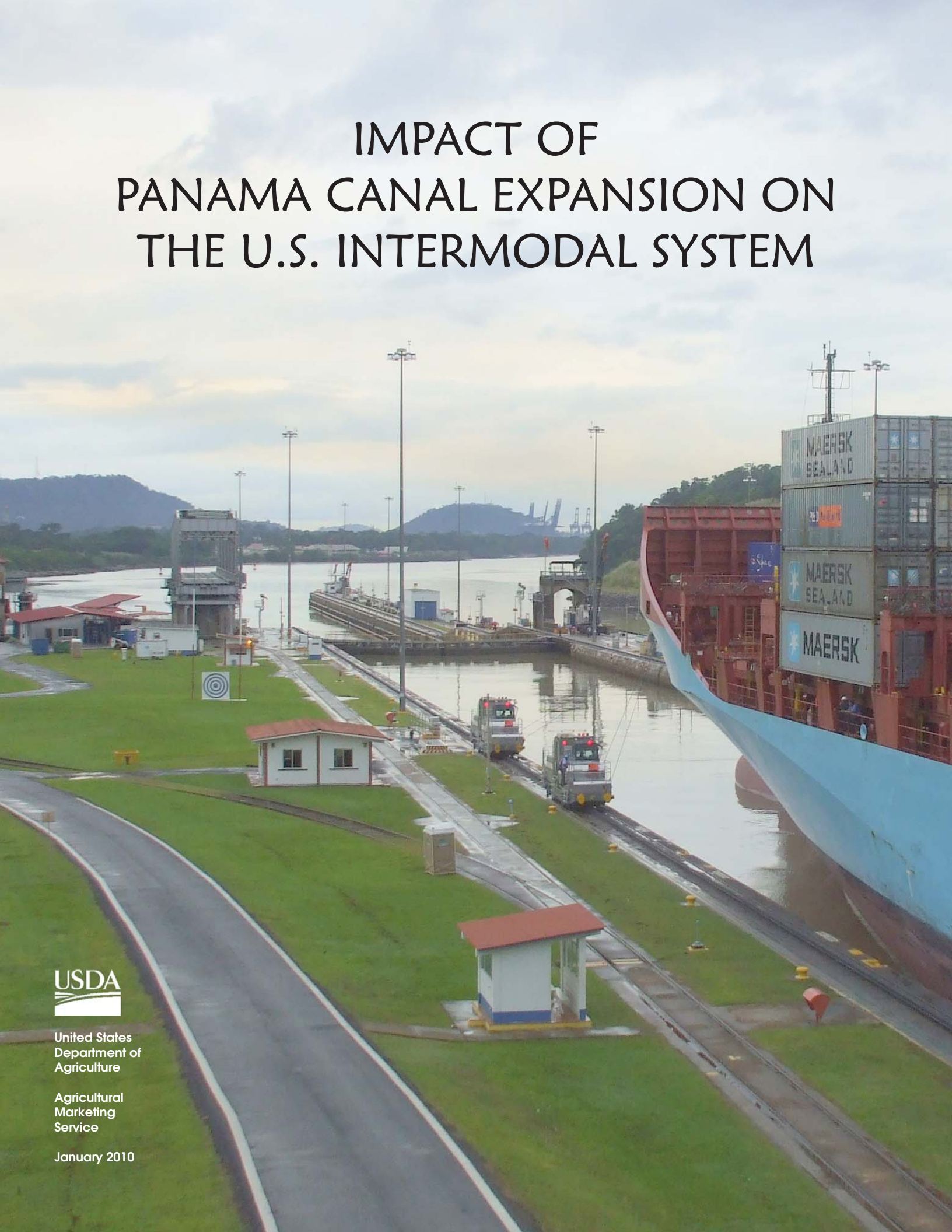
IMPACT OF PANAMA CANAL EXPANSION ON THE U.S. INTERMODAL SYSTEM



USDA

United States
Department of
Agriculture

Agricultural
Marketing
Service

January 2010

United States Department of Agriculture
Marketing and Regulatory Programs
Agricultural Marketing Service
Transportation and Marketing Programs

January 2010

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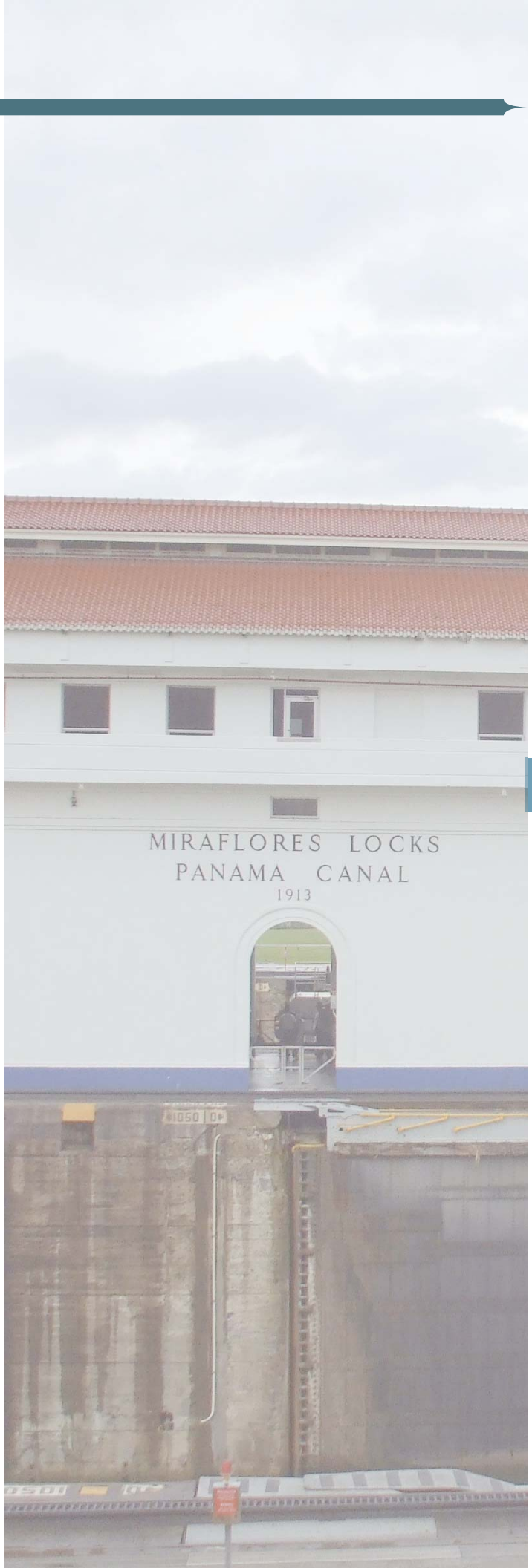
Acknowledgments

The author would like to acknowledge Maria Eugenia Sanchez of the Panama Canal Authority for proving data and pictures, and Kimberly Vachal of the Upper Great Plains Transportation Institute and Agapi Somwaru of the Economic Research Service for reviewing the manuscript.

Abstract

The Panama Canal expansion is expected to affect global transportation trade routes. The Panama Canal's main competitors for shipments from Asia to the U.S. East Coast are the U.S. Intermodal System and the Suez Canal. The Panama Canal is an efficient route, but is reaching its maximum capacity. However, this problem will be resolved by 2014 when the Panama Canal Expansion Project is completed. The Suez Canal route, especially, competes with the Panama Canal in the South and Southeast Asia–U.S. East Coast route due to its shorter navigation time of 21.1 days and its capacity to handle Post-Panamax vessels. The U.S. Intermodal System has the shortest ocean navigation time (Asia to U.S. West Coast) of 12.3 days. Transit time from the West Coast to the East Coast is another 6 days, for a total transit time from Asia to the East Coast of about 18.3 days. However, the reliability of ports and railroads frequently is compromised by labor problems and capacity expansion challenges. For the U.S. Intermodal System to remain competitive in the face of the Panama Canal expansion, further investment in U.S. infrastructure and a more integrated approach is needed to reduced bottlenecks in the system.



Introduction

According to the U.S. Department of Transportation (DOT), U.S. foreign trade of 1.4 billion metric tons (mt) accounted for 19 percent of global waterborne trade (7.6 billion mt) in 2006. From 2002 to 2006, global trade increased 23 percent, the greatest 5-year growth rate of the last 20 years. Foreign trade represented nearly 22 percent of U.S. gross domestic product (GDP) in 2006. DOT forecasts that it will reach 35 percent of the GDP by 2020 and 60 percent by 2030 (DOT 2009a). China's demand for primary products (petroleum, iron ore, coal, and grains) and its growth in the global consumer product container trade have been the main drivers of world trade increases.

More than 95 percent of U.S. cargo imports arrive by ships (DOT 2009a). To accommodate this increase in global trade, shipbuilders are making larger vessels. However, the larger Post-Panamax[1] vessels require deeper and wider shipping channels, greater overhead clearance, and larger cranes and shore infrastructure (Knight, 2008; DOT 2009a). Some U.S ports, such as the Ports of Long Beach, Savannah, Oakland, Charleston, and Seattle, can receive the Post-Panamax vessels. However, the efficiency of these ports is reduced by congestion caused by inland rail and road chokepoints (DOT 2009a). Congestion affects the service reliability of the U.S. transportation system. Capacity expansion in the transportation system is critical for economic growth (ACP 2006).

Marine cargo destined for the United States moves mainly through the Panama Canal, the Suez Canal, the Cape of Good Hope, and the U.S. Intermodal System (ACP 2006). This paper provides an in-depth analysis of the effect of the Panama Canal expansion on world transportation trade routes. Cargo will be diverted to the most efficient routes, changing the global flow of freight traffic. The paper also offers a brief history of the Panama and Suez Canal and their relationship to the U.S. Intermodal System. It focuses only on route transit times, not the times involved in warehouse and distribution to the final consumer.

1 Post-Panamax containerships usually move about 5,000 - 8,000 containers, have widths of 14 to 20 containers, and drafts of 15 meters, requiring an access channel of 17 meters deep. Super Post-Panamax vessels have a carrying capacity greater than 9,000 containers. (Knight 2008)

Panama Canal

In the late 1800s, the French began to build a sea-level canal across the Isthmus of Panama, but could not finish the project due to insufficient capital, difficult working conditions created by diseases—especially malaria and yellow fever—and a design that did not take into account the lower sea level on the Caribbean side of Panama than on the Pacific side (ACP 2001). On February 23, 1904, the United States bought the Canal Zone from Panama, paying $10 million to Panama and $40 million to the French Company Compagnie Nouvelle du Canal de Panama. In 1914, the Panama Canal was built at a cost of $375 million (ACP 2001). The United States ran Canal operations for 85 years, until December 31, 1999, when the Panama Canal Authority assumed its operation (ACP 2009).

The Panama Canal is 51 miles long (82 km) connecting the Caribbean Sea to the Pacific Ocean (Lloyd's Maritime Atlas 1999). Vessels transiting the Canal are raised and lowered 26.2 meters as the ship transits through the locks from one ocean to the other (Lloyd's Maritime Atlas, 1999 edition). The average in-transit time has increased from 9 hours in 1999 to 13.04 hours in 2008 (Lloyd's Maritime Atlas, 1999 edition; ACP 2009b). According to the Panama Canal Authority (ACP), during the first quarter of the year the average canal water time (CWT) was 35.09 in 2008 due to delays caused by critical maintenance work at the Pedro Miguel and Miraflores Locks (Table 1).

The Canal is reaching its maximum capacity. It carries more traffic than it was designed for and does not have the infrastructure to handle Post-Panamax vessels, which move 27 percent of the world's containerized maritime shipments (ACP 2006). On December 9, 2008, the

Table 1: Panama Canal transit times, 2007-2008

Year	Market segment	Average in-transit time* (Hours)	Average Canal water time** (Hours)	Percent change
2007	General cargo	10.08	28.34	181.0
	Refrigerated	8.87	26.54	199.2
	Dry bulk	13.41	37.89	182.7
	Tankers	13.07	43.51	232.9
	Container	9.90	18.90	90.9
	Vehicle carriers	11.52	21.30	84.9
	Passengers	9.82	13.36	36.0
	Others	18.61	45.32	143.5
	Total	**12.42**	**31.81**	**156.1**
2008	General cargo	12.86	36.64	184.8
	Refrigerated	10.74	33.11	208.2
	Dry bulk	14.75	41.62	182.1
	Tankers	14.88	45.27	204.2
	Container	10.62	19.10	79.9
	Vehicle carriers	12.15	22.42	84.4
	Passengers	10.21	13.92	36.3
	Other	15.72	49.47	214.7
	Total	**13.04**	**35.09**	**169.1**

*"In-transit time" is the time a vessel moves through the canal (from the first lock to the last one)

**"Canal water time (CWT)" is the total time a vessel spends transiting the canal, including arrival time, waiting time before entering the canal, in-transit time, navigation through the Gaillard Cut, etc.

Source: Panama Canal Authority (ACP), 2009b

Panama Canal Authority received financing to begin the Canal expansion program to handle greater cargo volumes and larger vessels. The project is expected to be finished by 2014 (ACP 2006; ACP 2009a). The Panama Canal is the main economic resource of the Republic of Panama (ACP 2006).

Panama Canal Market Segments and Competitiveness

The Panama Canal Authority classifies its market into eight segments (ACP 2006):

- Containerships
- Dry bulk vessels that carry grains, ores, or their derivatives
- Vehicle carriers
- Liquid bulk vessels, which transport chemical products, gases, and oil derivatives
- Reefers or refrigerated transport
- Cruise ships
- General cargo vessels
- Miscellaneous vessels such as fishing boats, navy and research vessels, dredges, and barges

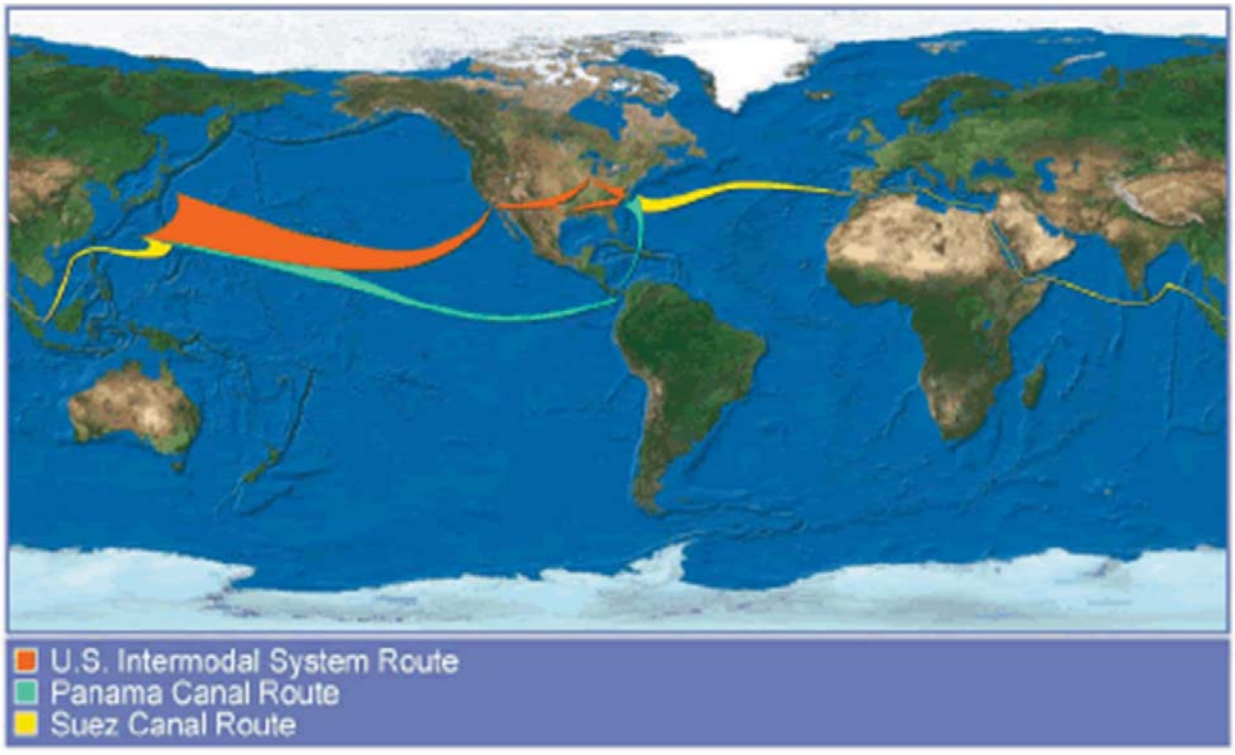
Containerships are the Canal's main source of income, followed by dry bulk, vehicle, and liquid bulk (ACP 2006).

The Panama Canal faces direct competition from alternative routes such as the U.S. Intermodal System, the Suez Canal, the Cape of Good Hope, and Cape Horn (ACP 2006). Currently, the main competitors are the U.S. Intermodal System and the Suez Canal (ACP 2006) (Figure 1). In 2006, the maritime transpacific route—containership services between Asia and the U.S. West Coast[2] —was the preferred route, accounting for 75 percent of Asian imports with an average navigation time of 12.3 days, plus 6 days from the West to the East Coast, totaling about 18.3 days (CSX 2009). Second is the Asia–Panama Canal–U.S. East Coast[3] route with 19 percent of Asian imports and an average navigation time of 21.6 days, followed by the Asia–Suez Canal–U.S. East Coast route handling 6 percent of Asian imports with an average navigation time of 21.1 days (SCT 2009).

2 U.S. West Coast ports comprise Los Angeles (LA), Long Beach (LB), and Seattle/Tacoma.

3 U.S. East Coast ports include New York/New Jersey, Savannah, Hampton Roads (Norfolk, Portsmouth, and Newport News), and Charleston.

Figure 1: Main competitors of the Panama Canal route



Source: Courtesy of The Panama Canal Authority

The Suez Canal

In the 13th century BC, the pharaohs created a canal linking the Nile River delta and the Red Sea (MSN 2009). The Suez Canal remained navigable, but was neglected for several thousand years. It was re-excavated or modified many times, then finally abandoned in the 8th century AD (EMDB 2009; MSN 2009). On April 25, 1859, the Compagnie Universelle du Canal Maritime de Suez (Universal Company of the Maritime Suez Canal) began re-dredging the canal. It was opened to navigation again on November 17, 1869, with a license to operate for 99 years at a total cost of $100 million (EMDB 2009; MSN 2009). In 1956, the Suez Canal was nationalized by the Egyptian Government.

The Suez Canal links the Mediterranean Sea to the Gulf of Suez on the Red Sea. On June 5, 1967, during the Six-Day War, it was closed and blockaded against Israel by Egypt. It was reopened on June 10, 1975 (EMDB 2009; MSN 2009). The Canal is 118 miles long (190 km); it contains no locks, and is 77 feet (23.5 m) deep. Ships with up to 68 feet (20.7 m) draft can navigate the Canal. Egypt plans to increase the draft to 72 feet (22 meters) by 2010, allowing for passage of Supertankers.[4] Currently, it is owned and maintained by the Suez Canal Authority of the Arab Republic of Egypt.

4 Supertankers are ships designed for the bulk transport of oil with a capacity up to 550,000 deadweight tonnage (DWT). DWT is a measure of how much weight of cargo or burden a ship can safely carry. (EMDB 2009; Wikipedia 2009)

Competitiveness

The Suez Canal route competes with the Panama Canal in the Asia–U.S. East Coast route, especially in cargo originating in South[1] and Southeast[2] Asia, due to its shorter navigation time to the U.S. East Coast and its capacity to handle Post-Panamax vessels (ACP 2006). Currently, the Panama Canal route and the transpacific route connecting to the U.S. Intermodal System are more efficient for shipments originating in Northeast Asia. For example, a weekly

containership service with the same cargo capacity between Northeast Asia and the U.S. East Coast using the Suez Canal requires about 11 vessels; each vessel makes 4.7 round trips per year, with a round-trip travel time of 77 days. Traveling through the Panama Canal, each vessel makes 6.5 round trips per year, with a 56-day round-trip travel time (ACP 2006). An alternative to the Suez Canal is the longer trip around Africa by the Cape of Good Hope. Bigger ships and ships avoiding the Canal toll fees often take this route. In addition, this route minimizes the potential of piracy off the Coast of Somalia. Private shipping companies paid about $150 million to pirates in 2008 (Washington Post 2009).

Panama versus the Suez Canal

The Suez Canal route's main advantage is its ability to handle Post-Panamax vessels, which offers the possibility of increased revenue from greater productivity (ACP 2006). For instance, a weekly service of 11 Post-Panamax vessels (8,000 TEUs[3] capacity) has an annual productivity of 38,000 TEUs per vessel and a total annual service of 410,000 TEUs through the Suez Canal. However, the same service using Panamax vessels (4,800 TUEs) through the Panama Canal results in an annual productivity of almost 31,000 TEUs per vessel and a total service capacity of 248,000 TEUs (ACP 2006). This represents an 18-percent decrease in each vessel's annual productivity and a nearly 40-percent drop in total service capacity.

The Suez Canal's average transit time is longer than that of the Panama Canal —14 hours for a southbound convoy and 10 hours for a northbound (Lloyd's Maritime Atlas, 1999 edition). The Panama Canal's average transit time was only 9 hours in 1999, but it increased nearly 45 percent in 2008, reaching 13.04 hours (Table 1). Delays and interruptions in Canal traffic reduce the Canal's service reliability, causing the Panama Canal route to become more expensive and impairing the Canal's competitiveness (ACP 2006). With the expansion of the Panama Canal, service reliability should increase because there will be fewer delays in transit time (ACP 2006).

1 South Asia includes Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan, Sri Lanka, the British Indian Ocean Territories, Pakistan, Myanmar, Tibet, and Iran.

2 Southeast Asia includes Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

3 Twenty Foot Equivalent Unit (TEU) is a 20-foot shipping container.

The U.S. Intermodal System

The U.S. Intermodal System is a complex of three distinct transportation modes: ocean shipment, movement by rail, and truck transport. Cargo must be transferred from one mode to the other, unlike the Canal routes, which consist of only the ocean container mode, and require no transfers. The U.S. Intermodal System is the main competitor with the Panama Canal expansion in the Northeast Asia[4] – U.S. East Coast route (ACP 2006). The Canal route is less costly and highly reliable but has a longer navigation time (21.6 days) than the U.S. Intermodal System route (18.3 days, depending on the carrier). The U.S. Intermodal System route comprises the transpacific maritime route (containership services between Asia and the U.S. West Coast), the U.S. East Coast Ports, the U.S. rail network, and the interstate highway system (ACP 2006; DOT 2009a) (figure 2).

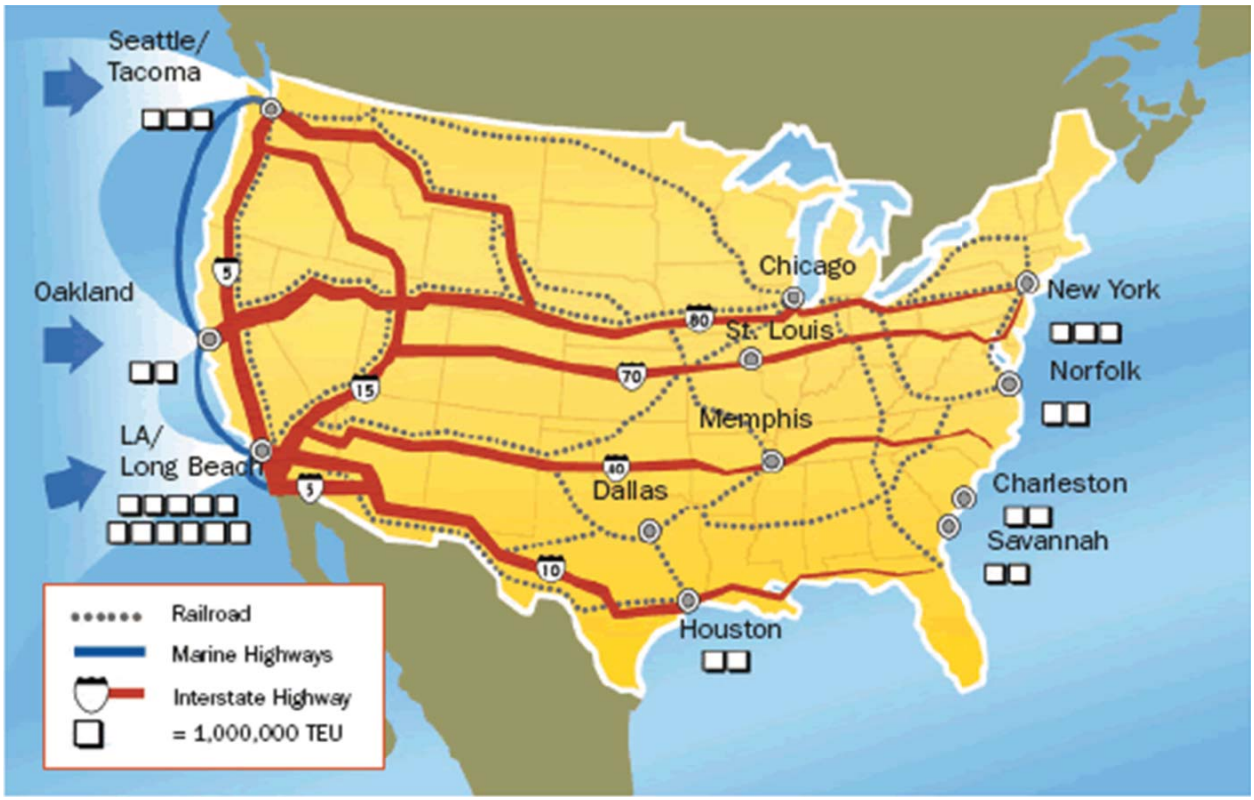
The U.S. Intermodal System comprises such diverse operators as ports, railroads, trucks, transshipment areas, and municipal and state governments (ACP 2006). The system's efficiencies are dependent on an advanced and sophisticated network of large commercial operators with highly trained personnel, as well as support services and industries to maintain the network (DOT 2009a).

Competitiveness

The major advantage of the U.S. Intermodal System is the opportunity it offers to develop economies of scale in the transpacific maritime route, which frequently uses Post-Panamax containerships, as it requires only five ships for a weekly service rotation compared with the eight ships required by the Panama Canal route (ACP 2006). However, port and railroad reliabilities have been affected by labor problems (strikes and shortage of labor to handle new cargo) and congestion caused by capacity expansion challenges. Ports must

4 Northeast Asia includes China, Hong Kong, Mongolia, Macau, Taiwan, Japan, South Korea, and North Korea.

Figure 2: U.S. West Coast gateways and corridors



Source: U.S. Department of Transportation, Maritime Administration, 2009

compete with community and environmental land uses (DOT 2009a) for land on which to expand. As trade increases, many of the U.S. top 10 container ports[5] are reaching their capacity (DOT 2009a). The ports of Los Angeles/Long Beach (LA/LB), New York/New Jersey (NY/NJ) , Seattle/Tacoma, Savannah, and Oakland accounted for nearly 69 percent of the U.S. foreign container trade in 2008 (DOT 2008 and 2009b).

Capacity Challenges

U.S. port container traffic is expected to double or triple by 2030 (DOT 2009a). In the coming years, the market for transportation services will be determined by rising transportation costs triggered by increasing port capacity (DOT 2009a) and environmental initiatives. Port costs are expected to be pushed up by:

- The switch to low-sulfur and cleaner-burning distillate fuels to reduce air pollution from ships, terminal facilities, and truck and rail connectors in and near highly populated port regions.
- Improving port terminal facilities' efficiency, hours of operations, and upgrading connections to regional and national road and rail networks.
- Reducing congestion in the current primary ports of LA/LB, and NY/NJ.

On average, the ports of LA/LB account for 43 percent of total TEU imported in the United States (DOT 2009b). New national policies and improved public-private investment coordination would be needed to increase capacity in the primary ports as well as to offer alternative routes (DOT 2009a; CMTS 2008).

Alternative Intermodal System Routes

Cargo may be diverted from southern California to other countries, such as the Port of Prince Rupert, Canada, and the Port of Lázaro Cárdenas and the port planned at Punta Colonet in Mexico. The port of Lázaro Cárdenas handles 17 percent of the U.S.–Mexico trade (El Informador 2008). The port's access channel is 18 meters and is located 532 miles closer to Houston by rail than Long Beach. In 2008, container traffic almost doubled—from 270,240 TEUs to 524,791 TEUs—from a year earlier and is expected to receive 6 million containers from Asia before 2015 (SCT 2009; El Informador 2008). Cargo is transported to the U.S. East Coast through the intermodal Lázaro Cárdenas-Kansas City corridor, which is operated by Kansas City de Mexico. To ship a container from China takes approximately 13 days to the Port of Lázaro Cardenas and 90 hours from the Port to Houston, Texas (Michoacán Ministry of Economic Development 2009).

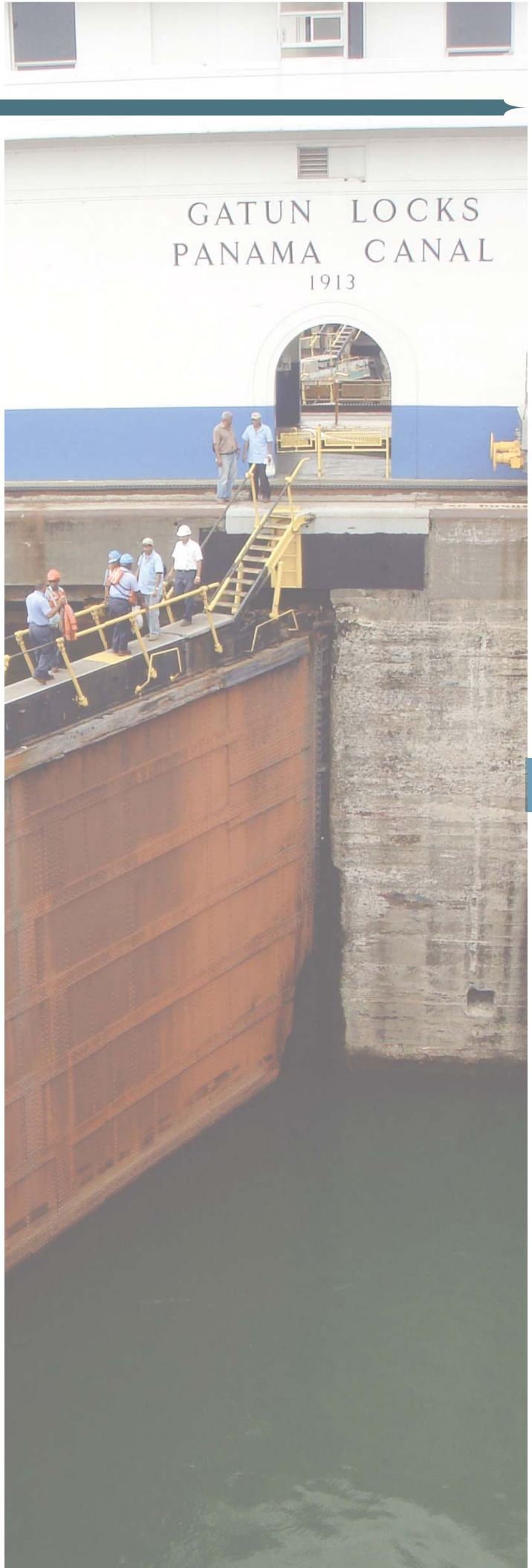
The Multimodal Punta Colonet project, located in the Baja California Peninsula about 150 miles south of San Diego, has the primary purpose of facilitating Asian exports to the United States. It can handle 6 million TEUs at an estimated cost of $5 billion (SCT 2008). This is the most important project of the 2007-2012 Mexico National Infrastructure Plan, yet it has been delayed twice due to the world financial crisis and market outlook. However, on January 27, 2009, the Mexican Government invited firms interested in the project to register by May 15, 2009 (Business News Americas 2009). Both the Punta Colonet project and the Port of Manzanillo expansion face environmental challenges.

In 2005, the Canadian Government created the Asia-Pacific Gateway and Corridor Initiative to strengthen Canada's competitive position in international commerce as a completely integrated intermodal system. It will include British Columbia Lower Mainland and Prince Rupert ports, road and rail connections stretching across western Canada and south to the United States, key border crossings, and major Canadian airports (Transport Canada 2007 and 2009). The main focus is on trade with the Asia-Pacific region. The ports of western Canada are 1 to 2 days closer sailing time to Asia-Pacific ports than the U.S. western ports (Transport Canada 2007). For example, sea journeys between Shanghai and North America are 68 hours faster through Prince Rupert than through Los Angeles and 32 hours faster through Vancouver than through Los Angeles.

5 The top 10 U.S. container ports are Los Angeles/Long Beach (LA/LB), New York/New Jersey (NY/NJ), Seattle/Tacoma, Savannah, Houston, Norfolk, Oakland, Charleston, Port Everglades, and Miami. (DOT 2008)

Conclusion and Further Research

Competitive transportation systems are critical for economic growth. Increases in global trade have put a strain on the U.S. logistics system and the world transportation network. Understanding current trade flows and continuing changes in international trade lanes is critical to optimizing system investment and operations within our own borders. Most U.S. trade moves through the Panama Canal, the Suez Canal, the Cape of Good Hope, and the U.S. Intermodal System. The Panama Canal is an efficient route, but is reaching its maximum capacity. These capacity challenges will be overcome by 2014, when the Panama Canal expansion project is finished. The Panama Canal expansion will increase efficiency to the U.S. Intermodal System by decongesting the West Coast main ports of LA/LB. Trade could be diverted to the East Coast ports for faster delivery. Transportation cost might decline in destination countries that have deeper access channels and the capacity to handle Post-Panamax vessels. For the U.S. Intermodal System to remain competitive in the face of the Panama Canal expansion, further investment in U.S. infrastructure and a more integrated approach is needed to reduce bottlenecks in the system. Future research should examine how expansion of the Panama Canal may redistribute trade volumes across the U.S. Intermodal System, including ports, railroads, and trucks. Trade reallocation to the East Coast would increase truck traffic and overall vehicle congestion to major interstates such as I-95 Corridor.



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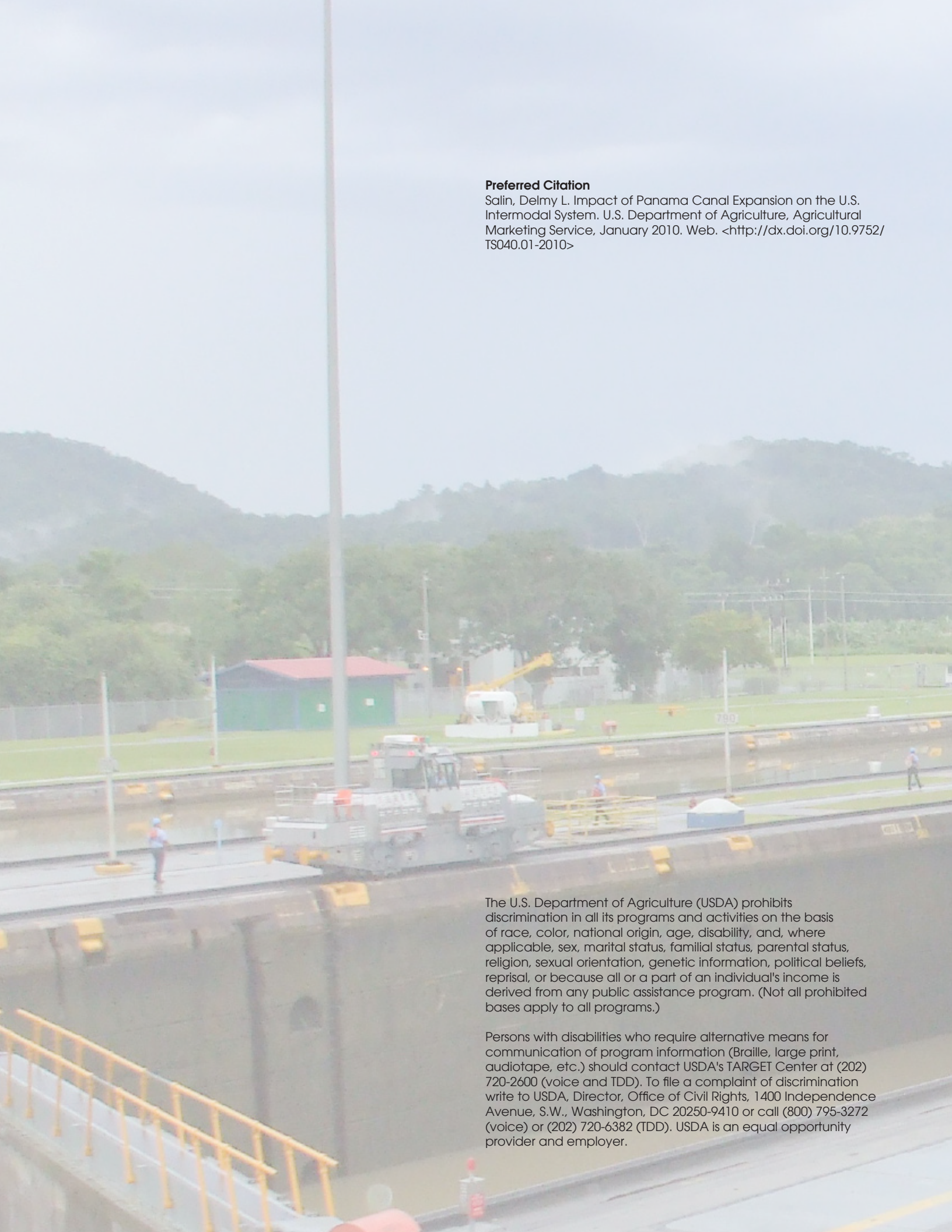

Preferred Citation
Salin, Delmy L. Impact of Panama Canal Expansion on the U.S. Intermodal System. U.S. Department of Agriculture, Agricultural Marketing Service, January 2010. Web. <http://dx.doi.org/10.9752/TS040.01-2010>