



UNANTICIPATED CLOSURE OF THE POE LOCK

One of the Nation’s most economically vital systems, the iron mining – steel production – manufacturing supply chain, is potentially the least resilient. The Soo Locks, connecting Lakes Huron and Superior, are a potential single point of failure in this supply chain. Analysis described here shows that an unexpected six-month closure of the locks would have devastating consequences for the National economy. The Department of Homeland Security, National Protection and Programs Directorate’s Office of Cyber and Infrastructure Analysis (OCIA) houses the National Infrastructure Simulation and Analysis Center (NISAC).¹ OCIA-NISAC analyzed the impact of an unanticipated closure of the Poe Lock, the only lock large enough to allow passage of the vessels carrying iron ore at the Soo Locks, located in Sault Ste. Marie, Michigan.

An unanticipated closure of the Poe Lock would likely result in widespread bankruptcies and dislocations throughout the economy. Over 10 million people in the United States and 2 - 5 million more in Canada and Mexico would lose their jobs and the North American economies would enter a severe recession. The recession impacts would be concentrated in the Great Lakes region though California and Texas would experience some of the largest job losses. Entire manufacturing industries would be debilitated, including: automobiles; appliances; construction, farming, and mining equipment; and railcars and locomotives.



Commercial shipping routes through the Great Lakes, showing the major ports along the Lakes. The supply chain connecting the iron ore mines in Minnesota and Michigan to the Great Lakes steel mills follows the same trade routes first started in 1855.

PERILS OF EFFICIENCY

The iron ore needed to make steel for these industries must pass through the Poe Lock.² This supply chain has operated for 160 years by transporting iron ore from mines in Minnesota and Michigan by Lake Carriers (Lakers) to the Great Lakes steel mills. It is the safest, cleanest, and most efficient way to move iron ore. The downside of this efficiency is a loss of resilience. Currently, there is no other way to move the quantity of iron ore needed. OCIA-NISAC investigated a number of other alternative modes of transportation, all of which are logistically constrained. Some of the alternative strategies included:³

Rail: Many of the steel mills do not have rail access, and even if they did, there are not enough railcars, locomotives, or train crews to move the amount of iron ore needed. The rail corridor between Minnesota and Chicago is currently very congested; moving the iron ore by rail would mean tripling the traffic between Duluth, Minnesota and Milwaukee, Wisconsin.

Truck: Many of the steel mills do not have truck access to the iron ore storage areas. Even if they did, there are not enough trucks or drivers in North America to move the necessary amount of iron ore from the mines to the mills. Based on the amount of iron ore needed to reach the mills, a truck would have to enter a mill, unload, and leave every 2.4 minutes.

Importing Iron Ore: Most North American steel mills do not use iron ore, but taconite, which is only available in Minnesota and Michigan. To change from taconite to iron ore could damage blast furnaces and change steel chemistry. Substantial testing would be required to ensure that the steel was made to the same specifications. More problematic is the nature of the Laker Fleet. The Lakers are all self-unloading, while iron ore vessels outside of the Great Lakes require port facilities that can do the unloading. Even if it were possible to get iron ore to the Great Lakes, there may be no way to unload it.

1. NISAC is a Congressionally-mandated center of excellence in modeling, simulation, and analysis of critical infrastructure.
2. Steel, herein, refers to steel made in a basic oxygen furnace (BOF), which converts iron ore into steel. BOF steel plants have historically been referred to as integrated steel mills and were the large steel mills located between Illinois and Pennsylvania. Most steel today is made in an electric arc furnace (EAF), and more commonly referred to as a 'mini-mill'. Mini-mills convert scrap steel into steel using electricity. BOF steel has the property of 'formability', which means that the steel can be pressed to a thin layer and formed to meet certain shapes and strengths, such as those for an automobile body or frame. EAF steel is used for its strength, particularly in the construction field, as structural steel or rebar. BOF steel and EAF steel are not interchangeable.
3. See the report, "The Perils of Efficiency: An Analysis of an Unexpected Closure of the Soo Locks and its Impacts," available on request from OCIA.



COMPLEXITIES OF THE SUPPLY CHAIN

An added complexity is the specificity of the steel used in automotive manufacturing. Automobile companies do not buy steel from a steel mill and make a car out of it; rather, automobile companies will order a particular type of steel processed at a specific rolling facility at a specific mill at a specific time and have it shipped to another tier 1 supplier for processing. To change any part of this process could take up to 1 year. One factor driving this is the automotive paint. Automobile companies do not buy paint because it adheres well to the steel; auto companies buy steel because it adheres well to the paint.

Almost every part of a car made with steel is made from a unique steel coil and there are about 1,500 different recipes of steel. The inability to make just one type of steel coil can lead to automobile lines shutting down.

The impact of a closure of the Poe Lock is recognized as a vulnerability to the automotive supply chain. As one industry executive put it, "the loss of the integrated mill steel supply for 180 days would be catastrophic to the North American Auto Industry including its tier 1 suppliers... There is no contingency plan, stockpile or off shore sourcing action that could come close to mitigating the situation."

ECONOMIC IMPACT OF THE POE LOCK

One of the Nation's most economically vital systems, the iron mining – steel production – manufacturing supply chain, particularly automobile manufacturing supply chain, is potentially the least resilient. USACE has called the Poe Lock "the Achilles heel of the Great Lakes Navigation System." OCIA analysis suggests that the Poe Lock is more aptly described as "the Achilles heel of the North American industrial economy." In terms of an impact to North American economic output and employment, it is hard to conceive of a single asset more consequential than the Poe Lock.

There are 13 thousand-footer Lakers on the Great Lakes; each one traveling east carries iron ore valued at about \$4 million based on today's value. According to our analysis, the North American economic output associated with each one of those vessels exceeds \$1.6 billion.

The United States has historical knowledge of how to respond to shocks caused by financial crises, oil prices or availability, or falling aggregate demand. There is no similar knowledge as to how one would respond to a supply shock where a large set of industries: automotive industry, appliance industry, construction, farm and mining equipment manufacturing, and railcar and locomotive manufacturing would have no way to function.



"When you're on a ship coming into the locks, especially a thousand-footer, the lock's 110 feet wide, the ship is 105 feet wide, and from the pilot house, your perspective, it doesn't look like the ship will actually even fit into the lock. So it's kind of a unique experience. It's amazing to watch the skill of the captains when they bring these big ships into such a small area."⁴

The Soo Locks has never had a major, long-term failure, which has led to an assumption that it will operate indefinitely. As one industry executive put it, users expect that "the Soo Locks will operate just as the sun rises every day." However, since the first lock of the Soo Locks opened in 1855, a new lock has been constructed about every 19 years. Today, the Poe Lock is 46 years old, and the additional smaller lock, the MacArthur Lock, is 73 years old. The U.S. Army Corps of Engineers (USACE) has noted in its 2012 Soo Locks Asset Replacement Report, numerous mechanical deficiencies and major structural repairs are needed to keep the existing locks operating.

CONTACTS

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For more information, contact OCIA@hq.dhs.gov or visit our website: <http://www.dhs.gov/office-cyber-infrastructure-analysis>

4. Kevin Sprague, USACE Detroit District, "Soo Locks Opens Despite Ice," on March 26, 2015 at <http://abc10up.com/soo-locks-open-despite-ice/>, accessed March 29, 2015