



LINCS: Leveraging, Integrating, Networking, Coordinating Supplies

TRANSPORTATION OPERATIONS CERTIFICATION TRACK

for Entry- to Mid-Level Professionals in Supply Chain Management

Developed by the LINCS in Supply Chain Management Consortium, comprised of the following educational institutions:

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Florida State College at Jacksonville
Georgia Institute of Technology
Harper College*

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San Jacinto College
St. Petersburg College
Union County College*

In partnership with the Council of Supply Chain Management Professionals.



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Title Page

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Preface

The information in this Preface is an overview of LINCS in Supply Chain Management.

Supply Chain Management (SCM) as a paradigm is nothing new to business and industry. However, academia and employers have recently seen SCM become a major focus. There are currently several industry-recognized certifications in SCM, largely focused on individuals with experience in management through the executive level. The curriculum in the certification tracks listed below is directed at those who have entry- to mid-level experience.

The curriculum for these certification tracks include eight topics in SCM:

1. SCM Principles
2. Customer Service Operations
3. Transportation Operations
4. Warehousing Operations
5. Supply Management and Procurement
6. Inventory Management
7. Demand Planning
8. Manufacturing and Service Operations

Each certification track can be taken on its own to earn one certification; multiple certifications can be earned in any order. Each certification track covers the basic elements of the primary certification track, which allows the learner to obtain a foundational understanding of the **best practices** and processes associated with each topic.

Common Learning Blocks accompany each certification track, providing an overview of SCM. It is highly recommended both the standalone Common Learning Blocks document **and** the certification track document be thoroughly reviewed **prior** to taking a national certification examination.

The content provided within this certification track relates specifically to **Transportation Operations**. The national certification examination will include questions on both the **Transportation Operations** content and the **Common Learning Blocks** content.*

*NOTE: Materials listed under *Optional Supplemental Resources* sections (in some certification track documents only) are not included on the national certification examination.



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Abstract

Transporting goods often requires multiple modes of transportation, and the combination of modes can vary depending on cost, values, dimensions, weights, frequencies, time-definite delivery requirements, and other special requirements (e.g., hazardous or refrigerated cargoes). This certification track is intended to train students in the basics of transportation operations so they can be prepared for transportation-related positions within supply chain management.

Key elements of this certification track include modes of transportation, transportation technology, company roles and operations within the transportation field, the impact of transportation on the overall economy, sustainability in transportation, and the evolution of the field to meet future needs.

The goal of this certification track is to prepare students to successfully pass the transportation operations national certification examination. The content for this certification track was developed by LINC'S in Supply Chain Management Consortium. **SCPro™ Fundamentals Certification** examinations are owned and administered by the Council of Supply Chain Management Professionals (CSCMP).





Learning Block 1: Business and Economy

Learning Block 1 Description

This learning block describes the role of **transportation** in the overall economy. It also describes the business impact of transportation and what is involved in managing transportation, for it provides business organizations with the opportunity to create operational efficiency and improve the bottom line.

Learning Block 1 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize the business of transportation and **logistics**
- Understand the economic impact of transportation
- Analyze the evolution of the transportation sector in the United States (U.S.)

Unit 1: The Business of Transportation and Logistics

A large truck or **tractor-trailer** traveling on an interstate highway is usually the first image people think of when they hear the terms transportation or **transportation operations**. The term logistics generally does not carry this connotation, though logistics is the movement and storage of materials, products, and services. People also associate trains hauling **freight** and delivery trucks carrying packages with transportation and transportation operations. Students of transportation operations often encounter this association when they try to explain their field to friends and family. People will often ask these students whether they are learning to drive a truck; although their answer is usually no, students are sometimes hard pressed to explain what is involved in the transportation operations industry. See *Figure 1* for an illustration of some of the different transportation options readily available.



Figure 1. Considerations in transportation management. Developed by LINCS in Supply Chain Management Consortium.



Understanding the Complexities of Transportation

Visualize every package inside a tractor-trailer, train, or delivery truck. These vehicles may be hauling freight, such as stuffed children's toys, life-saving medicine, food, fuel, or even lightbulbs. A tractor-trailer may carry only children's toys, but it may also carry different types of goods at the same time (see *Figure 2*). Toys, medicine, food, fuel, and lightbulbs have different handling and requirements, and transportation personnel are accountable to make sure these practices are followed.



Figure 2. Inside a freight carrier. Developed by LINCS in Supply Chain Management Consortium.

Multiple packages may have been ordered by one individual, which may arrive on different trucks or from different geographic points of origin; however, the individual may need the packages to arrive at the same time. A common example would be when a manufacturer receives multiple parts for building a product from different **suppliers**: If parts are not delivered to the manufacturer at the right time, small parts, such as a bolt, can delay the assembly of a multi-million dollar piece of equipment.

Because valuable freight may be stolen or could be misused during transit, transportation personnel must also consider the issue of security. Lastly, transportation personnel must ensure that packages are delivered to the intended recipients and that freight is managed in a cost-efficient manner.

Now, envision several hundred tractor-trailers a trucking company may utilize at any given time. Transportation personnel perform the functions involved in managing trucking company **fleets**. Many trucking companies run several hundred tractor-trailers across the country, and other companies have a smaller fleet which only serves certain regions. Companies with limited service areas either have to geographically restrict their business territories or transfer freight to other carriers to meet the needs of **customers** who want cross-country shipments. Transportation personnel are accountable for the coordination of shipments between multiple carriers.

Although driving a truck is an important part of the transportation operations field, believing transportation operations is only about truck drivers is similar to believing the movie business is only about actors. Producers, directors, make-up artists, camera operators, musicians, distributors, studios, and movie theaters are equally important to the movie business. The 2007-2008 strike by the Writers Guild of America proves how important other positions in the field are to the movie business—estimates



suggest the 100-day strike caused industry losses of anywhere between \$500 million to \$2.1 billion. Similarly, the transportation industry requires many supporting jobs to be efficient and successful.

Definition of Transportation

An appropriate way to understand the field of transportation operations is to consider this economic perspective: Transportation involves the physical movement of people and goods between origin and destination points, thereby creating time and place utilities. From a business standpoint, transportation **links** partners and facilities separated geographically in a company's **supply chain**, including customers, suppliers, distributors, plants, **warehouses**, and retail outlets. Transportation also provides the links between diverse entities spread across the global supply chain and connects the supply chain through moving **inventory** with trucks, trains, planes, ships, and **pipelines**. Transportation operations involve ensuring the flow of inventory from points of origin in the supply chain to points of use and consumption (i.e., destinations). It primarily involves three components: inbound, outbound, and **reverse logistics**. **Inbound logistics** support the **procurement** of materials and goods from supplier locations; **outbound logistics** support the distribution of materials and goods to customer locations; and reverse logistics support product **returns**, recycling, reuse of materials, and waste disposal.



Figure 3. Different modes of transportation. Developed by LINCS in Supply Chain Management Consortium with images from pixabay.com.

Unit 2: The Economic Impact of Transportation

According to the latest available data from the Bureau of Labor Statistics' Occupational Outlook Handbook (U.S. Department of Labor [DOL], 2014), there is an expected **growth** rate of 22% for available jobs in the transportation sector between 2012 and 2022 (i.e., much faster than the average growth of industry sectors). In fact, the same DOL (2014) data shows positive recent job growth during 2014 and 2015. According to the Bureau of Labor Statistics, "employment growth will be driven by the important role logistics plays in the transportation of goods in a global economy." With such exciting career **prospects** in the field, it would be valuable to know the economic impact of the transportation sector in the U.S.

Infrastructure

The transportation infrastructure in the U.S. is extensive; it includes over 4 million miles of public roadways (e.g., national highways, interstate highways, etc.). There are over 160 thousand miles of railway, 25 thousand miles of waterways, and 1.7 million miles of pipelines, including pipeline for gas and for hazardous liquid. In addition, the number of public airports in the U.S. is approximately 5,100.



Consumers create the need for and support investment in this tremendous infrastructure.

Think about how often people take flights for the joy of flying. Despite what airlines may advertise, very few people fly for the sake of flying. Most often, the need to fly somewhere arises because of other needs. For example, a sales manager may need to fly out to meet certain key accounts, a family may fly somewhere because they want to enjoy a vacation, or people may fly over the holidays to spend time with family. Most flights are taken because of the need to fulfill other **objectives**. Almost every form of transport falls into this category, in which people rarely travel without a defined need.

The same logic can extend to commercial transportation as well: companies usually do not transport goods if there is no good reason to move them. This means transportation is a **derived demand**: the **demand** for transportation services depends on the marketplace demand for other products. Consumers demanding more goods increase demand for goods close to the point of consumption. Conversely, consumers demanding fewer goods decrease demand for goods close to the point of consumption, and this reduced demand for transportation services affects the entire supply chain.



Figure 4. Transportation infrastructure. Developed by LINCS in Supply Chain Management Consortium.

The Impact of the Economy on Transportation

The market for transportation changes with the state of the economy because when consumers demand fewer things, the need for the transportation sector is reduced. On the other hand, when consumers demand more goods, the market for transportation also increases. This connection between the transportation sector and the economy was clearly visible during the economic crisis of 2008-2009. According to Coyle, Novack, Gibson, and Bardi (2011), a 12.2% **decline** in worldwide trade led to a reduced need for transportation services. Spending for transportation services in the U.S. fell 20.8% from 2008 to 2009. Demand for **less-than-truckload (LTL)** service fell nearly 30%, **truckload (TL)** revenues declined 4.4%, and rail carload volume dropped 18%. On the international front, **air cargo** traffic declined 11.3%, and ocean carriers scrambled to eliminate excess capacity.

Size of the Transportation Industry

As the world began to climb out of the global recession in 2010, the transportation industry took a turn for the better. The World Trade Organization (WTO) indicated faster-than-expected recovery in global trade flows would result in 13.5% growth of worldwide trade for the year (Coyle, Langley, Novack, & Gibson, 2013). In turn, the transportation industry began to recover with volume and revenue growth in all modes of transportation.

According to the 25th Annual State of Logistics Report from the Council of Supply Chain Management Professionals (2014), total U.S. business logistics costs in 2013 rose to \$1.39 trillion, a 2.3% increase from the previous year.



This increase corresponds to an approximate 2.5% growth of annual gross domestic product in the U.S. In addition, the transportation sector grew 2%, with most modes experiencing gains in revenue. Overall tonnage increased due to heavier average loads per shipment. The railroad sector revenues grew 3.6% as **intermodal transportation** gained market share in response to truck capacity shortages. As such, rail freight now moves more than 70% of the nation's coal, 58% of its raw metal ores, and more than 30% of its grain. **Motor carriers** transported about 9.4 billion tons of freight, or about 68.5% of the freight tonnage transported domestically. Although the air cargo sector made no gains in 2013, the water cargo sector's performance improved, rising 4.5%. Water-based carriers transported about 78% of U.S. exports by tonnage.

Unit 3: The Evolution of the Transportation Sector in the United States (U.S.)

Government agencies had often exercised tight controls over the transportation sector, which made it a highly regulated industry. In a highly regulated environment, government agencies dictate fare, rate, and route controls, making it difficult for transportation companies to enter the market and for many existing companies to be competitive.

Over the past several decades in the U.S., the transportation industry had to change to keep pace with the increased demands for air passenger travel and modes of freight. The demands have been largely driven by economic and population growth. Much of the needed changes were focused on building and improving transportation systems, developing new and innovative technologies, and modernizing transportation facilities and vehicles. Those changes alone, however, were not sufficient to meet the increased demands on the industry.

Another very significant force in changing the shape of the industry is known as *deregulation*. Over the past 30-35 years, the government has either relaxed or completely removed fare, rate, and route controls. The deregulation of these factors have enabled the aviation, motor carrier, rail, and maritime **shipping** industries to openly compete for business, which ultimately benefits the consumer and drives innovation to operate businesses more cost effectively. Additionally, it has opened opportunities for new competitors, which has created an environment of increased and improved innovation, more efficient processes, and, ultimately, more efficient transportation services across transportation modes.

For example...

Consider the airline industry. When airlines were regulated, they often operated protected routes and fare structures. Many of the long distance routes were profitable because the government-set fares were much higher than the actual costs to fly those routes. Those same airlines also flew more costly, shorter routes with government-set fares below the actual costs. When the airline industry was deregulated, the protected routes and fare structure fell apart, which forced the airlines to operate routes and set fares to be competitive.



Many airlines had to cut fares to be competitive as new airlines concentrated on the lucrative, high-volume, long-haul markets. However, in the smaller, less-dense markets, new commuter airlines also emerged, providing cost-efficient services in those markets. While airlines today are free to choose routes and set fares, they must do so without any government **regulation** (protection) and must do it profitably. Most analysts today agree airfares today are lower than they would have been if regulation of the industry continued.



Figure 5. Airline industry. Acquired from pixabay.com.

While this example is about passenger airlines, the same effect has been realized across modes of transportation as the various industries moved from government regulation to no regulation (deregulation).

Learning Block 1 Summary

This learning block defined transportation operations and discussed the key role transportation plays in U.S. and global economies. Transportation is a competitive force in business and is the activity that physically connects the business to its supply chain partners. Because of the transportation sector's significant impact to the economy, the U.S. government has often played a role in overseeing various aspects of the industry.

Over the past decades, the transportation industry in the U.S. changed to keep up with the demands driven by economic and population growth. It has transitioned from a highly government-regulated industry to an environment that is largely deregulated and reliant on competition.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 1 Practice Questions

1. **Transportation operations is mainly concerned with:**
 - a. Learning to drive a truck
 - b. Operating a forklift
 - c. Ensuring the flow of materials
 - d. Government-set rate structures

2. **What are the two major types of utilities created by transportation?**
 - a. Time and economic
 - b. Hedonic and economic
 - c. Time and place
 - d. Economic and utilitarian

3. **According to the U.S. Bureau of Labor Statistics (2014), the job growth rate in the transportation sector is expected to:**
 - a. Increase
 - b. Decrease
 - c. Remain flat
 - d. Remain an uncertainty

4. **Transportation provides the link between various:**
 - a. Entities in a supply chain
 - b. Government agencies
 - c. E-mail servers
 - d. Material movement in a warehouse

5. **According to the U.S. Bureau of Labor Statistics (2014), transportation growth will be driven by:**
 - a. Importance of logistics
 - b. Industry competition
 - c. Government regulation
 - d. Reduced employee salaries

6. **What are the various broad components of the transportation sector?**
 - a. Inbound, outbound, reverse
 - b. Eastward, westward
 - c. Downward, upward, sideways
 - d. Northward, southward



7. **Transportation is what kind of demand?**
- a. Direct
 - b. Consumer
 - c. Derived
 - d. Corporate
8. **The job availability in the transportation sector between 2014 and 2022 is expected to:**
- a. Grow by over 20%
 - b. Decline by approximately 20%
 - c. Grow marginally
 - d. Decline marginally
9. **The government process of relaxing and removing fare, rate, and route controls is known as:**
- a. Regulation
 - b. Deregulation
 - c. U.S. Roads Act
 - d. Transportation facility improvements
10. **A majority of U.S. exports (by tonnage) are carried by:**
- a. Rail freight
 - b. Road freight
 - c. Ocean freight
 - d. Airfreight





Learning Block 2: Transportation Modes

Learning Block 2 Description

There are five primary forms of transportation available in the transportation industry for moving a product from Point A to Point B: road transport, rail transport, water transport, air transport, and pipeline transport. Additionally, shipping with two or more modes of transportation is called intermodal transportation. The most appropriate mode of transportation depends on the kind of freight being shipped, the requirements of the shipper and customer, time availability, cost expectations, and other shipping factors. Each mode of transportation has its own unique features, advantages, and disadvantages, which are covered in this learning block.

Learning Block 2 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize different modes of transportation
- Understand the unique features, advantages, and disadvantages of road transport
- Explain the unique features, advantages, and disadvantages of rail transport
- Summarize the unique features, advantages, and disadvantages of water transport
- Interpret the unique features, advantages, and disadvantages of air transport
- Compare the unique features, advantages, and disadvantages of pipeline transport
- Explain the unique features, advantages, and disadvantages of intermodal transport

Unit 1: Modes of Transport

The five well known modes of transportation: road, rail, water, air, and pipeline compete or complement each other in terms of cost, speed, accessibility, etc. (Rodrigue, Slack, and Comtois, 2013) to maximize service while incurring the lowest cost. Therefore, figuring out how to transport goods is one of the most important business decisions a company has to make.

In this learning block, we will individually examine these five common modes of transportation along with some obvious advantages and disadvantages of each. It is not uncommon to utilize more than one mode to complete a shipment to achieve the desired goals of cost, speed, or efficiency. The following example illustrates the necessity of using multiple modes:



💡 For example...

A new cell phone assembly plant was constructed in Phoenix, Arizona. A large, critical piece of equipment for the new facility was manufactured in Tokyo, Japan. The plant manager and his team from the Arizona plant visited the Japanese facility to review the equipment before it was shipped. After the review was completed, the equipment was shipped from Tokyo, Japan to the assembly plant in Phoenix, Arizona.

The different modes of transportation employed for this transaction included

- **Air Transport:** The buyer (the plant manager and his team) flew to Japan to review the equipment and then flew back to Arizona.
- **Road Transport:** The buyer instructed that the completed equipment be moved in a **container** from the factory in Japan to the port of Tokyo via truck.
- **Water Transport:** The buyer directed that the container be shipped from the port of Tokyo, Japan, via a container ship, to a port in Los Angeles, California.
- **Rail Transport:** The buyer arranged to have the equipment transported from the Los Angeles port via rail to Phoenix, Arizona.
- **Intermodal Transport:** The buyer implemented intermodal transport by utilizing two or more methods of transportation.

Unit 2: Road Transport

Road-based transport almost always refers to freight movement by truck. In terms of **modal split**—the total revenue earned by the carriers operating within a specific transportation mode—road transport is by far the most dominant transportation medium in the U.S. Truck-based transportation companies typically collect over 75% of the total revenues collected by carriers across all modes.

As mentioned in learning block 1, there are over 4 million miles of public road in the U.S. compared to 160 thousand miles of railway, 25 thousand miles of waterways, and 1.7 million miles of pipelines (U.S. Department of Transportation, 2013). Therefore, the most convenient and time-efficient way to move products in the U.S. is through road transport. Trucks are almost always faster than trains and compare favorably with airfreight over short distances. Trucks have the advantage of going directly from point A to point B. Airfreight, on the other hand, has to be offloaded from planes and reloaded onto trucks to make the final delivery.

Trucks typically average 50 mph between cities, including stops. Over a 10-hour shift, a truck can cover approximately 500 miles. These ranges can be extended by employing effective driving strategies, such as the use of **team drivers**—where two drivers are assigned to a truck and alternate driving duties. However, as the travel distance gets longer, air transport (airfreight) becomes more time-efficient than road transport (trucks). For these reasons, most consumer goods will travel by truck at one point or another.



Figure 7. Road transport. Acquired from pixabay.com.



Common Trailer Capacities

There are several different kinds of truck trailers, but for long-distance moves, the most common are the 48-foot and 53-foot trailers. Many of the trailers on the interstate are 53-foot trailers. The standard **pallet-rack** measures 48 inches by 40 inches (length by width), and a typical 53-foot trailer can carry two rows of 13 **pallets**, for a maximum of 52 pallets, if double-stacked. This mandates the pallets to be loaded 48 inches side to side and 40 inches front to back. Depending on the nature of the freight, double-stacking the pallets may not be possible, due to weight restrictions.

On the other hand, the 48-foot trailers can accommodate two rows of 12 pallets, which would make the trailer capacity 24 pallets single-stacked or 48 pallets double stacked (see *Figure 8*) using the same loading format. Smaller trailers have their advantages, especially in cases where truckers may haul heavier types of freight. In U.S. federal guidelines, through the Freight Management and Operations Department, the commercial vehicle size and weight program permits truck-trailer combinations to weigh up to 80,000 pounds. The truck and empty trailer can weigh up to 36,000 pounds, which leaves approximately 44,000 pounds available for freight.

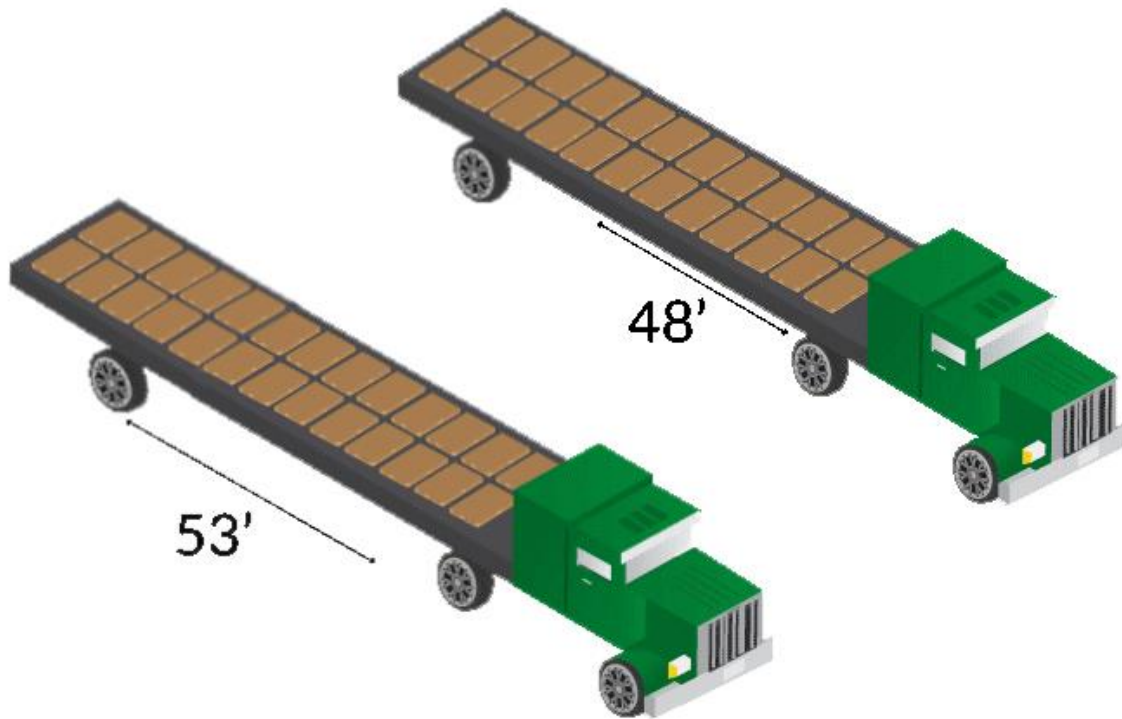


Figure 8. Comparing trailer capacities. Developed by LINCS in Supply Chain Management Consortium.



Selecting the Right Trailer for the Freight

With heavier freight, the maximum allowable weight may be reached before the stack limit of 52 pallets. In such cases, the extra space in the 53-foot trailer would be unnecessary and could potentially create situations which could damage the cargo. For this reason, smaller vehicles, such as box trucks and vans, are preferred for smaller loads or city deliveries; these vehicles are easier to manage in terms of maneuverability, parking, and fuel-efficiency.

Carrier Types and Classifications

The trucking industry can be classified based on the kinds of customers served and the volume of business targeted. Carriers are classified depending on the customers they serve as either **private carriers** or **for-hire carriers**. Private carriers' primary business is something other than transportation (typically manufacturing, distribution, or retail). Private carriers operate their own private fleet of vehicles, for their own internal purposes. Walmart is an example of a company with a large private fleet. For-hire carriers **offer** their transportation services to the general public for a fee. For-hire carriers are classified based on the freight volume they target; they can be classified as either truckload (TL) or less-than-truckload (LTL) carriers.

Truckload Carriers

As the name implies, TL carriers specialize in moving large volumes of freight for their customers. These carriers typically target shipments weighing between 15,000 to 50,000 pounds. TL carriers specialize in **door-to-door service**, which includes collecting freight at a point of origin and delivering directly to the destination without any intermediate stops (see *Figure 9*). This service is attractive to shippers because it reduces the transit time, likelihood of delays, and likelihood of shipments being damaged since the cargo is loaded and unloaded fewer times.

Less-Than-Truckload Carriers

LTL carriers typically specialize in smaller loads compared to TL carriers. LTL cargo is typically 150 to 20,000 pounds. LTL carriers operate by sharing trailer capacity among multiple shippers. A typical LTL carrier collects freight from several shippers and brings it to a central **terminal**. The freight is sorted based on geographic destinations and then loaded onto trucks a second time. Depending on the geographic region being serviced, the freight may be unloaded and reloaded several more times before final delivery.



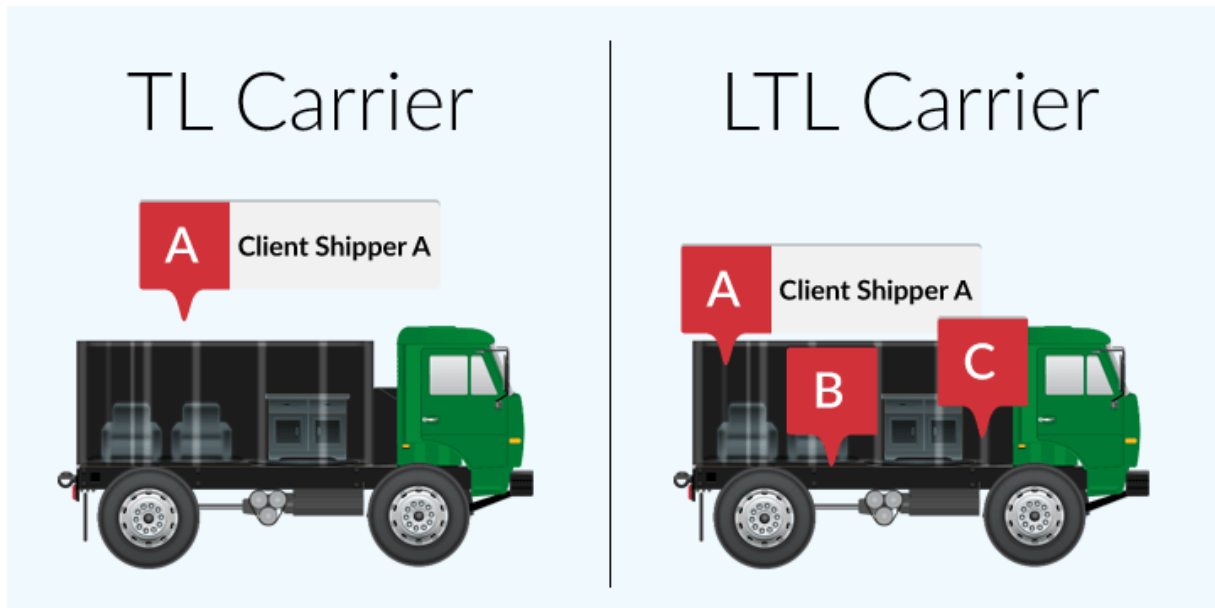


Figure 9. TL and LTL Carriers. Developed by LINCS in Supply Chain Management Consortium.

Unit 3: Rail Transport

Most people do not use railways as a mode of transportation unless they live in certain large urban pockets of the country (e.g., Chicago, Boston, or New York City). However, the same cannot be said about cargo and freight movements. Although trucking is the highest modal-revenue generator, railroads account for the highest **ton-miles** of freight transported in the U.S. Railroad companies combine many rail cars and **boxcars** (sometimes more than 100) in order to form trains for long distance routes (see Figure 10). A typical truck can carry 50,000 pounds of freight at most, but a typical rail car can carry three times the amount of a truck. Railroads have very high economies of scale and are very cost efficient for transporting large volumes of cargo over long distances.



Figure 10. Rail transport. Acquired from pixabay.com.

Typically, rail transport is at least 3 to 4 times more fuel-efficient than road transport. According to the Association of American Railroads (n.d.), trains can move a ton of freight over a distance of almost 450 miles on a single gallon of gas.

Trains take time, sometimes more than a week, to form out of rail cars provided from many different shippers. Additionally, an individual rail car might travel with multiple trains, stopping to transfer from one train to another, before it reaches its final destination. For these reasons, transportation by rail can take considerably longer than by truck, and it can have greater variability in the time required to complete cargo transit.



Unit 4: Water Transport

Water transport is the most important and commonly used form of transport in international trade. Ships account for more than 90% of international trade (see *Figure 11*). However, water transport is not restricted to international shipping or via oceans; transportation by water may also occur inland via lakes and rivers. Unlike other forms of transportation, water-based transportation has one obvious and hard-to-overcome disadvantage: the origin and destination locations must be located on navigable waterways. Only certain geographies can be serviced by water transport, and geographic **constraints** dictate the shipping routes, which may not be the most efficient route. For example, the shortest path between Jacksonville, Florida and Seattle, Washington would be to ship freight via TL carriers, LTL carriers, or rail cars despite the geographical proximity of both cities to the ocean. Water-based transportation between Jacksonville and Seattle would be a highly impractical option. Water-based carriers can be classified into Container Ships, **Bulk Carriers**, and **Break-Bulk** Ships.



Figure 11. Water transport. Acquired from pixabay.com.

Container Ships

Container ships are cargo vessels where freight is stored in 20-foot or 40-foot weather tight containers (see *Figure 12*). The capacity of a container ship is often described using **20-foot equivalent units (TEUs)**. One TEU is equivalent to the volume of one 20-foot container. Containers are loaded and unloaded using pier-side cranes. Transport bookings are based on container load.

- **Full container load (FCL):** The goods being shipped occupy an entire container.
- **Less-than-container load (LCL):** The goods being shipped occupy less than an entire container.



Figure 12. Container ship. Acquired from pixabay.com.

Bulk Carriers

Bulk carriers are **merchant ships** specially designed to transport unpackaged bulk cargo in their cargo holds (e.g., grains, coal, ore, and cement). Bulk ships may have single holds or cavities for hauling single commodities, or they may have multiple holds for transporting more than one type of product. The most common type of bulk carrier is a **tanker**, which moves bulk liquid cargo, such as petroleum (see *Figure 13*).



Figure 13. Oil tanker. Acquired from pixabay.com.



Roll-On, Roll-Off Vessels

Roll-on, roll-off vessels are specifically designed to transport cars and trucks to be driven on and off the ship. The port of Jacksonville, Florida has a lot of roll-on, roll-off vessels transporting cars (mainly Nissan and Infiniti) into the U.S.

Break-Bulk Ships

Break-bulk is the separation of a single consolidated bulk load into smaller individual shipments for delivery. Break-bulk ships accommodate dry goods too large to stow in a container. Break-bulk cargo is transported in bags, boxes, crates, drums, or barrels; unit loads of items secured to a pallet or skid are also used (see *Figure 14*).

Lighter Aboard Ship

The **lighter aboard ship (LASH)** system refers to the practice of loading barges (also called **lighters**) onto larger vessels for transport (GlobalSecurity.org, 2000-2015). LASH carriers are used to carry unpowered barges from one river port to another. LASH carriers submerge, barges are loaded, and the LASH carrier regains buoyancy for the transportation segment. Heavy-lift LASH carriers are called upon for moving large infrastructure, such as oil rigs (see *Figure 15*).



Figure 14. Oil barrels loaded on a ship. By LHOON (<https://www.flickr.com/photos/lhoon/161707777/>) [CC BY-SA 2.0], via Wikimedia Commons



Figure 15: Tugboat moving barge for loading onto LASH. By Christine [CC BY-SA 2.0], via Wikimedia Commons.

Unit 5: Air Transport

Although air travel is probably the most common form of long-distance transportation for people in the U.S., this is not the case for freight and cargo. However, airfreight is the top choice for time-sensitive freight (e.g., emergency medical supplies). In the case of air transport, passenger traffic refers to individuals flying on planes to get from Point A to Point B, and freight refers to products being shipped on the plane which do not belong to passengers. Pricing dynamics for air transport is based on the difference between passenger traffic and freight.

With road, rail, and water transport, passengers do not typically travel with freight. However, this rule may not apply with airfreight. Oftentimes, passenger airlines also operate a cargo division, which allows freight to be transported in the cargo bay on passenger aircrafts; of course, there are exceptions and not all cargo aircrafts carry passengers (see *Figure 16*). However, unlike passenger



traffic, cargo is not usually bi-directionally balanced. Although most passengers usually buy round-trip tickets (indicating the number of passengers in both outbound and inbound directions will be approximately the same), freight usually only travels one way. Freight flows from **manufacturing** centers to markets; however, the freight flow in the opposite direction is usually much smaller. Therefore, air carriers charge quite aggressively on the **headhaul** (or outbound trip) with generous discounting on the **backhaul** (or return trip) in order to entice volume.

In addition to commercial passenger airlines, there are also several cargo-only airlines (e.g., Atlas Air and Polar Air Cargo) and several parcel carriers (e.g., FedEx, DHL, and UPS) active in the airfreight business. In general, most shippers do not directly contact these transport companies and will deal with a **freight forwarder** instead. A freight forwarder is a logistics service provider who serves as an intermediary between a shipper and a carrier. Generally, they have large-scale relationships with the carriers. Because of their substantial buying power, they are usually in a position to offer considerable cost savings to their customers.



Figure 16. Headhaul versus backhaul. Developed by LINCS in Supply Chain Management Consortium.

Unit 6: Pipeline Transport

Pipeline transport is one of the least well-known modes of transportation. In fact, students of logistics are sometimes not aware of this mode of transportation. There are several reasons for the lack of knowledge about pipeline transport:

- It is not possible to transport solid objects via pipeline.
- Consumer goods are rarely transported exclusively by pipeline.
- Although pipelines are ubiquitous, they are rarely seen—trucks, trains, ships, and planes are visible to the public, but pipelines are often built underground in populated areas and typically only run above ground in remote areas.



Figure 17. Pipeline transport. Acquired from pixabay.com.



However, when companies need to move massive volumes of material (typically fluids) over long distances, pipelines can be integral components of supply chain operations. Pipelines serve as a primary means of transporting crude oil, refined oil, gasoline, and natural gas.

Awareness of pipelines has increased due to the controversial Keystone XL pipeline project. However, the Keystone pipeline is not the only major transportation pipeline—the U.S. has upward of 1.7 million miles of pipelines (U.S. Department of Transportation [USDOT], 2013). Pipelines are usually very expensive to set up and are typically owned and run by large multi-billion dollar companies. The cost of laying a pipeline includes acquiring pipes, digging extensive trenches, burying the pipeline, running pump stations, and sometimes running captive power plants. In addition, breaks or damages in the line are often very hard to detect. Pipelines are fairly slow in terms of speed of transit—the typical speed of fluid flow through commercial pipelines is between 3 and 5 mph. One big advantage of the pipeline setup is, once the initial high setup costs are absorbed, the amount of active manpower required for transporting large volumes of liquid is quite low.

Unit 7: Intermodal Transport

We have discussed several modes of transport, now let us go back and see what mode of transport we used to move our equipment from Japan to the U.S. As it turns out, it is hard to pin down any one mode of transportation. During different legs of the journey, the equipment was on a ship, truck, and a rail car. So basically, what we did was use many modes of transportation in the same journey (i.e., intermodal transport).

Prevalence of Intermodal Transport

The necessity of intermodal transport is illustrated by the example below.

For example...

A company needs to ship a large, heavy item to a residential customer. The company may use any mode of transportation, but for the purpose of this example, they may only choose one mode. If the company chooses to ship by rail, they can only use rail and not any other mode, not even to get the item to or from the rail station. Unless the company and the residential customer are both co-located with the rail station, it will be impossible to ship and deliver the item.

Somewhere during the transportation of goods, item delivery requires intermodal transportation. Even though most residences and commercial businesses have access to roads, they are not necessarily easily connected to train stations, airports, or sea ports, which are frequently used to transport goods. The combination of these transportation modes, or Intermodal Transport, enables efficient options to facilitate **customer service**.



The basic idea behind intermodal transportation is for a shipper to use two or more modes of transportation to move a shipment from origin to destination. Intermodal transport is used to leverage the relative strengths of each transportation mode or to overcome a challenge faced by a single mode. For example, water-based transport is only possible if a location is physically close to a navigable waterway. By loading freight onto rail cars and moving the cars to the port, one is able to overcome the challenge of an inland location, which may not be readily accessible otherwise. Intermodal transportation may involve moving the final mode of transportation via a secondary mode of transportation. For example, **trailer on a flatcar** is the transport of tractor-trailers with their loads on specially designed rail cars.

One of the major developments to allow intermodal transportation is the shipping container. Shipping containers are standardized steel boxes, which can be loaded onto container ships. They are strong enough to be stackable, which allows shippers to make the best use of limited available space. During unloading, an entire container can be lifted off of the container ship and placed on a flatbed rail car, or truck (see *Figure 18*).



Figure 18. Shipping containers awaiting transfer. Acquired from pixabay.com.

Containerized shipping allows for highly efficient transportation by reducing loading and unloading times and creating standardized shipping units. The most common container sizes are the 20-foot and 40-foot containers. Although the length is standardized at 20 foot, there are several different heights available, which changes the cargo volume itself. A ship with enough space for 10 TEUs has available cargo capacity for ten 20-foot containers (or their equivalent).

Advantages

Intermodal freight transport gives a company the flexibility on how to move freight. This process involves at least two modes of transportation. The more efficiently the company plans, the more money the company will save. This method reduces cargo handling, improves security, reduces damages and losses, and allows freight to be transported faster (Duff, n.d.)

Disadvantages

Intermodal freight transport may be costly depending on the number of modes of transportation. Some downfalls involve the high costs associated with moving freight using several types of modes of transport, as well as, the lack of communication and idle time of equipment. Also, equipment moving from one location to another empty adds to the costs (Duff, n.d.).



Learning Block 2 Summary

This learning block defined the various modes of transportation and which modes to use depending on the kind of freight, the requirements of the shipper and customer, time availability, cost expectations, and other factors. The five primary choices are road, rail, water, air, and pipeline transport. Intermodal transport uses mixed modes (more than two of the five) to achieve delivery objectives. Intermodal freight transport plays a major role in allowing organizations in a supply chain to adapt to market changes by providing options. The shipper will have choices on how to transport the freight; however, it could be a costly process if the company does not plan accordingly.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 2 Practice Questions

1. In the U.S., which form of transportation serves the highest geographic coverage?
 - a. Pipelines
 - b. Water
 - c. Road
 - d. Rail
2. The two major types of truckload carriers are:
 - a. Truckload and less-than-truckload
 - b. Truckload and lighter-than-truckload
 - c. Truckload and greater-than-truckload
 - d. Toll-paying and no-toll-paying
3. Typically, the kind of ship transporting new cars is called a _____.
 - a. Roll-on roll-off
 - b. Bulk Break
 - c. Bulk
 - d. Container
4. Pipelines are associated with:
 - a. High set-up costs
 - b. The coal industry
 - c. Consumer goods
 - d. Short distance fluid movement
5. Full Load Container is defined as:
 - a. Containers occupying an entire ship
 - b. Containers exceeding the weight requirements
 - c. Goods occupying the entire container
 - d. Containers only transportable by trucks
6. Which of the answer choices is not a transportation mode?
 - a. Road
 - b. Streaming
 - c. Rail
 - d. Pipeline
7. Which form of transportation has the highest modal split?
 - a. Rail
 - b. Pipeline
 - c. Streaming
 - d. Road



8. TEU stands for:

- a. Twenty equivalent unit-trains
- b. Ten English unit-trains
- c. Two equivalent users
- d. Twenty-foot Equivalent units

9. Over shorter distances, the shipping speeds of both modes of transportation are comparable.

- a. Road, Ocean
- b. Air, Pipeline
- c. Road, Airfreight
- d. Pipeline, Ocean

10. Which is the only mode of transport where carriers compete in the passenger and cargo sectors simultaneously?

- a. Air
- b. Road
- c. Pipeline
- d. Ocean





Learning Block 3: Transportation Economics

Learning Block 3 Description

Transportation personnel must understand basic cost factors and the revenue side of the transportation industry. These individuals make cost and pricing decisions almost daily, so it is not only a large part of their jobs, but it is also a large part of the industry. The current learning block includes information about basic economic factors, which transportation professionals must understand and recognize.

Learning Block 3 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Understand the concepts of **fixed costs** and **variable costs**
- Explain cost **considerations** in transportation
- Analyze models of pricing in transportation for LTL, TL, Air, and Ocean

Unit 1: Fixed Costs versus Variable Costs

Cost

Cost is the amount that has to be paid or given up in order to get something. For a business, cost is known as a monetary value of effort, material, resources, time and utilities consumed, **risks** incurred, and opportunity **given up** in production and delivery of a good or service. All business expenses are costs, but not all costs are expenses.

Fixed Costs

Fixed costs are expenses which do not change based on the level of usage. In the equipment example, the fixed cost is represented by the cost to purchase the equipment. Freight transportation includes fixed costs, such as LTL carriers imposing a charge into their **contracts** called the **absolute minimum charge (AMC)**. AMC is the minimum amount accepted, and carriers cannot accept anything less than the AMC. Also, when paying a fixed cost and shipping a TL or a full railcar, the amount paid will be for the full cost of the TL or the railcar, even if it is not loaded to full capacity.



Variable Costs

Variable costs are different from fixed costs because they change in direct proportion to the level of usage. In the equipment purchase example, in-plant maintenance costs would be an example of a variable cost. As the assembly plant runs the equipment for extended periods, maintenance costs would also increase. Freight transportation also includes several variable costs. For example, most transport carriers would expect shippers to pay more for freight when variable costs increase (i.e., distance covered, weight, and volume). *Figure 19* illustrates how fixed and variable costs manifest themselves in the case of transport.

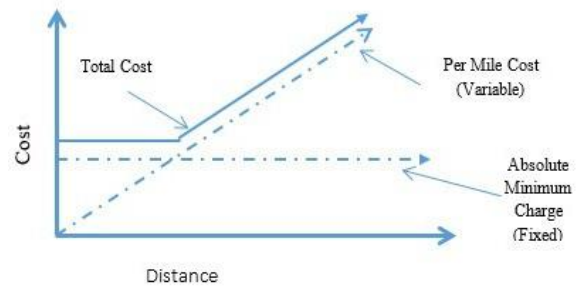


Figure 19. An example of fixed costs and variable costs. Developed by LINCIS in Supply Chain Management Consortium.

For example...

In the equipment purchase example provided in learning block 2, the buyer purchased manufacturing equipment for cell phone assembly. After installation and initial use of the equipment, the competing prices from other cell phones manufacturers drove a decrease in production at the Arizona assembly plant. As a cost cutting measure, the plant manager was forced to eliminate shifts and decrease production. The equipment was only running on a part-time basis; however, the plant manager is still faced with interest and payments on the equipment. The plant manager is still dealing with fixed and variable costs.

Unit 2: Cost Considerations in Transportation

Transportation personnel must consider cost factors when making carrier quotes for rates of specific shipments. Additionally, carriers must determine how much to charge for certain packages and how they relate to the price of other factors. These other factors could be major cost factors and are discussed in the remaining sections of this unit.





Figure 20. Climate-controlled truck. Developed by LINCS in Supply Chain Management Consortium.

Special Services

Special services products (e.g., temperature or climate control) cost more to ship because they require specific equipment or handling. For instance, chilled or frozen products require trucks with **reefers** to keep them cold during transit and during the winter just as, products that might require heated trucks to keep them from freezing. Additionally, fresh produce items often require certain types of handling, specialized equipment, and in certain cases, temperature-controlled equipment.



Figure 21. Truck carrying hazardous materials. Developed by LINCS in Supply Chain Management Consortium.

Hazardous Materials

Hazardous materials involve a number of substances or materials that can potentially pose an unreasonable risk to health, safety, or property when transported. Hazardous materials are divided into 10 classes: explosives, gases, flammable liquids, flammable solids, oxidizers, poisons, radioactive matter, corrosives, miscellaneous items, and other items. Examples of such hazardous materials include acids, fireworks, specific paints, and dynamite. Shippers tend to pay more when transporting hazardous materials mainly because not all carriers handle hazardous materials. The second reason for the expense is because specialized training and extra precautions must be taken when transporting hazardous material.



Figure 22. Truck carrying high-value goods. Developed by LINCS in Supply Chain Management Consortium.

High-Value Goods

Transporting expensive or rare goods requires extra fees from shippers for a number of reasons. First, burglars tend to take high-value goods rather than low-value goods; therefore, the amount of security and care exercised when transporting these items is higher than normal. The second reason for these extra fees is because high-value items usually require higher costs of insurance.



Figure 23. Truck carrying frail goods. Developed by LINCS in Supply Chain Management Consortium.

Risk

Frail goods are more likely to be damaged in transit than other goods are (e.g., eggs or glass products). These types of products would not necessarily be considered hazardous material or high-value goods, but shippers should expect to be charged more for these items than for items, which would not have a high risk of being damaged in transit.





Figure 24. Balance of freight. Developed by LINCS in Supply Chain Management Consortium.

Balance of Freight

Balance of freight requires the amount of freight going to a destination matches the amount going back to the starting point. For example, freight traveling from Atlanta, GA to Dallas, TX should equal the amount of freight traveling back from Dallas to Atlanta. With balanced freight, carriers are able to have compensating loads on the headhaul and the backhaul. However, having balance of freight is a rare occurrence. For example, in international trade between the U.S. and China, the U.S. receives much more containerized cargo from China than China receives from the U.S. This problem is not only found in international trade but in domestic trade as well. Domestic freight movements have organizations who avoid locating distribution facilities in the state of Florida due to high costs and a high number of empty backhauls (called **deadheads**). In cases with deadheads, carriers compensate for the empty backhauls by charging more on the headhauls.



Figure 25. Seasonality. Developed by LINCS in Supply Chain Management Consortium.

Seasonality

Prices for transportation tend to fluctuate with popular travel seasons of the year. For example, airline tickets tend to be more expensive when purchased during the holiday months of November and December. One reason for this extra expense is carriers know they will sell out their capacity during common travel times. This concept also applies to freight movements. For example, rates quoted by tankers, which are used to transport heating oil for November and December, are consistently higher prices than similar tankers are from January to April (Kavussanos & Alizadeh-M, 2002).

Unit 3: Pricing Models in Transportation

Personnel from various transportation modes handle their pricing models differently. Due to these differences, it is important to understand the basics of freight pricing across the different transport modes. This unit includes information about the different pricing models of the transportation modes discussed in this certification track.



Pricing for Less-Than-Truckload Carriers



Figure 26. Less-than truckload carrier. Developed by LINCS in Supply Chain Management Consortium.

The LTL industry sets pricing rates based on the **class rate system**. The class rate system aims to simplify the **process** for pricing freight with inherently different freight characteristics, such as sensitivity to heat and light, volatility, security required, etc. Instead of having a different price for every commodity, goods with similar freight characteristics are assigned to common freight groups called classes. There are 18 freight classes identified by a numeric value from 50 to 500 (**National Motor Freight Traffic Association**, 2015). Lower class **ratings** equate to lower prices.

Classes for different freight types are governed by the **National Motor Freight Classification**, which is under the National Motor Freight Traffic Association. These classifications are revised periodically by both of these organizations. Lower class ratings are given to low-value freight, which is easy to handle, unlikely to damage, and dense in nature; higher-class ratings are given to high-value freight, which is expensive, light, bulky, and more likely to get damaged.

Carriers sometimes allow shippers to group different rate classes into a master class called **freight-all-kinds (FAK)**. This master class exists to ease calculation and record keeping, among other things. In addition to the class rating assigned to the freight, carrier pricing is driven by shipment weight. Therefore, higher shipment weights require higher rates. However, the increase in rate according to weight is not linear; typically, **weight breaks** are applied at predetermined levels. Typical weight breaks are as follows:

- < 500 pounds,
- < 1,000 pounds,
- < 2,000 pounds,
- < 5,000 pounds,
- < 10,000 pounds, and
- < 20,000 pounds.

Additionally, LTL carriers typically apply discounts from the published rate at specific weight levels.

Pricing for Truckload Carriers



Figure 27. Truckload carrier. Developed by LINCS in Supply Chain Management Consortium.

Most TL shipments are priced on a point-to-point basis in which shippers pay flat rates for shipments between two points based on the capacities of the trucks. These rates are usually based on mileage between the two points and are called **mileage rates**. Other rate options outside of mileage include per pound, per lineal foot, per hundredweight, per item, and per short ton, though these are rarely used. TL carriers may impose additional surcharges above the mileage rate, and these are called **accessorials**. These include:

- **Fuel surcharge**: This is assessed to cover unexpected rises in price of fuel (typically diesel fuel). These surcharges are usually based on certain standard indices (e.g., U.S. average).
- **Single shipment**: This is added when there is zero (or limited) potential of repeat business.



- **Detention/demurrage:** These are added when shippers or receivers make truckers wait longer than normal.

Airfreight



Figure 28. Airfreight.
Developed by LINCS in
Supply Chain Management
Consortium.

Airfreight pricing is usually offered on a cost per kilogram basis: the rate per kilogram declines as the shipment weight increases. Pricing is usually offered on a door-to-door basis (i.e., shipper location to customer location), a door-to-airport basis (i.e., shipper location to airport), or an airport-to-door basis (i.e., airport to customer location). One price offered is the **next flight out price**, which is usually much more expensive than other prices offered, because if shippers do not want to wait for their goods, they can be shipped in the next available flight at an increased price. However, the most common type of pricing is a consolidated price. This price is used when an intermediary (e.g., freight forwarder) collects shipments from several small shippers and consolidates them to form one large shipment, thereby minimizing costs.

A unique costing item in airfreight is the **dimensional factor (DIM factor)**. The DIM factor is essentially the freight carriers' calculation of what items should weight based on their volume. The formula to calculate volume is $l \times w \times h$. Based on this calculation, air carriers would apply the DIM factor to estimate items' theoretical weight values. Then, carriers weight the package, compare the theoretical and actual weight, and the higher of the two weight values would apply for pricing purposes.

For example...

For example, FedEx and UPS use a DIM factor of 166 on domestic airfreight shipments (on inches and pounds). Therefore, if a package is 40 inches long, 30 in wide, and 50 inches high, the theoretical weight should be $(40 \times 30 \times 50) / 166 = 361.45$ pounds, which would round up to 362 pounds. If the actual weight was more than 361 pounds, the price for the actual weight would be applied. However, if the actual weight was less than 362 pounds, then the price for a 362 pounds package would be applied for shipping.

Ocean Freight



Figure 29. Ocean freight.
Developed by LINCS in
Supply Chain Management
Consortium.

Freight rates are typically quoted on an FCL or an LCL basis. Pound for pound, having an FCL usually costs substantially less than it costs to have an LCL. FCL shipments are usually priced per container, but LCL shipments are typically quoted on a weight or measurement of the shipment, which is more favorable for shipping companies. Similar to TL transport, several surcharges may be applied to ocean freight as well. These surcharges are outlined below.

- **Bunker adjustment factor:** This is an additional surcharge levied on the shippers to compensate for fluctuations in the price of ships' fuel and is also called a bunker surcharge.



- **Currency adjustment factor:** This is sometimes applied when currencies need to be converted.
- **Terminal handling charge:** This covers the charges for the movement of the freight when it is on the pier.

Learning Block 3 Summary

This learning block defines the impact of the costs involved in the various transportation modes. Speed of delivery is often important, but the cost of fast deliveries may not be worth the price. This learning block included explanations about a number of transportation modes and the reasons behind pricing. This information was included so an informed decision can be made about when different modes are being compared or when different options within a mode are being compared.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 3 Practice Questions

1. **The Bunker Adjustment Factor compensates for fuel price fluctuations for which mode of transportation?**
 - a. Motor Carrier
 - b. Ships
 - c. Rail
 - d. Pipeline

2. **Mileage (i.e., per mile) cost is an example of:**
 - a. Fixed cost
 - b. Total cost
 - c. Variable cost
 - d. Average cost

3. **Base pricing charged by truckload carriers is calculated using:**
 - a. Mileage rates
 - b. Over and above rates
 - c. Fuel charges
 - d. Toll and fuel charges

4. **FAK stands for:**
 - a. Fully automated kinetics
 - b. Fully automated knapsacks
 - c. Freight-all-kinds
 - d. Freight and knowing

5. **In airfreight, application of the dimensional factor is used to:**
 - a. Calculate the theoretical weight
 - b. Airport landing fees
 - c. Labor to unload the cargo
 - d. File the flight plan

6. **In the context of freight movement, AMC stands for:**
 - a. Absolute minimum charge
 - b. Miles covered
 - c. Movement covered
 - d. Absolute maximum charge

7. **An example of a fixed cost is:**
 - a. Accounting cost
 - b. Average cost
 - c. Absolute minimum charge
 - d. U.S. Dollars



- 8. Pricing rates established for less-than-truckload carriers are used for:**
- a. Standard cargo
 - b. Mileage
 - c. Differing freight characteristics
 - d. Seasonal adjustments
- 9. The most common airfreight pricing is:**
- a. Next flight out
 - b. Charter services
 - c. Dimensional factor
 - d. Consolidated
- 10. How many different rate classes are there for less-than-truckload motor freight?**
- a. 10
 - b. 15
 - c. 12
 - d. 18





Learning Block 4: Transportation Service Markets

Learning Block 4 Description

There are several different types of **operations** in the transportation services marketplace, and they are distinguished based on the nature of their businesses and the services they provide. In the equipment example provided in learning block 2, a buyer purchased a piece of manufacturing equipment and had it transported from Japan to the U.S. The buyer would have had several options at each stage of transport, including whether to deal with an operation directly or to go through an intermediary. This learning block will clarify the distinguishing features of these operations.

Learning Block 4 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize private fleets and transportation
- Understand **Asset-Based Carriers** and **owner-operators**
- Discuss **third-party logistics providers (3PLs)**
- Describe freight forwarders
- Explain **freight brokers**

Unit 1: Private Fleets and Transportation

Sometimes, shippers need to move freight and find it is more advantageous to transport it themselves, so they use private transportation. In private transportation, shippers own or lease certain pieces of equipment and use them to further their business (see *Figure 30*); this equipment is rarely, if ever, leased out to other companies. Therefore, companies who own private fleets are usually involved in industries other than transportation.

Most private transportation is completed using roads, so few companies have private fleets for non-road transportation (e.g., ocean or air). However, most pipelines are privately held and are usually not available for hire to other companies; even if private pipelines were available, most companies would not be able to use others' pipelines because they usually lead to specific companies' facilities.



As previously stated, private fleets tend to be more common for modes of ground transportation. For example, Walmart has a private fleet of more than 6,000 tractors and 55,000 trailers, which makes its private fleet larger than many other trucking companies (Walmart Private Fleet, n.d.). For other companies with private fleets, data suggest there are more than 33,000 companies in the U.S. with private fleets of 10 vehicles or more (Edwards, 2006). Private fleets not only haul freight, but they are also used to conduct multiple services, including work for cable, phone, and security companies. For example, AT&T owns a private fleet of trucks, which workers use to visit homes and provide customer service on different pieces of equipment.



Figure 30. Private transportation made on roadways. By Graham Richardson from Plymouth, England (DHL EY03HSDU) uploaded by oxyman) [CC BY 2.0], via Wikimedia Commons

Many advantages motivate companies to own private fleets, such as ensuring the best prices and the most convenience. For example, when large companies have the ability to move their own freight, outside transportation vendors provide competitive quotes because in-house transportation tends to be more convenient for companies. However, when outside vendors know companies have limited or no ability to move their own freight, vendors are less competitive with their rate quotes.

Unit 2: Asset-Based Carriers and Owner-Operators

Companies who are unable or uninterested in moving their own freight usually outsource freight movement to a specialized company. Companies can work directly with their freight companies, and other companies work through intermediaries. Large shippers and companies with substantial volumes of freight usually work directly with freight carriers known as asset-based carriers because they own their own trucks, tractors, and other pieces of equipment. Similarly, several small carriers own a handful of trucks operated by their owners (i.e., owner-operators).

Unit 3: Third-Party Logistics Providers

External suppliers and vendors who perform all or part of companies' logistics functions are known as 3PLs. Many large companies procure **raw materials** and finished goods from around the globe, so it is impractical, and sometimes impossible, to be present at procurement locations for ensuring efficient freight movement. Therefore, 3PLs interact personally with the freight for the companies who employ them. More specifically, 3PLs handle transportation needs for certain companies, including finding carriers to transport the freight, locating warehouses to store freight, and finding support equipment. Partnering with 3PLs is becoming increasingly popular because of the services they provide; in fact, over 85% of U.S. Fortune 500 companies now work with 3PLs (Magpantay, 2015). There are also different types of 3PLs. One type of 3PL includes asset-based carriers, indicating they move companies' freight on their own trucks and store it in their own warehouses. The other type of 3PL involves non-asset-based carriers, indicating they do not own any trucks or warehouses, but they choose the most available options from the open market.



Unit 4: Freight Forwarders

According to the **Federal Motor Carrier Safety Administration (FMCSA)**, a freight forwarder is an individual or entity available to the general public to provide transportation of property (except via pipelines, rails, or water) for compensation, which is provided when they

- Assemble and consolidate shipments, perform break-bulk, and distribute shipments
- Assume responsibility for transportation from the place of receipt to the place of destination (USDOT, 2014c)

Essentially, freight forwarders are intermediaries who carry out several different activities for their clients. In addition to storing, packaging, and handling the goods, they are also eligible to book cargo with transportation companies and issue their own bills of lading (which will be discussed in later learning blocks). Freight forwarders usually consolidate shipments from many smaller companies into larger shipments to receive volume discounts from freight carriers. Therefore, they are able to make profit margins by adding inflation factors to the prices quoted by carriers. With the volume discounts, these inflated prices are, in most cases, still lower than the prices small shippers and companies would be charged if they were working directly with freight carriers.



Figure 31. Freight forwarding. Developed by LINCS in Supply Chain Management Consortium.

As described, many of the descriptions, activities, and business models are similar between 3PLs and freight forwarders. Both are intermediaries assisting in freight movement, and they perform many of the same functions. As the transportation industry continues to grow and advance, it is difficult to recognize 3PLs from freight forwarders and vice versa; in fact, many freight forwarders brand themselves as 3PLs (Management Study Guide, 2013). However, the best way to recognize the difference between these intermediaries is to understand their focus. If the intermediaries' focus and expertise is specifically in transporting and not in warehousing, sorting, storing, consolidating, or repacking, then they are likely freight forwarders and not 3PLs. However, if their focus and business model is more general, they are likely 3PLs and not freight forwarders.

Unit 5: Freight Brokers

Another type of intermediary which facilitates the movement of freight for their customers, are known as freight brokers. Freight brokers' main purpose is to serve as a conduit for connecting freight carriers with shippers, similar to buying plane tickets using third-party websites (e.g., Priceline.com or Expedia.com). Freight brokers are not typically responsible for claims, insurance, etc., so they are less involved in the transportation process than 3PLs and freight forwarders.

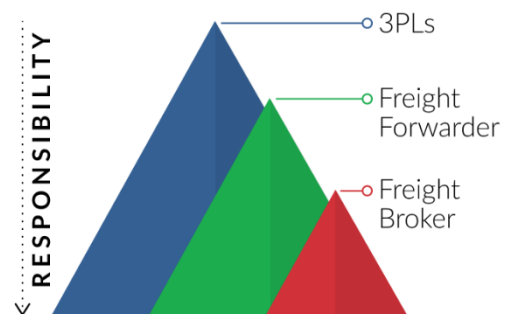


Figure 32. Levels of responsibility for freight intermediaries. Developed by LINCS in Supply Chain Management Consortium.



For example, freight brokers do not issue their own bills of lading (which will be discussed in later learning blocks); instead, carriers handle these types of documents directly.

To understand the difference between the freight intermediaries described before, it is important to remember each one provides varying levels of service, and they assume varying levels of responsibility. Typically, 3PLs assume the most responsibility and conduct the largest amount of service, followed by the freight forwarders, which are less involved in the process, and, finally, freight brokers assume the least amount of responsibility and service in the process (see *Figure 32*).

Learning Block 4 Summary

This learning block reviewed the different types of service companies operate within the transportation industry. They provide many different services, so it is important to understand what they truly offer with regard to the types of fleets owned, logistics providers involved, and the intermediaries included. This learning block also discussed the concept of owning private fleets, the reason organizations choose to own vs. outsource transportation vehicles, the various logistics providers included in the transportation process, and the options provided when choosing intermediaries.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 4 Practice Questions

1. **Private fleets are most common in which method of transport?**
 - a. Motor
 - b. Rail
 - c. Pipeline
 - d. Ocean

2. **Walmart operates a large private fleet with almost:**
 - a. 2,000 tractors
 - b. 4,000 tractors
 - c. 6,000 tractors
 - d. 10,000 tractors

3. **A key characteristic of a third-party logistics provider is:**
 - a. To schedule air cargo only
 - b. To perform all or part of companies' logistics functions
 - c. To provide motor carrier maintenance
 - d. Fleet management

4. **Companies maintain private fleets in order to:**
 - a. Lease vehicles for profit
 - b. Advertise their name on the trailer
 - c. Dominate the transportation industry
 - d. Maintain competitive pricing and convenience

5. **For a fleet to classify as a captive private fleet, the primary business usually:**
 - a. Has 50 drivers
 - b. Is something other than transportation
 - c. Maintains 500 trailers
 - d. Performs its own maintenance

6. **Which model offers more service and responsibility than do freight brokers?**
 - a. First party logistics providers
 - b. Small owner-operator
 - c. Third-party logistics providers
 - d. Fourth party logistics providers

7. **A Freight Broker's primary function is to:**
 - a. Connect freight carriers with shippers
 - b. File insurance claims
 - c. Observe container loading onto ships
 - d. Inspect goods which require shipment



8. **Third-party logistics providers who do not own any trucks, warehouses, or other equipment are also called:**
- a. Non-asset-based third-party logistics providers
 - b. Non-binding third-party logistics providers
 - c. Freight-after-knowing
 - d. Asset-weak third-party logistics providers
9. **AT&T has a large private fleet used to:**
- a. Haul packages for small companies
 - b. Keep technicians employed
 - c. Lease vehicles
 - d. Visit residences to provide customer service
10. **Which of these cannot issue their own bills of lading?**
- a. Third-party logistics providers
 - b. Independent carriers
 - c. Freight forwarders
 - d. Freight brokers





Learning Block 5: Transportation Technology

Learning Block 5 Description

Computers play a part in people's daily lives at home, in the workplace, and even during transit. Computers affect daily operations in the transportation field too—computer technology is changing the way transportation companies do business. This learning block will discuss how computers and networks function and how technological developments have impacted the transportation industry.

Learning Block 5 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Understand the basics of computer networks
- Summarize **electronic data interchange (EDI)**
- Define **transportation management systems (TMS)**
- Recall **automatic identification and data capture (AIDC)** systems such as **barcodes** and **radio frequency identification (RFID)**
- Explain **Global Positioning System (GPS)**
- Describe **collision avoidance systems**
- Discuss **logbooks** and **electronic logging devices (ELD)**

Unit 1: The Basics of Computer Networks

Computer Networks

Computer networks are made up of a series of connections (see *Figure 33*). The end points of those connections are called **clients**. Typically, a personal computer or smartphone would be a client. At the other end of the connection are large computers known as **servers**, which store information a client would request. When a user logs onto the network to access a page, the user's computer (the client) sends a request the server.

This system is how computer networks function, including the mother of all networks—the **Internet**. The ability to network machines has allowed the development of several modern tools put in place to ease transportation operations issues. These commonly used tools include EDI, TMS, and AIDC systems.





Figure 33. A computer network. Developed by LINCS in Supply Chain Management Consortium.

Unit 2: Electronic Data Interchange

EDI is defined as the electronic exchange of business documentation and information in a standardized format between computers, usually between different organizations. EDI replaces paper- or electronic-based documents with human readability with electronically coded documents in a language machines can read. With EDI, the sending computer creates the message and the receiving computer interprets the message without any human involvement. This improves transactional efficiency and reduces keystroke errors during manual entry processing.

One of the first places many companies implemented EDI was in the exchange of **purchase orders**. However, standard EDI language and transactions have been designed for the transportation industry, and they are widely used today. However, advances in computer technology, network technology, and transportation **software** will eventually replace EDI with the next generation of transactional processes (see Figure 34).



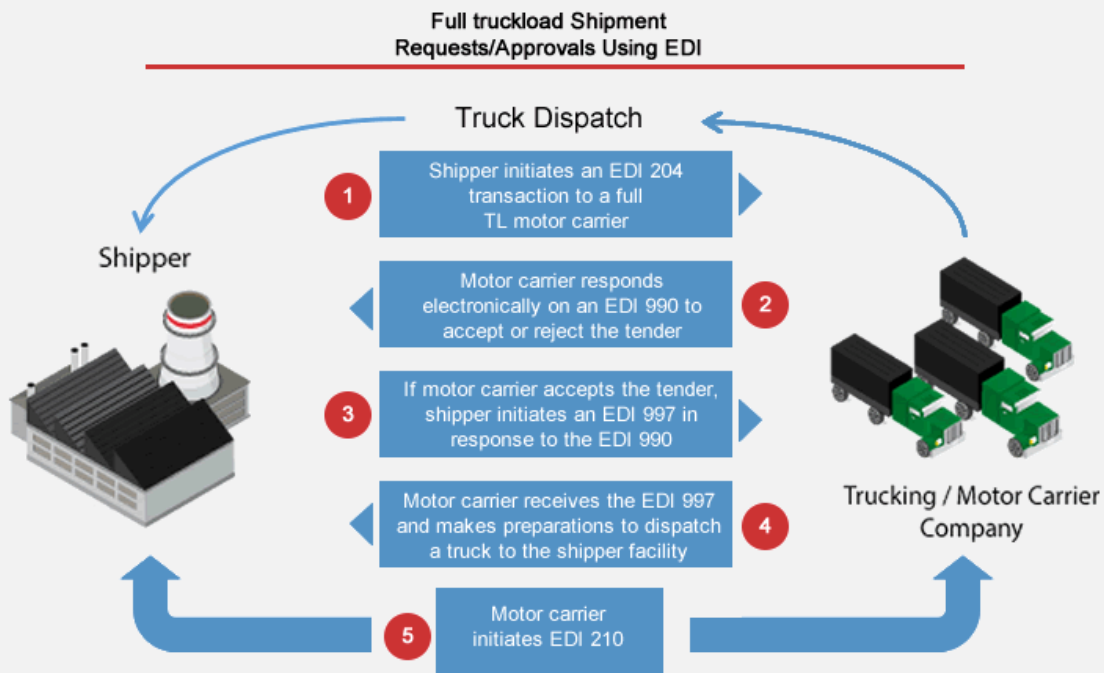


Figure 34. Full truckload shipment process. Developed by LINC'S in Supply Chain Management Consortium.

- 1 Shipper (manufacturer, **distribution center (DC)**, wholesaler, etc.) initiates an EDI 204 transaction (Motor Carrier Load Tender) to a full TL motor carrier. The EDI 204 includes:
 - Detailed pick-up and delivery information
 - Contact information
 - Description of goods, including weight and other units of measure
- 2 Motor carrier responds electronically on an EDI 990 (Response to a Load Tender) to accept or reject the tender including:
 - Acceptance or rejection of tender
 - Bid accepted or rejected (accepted bids include freight quote amount)
- 3 If motor carrier accepts the tender, shipper initiates an EDI 997 (Functional Acknowledgement) in response to the EDI 990
 - This serves as the receipt and lets the motor carrier know the tender and bid were accepted
- 4 Motor carrier receives the EDI 997 and makes preparations to dispatch a truck to the shipper facility
- 5 Motor carrier initiates EDI 210 (Motor Carrier Freight Details and **Invoice**)
 - This is for payment of freight charges (invoice)
 - Also Include payment instructions, delivery information, and proof of delivery

EDI Forms in this example are sent/received in an EDI (computer to computer) environment between the shipper and the carrier. The EDI forms use standard data sets to assure needed information is provided between the shipper and the carrier.



Unit 3: Transportation Management Systems

Consider a typical company producing goods at multiple geographic locations. Each location needs to ship freight out to different destinations, customers, and distributors. These needs create several shipping complexities for the company. If each location produces different goods, the rate classes (see learning block 2) would vary across locations. If each location is in a different place, a different set of freight carriers would be involved at each location. Each of these carriers would have their own contract with the company, and there can be substantial variance in terms across carriers for things like FAKs and discounts. Finally, the modal split would be different at the various locations as well. These factors can cause confusion and logistics problems at each location and shipments may be missed.

A TMS solution would be appropriate for a company producing goods at multiple locations. TMS is a powerful piece of computer software which controls, coordinates, and manages various transportation activities, including helping the user select the right carrier, rating the movement, tendering the load, printing the shipping documents, tracking the load, and billing the correct party for the freight. Key features of a good TMS solution include the 3 R's:

Rating	Rating: TMS helps shipping managers choose the carriers with the best cost by factoring in issues like FAK groupings, discounts, and accessories.
Routing	Routing: TMS helps shipping managers select the optimal routes to deliver freight to customers.
Reporting	Reporting: TMS helps shipping managers track carrier performance, customer service, cost, and other measures of carrier quality

Unit 4: Automatic Identification and Data Capture Systems

AIDC systems are tools for automatically identifying objects, collecting data about them, and entering the data directly into computer systems: technologies included in AIDC systems include barcodes and RFID.



Barcodes

The most common form of a barcode is the linear barcode, as shown in *Figure 35*. For the barcode to be scanned, it must be accurately printed and have adequate contrast between the bars and spaces, which is why a barcode is typically in black and white. Everything from cans of soup to entire trucks and rail cars have been marked with barcodes to easily identify them.

The beauty of a barcode is, depending on the coding convention used, almost any information can be embedded in the barcode, which is then read by a scanner. Once the barcode has been read, the information is sent directly to a database. The barcode provides a highly efficient method for automating freight and inventory tracking. For example, FedEx and UPS use barcodes for their packages. FedEx and UPS scan the barcodes to determine the final destinations for packages, and the destinations determine how packages are sorted and shipped.



Figure 35. Barcode. Acquired from pixabay.com.

Radio Frequency Identification

While barcodes are highly efficient in freight and inventory tracking, they have one drawback—they need to be seen to be read. Although barcodes are faster than manual counting, they are still time consuming for taking inventory of goods in transit. RFID solves this problem because, unlike barcodes, which are read by lasers or cameras, RFID tags are read by radio waves (see *Figure 36*). Therefore, RFID tags do not need to be seen to be read and a stock-taker can read several thousand RFID tags at the same time. According to estimates, RFID speeds the task of inventory and stock taking by over 94%.

RFID provides several benefits to transportation companies. RFID can ensure the right products are loaded onto the correct trucks. It allows companies to track the products being shipped. RFID is also used to track the containers used for shipping products. Accuracy is especially important when high value products are being shipped because companies lose more money if errors occur while transporting products with more value.

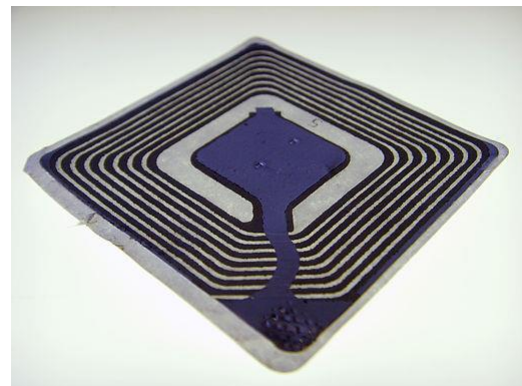


Figure 36. An RFID tag. By No machine-readable author provided. Maschinenjunge assumed (based on copyright claims). [GFDL or CC BY-SA 3.0], via Wikimedia Commons.

Unit 5: Global Positioning Systems

GPS has had a huge positive impact on the transportation industry. Vehicles and cell phones equipped with GPS allow real-time, non-intrusive monitoring of freight and personnel.



GPS is based on a network of satellites in the Earth's atmosphere (see *Figure 37*). Each satellite circles the planet twice a day in one of six orbits to provide continuous, worldwide coverage. Each satellite broadcasts radio signals and those signals are received and converted by GPS devices to determine their exact location.

In the transportation industry, GPS technology is critically important in order to map the most efficient routes for time-sensitive freight, to monitor traffic, and to maximize routes for enhanced fuel efficiency.

How GPS Works

GPS is a constellation of at least 24 satellites flying above the earth's surface. Each one circles the planet twice a day in one of six orbits to provide worldwide coverage.

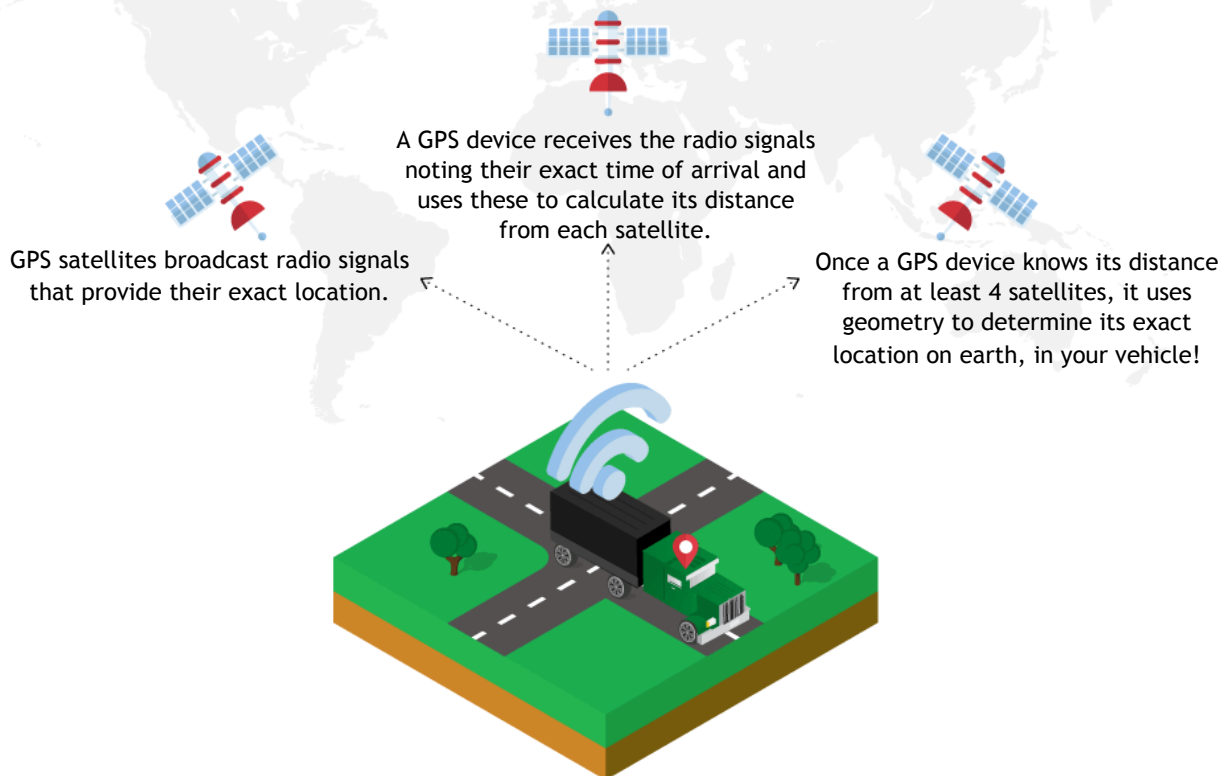


Figure 37. GPS functionality. Developed by LINCS in Supply Chain Management Consortium.



Unit 6: Collision Avoidance Systems

Collision avoidance systems and lane departure systems are technological developments designed to detect the likelihood of upcoming crashes. These devices are attached to or installed on the car itself. Once these systems detect possible crashes, depending on the type of system used and the programming of the system, drivers will see a warning or the car will take preventative action (e.g., applying the brakes). Collision detection systems use radar to keep track of the distance between the vehicle with a collision avoidance system and the surrounding vehicles. If the distance between vehicles rapidly shortens, these systems assume drivers do not see the vehicles in front of them and warns drivers accordingly. A similar idea was used for the adaptive cruise control system, in which a vehicle will automatically adjust its speed based on the speed of the vehicle in front of it.



Figure 38. Collision avoidance systems help prevent accidents. Acquired from pixabay.com.

Unit 7: Logbooks and Electronic Logging Devices

In the U.S., the FMCSA imposes certain restrictions on truck drivers, including how long they are allowed to drive in one day and how many days in a row they are allowed to drive before taking mandatory time off. To comply with these regulations, commercial vehicle drivers are expected to carry a logbook which records information, such as hours spent on and off duty, hours spent driving, and hours spent in the berth (see Figure 39).

DRIVER'S DAILY LOG		M / D /20	Personal Use Distance (km)	Distance Travelled (km)	Unit #	Licence Plate #	Prov																				
Carrier			End	End	Truck																						
Principal Address			Start	Start	1																						
Home Terminal			Total	Total	2																						
Driver's Name		I certify that this information is true and correct			3																						
Co-Driver's Name		Signature			4																						
Work Cycle	Midnight	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
1 (70/7)	Off-Duty	[Graph showing duty status over 24 hours]																								1	
2 (120/14)	Sleeper 2 Berth	[Graph showing duty status over 24 hours]																								2	
Off Duty Deferral	Day 1	[Graph showing duty status over 24 hours]																								3	
Day 2	Driving	[Graph showing duty status over 24 hours]																								4	
On-Duty (not driving)		[Graph showing duty status over 24 hours]																								Total Day	
Remarks		[Remarks section]																								Hours available for tomorrow (from monthly recap)	
Shipping Document No.(s)		Shipper(s) or		Commodity		CTPAT																					

Figure 39. Sample of a paper-based log book. Developed by LINCS in Supply Chain Management Consortium.



A standard, paper-based logbook is similar to a piece of graph paper, and drivers mark off duty, sleeper berth, driving, and on duty hours on a series of horizontal lines. Logbooks should also include the date, name of carrier, truck number, and total number of miles driven in a 24-hour period. If the driver has driven more than one truck, this must also be reported in the trucking logbook. Driver logbooks are reviewed by highway police at random and by the U.S. Department of Transportation's (USDOT) travelling patrols.

In the European Union, commercial vehicles are required to have electronic logging devices (EDLs) installed, and government agencies monitor them, while U.S. drivers and carriers continue using paper-based logbooks. On March 13, 2014, the FMCSA proposed making ELDs mandatory on U.S. interstate commercial buses and trucks (USDOT, 2014a). However, the ELD proposal is often debated in the trucking industry. Some companies want ELDs to ease the scrutiny and compliance of monitoring, but others are more hesitant because of high setup costs and other issues.

Unit 8: Cold Chain Technology

The term **cold chain** technology refers to the transportation of items required to be kept at a constant temperature, either cold or hot, to keep these types of products fresh, safe, and healthy. Cold chain technology not only transports these products, but it also handles the diagnostics, research, and investigational materials mandatory for controlled temperatures.

Consumable products usually require cold chain technology during transport, but other products to require this technology include pharmaceuticals and items for medical use (e.g., vaccines, blood, and live tissue).

The packing technology used for cold chain transportation falls into two categories: active shipper/package and passive shipper/package.

- An **active shipper/package system** utilizes a temperature-controlled container with a fan and dry ice and is run electronically; this system usually has two refrigeration units.
- A **passive shipper/package system** typically consists of gel packs, freezer packs, and/or dry ice within an insulated box; these systems can be single use or regulated. A **regulated shipper** can hold a product at an exact temperature for either 36 or 72 hours.



Figure 40. Refrigerated truck. Developed by LINCS in Supply Chain Management Consortium.



Other types of cold chain technology include:

- **Eutectic plates:** plates similar to gel packs
- Liquid nitrogen
- Quilts for travel times which are too short to justify more expensive equipment
- Reefers (refrigerated containers)

Ocean carriers shipping products requiring cold chain technology are called reefer ships. About 2.5% of ocean carriers are reefers ships (DYNAMAR, 2014). Reefer ships specialize in transporting temperature controlled products by using controlled atmosphere technology and remote monitoring technology. Reefer ships typically have higher cruising speeds to transport goods to their destinations with as little travel time as possible. The three different types of reefer ships are:

Conventional reefers

These reefer ships have a controlled temperature throughout the ship and have a top-opening hatch which allows cargo to be raised or lowered through.

Containerized reefers

These reefer ships have refrigerated containers onboard.

Side-door reefers

These reefer ships have a controlled temperature throughout and allow cargo to go in and out through the side of the ship.

Learning Block 5 Summary

This learning block defined key technologies to enable the various modes of transportation to operate effectively, efficiently and reliably. While forms of technology such as computer networks, EDI, TMS, barcodes, GPS, and ELDs are key components of a good transportation system, the processes are optimized when the technologies are synchronized to form a total transportation management system.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 5 Practice Questions

1. **Computer networks in the transportation industry enable the efficient use of:**
 - a. Receipt of satellite signals
 - b. Electronic data interchange and transportation management systems
 - c. Lane departure systems
 - d. Mandatory use of electronic logging devices

2. **The function of a server is to:**
 - a. Scan barcodes
 - b. Store and process information
 - c. Print reports
 - d. Send request to clients for information

3. **The exchange of documents between trading partners without any human interferences is conducted through:**
 - a. Transportation management systems
 - b. Global Positioning System
 - c. Electronic data interchange
 - d. Electronic logging devices

4. **Drivers use these to pay tolls at tollbooths:**
 - a. Barcode stickers
 - b. Cell phones
 - c. Radio frequency identification tags
 - d. Log books

5. **A Global Positioning System uses which type of technology to pinpoint device accuracy used in planning efficient routes?**
 - a. Satellite
 - b. Electronic data interchange
 - c. Internet
 - d. Transportation management systems

6. **Radio frequency identification uses this technology to identify goods:**
 - a. Personal computer
 - b. Satellite
 - c. Laser
 - d. Radio frequency



7. A transportation management system uses a rating feature to:
- a. Choose carrier based on cost
 - b. Research a Global Positioning System
 - c. Link electronic data interchange networks
 - d. Setup cold chain limits
8. An automatic identification and data capture system which does not need to physically see the item to read it is a (n):
- a. Global Positioning System
 - b. Radio frequency identification system
 - c. Barcode
 - d. Transportation management systems
9. Which technology is critical for driverless vehicles?
- a. Electronic data interchange
 - b. Servers
 - c. Laptops
 - d. Collision avoidance systems
10. A cold chain active shipping package uses:
- a. Liquid nitrogen
 - b. Gel packs
 - c. Refrigeration units
 - d. Quilts





Learning Block 6: Transportation Regulations

Learning Block 6 Description

Regulations and contracts make up a large part of transportation operations. While reading, remember regulations change regularly, so it is important to follow any updates on the material before carrying out the information included here.

The freight carriage business handles many regulations and contracts, including those with carriers, customers, and suppliers. Additionally, different regulations and contracts may apply for international shipping compared to domestic shipping, and vice versa. Regulations are important for a number of reasons, including following the law, being able to conduct business smoothly, and keeping everyone in the transportation industry safe.

Regulations change over time, but some are fairly constant, depending on specific areas in transportation operations. For example, regulations about contract laws are reasonably constant over time. Most countries and U.S. states who follow common law systems define contracts fairly similarly, but regulation definitions (e.g., freight pricing) have changed over time and had periods of tight and loose government regulations. These changing regulations will be detailed, along with contracts, in this learning block.

Learning Block 6 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Understand the elements of a legal contract
- Explain **uniform commercial code (UCC)**
- Discuss key **federal motor carrier safety regulations**
- Define **cabotage** laws in the U.S.
- Describe the role of key U.S. government agencies



Unit 1: Contracts

Contracts are central to any transportation professional's life because they are needed for shipping products (see *Figure 41*). In its most basic form, a contract can be considered a legally enforced agreement between two or more parties. People make agreements every day, but not all agreements can be considered a valid contract. A contract is generally understood in the transportation industry as an agreement between individuals or groups in which parties will complete tasks in exchange for other completed tasks; therefore, parties are expected to perform according to contract terms. If parties do not perform as contracts are outlined, then those parties would face law remedies.



Figure 41. Example of a contract. Acquired from pixabay.com.

An example of a simple contract would be when a shipper sends an email to a trucker to request the movement of goods from a specific source to a specific destination on a specific date for \$1,000. The trucker sends a return email and agrees. These emails can be classified as a contract. Contracts are written and considered within three essential terms: an offer, **acceptance**, and consideration.



Figure 42. Offer. Developed by LINC in Supply Chain Management Consortium.

Offer

An offer is a proposal or suggestion presented by individuals or groups when they are willing to complete a task. For example, a shipper asks a trucker to move 20 pallets of goods, each weighing 50 pounds, from Boston to Baltimore for \$1,800 on October 10th. The shipper made a specific offer, in specific volumes (20 pallets at 50 pounds each) on a specific date (October 10th), from/to specific places (Boston/Baltimore) at a specific price (\$1,800). This constitutes a valid offer.



Figure 43. Acceptance. Developed by LINC in Supply Chain Management Consortium.

Acceptance

The next important part of contracts is the acceptance. Legally, contracts do not exist until offers are formally accepted in written or verbal forms. Though they usually are, acceptances do not always need to be the same as offers; in fact, the UCC states acceptances can add terms which can become a part of the contract, unless offerors object within a reasonable amount of time. If offers and acceptances match, this agreement leads to contracts. If offers and acceptances do not match, this is known as a **negotiation**: a counteroffer to an individual's or groups original offer. In negotiations, offers and counteroffers are exchanged until both sides reach an agreement; this is also called a **meeting of the minds**.





Figure 44. Consideration.
Developed by LINC3 in
Supply Chain Management
Consortium.

Consideration

Consideration is a form of mutual obligation in which the parties are bound by contracts to perform at a certain level and agree to carry out their responsibilities. Considerations can hold value and give contracts legal validity. In the previous example, the \$1,800 the shipper agreed to pay was the consideration. The consideration (assuming the trucker accepted the offer) was stated; by emailing an agreement, the trucker agreed to move the goods in exchange for the shipper's \$1,800.

Unit 2: Uniform Commercial Code

When buying products nationally, it is important to understand the regulations involved are for the purchasing process and the ownership of the products. To solve potential misunderstandings among states, the UCC recommends a set of guidelines strict enough to be considered laws. The UCC has been enacted in 49 out of the 50 U.S. states (Louisiana is the only exception, but their enacted version has only a few differences from the original UCC). The UCC thus provides the legal basis for the terminology used in domestic U.S. transactions between parties in a transaction.

Several articles in the UCC focus on certain transactions (e.g., Article 2 for sales and Article 2A for leases). Article 7 of the UCC is most relevant article to the transportation industry: it covers warehouses, bills of lading, titles, and similar topics. In this article, the UCC defines several different terms of trade applicable in domestic transportation, including **Free on Board (FOB)** and **Free Alongside Ship**. These terms of trade determine who pays for transportation, who owns the goods in transit, and who can file claims, if needed. Commonly used terms, according to the UCC, are listed in *Figure 45*.

UCC Term	Responsibility for Payment of Freight Charges	Ownership of Goods in Transit	Who can file claims
FOB Destination, Freight Prepaid (Allowed)	Seller	Seller	Seller
FOB Destination, Freight Collect	Buyer	Seller	Seller
FOB Destination, Freight Prepaid and Added (Charged back to Buyer on invoice)	Seller	Seller	Seller



UCC Term	Responsibility for Payment of Freight Charges	Ownership of Goods in Transit	Who can file claims
FOB Shipping Point, Freight Prepaid (Allowed)	Seller	Buyer	Buyer
FOB Shipping Point, Freight Collect	Buyer	Buyer	Buyer
FOB Shipping Point, Freight Prepaid and Added (Charged back to Buyer on invoice)	Seller	Buyer	Buyer

Figure 45. UCC FOB terms and their implications. Developed by LINCS in Supply Chain Management Consortium.

Unit 3: Federal Motor Carrier Safety Regulations

Federal motor carrier safety regulations are important to follow for many reasons. People have argued the regulations are unnecessary, but these regulations have helped many people stay safe in different situations (e.g., having speed limits on roads). Specifically for commercial freight, these regulations are set by the FMCSA, an agency operating within the USDOT. The FMCSA has issued several regulations designed to minimize incidents caused by commercial motor carriers operating on public roads.

Federal Motor Carrier Safety Administration Definition of Commercial Vehicles

According to the FMCSA, a **commercial motor vehicle** is defined as a self-propelled or self-towed motor vehicle used on highways in **interstate commerce** to transport passengers or property when the vehicle falls into one of four categories:

- 1 The vehicle has a gross vehicle weight or a gross combination weight of 10,001 pounds or more, whichever is greater.
- 2 The vehicle is designed or used to transport more than eight passengers, including the driver, for compensation.
- 3 The vehicle is designed or used to transport more than 15 passengers, including the driver, without compensation.
- 4 The vehicle is of any size and is used to transport hazardous material in quantities which require a **placard** (USDOT, 1988).



According to this definition, these regulations only apply to commercial carriers of a particular sort and not to personal vehicles or non-commercial drivers. Taxicabs are also exempt from these regulations. The FMCSA Safety Regulations section includes information about key safety regulations issued by the FMCSA.

Federal Motor Carrier Safety Administration Safety Regulations

Two examples of FMCSA safety regulations are:

- **Cell phone ban:** Starting in January of 2012, drivers of commercial vehicles have been prohibited from holding a cell phone while operating a vehicle. This does not mean drivers cannot speak on their cell phones; instead, it means drivers cannot hold their cell phones, so using cell phone with speakers engaged or with earpieces is acceptable.
- **Emergency equipment:** Commercial vehicles must be equipped with appropriate fire extinguishers, warning devices, and spare fuses, if needed.

Federal Motor Carrier Safety Administration Driver Rules

The FMCSA also has a series of regulations for people who are allowed to become a commercial motor vehicle driver. Drivers must satisfy specific requirements to drive commercial motor vehicles:

- ✓ Be at least 21 years old to operate in interstate commerce (between states)
- ✓ Be at least 18 years old to operate in **intrastate commerce** (within a state)
- ✓ Be at least 21 years old to transport hazardous material, if the vehicle requires placarding
- ✓ Read, speak, and understand the English language well enough to communicate with the general public and regulatory officials
- ✓ Be able to operate commercial motor vehicles safely
- ✓ Have the ability and training to safely load and secure cargo
- ✓ Possess a valid medical examiner's certificate or medical waivers and exemptions
- ✓ Possess a valid driver's license for the type of vehicle being operated

Hours of Service Rules

The FMCSA also issued a series of guidelines about how much drivers are allowed to drive, and these are called the **hours of service (HOS) rules**. Fatigue, both mental and physical, is often a main contributor in truck incidents because it can cause lapses in judgment and concentration, especially at higher speeds on interstate highways. In fact, driver fatigue and consequential judgment errors have been blamed for over 12% of crashes involving large trucks and buses in 2012 (USDOT, 2014b). Drivers must adhere to the HOS rules. These guidelines continue to change, so the accuracy of these rules cannot be guaranteed subsequent to publication of this document.

- 1 Drivers can drive up to 11 hours, following 10 consecutive hours off-duty; however, in no case should drivers drive for 14 hours after coming on duty.
- 2 Drivers must take a 34-hour break from driving and other duties once every 168 hours (i.e., every 7 days). In addition, drivers cannot drive for more than 60 to 70 hours in any time frame of 7 to 8 consecutive days.
- 3 Drivers must keep a daily record of their activities for each 24-hour cycle in a daily logbook. Entries should be kept in the employers' office and be reviewed for accuracy and compliance.



Unit 4: Cabotage

Cabotage, from the French word “caboter,” means to sail coastwise or “by the capes” to reserve a country’s domestic maritime transportation for its own citizens. U.S. cabotage laws have been in place since 1789, and the Jones Act, titled after its sponsor, Senator Wesley Jones, was passed as part of the Merchant Marine Act of 1920. As a result, federal legislation imposes four primary requirements on vessels delivering goods between U.S. ports (see *Figure 46*). The vessels must be:

- Owned by U.S. companies that are controlled by U.S. citizens with at least 75 percent U.S. ownership,
- At least 75 percent crewed by U.S. citizens,
- Built (or rebuilt) in the U.S., and
- Registered in the U.S.

These requirements apply to all trade between ports in the U.S. mainland, Alaska, Guam, Hawaii, The Mariana Islands, Puerto Rico, and the Virgin Islands. Cabotage principles are designed to guarantee the participation of U.S. citizens in its own domestic trade. These laws also sustain our merchant marine and provide a preference to U.S. labor and industry.

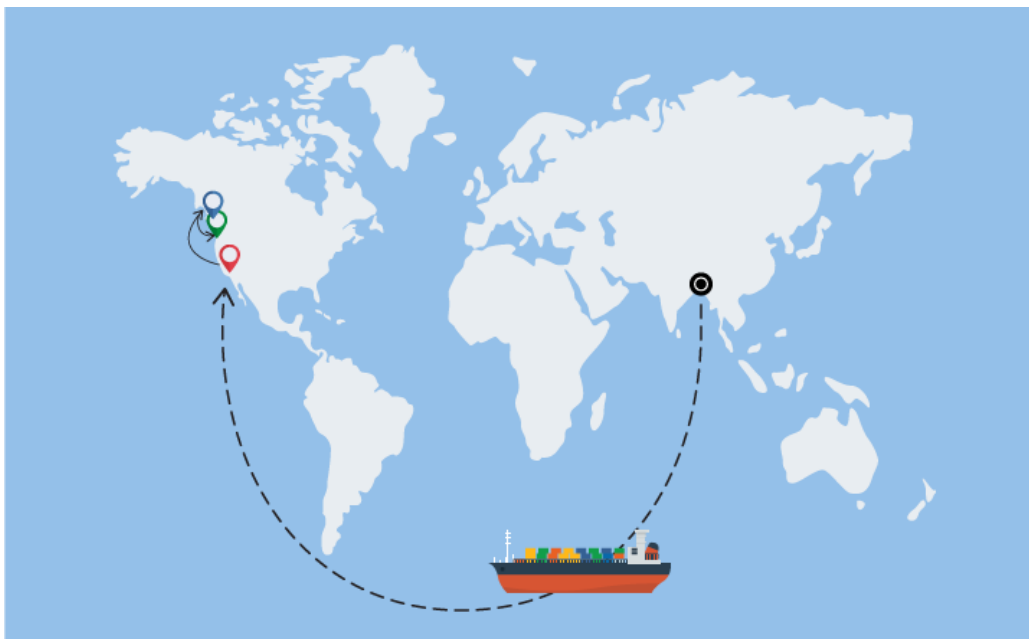


Figure 46. U.S. Cabotage laws support U.S. labor and a domestic maritime industry. Developed by LINCS in Supply Chain Management Consortium.

For example...

A ship registered in Philippines is loaded with cargo and sets sail for the U.S. port of Los Angeles, departing from China. When it arrives at the Port of Los Angeles, it drops the portion of its U.S. cargo destined for Los Angeles. The same ship then proceeds to Seattle, Washington to drop off more, and then proceeds to Portland, Oregon to drop off the remaining cargo. Once the ship is completely off-loaded in Portland, it is re-loaded with cargo destined for Tokyo, Japan (a foreign



location).

In this example, the ship complies with U.S. cabotage laws by dropping cargo at multiple U.S. ports and then picking up cargo destined for a foreign location, in this example, Tokyo, Japan.

Based on U.S. cabotage law, the cargo picked up by the ship in Portland could not have been delivered to another U.S. port. Had the ship also picked up cargo in Los Angeles and/or Seattle (or any U.S. port), that cargo could not be delivered to another U.S. port, only to a foreign port.

However, foreign registered ships are permitted to pick up empty containers at one U.S. port, and drop them at another U.S. port.

Unit 5: The Role of Key U.S. Government Agencies in Transportation

As discussed previously, the transportation industry contains many regulations, and people involved in the transportation field should understand the regulations applicable to their specific roles. This unit lists key agencies and their main roles as they relate to the transportation sector. Further details about the latest regulations can be found on their respective websites.

U.S. Department of Transportation

The role of the USDOT is to serve the U.S. by ensuring a fast, safe, efficient, accessible, and convenient transportation system.



Federal Highway Administration

This institute administers intermodal transportation programs in cooperation with states.



Federal Railroad Administration

This organization oversees federal freight railroad safety.



Federal Aviation Administration

This administration manages civil aviation safety and administers the U.S. air traffic control system.





Maritime Administration

This agency oversees federal waterborne transportation initiatives (e.g., ships and shipping, shipbuilding, port operations, vessel operations, national security, environment, safety, and the merchant marine system).



Federal Motor Carrier Safety Administration

As previously discussed, the FMCSA enforces safety regulations for commercial motor vehicle drivers and vehicle safety.



Federal Pipeline and Hazardous Materials Safety Administration

This **Federal Pipeline and Hazardous Materials Safety Administration** regulates, researches, and educates to improve the safety of pipeline and hazardous materials transportation.



National Highway Traffic Safety Administration

This organization administers safety programs and sets and enforces standards for federal safety and Corporate Average Fuel Economy fuel efficiency. The agency also regulates motor vehicles and equipment, investigates defects in motor vehicles, provides grants to state and local governments for highway safety programs, and conducts research on driver behaviors and traffic safety.



Surface Transportation Board

This board is an independent, bi-partisan agency housed within USDOT; it is responsible for the economic regulation of interstate surface transportation (primarily railroads) within the U.S. The board also ensures competitive, efficient, and safe transportation services are provided to meet the needs of shippers, receivers, and consumers. This board also resolves railroad rate and service disputes and reviews proposed railroad mergers.

Department of Homeland Security

The Department of Homeland Security's mission is to secure the nation from the many threats the U.S. faces. This includes areas ranging from aviation and border security to emergency response and cybersecurity.



U.S. Customs and Border Protection

The U.S. **Customs and Border Protection** facilitates lawful international travel and trade; prevents the illegal entry of goods and people into the U.S.; integrates enforcement of customs, immigration, border security, and agricultural protection; inspects cargo, including containers; and examines ship crews and cruise ship passengers arriving in U.S. ports from any foreign port.

Transportation Security Administration

This **Transportation Security Administration** was created to strengthen the security of the U.S. transportation systems and to ensure the freedom of movement for people and commerce. Alongside the Customs and Border Protection, it is responsible for Operation Safe Commerce, which attempts to verify the contents of containers at their point of origin, ensures the physical integrity of the containers in transit, and tracks the movement of cargo and passenger transportation from origin to destination.

U.S. Coast Guard

The **U.S. Coast Guard** is one of the five armed forces of the U.S. and the only military organization within the Department of Homeland Security. It safeguards U.S. maritime interests around the world and evaluates, boards, and inspects commercial ships as they approach U.S. waters. The Captain of the Port is the Coast Guard officer responsible for the security and safety of vessels and waterways in each U.S. port area.

Federal Maritime Commission

The **Federal Maritime Commission** regulates U.S. ports and port operations and the U.S. international ocean transportation system, and it investigates and rules on complaints regarding rates, charges, classifications, and practices of common carriers, **marine terminal operators**, and **Ocean Transportation Intermediaries**. In addition to administering the Shipping Act of 1984 and the Ocean Shipping Reform Act of 1998, this organization also licenses shipping companies. These acts provide marine terminal operators with anti-trust immunity under certain conditions to enter into agreements with each other to discuss rates, conditions of service, or cooperative working arrangements. The Federal Maritime Commission reviews and processes these agreements, ensuring they contain no provisions likely to produce an unreasonable increase in transportation costs or an unreasonable decrease in service.

National Transportation Safety Board

This agency independently investigates air, rail, marine, and pipeline accidents and determines probable cause. The organization also conducts plenty of research to recommend safety improvements, and it coordinates post-accident victim assistance.



Learning Block 6 Summary

This learning block defined the importance of creating and following regulations and contracts within transportation functions to ensure safe and well-defined processes for shipping products. Additionally, this learning block covered several of the most important topics about regulations and contracts in the transportation industry including the UCC governing U.S. transactions, HOS rules for public safety, and cabotage, and the role of various U.S. government agencies.



*Figure 6. Transportation Operations.
Developed by LINCS in Supply Chain
Management Consortium.*



Learning Block 6 Practice Questions

1. To help promote safety and comply with Federal Motor Carrier Safety Administration hours of service rules, commercial drivers must:
 - a. Maintain a daily driving record log for each 24-hour cycle
 - b. Attend a weekly hours of service rules class
 - c. Attend a driver safety class once every month
 - d. Get a monthly vision screening exam

2. A company asks a trucker to move goods from the company's factory to a remote warehouse. Is this an offer?
 - a. Yes, because there was an agreement (i.e., acceptance)
 - b. No, because it was only verbal
 - c. No, because there was not something of value offered (i.e., no consideration)
 - d. Yes, because it involved the movement of goods

3. Which type of law or agency prohibits the German flag carrier Lufthansa to operate commercial flights from Dallas, Texas to Miami, Florida?
 - a. U.S. Customs
 - b. U.S. Coast Guard
 - c. Cabotage
 - d. U.S. National Transportation Safety Board

4. Article 7 of the Uniform Commercial Code does not cover:
 - a. Warehousing
 - b. Bill-of-lading
 - c. Titles
 - d. Hours of Service rules

5. The Uniform Commercial Code has been fully enacted in 49 of the 50 U.S. states except:
 - a. New Mexico
 - b. Louisiana
 - c. California
 - d. South Carolina

6. An element not necessary for contract is:
 - a. Offer
 - b. Acceptance
 - c. Consideration
 - d. At least two signatures



7. **UCC stands for:**
- a. United Committee on Charges
 - b. Universal Contract Carrier
 - c. United Contract Carriage
 - d. Uniform Commercial Code
8. **What is the minimum age for driving an interstate truck?**
- a. 18
 - b. 21
 - c. 25
 - d. 32
9. **According to the Uniform Commercial Code, FOB stands for:**
- a. Free on Board
 - b. Freight on Board
 - c. Freight on Balance
 - d. Free on Basis
10. **A driver can drive up to 11 hours following 10 consecutive hours off-duty. Driver on- and off-duty hours are dictated by the:**
- a. Carrier contracts
 - b. Uniform Commercial Code
 - c. International Commercial Terms
 - d. Hours of service rules





Learning Block 7: Transportation and Global Supply Chains

Learning Block 7 Description

This learning block deals with logistics and transportation in an international context. The importance of international trade, documents needed to facilitate global transportation, and the terms and conditions used in the movement of merchandise goods across borders are discussed in this learning block.

Learning Block 7 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Explain the importance of international trade
- Define **international commercial terms (INCOTERMS)**
- Name key documents in international trade

Unit 1: The Importance of International Trade

The World Trade Organization (WTO) is a forum where governments can negotiate trade agreements. The stated goal of the WTO (2015) is to "help trade flow as freely as possible—so long as there are no undesirable side effects—because this is important for economic development and well-being." As of June 2014, the WTO had 160 members (WTO, 2015). The WTO also tracks the statistics of world trade. The value of international trade is significant because the U.S. exports approximately 1.580 trillion dollars of product, second only to China, and imports more than 2.359 trillion dollars of product, which makes the U.S. the largest importer of products (WTO, 2014).

World trade, interregional trade, and intraregional trade have increased tremendously, and the transportation sector has expanded as a result. Since ocean and air transportation dominate global trade, the statistics of these two sectors give a good indication of the general growth of the transportation sector. The world maritime fleet grew from 8,034 million tons loaded in 2007 to 9,548 million tons loaded in 2013 (United Nations Conference on Trade and Development, 2014). Passenger traffic in airlines grew from around 370 billion revenue passenger kilometers in 2007 to around 470 billion revenue passenger kilometers in 2012 (International Air Transport Association, 2013). In addition, airfreight traffic grew from 14.8 billion freight ton kilometers in 2007 to 15.2 billion freight ton kilometers in 2012, which includes a severe crash to around 12 billion freight ton kilometers during the height of the global recession in 2009 (International Air Transport Association, 2013).



Figure 47. International trade. Developed by LINCS in Supply Chain Management Consortium.



Unit 2: International Commercial Terms

USPS, FedEx, or UPS may ask specific questions when someone sends documents or packages through their service to determine the terms and conditions the shipper wants and what price they are willing to pay:

- Who is paying for the shipment? Return shipments are often paid for by the business who sold the products via return labels.
- Does the shipper want insurance? If yes, then how much?
- Does the shipper want priority mail/overnight delivery (air) or normal delivery (road)?
- Does the shipper want confirmation the document or package has arrived?

Even though these questions appear simple, the environments for business can differ among countries by culture, regulatory and legal environments, language (even if English is spoken), and ways of doing business. To prevent confusion and unnecessary litigation, the International Chamber of Commerce, headquartered in Paris, France, came up with a set of standard rules called INCOTERMS in 1936. Over the years, there have been several modifications to these rules, and the current eighth version is called INCOTERMS® 2010, which came into effect on January 1, 2011 (ICC, 2010). The INCOTERMS are three-letter abbreviations to help answer three basic questions:






- 1 Who pays for the transportation?
- 2 Who owns the title of the goods?
- 3 When does the risk pass from the buyer to the seller and who pays for the liability?

The INCOTERMS are prominently written in transportation documents, including the **bill of lading**, the contract, the **commercial invoice**, and the **packing list**, in addition to other documents prescribed by buyers and sellers. The 11 INCOTERMS and a brief description of each are described in this unit. Carriers mentioned in the descriptions of the INCOTERMS may be substituted for first carrier in the case of multimodal transportation.








International Commercial Terms








DESCRIPTION	    	FREIGHT/RISK	MORE DETAILS						
EXW Ex Works	<table border="1"> <tr><td style="background-color: #0056b3; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #ffc000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #cc0000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Seller's Premises Risk Seller's Premises	Ex Works The INCOTERM ex works (EXW) is indicative of the seller being responsible for making the goods available at the seller's premises. The buyer bears transportation costs from the seller's premises to the destination. Ownership of goods transfers from the seller to the buyer when goods are handed over to the carrier and the carrier leaves the seller's premises. Risk and liability pass to the buyer as soon as goods are made available to the buyer. The modes of transportation available with EXW goods are air, rail, road, multimodal, containerized, sea, and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
Free Carrier	<table border="1"> <tr><td style="background-color: #0056b3; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #ffc000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #cc0000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Handler Risk Freight Handler	Free Carrier The INCOTERM free carrier is indicative of the seller clearing the goods for export and handing the goods over to a carrier and place designated by the buyer. The buyer bears transportation costs when the goods are handed over to the carrier at a place designated by the buyer. Ownership of goods transfers to the buyer when goods are handed over to the carrier designated by the buyer. Risk and liability pass to the buyer as soon as goods are made available to the carrier. The modes of transportation available with free carrier goods are air, rail, road, multimodal, containerized, sea, and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
Free Alongside Ship	<table border="1"> <tr><td style="background-color: #0056b3; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #ffc000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> <tr><td style="background-color: #cc0000; color: white;">SELLER</td><td style="background-color: #0056b3; color: white;">BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Shipside in port of departure Risk Shipside in port of departure	Free Alongside Ship The INCOTERM free alongside ship is indicative of the seller clearing the goods for export and placing them alongside the ship at the designated port. The buyer bears transportation costs after the goods are placed alongside the ship. Ownership of goods transfers to the buyers when goods are placed alongside ship designated by the buyer. Risk and liability pass to the buyer as soon as goods are placed alongside the ship at the port designated by the buyer. The modes of transportation used with free alongside ship goods are sea and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								




DESCRIPTION	    	FREIGHT/RISK	MORE DETAILS						
FOB Free on Board	<table border="1"> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight On board ship Risk On board ship	Free on Board The INCOTERM FOB is indicative of the seller clearing the goods for export and placing them on board the ship at the designated port. The buyer bears transportation costs from when the goods are placed on board the ship; the seller loads the cargo onto the ship. Ownership of goods transfers to the buyer when the goods are placed on board the ship designated by the buyer. Risk and liability pass to the buyer as soon as goods are placed on board the ship at the origin port designated by the buyer. The modes of transportation available with FOB goods are sea and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
Cost and Freight	<table border="1"> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Port of destination Risk On board ship	Cost and Freight The INCOTERM cost and freight is indicative of the seller clearing the goods for export and paying the charges, including freight charges, until the goods reach the destination port designated by the buyer. The buyer pays transportation costs after the goods reach the destination port. Ownership of goods transfers to the buyer when the goods are placed on board the ship designated by the buyer. Risk and liability pass to buyer as soon as goods are placed on board the ship at the origin port designated by the buyer. The modes of transportation available with cost and freight goods are sea and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
CIF Cost, Insurance, Freight	<table border="1"> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Port of destination Risk Port of destination	Cost, Insurance, Freight The INCOTERM cost, insurance, freight (CIF) is indicative of the seller clearing the goods for export and paying charges, including freight charges, until the goods reach the destination port designated by the buyer. The seller buys insurance for the goods on behalf of the buyer. The minimum insurance guaranteed by carriers in case of damages during the voyage is governed by international treaties for imports and exports and never adequately cover the cost of goods. Separate insurance may be requested by the buyer, which CIF covers. The seller pays for loading, freight, and insurance for the cargo until the destination port. The buyer pays transportation costs after the goods reach the destination port. Ownership of goods transfers to the buyer when the goods are placed on board the ship designated by the buyer. Risk and liability pass to the buyer as soon as the goods are placed on board the ship at the origin port designated by the buyer. The modes of transportation available with CIF goods are sea and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								



DESCRIPTION	    	FREIGHT/RISK	MORE DETAILS						
CPT Carriage Paid To	<table border="1"> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Destination Risk Freight Handler	Carriage Paid To The INCOTERM carriage paid to (CPT) is indicative of the seller clearing the goods for export and paying charges, including freight charges, until the goods reach the destination designated by the buyer. The buyer pays transportation after the goods reach the destination. CPT is similar to CIF, except the buyer pays for insurance for the goods. Ownership of goods transfers to the buyer when the goods are placed on board the mode of shipment designated by the buyer. Risk and liability pass to the buyer as soon as the goods are placed on board the carrier designated by the buyer. The modes of transportation available with CPT goods are air, rail, road, multimodal, containerized, sea, and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
CIP Carriage and Insurance Paid To	<table border="1"> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Destination Risk First freight handler	Carriage and Insurance Paid To The INCOTERM carriage and insurance paid to (CIP) is indicative of the seller clearing the goods for export and paying charges, including loading, freight, and insurance charges, until the goods reach the destination designated by the buyer. The buyer pays transportation costs after the goods reach the destination. CIP is the same as CPT, except the seller buys insurance on behalf of the buyer. Ownership of goods transfers to the buyer when the goods are placed on board the mode of shipment designated by the buyer. Risk and liability pass to the buyer as soon as the goods are placed on board the carrier designated by the buyer. The modes of transportation available with CIP goods are air, rail, road, multimodal, containerized, sea, and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
Delivered at Place	<table border="1"> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Place of Destination Risk Arriving means of transport at destination	Delivered at Place The INCOTERM delivered at place is indicative of the seller being discharged of responsibilities when the goods are available to the buyer on the mode of transportation on which the goods have arrived and are ready for unloading at the designated destination. The seller does not clear the goods for export or provide insurance. The buyer pays transportation costs from unloading the goods at the designated destination onwards. Ownership of goods transfers to the buyer as soon as the buyer begins unloading the goods at the designated destination. Risk and liability pass to the buyer as soon as the buyer starts unloading the goods at the designated destination. The modes of transportation available with delivered at place goods are air, rail, road, multimodal, containerized, sea, and inland waterways.
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								
Delivered at Terminal	<table border="1"> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> <tr><td>SELLER</td><td>BUYER</td></tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Destination Risk Destination	Delivered at Terminal The INCOTERM delivered at terminal is indicative of the seller clearing the goods for
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								



DESCRIPTION		FREIGHT/RISK	MORE DETAILS						
			<p>export and paying charges, including loading, freight, and unloading charges, at the designated terminal. The seller is discharged of responsibilities when the goods are available to the buyer at the designated terminal after they have been unloaded from the mode of transportation. A terminal would include places, either covered or not, such as quays, warehouses, container yards, and road, rail, or air cargo terminals. The buyer pays transportation costs after unloading the goods at the designated destination onwards. Ownership of goods transfers to the buyer as soon as the seller finishes unloading the goods at the designated destination. Risk and liability pass to the buyer as soon as the seller finishes unloading the goods at the designated destination. The modes of transportation available with delivered at terminal goods are air, rail, road, multimodal, containerized, sea, and inland waterways.</p>						
Delivered Duty Paid	<table border="1"> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> <tr> <td>SELLER</td> <td>BUYER</td> </tr> </table>	SELLER	BUYER	SELLER	BUYER	SELLER	BUYER	Freight Destination Risk Destination	Delivered Duty Paid <p>The INCOTERM delivered duty paid is indicative of the seller clearing the goods for export and paying charges, including loading, freight, and unloading charges, until the goods reach the buyer's location. The seller is discharged of responsibilities when the goods are unloaded at the buyer's location. The seller bears costs until the goods are delivered to the buyer's location. Ownership of goods transfers to the buyer at the final destination as designated by the buyer. Risk and liability pass to the buyer after goods have been delivered to their final destination. The modes of transportation available with deliver duty paid goods are air, rail, road, multimodal, containerized, sea, and inland waterways.</p>
SELLER	BUYER								
SELLER	BUYER								
SELLER	BUYER								

Choosing the Right INCOTERM

Several factors determine which INCOTERM should be used. The nature of the product is important in determining the terms for transport. For example, very heavy or sensitive capital machinery is often sold EXW, especially when the machinery is specialized so there are only a handful of vendors in the world who make it. The seller would be in a strong position and would not want to take the added risk and responsibility of shipping—instead they would sell the machinery EXW. Countries may prefer domestic buyers to buy under certain terms because countries want to promote their own shipping industries.

Using the INCOTERMS appropriately is very important in order for international trade to go smoothly. This example illustrates the importance of the INCOTERMS:





For example...

A bourbon maker in Lexington, Kentucky, received an inquiry from a potential buyer in France for 4,000 bottles of Bourbon, aged 10 years, minimum 80 proof. The potential buyer requested a firm price, CIF, to Marseille, France. The bourbon maker proceeded by examining relevant costs (in USD) as follows:

The buyer has asked for a price CIF (Marseille), which means the seller is responsible for the cost, insurance, and freight to the destination (Marseille, France).

This bottle of Bourbon, when purchased in Lexington, is \$75.00/bottle

Current FOB Lexington price is **\$75.00**.

There are 100 bottles in each case of bourbon; \$75.00/bottle multiplied by 100 bottles, in a case is, **\$7,500.00/case**.

FOB (Lexington) is **\$7,500.00/case**.

To ship the case of bourbon from Lexington to Marseille will include:

\$7,500.00 case price + \$100.00 rail freight + \$30.00 wharfage and handling + \$500.00 ocean freight = **\$8,130.00/case**

Cost and freight (Marseille) = **\$8,130.00/case**

In order to account for any eventualities, the seller wants to insure the shipment for a value of the CIF price plus 10%. Note that this is fairly standard practice—goods are usually insured for 110% of their value in such transactions.

$\$8,130/\text{case} \times 1.1 = \mathbf{\$8,943.00/\text{case}}$

The cost of Marine insurance for coverage in a refrigerated cargo space is \$1 for every \$100 of cargo

$\$8,943.00 \div \$100.00 = \mathbf{\$89.43 /\text{case}}$

The cost of the case is now

$\$8,130.00 + \$89.43 \text{ insurance} = \mathbf{\$8,219.43/\text{case}}$

The new cost per bottle is $\$8,219.43/\text{case} \div 100 \text{ bottles} = \mathbf{\$82.1943/\text{bottle}}$

There is also a French **consular invoice** fee of \$100.00 required to bring the cases of Bourbon into France

Since one invoice covers 4,000 bottles of bourbon, $\$100.00 \text{ invoice} \div 4,000 \text{ bottles} = \mathbf{\$0.025/\text{bottle}}$

So, the total cost per bottle including cost, insurance, and freight is $\$82.1943 + \$0.025 = \mathbf{\$82.2193 \text{ rounded to } \$82.22 \text{ CIF (Marseille)}}$

	Quantity	Price per bottle	Cost per case	Cost per invoice
Bourbon	100	\$75	\$7,500	
Rail freight			\$100	
Wharfage and handling			\$30	
Ocean			\$500	
Cost and Freight			\$8,130	
Marine insurance			\$89.43	



Subtotal		\$82.1943	\$8,219.43	
Consular invoice (4,000 bottles)		\$0.025		\$100
Total cost per bottle CIF (Marseille)		\$82.22 (rounded)		

Therefore, in this example, \$75.00 FOB (Lexington) = \$82.22 CIF (Marseille), or the cost per bottle in Lexington, Kentucky is \$75.00, but to ship this order to Marseille, France CIF the cost per bottle increases to \$82.22 (in U.S. dollars). This type of **conversions** can cause confusion in practice, so it is important to know how they can impact pricing. Freight forwarders are usually a good resource to assist shippers perform conversion pricing.

Unit 3: Shipping Documents

Shipping documents are necessary to provide proof of the execution of a legal contract between a buyer and seller. Shipping documents establish a trail for the physical movement of goods. These documents also help intermediaries like banks, governments, and inspection agencies verify the authenticity of goods, tax goods at **differential** rates, and help process payments to the sellers. The main shipping documents used in shipments are discussed in this unit.



Commercial Invoice

The seller creates a commercial invoice. This document states the nature of the goods, the dimensions, the weight, the INCOTERMS used for the shipment, the currency to be used in the trade, the shipping information, and the names and addresses of the buyer and seller.

Packing List

A packing list breaks down the shipment in unit sizes (e.g., drums, pallets, boxes, or bags). It disaggregates the description provided in the commercial invoice and lists which units of goods are physically packed together.

Certificate of Origin

Certain countries give preferential access to the least developed or underdeveloped countries at concessional import tariffs. In such cases, the importer would need to furnish a **certificate of origin** from the exporter to prove the goods were actually made in the country of the exporter. In most cases, the Chamber of Commerce in the exporter's country issues this document.

Bill of Lading/Air Waybill

The bill of lading, or an **air waybill (AWB)**, is the primary transportation document and establishes ownership of the goods and is used as evidence in case of any disputes. The bill of lading lists the names and addresses of the buyer and seller, INCOTERMS used for the terms of trade, the terms of contract for transportation, the name of the carrier, and identifies marks of the shipment. The three main functions of a bill of lading are:

1. It is a contract confirming the shipment has been carried out by the carrier on behalf of the shipper.
2. It is a receipt by the carrier stating the goods have been received from the shipper.
3. It is a certificate of the title of the goods.

Certificate of Inspection

When the buyer or seller wants to verify the quality or authenticity of the goods, the buyer or seller will have the goods inspected by an independent body. The independent inspection agency then issues a **certificate of inspection** with or without any defects noted on it.



Certificate of Insurance

When buyers and sellers use the CIF and CIP INCOTERMS, or if buyers and sellers want to buy insurance independent from the INCOTERMS, then the insurance agency issues a **certificate of insurance** for a small premium. The premium is based on country and commercial risk. Areas with political instability tend to have the highest premiums to cover insurance.

Export/Import Licenses

Certain countries prohibit or limit the import and export of certain kinds of goods. Sometimes because of the dual nature of technology (e.g., military and commercial), countries might want to trade in certain commodities with limited nations. The U.S. bans most high end processors and electronics from being exported to many countries. Other countries may ban exports to or imports from the U.S. due to concerns for health, safety, or geopolitics. Poultry exports have been banned from the U.S. to Japan, South Korea, and the European Union due to safety concerns regarding the avian flu (WHOtv.com, 2014). Alternately, Russia has banned poultry exports from the U.S. for geopolitical reasons (Rooney, 2014). Importers and exporters need to check in advance whether the goods they wish to trade in are on a negative or restricted list by any of the countries concerned, and obtain the export/**import licenses**, if required, in advance.

Learning Block 7 Summary

This learning block discussed the vital role transportation serves in terms of international trade. INCOTERMS were also discussed to show the standard ways of defining ownership, risk, liability, and payment terms in international transportation. The learning block covered the various types of INCOTERMS and their importance in processing international shipments. Finally, this learning block covered the commercial documents necessary to prove the execution of a transportation contract.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 7 Practice Questions

1. **Together, which two sectors dominate global trade?**
 - a. Ocean, Pipeline
 - b. Motor Carrier, Rail
 - c. Rail, Pipeline
 - d. Air, Ocean

2. **A court is trying to decide the ownership of goods. Which document is the court most likely to rely on to prove ownership?**
 - a. Bill-of-lading
 - b. Commercial invoice
 - c. Packing slip
 - d. Certificate of insurance

3. **In international trade and transportation, international commercial terms are necessary to:**
 - a. Limit imports
 - b. Prevent confusion and unnecessary litigation
 - c. Assure the seller always pays transportation costs
 - d. Promote U.S. exports to France

4. **The terms of trade are delivered at place to the Port of Seattle (origin: New York) for a particular shipment of goods, and the forklift operator damages the goods while unloading them from the ship. Who bears the liability for the damaged goods?**
 - a. Seller
 - b. Insurance company
 - c. Carrier
 - d. Buyer

5. **With freight on board terms, when does the ownership of goods transfer to the buyer?**
 - a. When goods are placed on ship designated by the buyer
 - b. When goods are placed on ship designated by the seller
 - c. When goods are at the seller's facility
 - d. When goods are at the buyer's facility

6. **When using cost, insurance, freight terms, which of the answer choices do not apply?**
 - a. Seller clears goods for export
 - b. Seller pays for transportation costs after goods reach destination
 - c. Seller pays charges, including freight, until goods reach destination point
 - d. Seller buys insurance



7. If the buyer and seller are independently verifying the quality of the goods, the buyer would insist on a:
- a. Commercial invoice
 - b. Bill-of-Lading
 - c. Certificate of inspection
 - d. Certificate of insurance
8. The liability for and ownership of goods pass from the seller to the buyer in which of the 11 international commercial terms?
- a. All 11
 - b. None of the 11
 - c. Cost, insurance, freight and free on board
 - d. Carriage paid to
9. The Bill-of-Lading, also known as an air waybill, does not establish:
- a. Ownership of goods
 - b. Evidence to resolve disputes
 - c. Carrier receipt of goods
 - d. Transportation costs
10. The U.S. gives preferential tariffs to clothes manufactured in Panama. Which document would an importer in the U.S. request from an exporter to take advantage of lower tariffs for shirts from Panama?
- a. Commercial invoice
 - b. Certificate of analysis
 - c. Certificate of origin
 - d. Certificate of insurance





Learning Block 8: Risk Management and Security in Transportation

Learning Block 8 Description

Risk management and security are growing areas of concern within transportation. Several issues plague personnel in the transportation and supply chain industries, including **product pilferage**, security breaches, and piracy at sea. Companies within these industries often take several approaches to reduce these risks: this learning block includes information about the basics of these approaches and how they are implemented in the supply chain.

Learning Block 8 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Define risk management
- Identify sources of risk in the supply chain
- List risk management techniques
- Explain transportation security initiatives

Unit 1: Understanding Risk

In the equipment purchase example provided in learning block 2, a buyer purchased equipment to assemble cell phones. If the buyer had financed the equipment, it is very likely the commercial lender would have insisted the buyer maintain full coverage on it. In addition, when the equipment was loaded onto the ship from Tokyo, Japan to Los Angeles, California, the buyer would likely have purchased insurance as well. The buyer would do these things to avoid risking a financial loss.

Most literature agrees with the notion of risk being associated with undesirable outcomes. This association exists outside the transportation sector as well. In casual conversation, people are much more likely to say they were at risk for heart disease (a negative outcome) than they were at a risk of winning the lottery (a positive outcome). Risk is associated with negative outcomes for most people.

Therefore, for the purposes of this certification track, risk is defined as a hazard or danger with the possibility of incurring loss or misfortune. Research suggests there are substantial implications for supply chain disruptions (e.g., hurricanes shutting down ports) to companies, including stock price declines of almost 9%, lower operating performance for several years, and increased inventory.



Unit 2: Sources of Risk in a Supply Chain

There are many underlying reasons and explanations of risks found throughout the supply chain, but this unit will begin to describe a few of them in detail. For example, **product loss** occurs when products and goods are lost along the supply chain for various reasons, and damage of products are often the result of mishandling products or loading delivery trucks incorrectly. Additionally, contamination results from incorrect storage of goods or too much exposure to other products. Lastly, delivery glitches occur when deliveries are either stopped or slowed down for a number of reasons.



Figure 48. Product loss.
Developed by LINCS in Supply
Chain Management
Consortium.

Product Loss

A large challenge in freight movement is transferring goods to the correct addresses, at the right times, in the right amounts, and at the lowest costs. When goods are lost in transit, shippers usually expedite the follow-up shipment to ensure goods reach the store shelves despite the loss. In addition, shippers might go through claims processing, their costs of insurance can go up, and they might send a second shipment of goods to compensate for the lost goods. It has been argued the costs of product losses, or **indirect costs**, can be several times the original cost of the shipment itself. Product losses can happen for several reasons. For example, piracy on open water or hijacked carriers can cause entire containers of shipments to go missing. Not only do these actions cause losses of goods, but they also put crews and drivers at risk for injury or death. *Pilferage*, however, occurs when packages or items are stolen by the people who were trusted with them (e.g., freight handlers, equipment operators, and managers). **Shipment jettisoning** occurs when the master of an ocean-going vessel may feel the integrity or safety of the vessel or crew is at risk. Ship masters are required to note the location of the jettisoned cargo, but it is almost never recovered.





Figure 49. Product damage.
Developed by LINC3 in Supply
Chain Management
Consortium.

Product Damage

Product damage can occur when freight is not handled in accordance with requirements. Sometimes, damaged products may still be sellable for a fraction of the original value, but in other cases, they must be written off as a loss. Product damage is a major issue with specialized freight, such as cold-chain goods. Several factors can compromise the integrity of cold-chain goods; for example, power failures can occur while the goods are in storage, which can be catastrophic. Most refrigerated vehicles have back-up power sources, but unforeseeable events happen, and the entire product needs to be written off.

Similarly, incorrect equipment loading can damage goods during long, and often perilous, trips. Incorrect equipment loading can occur when workers leave too much space between products, which allows the products to move around in the truck easily; also, workers might inefficiently stack the products by loading heavy products on top of lightweight products. Even when workers complete the tasks according to companies' manuals, accidents do happen, and these accidents may cause damage to freight during transit.



Figure 50. Contamination.
Developed by LINC3 in Supply
Chain Management
Consortium.

Contamination

Contamination is a large issue in transportation operations, especially for products such as food and medical supplies. The most common type of contamination can occur when consumables are exposed to tampering, but there are many other types of contamination shippers should be aware of when their goods are being transferred. Incidental exposure to contaminants; for example, can occur if multiple types of freight are co-mingled. This type of exposure is another concern for shippers, so it should be carefully observed when dealing with freights of different types.





Delivery Glitches

A key aim of efficient transportation is ensuring the process of fulfilling orders is timely and efficiently. Therefore, delivery glitches, which are areas in the supply chain which stop or slow down deliveries of goods, are a large concern for personnel in transportation operations. Common reasons for delivery glitches can include capacity shortages, labor disruptions, and other uncontrollable issues, such as major weather changes. Capacity shortages occur when there is not enough personnel to cover deliveries, so temporary personnel are employed; this is especially common in times of increased deliveries, such as the holidays. Also, labor disruptions can include union strikes or similar glitches in the delivery process.

Figure 51. Delivery glitches.
Developed by LINC'S in Supply
Chain Management
Consortium.

Unit 3: Risk Management Techniques

A business risk comes in a variety of forms over the course of the business life cycle. Some risks occur during the course of business operations, while others are due to extraordinary circumstances that are not easily identified. Regardless of a company's business model, industry or level of earnings, business risks must be identified as a strategic business planning. Once risks are identified, companies take the appropriate steps to manage them to protect their business assets (Horton, 2015).

Risk Management

For example...

In the example provided in learning block 2, a buyer purchased cell phone assembly equipment. When the buyer brings the equipment to Phoenix, Arizona, the buyer can purchase equipment insurance, which transfers the risk from the buyer to the insurance company: this is known as **risk transfer**. The buyer also keeps the equipment housed and secured inside the plant, which decreases the amount of risk and is known as **risk reduction**. Unfortunately, incidents can still occur, such as natural disasters which could level the plant. The only way the buyer would be completely free of risk is if the equipment was never bought in the first place, and this is called **risk avoidance**.

Risk management techniques will be discussed in this unit. Here are the three key potential risk management to consider:

Risk Avoidance

Sometimes, the easiest solution to risk management is avoiding risky issues entirely. For example, in the wake of a substantial number of piracy attempts off the coast of Somalia from 2008 to 2010, the



Norwegian company Odfjell decided to avoid having its ships avoid the route entirely, even if it meant taking more time to get freight to its destination (CNN, 2008). This type of strategy, however, has its own risks, such as increased time for delivery, creation of new routes, and other similar issues. Sellers in transportation operations, however, may choose to avoid transportation risk by selling FOB; then, the ownership, risk, and title of goods would pass on to the buyers before the risky trip begins. This technique also provides disadvantages for companies, such as losing business to customers who might want to go with carriers who are willing to take the risks.

Risk Reduction

Risk avoidance is a straightforward approach to managing risk, but it is not always the most practical or the most valuable. For example, if carriers choose not to do business in particular territories because of the potential for high risk, companies may take their business to other carriers more willing to take those risks. However, in order to reduce the amount of risk rather than avoid it altogether, companies participate in **hedging** and **postponement** strategies.

Hedging refers to the strategy firms use to reduce the amount of exposure to risks. Companies do this by choosing to spread their business across multiple carriers instead of relying on a smaller amount of suppliers or vendors for product inputs. In fact, large companies will work with over 20-30 carriers at one time in order to hedge their risks broadly. It is important to hedge because having more suppliers and vendors reduces the amount of overall risk if any number of them lose, damage, or contaminate products; however, having fewer suppliers and vendors will leave a much smaller amount of options to choose from if risks are not managed properly.

Postponement refers to the strategy of delaying companies' committing to the final forms of products for as long as possible in the delivery process. Postponement ensures there is less inventory to manage, and, consequently, less risk. Dell, the computer company, uses postponement strategies to reduce their transportation and logistics costs. Since Dell does not produce the final product until the customer orders it, they are able to reduce the movement of products and the amount of materials needed.

Risk Transfer

Unfortunately, risks may be deemed too problematic or expensive for companies to manage on their own, even when applying hedging and postponement techniques. In these cases, the companies and shippers may choose to transfer the risk to someone else. Insurance companies are the primary other method for transferring risk. Insurance companies gather risk from many different customers into a more predictable risk profile and call it the **Law of Large Numbers**. Using this law, insurance companies estimate the likelihood of bad events happening across many users. Then, they calculate the expected payout of the event and decide how much to charge every subscriber to cover this cost.

Unit 4: Transportation Security Initiatives

General regulations and contracts for transportation operations were discussed in learning block 6, but this unit provides information about regulations and initiatives specifically geared toward risk management. After the September 11th attacks, the U.S. government implemented a series of initiatives to reduce the likelihood of the country being exposed to further malicious activities. These initiatives are directly relevant to the transportation business. This unit describes security initiatives in further detail.





Figure 52. Transportation security. Developed by LINCS in Supply Chain Management Consortium.

Advance Manifest Regulations

These regulations apply to ocean carriers entering U.S. waters; vessels are expected to submit a cargo declaration before they reach U.S. shores. The advance manifest regulations are designed to ensure U.S. Customs and Border Protection has the necessary information beforehand and can deny unloading status to containers in advance, if needed.

Maritime Transportation Security Act

The Maritime Transportation Security Act was fully implemented in 2004 and explains high-risk ocean vessel requirements, which includes policies about approved security plans to address how crews will respond in case of an emergency incident. High-risk ocean vessels include those hazardous materials carriers and significant sized vessels, which could restrict access to the port when entering the territorial waters of the U.S. These vessels' security plans must also be updated every five years. If these security plans are not available, the vessels can be denied entry onto U.S. shores. In addition, the Maritime Transportation Security Act prescribes these types of security plans for high risk port terminals (e.g., alternative fuel terminals and cruise ship terminals).

Container Security Initiative

This initiative aims to identify and inspect shipping containers bound for the U.S. from countries where there are higher risks of terrorism. Additionally, inspections are conducted at foreign ports, thereby minimizing chances of letting dangerous containers through to U.S. shores. Most of this inspection is conducted using non-intrusive technology, such as x-rays, as not to slow down loading times for the containers.

Customs-Trade Partnership against Terrorism

Unlike earlier initiatives, the Customs-Trade Partnership Against Terrorism (C-TPAT) is not mandatory; however, C-TPAT certified companies acquire considerable advantages. For example, once companies are certified as C-TPAT compliant, they are regarded as a reduced risk, which means they have a documented process of measuring and limiting risk through their whole supply chain. Such partner companies typically benefit by having fewer customs inspections and faster processing of shipments.

Free and Secure Trade

Like the C-TPAT, the Free and Secure Trade (FAST) program is also voluntary. However, it is only applicable to shipments originating in Canada or Mexico. Also, in order to be members of the FAST program, companies must already be C-TPAT certified. Any truck using FAST-lane processing on either the Canadian or the Mexican border must belong to a C-TPAT-approved carrier, must carry qualifying goods from a C-TPAT-approved importer, and must be driven by someone with a valid FAST Commercial Driver Registration ID Card.



Learning Block 8 Summary

This learning block discussed why risk management is a growing area of concern within the transportation function. The materials discussed issues which could create risk and the various actions companies can take to avoid those risks. This learning block also reviewed several different enacted security initiatives used to reduce the risks of shipping products.



*Figure 6. Transportation Operations.
Developed by LINC3 in Supply Chain
Management Consortium.*



Learning Block 8 Practice Questions

1. **Free and Secure Trade is only applicable for Free and Secure Trade-lane shipments originating in:**
 - a. European countries
 - b. Canada and Mexico
 - c. Panama and U.S.
 - d. India

2. **Supply chain does not include:**
 - a. Loss of product
 - b. Pilferage
 - c. Contamination
 - d. Government regulations

3. **Under the Container Security Initiative, containers are inspected:**
 - a. At foreign ports before shipment to the U.S.
 - b. When they arrive in the U.S.
 - c. When they are in transit
 - d. In the U.S. when the container is opened

4. **Which of these mathematical laws is the basis of the insurance industry?**
 - a. Pythagorean Theorem
 - b. Central Limit Theorem
 - c. The Law of Large Numbers
 - d. Transaction Cost Theory

5. **Why does a ship's master have the authority to jettison the ship's cargo, if needed?**
 - a. For crew or vessel integrity and safety
 - b. To reduce fuel consumption
 - c. To expedite the journey
 - d. To reduce product spoilage

6. **The notion of risk in transportation is associated with:**
 - a. Only negative occurrences
 - b. Only positive occurrences
 - c. Negative and positive occurrences
 - d. Weight



7. The risk management approach where the final product is not assembled until as late as possible is called:
- a. Hedging
 - b. Avoidance
 - c. Postponement
 - d. Dredging
8. Amazon has relationships with over 20 less-than-truckload carriers for inbound freight. This is an example of which type of risk reduction?
- a. Hedging
 - b. Law of Large Numbers
 - c. Competitive bidding
 - d. Relationship management
9. Risk avoidance techniques deal with avoiding risks:
- a. For ships on very lengthy journeys
 - b. For goods shipped in containers
 - c. In their entirety
 - d. In specific geographical areas
10. Which initiative is voluntary?
- a. Maritime Transportation Security Act
 - b. Container Security Initiative
 - c. Customs-Trade Partnership Against Terrorism
 - d. Free and Secure Trade





Learning Block 9: Transportation Sourcing and Management

Learning Block 9 Description

In this learning block, various aspects of transportation work for an organization will be covered; specifically, how transportation operations personnel make decisions and tools used in the decision-making processes. The complex economic and global trade environment, have put pressure on shippers and their procurement teams to select the right suppliers and transportation partners. Fortunately, industry analysts have developed strategic transportation sourcing tips designed to develop collaborative solutions to make the best possible and lowest risk decision (Burnson, 2016).

Learning Block 9 Learning Objectives

Upon completing this learning block, the learner will be able to:

- List approved carriers, **Standard Carrier Alpha Codes (SCACs)**, **freight tariffs**, and insurance
- Discuss transportation and route optimization
- Define **modal optimization**
- Explain transportation metrics
- Recall transportation operations roles and functions

Unit 1: Carrier Identifiers

According to the USDOT (2013), there are over 500,000 trucking companies and almost 650 railroad companies in the U.S. These companies vary by geographic reach, services rendered, and price. The marketplace is incredibly complex, which means companies need ways to differentiate between carriers.

Approved Carriers

Most companies pre-approve carriers to meet their company specific criteria. While carriers must meet basic requirements defined by U.S. government agencies, many companies define specific and unique needs for their carriers. If carriers meet the transportation requirements, then they are approved for company use.



U.S. Department of Transportation and Interstate Operating Authority Number

Motor carriers have to comply with a basic set of requirements, which includes being authorized by the USDOT to transport goods for hire and having a USDOT and having an Interstate Operating Authority number: These basic requirements provide a carrier’s legal authority to operate. This provides access to elements like a particular carrier’s fleet size, accident history, and claims based on these numbers through the USDOT (www.saferys.org).

Standard Carrier Alpha Code

In addition to having the USDOT number and the Interstate Operating Authority number, a freight carrier will also have a SCAC. An SCAC is a unique two- to four-letter code which identifies a freight carrier. SCAC are printed on bills of lading, as well as other shipping documents, and are required for EDI transactions. SCAC are especially useful when using TMS to schedule freight pickups and drop-offs, or when using an EDI system to send and receive transactions, bills of lading, and payments. *Figure 53* shows a list of sample SCAC.

Carrier Name	SCAC
CSX Transportation	CSXT
FedEx Freight	FEXF
Maersk Line	MAEU
Old Dominion	ODFL
Yellow Freight	YFSY

Figure 53. Listing of sample SCAC. Developed by LINC in Supply Chain Management Consortium.

Unit 2: Specialized Services/Circumstances

Freight carriers will often charge an additional amount for certain specialized services and circumstances. These charges are usually grouped into a category called **accessorial charges**. Examples of accessorial charges (also called accessorials) include inside delivery charges, congested area surcharges, detention/demurrage, and fuel price surcharges. Most TMSs are able to help transportation personnel track these charges.

For example, suppose a company needs to move 2,500 pounds of freight from Auburn, Alabama to Hollywood, Florida, class = 80. The company has received the rate quote from a freight carrier, as shown in *Figure 54*.



36830 (Auburn, AL) to 33019 (Hollywood, FL)								
Class Rating	<500 pounds(L5C)	500 to 1000 pounds (M5C)	1000 to 2000 pounds (M1M)	2000 to 5000 pounds (M2M)	5000 to 10000 pounds (M5M)	10000 to 20000 pounds (M10M)	>20000 pounds (M20)	
500	600	550	500	450	400	350	300	
400	550	500	450	400	350	300	250	
300	500	450	400	350	300	250	200	
250	450	400	350	300	250	200	150	
200	400	350	300	250	200	150	120	
175	350	300	250	200	150	120	100	
150	300	250	200	150	120	100	90	
125	250	200	150	120	100	90	85	
110	200	150	120	100	90	85	75	
100	150	120	100	90	85	75	70	
92.5	120	100	90	85	75	70	50	
85	100	90	85	75	70	50	45	
77.5	90	85	75	70	50	45	40	
70	85	75	70	50	45	40	35	
65	75	70	50	45	40	35	30	
60	70	50	45	40	35	30	28	
55	50	45	40	35	30	28	25	
50	45	40	35	30	28	25	20	

Pickup	Drop	National Motor Freight Classification	Discount	AMC
Points in the U.S.	Points in the U.S.	FAK 50 (50 - 85)	22% up to 20,000 pounds	\$300
		FAK 150 (92.5 - 200) Actual (All other Classes)	33 % up to 40,000 pounds, 5% thereafter	

Figure 54. Rate quote from a freight carrier. Developed by LINC3 in Supply Chain Management Consortium.

Although most TMSs will be able to do these steps, Steps 1-4 and Figure 55 show how to calculate the estimated cost of this shipment manually.



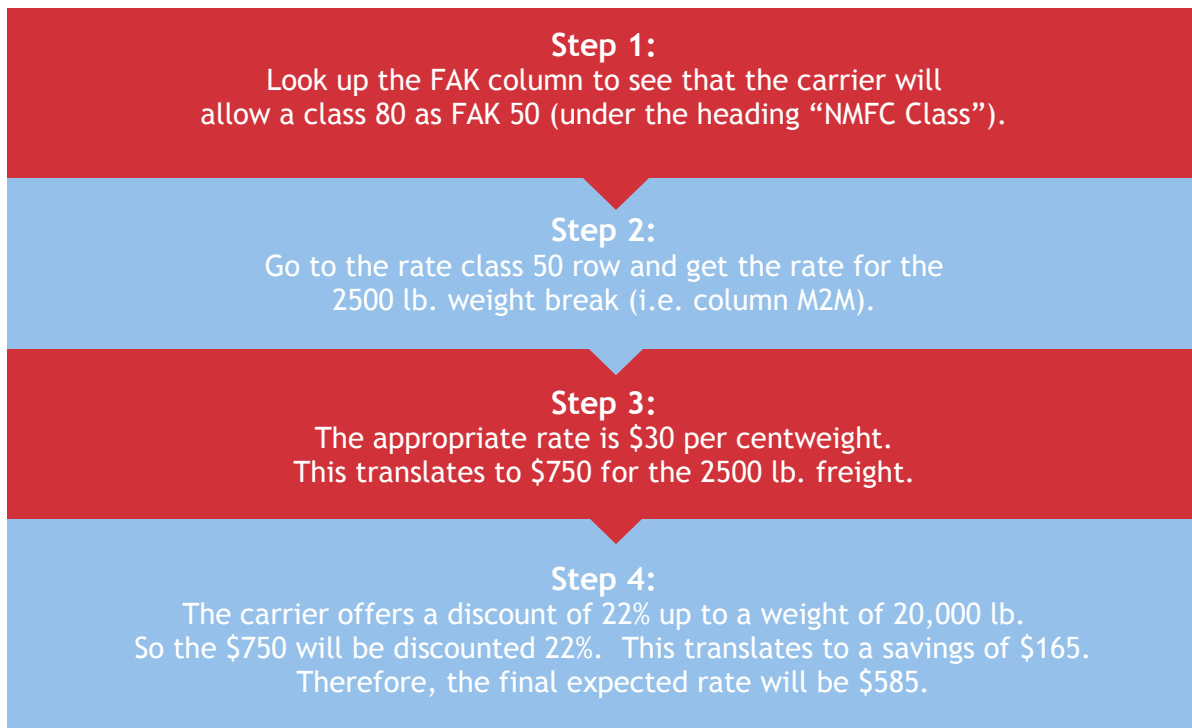


Figure 55. Four steps that outline how to calculate estimated cost. Developed by LINCS in Supply Chain Management Consortium.

Transportation insurance is another important factor transportation personnel need to keep in mind. Although transportation companies are expected to carry a certain amount of insurance, this coverage is usually quite limited. Therefore, shipping/transportation personnel may purchase coverage for more than the amount offered by the carrier. In international shipments, for example, it is common practice for the sender of the goods to insure the goods at 110% of their true value. Typically, such insurance will cover goods in transit and goods, which may be temporarily stored during the course of transit.

Determining Factors for Freight Tariffs

Once transportation personnel have a list of approved carriers, they will determine which carrier will receive the freight on any given geographic lane. Although several factors play a part in this final determination, cost is a primary consideration.

As mentioned in learning block 3, different modes of transportation have different pricing models. However, pricing models have the same basic features for determining freight tariffs. Quoted tariffs are usually a function of three attributes: distance, product characteristics, and any specialized services or circumstances. Tariffs are generally quoted on the basis of **centweight** (i.e., 100 pounds).

Distance

For example, airfreight works on the basis of **zone-to-zone pricing**, meaning the origin and destination would be grouped



Figure 56. Freight tariffs. Developed by LINCS in Supply Chain Management Consortium.



into certain zones. The shipper will pay the inter-zone rate between these zones. A similar idea is applied in trucking, but by a different name. In the trucking and motor freight business, grouping origins and destinations into zones is carried out through **rate basis point**. A rate basis point is the major shipping point in a catchment area. For ease of calculation, motor carriers assume the origin and destination points in the catchment area are the same as the rate basis point. They then quote rates based on one rate basis point to another rate basis point. Thus, the **quoted rates** are not exactly based on the mileage, though they are close.

Product Characteristics

As we have discussed in Learning Block 3, the motor carrier industry uses a freight classification system to determine freight tariffs. While this system is available for both TL and LTL carriers, it is much more common to see it in LTL freight than in TL freight. Certain products need more care, or higher levels of caution, while being transported. Carriers expect to be compensated at a higher rate for these products than they do for products which require less care.

The four criteria carriers usually use to determine these rate classes are:

- 1 Density
- 2 Storability
- 3 Handling
- 4 Liability

Based on this system, freight can be classified into 18 categories identified by a numeric value between 50 and 500. A lower-class rating equals a lower price. Low-value freight, which is easy to handle, unlikely to damage, and dense, will receive lower class ratings than expensive, light, and bulky freight, which is more likely to be damaged. Sometimes carriers will allow shippers to group different rate classes into a master class (i.e., FAK). The FAK classification eases calculation and record keeping for carriers. In addition, most carriers will provide a discount from the quoted rate (usually between 20% and 50%) based on weight-breaks or rate classes.

Unit 3: Modal Optimization

The first approach to manage transportation expenses is good negotiation. The transportation services marketplace is not unlike the market for used cars or a new house. Companies rarely pay the sticker price. The quoted rate or **base rate** is usually only a starting price for negotiation. Common approaches transportation personnel take to reduce costs are negotiating around FAK classification and discounting. A carrier who provides a lower FAK class for consolidated freight is typically offering a better deal. In addition, larger volumes of freight committed will be offered better rates.



There are other approaches transportation personnel can take to reduce transportation costs. Most of them attempt to use the most efficient transportation modes available and fall under an emerging field called modal optimization. This unit covers exciting developments in modal optimization.

Merge in Transit

The basic idea behind **merge in transit (MIT)** is straightforward—pound for pound. Since larger shipments (and TL shipments) are more cost-efficient than smaller ones (and LTL), it can be financially rewarding for transportation personnel to find other companies willing to share the costs of shipping. In an MIT system, smaller volume shippers may agree to merge their freight at a central merge point for further shipment. The system works best when multiple vendors for the same **end customer** are able to cooperate. Sometimes end customers may actually encourage vendors to seek MIT opportunities to lower the number of incoming shipments.

Pooled Distribution

The idea behind **pooled distribution** is the exact opposite of MIT. In such a system, shipping/transportation personnel will try to maintain large volume shipments until as late in the delivery cycle as possible. Instead of shipping directly from the plant or warehouse to the end customer, personnel will try to ship goods on consolidated trailers, regional terminals, or cross-docks. When goods reach these locations, the pool is offloaded, sorted, and loaded onto smaller delivery trucks for last-mile delivery.

Drop Trailer Programs

A key regulation in transportation, especially motor carriage (i.e., TL and LTL), deals with HOS. Any hours a driver is not actually driving are non-value added time for freight movement. Therefore, transportation companies have devised drop-trailer programs for large customers in order to minimize down-time. Instead of bringing a trailer to be live-loaded, a driver leaves an empty trailer at the shipper's facility. When the trailer is ready for pickup, the driver brings their tractor to the distribution center and picks-up the loaded trailer. At the same time, the driver may drop off another empty trailer. So basically, the driver picks up a loaded trailer and leaves an empty one at the shipper's facility. Through this method, the process of live loading is eliminated and reduces waiting time for drivers, which eliminates costly accessorial charges. In addition, shippers can load the trailer at their own convenience. This also ensures efficient material flow through warehouses and may eliminate the need for dedicated floor-space and touch points, thereby reducing the likelihood of product damage.



Unit 4: Transportation/Route Optimization

Other optimization functions play important roles in the transportation business, but they are not immediately obvious. Sometimes these functions are hidden below so many layers of applications, many end users do not even realize they are present. Route modeling and optimization is one of these applications. Route modeling and optimization systems try to eliminate as much waste or non-value activities from the process as possible. These systems attempt to optimize the output from the given the cost for the end user. These systems answer very fundamental questions for a **transportation manager**: What should be moving, from where should it be going, and to where should it be headed?

Transportation optimizers are constantly improving, and the algorithms they run are usually proprietary. TMSs utilize three important factors: **decision variables**, constraints, and objectives.

Decision Variables

Decision variables are attributes the end user or transportation personnel can control. For example, if a company has multiple manufacturing locations, transportation personnel may be able to control the volume of freight shipped from one location versus the others.

Transportation personnel may decide the most optimal method for serving the end customer is to ship the ordered goods from one location. Alternately, transportation personnel may decide to split the outbound orders from multiple locations.

Constraints

Transportation personnel have little or no control over constraints. For example, when a customer orders a certain amount of goods, the order quantity is a constraint. Transportation personnel may not care where the goods are being shipped from, but the order needs to be filled on time and in full.

Similarly, the mileage between two points is a constraint, because it is not something personnel can influence in any way. A common metric is ton-miles: If a freight weighing one ton moves one mile, it is said to have traveled one ton-mile. Ton-miles are a measure of the total distance covered by the outbound (or inbound) freight for a company.

Objectives

The objective is the main priority for transportation personnel. For example, primary interest include minimizing the shipping total, minimizing total cost, or a combination of both. Additionally, priorities may be in maximizing the number of on-time and in-fill orders.

Route modeling and optimization transportation systems help transportation personnel select the optimal combination of decision variables in a way to ensure the objectives are met (or come as close as possible) while satisfying as many constraints as possible.



Unit 5: Transportation Operations Metrics

An important element of any transportation job is to always strive for improvement. Most organizations have a defined set of metrics, or measures, to provide feedback on a process or task. Data is collected and measured in various forms and an output is derived to display if the process is performing within the intended limits. If the data show a process is performing beyond an intended (upper or lower) limit, corrective actions may be necessary. These metrics, along with why they are important, are discussed in this unit. The term cost refers to **freight cost** in this unit unless otherwise specified.

Cost Metrics

Cost per Unit Shipped

The **cost per unit shipped** is the ratio of shipping costs divided by the total number of units shipped in a given time period. Lower costs per unit shipped are generally better.

Cost per Ton-Mile

The total expense the shipper incurs on transportation can be divided by the total ton-miles to get the **cost per ton-mile**. As with most **cost metrics**, lower is usually better.

Cost as a Percentage of Sales

Freight costs as a percentage of sales are a good indicator of the overall health of the transportation department. This can be calculated by adding up the total shipping cost in a given time period (e.g., per quarter) and dividing by the total dollar value of sales in the same time period. As with most other cost-related metrics, lower is usually better.



Time Metrics

Average Transit Time

Transit time is measured as the amount of time it takes goods to travel: starting from the time they leave the shipper's door and ending when they arrive at the customer's door. The **average transit time** can be calculated by taking the transit time for every single shipment and dividing it by the total number of shipments. Lower average transit times are generally better. This is an important metric for freight personnel to watch because it relates directly to the total lead-time the seller can promise to the buyer.

Average Vehicle Turnaround Time

Average vehicle turnaround time is defined as the average time elapsed between when a vehicle arrives at a company's facility and when it leaves the facility. The average vehicle turnaround time can be calculated by adding up vehicle turnaround times and dividing by the total number of vehicles arriving at or leaving the facility. This metric is most often used for ground transportation or specialized air-cargo operators. Lower average turnaround times are typically better.

On-Time Pickup

On-time pickups are crucial for delivering orders within the time promised. This metric is calculated by dividing the number of on time pick-ups the freight carrier makes in a given time period by the total number of shipments in the same time period. Higher numbers are typically better.

On-Time Delivery

On-time delivery is a very important metric for customers and is calculated by the total number of deliveries made on time divided by the total deliveries in a given period of time. With this metric, higher numbers are better!



Accuracy

Claims as a Percent of Freight Costs

Claims and damages are indicative of problems somewhere in the shipping process. The problems could be in terms of packaging (e.g., pallets are not shrink-wrapped properly) or in terms of the carrier's performance (e.g., rough handling). This metric is calculated by adding up the total loss and damage claims and dividing by the total freight costs. This **claims as a percent of freight costs** metric is often measured on a per-carrier basis to compare the relative performances of carriers.

Average Freight Bill Accuracy

This metric is measured as the total number of error-free freight bills submitted by a carrier and is divided by the total number of freight bills submitted by the carrier. The errors are usually in terms of incorrect pricing, incorrect weight, etc. This metric is also often compared on a carrier-by-carrier basis. Like the on-time pickup metric, this metric should not vary much between modes and higher is better.

Order Fill Rate

The **order fill rate** can be understood as the percentage of incoming customer orders filled on time. This can be calculated by taking the total number of completely filled orders and dividing by the total number of orders. As with many of the other metrics, higher is usually better.

Unit 6: Transportation Operations Roles and Functions

There are endless job opportunities in a typical transportation company. However, the specific job roles will vary depending on the type of Transportation Company and the industry served. For example, a motor carrier will employ drivers, diesel mechanics, and operations personnel to track inbound and outbound shipments. Ocean carriers may also employ operations personnel, but they do not employ drivers and mechanics. Many of the typical jobs related to transportation operations are discussed in this unit.

Intermodal Personnel

Personnel need to define creative solutions for customers, and they are responsible for choosing the most efficient and cost-effective modes to move freight using motor carriers, railroads, ocean carriers, and air carriers. Personnel employed in this role are most likely to work for a freight forwarder or broker and focus on multiple transportation modes when one alone is not sufficient.



<p>Logistics Personnel</p>	<p>Logistics personnel use analytical skills and have knowledge of transportation metrics to understand, predict, and/or control logistics and transportation operations and processes. Logistics personnel are skilled in data management, analyzing performance, identifying problems, and developing recommendations. These skills are integral to improving logistics and transportation operations.</p>
<p>Dispatchers</p>	<p>Dispatchers are specialized operations personnel, and their main role involves meeting customer needs promptly and responsively by efficiently routing trucks, rail cars, and manpower. Dispatchers are usually customer service specialists and are skilled in building and maintaining relationships with various levels of workers and customers.</p>
<p>Operations Personnel</p>	<p>There are a variety of roles generally classified within an operations organization. Drivers, mechanics, facilities, security, and numerous other roles and positions are grouped here, and they are the basic foundation to a successful transportation company.</p>
<p>Support Personnel</p>	<p>As with any organization, support personnel are the backbone of a successful organization. A few support personnel roles are defined in human resources, information technology, finance, and marketing and sales.</p>
<p>Transportation Supervisor</p>	<p>Employment as a transportation supervisor is generally not defined as an entry or mid-level position. Transportation supervisors have extensive decision-making and personnel responsibilities. Supervisors usually have experience in operations; logistics, customer service, and other operational roles provide a great foundation to be effective as a supervisor or manager.</p>

Learning Block 9 Summary

This learning block covered various **sourcing** and management techniques used to move freight. The importance of using approved carriers and the value of SCACs were discussed along with techniques and processes to achieve route and modal optimization. Key transportation metrics were reviewed to define if processes are operating efficiently and effectively. Finally, job roles and functions were outlined to provide an overview of potential employment opportunities.



Figure 6. Transportation Operations. Developed by LINCIS in Supply Chain Management Consortium.



Learning Block 9 Practice Questions

1. **Job roles vary from company to company based on:**
 - a. U.S. Department of Labor
 - b. The type of company
 - c. Internal human resource policies
 - d. The overall economy
2. **Freight rates and tariffs are usually quoted on the basis of:**
 - a. Centweight
 - b. Milweight
 - c. Decweight
 - d. Maxweight
3. **In terms of freight bill accuracy, which of the answer choices is true?**
 - a. None of the modes are very accurate
 - b. Rail freight is always the most accurate
 - c. Ocean freight is expected to be the least accurate
 - d. There should be no difference between modes
4. **Which of these are not forms of modal optimizations?**
 - a. Merge-in transit
 - b. Pooled distribution
 - c. Drop trailers
 - d. Containerized cargo
5. **A standard carrier alpha code is a unique code assigned for:**
 - a. Freight carrier name identification
 - b. Freight carrier billing addresses
 - c. Determining pricing for tariffs
 - d. Determining modal optimization
6. **SCAC stands for:**
 - a. Short-term acceptable carrier
 - b. Standard carrier acceptable carriage
 - c. Standard carrier alpha code
 - d. Short carriage acceptable carrier
7. **In route optimization, the things personnel can change are called:**
 - a. Constraints
 - b. Decision variables
 - c. Resources
 - d. Objectives



- 8. Which four product characteristic criteria are used to determine the appropriate rate class?**
- a. Packaging, handling, volume, and hazards
 - b. Handling, shelf-life, manufacturing date, and weight
 - c. Hazards, density, volume, and weight
 - d. Density, storability, handling, and liability
- 9. Metrics are important in the transportation industry in order to:**
- a. Measure and determine process effectiveness
 - b. Modify rate tables
 - c. Identify new carriers
 - d. Calculate tariffs and special charges
- 10. From a customer perspective, the most important metric is most likely:**
- a. Average vehicle turn-around-time
 - b. Cost as a percentage of sales
 - c. On-time delivery
 - d. Claims as a percentage of freight costs





Learning Block 10: Sustainability and Innovation in Transportation

Learning Block 10 Description

New developments and innovations in technology have helped shape the transportation industry and helped create a more sustainable environment. These innovations have incorporated advanced materials, innovative engineering designs, and the use of alternative fuels to create ways for the transportation industry to provide cost-effective services with a less adverse impact to the environment. This learning block provides information and examples to show how these new, innovative developments in technology across various modes are leading to an improved sustainable environment.

Learning Block 10 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Define sustainability
- Explain sustainability metrics
- Contrast the impact of innovation and technology on sustainability
- Describe the latest technology trends across transportation modes

Unit 1: Sustainability in Transportation

Sustainability in transportation is an important issue because the transportation sector uses a significant amount of fossil fuels and emits nearly one fifth of greenhouse gasses on Earth (Kahn Ribeiro et al., 2007).

The University of Plymouth Centre for Sustainable Transport provides a widely accepted definition of sustainable transportation:

- Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health and with equity within and between generations;
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy;
- Limits emissions and waste within the planet's ability to meet them, minimizes consumption of non-renewable sources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.



The general framework to measure sustainability are the **Triple Bottom Line (TBL) metrics**. The TBL consists of economic, environmental, and societal planning framework.

Environmental	Societal	Economic
<p>Create solutions compatible with and an enhancement to the natural environment, reduce emissions and pollution from the transportation system, and reduce material resources required to support transportation</p>	<p>Meet the social needs by making transportation accessible, safe, and secure.</p>	<p>Support economic vitality while developing infrastructure in a cost-effective manner. Costs need to be within the ability of people to pay for success.</p>

Unit 2: Sustainability Metrics

The framework popularly used to evaluate sustainability is called the TBL, as mentioned before. John Elkington (1994) created the concept to measure the economic, environmental, and societal impacts of limiting fossil fuel usage in transportation. *Figure 27* illustrates the concept of TBL where the intersection of the three bottom lines is the ideal place where transportation businesses want to achieve sustainability. Each bottom line in TBL framework is broken down into various subdivisions, and examples of how parts of the transportation industry use these bottom lines are given in this unit.



Figure 57. The triple bottom line. Developed by LINCIS in Supply Chain Management Consortium.

Environmental Bottom Line	Societal Bottom Line	Economic Bottom Line
<ul style="list-style-type: none"> • Material use measures: Percentage of recycled metal used in new vehicles • Energy use measures: Miles per gallon/alternative fuels used • Solid residue measures: Particulate matter emitted • Liquid residue measures: Oil spillage/non-recycled oil used by vehicles • Gaseous residue measures: Carbon footprint 	<ul style="list-style-type: none"> • Suppliers: Percent of minority-owned business supplying to the transportation sector • Customers: Percent of backhauls customers agree to • Employees: Number of accidents/workers injured per thousand employees • Local Community: Percent of income donated to local community 	<ul style="list-style-type: none"> • Cash flow and growth management measures: Net profit • Balance sheet measures: Return on working capital regarding asset utilization • Productivity and efficiency measures: Landed cost/cost of inventory • Demand management measures: Inventory turnover/fill rate • Capitalization measures: Cost of capital



Unit 3: Innovation in Transportation

Advanced technology developments are reshaping the transportation industry and have the potential to profoundly impact transportation in the future. Innovations have been developed across transportation modes, and the focus of these developments has been providing improved services at a lower cost, which will create a more favorable impact to the environment. Examples of these innovations and advances are discussed in this unit.



Figure 58. Rail transportation.
Developed by LINC'S in Supply
Chain Management Consortium.

Rail Transportation

Recently, Electro-Motive Diesel, along with the engineering expertise of Progress Rail, Electro-Motive, and Caterpillar, released the first of six pre-production tier four compliant locomotives. Their stated goal with this design was to take this product line to the next level in terms of innovation and sustainability by optimizing fuel efficiency and improving emissions performance over previous models. The improvements in reliability and maintainability will also have better utilization and lower maintenance costs.

In addition to locomotive innovations, railways are continually developing new processes and other technologies to help ensure rail cargo security and safety, including accident prevention. These examples are in various stages of development and implementation:

- **Wayside detectors:** These sensors identify defects, such as overheated bearings and damaged wheels on passing rail cars.
- **Acoustic detectors:** These trackside systems use acoustic measures to evaluate the soundness of internal bearings to identify those nearing failure.
- **Track geometry cars:** These high technology cars use electronic and optical instruments to inspect track alignment and rail flaws in order to determine where tracks need maintenance before an accident happens.

Air Transportation



Figure 59. Air transportation.
Developed by LINC'S in Supply
Chain Management Consortium.

During an aircraft design phase, it is not unusual for collaboration between the aircraft primary designer (like Boeing or Airbus) and the suppliers to the industry and U.S. government agencies, like NASA, to leverage the latest technologies and innovation.

During the Boeing 777 development, Boeing worked closely with NASA to leverage technology used on the U.S. space programs. Boeing was able to easily incorporate lightweight composite materials, new radial tire designs, and other contributions, which resulted in greater operating efficiency, environmental compatibility, and safety.

More recently, during development and production of the Boeing 787 Dreamliner, one of the main goals was to reduce carbon emissions in addition to improving fuel efficiency. Boeing was able to accomplish



these goals by using many new technologies, including using lightweight carbon-fiber for the fuselage and wings instead of the typical aluminum to reduce weight, and worked closely with General Electric to increase the fuel efficiency, which yielded a 30% reduction in fuel consumption when compared to previous engine models. These technological advancements and innovations greatly contribute to a more sustainable environment.

Road Transportation



Figure 60. Road transportation.
Developed by LINCS in Supply
Chain Management Consortium.

Motor carrier transportation is the most dominant and convenient form of moving goods. Considering the vast number of tractors (able to pull trailers), delivery vans, and other goods-movement vehicles, innovations and technological advances in engine design, performance, and safety have a significantly favorable impact to the environment.

For example, Daimler Trucks of North America, through Freightliner, Western Star, Detroit Diesel and Thomas Busses, stated “sustainability is not just our aspiration. It’s our obligation.” Daimler’s goal is to make transporting goods as sustainable and safe as possible for future generations, and their efforts are focused on an initiative called shaping the future. The result of this initiative has enabled the delivery of clean drive systems to meet the needs for efficient transportation solutions while improving air quality. These technologies are offered though hybrid, electric, natural gas, and clean diesel power tractors. In addition to advanced, clean drive systems, newer trucks are outfitted with active technologies to prevent accidents as well as passive systems to protect occupants in a crash.

Los Angeles, California is a smog-choked region, which could benefit from these new technology power tractors, but officials are also considering other alternatives. Siemens AG has developed, and is currently testing, a trolley-like system relying on overhead wires for specially equipped hybrid-electric freight-drive trucks. This technology would go a long way to reduce noxious vehicle emissions in the congested Los Angeles and Long Beach seaports, where cargo transport is accountable for a significant amount of the smog.

Water Transportation



Figure 61. Water transportation.
Developed by LINCS in Supply
Chain Management Consortium.

Like other modes of transportation previously mentioned, ship design and other maritime innovations have enabled safer, cost-efficient alternatives to help preserve a sustainable environment. According to the National Academy of Engineering, more than 90% of world trade is moved by the maritime industry. Additionally, seaborne trade has more than quadrupled in the past 40 years and now exceeds 6 billion tons per annum, with 4% predicted annual growth. There are approximately 10,000 shipping companies operating a commercial shipping fleet of approximately 50,000 vessels.



In recent years, new improvements have been made in the productivity of shipbuilding, hull efficiency, propulsion efficiency, and many forms of on-board automation to help provide cost-efficient services and sustainable systems.

By 2020, the National Academy of Engineering also stated it is likely ships will only be permitted to burn low-sulfur diesel oil, marine-gas oil, or be required to install treatment technologies to reduce emissions. This will encourage further efforts to improve efficiencies of hull and propulsion systems.

One such change is already underway. A company named LadeAS was established in 2010 to develop the project Vindship™. A Norwegian patent was issued in 2012 on Project Vindship™, which is a hybrid merchant vessel for sustainable sea transport. This vessel will be a hybrid eco-efficient ship powered by the wind and **liquefied natural gas**. The hull will be shaped like a symmetrical air foil, and with liquefied natural gas fuel propulsion, it is estimated there will 60% fuel savings and emission reductions compared to the 80% fuel usage and emissions existing ship designs.

Learning Block 10 Summary

This learning block couples the issue of technological change and how those changes and innovations can create a more sustainable environment. The transportation industry is constantly evolving due to advances in technology to meet consumer demand. These technological advances are also creating a more sustainable environment to enable continued growth in the industry. Global concerns about climate change, energy use, environmental impacts, and pricing efficiency require new and different approaches to transportation solutions and systems in the U.S. and internationally to create cost-effective services with less adverse impact to the environment. Metrics are also provided to determine the overall effect to measure the changes.



Figure 6. Transportation Operations. Developed by LINCS in Supply Chain Management Consortium.



Learning Block 10 Practice Questions

1. **Sustainability in transportation is an important issue because:**
 - a. A significant amount of fossil fuels are used
 - b. The industry only emits a very small percentage of greenhouse gasses
 - c. It creates funding for new ship designs
 - d. The railroads have not made any improvements
2. **Motor carrier tractor innovations have resulted in:**
 - a. Smaller diesel engines
 - b. Larger cabs for drivers
 - c. Hybrid, electric, natural gas, and clean diesel engines
 - d. Longer production times
3. **Sustainability metrics for transportation were developed to:**
 - a. Support tax increases
 - b. Increase company revenues
 - c. U.S. Department of Transportation mandates
 - d. Assess environmental, economic, and social impacts
4. **One of the environmental benefits of sustainable actions is:**
 - a. An increase of material resources
 - b. Increase in sulfur emissions
 - c. Reduction of emissions and pollutants
 - d. Reduction in gasoline prices
5. **More than 90% of the world trade is dependent on which mode of transportation?**
 - a. Aircraft
 - b. Ships
 - c. Motor Carrier
 - d. Rail
6. **Aircraft improvements in fuel efficiency and reductions in emissions is a result of:**
 - a. Design innovations
 - b. Bigger engines
 - c. Lighter cargo loads
 - d. Shorter trips
7. **Which innovation have railroads implemented to promote safety and prevent accidents?**
 - a. Installed wayside and optical detectors
 - b. Implemented safety inspections
 - c. Perform periodic checks of rail cars
 - d. Reduced travel speeds



- 8. Sustainability is the responsibility of:**
- a. Engineers working on new designs
 - b. Financial managers
 - c. Truck drivers
 - d. Everyone
- 9. The seaports of Los Angeles and Long Beach are considering hybrid-electric freight-drive trucks in order to:**
- a. Reduce the dense smog around the seaports
 - b. Increase the use of electricity
 - c. Safeguard against prices increases in diesel fuel
 - d. Get new trucks
- 10. How can the transportation industry meet the predicted growth demands of the marketplace?**
- a. Use aircraft for quicker deliveries
 - b. Match design innovations to meet sustainability goals to create cost-efficient services
 - c. Build more trucks and ships
 - d. Reduce prices to beat the competition



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Practice Questions Answer Key

Learning Block 1

1. C
2. C
3. A
4. A
5. A
6. A
7. C
8. A
9. B
10. C

Learning Block 5

1. B
2. B
3. C
4. C
5. A
6. D
7. A
8. B
9. D
10. C

Learning Block 9

1. B
2. A
3. D
4. D
5. A
6. C
7. B
8. D
9. A
10. C

Learning Block 2

1. C
2. A
3. A
4. A
5. C
6. B
7. D
8. D
9. C
10. A

Learning Block 6

1. A
2. C
3. C
4. D
5. B
6. D
7. D
8. B
9. A
10. D

Learning Block 10

1. A
2. C
3. D
4. C
5. B
6. A
7. A
8. D
9. A
10. B

Learning Block 3

1. B
2. C
3. A
4. C
5. A
6. A
7. C
8. C
9. D
10. D

Learning Block 7

1. D
2. A
3. B
4. D
5. A
6. B
7. C
8. A
9. D
10. C

Learning Block 4

1. A
2. C
3. B
4. D
5. B
6. C
7. A
8. A
9. D
10. D

Learning Block 8

1. B
2. D
3. A
4. C
5. A
6. A
7. C
8. A
9. C
10. C



Transportation Operations Certification Track Glossary

*: Indicates terms coming, in part or in whole, from the Supply Chain Management Terms and Glossary from August 2013.

0-9

20-Foot Equivalent Unit (TEU)*: Standard unit for counting containers of various capacities and for describing the capacities of container ships or terminals. One 20 Foot ISO container equals 1 TEU. One 40 Foot ISO container equals two TEU. A 20 foot container is typically 8.5 feet tall and 8 feet wide outside and has an internal capacity of 1,170 square feet.

3PL: See *Third-Party Logistic Provider*.

A

Absolute Minimum Charge (AMC): A fixed cost presented in contracts listed as the minimum amount accepted.

Acceptance: The second important phase of creating a contract after the offer phase. The recipient of the offer must accept the offer in order to move forward with creating a contract in the consideration phase.

Accessorial Charge*: A carrier's charge for accessorial services, such as loading, unloading, pickup, and delivery, fuel surcharges, single shipments, and detention/demurrages. See *Accessorials*.

Accessorials: See *Accessorial Charge*.

Active Shipper/Package System: Utilizes an electronic, temperature-controlled container with a fan and dry ice; this system usually has two refrigeration units.

AIDC: See *Automatic Identification and Data Capture System*.

Air Cargo*: Refers to freight moved via air transportation.

Air Waybill (AWB)*: A bill of lading for air transport serving as a receipt for shippers and indicates carriers have accepted the goods listed. Acceptance obligates carriers to carry the consignment to the airport of destination according to specified conditions.

AMC: See *Absolute Minimum Charge*.

Asset-Based Carrier: A type of 3PL who moves a company's freight on their own trucks and stores them in their own warehouses.

Asset Utilization: A measure of how well a company is using its resources. The quality of the company's management can also be inferred from this measurement.

Automatic Identification and Data Capture (AIDC) System: Provides tools for automatically identifying objects, collecting data about them, and entering data directly into computer systems. Technologies usually considered a part of AIDC include barcodes and RFID.



Average Transit Time: This time metric can be calculated by taking the total time, from pickup to delivery, of a shipment for every single shipment and dividing it by the total number of shipments.

Average Vehicle Turnaround Time: The average time elapsed between when a vehicle arrives at a company's facility and when it leaves the facility. This time metric can be calculated by adding up vehicle turnaround times and dividing by the total number of vehicles arriving at or leaving from the facility.

B

Backhaul*: The portion of a transport trip typically associated with trucking, which is incurred when returning a vehicle to its point of origin. Ideally, carriers will have freight to carry back, but if the trip is empty, it is called deadhead.

Balance of Freight: An ideal situation where freight going to a destination matches the amount going back to the starting point.

Balance Sheet Measures: A balance sheet keeps track of profits and losses (i.e., return on working capital), and this measure is used in determining the economic bottom line. See also *Asset Utilization*.

Barcode*: A symbol consisting of a series of printed bars representing values. A system of optical character reading, scanning, and tracking of units by reading a series of printed bars for translation into a numeric or alphanumeric identification code. A popular example is the UPC code used on retail packaging.

Base Rate: The starting price for a negotiation. See also *Quoted Rate*.

Best Practice*: A specific process or group of processes that have been recognized as the best method for conducting an action. Best practices may vary by industry or geography, depending on the context. Best practices methodology may be applied with respect to resources, activities, cost objectives, or processes. Note: Best practices that are generally available from any source should be analyzed to determine their applicability to given situations before being used as a guideline or benchmark.

Bill of Lading*: A transportation document containing the terms and conditions between shippers and carriers: also referred to as a contract of carriage.

Boxcar*: An enclosed rail car typically 40 to 50 feet long used for packaged freight and bulk commodities.

Break-Bulk*: The separation of a single consolidated bulk load into smaller, individual shipments for delivery to the ultimate consignees. This is preceded by a consolidation of orders at the time of shipment, where many individual orders destined for a specific geographic area are grouped into one shipment in order to reduce cost for shippers.

Bulk Carrier: A merchant ship specifically designed to transport unpackaged bulk cargo in its cargo hold, such as grains, coal, ore, and cement.

Bunker Adjustment Factor: An additional surcharge levied on the shippers to compensate for fluctuations in the price of ships' fuel; this is also called a bunker surcharge.

C

Cabotage*: A federal law requiring coastal and inter-coastal traffic to carry goods in U.S.-built and registered ships.

Capitalization Measures: Figures and ratios used to measure the amount of capital a company has on its balance sheets. This measure is used in determining the economic bottom line.



Carriage and Insurance Paid To (CIP)*: An INCOTERM used primarily for multimodal moves; it is the same as CPT, except with CIP sellers must also purchase cargo insurance in the buyers' names. See also *INCOTERMS*.

Carriage Paid To (CPT)*: Similar to CIF, except buyers pay for insurance. Sellers, however, are responsible for export clearance. See also *INCOTERMS*.

Carrier: A firm which transports goods or people via land, sea or air.

Cash Flow and Growth Management Measures: Figures and ratios used by companies to measure how much cash flow exist (i.e., the amount of cash available) and the overall financial health of the company from an accounting perspective. This measure is used in determining the economic bottom line.

Centweight: Tariffs are generally quoted on a 100-pound basis.

Certificate of Inspection: A certificate verifying the quality or authenticity of goods; this certificate is issued by an independent inspection agency.

Certificate of Insurance: A certificate issued by an insurance agency when buyers and sellers use the CIF and CIP INCOTERMS or if buyers and sellers want to buy insurance independent of the INCOTERMS, which is issued for a small premium.

Certificate of Origin*: An international business document certifying the country of origin of the shipment.

CIF: See *Cost, Insurance, Freight*.

CIP: See *Carriage and Insurance Paid To*.

Class Rate System*: A classification and uniform distance system used to create class rates. A class rate is available for any product between any two points. Instead of having a different price for every commodity, goods with similar freight characteristics are assigned to common freight groups called classes. There are 18 freight classes identified by a numeric value from 50 to 500. Lower class ratings equate to lower prices.

Client: A personal computer or smartphone is a client. At the other end of the connection are large computers known as servers, which store information a client would request.

Cold Chain: The transportation of items requiring a constant temperature, either cold or hot, to keep products fresh, safe, and healthy. Cold chain technology also handles the diagnostics, research, and investigational materials mandatory for controlled temperatures.

Collision Avoidance Systems: Technological development systems designed to detect the likelihood of upcoming crashes or departures from drivers' lanes. Once these systems detect possible crashes or lane drifts, they warn the drivers to take preventive action. Collision detection systems use radar to keep track of the distance between vehicles and the vehicles in front of them.

Commercial Invoice*: A document created by sellers. An official document used to indicate, among other things, the names and addresses of buyers and sellers, the product(s) being shipped, and their value for customs, insurance, or other purposes.

Commercial Motor Vehicle: A self-propelled or towed motor vehicle used on a highway interstate or intrastate commerce to transport passengers or property when the vehicle falls into one of the categories identified by the FMCSA.



Consideration: A form of mutual obligation in which parties are bound by contracts to perform at a certain level and agree to carry out their responsibilities. Considerations can hold value and give contracts legal validity.

Constraint*: A bottleneck, obstacle, or planned control limiting the utilization of capacity. Managers have little or no control over constraints.

Consular Invoice*: A document, required by some foreign countries, describing a shipment of goods and showing information, such as the consignor, consignee, and value of the shipment. This invoice is certified by a consular official of the foreign country, used by the country's custom.

Consumer: Someone who purchases goods and/or services for personal use.

Container*: 1) A box, typically 10 to 40 feet long, primarily used for ocean freight shipments. For travel to and from ports, containers are loaded onto truck chassis or railroad flatcars. 2) The packaging, such as a carton, case, box, bucket, drum, bin, bottle, bundle, or bag, which an item is packed into.

Contract*: A legally binding agreement between two or more parties to provide specific products or services.

Conversion: The process of taking one or more materials and processing them to create a new materials or products.

Cost and Freight*: The cost of merchandise and freight costs. Sellers are responsible for the product and the transportation costs to the destination point. See also *INCOTERMS*.

Cost, Insurance, Freight (CIF)*: A trade term requiring the seller to arrange for the carriage of goods by sea to a port of destination, and provide the buyer with the documents necessary to obtain the goods from the carrier. See also *INCOTERMS*.

Cost Metrics: Measures of a company's financial performance.

Cost Per Ton-Mile: A cost metric of the total expenses the shipper incurs on transportation divided by the total ton-miles.

Cost Per Unit Shipped: The ratio of shipping costs divided by the total number of units of goods shipped in a given time period.

CPT: See *Carriage Paid To*.

Currency Adjustment Factor*: An added charge assessed by water carriers for currency value changes. It is sometimes applied when currencies need to be converted.

Customer*: 1) In distribution, the trading partner or reseller. 2) In direct-to-consumer, the end customer or user.

Customer Service*: Activities between buyers and sellers to enhance or facilitate the sale or use of sellers' products or services.

Customs and Border Protection*: Formed during the creation of the Department of Homeland Security in 2003, customs and border protection consists primarily of the customs inspection function formerly performed by the U.S. Customs Service as part of the Department of Treasury. Customs and border protection also consists of the immigration inspection function, formerly performed by the Immigration and Naturalization Service, and the Border Patrol, which was formerly a part of the Department of Justice.



D

Deadhead*: The return of an empty transportation container back to a transportation facility. This is a commonly used description of an empty backhaul.

Decision Variables: Variables the end user or transportation manager can control.

Decline: As demand continues to drop, companies try to adopt product innovations to keep customers interested, but eventually, products do not appeal or meet customers' expectations. At this stage, cost is a critical factor.

Delivered at Place: The INCOTERM indicating sellers are discharged of responsibilities when goods are available to buyers on the mode of transportation where the goods have arrived. See also *INCOTERMS*.

Delivered at Terminal: The INCOTERM indicating it is the seller's responsibility to clear the goods for export and pay loading, freight, and unloading charges at the designated terminal. See also *INCOTERMS*.

Delivered Duty Paid*: The maximum obligation assumed by sellers. Sellers are responsible for risk and charges up to the consignors' door. See also *INCOTERMS*.

Demand*: What customers or users actually want. Demand is typically associated with the consumption of products or services as opposed to a prediction or forecast.

Demand Management Measures: Figures used to measure the effects or efficiency of elements in a demand plan. This measure is used in determining the economic bottom line.

Derived Demand*: A term in economics in which demand for one good or service occurs as a result of demand for another. For example, demand for coal leads to derived demand for mining, as coal must be mined for coal to be consumed.

Detention/Demurrage*: The carrier charges and fees applied when rail freight cars, ships, and carriers are retained beyond a specified loading or unloading time.

Differential*: A discount offered by a carrier who faces a service time disadvantage over a route.

DIM: See *Dimensional Factor*.

Dimensional Factor (DIM): The freight carriers' opinions of what items *should* weigh based on their volume.

Dispatchers: Transportation personnel who route trucks and manpower efficiently in order to meet customer needs promptly and responsively. Dispatchers often have specialized knowledge regarding transportation requirements for various specialized commodities.

Distribution Center (DC)*: An inventory holding warehouse facility for manufacturing.

Door-to-Door Service: Shipping service in which freight is collected at a point of origin and delivered directly to the destination without any intermediate stops.

E

EDI: See *Electronic Data Interchange*.

Electronic Data Interchange (EDI)*: Intercompany, computer-to-computer transmission of business information in a standard format.



Electronic Logging Device (ELD): EDL is an electronic solution that enables professional truck drivers and commercial motor carriers to easily track Hours of Service (HOS) compliance. It is intended to help create a safer work environment for drivers, and make it easier, faster to accurately track, manage, and share records of duty status. ELD connects to the truck's engine to record if the truck is in motion.

End Customer: The final consumer who purchases the product.

Energy Use Measures: Figures or ratios used to measure energy use or the efficiency of energy use. This measure is used in determining the environmental bottom line.

Eutectic Plate: Plates similar to gel packs and used in cold chain technology.

Ex Works*: The buyer assumes total responsibility for the shipment. Delivery is accomplished when the product is handed over to the buyer's representative at the shipper's plant or distribution center. The buyer is responsible for the freight costs, insurance, export and import clearance, and customs charges. See also *INCOTERMS*.

EXW: See *Ex Works*.

F

FAK: See *Freight-All-Kinds*.

FCL: See *Full Container Load*.

Federal Maritime Commission: A regulatory agency controlling services, practices, and agreements of international water common carriers and noncontiguous domestic water carriers.

Federal Motor Carrier Safety Administration (FMCSA): Enforces safety regulations for commercial motor vehicle drivers and vehicle safety.

Federal Motor Carrier Safety Regulations: These regulations are set by the FMSCA for commercial freight, the FMSCA has issued several regulations designed to minimize incidents caused by commercial motor carriers operating on public roads: including cell phone bans and emergency equipment regulations.

Fixed Cost*: Non-fluctuating costs with business volume in the short run. Fixed costs include items such as depreciation on buildings and fixtures.

Fleet: A group of transportation modes working together to accomplish a similar goal (usually to provide deliveries for customers).

FMCSA: See *Federal Motor Carrier Safety Administration*.

FOB: See *Free on Board*.

For-Hire Carrier*: A carrier providing transportation services to the public for a fee.

Free Alongside Ship*: Requires sellers to deliver products alongside a given vessel at a port. See also *INCOTERMS*.

Free Carrier*: Document requiring sellers to fulfill certain responsibilities when products are delivered to carriers. See also *INCOTERMS*.

Free on Board (FOB)*: Contractual terms between buyers and sellers, which define where title transfers take place.

Freight*: Goods being transported from one place to another.



Freight-All-Kinds (FAK)*: An approach to rate-making in which the ante is based only upon the shipment weight and distance; widely used in trailer on a flat car services.

Freight Broker: A freight broker's main purpose is to serve as a conduit for connecting freight carriers with shippers, similar to buying plane tickets using third-party websites (e.g., Priceline.com or Expedia.com).

Freight Cost: The cost of transporting goods, which is reflective of a number of factors excluding normal transportation costs. The main determining factors of freight rate are mode of transportation (e.g., truck, ships, train, air, and craft), weight size, distance, points of pickup and delivery, and the type of goods being shipped.

Freight Forwarder: An organization providing logistics services as an intermediary between shippers and carriers, typically on international shipments. Freight forwarders provide the ability to respond quickly and efficiently to changing customer and consumer demands as well as international shipping (import/export) requirements.

Freight Tariffs*: The fees and rules applied by a carrier for its services transporting freight.

Fuel Surcharge: Assessed to cover unexpected rises in price of fuel (typically diesel fuel). These surcharges are usually based on certain standard indices (e.g., U.S. average).

Full Container Load (FCL)*: A term used when goods occupy a whole container.

G

Gaseous Residue Measures: Figures and ratios used to measure the creation of various gases and their subsequent residual remains. This measure is used in determining the environmental bottom line.

Global Positioning System (GPS)*: A system which uses satellites to precisely locate an object on earth. Used by trucking companies to locate over-the-road equipment.

GPS: See *Global Positioning Systems*.

Growth: In this stage the sales of products are expanding. Changes to product design, manufacturing processes, and quality are evolving to maximize this revenue stream. Also, the supply chain is monitored and evaluated to make sure production capacity can be maintained or even expanded.

H

Hazardous Material*: A substance or material the USDOT has determined to be capable of posing a risk to health, safety, and property when stored or transported in commerce.

Headhaul: The portion of a transport trip typically associated with trucking, which is incurred when a vehicle leaves toward its destination from its point of origin.

Hedging: A risk strategy firms use to reduce the amount of exposure to risks. Companies do this by choosing to spread their business across multiple carriers instead of relying on a smaller amount of suppliers or vendors for product inputs.

HOS: See *Hours of Service Rules*.

Hours of Service (HOS) Rules: A series of guidelines about how many hours, drivers are allowed to operate their commercial vehicle.



Import License*: Official authorization issued by a government agency which allows for the transport of goods across their national boundaries. Licenses may be required for all, or only specific classes, of commodities.

Inbound Logistics*: The movement of materials from suppliers and vendors into production processes or storage facilities.

INCOTERMS*: International terms of sale developed by the International Chamber of Commerce to define sellers' and buyers' responsibilities. INCOTERMS are as follows: Ex Works; Free Carrier; Free Alongside Ship; Free on Board; Cost and Freight; Cost, Insurance, Freight; Carriage Paid To; Carriage and Insurance Paid To; Delivered at Place; Delivered at Terminal; and Delivered Duty Paid.

Indirect Cost*: A resource or activity cost, such as operation costs and overhead. This cost cannot be directly traced to a final cost object because no direct or repeatable cause-and-effect relationship exists. An indirect cost uses an assignment or allocation to transfer cost.

Intermodal Transportation*: Transporting freight by using two or more transportation modes, such as a truck and rail or a truck and oceangoing vessel.

Internet*: A computer term referring to an interconnected group of computer networks from all over the world (i.e., a network of networks). Accessed via a modem and an online service provider, it contains many information resources and acts as a giant electronic message routing system.

Interstate Commerce*: The transportation of persons or property between states.

Intrastate Commerce*: The transportation of persons or property between points within a state. A shipment between two points within a state may be interstate if the shipment had a prior or subsequent move outside of the state and the intent of the shipper was an interstate shipment at the time of shipment.

Inventory*: Components, raw materials, work in process, finished goods, and supplies required for the creation of goods and services. It can also refer to the number of units and/or value of the stock of goods held by a company.

Invoice*: A detailed statement showing goods sold and amounts for orders. The invoice is prepared by sellers and is the document that buyers use to make payments.

Lane Departure Systems: Similar to collision avoidance systems, these systems are designed to detect the likelihood of departure from drivers' lanes. Once they detect a possible lane drift, cars with these systems may warn the driver or take preventive action, depending on how they are programmed.

LASH: See *Lighter Aboard Ship*.

Law of Large Numbers: Used by insurance companies to gather risk from many different customers into a more predictable risk profile.

Less-Than-Container Load (LCL): Shipment that is less than a complete container load.

Less-Than-Truckload (LTL): Trucking companies that consolidate and transport smaller shipments of freight by utilizing a network of terminals and relay points.

Lighter*: A flat-bottomed boat designed for cross-harbor or inland waterway freight transfer. The terms *barge* and *lighter* are used interchangeably, but a barge usually refers to a vessel used for a long haul, while a lighter is used for a short haul. See also *Lighter Aboard Ship*.



Lighter Aboard Ship (LASH): Refers to the practice of loading barges (also called lighters) onto larger vessels for transport. See also *Lighter*.

Link*: The transportation method used to connect the nodes (plants, warehouses) in a logistics system.

Liquefied Natural Gas: An alternative fuel source created by chilling natural gas and squeezing it down to 1/600 of its original volume. Natural gas is considered one of the most environmentally friendly fossil fuels available.

Liquid Residue Measures: Figures and ratios used to measure the amount of liquid remaining after processing or conversion. This measure is used in determining the environmental bottom line.

Logbook*: A daily record of the hours interstate drivers spend driving, off duty, sleeping in the berth, or on duty but not driving.

Logistics*: The process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods, services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements.

LTL: See *Less-Than-Truckload*.

M

Manufacturing: The phase of the product life cycle in which a prototype is built and tested, and then the mass production of the product is completed.

Marine Terminal Operator: Provides facilities such as wharfage, docks, or warehouses to ocean carriers.

Material Use Measures: Figures and ratios used to measure the amount or efficiency of materials used during a process. This measure is used in determining the environmental bottom line.

Meeting of the Minds: Contract negotiations in the acceptance phase in which offers and counteroffers are exchanged until both sides reach an agreement.

Merchant Ships: Also known as bulk carriers and are specially designed to transport unpackaged bulk cargo in their cargo holds (e.g., grains, coal, ore, and cement).

Merge in Transit (MIT)*: The process of combining or merging shipments from multiple suppliers that are going directly to the buyer or to the store, bypassing the seller. This is essentially a drop shipment from several vendors to one buyer, which is being combined at an intermediary point prior to delivery.

Mileage Rate*: A rate based on the number of miles the commodity is shipped.

Modal Optimization: An emerging field of transportation management that attempts to use the most efficient transportation modes available. Examples of this field include MIT, pooled distribution, and drop trailer programs.

Modal Split*: The relative use made of the modes of transportation; these statistics used include ton-miles, passenger miles, and revenue.

Motor Carrier*: Also referred to as common carriers, an enterprise that offers service via land motor carriage.

N

National Motor Freight Classification*: A tariff that contains descriptions and classifications of commodities and rules for domestic movement by motor carriers in the U.S.



National Motor Freight Traffic Association: An organization that publishes the National Motor Freight Classification and issues SCACs.

Negotiation: A counteroffer to an individuals or groups original offer.

Next Flight Out Price: Usually much more expensive than other prices offered because of the expedient shipping.

O

Objective: The goal that the manager is ultimately interested in achieving for the company.

Ocean Transportation Intermediaries: Intermediary companies between the shipper and the carrier that are either freight forwarders or carriers available to the public that do not own their own vessels. These intermediaries are regulated by the Federal Maritime Commission.

Offer*: A document that describes a business transaction to be performed. An example would be a request to a carrier to pick up goods for shipment.

On-Time Delivery*: A time metric defined as the percentage of orders received on time by the company from its suppliers (inbound), or delivered on time to the company's customers (outbound).

On-Time Pickup: This time metric is calculated by dividing the number of pick-ups that the freight carrier makes on time in a given time period by the total number of shipments in that time period.

Operations: The planning and manufacturing (conversion) of goods.

Order Fill Rate: 1) An indicator that provides insights into achieving the perfect order and into the fulfillment process. 2) The percentage of incoming customer orders that are filled on time. This can be calculated by taking the total number of completely filled orders and dividing by the total number of orders.

Outbound Logistics*: The process related to the movement and storage of products from the end of the production line to the end user.

Owner-Operator*: A trucking operation in which the owner of the truck is also the driver of the truck.

P

Packing List*: List showing merchandise packed and merchandise particulars. Normally prepared by shippers but not required by carriers.

Pallet*: The platform that cartons are stacked on and then used for shipment or movement as a group. Pallets may be made of wood or composite materials. Pallets have electronic tracking tags, and most are recycled.

Pallet-Rack*: A single or multi-level structural storage system that is utilized to support high stacking of single items or palletized loads.

Passive Shipper/Package System: The packing technology used for cold chain transportation that typically consists of a box with gel packs, freezer packs, and/or dry ice within an insulated box; these can be single use or regulated.

Pipeline: Mode of transportation used for handling inter-city ton-mileage of freight, including crude oil, refined oil, gasoline, and natural gas.

Placard: Sign attached to the outside of a vehicle that indicates items, such as vehicle registration information or whether hazardous materials are being transported.



Pooled Distribution*: A shipping term for the practice of combining shipment from multiple shippers into a truckload in order to reduce shipping charges.

Postponement*: The delay of final activities (e.g., assembly, production, and packaging) until the latest possible time. A strategy used to eliminate excess inventory in the form of finished goods that may be packaged in a variety of configurations and used to maximize the opportunity to provide a customized end products to customers.

Private Carriers: A carrier that provides transportation services to firms and owns or leases their vehicles without a fee. Private motor carriers may haul at a fee for wholly owned subsidiaries.

Process*: A series of time-based activities that are linked to complete a specific output.

Procurement*: The activities associated with acquiring products or services. The range of activities can vary widely between organizations to include parts of the functions of procurement planning, purchasing, inventory control, traffic, receiving, incoming inspection, and salvage operations.

Product Loss: Occurs when products are lost for any number of reasons, including piracy on ships, pilferage, and others.

Product Pilferage: Occurs when packages or items are stolen by the people who were trusted with them (e.g., freight handlers, equipment operators, and managers).

Prospect: A term that refers to being a prospective or potential customer.

Purchase Order*: The purchaser's authorization used to formalize a purchase transaction with a supplier. The physical form or electronic transaction buyers use when placing orders for merchandise.

Q

Quoted Rate: The starting price for negotiation. See also *Base Rate*.

R

Radio Frequency Identification (RFID)*: The use of radio frequency technology, including RFID tags and tag readers to identify objects. Objects may include virtually anything physical, such as equipment, pallets of stock, or even individual units of product.

Rate Basis Point*: The major shipping point in a local area; points in the local area are considered to be the rate basis point. Motor carriers then quote rates based on one rate basis point to another rate basis point. The quoted rates are not exactly based on mileage, but they are close.

Rating: Occurs when TMS helps shipping managers choose the best cost carriers by factoring in issues such as FAK groupings, discounts, and accessories.

Raw Materials*: Crude or processed material that can be converted by manufacturing, processing, or both, into new and useful products.

Reefer*: A term used for refrigerated vehicles.

Regulated Shipper: A type of cold chain technology that can hold products at an exact temperature for either 36 or 72 hours.

Regulation: An important guideline that must be followed in transportation industries in order to remain lawful, conduct business smoothly, and keep everyone in the transportation industry safe.

Reporting: Occurs when TMS helps a shipping manager by tracking carrier performance, customer service, cost, and other measures of carrier quality.



Return: Material that has been rejected by customers or buyers' inspection department and is awaiting shipment back to the supplier for a repair or replacement.

Reverse Logistics*: A specialized segment of logistics focusing on the movement and management of products and resources after the sale and delivery to customers and includes product returns for repair and/or credit.

RFID: See *Radio Frequency Identification*.

Risk: A cost consideration in transportation that sometimes increases the cost of shipping for products that are at higher risk of being damaged in transit than other products.

Risk Avoidance: The act of reducing the amount of risk so much that a task is completely avoided or not completed.

Risk Management*: Identifying, evaluating, and ranking the priority of risks followed by synchronized and cost-effective application of resources to lessen, monitor, and control the probability and/or impact of unfortunate events.

Risk Reduction: Occurs when companies participate in hedging or postponement strategies in order to reduce the amount of risk presented in transportation industries.

Risk Transfer: The act of transferring risk over to other parties that are created to receive and handle those risks (e.g., insurance companies).

Roll-On, Roll-Off*: A type of ship designed to permit cargo to be driven on the ship at origin and off the ship at destination; used extensively for the movement of automobiles.

Routing*: Process of determining how shipment will move between origin and destination. Routing information includes designation of carriers involved, actual route of carriers, and estimated time in route.

S

SCAC: See *Standard Carrier Alpha Code*.

Server: Large computers located at the other end of Internet connections. When a user logs onto the network to access a page, the user's computer sends a request to the server.

Shipment Jettisoning: Occurs when cargo is discharged because the master of an ocean-going vessel may feel that the integrity or safety of the vessel or crew is at risk.

Shipping*: 1) The act of conveying materials from one point to another. 2) The functional area that prepares the outgoing shipment for transport.

Single Shipment: An additional surcharge that is added when there is no (or limited) potential of repeat business.

Software: Refers to the brain of the machine—the programs that make the machine run, such as the operating system.

Solid Residue Measures: Figures and ratios used to measure the amount of particulate matter emitted during processing. This measure is used in determining the environmental bottom line.

Sourcing: The process of purchasing or procuring products and services.



Standard Carrier Alpha Code (SCAC)*: A unique 2 to 4-letter code assigned to transportation companies for identification purposes. SCAC codes are required for EDI, and are printed on bills of lading and other transportation documents.

Supplier*: An individual or an organization who supplies goods or services to companies. This is also sometimes referred to as a vendor.

Supply Chain*: 1) Starts with unprocessed raw materials and ends with final customers using the finished goods by linking many companies together. 2) The material and informational interchanges in the logistical process stretches from acquisition of raw materials to delivering finished products to the end user. Vendors, service providers, and customers are links in the supply chain.

Supply Chain Management (SCM)*: The design and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Notably, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party logistics providers, and end customers.

Sustainability*: Refers to efforts a company makes related to conducting business in a socially and environmentally responsible manner. It includes elements such as sustainable development, corporate social responsibility (CSR), stakeholder concerns, and corporate accountability.

T

Tanker: The most common type of bulk carrier that moves bulk liquid cargo, such as petroleum.

Team Drivers: Two drivers who are assigned to one truck and alternate driving duties.

Terminal: Includes places, either covered or not (e.g., quays, warehouses, container yards, and road, rail or air cargo terminals), in which goods are made available to buyers after being unloaded.

Terminal Handling Charge: This covers the charges for the movement of the freight when it is on the pier.

TEU: See *Twenty-Foot Equivalent Unit*.

Third-Party Logistics Provider (3PL)*: Outsourcing of a company's logistics operations to a specialized company. Services they provide are transportation, warehousing, cross-docking, inventory management, packaging, and freight forwarding.

TMS: See *Transportation Management System*.

Ton-Mile*: A measure of output for freight transportation; it reflects the weight of the shipment and the distance it is hauled. This metric is calculated by multiplying the amount of good shipped (in tons) and distance traveled (in miles).

Tractor*: The tractor is the driver compartment and engine of the truck. It has two or three axles, depending on the type of tractor used.

Trailer*: The part of the truck that carries the goods.

Trailer on a Flatcar*: Transport of tractor trailers with their loads on specially designed rail cars.

Transportation: The physical movement of people and goods between origin and destination points, thereby creating time and place utilities.



Transportation Management System (TMS)*: A computer system designed to provide optimized transportation management in various modes along with associated activities, including managing shipping units, labor planning and building, shipment scheduling through inbound, outbound, intra-company shipments, documentation management (especially when international shipping is involved), and third-party logistics management.

Transportation Manager: The generic term used to refer to the person responsible for the various roles involved in transportation management.

Transportation Operations: Focuses on the timely movement of materials and products within an organization and between organizations.

Transportation Security Administration*: Transportation Security Administration was created to strengthen the security of the nation's transportation systems and ensure the freedom of movement for people and commerce. Together with the customs and border protection, Transportation Security Administration is responsible for Operation Safe Commerce, which attempts to verify the contents of containers at their point of origin, ensures the physical integrity of the containers in transit, and tracks the movement of cargo and passenger transportation from origin to destination.

Transportation Supervisors: Transportation personnel who are usually with transportation service providers and responsible for dispatch duties of the drivers, driving supervision, monitoring of safety, and HOS and other USDOT regulation compliance.

Triple Bottom Line (TBL) Metrics*: Metrics that measure ecological and social performance in addition to financial performance.

Truckload (TL): Trucking companies that move full truckloads of freight directly from the point of origin to destination.

U

UCC: See *Uniform Commercial Code*.

Uniform Commercial Code (UCC): Provides the legal basis for the terminology used in domestic U.S. transactions between parties in a transaction.

U.S. Coast Guard: One of the five armed forces of the U.S. and the only military organization within the Department of Homeland Security. It safeguards U.S. maritime interests around the world and evaluates, boards, and inspects commercial ships as they approach U.S. waters. The Captain of the Port is the Coast Guard officer responsible for the security and safety of vessels and waterways in each U.S. port area.

V

Variable Cost*: A cost that fluctuates with the volume or activity level of business.

W

Warehouse*: Storage place for products. Principal warehouse activities include managing the receipt of product, storage, shipment, and order picking.

Weight Break*: The shipment volume at which the LTL charges the minimum TL weight.

Z

Zone-to-Zone Pricing: A pricing system where shipping origins and destinations are grouped into specific zones. The shipper will pay the inter-zone rate between these zones.



Addendum

The previous document version was V2.38 (file name LINCS.TO.v2.38.02282017).

Current version is v2.39 (file name LINCS.TO.v2.38.0xxx2017) and contain the following updates with **no changes to the content**:

*Removed from Title Page (p. 2) "LINCSEducation.org" and replaced with "CenterForSupplyChain.org".

*On page 20 of the Word document, changed the following sentence from reading:

"There are several different kinds of truck trailers, but for long-distance moves, the most common are the 48-foot and 53-foot trailers. The majority of the trailers on the interstate are 53-foot trailers. The standard pallet-rack measures 48 inches by 40 inches (length by width), and a typical 53-foot trailer is able to carry two rows of 15 pallets, for a maximum of 30 pallets. This mandates the pallets to be loaded 48 inches side to side and 40 inches front to back. Depending on the nature of the freight, double-stacking the pallets may be possible, which will double the trailer capacity from 30 to 60 pallets.

On the other hand, the 48-foot trailers can accommodate two rows of 14 pallets, which would make the trailer capacity 28 pallets single-stacked or 56 pallets double stacked (see Figure 8) using the same loading format. Smaller trailers have their advantages, especially in cases where truckers may haul heavier types of freight. In U.S. federal guidelines, through the Freight Management and Operations Department, the commercial vehicle size and weight program permits truck-trailer combinations to weigh up to 80,000 pounds. The truck and empty trailer can weigh up to 36,000 pounds, which leaves approximately 44,000 pounds available for freight."

Now reads:

"There are several different kinds of truck trailers, but for long-distance moves, the most common are the 48-foot and 53-foot trailers. Many of the trailers on the interstate are 53-foot trailers. The standard pallet-rack measures 48 inches by 40 inches (length by width), and a typical 53-foot trailer can carry two rows of 13 pallets, for a maximum of 52 pallets, if double-stacked. This mandates the pallets to be loaded 48 inches side to side and 40 inches front to back. Depending on the nature of the freight, double-stacking the pallets may not be possible, due to weight restrictions.

On the other hand, the 48-foot trailers can accommodate two rows of 12 pallets, which would make the trailer capacity 24 pallets single-stacked or 48 pallets double stacked (see Figure 8) using the same loading format. Smaller trailers have their advantages, especially in cases where truckers may haul heavier types of freight. In U.S. federal guidelines, through the Freight Management and Operations Department, the commercial vehicle size and weight program permits truck-trailer combinations to weigh up to 80,000 pounds. The truck and empty trailer can weigh up to 36,000 pounds, which leaves approximately 44,000 pounds available for freight."

*On page 20, *Figure 8* was updated to make corrections to the number of pallets in each trailer.

*Updated *Figure 6: Transportation Operations* image in each Learning Block Summary (multiple pages).

