woodswether

Port KC will renovate the existing port and build a new dock to double the volume of barge traffic.

Second port

Port KC will build a second port at the former AK Steel mill plant near the Blue and Missouri rivers. The project is being completed in four phases.



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SOUTH SIOUX CITY, NEB. (KTIV) - South Sioux City, Nebraska is making major strides in economic development in Dakota County after the recent approval for an "Inland Port Authority". That project in conjunction with Dakota City as well.







Mayor of Fremont, Nebraska announces first inland port authority board

27 MAR 2023	-		Port	FREMONT LOGISTICS HUB			
	-		-		A NEBRASKA INLAND PORT AUTHORITY		

homeowners want to sell

BY: CINDY GONZALEZ - JANUARY 2, 2025 7:28 PM

on \$90M business park project