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## **SHIPPER AND CARRIER RESPONSE TO THE JUNE-JULY 2008 UPPER MISSISSIPPI RIVER FLOOD EMERGENCY CLOSURE OF LOCKS 12-25**



US Army Corps  
of Engineers®

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# Navigation Economic Technologies

The purpose of the Navigation Economic Technologies (NETS) research program is to develop a standardized and defensible suite of economic tools for navigation improvement evaluation. NETS addresses specific navigation economic evaluation and modeling issues that have been raised inside and outside the Corps and is responsive to our commitment to develop and use peer-reviewed tools, techniques and procedures as expressed in the Civil Works strategic plan. The new tools and techniques developed by the NETS research program are to be based on 1) reviews of economic theory, 2) current practices across the Corps (and elsewhere), 3) data needs and availability, and 4) peer recommendations.

The NETS research program has two focus points: expansion of the body of knowledge about the economics underlying uses of the waterways; and creation of a toolbox of practical planning models, methods and techniques that can be applied to a variety of situations.

## **Expanding the Body of Knowledge**

NETS will strive to expand the available body of knowledge about core concepts underlying navigation economic models through the development of scientific papers and reports. For example, NETS will explore how the economic benefits of building new navigation projects are affected by market conditions and/or changes in shipper behaviors, particularly decisions to switch to non-water modes of transportation. The results of such studies will help Corps planners determine whether their economic models are based on realistic premises.

## **Creating a Planning Toolbox**

The NETS research program will develop a series of practical tools and techniques that can be used by Corps navigation planners. The centerpiece of these efforts will be a suite of simulation models. The suite will include models for forecasting international and domestic traffic flows and how they may change with project improvements. It will also include a regional traffic routing model that identifies the annual quantities from each origin and the routes used to satisfy the forecasted demand at each destination. Finally, the suite will include a microscopic event model that generates and routes individual shipments through a system from commodity origin to destination to evaluate non-structural and reliability based measures.

This suite of economic models will enable Corps planners across the country to develop consistent, accurate, useful and comparable analyses regarding the likely impact of changes to navigation infrastructure or systems.

NETS research has been accomplished by a team of academicians, contractors and Corps employees in consultation with other Federal agencies, including the US DOT and USDA; and the Corps Planning Centers of Expertise for Inland and Deep Draft Navigation.

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## SUMMARY

Mississippi River Locks 12-25 (UMR 556 to 241) are critical to navigation on the Upper Mississippi River. In 2007 Lock 12 passed about 18 million tons, and Lock 25 passed about 30 million tons. Between June 13 and July 5, 2008, these locks were sequentially closed to navigation traffic for an unscheduled shutdown of the river due to flooding.

A survey of the shippers and carriers affected by the emergency lock closures was conducted between 14 January and 6 March for the purpose of discerning industry reactions to the closures and the associated costs.

The Waterborne Commerce Statistics Center (WCSC) database was queried for the names of all shippers that normally transport commodities through Locks 12-25. A total of 177 companies that transported 50,000 tons or more through the locks in 2006 (the most recent data available) were selected to receive the shipper survey. Completed survey forms were received from 57 companies, representing a response rate of 32 percent. However, a follow-up telephone campaign resulted in an additional 14 replies, increasing the overall response rate to 40 percent.

As would be expected, shipper reactions to the closure varied. Seventeen of the responding shipping companies indicated that they stockpiled product and waited for UMR locks to re-open, at a total reported cost of \$2,168,000. Fifteen shippers responded that they ceased operations during the period of closure, incurring additional costs of \$4,736,500. Total costs of \$1,113,000 were reported by companies that switched to all-overland mode for product delivery, and for companies that altered production during the period of closure additional costs incurred totaled \$2,025,000. Twenty-six different commodities and a total of 417,700 tons were impacted, as provided in responses from 8 different companies. Replies from nearly half of the respondents appear to indicate that a change in intermediate or long-term transportation strategy was not required for what was considered to be a short-term closure.

The major carriers using Locks 12 – 25 were also surveyed during this effort. A total of 48 companies were contacted. Completed survey forms were received from 18 companies, representing a response rate of 38 percent. Through the follow-up telephone campaign seven additional responses were received, increasing the overall response rate to 52 percent. For the carriers that responded, estimated total additional costs associated with the lock closures were \$2,023,000 for delay costs, \$7,594,000 for lost revenue, and \$115,000 for logistics. Total tonnages impacted were 789,500 tons for 15 different commodities.

Prior to conducting the survey, conversations were held with several navigation industry representatives and port captains to obtain their perspective on what happened during the June/July emergency lock closures. This feedback helped in designing the survey questions, and it also brought to light valuable insights on issues regarding this type of unscheduled lock closure that warrant documentation.

1. Communication was excellent, and the daily conference calls between the Rock Island District Corps of Engineers (MVR) and industry kept industry apprised of the river situation and helped to lessen the impact.
2. With the forecasting capabilities of the National Weather Service (NWS) and the MVR Water Control section, river levels could be predicted well in advance so that industry had about a one-week warning that the locks would likely close due to flooding.
3. Advance notification allowed companies to move vessels out of areas scheduled to close. Most companies that wanted to get out of an area moved their vessels downstream of the lock and dam system into the open river below St. Louis to continue to do business, or they moved tows to the Illinois River where the water was low. Some moved upstream of Lock 11 where the system was open and they either got work done up there or they moved to a holding area and were ready to go when the downstream locks opened again.
4. Any company changes in procedures would be for the short-term as a 5-6 day notice does not allow enough time for shippers to redirect vessels or for towing companies to make adjustments. A 3-week shutdown of the navigation system is not considered long enough to significantly impact business practices.
5. The shutdown in the upper system had a domino effect on costs associated with other producers and shippers due to products not being delivered because of the flood. This impact rolled all the way to New Orleans when vessels did not arrive as planned, and then all the delayed tows arrived in New Orleans at the same time and had to wait to unload.

In addition to the survey work, an analysis of the Operation and Maintenance of Navigation Installations (OMNI) data for the closure period was undertaken to assess shipper and carrier reactions to, and the impacts of, the June-July 2008 closure event. The following conclusions were reached as a result of the analysis of OMNI data:

- Tow delays greatly exceeded normal levels as a result of the closure.
- Tow arrivals spiked higher after the locks were reopened, and remained above pre-closure levels.
- Overall, tonnage decreased significantly during the 2008 flood year as was the case in the 2001 and 1993 flood years.
- In 2008, although total tons decreased significantly from 2007 levels, tons of crude materials and machinery and equipment actually showed an increase over the previous year.

Assessing the short-and long-term impact of a natural disaster on the national and regional economy is always difficult as it is never just a “one issue event.” As in the 2008 flood event, waterborne transportation was not the only industry to feel the effects.

Impacts spillover into other issues of regional economic losses, agriculture losses, the loss of infrastructure and structures, transportation disruptions, and so on. Although the June/July 2008 flooding affected only 13 of the locks on the UMR system, impacts undoubtedly were experienced in areas far beyond the scope of this survey.

SHIPPER AND CARRIER RESPONSE TO THE  
JUNE-JULY 2008 UPPER MISSISSIPPI RIVER FLOOD  
EMERGENCY CLOSURE OF LOCKS 12-25

1. INTRODUCTION

Severe storms throughout the Midwest in June-July 2008 produced heavy rainfall and runoff within the 142,000 square-mile watershed above Lock and Dam 25 (river mile 241.3). Over the course of this flood event the Mississippi River would encounter above-flood stages in many locations within the Rock Island District, and flood stages near or above the 1993 levels would occur in some locations.

Beginning June 10 Upper Mississippi River (UMR) locations from Dubuque, Iowa (Lock 11) to Saverton, Missouri (Lock 22) were forecast to experience moderate to major flooding. By June 12, the Mississippi River locks were scheduled to shut down as the flooding continued and near record forecasts were expected along the mainstem Mississippi River from Lock 15 (Rock Island, IL) to Lock 22. Flooding conditions resulted in the closure of navigation locks beginning June 14, and by the end of the day on June 15, Lock 11 would be the only lock remaining open over 315 miles of the UMR making the river non-navigable to commercial river traffic. As of June 14, major flooding was occurring from Lock 15 to Lock 19 (Keokuk, Iowa) and was forecasted downstream to Lock 25 (Winfield, Missouri).

On June 17 the Coast Guard closed the river to all recreational traffic from Lock 14 (UMR mile 493.3) south to the Jefferson Barracks (I-255) bridge on the south end of St. Louis (UMR mile 168.7). Within the Rock Island District, 23 of 26 recreation areas were expected to be closed for approximately two weeks.

All lock crews were fully engaged in flood fights to save lock buildings, equipment and facilities. In addition to the damages sustained in local communities and levee districts, Federal infrastructure was also heavily damaged by the flooding which included the locks and dams along the Mississippi River from Bellevue, Iowa (Lock 11) to Saverton, Missouri (Lock 22).

As the flood waters moved down river and the locks began to reopen, attention was turned toward the navigation industry and the potential impacts they incurred as a result of the June 14 – July 5 emergency closure of the Upper Mississippi River navigation locks. It was determined that a survey of the major waterborne shippers and carriers would be conducted for the purpose of identifying and measuring the economic impacts of the flood's disruption of shipping on the Mississippi River.

Prior to survey design, conversations were held with operations managers and port captains from several of the large shipping and towing companies to get their perspective

on what happened during the flood. Input from these industry representatives was invaluable for identifying the important issues to be addressed, narrowing the focus of the survey, and developing questions that are meaningful and inclusive of all important ideas.

The survey of the shippers and carriers affected by the lock closures was conducted between 19 January and 27 February 2009 to determine what measures were taken by industry to mitigate the effects of the lock closures and to estimate the total costs to industry that resulted from the closure events. This report documents the results of those industry surveys.

In addition to the industry surveys, an analysis of the Operations and Maintenance of Navigation Installations (OMNI) data for Locks 12-25 was conducted. The purpose of this analysis was to examine and assess the changes in tow arrivals and delays, and tonnage by commodity group. An additional purpose was to identify changes in operating procedures attributable to the closure, and to draw comparisons with the industry survey responses.

## 2. PROJECT DESCRIPTION

The Upper Mississippi River (UMR) navigation system extends from Minneapolis – St. Paul downstream to the confluence of the Ohio River. It includes 29 locks on the UMR and approximately 1,200 miles of navigable waterway within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. This system is a vital part of our national economy and is an integral link in the Nation’s intermodal transportation system. Figure 1 shows the location of all locks on the Upper Mississippi River System.

During the June-July 2008 flood event 13 of the UMR locks were closed to navigation traffic causing, among other things, a temporary halt in this regional, national and international transportation network. One method of determining the impact of the June-July 2008 flooding on the waterborne commerce in the UMR region is to analyze the performance of key lock systems located on the affected waterway. For this particular event the activity of Lock 25 at Winfield, Missouri is displayed in table 1 to provide a look at how the flood impacted commodity flow. For the period June through July 2007, 576 tows carried nearly 8.2 million tons through Lock 25. During that same period in 2008, 359 tows carrying almost 5.1 million tons passed through Lock 25. Overall, commodity traffic through Lock 25 for this time period declined by 38 percent in 2008.

Figure 1  
UMR Locks



Table 1  
 Lock 25 Commodity Traffic  
 June-July 2007 & 2008  
 (Thousands of Tons)

Commodity	2007	2008	Percent Change
Coal	1,140.7	671.4	
Petroleum	121.7	52.2	
Chemicals	669.5	456.0	
Crude Materials	715.7	813.4	
Manufactured Goods	305.4	194.2	
Farm Products	5,226.6	2,831.1	
Manufactured Machinery	11.0	38.5	
Other	3.0	3.1	
Total	8,193.7	5,059.9	-38%

Source: OMNI Data

### 3. ADVANCED CLOSURE NOTIFICATIONS

During this flood event, the Rock Island District of the U.S. Army Corps of Engineers conducted daily phone conferences with navigation industry to keep them apprised of situations occurring on the river. The forecasting capabilities of the National Weather Service and the Rock Island District water control section made it possible to estimate river levels in advance. The navigation industry had about a one-week warning when the locks would likely close due to flooding. This advanced notice allowed time for industry to prepare for the pending closures.

Based on OMNI data, Locks 12-25 were closed from 12 June – 5 July 2008, an actual duration of 24 days. The remainder of the system, Locks 1-10, 26 and 27, was open during this flood event. The length of closure at each lock varied from 1 day to more than 22 days. Table 2 presents the closure summary for all Upper Mississippi River locks impacted by the June-July 2008 Mississippi River flood.

Table 2  
Lock Closure Summary  
June 2008 Mississippi River Flood

LOCK	LOCK CLOSED	LOCK OPEN
L/D 12	CLOSED at 0210 on 6-14-08	OPENED at 1000 on 6-15-08
L/D 13	CLOSED at 0400 on 6-14-08	OPENED at 1800 on 6-18-08
L/D 14	CLOSED at 0400 on 6-14-08	OPENED at 1600 on 6-18-08
L/D 15	CLOSED at 1520 on 6-14-08	OPENED at 0200 on 6-20-08
L/D 16	CLOSED at 1130 on 6-12-08	OPENED at 0800 on 6-26-08
L/D 17	CLOSED at 0253 on 6-12-08	OPENED at 0800 on 6-27-08
L/D 18	CLOSED at 0215 on 6-13-08	OPENED at 1330 on 6-27-08
L/D 19	CLOSED at 2108 on 6-13-08	OPENED at 2110 on 6-28-08
L/D 20	CLOSED 6/12/08 at 9:20 PM	OPENED at 0900 on 7-4-08
L/D 21	CLOSED at 1735 on 6-13-08	OPENED at 1100 on 7-3-08
L/D 22	CLOSED at 1740 on 6-13-08	OPENED at 0600 on 7-4-08
L/D 24	CLOSED at 0800 on 6-14-08	OPENED at 1501 on 7-3-08
L/D 25	CLOSED at 1000 on 6-13-08	OPENED at 1100 on 6-13-08
	CLOSED at 1125 on 6-13-08	OPENED at 1224 on 6-13-08
	CLOSED at 1330 on 6-13-08	OPENED at 2025 on 6-13-08
	CLOSED at 2109 on 6-13-08	OPENED at 0107 on 6-14-08
	CLOSED at 0732 on 6-14-08	OPENED at 0635 on 7-5-08

The river was also closed to recreational traffic from Lock 14 at LeClaire, Iowa (UMR Mile 493.3) south to the Jefferson Barracks bridge on the south end of St. Louis (UMR Mile 167.7). Although the Coast Guard shut down all river recreational traffic for a few weeks, the river was never officially closed to commercial river traffic.

#### 4. SHIPPER SURVEY

a. Survey Procedures. An OMB-approved Shipper Survey (Control #0710-0001) was used to capture and evaluate shipper reactions to the emergency closures at Locks 12-25. The purpose of this survey was to identify the total economic costs and the operational changes to industry associated with the closure event. Shippers were defined as companies that annually move 50,000 tons or more through these locks. A total of 177 shipper surveys were sent out on 14 January 2009.

The survey carried a suspense date of 27 February 2009. All surveys were conducted through the mail as funding and logistics prohibited actual on-site interviews. Completed forms were received from 57 companies, representing a response rate of 32 percent from the initial mailing. Through the follow-up telephone campaign, all of the shippers who had not yet responded were contacted and 14 additional responses were received, increasing the response rate for this group to 40 percent.

b. Survey Responses. The survey questions with corresponding feedback follow. For ease of reading and presentation, much of the data is provided in table format. In all areas possible, survey responses are presented along with the types of commodities involved or the types of facilities that provided information. The intent is to be able to draw some conclusions as to what commodities or what shipping/towing facilities are most likely to be impacted by lock closures on the Upper Mississippi River navigation system

*Q1. Was your company impacted by the emergency lock closures during the June-July 2008 flooding on the Upper Mississippi River?*

R1.

As with most surveys, responses are generally received only from those companies that experienced impacts. However, this leaves a void in the analysis as to what the no responses mean. For this survey, those companies that were not affected by the flood event were requested to return the survey so that there would be a record of no impacts.

The table below shows that for those that responded, over half of the companies were not affected.

Table 3  
Response Summary Shipper Survey Question 1

Response	Count	Percent
Yes	30	42
No	40	56
No Answer	1	2
Total	71	100

*Q2. During the unscheduled closure of the Upper Mississippi River locks, what was your company's response and, if a reasonable estimate can be made, what was the additional cost?*

R2.

Table 4 includes the number of responses for each response category provided on the survey and the type of facility. Additional costs are the data provided by each individual company that offered a response.

Table 4  
Response Summary Shipper Survey Question 2

Response Category	Was Your Company Impacted		Additional Cost (\$)	Type of Facility
	Yes	No		
No change in procedures.	2	10		
Stockpiled product and waited for UMR locks to re-open.	17	12	50,000 100,000 20,000 1,000,000 375,000 3,000 300,000 140,000 100,000 80,000	Coal terminal Bulk commodities intermodal terminal Petroleum fuel & terminal co. General purpose bulk terminal Bulk transshipment terminal Liquid chemicals Transportation service provider (barge/tow) Corn processing factory Grain elevator Grain elevator
Switched to all-overland mode for product delivery from existing sources.	10	18	45,000 \$47/ton 600,000 28,000 200,000 40,000 200,000	Feed mill Power plant-electricity Cement manufacturer Inorganic liquid chemicals Corn processing factory Grain elevator Portland cement distribution terminal
Switched to different waterway routing for product delivery from existing sources.	2	23	100,000	Crushed limestone
Switched product source to an entirely new source.	1	24	0	
Ceased operations during the period of closure.	15	15	12,500 125,000-300,000 10,000 250,000 54,000 4,000,000 60,000 50,000	Rail-to-barge transloading terminal Aggregate plant River terminal-steel unload, heavy picks Transportation service provider (barge/tow) Transport construction equipment Corn processing factory Grain elevator Grain elevator
Altered production during the period of closure.	13	15	25,000 2,000,000	Rail-to-barge transloading terminal Corn processing factory
Switched production to another facility.	2	24	0	
Purchased intermediate or final product, rather than produced.	1	24	300,000	Corn processing factory
Other or combinations of the above.	2	11	140,000 4,000,000	Electric generating facility Electric utility

Additional Comments Provided by Respondents:

- Resulted in total volume of grain shipped outbound by 2 million bushels.
- Customers impacted more than us. We are a terminal more than a shipper. Costs of tonnages stranded or delayed by closure borne by transportation companies and product owners more than us.
- Consumed stockpile, deferred delivery; added costs (\$140,000) to "catch up" after reopening of locks. Demurrage plus additional labor = \$140,000+.
- Offloaded 13 barges in 2008 but not affected by the closure; no barges were scheduled at that time.
- While last summer's lock closing did not impact us, it would most certainly have had an impact if it had happened either earlier or later in the year.
- 'Partially' ceased operations during period of closure.
- The "ceased operations" impact amount of \$4 million and "Altered Production" of \$2 million – was the result of flood, not simply lock closure.
- Our main mode of transportation is by barge. Whenever that is impossible we have to rely on trucking.
- We had to drawdown emergency coal stockpiles and were forced to enter new transport and coal contracts to replace.
- The flooding and closure was a force majeure under our existing barge contract and we were forced to buy much higher priced freight to make up the lost shipments.

*Q3. Which of your commodities and tonnages were affected by this closure?*

R3.

Commodities and tonnages reported as affected by responding companies are presented in table 5 along with the type of shipping facility impacted and any other comments that respondents included on their survey feedback.

Table 5  
Response Summary Shipper Survey Question 3

Commodities Affected	Tonnages Affected	Type of Facility	Comments
Corn	15,400	Feed mill	
Coal	100,000	Rail-to-barge coal transloading terminal	
Corn	20,000	Barge loading grain elevator	Decreased volume
Coal		Local carrier of bulk products	Changed origin/ destination points
Grain		Grain elevator	
Grain, coal, salt, steel, iron, cement, cottonseed, fertilizer		Bulk commodities intermodal terminal	
High BTU coal		Electric generating facility	Barged from down south facility
Fertilizer		Municipal dock	Impacted mostly by rail car problems than closure
Sand & gravel		Sand/aggregate plant	Affected production
Fuel (coal)		Electric generating facility	
Salt		Terminal dock, bulk & packaged goods	Delivery delayed
Asphalt	12,400	Petroleum fuel & terminal co.	
Corn, beans, wheat		Grain terminal	
Limestone for concrete	50,000	Aggregate plant	
Limestone for chemical plants	50,000		
Cement	26,919	Cement manufacturer	Approx 1,035 truckloads
Salt, pig iron, potash, urea		General purpose bulk terminal	
Grain Fertilizer/other prod Woodchips Steel & others			Going south to Gulf Coming up from Gulf Going to Ohio River Pt Coming up from gulf
Coal		Bulk transshipment terminal	Going north out of St. Louis
Sodium hydroxide		Inorganic liquid chemicals	
Unloading of heavy picks		River terminal	
Grain, grain by-products, coal, salt, fertilizer, veg oil		Transportation service provider	As a service provider we towed these commodities
Transport construction equipment		River terminal dock	
Corn gluten feed	60,000	Corn processing factory	
Coal	75,000		
Sand		Sand and gravel company	Had to barge sand to our sister company
Corn, beans, wheat		Grain elevator barging to New Orleans	
Corn, soybeans, wheat		Grain elevator barging to New Orleans	
Corn, soybeans, soft red wheat		Grain handling	
Portland cement	8,000	Cement distribution terminal	
Coal	200,000-250,000	Electric utility	Tons were a contract commitment; had to replace at a higher cost of \$16/ton

*Q4. Did the closure of Upper Mississippi River locks cause your company to alter its intermediate or long-term transportation strategy (e.g. switch to all-overland modes, increase stockpiles, etc.)?*

R4.

In Question 2, identified changes in procedures during the closure period were for the short-term. Responses to question 4 appear to indicate that the overall length of closure of 24 days may not be long enough to warrant making intermediate or long-term strategy changes.

Table 6  
Response Summary Shipper Survey Question 4

Response	Count	Percent
Yes	5	7
No	29	41
No Answer	37	52
Total	71	100

*Q4a. How will this impact your total commodity transportation or other costs (per year)?*

R4a.

- Did not impact, delivered all tonnages.
- We are handlers only and do not trace title to products, nor do we absorb transportation costs.
- Ceased transportation during closure.
- We were unable to receive enough road salt for the year which drove up prices and caused shortages in the Quad Cities.
- The coal unit trains had to be stockpiled during the outage (additional cost to customer), but all scheduled product was shipped.
- If repeated, future plans would include relocation to a more dependable source of barge transport, closure of this facility.
- We could not dredge/produce since product was not moving by barge.
- Barge being the most economical, any shipments, if possible, by truck were extremely cost prohibitive.
- We have contingencies in place to transport cement from Hannibal, MO, whenever the river shuts down.

*Q5. Did the closure of the Upper Mississippi River locks cause your company to take any other long-term permanent measures (e.g. switch production to another facility, purchase intermediate or final product rather than produce, etc.)?*

R5.

As in question 4, responses seem to indicate that long-term permanent changes do not accompany a short-term lock closure.

Table 7  
Response Summary Shipper Survey Question 5

Response	Count	Percent
Yes	3	4
No	33	47
No Answer	35	49
Total	71	100

The additional comments offered in explanation of responses are provided in table 8, along with the commodities affected and the type of shipping facility that responded.

Table 8  
Additional Comments Summary

Response	Comment	Commodities Affected	Type of Facility
Yes	Switched production to a plant on Cumberland River.	Limestone	Aggregate plant
Yes	We had to purchase product in addition to ours due to shortage with barges not moving.	Sand	Sand & gravel company
Yes	Some shipments were switched to the Ohio River.	Corn, soybeans, soft red wheat	Grain handling
No	We cannot switch	Salt, pig iron, potash, urea	General purpose bulk terminal
No	Not at present	Sodium hydroxide	Inorganic liquid chemicals
No	Operating on the Mississippi River system is our main focus. There are no other options.	Grain, grain by-products, coal, salt, fertilizer, vegetable oil	Transportation service provider
No	We carry coal inventories to protect against emergencies like this, but those emergency stocks must be replaced.	Coal	Electric utility

*Q5a. How will this affect your company's long-term operating costs (per year)?*

R5a.

Table 9  
Response Summary Shipper Survey Question 5a

Response	Type of Facility
Minor adjustments.	Rail-to-barge transloading terminal
It will not other than lost revenue.	Bulk commodities intermodal terminal
The production will be down the whole year and \$ per MW (megawatt) also.	Power plant-electricity
Our company may receive biomass to fuel the plant.	Power plant-coal
Lost 5 days of production.	Sand/aggregate plant
Should not (affect long-term operating costs).	Petroleum fuel and terminal co.
Added \$500,000 to our cost in 2008.	Aggregate plant
Overall costs were not affected drastically, but revenue was down during this period.	Transportation services provider (barge/tow)
Loss of revenue during closure.	Transportation construction equipment
Dredge production was down but the costs were the same -- so increased costs, less sales.	Sand and gravel company
Costs increase dramatically whenever barging is not available.	Portland cement distribution terminal

*Q6. Was your company impacted by low water levels on the Mississippi River following the flooding?*

R6.

Table 10  
Response Summary Shipper Survey Question 6

Response	Count	Percent
Yes	16	22
No	21	30
No Answer	34	48
Total	71	100

*Those who responded 'Yes' offered the following feedback on how their company was affected by low water levels:*

- Poor management in Pool 16 kept us from loading requested tonnage on barges.
- Lighter drafts (increased freight costs).

- Local fleets dealing with low water at Port of St. Louis were unable to service our dock as quickly as usual.
- Delivery delays-stranded shipments (dredging).
- Silt deposit.
- Barge traffic severely slowed; tighter inventories.
- When water level stage is at "0" or less we can only bring one barge at a time to the dock instead of two at a time.
- Load lighter drafts.
- Slower transit times.
- Less product on each barge caused additional shortages.
- Delay in receipt of raw materials.
- Barges that were due in to our dock for unloading were below the closure and that created delay for us.
- In several instances, channel depth and buoy placement was poor or missing and groundings occurred.
- We were unable to load the barges as full as normal due to the low water level.
- Couldn't load barges to a normal draft.
- Lost approximately 1 week of contractual deliveries due to low water. This impact is included in the total estimated \$4 million impact to our company.

*Q7. Did enhanced forecasting capabilities and daily communications with industry provide enough advanced warning to lessen the impacts to your company from the June-July 2008 closure event?*

R7.

Good communications in advance of a pending closure event allows industry to make decisions that will lessen the impacts on their companies. As indicated in the summary table below, 35 percent of the respondents did feel that forecasting and advanced warning made a difference in their daily operations and planning.

Table 11  
Response Summary Shipper Question 7

Response	Count	Percent
Yes	25	35
No	11	16
No Answer	35	49
Total	71	100

*Q8. Other comments provided by respondents.*

R8:

- Not impacted by emergency closure this year due to the availability of local grain.
- This company sold the grain business over 1 year ago. We are only affected by high waters when water elevation is above 17.6 and shut down the railroad by the Quad Cities. We do not ship by barge at this time, we use the railroad.
- The closures did not effect our operations at that time. We had plenty of product on hand at the time of the closure. As in the past closures, we can receive product by rail for short periods of time. It is more costly and we depend on the river to survive.
- We are a terminal facility and as such we are a handler of products, not a shipper or owner. The river closure impacted us in the sense that product did not reach us for handling, but barge transportation costs related to the closure were borne by the shippers more so than us.
- Our company was impacted but not upstream of Lock 25. We have no stone requirements upstream of Lock 25.
- We do not ship through Locks 12-25; we are south of St. Louis.
- When forecasting lock closures, accurate re-opening forecasts (at closure with interim updates) is beneficial to adjusting mine production schedules and, when necessary, arranging replacement power production or purchase.
- The delays in barges created a log jam. This resulted in several barges arriving in tandem rather than spread out. This created demurrage fees for us totaling \$5,000.
- This company was sold in June 08.
- Our facility was flooded; therefore, the lock closures did not affect our business. The flood sure did!
- The forecasting was helpful for planning; but did not reduce costs significantly.
- This happened during our slow time of year.
- Our company sold all marine assets in 2006. We never used any locks prior to this date either.
- All of our barges move on the Lower Mississippi and Ohio River. The only impact was when the St. Louis Port closed and the northbound traffic was cut back.
- Our Plant relies on coal shipment through locks, from Lock 11, and from the locks to the north of Lock 11.
- Forecasts helped lessen the impacts but were hard to obtain. As a facility in St. Louis, our operations were only affected by the boats and barges that were unable to come to town. Lost revenue in fleeting services about \$125,000.
- Although we have shipped products via barge in the past, we did not ship anything via barge during 2008.
- Notice to mariner received timely.
- Our company mostly goes from the 180 mm (mile marker) South.
- Our elevators were affected at 5 locations: Louisiana, MO; East Hannibal, IL;

LaGrange, MO; Meekers Landing, IA, McGregor, IA; Albany, IL & Fulton, IL. Each location was impacted differently but all incapable of shipping any commodities to market. Had significant market losses due to inability to receive and ship grain, but were able to maintain the integrity of facilities and structures, and did not lose any inventory.

- Forecasting and the internet availability of reports were significant for us in our daily operations and planning.
- The Corps, Coast Guard and National Weather Service coverage of the events aided us greatly in keeping us informed of the scope and duration of the event, which helped contingency planning. Nice job in a very unfortunate set of circumstances for all concerned.

## 5. CARRIER SURVEY

a. Survey Procedures. The OMB-approved Carrier Survey (Control #0710-0001) was conducted of the major towing companies that normally use Locks 12-25. The purpose of this survey was to identify carrier reactions to the emergency closure due to the flooding.

A total of 48 carrier surveys were sent out to operators listed in the WCSC database that handled traffic through Locks 12-25. Completed survey forms were received from 18 companies, representing a response rate of 38 percent. Through the follow-up telephone campaign, all of the carriers who had not yet responded were contacted and seven additional responses were received, increasing the response rate for this group to 52 percent.

b. Survey Responses.

*Q1. Was your company impacted by the emergency lock closures during the June-July 2008 flooding on the Upper Mississippi River?*

R1.

As in the shipper survey, the carrier survey also requested that companies not affected by this flood event return the survey so that there would be a record of no impacts. The table below shows that for those that responded, half of the companies were not affected.

Table 12  
Response Summary Carrier Survey Question 1

Response	Count	Percent
Yes	11	44
No	12	48
No Answer	2	8
Total	25	100

*Q2. How did your company operate during the 2008 unscheduled lock chamber outage on the Upper Mississippi River locks?*

R2.

Responses to this question are presented with the types of commodities impacted for those companies that provided a response.

Table 13  
Response Summary Carrier Survey Question 2

Response Category	Number of Responses	Commodities Impacted at Responding Companies
Barges were tied up at fleeting areas; towboats operated elsewhere in the system.	5	Caustic soda, liquid fertilizer, corn, beans, salt, fertilizer, scrap, soybean meal, cement, coal, grain, coke, diesel fuel, steel, aggregates, yellow corn, non-GMO corn; liquid & dry cargo
Towboats remained in queue with barges	5	Sand & gravel, caustic soda, liquid fertilizer Grain, coal, general bulk, steel-related, cement, fertilizers, liquids, refined products
Towboats (light) held positions in queue.	0	
Company avoided the lock when possible.	2	Liquid fertilizer, coal, grain, fertilizers, scrap, coke, cement, diesel fuel, caustic soda, steel, aggregates
No answer.	12	
Other (please explain): * Shut down operations and fought flood conditions daily. * Vessels possibly standing by south of the impacted area. * Worked with our customers to determine alternate destinations avoiding the lock closures. * Boats and barges were fleeted at MI.143.MO.R until locks were opened. * Barges ready to move held in fleets. * Boats operated above closures as much as possible, but eventually tied up. Other boats were deployed off the river. * Felt no impacts on Upper Mississippi itself, the subsequent water levels between St. Louis and Cairo had an effect on our operations. Liquid cargo transportation to the Illinois River was slowed while towboats waited for the river's water levels to normalize.	7	Fertilizer, grain, caustic soda, liquid fertilizer, cement, grain, salt, coal, general bulk, steel related, liquids, scrap, coke, diesel fuel, aggregates, liquid cargo

*Q3. Which commodities and tonnages were affected by this unscheduled closure resulting from the flood of 2008?*

R3.

Commodities and tonnages are presented with the corresponding type of facility impacted and any other comments that respondents included on their survey feedback.

Table 14  
Response Summary Carrier Survey Question 3

Commodities Affected	Tonnages Affected	Type of Facility	Comments
Sand and gravel		Sand & gravel mining/dredge	
Fertilizer and grain		Barge terminal & towing operations	No movements
Caustic soda (3 loads)	4500 short tons	Inland tank barge company	Also affected 4 empty barges
Liquid fertilizer (3 loads)	10,039 short tons		
Liquid fertilizer	24,000	For-hire carrier	
Cement	8,000	Towing company	Had scheduled to loan a 6-barge tow during time of closure w/8,000 tons
Grain Salt Coal General bulk Steel related Cement Fertilizers Liquids	510,000 110,000 5,000 52,000 35,000 13,000 12,000 6,000	Major inland barge carrier	
Corn, beans, steel, salt, fertilizer, scrap, soybean meal		Transportation/hauling company	
Cement		Towing company	
Corn, grain, fertilizers, scrap, coke, cement, diesel fuel, caustic soda, steel, aggregates		Barge company	Season became compressed due to both closures on river last season which caused the need for more equipment to be used to fulfill the reason's requirements.
Yellow corn, soybeans, non-GMO corn		Private carrier	

*Q4. If a reasonable estimate can be made, what additional costs (over and above normal operations) did you incur as a result of the unscheduled closure at Upper Mississippi River locks?*

R4.

Table 15 presents the additional costs incurred for the all of the companies that provided data for each of the response categories. The type of facility providing cost information is also given as a cross reference to show what towing facilities are most likely to be impacted by lock closures on the Upper Mississippi River navigation system.

Table 15  
Response Summary Carrier Survey Question 4

Response Category	Number of Responses		Additional Cost (\$)	Type of Facility
	Yes	No		
Delay cost	9	0	5,000 100,000 120,000 8,000 938,000 50,000 802,037	Sand & gravel mining/dredge Inland tank barge company For-hire carrier Towing company Major inland barge carrier Transportation/hauling company Barge company
Lost Revenue	6	1	75,000 200,000+ 100,000 4,185,000 250,000 2,784,149	Sand & gravel mining/dredge Barge terminal & towing operations Inland tank barge company Major inland barge carrier Transportation/hauling company Barge company
Logistics	4	0	15,000 100,000	Inland tank barge company Transportation/hauling company
Other (specify)	3		50,000+ for moving equipment, sand bagging, longer commutes to work  Up to \$2,000,000 from geographic areas impacted  None-our tows were chartered so our customers lost from lock closure; our company revenue was not impacted	Barge terminal & towing operations  Barge company  For-hire carrier

*Q4a. Over what time period were those costs incurred?*

R4a.

The official closure period reported in OMNI of June 14 – July 5 corresponds with the reported time period that companies incurred additional costs. Costs incurred beyond the July 5 end date reflect the lingering impact of the closure once the river opened, as noted in one comment below.

- 4 days of lost production due to lock closure
- Other: moving equipment, sandbagging, longer commutes to work. May-July
- June 13 - July 7, 2008
- July 1-July 9

- June 15 - July 10
- June 14-July 5, 2008 {Note: costs reflect lingering impact of closure once river opened.}
- Spring and summer
- 6/13/08 - 7/5/08
- Approximately 45 days, beginning of June 2008 thru mid to late July 2008.

*Q5. Did this experience with the closure of the Upper Mississippi River locks resulting from the flood of 2008 cause your company to adopt any new operating procedures to accommodate lock outages elsewhere in the system?*

*If so, what procedures were put in place and for what duration?*

R5.

Two companies reported a change in operating procedures; 7 companies reported no change.

Table 16  
Response Summary Carrier Survey Question 5

Response	New Procedure	Type of Facility	Additional Comments
Yes (2)	Shifted some horse-power to IL River & Lower Miss; also had to de-crew boats that normally run the Upper Mississippi River  Rebuilt a fabrication shop bringing elevation up.	*Transportation Company  *Barge terminal/towing operations	
No (7)		*Sand & gravel mining/dredge *For-hire carrier *Towing company *Major inland barge carrier  *Private carrier *Towing company *Barge company	Have standard procedures in place for unplanned events as well as planned closures to minimize impact.  How can you adopt new operations procedures to accommodate unknown and unforeseen events?
N/A (1)		Inland tank barge company	
No answer (13)			
Total - 23			

*Q6. Did you have vessels stranded on the river? If so, where and how many?*

R6.

Not all flood impacts occurred at the locks. Media reports during this flood event indicated that two different industry groups reported as many as 8-10 tows (about 150 barges) were stranded or sidelined at places on the Upper Mississippi River. Responses from Carriers surveyed are listed in table 17.

Table 17  
Summary Response Carrier Survey Question 6

Response	Number of Vessels & Location	Type of Facility
Yes	1 vessel & 3 UAN (liquid fertilizer) barges @ RM 517.6 UM 3 loaded caustic barges @ St. Louis RM 176 UM; 3 empty caustic barges @ Camanche RM 518 UM; 1 empty caustic barge @ St. Paul RM 837 UM	Inland tank barge company
Yes	2 loaded northbound at M167 on Upper; the two tows were stopped for a combined total of 15 days	For-hire carrier
Yes	10 total boats were impacted part of the time, equating to approximately four full-time. They were delayed throughout the range indicated (6/14-7/5).	Major inland barge carrier
Yes	We did have a few vessels stranded but only for a short period of time. Communication allowed us to limit our exposure.	Transportation company
Yes	6 boats stranded (3 at Dubuque, 3 at Davenport); 1 boat also stranded at Burlington; 6 more boats were able to get off of the river prior to the locks closing.	Barge company
No (4)		Sand & gravel mining/dredge Barge terminal/towing oper. Towing company Private carrier
No Answer (14)		
Total - 23		

*Q7. Was your company impacted by the low water levels on the Mississippi River following the flooding? If yes, please explain.*

R7.

Silt carried by the flood water was deposited in the lower river area around St. Louis, Missouri, creating low water levels in this area and causing a variety of issues for navigation traffic.

Table 18  
Summary Response Carrier Survey Question 7

Response	Count	Percent
Yes	7	29
No	3	13
No Answer	14	58
Total	24	100

*If yes, please explain:*

- After traffic resumed, backups at Lock #14 caused several hours of delay and an additional 2 days of lost production.
- Much dredging was needed in our area after the flood water receded.
- The barges were loaded to a lighter draft to avoid groundings.
- We experienced impact to draft levels, tow sizes and speed of operations. Channel delays were also above normal levels.
- Boats were grounding causing delay and lost revenue. Tow sizes are also affected.
- The low water caused many delays once the pools fell back to their normal levels. A lot of shoaling caused industry grounding and subsequent dredging to reopen the channel. Many more days lost.
- Barge loadings were at lighter drafts, tow sizes cut back, transit/channel delays due to low water.

*Q8. Did enhanced forecasting capabilities and daily communications with industry provide enough advanced warning to lessen the impacts to your company from the June/July 2008 closure event?*

R8.

Table 19  
Summary Responses Carrier Question 8

Response	Count	Percent
Yes	7	29
No	2	8
No Answer	15	63
Total	24	100

*Q9. Other comments*

- We do not run on the UMR.
- Technology on weather, cresting and levees helped tremendously in our planning.
- Additional costs incurred due to lost barge days and additional fleeting costs.
- The communication allowed our company the opportunity to divert loaded tows to other river segments thus avoiding the lock closures on the Upper Miss.
- Our company was only operating on the Missouri River during this period.
- Did not operate above St. Louis for year of 2008. Also, business was sold to AEP on June 23, 2008.
- Our company does not operate in this section of the river.
- (a) Delay cost reflects direct boat cost and fleeting expense on trapped barges.
- (b) Lost revenue is based on barge days lost both during closure and after opening due to logistical issues caused by the closure.
- Any information pertaining to any river segment that can be shared with the industry allows us to make decisions to lessen the impact.
- We are a harbor company also so we made sure our CTNE boats were in our harbor to keep eye on fleets. Forecasts were important so we knew how much time we had to get back to our harbor.
- This survey is focused on the June closure, but keep in mind that there was also an April/May closure that was just behind us. The industry was just getting back to normal operations when the second closures hit. We had to start and stop twice and lost the better part of two months from an average 8-month season.
- Daily communications with industry allowed us to re-route company-operated barges to other rivers during the closure event.

OMNI DATA EVALUATION.

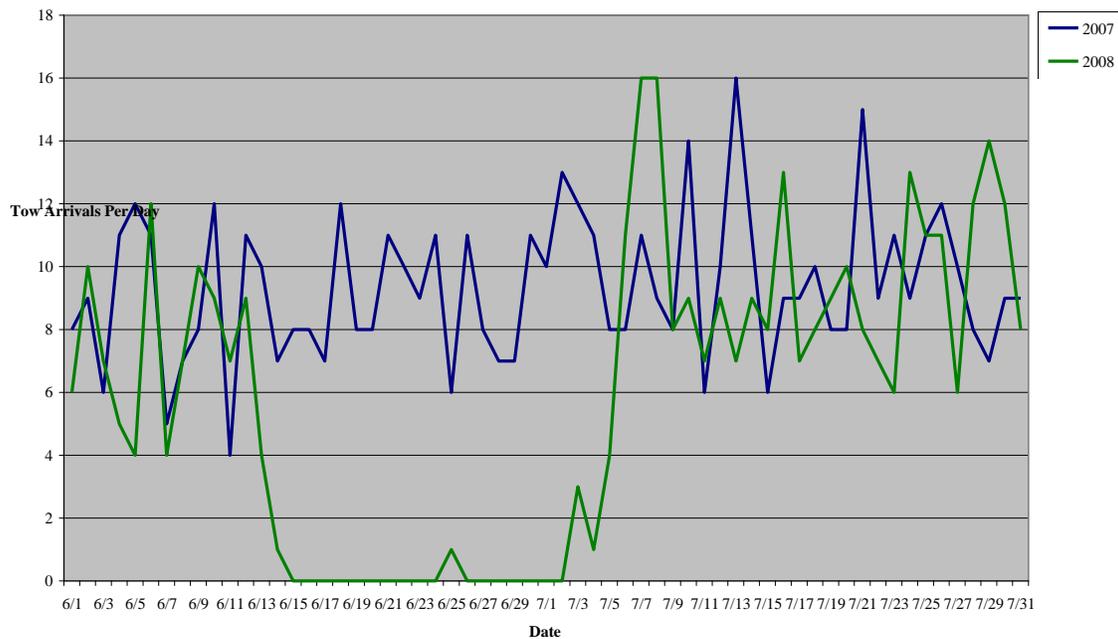
a. Introduction. This evaluation uses the US Army Corps of Engineers Operations and Maintenance of Navigation Installations (OMNI) data to investigate shipper and carrier response to the June–July 2008 Upper Mississippi River (UMR) flooding and resulting unscheduled main and auxiliary lock closures. UMR lock closure durations are shown on table 20. OMNI data indicates that at least one and most of the time several of the UMR locks were closed during the period 6-12-08 to 7-05-08.

Table 20  
Lock Closure Summary for June-July 2008 Mississippi River Flood  
(MVP, MVR, MVS)

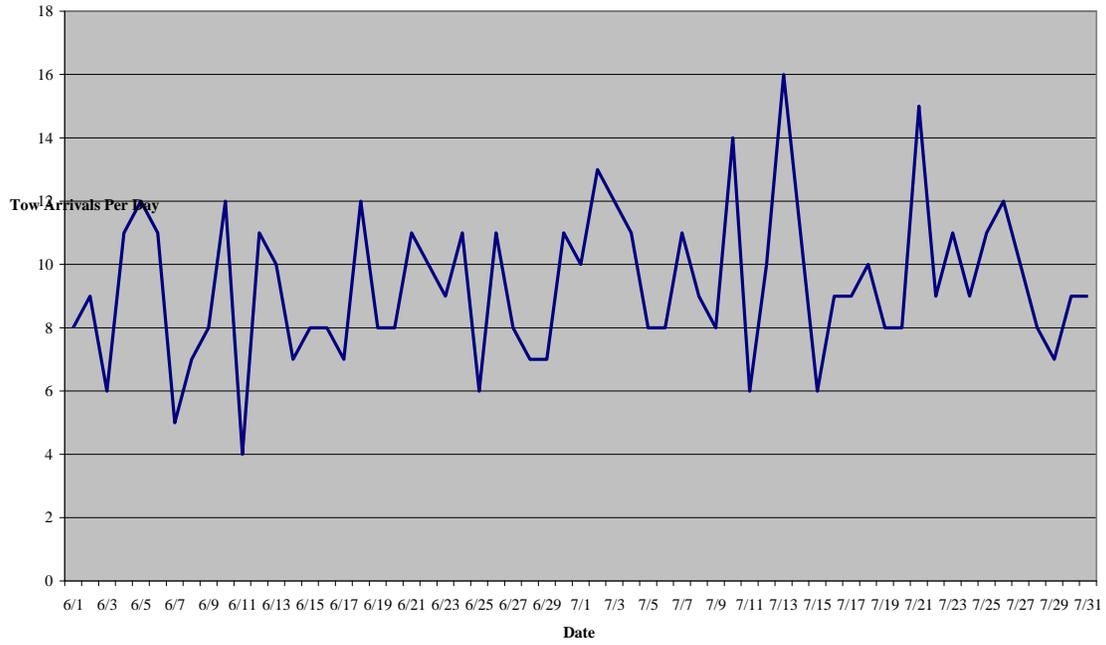
LOCK	LOCK CLOSED	LOCK OPEN	Duration of Closure (Days)
L/D 1 - 10	N/A	N/A	N/A
L/D 11	N/A	N/A	N/A
L/D 12	CLOSED at 0210 on 6-14-08	OPENED at 1000 on 6-15-08	1
L/D 13	CLOSED at 0400 on 6-14-08	OPENED at 1800 on 6-18-08	4
L/D 14	CLOSED at 0400 on 6-14-08	OPENED at 1600 on 6-18-08	6
L/D 15	CLOSED at 1520 on 6-14-08	OPENED at 0200 on 6-20-08	6
L/D 16	CLOSED at 1130 on 6-12-08	OPENED at 0800 on 6-26-08	14
L/D 17	CLOSED at 0253 on 6-12-08	OPENED at 0800 on 6-27-08	15
L/D 18	CLOSED at 0215 on 6-13-08	OPENED at 1330 on 6-27-08	14
L/D 19	CLOSED at 2108 on 6-13-08	OPENED at 2110 on 6-28-/08	15
L/D 20	CLOSED 6/12/08 at 9:20 PM	OPENED at 0900 on 7-4-08	23
L/D 21	CLOSED at 1735 on 6-13-08	OPENED at 1100 on 7-3-08	21
L/D 22	CLOSED at 1740 on 6-13-08	OPENED at 0600 on 7-4-08	22
L/D 24	CLOSED at 0800 on 6-14-08	OPENED at 1501 on 7-3-08	20
L/D 25	CLOSED at 1000 on 6-13-08	OPENED at 1100 on 6-13-08	22+
	CLOSED at 1125 on 6-13-08	OPENED at 1224 on 6-13-08	
	CLOSED at 1330 on 6-13-08	OPENED at 2025 on 6-13-08	
	CLOSED at 2109 on 6-13-08	OPENED at 0107 on 6-14-08	
	CLOSED at 0732 on 6-14-08	OPENED at 0635 on 7-5-08	
L/D 26	N/A	N/A	N/A
L/D 27	N/A	N/A	N/A

b. Tow Arrivals. One way of determining how shippers and carriers reacted to the closure is to look at the number of commercial tow arrivals per day. If we can discern that the arrival pattern changed during the closure, we can conclude that the closure caused commercial carriers and shippers to change the way they used the UMR locks during the closure. Figures 2 - 4 show the number of tow arrivals per day during the months of June and July for the years 2007 and 2008 at Lock 25. From figures 2 and 4 we can see the drop off in arrivals coincident with the beginning of the 2008 UMR flooding. Also we can observe a build up of towboat arrivals at Lock 25 in anticipation of Lock 25 re-opening, and a dramatic spike in arrivals following reopening of Lock 25. This spike in arrivals may indicate several tows were tied off along the river bank waiting for Lock 25 to re-open. The shipper-carrier surveys may provide more information and insight. Average arrivals per day for the June 1-12 period prior to the closure of Lock 25 in 2008 were 7.5 tows per day, as compared to 8.6 tow arrivals per day during a similar period in 2007. For the July 5-31, 2008 period following the reopening of Lock 25 average towboat arrivals were 9.6 tow arrivals per day. This compares with 9.7 arrivals per day for the similar period in 2007. Figure 5 presents a comparison of arrivals per day for the entire year for 2007 and 2008.

**Figure 2: Tow Arrivals Per Day  
Lock 25, June-July 2007 and June-July 2008**



**Figure 3: Tow Arrivals Per Day  
Lock 25, June-July 2007**



**Figure 4: Tow Arrivals Per Day  
Lock 25, June-July 2008**

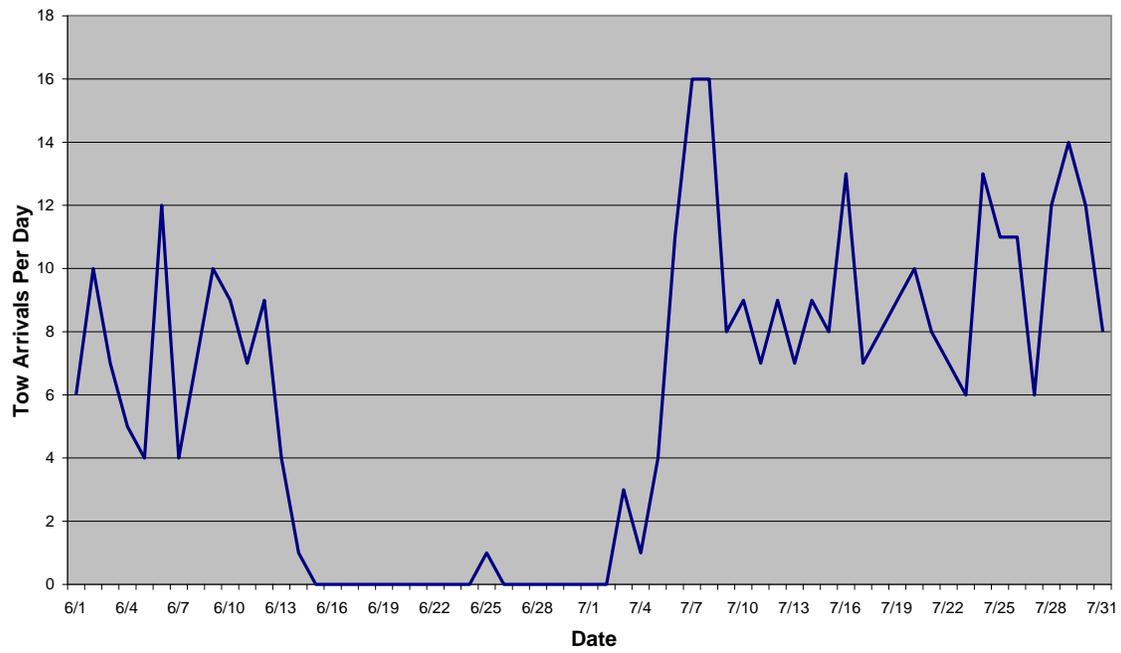
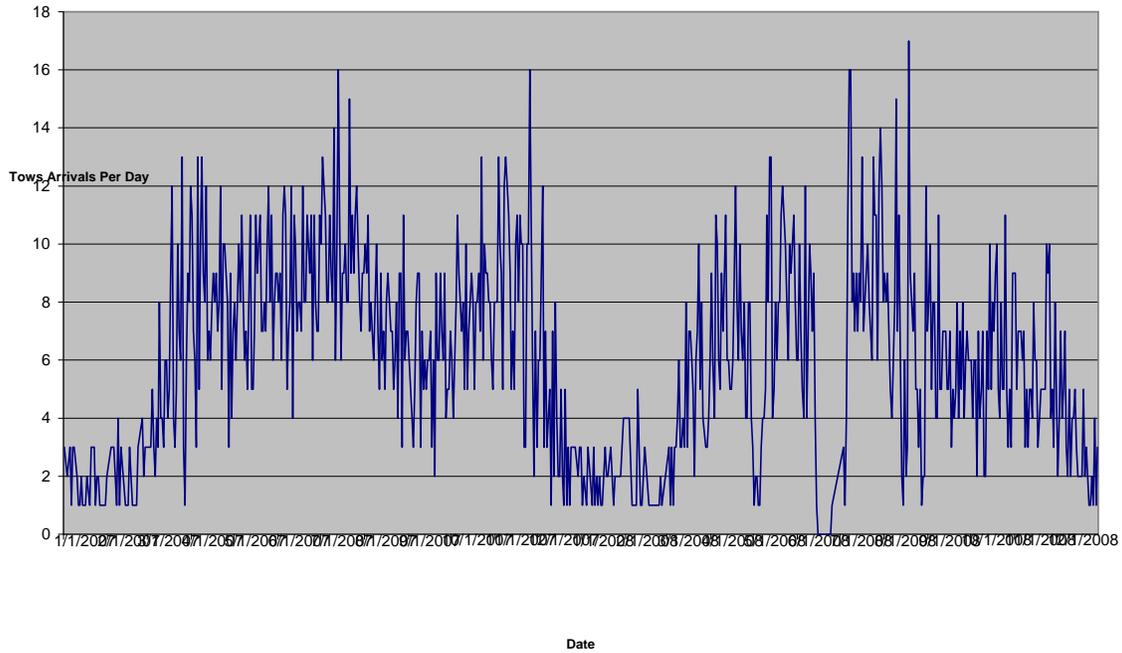


Figure 5: Tow Arrivals Per Day  
UMR Lock 25 (2007-2008)



c. Tons and Commodity Groups. First, table 21 defines the commodity codes for the OMNI data system. Referring to table 22 (and on figure 5), the overall decline in traffic on the UMR (particularly since 2002) makes it difficult (by only looking at OMNI data) to separate closure related impacts from long term traffic declines. The shipper and carrier surveys are very important in determining whether and how much of impacts occurred because of the lock closures. Having said that, as depicted on table 23 the almost 7 million ton (23%) decline in traffic at UMR Lock 25 from 2007 to 2008 does indicate a major impact of the flood related lock closures. In the past 15 years, major flooding has occurred on the UMR in 2008, 2001, and in 1993. As can be seen from figure 6, Lock 25 shows a major drop in tons for each of the flood years. Although traffic at Lock 25 declined from 2007 to 2008 (which was the flood year), table 23 shows that in 2008 crude materials and machinery and equipment actually showed an increase over the previous year.

Table 21 - OMNI System Commodity Codes

<b>Commodity Codes</b>	
<b>Code</b>	<b>Description</b>
01	Empty Barges
10	Coal, Lignite & Coal Coke
20	Petroleum & Petroleum Products
21	Crude Petroleum
22	Gasoline, Jet Fuel, Kerosene
23	Distillate, Residual, & Other Fuel Oils; Lubricating Oils And Greases
24	Petroleum Pitches, Coke Asphalt, Naptha And Solvents
30	Chemicals & Related Products
31	Fertilizer-Nitrogenous, Potassic, Phosphatic & Others
32	Organic Industrial Chemicals (Crude Products) From Coal, Tar, Petroleum, & Natural Gas, Dyes, Organic Pigment Dyeing & Tanning Materials, Alcohols, Benzene; Inorganic Industrial Chemicals (Sodium Hydroxide); Radioactive & Associated Materials; Drug; Soap, Detergent, Cleaning Preparations, Paints, Gum and Wood Chemicals; Synthetics (Plastic Materials, Synthetic Rubber, Synthetic Fiber), Liquid Sulfer
40	Crude Materials, Inedible, Except Fuels
41	Forest Products, Lumber, Logs, Woodchips
42	Pulp, Waste Products
43	Sand, Gravel, Stone & Crushed Rock; Limestone Flux & Calcareous Stone
44	Iron Ore; Iron Steel Waster & Scrap
45	Marine Shells, Unmanufactured
46	Non-Ferrous Metallic Ores (Incl. Alumina); Non-Ferrous Metallic Waste And Scrap
47	Dry Sulphur, Liquid And Dry; Clay; Salt
48	Slag
50	Primary Manufactured Goods
51	Paper & Allied Products
52	Building Cement & Concrete; Lime; Glass
53	Primary Iron & Steel Products (Including Ingots, Tube, Pipe, Bars, Rods, Plates, Sheets And Shapes)
54	Primary Non-Ferrous Metal Products; Also, Fabricated Metal Products (Near-Final Form--Any Type Of Metal)
55	Primary Wood Products; Veneer, Plywood
60	Food & Farm Products
61	Fresh Fish & Other Marine Products
62	Wheat
63	Corn
64	Rye, Barley, Rice, Sorghum & Oats
65	Oilseeds-Soybean, Flaxseed, And Others
66	Vegetable Products
67	Animal Feed, Grain Mill Products, Flour And Other Processed Grains
68	Other Agricultural Products (Including Food And Kindred Products)
70	All Manufactured Equipment And Machinery (Including Ordnance And Accessories, Machinery, Electrical Machinery Transportation Equipment, Instruments, Photographic And Optical Goods, Watches And Clocks, And Miscellaneous Products Of Manufacturing)
80	Waste Material; Garbage, Landfill, Sewage Sludge, & Waste Water
91	Multi-commodities shipped in Containers
92	Multi-commodities shipped on Pallets
99	Commodity Is "Unknown" Or Cannot Be Located On This List

Table 22  
Historical Tons  
Upper Mississippi River, Lock 25

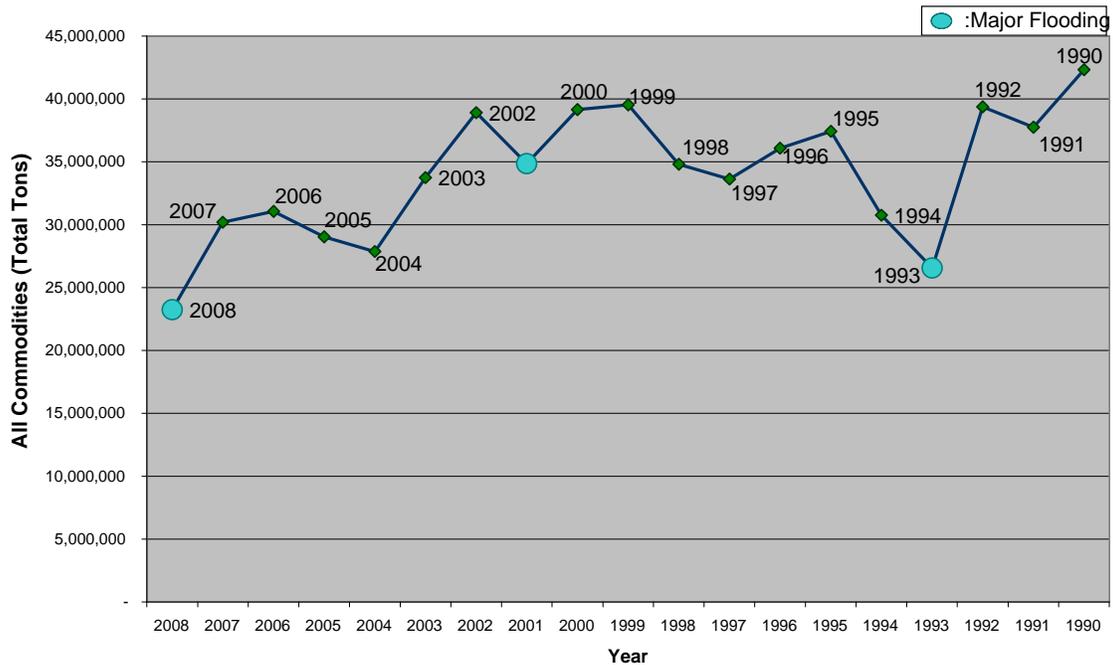
	CY2006	CY2005	CY2004	CY2003	CY2002	CY2001	CY2000
<b>All Commodities</b>	<b>31,061,559</b>	<b>29,043,655</b>	<b>27,870,702</b>	<b>33,749,527</b>	<b>38,916,145</b>	<b>34,855,844</b>	39,161,898
<b>10 - All Coal, Lignite, and Coal Coke</b>	4,543,003	4,290,016	3,551,748	3,860,166	4,123,628	3,971,801	4,055,418
<b>20 - All Petroleum and Petroleum Products</b>	327,792	457,010	413,666	537,351	545,982	332,384	653,605
<b>30 - All Chemicals and Related Products</b>	2,719,332	2,913,481	3,018,450	3,095,554	2,978,193	2,895,786	3,294,195
<b>40 - All Crude Materials, Inedible, Except Fuels</b>	2,609,221	2,556,277	2,251,896	1,935,045	1,804,502	2,303,764	2,457,002
<b>50 - All Primary Manufactured Goods</b>	1,815,454	1,968,188	1,790,894	1,839,210	1,775,614	1,712,533	1,930,010
<b>60 - All Food and Farm Products</b>	18,926,126	16,617,658	16,784,665	22,349,908	27,172,372	22,927,973	26,793,793
<b>70 - All Manufactured Equipment &amp; Machinery</b>	32,072	73,541	22,017	23,881	33,617	39,494	64,164
<b>80 - All Waste Material</b>	1,500				1,510		3,700
<b>90 - All Unknown or Not Elsewhere Classified</b>	87,056	167,484	37,366	108,412	480,727	672,109	510,011

	CY1999	CY1998	CY1997	CY1996	CY1995	CY1994	CY1993
<b>All Commodities</b>	<b>39,536,830</b>	<b>34,819,845</b>	<b>33,638,634</b>	<b>36,088,709</b>	<b>37,434,409</b>	<b>30,758,651</b>	<b>26,560,658</b>
<b>10 - All Coal, Lignite, and Coal Coke</b>	3,244,565	3,361,987	2,878,844	3,250,294	2,939,797	4,032,095	2,606,328
<b>20 - All Petroleum and Petroleum Products</b>	534,308	685,813	485,409	588,125	764,469	422,180	343,385
<b>30 - All Chemicals and Related Products</b>	2,737,150	2,946,719	2,701,657	2,984,017	3,037,751	3,647,344	3,026,430
<b>40 - All Crude Materials, Inedible, Except Fuels</b>	1,986,722	2,321,435	2,388,319	1,866,920	1,798,275	1,678,225	1,568,269
<b>50 - All Primary Manufactured Goods</b>	2,088,024	1,760,930	1,457,289	1,363,992	1,687,051	1,777,223	1,273,337
<b>60 - All Food and Farm Products</b>	28,507,755	23,475,543	23,397,384	25,800,917	26,904,242	19,125,865	17,687,300
<b>70 - All Manufactured Equipment &amp; Machinery</b>	61,652	33,115	28,647	29,412	21,329	16,810	37,079
<b>80 - All Waste Material</b>		10,750	1,500	3,000	1,500		1,500
<b>90 - All Unknown or Not Elsewhere Classified</b>	376,654	223,553	299,585	202,032	280,025	58,909	17,030

**Table 23**  
**Total Tons, Lock 25 by Commodity Group (OMNI Data)**

	June-July (2007)	Entire Year (2007)	June-July (2008)	Entire Year (2008)
Coal (10-19)	1,140,742	4,189,537	671,402	3,358,954
Petroleum (20-29)	121,742	527,621	52,200	315,701
Chemicals (30-39)	669,541	3,286,387	455,993	2,751,038
Crude Materials (40-49)	715,699	2,182,769	813,375	2,853,001
Manufactured Goods (50-59)	305,384	1,370,615	194,246	942,427
Food & Farm Products (60-69)	5,226,573	18,584,302	2,831,115	12,819,299
Machinery & Equipment (70-79)	11,000	41,570	38,472	154,130
All Other (80-99)	3,000	21,943	3,100	48,784
<b>Total</b>	<b>8,193,681</b>	<b>30,204,744</b>	<b>5,059,903</b>	<b>23,243,334</b>

**Figure 6: Upper Mississippi River  
Lock 25 (Tons Locked)**



d. Delays and Other Metrics. As can be seen in tables 24 and 25, average tow delays at Locks 22 and 25 increased from 2007 to 2008 which reflects the 2008 flood and subsequent lock closures. Also significantly fewer tows locked through the Upper Mississippi River Locks during June – July 2008 and for the entire 2008 as compared with the previous year (and actually the previous 5 years). Other metrics such as percent empty barges and tons per barge did not change from 2007 to 2008. Average barges per tow actually decreased from 2007 to 2008. The surveys and additional discussion with industry may help explain these other metrics.

Table 24  
Average Tow Delay (All Tows)  
June-July 2007

	June – July		Entire Year	
	Total Number of Tows	Average Delay/Tow (Hours)	Total Number of Tows	Average Delay/Tow (Hours)
Lock 15	615	1.79	2344	1.23
Lock 18	563	1.77	2085	1.17
Lock 20	554	1.64	2155	1.28
Lock 22	569	1.89	2280	1.49
Lock 25	571	2.52	2337	1.85

Table 25  
Average Tow Delay (All Tows)  
June-July 2008

	June – July		Entire Year	
	Total Number of Tows	Average Delay/Tow (Hours)	Total Number of Tows	Average Delay/Tow (Hours)
Lock 15	394	1.49	1800	1.11
Lock 18	339	1.24	1611	1.51
Lock 20	383	1.80	1682	1.27
Lock 22	348	2.70	1763	2.36
Lock 25	358	3.50	1825	2.50

e. Conclusion. This document describes an analysis of OMNI data at Locks 15, 18, 20, 22, and 25. The following conclusions were reached as a result of this analysis:

- Tow delays greatly exceeded normal levels as a result of the closure.
- Tow arrivals spiked higher after the locks were reopened, and remained above pre-closure levels.
- Overall, tonnage decreased significantly during the 2008 flood year as was the case in 2001 and 1993 flood years.
- In 2008, although total tons decreased significantly from 2007 levels, tons of crude materials and machinery and equipment actually showed an increase over the previous year.



The NETS research program is developing a series of practical tools and techniques that can be used by Corps navigation planners across the country to develop consistent, accurate, useful and comparable information regarding the likely impact of proposed changes to navigation infrastructure or systems.

The centerpiece of these efforts will be a suite of simulation models. This suite will include:

- A model for forecasting **international and domestic traffic flows** and how they may be affected by project improvements.
- A **regional traffic routing model** that will identify the annual quantities of commodities coming from various origin points and the routes used to satisfy forecasted demand at each destination.
- A **microscopic event model** that will generate routes for individual shipments from commodity origin to destination in order to evaluate non-structural and reliability measures.

As these models and other tools are finalized they will be available on the NETS web site:

<http://www.corpsnets.us/toolbox.cfm>

The NETS bookshelf contains the NETS body of knowledge in the form of final reports, models, and policy guidance. Documents are posted as they become available and can be accessed here:

<http://www.corpsnets.us/bookshelf.cfm>

