Chapter 3

International Logistics Infrastructure

For the manager of international logistics, it is important to have a good understanding of the challenges presented by the different levels of infrastructure found abroad. It is always one of the first problems encountered by an international manager; things don't work abroad like they do at "home." There are different standards, there are different expectations of performance, there are things that work much better, and there are things that do not work as well—in some cases, not at all. Adapting to those differences, and anticipating problems before they arise, are part of the assets of an experienced international logistics manager.

The issue with learning how to manage these differences in infrastructure is that they are difficult to generalize in one particular comment or statement. Most challenges tend to be concentrated in some small geographic areas, and in most cases are limited to a single location: A specific port is not equipped with sufficient cold-storage warehousing space, does not have an appropriately sized crane, or is experiencing delays in getting the goods from the port to the remainder of the country; a road is particularly congested, a specific tunnel has recently been closed, or a railroad is experiencing shortages of appropriate cars. These challenges force the manager involved in international logistics to recognize the possibility of serious problems. The purpose of this chapter is to present enough information and examples to encourage him or her to ask questions at the onset of a transaction, so that there are no discrepancies between the expectations of the company and what can be achieved.

3.1 Definitions

Before going much further, it would be useful to determine what is meant by "infrastructure" in the context of international logistics. A few dictionary definitions would be a good start:

> The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication.[1]
>
> A collective term for the subordinate parts of an undertaking; substructure, foundation. The permanent installations forming a basis for military operations, as airfields, naval bases, training establishments, ... etc.[2]

In the field of logistics, the definition can be very broad: Infrastructure is a collective term that refers to all of the elements in place (publicly or privately owned goods) to facilitate transportation, communication, and business exchanges. It would therefore include not only transportation and communication

elements, but also the existence and quality of public utilities, banking services, and retail distril channels. To this list, it makes sense to add the existence and quality of the Court system, the defe intellectual property rights, and the existence of standards. As these concepts are introduced in this ch their inclusion into the concept of infrastructure will become more acceptable.

The study of infrastructure is important because the movement of goods and of documents, as w the movement of money and information, is dependent on these infrastructure components.

3.2 Transportation Infrastructure

The infrastructure that most obviously affects the movement of goods internationally is the transport structure. Without a good understanding of the transportation infrastructure that a shipment will f manager may package a product inappropriately, may face delays, or may even be faced with unexpe damaged merchandise.

3.2.1 Port Infrastructure

Port infrastructure is made up of several items, most of which are interconnected, and obviously affe type of ships that can call on a given port, as well as the type of merchandise that can transit throu

With the advent of the much larger post-Panamax* containerships, ports have been faced with challenges. Specifically, the size of those ships is stretching the capabilities of the ports: They are v longer, higher above the water, and have a much deeper draft. Between 2005 and 2007, it is expecte 150 vessels with a capacity in excess of 8,000 TEUs—twenty-foot equivalent units, or twenty-foot cor ers—will come into service, most of them on the transpacific routes between the United States, J China, Singapore, and Hong Kong. Such large ships mean that as many as 4,000 forty-foot conta need to be loaded or unloaded in a single port.[3]

Depth of Water

The first issue is undoubtedly the depth of the water of a port, also called the **draft** of a port. In many p the depth of the channels and of the berths, which had been sufficient to accommodate Panamax shi not sufficient to accommodate the newer larger ships. Therefore, in a great number of ports, the authorities have had to engage in dredging activities in order to allow ships with drafts exceeding forty (13.5 meters) to access the port.[4] Only a few ports with naturally deep channels have been exempt from activity.

This dredging of channels and ports can be exceedingly expensive, but ports have little alternativ to undertake this improvement of their capabilities. Competition is such that ships would call different port if one were not expanding.[5]

In a parallel fashion, longer ships require longer turning circles, and therefore a redesign—dredging—of different access channels. As ships become yet longer, wider, and heavier, the challeng the ports will be to keep up with these ships' requirements and adapt.[6]

Bridge Clearance

Another factor of great importance in ports is the clearance under its bridges. In many older ports, suc New York-New Jersey, the bridges are too close to the water, leaving very little clearance for tall shi ships carrying outsized cargo. In some cases, the cargo has to be partially dismantled or repositione the ship lowered with ballast water and the delivery made at low tide so that it clears the bridge spa

* A Panamax ship is a vessel whose dimensions allow it to cross the Panama Canal. A post-Panamax ship is a vessel too large to fit thr the Panama Canal locks. For more information on the size of ships, please see Section 11.2.

All of these factors (depth of channels and berths, as well as bridge clearance) are likely to affect how ports are used in the future. There is a strong likelihood that some ports will not be able to make the necessary infrastructure adjustments to accommodate the largest ships and that there will be a need to create large port hubs, to and from which mega-containerships will travel. Smaller ports would then be served by smaller "feeder" ships that would not tax the ports' infrastructure beyond their capacity.[8] Such ports were created in the 1990s in the Mediterranean Sea: Marsaxlokk in Malta and Cagliari in Sardinia (Italy) serve as trans-shipment ports, loading and unloading large containerships in a deep-water port and using feeder services to serve the local markets and shallower ports of France, Italy, and Spain.[9] In 2005, the Chinese government inaugurated the first phase of the deep-water Port of Yangshan, near Shanghai, to accommodate larger ships.[10] There have been discussions of a large port fulfilling the same function on the Atlantic Coast of the United States, to alleviate the constraints presented by the current older ports of New York and Philadelphia.

Cranes

Port terminals have found out that the width of those post-Panamax ships can also be a challenge for their cranes. Traditional Panamax ships can be loaded with up to thirteen containers in the width of a ship (see Figure 3-1). Some of the post-Panamax ships can be loaded with as many as eighteen containers side-by-side. This presents a problem for ports in which the cranes cannot reach the far side of the ship. Early on, ports managed their lack of crane capacity by loading ships from one side, turning the ships around, and then loading the remainder of the containers. The problem was one of balance, as the ships seriously list if they are heavier on one side. Today's ports have made considerable investments in new large-capacity cranes that can load these large ships.

Another obvious alternative is for ports to increase the reach of the cranes. This modification is also accompanied by a need to increase the height of the cranes, as the vessels are higher. These modifications can be quite costly for a port and new cranes capable of serving these ships can cost $50 million.[11]

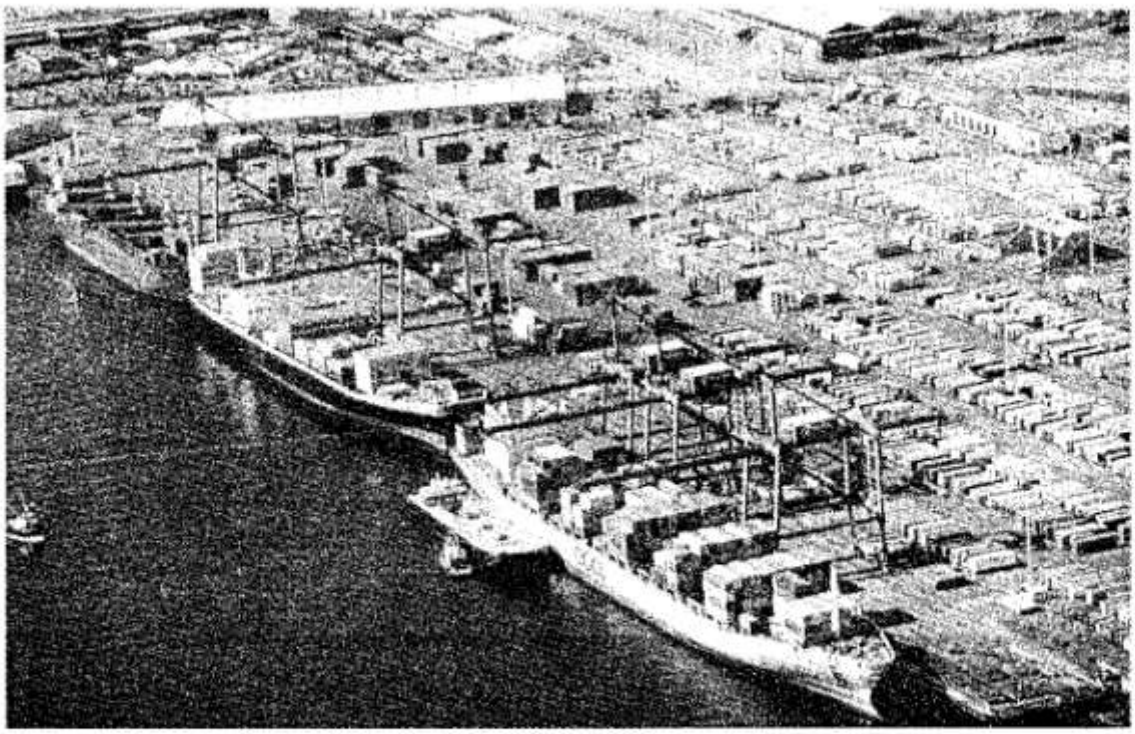

Figure 3-1 *A Traditional Container Berth and Gantry Cranes*
Source: Photo © National Oceanic and Atmospheric Administration. Used with permission.

Another alternative, chosen by the stevedoring company Ceres at the Port of Amsterdam's Para Terminal, is to create an indented **berth** to allow the ship to be loaded from both sides (see Figure 3-2) advantage of this configuration is that it allows the ship to be loaded with up to twelve cranes rather the maximum of six in a traditional port. This alternative speeds up the loading of the ship considera from a maximum of 160 containers per hour (the world record held by the Port of Singapore f traditional berth) to up to 300 containers per hour, decreasing the time that a ship spends in port therefore increasing its profitability.[12]

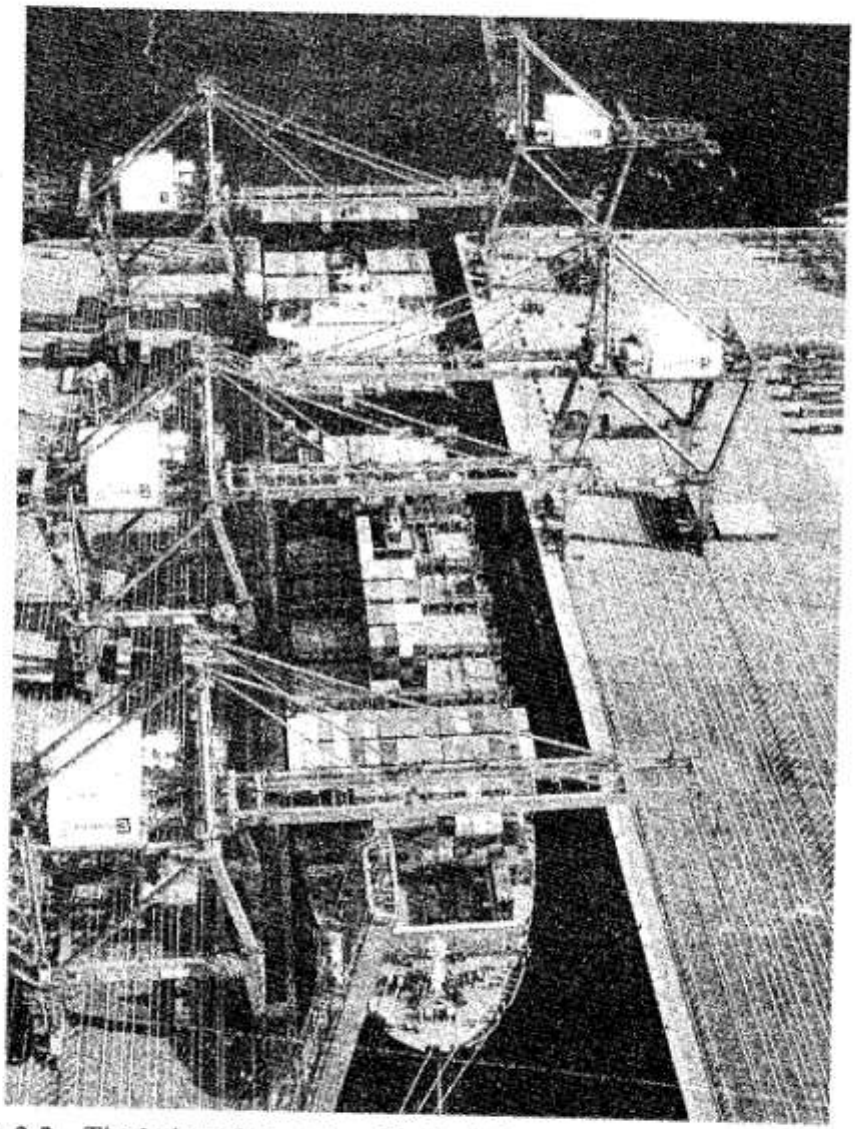

Figure 3-2 *The Indented Container Berth of the Paragon Terminal in Amsterd*
Source: Photo © Ceres Paragon Terminals. Used with permission.

For shippers handling non-containerized cargo, the cranes' capacity is a major factor in deciding throug which port to send a specific cargo. Cigna Insurance publishes a directory called *Ports the World* that lists the equipment of any port in the world, specifically the capacity of its cranes (see Tab 3-1).[13] It should be obvious that the crane at the port of destination should have at least the same capacity the one that was used to load the cargo. Failure to pay attention to that fact is likely to lead to a dismantlin of the cargo or to the use of an oversized crane, both of which could place the cargo in jeopardy.

Table 3-1 *Typical Entries in Ports of the World Booklet*

Piraeus, Greece

Facilities

Transportation Services	Truck, Rail, and Barge
Cargo Storage	Covered: 245,000 m^2
	Open: 1.6 million m^2
	Refrigerated: adequate
Special Cranes	Heavy lift: 130 tons
	Container: 2 with 40-ton capacity
Air Cargo	Hellinikon Airport: 14 kilometers

Cargo Handling

Containerized, bulk, and general cargo can be handled by existing port equipment. 2 RO/RO and 7 tanker terminal berths are available. Specialized handling is also provided for ore and bulk commodities.

General

Winters are mild (3°C to4°C average) with summers hot (42°C) and relatively dry (40 cm annual rainfall). Container facilities are being expanded. Plans include the development of an open area of 320,000 m^2 for the Ikonion Container facility.

Takoradi, Ghana

Facilities

Transportation Services	Truck and Rail
Cargo Storage	Covered: storage adequate; transit shed accommodate 12,500 tons of general cargo.
	Open: 5,000 tons capacity
Special Cranes	Heavy lift capacity is 17.5 tons
Air Cargo	Accra Airport: 260 kilometers

Cargo Handling

Normal cargo can be handled through Takoradi. This port also has bulk, tanker, and RO/RO berths for specialized cargo handling.

General

Average rainfall is approximately 70 cm, with heaviest accumulations from April through August. Temperatures range from 16°C to30°C. Fixed shore facilities are to be upgraded and new equipment provided.

Port Operations

Another issue in ports is the way the port is managed, particularly its work rules, which are often dictated by strong unions. Some ports, such as the Port of Long Beach on the Pacific Coast of the United States, only operate eight hours a day [14] instead of the much more efficient twenty-four hours a day, seven days a week of most Asian Pacific Rim ports. Work rules can also be mind-bogglingly complex and hamper the efficiency of ports to the point where they are less and less competitive:[15] In the 1950s, unions dominating the ports of South America were refusing to unload containers,[16] for example. When there are attempts at modifying these rules, strikes are common: Some Japanese and European ports are plagued with recurring work stoppages.

Warehousing Space

Finally, it is critical to understand the amount of warehouse storage space that exists in the port. In most instances, it is necessary for merchandise to be placed in some storage areas that are protected from the

elements (specifically rain and sun). If these storage areas are not available or are overcrowded, ther likely that cargo will be left exposed, leading to possible damages. Cigna's *Ports of the World* lists amount of covered storage space available in every port (see Table 3-1).

Even if the cargo can tolerate being left exposed to the elements, another concern is the possibilit flooding in the container—or cargo—staging area. It is not unusual, when bad weather strikes, to s port's container yard flooded, and the containers at the bottom of a stack partially immersed, even modern port. During the Katrina hurricane of September 2005, hundreds of containers were submerge the water surge in the port of New Orleans (see Figure 3-3). For shippers involved with refrigerated ca those issues are compounded with the need for reliable power supply, as well as proper reefer storage ar equipped with power outlets and personnel competent enough to monitor the temperature charts of refrigerated containers.

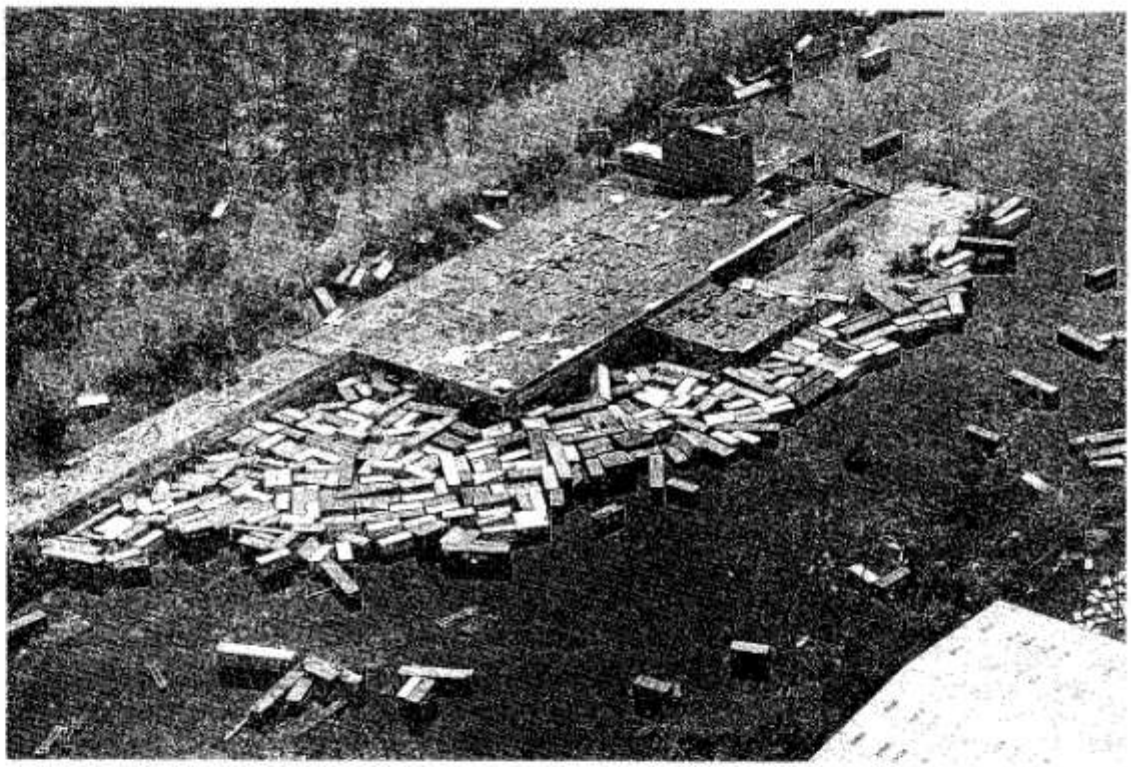

Figure 3-3 *Containers Damaged by Hurricane Katrina in the Port of New Orleans (2005)*
Source: Photo © Illinois.com. Used with permission.

Connections with Land-Based Transportation Services

Yet another issue in ports are their connections to the remainder of the country's transport infrastruct such as rail and road access. In some cases, there is so much congestion in the access roads to port termi that cargo can be delayed substantially. This is a major issue in just about every port in the world, particularly in North and South America and in China. Most ports are obviously located near the ocean, the cities that developed around these ports are located between the port and the hinterlands, where cargo eventually has to go. Therefore, every piece of cargo that is shipped through the port has to tr through the city, which creates a serious strain on road and railroad infrastructures to the port and engend serious traffic jams and the resentment of the local population. Ports are actively looking at overcom these bottlenecks.[17]

The Ports of Los Angeles and Long Beach inaugurated in 2002 the Alameda Corridor, a north-south, twenty-mile rail link between the ports and the transcontinental rail yards on the eastern edge of the city of Los Angeles (see Figure 3-4). The Corridor is a thirty-three-feet deep trench that cuts through the city's neighbor-hoods and is uninterrupted by road traffic.[18]

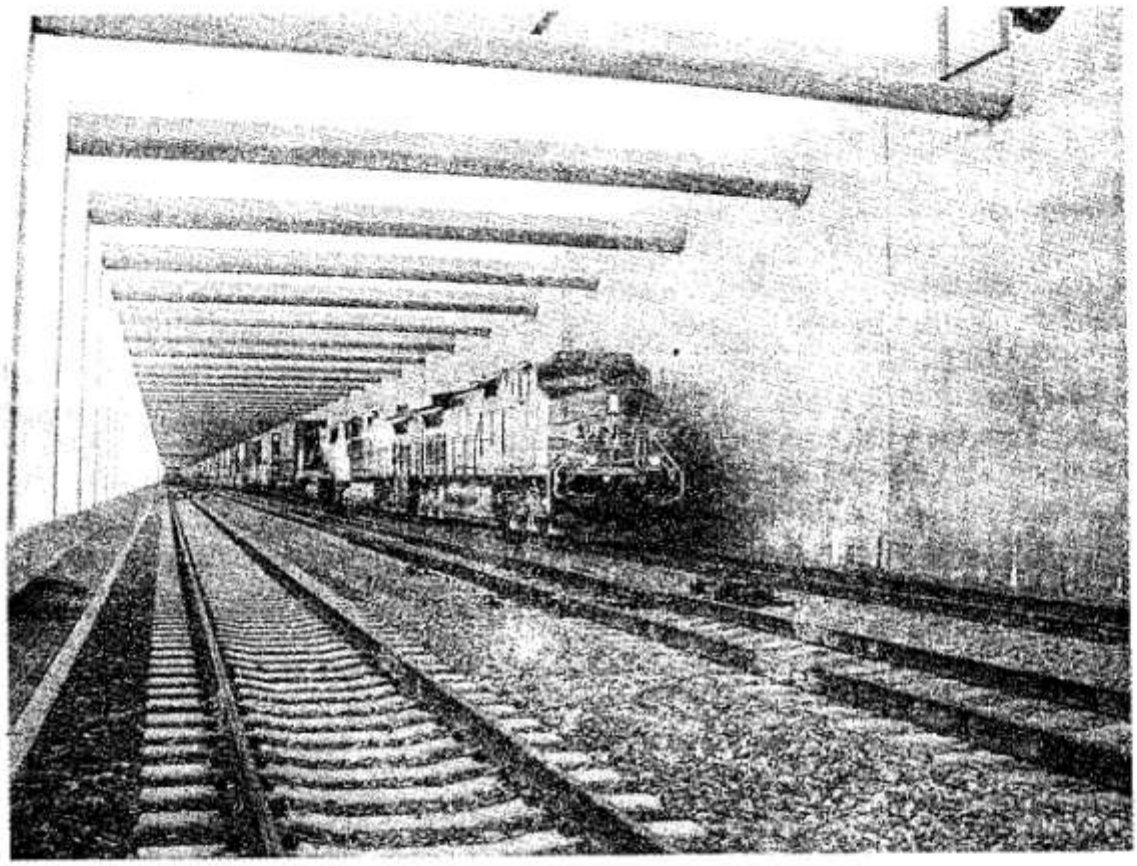

Figure 3-4 *The Alameda Corridor between the Port of Long Beach and East Los Angeles*

Port Capacity

Yet another issue in ocean transportation is the strained capacity of ports, as many ports are operating at capacity or very near their capacity. Because ports tend to be physically located between an ocean and a city, there are limits in the ways that they can expand as their traffic increases. Many ports add capacity by gaining on the sea with landfills or by purchasing real estate that is then transformed into port terminals, both of which tend to be quite costly. For example, the port of Santos in Brazil is located on a "river" that stretches between an island and the main land. The older port is located on the island, and it cannot expand because it is constrained by the city of Santos on one side and the river on the other side, on which it cannot gain because the river cannot be made narrower. All of the port expansion has been on the other side of the river, but, there again, it is limited by the river and suburbs that are growing along with the city.

In the United States, there is, for example, an increasing need for additional capacity in container terminals on the Pacific Coast, but it is highly unlikely that much capacity can be added economically. However, the greatest need is probably in Liquefied Natural Gas (LNG) terminals; in 2004, the United States imported only 2 percent of its needs in natural gas using a total of five terminals.[19] Several could be built in the northeast of the country or in California, but the coastal areas are heavily urbanized and popular opposition is substantial. Although they are much more expensive, off-shore terminals may be the only alternatives to increase the United States' capacity to import LNG.[20]

3.2.2 Canals and Waterways Infrastructure

Maritime transportation is also quite dependent on the existence and proper maintenance of canals and other maritime channels. Their size, as well as the size of their locks, has a great influence on international trade. For example, ships sized to get through the Suez Canal are called Suez-Max ships, and those sized to get through the Panama Canal are called Panamax ships. The current trend in shipbuilding is to create ships that are much too large to fit through the Panama Canal: These vessels are called post-Panamax ships.

From an international logistics standpoint, several waterways are fundamentally and strategically important. However, these waterways have lost their monopoly, as alternatives were developed to circumvent their shortcomings.

- **The Bosporus Strait in Turkey:** Joining the Black Sea to the Mediterranean Sea, it is the only water link between the Black Sea and the oceans. A large percentage of the merchandise trade between Russia and the rest of the world transits through it, creating severe congestion and raising safety concerns for the city of Istanbul, which is built on both sides of the Strait. Several efforts have been made to convert some of that traffic to a network of pipelines.[21]
- **The Suez Canal:** It allows ships to avoid traveling around the entire continent of Africa when they are going from the Persian Gulf to Europe. When it was closed after the Six-Day War in 1967, oil companies started to build much larger oil tankers, to make the voyage around the Cape (South Africa) more cost-effective. Since its reopening in 1975, the Canal has recaptured some of the traffic it had lost, through a widening and deepening effort. However, the Canal is still too shallow for many ships, and its tolls are prohibitive. The cost of a round trip through the Canal can reach U.S. $500,000.[22]
- **The Panama Canal:** It allows ships to avoid traveling around South America. However, the Canal is remarkably "slow," because ships can only travel in one direction at a time, and it is essentially running at its maximum capacity. Wait times to enter the Canal average twenty-two hours.[23] However, despite the emergence of land bridges (see Section 3.2.4) in the United States, and the emergence of post-Panamax ships, the Canal still retains its commercial importance and its tolls are competitive, averaging U.S. $67,000.
- **The Saint Lawrence Seaway:** It links the Great Lakes to the St. Lawrence River and the Atlantic Ocean. Unfortunately, the Seaway is narrow and few ships can pass through its locks. It is also plagued by ice, and the Welland Canal—which links Lake Erie to Lake Ontario and bypasses the Niagara Falls—closes from January to March. This has forced companies to find alternative means of transportation, and the traffic through the Seaway is down 45 percent from what it was twenty years ago.[24]

The absence of certain waterways is also detrimental to international trade and the efficient movement of goods. For example, there had been considerable talk about a canal through Nicaragua that would be "parallel" to the Panama Canal and be free of locks, an advantage that would speed up the transit time considerably.[25] A railroad "land bridge" was also once proposed for the same region. However, both of these projects have been abandoned, and the Panama Canal is, for the foreseeable future, the only water connection between the Atlantic and the Pacific. A canal through the Isthmus of Kra in Thailand—the Malay Peninsula—which would bypass the Strait of Malacca and the Port of Singapore would speed up the transit time between Europe and the Far East as well. This project has been in the planning stages on and off in the past decade within the Thai government and there is increased interest on the part of Malaysia, Indonesia, and China.[26] No decision had been made by summer 2006.

The same lack of infrastructure is found in freshwater passages. After the War in the Balkans, there was a period during which there was no freshwater communication between the Black Sea and Northern

Europe, as many bridges were demolished on the Danube River[27] and barges could not pass. There is still no freshwater communication between the Mediterranean Sea and Northern Europe, as the construction of a canal between the Rho^ ne River and the Rhine River is still being debated;[28] however, the Europakanal, a canal between the Rhine and the Danube, was completed in 1992, and is heavily traveled.

3.2.3 Airport Infrastructure

Airports are also a fundamental part of the transportation infrastructure. There are fewer critical issues in the management of an international airport than there are in a port, but they can be just as constraining.

Runways

The runways of an airport determine the type of aircraft that they can serve. The lengths of the runways are particularly relevant, as they generally determine whether the airport can support direct flights to faraway places. Many airports in the world cannot accommodate the large jumbo jets that serve international destinations because the runways were designed mostly for smaller aircraft. As the cities around the airports grew, they became landlocked, unable to extend their runways. Several cities have had to build airports far from their city centers, in order to build facilities that can accommodate international flights. Whereas Charles de Gaulle Airport in Paris, France, and Heathrow Airport in London, UK, (both built in the 1970s) are about fifteen miles (twenty-five kilometers) from the cities they serve, the airports built in the 1990s are much further away: Denver International is twenty-three miles (thirty-seven kilometers) from the city and Malpensa in Milan, Italy, is thirty miles (forty-eight kilometers) away.[29]

A second concern is the number of runways, which determines the capacity of the airport. Most airports have more than one runway, but the busiest airport—in number of passengers—in the world has four runways (Hatfield Airport in Atlanta, Georgia, USA), and both Chicago O'Hare and Dallas-Fort Worth International have seven. An airport can be quite constrained by its lack of runways; for years, Narita Airport in Tokyo had only one runway to accommodate its traffic. It was stretched to capacity, and there was no way to build a second runway as a number of small farmers refused to sell their land to the airport.[30] Because, by law, the Japanese government cannot expropriate them, the airport cannot build the runway on their land, and travelers and cargo shippers are inconvenienced as the number of flights in and out of Narita is limited, increasing the landing fees. Narita has finished a second runway that avoids the reluctant farmers' land, but it is too short to accommodate jumbo jets, which constitute 90 percent of the Narita traffic, so it is only used for local traffic.

A single runway also increases the probability of delays as the slightest accident or malfunction will immobilize the entire airport.

Hours of Operation

Another concern of importance is the time frame during which airports are operating. Because most airports are geographically close to large cities, their hours of operations are generally limited by noise constraints and they operate only during "day hours." Because cargo tends to fly at night, specialized cargo airports that are located outside of large cities and can operate twenty-four hours a day, seven days a week, have started to emerge such as Prestwick in Scotland, Hahn in Germany, and Chateauroux in France.[31] To some extent, this development mirrors that of the Memphis airport, which has become the largest cargo airport in the world, with 3.6 million tons of freight in[32] even though it is not located near a large metropolitan center.

Warehousing Space

Another concern of importance for cargo shippers is the existence of appropriate warehouse space at ai airport; cargo should be protected while it is in transit, and not left to the elements. This is particularly important as air cargo tends to be—erroneously—not as well packaged as cargo destined for ocear shipping.

The problem is even more acute for refrigerated warehouse space, which can be in very short supply.

3.2.4 Rail Infrastructure

Another element of the transportation infrastructure of a country is its railroad network. In the eighteenth and early nineteenth centuries, railroads became the most important means of long-distance land transportation. In Europe, the United States, India, Africa, and Asia, a dense network of railroads was built, sometimes under the impetus of colonizing forces who wanted to be able to move troops quickly. This historical development led to some decisions that, a century and a half later, are causing significant problems. To prevent possible invaders from using their railroad infrastructures, Spain, Brazil, and Russia developed railroad gauges (the width between the rails) that were incompatible with the rest of Europe. While it did prevent military troops from using the network, this decision is still causing trouble for any type of rail transportation between these countries and their neighbors. For example, most trains stop at the French-Spanish border so that cargo can be shifted to railcars that are appropriate for the gauge used in the other country; others—including passenger trains—slow down to a crawl while specially designed axles expand or contract.[33] For Brazil, the cost of the rolling stock is substantially higher as every car and locomotive must be adapted to its unusual gauge size, whether they are purchased new or used, and trains have to travel slower because the cars are much wider than what the rail was designed to handle and therefore are less stable.

Most countries have updated their railroad infrastructure as their economies grew. However, in a few countries, the economy has grown much faster and the infrastructure has not been able to keep pace. Such is the case in China, where demand far outstrips supply in terms of rail transportation. China's network satisfies only 60 percent of current demand.[34] The Chinese government has pledged to develop further links that will be vital to connect the port cities of the southeast to inland cities.[35] Such rail links are critical when the road infrastructure is not yet fully developed.

Over the years, though, as roads and trucks improved, many countries' rail-roads gradually lost their focus on shipping merchandise and shifted their efforts to high-speed passenger transportation; such is the case of Europe, where most merchandise is shipped by means other than railroad, but where intercity rail passenger transportation is commonplace, convenient, fast, and competes with airlines over small distances. The best examples are the French (now European) *Trains à Grande Vitesse* (TGV), which connect Paris to London in three hours (dubbed the Eurostar) and Paris to Brussels in an hour and a half (the Thalys).There is only one TGV dedicated to merchandise transport, and it is used by the French Postal Service ("La Poste") exclusively for mail tra sportation (see Figure 3-5). A similar switch from merchandise to high-speed passenger transport occurred in Japan; the Shinkansen train covers the 192 kilometers (120 miles) between Hiroshima and Kokura in less than forty-five minutes, for example. These high-speed trains run on dedicated tracks that are separate from the remainder of the slower rail infrastructure.

Multi-Modal Emphasis

In the last two decades, three factors have contributed to the renewal of merchandise traffic on railroads: The congestion of roads has worsened, concerns about pollution and noise have increased, and the creation

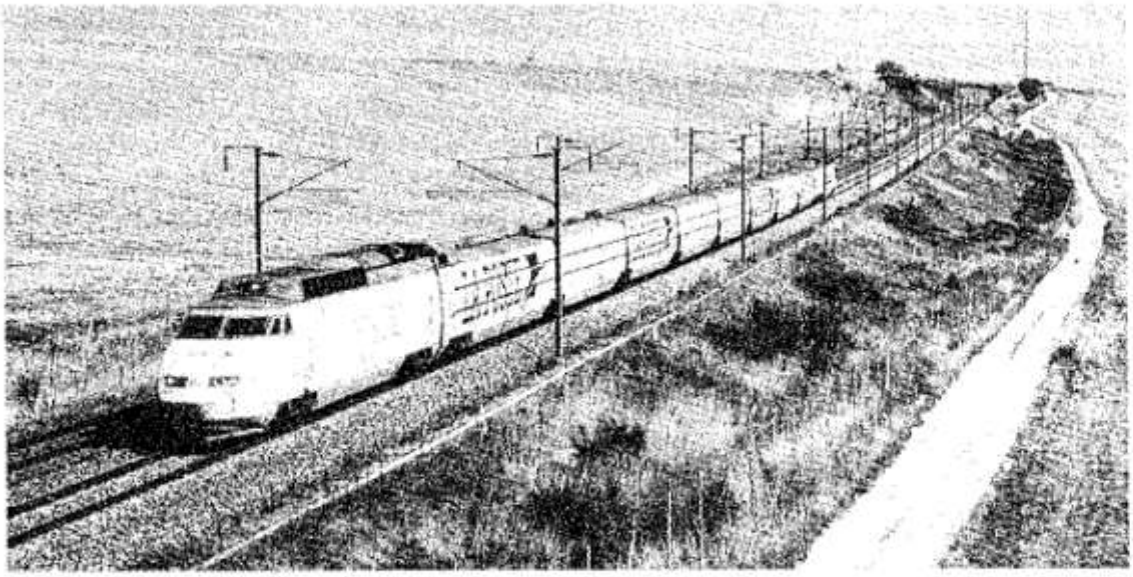

Figure 3-5 *The Only "Merchandise" High-Speed Train, Used by the French Postal Service*
Source: Photo © Peter Schokkenbroek. Used with permission.

of the multi-modal container has eliminated the need to load and unload merchandise from the traditional boxcars.

In the United States, railroads have invested heavily in the modernization of their rolling stocks; they have shifted from boxcars to piggy-back cars—allowing them to carry truck trailers—and to container cars. At the same time, they have improved their infrastructure by increasing the height clearances in tunnels and other areas, allowing trains to transport containers "double-stacked" (i.e., twice as many containers as a single-stack train would). Figures 13-8 and 13-9 illustrate these concepts. American trains tend to be exceedingly long, with at least 100 cars, allowing a crew of a few individuals to move in excess of 200 containers or truck trailers, making them particularly cost-effective. In addition, because passenger rail transport is almost nonexistent in the United States—with the minor exception of the north-eastern part of the country—cargo trains have priority on the network and tend to be relatively fast.

Unfortunately, such improvements have not yet been made to the European infrastructure, which still consists mostly of aging boxcars.[36] Moreover, the emphasis on passenger transportation gives priority to passenger trains, and relegates cargo trains to second-class status, making them slow and inefficient cargo movers. Attempts to create high-speed cargo railroad links from ports in Northern Europe to ports in the Mediterranean have been made,[37] but politics and administrative delays are unlikely to make this corridor a reality for some years.[38]

In the same fashion, the success of North American railroads has enticed several developments in Asia. There are plans to significantly modernize the trans-Siberian railroad, which would allow cargo to be shipped from Asia (Vladivostok) to Europe by rail.[39] There are also plans to create a Trans-Asian railroad, which would connect Singapore and Seoul to Europe via Turkey.[40] However, the obstacles that remain to such a venture are substantial, and its completion is far from certain.

Land Bridges

A consequence of the increased efficiency of the railroads in the United States has been the creation of land bridges. The concept of a **land bridge** is based on the idea that containerized ocean cargo needs to "cross" some landmass; for example, cargo from South-East Asia needs to cross North America on its way to Europe. One alternative is to take the Panama Canal; however, it is a fairly long voyage south in the Pacific

to reach Balboa, and a fairly long voyage north in the Atlantic onto Europe. Another alternative is to take the cargo around India and through the Suez Canal, which is inconvenient and expensive.

The best alternative is to cross North America on a land bridge; the cargo is unloaded from a large containership somewhere on the West Coast of the United States or Canada, and shipped by double-stack train to the East Coast. The journey is faster and cheaper than by ocean. In addition, it allows shipping lines to use post-Panamax ships on their trans-Pacific and trans-Atlantic routes, which is also more efficient. A consequence of this trend is that cargo going from Taipei to Barcelona is going to transit through Chicago. Such variations from the traditional itinerary of Taipei-Panama-Barcelona are said to be "transparent" to the shipper, which means that it is unaware of them. However, such a transparent voyage may expose the shipment to lower temperatures than those the shipper expected and a shipment may not be protected adequately enough for the extremes in temperature.

3.2.5 Road Infrastructure

In addition to the infrastructure of ports, airports, and railroads, a great amount of shipping moves by road, especially on the last "leg" of the journey, from the port, airport, or rail terminal to its final destination.

The road infrastructure of a country is evaluated somewhat differently than the rest of its transportation infrastructure. In no country is there a shortage of roads, for example; however, there certainly are issues regarding the quality and maintenance of the network, its congestion, as well as the existence of high-speed links between major metropolitan areas. The concern therefore is not one of density, but one of usability.

Quality

The road infrastructure of a country is generally described in documents such as the U.S. Department of Commerce's *Country Commercial Guides*[41] or the CIA's *World Factbook*[42] in terms of total miles of road, and of the percentage of these roads that are paved. For example, the country of Argentina is listed as having 215,000 kilometers (134,000 miles) of roads, of which 63,500 kilometers (39,500 miles)—29.5 percent—are paved. Even in the United States, paved roads only represent 90 percent of the road infrastructure.[43]

However, this is somewhat misleading, as most of the traffic obviously utilizes paved roads, and the unpaved roads serve remote rural areas. In addition, the condition of a paved road makes a substantial difference in its usefulness; an over-crowded, two-lane highway riddled with potholes is not very conducive to the safe transportation of cargo. Such is the case with the roads in the countries of Belarus, Albania, Romania, Lithuania, and Latvia. The government of Poland estimates that 80 percent of its roads are in unsatisfactory or bad conditions;[44] cargo shipped under such conditions has to be particularly well packaged. Unfortunately, there is no statistical source that indicates the condition of the roads in a country, and because there are substantial variations from one region of a country to another, it is even more difficult to evaluate. China has a very good road infrastructure between Guangzhou and Shanghai, for example, but the interior of the country is plagued with deficient and outdated roads.[45]

Congestion of the road infrastructure is also endemic to certain cities: There are too many cars, trucks, and other vehicles on the road, and deliveries are difficult to make (see Figure 3-6). In Calcutta, India, the traffic is so congested that the average speed in the city is five mph (eight km/h); most people travel by rickshaw or by public transportation rather than by car.[46] In Delhi, the government has created a category of vehicles, called VVIP—Very Very Important Persons—that are allowed to zip through traffic with blaring sirens and flashing lights.[47] In many developed countries' cities, a system of alternating days for traffic has been instituted; vehicles with odd-numbered license plates are only allowed to travel on odd-numbered

Figure 3-6 *Traffic Congestion in Lagos, Nigeria*
Source: Photo © Onyisi Agalim, www.Galbe.com. Used with permission.

days, and vehicles with even-numbered license plates can only travel on even-numbered days. Such is the case in Lagos, Nigeria, for example. The problem is compounded by the fact that resourceful Nigerians obtain two license plates for every vehicle from corrupt civil authorities, and change the plates every morning.

Although congestion is a problem that is extreme in developing countries, it is certainly also present in large metropolitan areas in Europe, Japan, and the United States. As the number of automobiles increases, the situation will worsen further and make deliveries to customers more problematic and inefficient. Many delivery firms are now using motorcycles and mopeds, which are more maneuverable in large cities. London enacted a very effective tax system to prevent vehicles from entering the heart of the city; vehicles' license plates are monitored and recorded through a closed-circuit television system and commuters are charged £8.00 for each day they travel into the city. Residents receive a 90 percent discount of this daily rate. Traffic in the city has decreased approximately 15 percent since this measure was enacted, and congestion is said to have decreased 30 percent, although it is not known how the city of London measures congestion.[48]

Yet another issue in cities is the confusion that can be generated by the lack of signage and a different addressing system. While most Northern American cities have a "grid" of east-west and north-south streets, with a fairly logical numbering sequence of streets and buildings, European cities are plagued with a maze of different streets that change names at each—or so it seems—intersection. Mexico City has an extraordinarily confusing system of streets; there are nearly 800 streets named after Benito Jua´rez, 760 named for Miguel Hidalgo, and 300 streets renamed every year. To make things more interesting, 80,000 city blocks have no signage at all.[49] Japan has the tradition of numbering buildings on a street in the order in which they were built, and not in a sequential order based on location. Most of Bombay's addresses are not based on street names, but defined by a succession of smaller and smaller areas: A person's address will include the name of the house, the name of the street, the name of the block, the name of the city, and the

city code. In addition, there will be an east or a west, depending of which side of the railroad track the b is, with parallel structures on either side. Such systems make it challenging to deliver goods to a customer. The worst situation from this perspective is on the island of Saipan in the Northern Mar Islands, with a population of 70,000, which still has no address system at all.[50]

To decrease the congestion in cities, countries have built a network of high-speed links that a smaller cities while connecting the larger ones. These limited access highways speed up considerably transportation of goods between cities. Never-theless, these highways are subject to a number of rules regulations, some of which limit the size of the trucks that can travel on them and the speed at which can travel. Because these rules vary from country to country, it can be a challenge to arrange internati truck transportation of merchandise. In addition, in many countries, access to high-speed highway limited to vehicles that pay a toll, making such roads an expensive alternative. In France, for example private company running the high-speed highway system charges approximately €0.20 per kilometer (€ per mile) for semi-trucks.

Civil Engineering Structures (Ouvrages d'Art)

If the country is mountainous, these high-speed thoroughfares are built with numerous bridges and tun designed to "eliminate" the constraints of the landscape. A perfect example of such a highway is the Ita Autostrade, which runs along the Appennine Chain and is seemingly an unending succession of tunnels bridges. Such engineering structures are called collectively (in French) *ouvrages d'art*—art structures—it is an apt moniker; unfortunately, there is no equivalent in English, so the French term will be used.

The dependence of international trade on such *ouvrages d'art* cannot be under-estimated: Most nat borders are either water (oceans or lakes) or mountains at the watershed separation. To cross these nat borders, bridges or tunnels have to be built. The Chunnel—the tunnel built under the English Chan between France and Great Britain—is a case in point. Until its opening in 1994, shipping goods from country to the other was delayed by a fairly lengthy ferry voyage, which sometimes could be delayed cancelled due to bad weather. The Chunnel has substantially shortened shipping times between the countries, although it is quite expensive.

Another international route that has been radically changed by *ouvrages d'art* is the trade betw Western Europe and the Middle East, with the opening of the two suspension bridges in Istanbul, one 1973 (Boğaziçi Bridge), the other in 1988 (Fatih Sultan Mehmet Bridge). These are the only two brid that allow road transportation between Europe and Asia, save for an itinerary north of the Black S through Bulgaria, Romania, the Ukraine and Russia. To date, there is no rail link from Southern Europe Asia, as the Orient Express ends on the European side of Istanbul, and the Baghdad Railway starts on Asian side. No rail link is available between the two stations, and passengers and cargo cross the Bospo on the bridges or by using ferries.

The so-called Øresund Fixed Link between Copenhagen, Denmark, and Malmö, Sweden, is anot example of an *ouvrage d'art* that has significantly altered the transportation landscape of an internatio border: It actually is a succession of three bridges and a tunnel, with a switchover on an artificial islanc the middle of Flinte Channel It is the first terrestrial communication between the two countries, and replaces a forty-five minute ferry ride with an eight-minute drive. More importantly, it is the first land l between Western Europe and the Scandinavian countries.[51]

The Millau Bridge in southern France opened in 2004 and is another highway bridge that significan reduces transportation times (see Figure 3-7). It links two high plateaus that are bisected by a deep ri gorge, for which the only crossing was in the middle of the small town of Millau. Before the construction the bridge, vehicles had to travel down approximately 300 meters (1,000 feet) through a series of hairp turns to the city, across the river, and then climb up the same distance on the other plateau. The town w

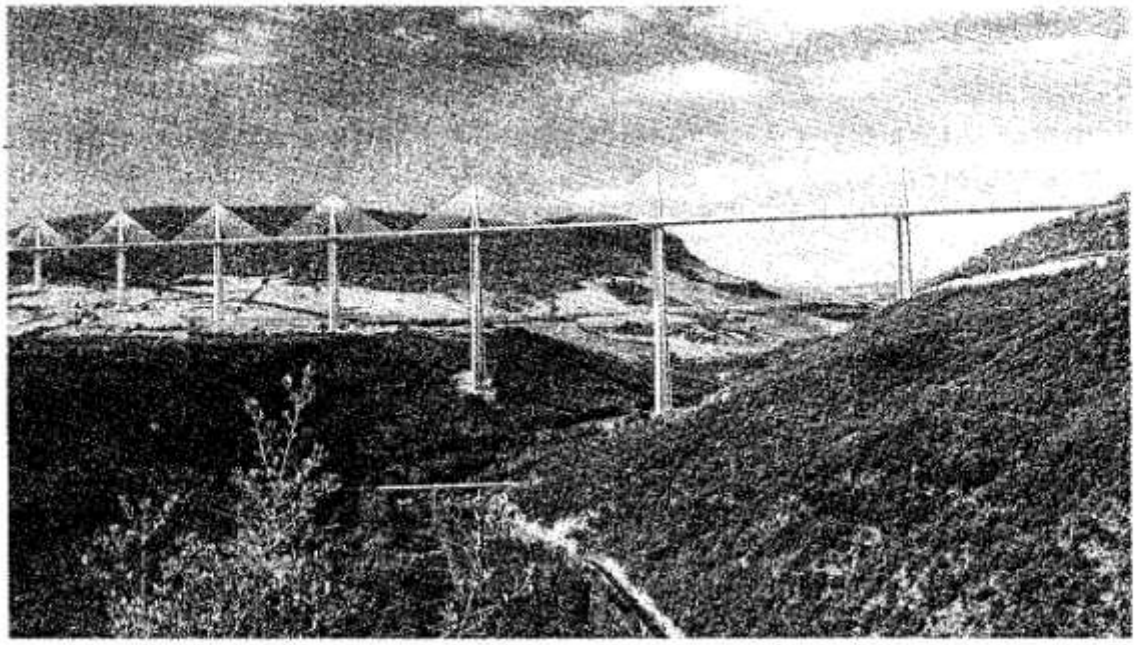

Figure 3-7 *The Millau Bridge*

infamous for its traffic jam, and it was not unusual to spend two hours to go from one plateau to the other. With the bridge, it takes less than one minute. The bridge is 345 meters above the river (1,150 feet), about twenty meters higher than the Eiffel Tower, and was built in a little over three years.[52]

Some bridges are much less architecturally noticeable but no less important to the economies of the countries they link. For example, the United States and Canada, for a significant portion of their common border, are only "connected" by a bridge and a tunnel in Detroit, Michigan (to Windsor, Ontario), and a few bridges near Buffalo, New York. At least one of those bridges, the Peace Bridge between Buffalo and Fort Erie, Ontario, is used at its maximum capacity and has not been expanded since 1927.[53]

Another example of the critical nature of bridges and other structures can be seen in the tiny island nation of Palau, where a bridge collapse between the capital city of Koror and the main island of Babelthuap created an economic nightmare. People on the main island used to commute to the capital via the bridge, which has been inadequately replaced with ferry services.[54] Only its reconstruction will allow the country's economy to recover. The building of a bridge can also alter the character of a region; for example, Prince Edward Island is now connected to the rest of Canada by a newly built bridge, and its residents are divided on its impact on their life and economy.[55]

Moreover, it is not just in developing countries that the failure of such infrastructures can be catastrophic: All *ouvrages d'art* are vulnerable. In March 1999, a deadly fire occurred in the Mont-Blanc tunnel between France and Italy, under the Alps; the tunnel was closed until April 2002. This forced trucks to use the Fre´jus tunnel, the only other tunnel under the Alps between France and Italy, or to make a substantial detour along the Mediterranean coast, neither option being a good alternative. A fire in the Saint Gothard tunnel—the second longest road tunnel in the world, between Switzerland and Italy—forced its closure in October 2001; while the tunnel was reopened in December 2001, it was limited to half of its traffic capacity until April 2002, as traffic was only allowed in one direction at a time.

3.2.6 Warehousing Infrastructure

It is evident that transportation is dependent on an infrastructure that allows the movement of goods.

However, it is equally important to realize that cargo is often stationary when it "waits" for tl transportation alternative to be available. Therefore, it is important for a shipper to obtain informatio the warehousing infrastructure of the locations where a shipment will be in layover.

The issues revolving around the warehousing infrastructure concern the protection of the good they are waiting while in transit. Will they be protected from the rain? From the sun? From f floods? From (unusual) cold? A savvy international logistics manager will attempt to determine the tions under which the goods will be kept, and will then determine whether they are correctly packa whether they need to be shipped through a different itinerary. The Cigna Insurance Company's *Port World* booklet[56] (see Table 3-1) lists the warehouse space available in each port.

In many cases as well, shippers will use public warehouses for storage purposes, in order to goods to their customers without having to resort to an international shipment. This enables the cc to provide much better customer service by delivering goods with a much shorter lead time.

Unfortunately, the warehousing infrastructure of a country is difficult to evaluate, as there are no sources of information on the availability and quality of public warehouses. Therefore, in those cases a company is considering using a public warehouse to serve its customers, it would be best to plan ar visit to the location considered, as the standards used in public warehousing management may b different than the ones expected.

3.3 Communication Infrastructure

In addition to the transportation infrastructure, the communication infrastructure is also of subs importance to international logistics. The ability to communicate with customers and suppliers, ei mail, by phone, or through other electronic media, is very important to the smooth operation international transaction. Unfortunately, there are different expectations of service and performa communication means from country to country.

3.3.1 Mail Services

The ability of the postal services to deliver mail on time and reliably should be a given in most dev countries. However, there is ample anecdotal evidence that it is not the case in all places. On occasions, there are unacceptable delays and errors: While the European Union countries strive to letters sent to a national address on the day after it is mailed—a so-called *D+1* policy—and on the day if it is international mail within the European community, this is a difficult standard to achieve especially before its national postal service was privatized, was notoriously unreliable. France has p strikes of its mail service and of its national railway service, both of which can substantially del delivery of mail. In South Africa, the mail service has become so unreliable that businesses and inc als no longer trust it enough to send payments, forcing them to make payments in person or through b

Another issue is the safety of the mail: Will a letter or package make it to its destination, or will it b damaged, or stolen in transit? Because postal services tend to be very large employers, it is diffi screen all employees effectively. There have been countless documented instances of postal emp stealing the contents of parcels, removing the contents of letters—especially cash, checks, and cards—before they reach their destination. Developing countries have an even greater problem, as employee wages tend to be modest, and the temptations are many.

Many firms intent on ensuring that their postal communications are safely delivered have swi especially for international documents' exchanges, to private services such as DHL or FedEx. Wh costs of private services tend to be much higher than the costs of the traditional postal services,

companies have gained much market share, thanks to their reputation for greater reliability. In particular, the customers' ability to track packages and documents online has increased this perception.

Another phenomenon is the exploitation (arbitrage) of the differences in prices and mail categories for international mail from one country to another. A direct marketer sending a substantial number of identical mail pieces internationally will determine in which country that particular mailing is going to cost the least amount; it will then ship the mailing materials in bulk to a company operating a remailing service in that country. The remailer will then place the individual items in the mail and so the overall mailing costs to the marketer will be lower. Commercial materials emanating from France have come to the author from Denmark, Great Britain, and the Netherlands; the lowest cost provider was probably determined by the fact that the weight of the materials being sent placed them in different price categories in different countries.

3.3.2 Telecommunications Services

Slightly different issues are facing telecommunication services; not only has the demand for voice telecommunication increased about 10 percent a year, but the demand for data telecommunication has essentially doubled every year for the past ten years, and shown no sign of slowing down. Some countries have been able to build a sufficiently large domestic infrastructure to carry this increased load, often by using their already existing infrastructure. Many gas and oil pipelines have been given the added responsibility of transmitting data through a fiber-optic line laid in their midst.[58] Many countries, though, have not been able to keep up with such growth, and telecommunications in those countries are slow and not very reliable: In 2001, Ghana, for example, had only 249,000 phone lines for 20,000,000 inhabitants, or one line for every eighty persons.[59]

This reliability is the primary concern in several countries where the economy has grown quickly; the domestic communication infrastructure did not follow. Phone service is notoriously unreliable, with phone conversations disconnected, phone calls regularly connected to wrong numbers, and dial tones all but absent.[60] Fortunately, in some of those countries, a phenomenon known as **leap frogging** has taken place. Because the "old" land-based telephone infrastructure is not working properly, people have switched to cellular phones very quickly and bypassed the land-based system. This switch is facilitated by the fact that many countries quickly adopted a single operating standard, which makes for easy portability and for increased convenience. Such is the case in places like the Czech Republic, where cellular phones now have a greater penetration rate than land-based telephones. In China, there are almost half as many cellular phones as there are land-based phones, and the rate of growth in cellular phones far surpasses that of the traditional technology. Countries such as the United States, which have a strong land-based infrastructure, have been slower at switching to cellular phone usage. As of 2005, the United States was forty-first in the world when ranked by the percentage of its population that owned a cellular telephone. Although this ranking was due to the fact that the land-based infrastructure is very good (and people have less of an incentive to switch), it was also due to the fact that there are four different operating technologies competing for cellular phone customers, and therefore that there are four times as many towers to be built (and paid), making cellular phone service particularly expensive.

On the international side, telecommunications are heavily dependent on a network of underwater cables that run across the Atlantic, the Pacific, the Mediterranean Sea, or other large bodies of water. As telecommunication traffic has increased, the capacity of these cables has also increased dramatically. Altogether, though, there are still very few cables (only seven cross the Northern Atlantic), and their vulnerability is extraordinary. Although they are buried on the portion of their route that is located in shallow water, they are for the most part simply laid on the floor of the oceans, at the risk of being snagged by fishermen's nets and boat anchors.[61] When these cables cross land, they are just as vulnerable and at the mercy of a careless

backhoe operator or other accident.[62] Whenever they are snagged or damaged, traffic on that cable seiz until it is repaired. In an outstanding article in *Wired* Magazine, Neal Stephenson followed the constructi of the FLAG—Fiber-optic Link Around the Globe—and reported on the vulnerability of this network: F example, five of the major worldwide cables are routed through a single building in Alexandria, Egypt.[63]

Satellite telecommunications are no less dependent on a limited number of alternatives and therefore ju as vulnerable; because satellites are increasingly heavily used for communications such as television pr grams, their capacity is entirely used, and the failure of a single satellite can wreak havoc on telecommur cations. Such was the case when PanAmSat's Galaxy V failed in May 1998.[64]

Other telecommunication infrastructures are vulnerable; the Internet, although touted as "robust," is st very dependent on so-called "root-servers" that keep the list of addresses on the Internet. In the summer 1997, Root Server A, located in Hernston, Virginia, the mother of all root-servers, "lost" its master lis Internet traffic was disrupted worldwide for several hours.

3.4 Utilities Infrastructure

Another area of concern for the manager involved in international logistics is the utilities infrastructur While it is generally taken for granted that all utilities—electricity, water, sewage, gas—are available i most countries, experience shows that there is often a shortage of one or more of these commodities i many countries, including developed countries. And while utilities are not directly an issue in transportatio they can become critically important when a company is considering operating a warehouse or establishin a corporate office.

3.4.1 Electricity

The most common problem with utilities is the availability and reliability of electrical power. It is commo in countries where the rate of economic growth outpaces the rate of growth in electricity production to hav blackouts for part of the day. Actually, the situation is endemic in sub-Sahara Africa, where there ar scheduled blackouts because the production of electricity is much lower than the demand for it; household and businesses therefore plan their days around the availability of electricity.[65] India and China are als affected by recurring blackouts,[66] and so is Saudi Arabia.[67] However, this is not a phenomenon that i limited to developing countries; the availability of electricity is sometimes also disrupted in developec countries. Such was the case in California in the summer of 2001, during which there were substantia supply and demand imbalances and numerous shortages. However, recent evidence has shown that, ever though there were infrastructural shortages at the root of the problem, the speculative behavior of the Enro Corporation was mostly responsible for the wild price fluctuations that Californians experienced.

On the other hand, some countries have abundant electrical resources: Brazil and Paraguay share the Itaipu Dam (see Figure 3-8), which provides 82 percent of Paraguay's electrical needs and 26 percent of Brazil's. Nevertheless, for those areas of Brazil that are geographically far from Itaipu, there are still shortages and temporary blackouts.

In addition to problems of production, the utilities are sometimes the victims of theft; households and businesses bypass their meters or tap directly in the grid without the "inconvenience" of a meter, preventing utilities from collecting enough income to be able to invest in additional capacity. A World Bank loan to India to build additional power plants was actually made conditional on the utility getting paid for a greater percentage of its production.[68] In Russia, an endemic problem is the theft of the electrical wires for scrap, a "business" that killed 500 thieves in 1999 and forced the Russian government to replace 15,000 miles of high-tension wires,[69] without mention of the disruptions to businesses and individuals.

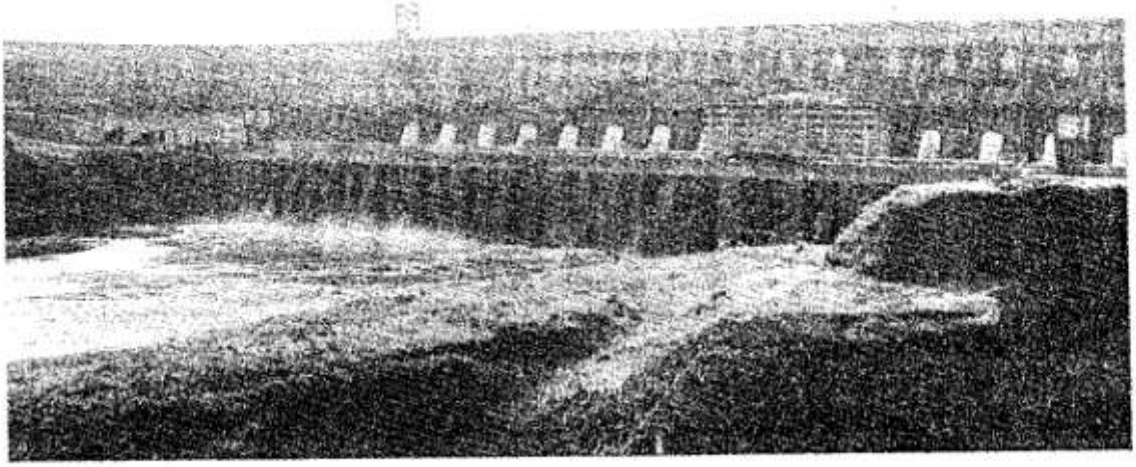

Figure 3-8 *The Itaipu Dam*

3.4.2 Water and Sewer

Water supply is also a concern in many countries in the world, leading to interruptions, rationing, and recurring water shortages.[70] It is not uncommon for cities to ration water in the middle of a drought period, on some occasions reducing the availability of water to a few hours a day or a few days a week.[71] As populations in cities increase, the infrastructure delivering water to the cities is often overtaxed, which can lead to potentially catastrophic problems, especially in cities with aging infrastructures. For example, New York City gets most of its water from reservoirs 125 miles away, and it is delivered by two tunnels that were built in 1917 and 1937. Neither of these tunnels has ever been shut down for repairs, as the city would not be able to function without the water they deliver.[72] A new water tunnel is currently under construction and is scheduled to start operating in 2020. Many cities have leaky pipes and lose a portion of their supply to those leaks; the city of Manila, in the Philippines, estimates it loses *half* of its water production through leaks and illegal siphoning of the water.[73]

The quality of the water is also a concern: In many cities, the water delivery infrastructure is not well protected, leaving a strong possibility of bacterial contamination, and forcing users to boil the water before they use it. This procedure is a common recommendation given by international travelers. The World Bank estimates that no more than 80 percent of the world population has "reasonable access" to clean water, defined as access to within one kilometer (0.62 miles) of the house.[74]

On the other end, the infrastructure designed to remove used water is also critical. Many countries have inadequate or overburdened sewer treatment facilities, resulting in the pollution of water tables and adjacent bodies of water, or problems with sewer backups at times of heavy rains, for example. While less critical than water availability to the proper operation of a warehouse or distribution center, sewer service is still important as it can be a nuisance to have employees deal with stench or frequent cleanups. The World Bank estimates that less than 60 percent of the world population has access to adequate sanitation.[75]

Similar observations can be made about refuse removal, a service generally provided by the municipalities, but which can be unreliable; strikes of municipal workers can take several days, during which no pickup is conducted, resulting in a problem in the operation of any type of business.

3.4.3 Energy Pipelines

The infrastructure of access to energy is also of importance. As most of the easily accessible oil and gas fields are near the end of their life expectancies, energy resources now come from remote areas that are difficult to operate and from where it is difficult to ship. Building energy pipelines from those areas is a challenge, and the obstacles include the weather—the Alaskan pipeline—natural barriers, political issues,[76] environmental challenges,[77] and bickeringbetween the oil companies and the governments of the countries in which they were building.[78]

Nevertheless, the infrastructure of pipelines is growing and allows an ever-greater percentage of the energy needs of the world to no longer be transported by ships, trucks, and railroads.

Review and Discussion Questions

1. What are the main elements of the maritime transportation infrastructure? How would the quality and dependability of the maritime transportation infrastructure affect an international shipment?
2. What are the main elements of the air transportation infrastructure? How would the quality and dependability of the air transportation infrastructure affect an international shipment?
3. What are the main elements of the land transportation and warehousing infrastructure? How would the quality and dependability of these infrastructures affect an international shipment?
4. What are the main elements of the communication and utilities infrastructure? How would the quality and dependability of these infrastructures affect an international shipment?