

Impacts of the 2008 Floods on Railroads in Illinois and Adjacent States

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ABSTRACT

Near record floods in the Midwest during the spring-summer of 2008 brought massive damages to railroads and train movement problems. Illinois is in the busiest rail area of the nation. All seven of the nation's seven major railroads experienced losses. The damages led to closures of 56 rail lines in the 5-state area centered on Illinois, and many closures lasted a week or longer. Many passengers could not travel on Amtrak trains since many were cancelled for weeks. The damaged tracks led to eight train wrecks and nine bridges were ruined. The damage costs to the 15 railroads affected were \$85 million; the revenues lost totaled \$69 million; and the total of \$154 million rates as one of the major rail losses on record.

Key Words: floods, railroads, Midwest, heavy rains, damages

INTRODUCTION

The Midwest experienced a stormy and wet winter from December 2007 to February 2008. Then the February-April period was the wettest on record for the Midwest, averaging 39 cm of precipitation across the region. This saturated the soils. Beginning in March, and continuing through June, there were several major rainstorms that occurred in the Illinois, Indiana, Iowa, Missouri, and Wisconsin area. These events created sizable floods on the small and large rivers of this 5-state area.

This severe flooding produced major problems for the areas numerous high volume railroads. Prior studies have shown that flooding hurts the rail industry much more than other forms of surface transportation because they have more spatial flexibility than railroads (Changnon, 2006). The 2008 floods washed out rail roadbeds, buried rail lines underwater, and destroyed several rail bridges, leading to 56 line closures that lasted anywhere from 2 to 48 days. Trains were halted and hundreds had to take long, costly detours over other non-flooded railroads. Travelers on numerous key Amtrak trains could not get served due to numerous train cancellations resulting from flooded tracks and closed lines.

Atmospheric sciences research in recent years has emphasized assessments about how weather affects the environment, society, and the economy. A recent book published by the American Meteorological Society addressed the weather impacts on U.S. railroads (Changnon 2006). This study assesses how varying rain conditions created different kinds of floods and damaged railroads.

Floods in the 5-state area were financially devastating to the railroads because this area has a dense network of very busy rail lines. The nation's three busiest rail centers are Chicago, Kansas City, and St. Louis, and the heavy rains and ensuing flooding occurred in the area between these centers where rail traffic is exceptionally frequent and valuable. At times, trains were trapped and had to wait days before they could be moved. Several busy mainlines were closed for days and weeks. Eight trains experienced accidents related to the flooding. Most of the region's railroads cooperated and allowed trains of a closed railroad line to detour onto their non-flooded lines to get around the flooded area. The railroads most impacted by the 2008 flooding were in Illinois and Iowa where rail-flood problems occurred in most parts of both states. The lines in the flooded area are shown on figure 1, and the line closures are marked, including the number of days the line was closed.

The costs to the railroads included loss of business and penalties for late shipments. Costs also included those related to recovery actions, such as the laying of new roadbeds and track, bridge rebuilding, and car and engine repairs. Train crews often became a problem since the detours required much additional time and thus additional crews. Detours were circuitous and costly due to the greater distances traveled, added train crews, and the high costs of fuel in 2008. The floods even damaged valuable rail museums. For example, the Mid-Continent Railway Museum in Wisconsin was flooded under several feet of water when the Baraboo River overflowed and created much damage to its facilities (Carstens, 2008).

The damages and operational problems created for each of the 15 railroads impacted by the flood are described. Then, the region's problems, responses, and costs are reviewed.

HEAVY RAINS AND FLOODING

A heavy rainstorm in mid-March produced 25 to 33 cm of rain in southeastern Missouri and southern Illinois, following a winter with above normal precipitation in Illinois, Missouri, Iowa, and Wisconsin (Changnon et al., 2008). Rainfall in April from southern Missouri to the eastern half of Iowa and into southern Wisconsin was 150 to 200 percent of normal. Heavy rains, 6 to 13 cm, fell on April 3-4 across southern Missouri and southern Illinois and created several flash floods. Another major rainstorm on April 9-10 (8 to 10 cm) fell across northeastern Missouri and southeastern Iowa. In May, heavy rains again fell across Iowa, Illinois, Missouri, and Indiana. Monthly amounts were 150 to 200 percent of normal.

June was also very wet with monthly amounts greater than 200 percent of normal across Iowa, Missouri, southern Wisconsin, south-central Indiana, and central Illinois (MRCC, 2008). Many rain totals exceeded 30 cm in central-east Iowa, south-central Indiana, and northern Missouri. Elsewhere totals ranged from 20 to 26 cm. One Indiana weather sta-

tion had 51 cm in June, double the previous record. July rainfall was 150 percent of normal in a small area of central Iowa and northeastern Missouri (MRCC, 2008). Elsewhere in the 5-state area with floods, the July rainfall was near normal with less than normal in the northern half of Wisconsin and across Indiana. August had below normal rainfall throughout the 5-state area.

The result of the extremely wet winter and spring 2008 was devastating flooding in Iowa, southern Wisconsin, southern Indiana, southern and western Illinois, and northern Missouri. In Iowa, record crests occurred on the Cedar River and several other tributaries of the Mississippi River. By late April, the Mississippi River had exceeded its past record highs set in 1973 in the Arkansas-Mississippi area (Natural Hazards Observer, 2008).

At the end of June, streamflows of many rivers in western Illinois, eastern Iowa, northern Missouri, and southern Wisconsin were 190 to 200 percent of normal levels. Flood waters spread over many lands, and the occasional intense rainstorms brought several flash floods in the 5-state area. Flooding extended into July but began to rapidly diminish after mid-July. The year's highest levels on the Mississippi River from Dubuque south to Cairo (Fig. 1) occurred during the July 1-5 period, and then fell to more normal levels by the end of July (Scott, 2008).

PROBLEMS EXPERIENCED BY RAILROADS

Railroads are classified into three classes according to their income and size. The nation has seven "major railroads," each a Class 1, with earnings greater than \$90 million annually and with thousands of kilometers of tracks extending across multi-state areas. These seven include the Burlington Northern Santa Fe, Canadian National, Canadian Pacific, CSX, Kansas City Southern, Norfolk Southern, and Union Pacific. Class 2 railroads are also labeled as "regional," and these railroads have incomes between \$40 and \$90 million annually with more than 570 km of tracks. They typically have rail lines in 1 or 2 states. The Class 3 railroads have annual incomes less than \$40 million with trackage less than 160 km and often are labeled as "short Lines." These typically serve local industries like grain elevators, and act to feed freight shipments to the larger railroads. The impacts of the flooding are presented for each railroad according to these three classes, plus those experienced by Amtrak.

Amtrak is a government-sponsored railroad that operates passenger trains over the lines of the seven major railroads. Amtrak service was seriously affected in 2008 by line closures on its host routes (Lamkenau, 2008). Severe flooding in southern Illinois, south of Carbondale (Fig. 1) in March, closed the CN mainline. Amtrak stopped the *City of New Orleans* at Carbondale on March 19, and all passengers were bussed to Memphis. Busses brought northbound passengers from Memphis to Carbondale. This line was re-opened on March 25, and the train resumed operations between Chicago and New Orleans on March 26.

Because of early June flooding on the east-west BNSF mainline in Iowa (Fig. 1), the *California Zephyr* did not run east of Denver beginning on June 13, but resumed operation on July 7. The *Southwest Chief* was suspended on the BNSF line between Chicago and Kansas City from June 17 until July 1 due to flooding. The *Empire Builder's* route

over the Canadian Pacific (CP) from Chicago to St. Paul was disrupted by flooding in southern Wisconsin. The train was suspended on June 10, and resumed operations on June 27 by using a detour on the UP line from Chicago to Milwaukee and on to La Crosse.

Major Class One Railroads

The *Burlington Northern Santa Fe* (BNSF) was the hardest hit of the seven major railroads. This is the nation's largest railroad and has three heavily trafficked main lines in the 5-state area. The mainline between Denver and Chicago, which runs west-east across Iowa and Illinois, was submerged at several locations (Fig. 1) and was closed for 7 days near Ottumwa. In Illinois, a levee along the Mississippi River broke and flooding submerged this main line for 16 days. The busy BNSF line between the Twin Cities and Chicago was closed for several days at two flooded locations along the Mississippi River in Wisconsin (Fig.1). The BNSF and CN also closed their flooded parallel lines from Dubuque to Portage, Illinois.

BNSF's very busy transcontinental route between Chicago and the West Coast was threatened at Ft. Madison (Fig.1). To avert closure, the BNSF used thousands of tons of gravel to raise 17 miles of the main line by 1 to 2 feet alongside the Mississippi River (Lustig, 2008). However, a large washout occurred in Missouri and closed this line for three days in June. Sections of the BNSF lines north and south of St. Louis were also closed, often because flood gates in several urban locations were closed by the U.S. Corps of Engineers. The BNSF line south of St. Louis and along the Mississippi River was flooded and closed during March, and then closed again until July 7 when flood gates at Cape Girardeau were closed.

The *Canadian National* (CN), owner of the former Illinois Central lines in the 5-state area, had two busy mainlines seriously damaged by the floods. One extends from Chicago to New Orleans, and the other goes west from Chicago to Omaha. Heavy March rains across southern Illinois created flooding that closed both of CN's north-south lines there (Fig. 1). Most flooding was a result of a March rainstorm that put down 28 to 33 cm of rain. Water 30 cm deep covered the CN mainline south of Carbondale (Fig. 1), and a 2-meter deep washout left the track suspended in mid-air for several hundred meters near Makanda. This stopped all trains and a grain train was stranded. All other freight traffic was shifted to the CN's other north-south line from near Effingham into Kentucky (Fig.1). Then, heavy rains and flooding closed this line in two locations; thus, both CN north-south lines were closed and all trains were stopped for three days.

Severe rainstorms in early June in Iowa hurt the CN. Several sections of its west-east line were out of service, as shown in figure 1. Trees fell across the lines, high waters threatened bridges, and many tracks were flooded. The line in western Iowa was flooded with water going over a bridge near Dennison, and a 730-meter section of the bridge was destroyed. As a result, the Fort Dodge–Omaha section of this line was closed for 8 days. Water was also over this CN line in central Iowa and tracks were buried by a major mud slide near Cedar Falls. Ten rail cars were put on a bridge near Cedar Falls to try to stabilize it. The line west from Dubuque to Cedar Falls was closed for 8 days. The BNSF and CN closed their flooded parallel lines from Dubuque to Portage, Illinois. This trapped

eight CN trains in Dubuque. The CN mainline in central Wisconsin was closed on June 8, and all trains were held until waters receded on June 11.

The *Canadian Pacific's* (CP) mainline between La Crosse and Chicago was closed in central Wisconsin when one meter of water covered the rails. CP trains were detoured over several routes including Wisconsin & Southern (WS) between Madison and northern Illinois. Service on the CP line was restored 19 days later. A detouring CP train on the IC&E derailed in northern Illinois on June 24, closing the busy IC&E line between Chicago and Savanna for two days.

In the 5-state area the *CSX Railroad* has busy lines extending from Chicago south and an east-west main from St. Louis east to Indianapolis and on to many East Coast locations. The north-south mainline became flooded near Beecher, Illinois, closing the shared mainlines of CSX and UP on March 26. The flooding led to the derailment of 22 cars of a UP freight, and this further blocked the line for 4 days. CSX trains were detoured to the east. The CSX mainline between Indianapolis and St. Louis was closed at Greencastle, Indiana by a washout on June 8. The line was opened on June 12, and 28 stalled trains resumed operations..

The *Kansas City Southern* (KCS) lines served to handle many train detours. Flooding in Missouri, Arkansas, and Mississippi during April and May affected many train operations leading to detours over the KCS lines. Heavy rains occurred across KCS territory with minor flooding in western Missouri, and KCS trains south of Kansas City had to move very slowly for 20 days. Flooding covered the rail line along the Mississippi River at Louisiana, Missouri, and led to closure for two weeks of the KCS line to St. Louis.

An eastbound freight train on the *Norfolk Southern* (NS), going from Kansas City to Decatur, derailed 32 cars east of Hannibal (Fig. 1) on June 3, a result of the failure of a flooded bridge (Railroad Illustrated, 2008). The flood waters also brought debris onto the line but the line was reopened two days later. The Corps of Engineers closed the flood gates at Hannibal, Missouri, on June 13, closing the busy Decatur-Kansas City line for 21 days, a major problem since this line carries much freight from the West Coast to East Coast sites. Flooding from levee failures also eroded the line near Hannibal.

Flood troubles on the *Union Pacific* (UP) began early. The UP has three main lines in the 5-state area, plus several other lines once owned by the C&NW Railroad. A flash flood in southern Illinois in March washed out the roadbed under 85 meters of UP line near West Vienna. Seven cars of a passing UP train derailed, and two crewmen were injured. UP's main line across Iowa and Illinois handles 70 trains each day, and it experienced numerous problems including closure when the Cedar River bridge was threatened. The line west of Cedar Rapids was closed for 3 days, and the UP closed this mainline again when the bridge across the Cedar River at Waterloo collapsed on June 10. The UP closed the Chicago-Omaha mainline near Cedar Rapids for 6 days and the rail yards there were flooded. The UP had 175 trains held awaiting the line's opening, and after it was opened, it took three days to clear this mass of stalled trains (Lustig, 2008) The UP's mainline between St. Paul and Chicago was closed in Wisconsin (Fig. 1) by floods on June 8.

Regional Class Two Railroads

In April many trains of the *Iowa, Chicago & Eastern* (IC&E) had to detour due to the floods in Iowa. High waters destroyed a bridge south of Marquette, Iowa. Due to levee failures, the Mississippi River flooded and closed the IC&E main line at Davenport on April 26. IC&E trains going to and from Chicago were detoured onto the CP line. In late April, IC&E trains from the Twin Cities (MN) to Kansas City were shifted to the UP line from Mason City to Kansas City (Fig. 1). The IC&E line from Davenport to Kansas City was closed for 7 days at a site near Davenport, and for 35 days at another badly flooded location. The CP handled 46 detoured IC&E trains going to Chicago, and the UP handled 29 IC&E trains from Kansas City to Des Moines.

Heavy rains in northeastern Iowa on June 7-8 washed out the IC&E line for 3 miles between Marquette and Mason City (Fig.1). A bridge on this line was washed away and this line was closed for 12 days north of Clinton. A train derailed south of Marquette on July 9, 30 cars derailed, and four engines fell into the Mississippi River causing serious injuries to the crew. The Rock River flooded the IC&E line between Rockford and southern Wisconsin for 6 days.

Several railroads used the IC&E for detouring trains around floods. UP trains used the line between Clinton and Kansas City from June 7 to 10. UP coal trains going east from Kansas City used the IC&E at Kansas City to get across Iowa before the line closed. The IC&E handled some BNSF detours from Savanna to Clinton. The IC&E bridge over the Iowa River at Columbus Junction collapsed on June 25, dumping the engines of a passing freight train into the river and injuring the crew.

The *Iowa Interstate* (IAIS) operates an east-west main line from Omaha east to Chicago, plus several branch lines in both states. The IAIS had several lines in Iowa closed by floods in early June. A branch line at Des Moines was closed 18 days by washouts. The UP put a train on IAIS mainline from Omaha to Des Moines on June 8, but it was stopped by a major washout that closed the line for ten days. A short line, the Cedar Rapids and Iowa City Railway (CIC), closed its damaged bridge over the Iowa River near Amana, cutting off IAIS access to Cedar Rapids for 23 days. Several Iowa City-based trains, which normally ran to Cedar Rapids (north) and to Rock Island (east), were stopped. The IAIS line between Davenport and Iowa City was closed for 13 days (Fig. 1), and a train near Davenport hit a washout and was wrecked on June 13.

The *Wisconsin and Southern* (WS) has four lines that radiate out of Madison, and three were closed for more than 30 days. The line south from Madison, which had been hosting detoured CP and UP trains, had to be closed for 2 days.

Class Three Short Lines

The Cedar River in Iowa, which crested at record levels in June, wiped out the bridge of the *Cedar Rapids & Iowa City* (CIC) at Cedar Rapids on June 12. The bridge was also used by the IAIS, and was closed 23 days.

The June floods created major havoc for the *Iowa Northern* (IANR). Its rail car shops were flooded at Waterloo, just southeast of Cedar Falls (Fig.1), but the IANR managed to get all stored rail cars moved out of town. IANR had several washouts north of Cedar

Rapids, and a 2-mile one near Mason City closed the line for 14 days. The UP's destroyed bridge near Cedar Rapids severed the CIC and IANR lines which also used this bridge. The city of Waterloo closed its flood gates on June 10, thus closing the IANR route south to Cedar Rapids for 24 days.

The *Louisville & Indiana* (L&I) line between Indianapolis and Louisville was closed when a bridge was washed away on June 8. The line was re-opened 23 days later when the bridge was re-built.

The *Indiana Railroad* (IRR) line to Newton, Illinois, had multiple washouts and a washed out bridge, leading to its closure for 6 days. The Terre Haute-Bedford line also had many washouts, being closed for 7 days. The line near Indianapolis had major washouts and was closed for 48 days.

The *Peoria and Western* line from Peoria west to Keokuk, Iowa, was closed for 29 days. The bridge over the Mississippi River at Keokuk was considered unsafe to cross due to high water and swift currents.

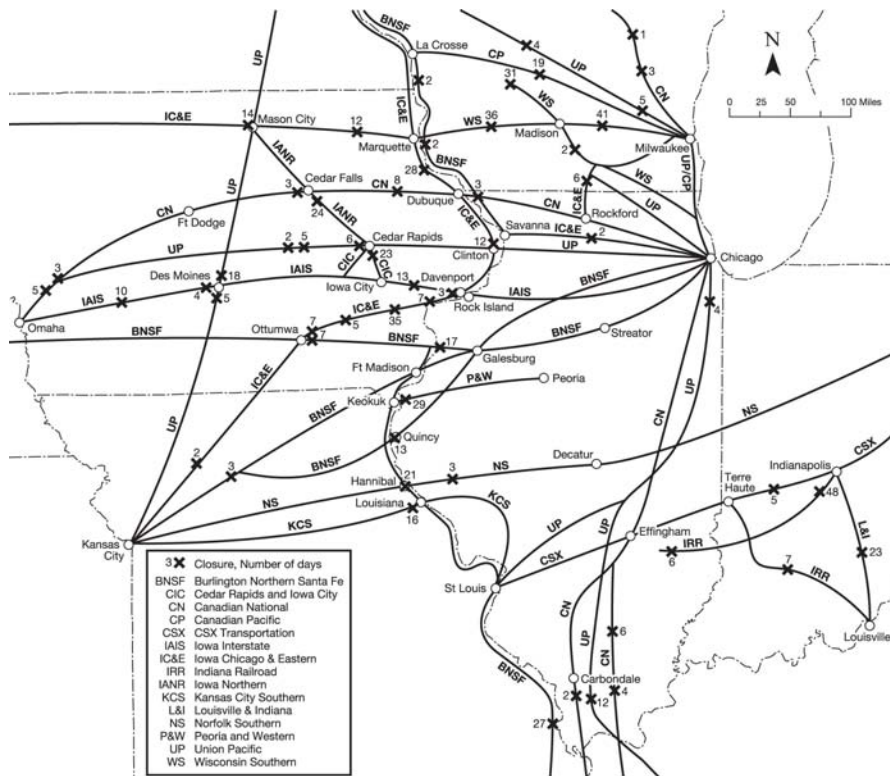


Figure 1. Rail lines in the flooded area, and locations of line closures are shown along with the number of days closed.

ECONOMIC IMPACTS

Flood-related damages to tracks, roadbeds, bridges, signals, and other railroad facilities were excessive, totaling \$85 million in costs to repair. The 2008 revenue losses also were quite high, \$69 million. The total losses and costs was \$154 million. This was high but much less than those caused by the record high waters and long lasting 1993 Midwestern floods, which caused railroad losses and costs amounting to \$495 million, the highest ever experienced in the U.S. (Changnon, 1996). Replacement of washed-out rail lines and roadbeds cost \$1.2 million per mile, and there were 31 such miles costing \$37 million to repair. The costs to repair lines that were under water averaged \$130,000 per mile, and with 134 miles under water, the total cost to repair them was \$17.4 million.

Table 1 shows the 2008 damages experienced by each railroad. The BNSF had the greatest damages, \$26 million. Also shown in the table are losses in income due to the floods. The BNSF and UP had the greatest revenue losses. The state of Iowa's Railway Finance Authority provided \$4 million to the regional and local railroads to help restore their damaged lines in Iowa.

Table 1. The economic impacts of the floods of 2008, and the values shown are millions of dollars.

Railroad	Damage Costs	Revenue Losses
Amtrak	2	3
BNSF	26	9
CN	17	10
CP	4	3
CSX	3	2
IC&E	10	6
IAIS	3	3
KCS	1	3
NS	1	4
UP	14	15
WS	2	1
Short Lines (4)	2	1
Total	85	69

SUMMARY

The railroad problems caused by the 2008 floods, and the responses the railroads used to address the problems are listed in table 2. The problems included both damages and losses in revenue due to trapped trains and delayed shipments. Rainfall during January-July 2008 exceeded 65 cm in Illinois, Indiana, Iowa, and Missouri, and amounts ranked

as the highest on record. The numerous heavy rain events led to numerous severe floods of near record proportions.

Table 2. The problems and responses used by the railroads to deal with the 2008 flood problems.

Problems	Responses
washed out lines	detours of trains
submerged tracks and rail yards	repairs of track and roadbeds
damaged/destroyed bridges	bridges rebuilt
lines closed for days	passengers bussed
trains trapped	repaired rail cars
shipments delayed	rebuilt railroad facilities

Flooding along the Mississippi River was a major problem for the railroads since so many lines cross the river and/or are built parallel to the river. Below is a list of the thirteen locations where rail lines were closed as a result of flooding along the Mississippi River, listed from north to south sites.

- La Crosse, WI—BNSF
- Prairie du Chien, WI—BNSF
- Guttenberg, IA—IC&E
- Portage, IL—BNSF and CN
- Clinton, IA—IC&E
- Davenport, IA—IC&E
- Burlington, IA—BNSF
- Ft. Madison, IA—BNSF
- Keokuk, IA—P&W
- Quincy, IL—BNSF
- Hannibal, MO—NS
- Louisiana, MO—KCS
- Cape Girardeau, MO—BNSF

This list reveals that the BNSF was stopped at 7 of the 13 locations, further revealing why the BNSF suffered the most losses from the 2008 floods. In the flooded area, the BNSF had the greatest mileage of heavily traveled mainlines between the Midwest and the West Coast. The railroads crossing the Mississippi River on bridges between the Quad cities and St. Louis all had serious problems with the bridges and their approaches across adjacent flood plains. The bridges included, from north to south, the ones at Burlington, Ft. Madison, Keokuk, Quincy, Hannibal, and Louisiana. Flooding in this 5-state area was a major problem for all the nation's seven largest railroads.

There were nine rail bridges destroyed or seriously damaged. Their state locations are listed in table 3, revealing that six occurred in Iowa. Also listed in the table are the number of train wrecks from the flood. Notably, four of the eight train wrecks were in Illinois. The number of line closures reveal that Iowa led with 23, followed by Wisconsin and Illinois each with 12 lines closed. The 56 closures totaled 640 days, an average of 11 days per closure.

Table 3. Number of rail bridges destroyed or badly damaged, the number of train wrecks, and number of rail line closures due to the 2008 flood.

States	Bridges	Train Wrecks	Line closures
Illinois	2	4	12
Indiana	1	0	4
Iowa	6	3	24
Missouri	0	0	5
Wisconsin	0	1	12
Total	9	8	56

Many problems and major costs were experienced by the Midwest's railroads in dealing with the 2008 floods. However, regional railroad experts noted that the flooding was not as severe as experienced in 1993. The economic impact of the 2008 floods totaled \$154 million, roughly a third of the record losses/costs of \$495 million resulting from the 1993 floods that occurred in the same general area (Changnon, 1996).

ACKNOWLEDGMENTS

I appreciate the extensive data and information provided by representatives of the railroads impacted by the flooding. Sara Olson prepared the illustration.

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