

**THE LOCAL AND REGIONAL
ECONOMIC IMPACTS OF
THE PORT OF HOUSTON, 2006**

**PREPARED FOR:
PORT OF HOUSTON AUTHORITY
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EXECUTIVE SUMMARY

Martin Associates was retained by the Port of Houston Authority (PHA) to estimate the economic impacts generated by marine cargo activity at the public and private marine terminals located along the Houston Ship Channel. The public marine terminals are those owned by the Port of Houston Authority and include the Houston Public Grain Elevator #2, the Fentress Bracewell Barbours Cut Container Terminal, the Bulk Materials Handling Plant, Jacintoport, the Care Terminal, the PHA terminals in the Houston Turning Basin, and the Woodhouse Terminal. Private terminals include the petroleum refineries, general cargo terminals (i.e., Manchester Terminal), the petrochemical plants and the dry bulk/fertilizer terminals.

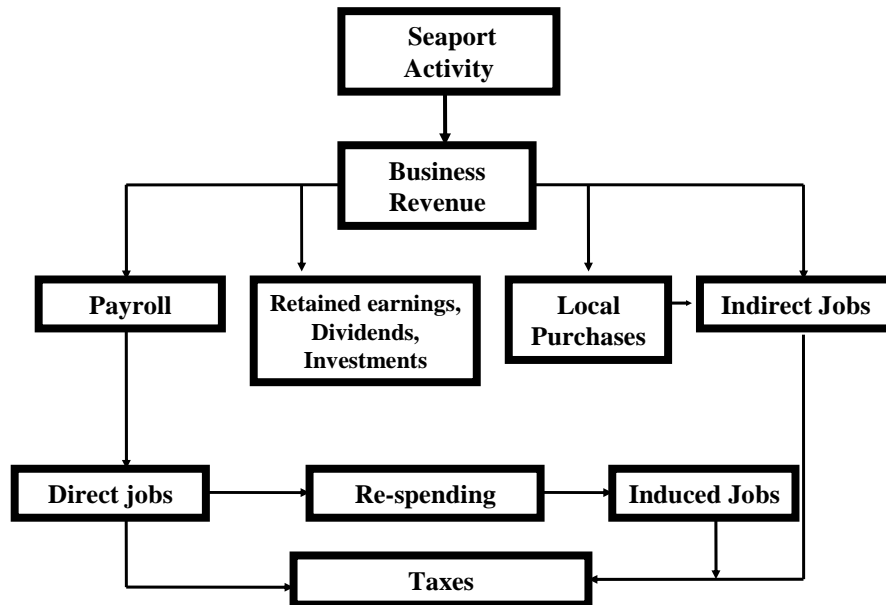
The impacts are measured for the year 2006 and separate economic impact models have been developed to measure the impacts generated by the PHA public facilities and the impacts generated by the total marine cargo and vessel activity at both the public and private marine terminals. These economic impact models can be used to estimate annual updates, as well as to test the sensitivity of the impacts to changes in such factors as marine cargo tonnage levels, labor productivity and work rules, new marine facilities development and expansion, and the impacts of harbor and channel deepening. The models can also be used to compare the economic impacts of marine activity with non-maritime development of waterfront land.

For the most part, the same methodology has been used to estimate the 2006 economic impacts as was used to estimate the economic impacts of the Port of Houston in 2002¹. Therefore, the results of this study can be directly compared with those of the earlier study, which measured the economic impacts of activity in calendar year 2000.

Exhibit E-1 graphically demonstrates how seaport activity impacts the local and regional economies. As this exhibit indicates, the marine cargo and vessel activity initially generate business revenue to the firms supplying marine services. This revenue is used to purchase employment (direct jobs) to provide the services, to pay stockholders and for retained earnings, and to purchase goods and services from local firms, as well as national and international firms (creating indirect jobs with these firms). Businesses also pay taxes from the business revenue.

¹The Economic Impact of the Port of Houston, prepared for the Port of Houston Authority, 2002, by Martin Associates.

Exhibit E-1
Flows of Economic Impacts through the Economy



The employees hired by the firms receive wages and salaries (personal income), a portion of which is saved, while another portion is used to buy goods and services such as food, housing, clothing, health care, etc. These purchases create a re-spending impact throughout the economy, known as the personal income multiplier. As a result of these local purchases, additional jobs (known as induced jobs) are created in the local economy. Local purchases are also made by the firms directly dependent upon the Port of Houston, including the petroleum refineries and petrochemical plants located along the Houston Ship Channel, as well as firms providing services to the Port such as stevedores, terminal operators, trucking firms and railroads, steamship lines and agents, and freight forwarders. The local purchases by directly dependent firms create indirect jobs. Finally, taxes are paid by individuals employed with the firms providing the services to the marine terminals and by the firms directly dependent upon the Port.

As demonstrated by this chart, four types of impacts are measured:

- Jobs;
- Employee earnings;
- Business revenue;
- State and local taxes.

With respect to jobs, four types of job impacts are measured. These are direct, induced, indirect and related jobs. The job impacts are defined as follows:

- Direct jobs are those jobs with local firms providing support services to the seaport. These jobs are dependent upon this activity and would suffer immediate dislocation if the seaport activity were to cease. Seaport direct jobs include jobs with railroads and trucking companies moving cargo to and from the PHA's marine terminals and private terminals, members of the International Longshoremen's Association (ILA) and non-ILA dockworkers, steamship agents, freight forwarders, ship chandlers, warehouse operators, bankers, lawyers, terminal operators, and stevedores.
- Induced jobs are jobs created locally and throughout the regional economy due to purchases of goods and services by those directly employed. These jobs are with grocery stores, the local construction industry, retail stores, health care providers, local transportation services, local and state government agencies providing public services and education to those directly employed, and businesses providing professional and business services in support of those directly employed. These goods and services would also be discontinued if seaport activity were to cease.
- Indirect jobs are those jobs generated in the local economy as the result of local purchases by the firms directly dependent upon seaport activity. These jobs include jobs in local office supply firms, equipment and parts suppliers, maintenance and repair services, insurance companies, consulting and other business services. If port operations were discontinued, these indirect purchases and the associated jobs and income would also be discontinued.
- Related jobs are with manufacturing and distribution firms -- such as steel fabrication firms using the steel imported through the marine terminals, manufacturers producing or consuming containerized cargo, and firms producing and consuming dry and liquid bulk cargoes such as petrochemical firms. Related jobs are not dependent upon the seaport marine terminals to the same extent as are the direct, induced and indirect jobs. For example, these firms can and do use other ports. It is the demand for the final product, i.e. steel products, that create the demand for the employment with these shippers/consignees, not the use of a particular seaport or marine terminal. It is to be emphasized that the employment with firms counted as directly dependent upon the port activities are excluded from the related jobs to avoid double counting.

The employee earnings consist of wages and salaries and include a re-spending effect (local purchases of goods and services by those directly employed), while business revenue consists of total business receipts by firms providing services in support of the marine activity. State and local taxes include taxes paid by individuals, as well as firms dependent upon the seaport activity.

The study is based on interviews with 1,046 firms providing services to the cargo and vessels handled at the PHA's marine terminals and the private terminals along the Houston Ship Channel. These firms represent more than 95 percent of the firms in the Houston seaport community, underscoring the defensibility of the study. Furthermore, the impacts can be traced back to the individual firm. The data collected from the interviews were then used to develop an operational model of the PHA public and private marine terminals.

SUMMARY OF IMPACTS GENERATED BY THE PORT OF HOUSTON

The economic impacts generated by the public and private marine terminals are summarized in Exhibit E-2.

Exhibit E-2
Summary of the Local and Regional Economic Impacts Generated by
the Port of Houston

	PUBLIC TERMINALS	PRIVATE TERMINALS	TOTAL
JOBS			
DIRECT	20,021	38,121	58,142
INDUCED	20,516	41,198	61,714
INDIRECT	28,024	51,103	79,127
RELATED JOBS	<u>324,586</u>	<u>261,480</u>	<u>586,066</u>
TOTAL	393,147	391,902	785,049
PERSONAL INCOME (1,000)			
DIRECT	\$932,308	\$1,901,192	\$2,833,500
RE-SPENDING/CONSUMPTION	\$2,450,850	\$4,997,854	\$7,448,705
INDIRECT	\$1,116,043	\$2,032,026	\$3,148,069
RELATED INCOME	<u>\$8,842,088</u>	<u>\$16,992,606</u>	<u>\$25,834,695</u>
TOTAL	\$13,341,289	\$25,923,679	\$39,264,968
ECONOMIC VALUE (1,000)			
DIRECT REVENUE	\$2,925,739	\$5,158,941	\$8,084,680
LOCAL PURCHASES	\$2,084,502	\$3,828,493	\$5,912,995
RELATED OUTPUT	<u>\$66,448,319</u>	<u>\$37,143,683</u>	<u>\$103,592,001</u>
TOTAL	\$71,458,560	\$46,131,116	\$117,589,676
STATE & LOCAL TAXES (1,000)			
DIRECT, INDUCED AND INDIRECT	\$422,925	\$839,521	\$1,262,446
RELATED STATE AND LOCAL TAXES	<u>\$831,156</u>	<u>\$1,597,305</u>	<u>\$2,428,461</u>
TOTALS	\$1,254,081	\$2,436,826	\$3,690,907

Totals may not add due to rounding

Specifically, the public and private marine facilities generated the following impacts in the State of Texas in 2006:

- **785,049 jobs in Texas** are in some way related to the cargo moving via the public and private marine terminals at the Port of Houston.

- Of the 785,049 jobs in Texas, **58,142 direct jobs** are generated by the marine cargo and vessel activity (including the cruise operations at the Port of Houston) at the public and private marine terminals. About 78 percent of these direct jobs are held by residents of Harris County.
- As the result of local and regional purchases by those 58,142 individuals holding the direct jobs, an additional **61,714 induced jobs** are supported in the regional economy.
- **79,127 indirect jobs** were supported by \$5.9 billion of local purchases by businesses supplying services at the marine terminals and by businesses dependent upon the Port of Houston.

In 2006, marine cargo activity at the public and private marine terminals at the Port of Houston and along the Houston Ship Channel generated a total of \$117.6 billion of total economic activity in the State of Texas.

- Of the \$117.6 billion, \$8.1 billion is the direct business revenue received by the firms directly dependent upon the Port and providing maritime services and inland transportation services to the cargo handled at the marine terminals and the vessels calling the port, as well as ship and rig repair and maintenance services. An additional \$5.9 billion is used for local purchases. The remaining \$103.6 billion represents the value of the output to the State of Texas that is created due to the cargo moving via the Port of Houston marine terminals and private marine terminals. This includes the value added at each stage of producing an export cargo, as well as the value added at each stage of production for the firms using imported raw materials and intermediate products that flow via the marine terminals and are consumed within the state. The majority of these user impacts are associated with the imported steel products receipts.
- Marine activity supported nearly \$39.3 billion of total personal wage and salary income and local consumption expenditures for Texas residents. This includes \$13.4 billion of direct, indirect, induced and local consumption expenditures, while the remaining \$25.8 billion was received by the related port users. The 58,142 direct job holders received \$2.8 billion of direct wage and salary income.

A total of \$1.3 billion of direct, induced and indirect state and local tax revenue was generated by maritime activity at the public and private terminals along the Houston Ship Channel. In addition, \$2.4 billion of state and local taxes were created due to the economic activity of the related users of the cargo moving via the public and private marine terminals. The total tax impact, including the impact of the related port users is \$3.7 billion.

PORT OF HOUSTON AUTHORITY PUBLIC TERMINAL IMPACTS

The jobs, income, revenue and tax impacts generated by the Port of Houston Authority's marine terminals are a subset of the port-wide impacts discussed in the previous section. It is important to separately identify and develop an economic impact model of the impacts generated by the Port of Houston Authority's marine terminals, in order to assess the impacts of new public investment in port facilities and to provide a tool to assist the Port of Houston Authority in future public port planning decisions. The impacts summarized in this section are those generated by the Port of Houston Authority's marine cargo and passenger cruise terminals, including the Houston Public Elevator #2; the Fentress Bracewell Barbours Cut Terminal; PHA terminals at Jacintoport and the Care Terminal, Bayport, Galveston Container Terminal, the Bulk Materials Handling Plant, and the Houston Turning Basin; the Woodhouse Terminal.

- Of the 785,049 jobs held by Texas residents that are related to marine cargo and vessel activity at public and private marine terminals at the Port of Houston, **393,147 jobs are related to activity at the Port of Houston Authority-owned facilities.**
- Of the 393,147 total jobs in some way related to the Port of Houston Authority's marine terminals, **20,021 direct jobs are generated by marine cargo activity at the PHA terminals.**
- As the result of local purchases by these 20,021 directly employed individuals, an additional **20,516 induced jobs are generated in the local economy.**
- About \$2.1 billion of local purchases by firms providing services to the PHA marine terminals supported an additional **28,024 indirect jobs.**

In 2006, marine cargo activity at the public marine terminals at the Port of Houston and along the Houston Ship Channel generated a total of \$71.5 billion of total economic activity in the State of Texas.

- Of the \$71.5 billion, \$2.9 billion is the direct business revenue received by the firms directly dependent upon the Port and providing maritime services and inland transportation services to the cargo handled at the marine terminals and the vessels calling the port, as well as ship and rig repair and maintenance services. An additional \$2.1 billion is used for local purchases. The remaining \$66.5 billion represents the value of the output to the State of Texas that is created due to the cargo moving via the Port of Houston marine terminals. This includes the value added at each stage of producing an export cargo, as well as the value added at each stage of production for the firms using imported raw materials and intermediate products that flow via the marine terminals and are consumed within the State.

- Marine activity supported nearly \$13.3 billion of total personal wage and salary income and local consumption expenditures for Texas residents. This includes \$4.5 billion of direct, indirect, induced and local consumption expenditures, while the remaining \$8.8 billion was received by the related port users.

A total of \$422.9 million of direct, induced and indirect state and local tax revenue was generated by maritime activity at the public terminals along the Houston Ship Channel. In addition, \$831.2 million of state and local taxes were created due to the economic activity of the related users of the cargo moving via the public marine terminals.

ECONOMIC IMPACT OF REDUCED CHANNEL DEPTH

As part of the 2006 Port of Houston Economic Impact Study, Martin Associates evaluated and quantified the economic cost to shippers/consignees using the marine terminals along the Houston Ship Channel of the loss of one foot increments of channel depth. Currently the Houston Ship Channel is maintained at varying depths, ranging from 45 ft. to 36 ft. At the current sailing drafts, the one way cost of moving the 240.9 million tons of cargo on the Houston Ship Channel is \$1.1 billion. If each vessel were to lose one foot of sailing draft, the total voyage cost would increase by \$73.4 million tons per year. If two feet of draft were lost, the cost of calling the marine terminals along the Houston Ship Channel would increase to nearly \$1.3 billion per year, an increase of \$159.5 million annually over the baseline cost. If five feet of draft were lost on the Ship Channel, the cost to importers/exporters using the Ship Channel would increase by \$582.4 million annually over the baseline cost.

COMPARISON OF PORT-WIDE IMPACTS WITH THE 2000 IMPACT MEASURES

Between 2000 and 2006, total cargo handled at the public and private terminals at the Port of Houston increased from 191.4 million tons in 2000 to 240.9 million tons in 2006. This growth in activity has resulted in an increase in the economic impact generated by the Port of Houston in the local and state economies.

The basic methodology used to measure the 2000 economic impacts is the same as that is used by Martin Associates for this current study, with the following exceptions. In 2006, the personal income multiplier used to estimate the re-spending impact has been updated by the U.S. Bureau of Economic Analysis for the Houston metropolitan area -- in 2000, the income multiplier was estimated by the Bureau of Economic Analysis for the entire transportation sector in the region. As of 2006, the Bureau of Economic Analysis now provides an estimate of the personal income multiplier for the water transportation sector of the metropolitan region, which more accurately reflects the higher wages and re-spending impact associated with port generated jobs compared to the transportation sector in total, which also includes mass transit, taxis, air and surface transportation sectors. In 2000, the personal income multiplier was 2.237 while in 2006, the income multiplier for the water transportation sector is 3.626, reflecting the higher wages in this sector. As a result, for a given dollar of income, the updated multiplier will generate a much larger induced job

impact and greater re-spending impact.

Also included in the 2006 study is an estimate of the total economic impact associated with the cargo moving via the Port. In past studies, only the related job impacts with port users were estimated.

The focus on the comparisons should, therefore, be on the direct job impacts, since the same methodology to measure the direct impacts was used both in estimating the impacts in 2000 and in this current study.

The most significant tonnage changes are summarized as:

- Liquid bulk cargoes including petroleum and petroleum products grew by 36.6 million tons;
- Containerized cargo grew by 6.2 million tons;
- Dry bulk cargo grew by 3.9 million tons;
- Iron and steel cargoes grew by 2.3 million tons;
- Other breakbulk cargo grew by 0.8 million tons;
- Automobiles and Ro/Ro cargo grew by 330,000 tons;
- Bagged grain grew by 240,000 tons;
- Grain exports fell by nearly 1 million tons.

The growth in tonnage and vessel calls resulted in an increase in port-wide economic impacts. Exhibit E-3 presents a comparison of the total impacts generated by both public and private terminals.

Exhibit E-3
 Comparison of Direct Economic Impacts: 2000-2006
 Public and Private Marine Facilities

	2006	2000	CHANGE
JOBS			
DIRECT	58,142	54,730	3,412
INDUCED	61,714	34,980	26,734
INDIRECT	<u>79,127</u>	<u>53,203</u>	<u>25,924</u>
TOTAL	198,983	142,913	56,070
PERSONAL INCOME (1,000)			
DIRECT	\$2,833,500	\$2,274,306	\$559,194
RE-SPENDING/CONSUMPTION	\$7,448,705	\$2,813,771	\$4,634,934
INDIRECT	<u>\$3,148,069</u>	<u>\$2,124,843</u>	<u>\$1,023,226</u>
TOTAL	\$13,430,274	\$7,212,920	\$6,217,354
DIRECT REVENUE (1,000)	\$8,084,680	\$6,872,322	\$1,212,358
LOCAL PURCHASES (1,000)	\$5,912,995	\$3,992,811	\$1,920,184
STATE AND LOCAL TAXES (1,000)	\$1,262,446	\$649,163	\$613,283

Totals may not add due to rounding

Between 2000 and 2006, direct jobs increased by 3,412 jobs. As shown in Exhibit VI-3, the largest employment gains, about 1,200 jobs, were recorded with freight forwarders, reflecting the growth in containerized cargo and steel. Other large employment gains occurred with longshoremen and dockworkers, reflecting the growth in containerized cargo, steel and other breakbulk cargoes. Employment with port-dependent shippers/consignees, particularly those shipping and receiving liquid and dry bulk cargoes also increased. This growth in port-dependent shippers and consignees of liquid bulk cargoes corresponds to the more than 32 million ton increase in petroleum and liquid bulk cargo over the three year period. Other increases in direct jobs were recorded for jobs with marine construction and warehousing, reflecting the growth in containerized cargo and imported steel. Terminal jobs increased due to the growth in liquid bulk cargoes and steel.

On a commodity specific basis, the major employment gains were generated by the growth in containerized cargo and steel followed by growth in employment associated with liquid bulk (crude, petroleum products and chemicals) Also, growth in jobs with miscellaneous breakbulk cargoes was recorded and associated with the 2.8 million ton increase in breakbulk cargoes. The decline in jobs with autos and Ro/Ro cargo reflects the allocation of a dependent shipper importing auto parts to containerized cargo. In the 2002 study, these dependent consignees were assigned to the auto/RoRo commodity category. In fact the auto parts are moving in containers.

Induced jobs increased significantly due to the change in the multiplier, as described previously and as a result comparisons cannot be made with respect to induced jobs over the 2000-2006 period.

Indirect jobs increased by 25,924 jobs reflecting the growth of local purchases from \$4 billion in 2000 to nearly \$6 billion on 2006.

Related jobs increased significantly over time reflecting the growth in tonnage, particularly the growth in containerized cargo, breakbulk cargo and steel products.

In summary, the public and private marine terminals at the Port of Houston continue to be an economic engine for the Houston area, Harris County and the State of Texas. In the last six years the port activity has added 3,400 new direct jobs annually, and the salary of these job holders has increased from \$41,560 to \$48,730. The importance of the Port's public and private marine terminals to the State is underscored by the fact that the total value of the economic impact of the public and private marine terminals is measured at \$117.6 billion and 785,049 jobs in the State of Texas are related to the marine activity at the public and private terminals along the Houston Ship Channel.

I. OVERVIEW OF THE ANALYSIS AND SUMMARY OF RESULTS

Martin Associates was retained by the Port of Houston Authority (PHA) to measure the local and regional economic impacts generated by cargo and vessel activity at the Port of Houston Authority's marine terminals -- including the Houston Public Grain Elevator #2, the Fentress Bracewell Barbour's Cut Container Terminal, the Bulk Materials Handling Plant, Jacintoport, the Care Terminal, the PHA terminals in the Houston Turning Basin, and the Woodhouse Terminal, as well as the impacts generated at the private marine terminals along the Houston Ship Channel -- petroleum refineries, petrochemical plants, general cargo facilities (i.e., Manchester Terminals), and dry bulk terminals. Impacts are estimated in terms of jobs, personal earnings, business revenue, and state and local taxes. The impacts are estimated for marine cargo, vessel activity and passenger cruise operations in 2006. In addition to quantifying the baseline impacts of the Port of Houston Authority's marine terminals and the impacts of the private marine terminals, two economic impact models have been developed -- one specifically for the PHA's marine terminals and the other for the combined activity at private marine terminals and the PHA-owned terminals. These models can be used in evaluating the sensitivity of impacts to changes in tonnage, labor productivity, labor work rules, commodity mix, inland origins/ destinations of commodities and vessel size. The models can also be used to evaluate the impacts of new terminal development and channel dredging and widening, as well as for annual updates.

The methodology used in this analysis has been developed by Martin Associates and has been used to estimate the economic impacts of seaport activity at public and private marine terminals of more than 200 United States and Canadian ports. This study is essentially an update of the economic impact study conducted for the Port of Houston Authority in 2002 (using 2000 annual data). With respect to other Texas ports, Martin Associates has developed economic studies for the Ports of Brownsville, Beaumont, Port Arthur, Orange, Victoria, Texas City, Corpus Christi, Freeport and Port LaVaca-Point Comfort. The methodology has been used in studies that have been presented before the International Trade Commission, the Council of Economic Advisors, the Federal Reserve Board the Canadian Justice Department, and several U.S. Presidents.

In addition to estimating the economic impacts of cargo activity at the Port of Houston Authority terminals and private terminals along the Houston Ship Channel, Martin Associates also conducted a detailed analysis of the economic cost of the loss of Ship Channel depth due to silting and the absence of maintenance dredging.

The remainder of this chapter presents an overview of the economic impact analysis and consists of the following sections:

- Flow of economic impacts through the local and regional economies;
- The structure of the impact analysis;
- Summary of the methodology;

- Commodities included in the analysis.

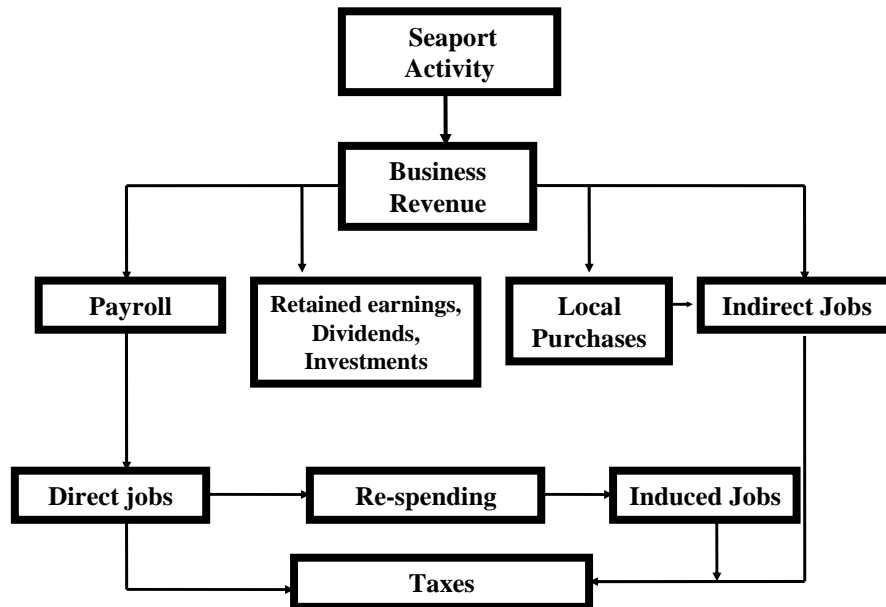
1. **FLOW OF IMPACTS**

Waterborne activity at a seaport contributes to the local and regional economy by generating business revenue to local and national firms providing vessel and cargo handling services at the marine terminals. These firms, in turn, provide employment and income to individuals, and pay taxes to state and local governments. Exhibit I-1, on the following page, shows how activity at marine terminals generate impacts throughout the local, state and national economies. As this exhibit indicates, the impact of a seaport on a local, state or national economy cannot be reduced to a single number, but instead, the seaport activity creates several impacts. These are the revenue impact, employment impact, personal income impact, and tax impact. These impacts are non-additive. For example, the income impact is a part of the revenue impact, and adding these impacts together would result in double counting. Exhibit I-1 shows graphically how activity at the PHA's marine terminals and private marine terminals generate the four impacts.

1.1 Business Revenue Impact

At the outset, activity at the port generates business revenue for firms which provide services. This business revenue impact is dispersed throughout the economy in several ways. It is used to hire people to provide the services, to purchase goods and services, and to make Federal, state and local tax payments. The remainder is used to pay stockholders, retire debt, make investments, or is held as retained earnings. It is to be emphasized that the only portions of the revenue impact that can be definitely identified as remaining in the local economy are those portions paid out in salaries to local employees, for local purchases by individuals and businesses directly dependent on the seaport, in contributions to state and local taxes, in lease payments to the Port of Houston Authority by tenants, and wharfage and dockage fees paid by the steamship lines to the Port of Houston Authority.

Exhibit I-1
Flow of Economic Impacts Generated by
Marine Activity



1.2 Employment Impact

The employment impact of seaport activity consists of four levels of job impacts:

- Direct employment impact -- jobs directly generated by seaport activity. Direct jobs generated by marine cargo include jobs with railroads and trucking companies moving cargo between inland origins and destinations and the marine terminals, longshoremen and dockworkers, steamship agents, freight forwarders, stevedores, etc. It is to be emphasized that these are classified as directly generated in the sense that these jobs would experience near term dislocation if the activity at the PHA marine terminals or private terminals were to be discontinued.

- Induced employment impact -- jobs created throughout the local economy because individuals directly employed due to seaport activity spend their wages locally on goods and services such as food, housing and clothing. These jobs are held by residents located throughout the region, since they are estimated based on local and regional purchases.

- Indirect employment impact -- jobs created locally due to purchases of goods and services by firms, not individuals. These jobs are estimated directly from local purchases data supplied to Martin Associates by the 1,046 companies interviewed as part of this study, and include jobs with local office supply firms, maintenance and repair firms, parts and equipment suppliers, etc. It is to be emphasized that special care was taken to avoid double counting, since the current study counts certain jobs as direct (i.e., trucking jobs, jobs with railroads, jobs with insurance companies and admiralty law firms, etc.) which are often classified as indirect by other approaches, notably the input/output model approach.
- Related user employment impact -- jobs with firms using the seaport to ship and receive cargo. While the facilities and services provided at PHA's marine terminals are a crucial part of the infrastructure allowing these jobs to exist, they would not necessarily be immediately displaced if marine activity were to cease.

1.3 Personal Earnings Impact

The personal earnings impact is the measure of employee wages and salaries (excluding benefits) received by individuals directly employed due to seaport activity. Re-spending of these earnings throughout the regional economy for purchases of goods and services is also estimated. This, in turn, generates additional jobs -- the induced employment impact. This re-spending throughout the region is estimated using a regional personal earnings multiplier, which reflects the percentage of purchases by individuals that are made within the Houston region. The re-spending effect varies by region -- a larger re-spending effect occurs in regions that produce a relatively large proportion of the goods and services consumed by residents, while lower re-spending effects are associated with regions that import a relatively large share of consumer goods and services (since personal earnings "leak out" of the region for these out-of-regional purchases). The direct earnings are a measure of the local impact since they are received by those directly employed by seaport activity.

1.4 Tax Impact

Tax impacts are tax payments to the state and local governments by firms and by individuals whose jobs are directly dependent upon and supported (induced and indirect jobs) by activity at the marine terminals.

2. IMPACT STRUCTURE

The four types of economic impacts are created throughout various business sectors of the state and local economies. Specifically, four distinct economic sectors are impacted as a result of activity at the marine terminals. These are the:

- Surface Transportation Sector;
- Maritime Services Sector;
- Shippers/Consignees using the Port;
- Port of Houston Authority.

Within each sector, various participants are involved. Separate impacts are estimated for each of the participants. A discussion of each of the economic impact sectors is provided below, including a description of the major participants in each sector.

2.1 The Surface Transportation Sector

The surface transportation sector consists of both the railroad and trucking industries. The trucking firms and railroads are responsible for moving the various cargoes between the marine terminals and the inland origins and destinations.

2.2 The Maritime Services Sector

This sector consists of numerous firms and participants performing functions related to the following maritime services:

- Cargo Marine Transportation;
- Vessel Operations;
- Cargo Handling;
- Federal, State, and Local Government Agencies

A brief description of the major participants in each of these four categories is provided below:

- Cargo Marine Transportation - Participants in this category are involved in arranging for inland and water transportation for export or import freight. The freight forwarder/customhouse broker is the major participant in this category. The freight forwarder/customhouse broker arranges for the freight to be delivered between the terminals and inland destinations, as well as the ocean transportation. This function performed by freight forwarders and customhouse brokers is most prevalent for general cargo commodities.

- Vessel Operations - This category consists of several participants. The steamship agents provide a number of services for the vessel as soon as it enters the port; the agents arrange for pilot services and towing, for medical and dental care of the crew, and for ship supplies. The agents are also responsible for vessel documentation. In addition to the steamship agents arranging for vessel services, those providing the services include:
 - Chandlers - supply the vessels with ship supplies (food, clothing, nautical equipment, etc.);
 - Towing firms - provide the tug service to guide the vessel to and from port;
 - Pilots - assist in navigating the vessels along the Houston Ship Channel to and from the PHA marine terminals and private marine terminals;
 - Bunkering firms - provide fuel to the vessels;
 - Marine surveyors - inspect the vessels and the cargo;
 - Shipyards/marine construction firms - provide repairs, either emergency or scheduled as well as marine pier construction and dredging.

- Cargo Handling - This category involves the physical handling of the cargo at the terminals between the land and the vessel. Included in this category are the following participants:
 - Longshoremen - include members of the International Longshoremen's Association (ILA), as well as non-ILA dockworkers that are involved in the loading and unloading of cargo from the vessels, as well as handling the cargo prior to loading and after unloading.
 - Stevedoring firms - manage the longshoremen and cargo-handling activities. Stevedoring services at the Port of Houston Authority terminals are provided by private stevedoring companies.
 - Terminal operators - are often stevedoring firms who operate the maritime terminals where cargo is loaded and off-loaded.
 - Warehouse operators - store cargo after discharge or prior to loading and consolidate cargo units into shipment lots.

- Government Agencies - This service sector involves Federal, state and local government agencies that perform services related to cargo handling and vessel operations at the Port. U.S. Customs, Bureau of Immigration, U.S. Department of

Labor, U.S. Department of Agriculture, U.S. Coast Guard, the Army Corps of Engineers, and U.S. Department of Commerce employees are involved. These services are provided by the government offices located in the Houston area.

2.3 Banking/Insurance/Law Sector

While this service sector is not directly involved in cargo or ship operations, it nonetheless does provide services such as financing export/import transactions and insuring cargo and vessels. Also included in this sector are legal firms specializing in maritime law.

2.4 Shippers/Consignees

Two categories of shippers and consignees are considered in the analysis: those that are totally dependent on the public and privately-owned marine terminals and those located throughout the regional economy whose business is only related to the Port. Those in the first category would most likely shut down operations if the marine terminals were not available for their use, while those in the second category would ship or receive materials via another port. Related jobs consist of jobs with steel fabrication firms, users and producers and consumers of containerized cargo and breakbulk cargo, and farmers producing the grain for export. Dependent shippers/ consignees include employees of the oil refineries and petrochemical plants that are dependent upon the receipt of crude and chemicals by vessel/barge and the shipment of refined product by vessel/barge, as well as plants on the Houston Ship Channel that are dependent upon the receipt or shipments of steel products and other miscellaneous breakbulk cargoes. For this current study, the majority of shippers and consignees are with petrochemical plants and petroleum refineries.

2.5 Port of Houston Authority

The Port of Houston Authority sector includes those individuals employed by the Port of Houston Authority whose purpose is to oversee port activity at the PHA-owned marine terminals.

3. SUMMARY OF METHODOLOGY

The purpose of this section is to provide a summary of the methodological approach used to estimate the economic impacts of the vessel and cargo activity at the public and private terminals at the Port of Houston.

3.1 Data Collection

The cornerstone of the Martin Associates approach is the collection of detailed baseline impact data from firms providing services at the PHA marine terminals and the private terminals. To ensure accuracy and defensibility, the baseline impact data were collected from interviews with 1,046 firms in the Houston maritime community. These firms represent the universe of firms providing services at the Port of Houston's public and private marine terminals located along the Houston Ship Channel, as identified by:

- "The Journal of Commerce", Transportation Telephone Tickler;
- PHA's internal customer and tenant lists;
- The Port of Houston, Port Directory;
- Prior economic impact studies conducted by Martin Associates for the Port of Houston Authority.

These 1,046 firms represent a greater than 95 percent coverage of all firms identified in the seaport community. For the most part, multiple interviews were conducted with several persons in each firm. Exhibit I-2 shows the distribution of interviews by industry.

Exhibit I-2
Distribution of Interviews by Industry

	Total
Lines/Agents	175
Freight Forwarders	271
Chandler	28
Government	8
Shipper/Consignee	86
Maritime Services	119
Warehouse/Repair	202
Surveyor	68
Tug & Barge Operators	23
Ship Assist	4
Pilots	1
Railroads	4
Bunkering	6
Stevedores/Terminals	49
Automobile Processing	1
International Longshoremen	1
TOTAL	1,046

*The 271 freight forwarders were interviewed as part of the 2002 study.

3.2 Direct Jobs, Income and Revenue Impacts

The results of these interviews were then used to develop the baseline direct job, revenue and income impacts for the economic sectors and job categories associated with the PHA's marine terminals, as well as the private terminals.

The direct tax impacts are estimated at a state, county and local level based on actual per capita income levels as published by the Tax Foundation.

This baseline survey data was also used to develop operational models which can be used to update the impacts of the Port of Houston Authority's marine terminals and private terminals on an annual basis and to evaluate the impacts of changes in:

- Marine cargo tonnage, by commodity;
- Seaport labor productivity and work rules;
- Modal distribution of seaport cargo (what percent of the inland transportation of a commodity is truck versus rail), as well as the geographical distribution of each commodity;
- Vessel calls and vessel size;
- New carrier services.

Also, the operational models can be used to evaluate alternative facilities expansion projects and new marine terminal construction, as well as the impacts associated with channel dredging and widening.

3.3 Induced Impacts

Induced impacts are those generated by the purchases of the individuals employed as a result of seaport activity. For example, a portion of the personal earnings received by those directly employed due to activity at the marine terminals is used for purchases of goods and services, both regionally, as well as out-of-the region. These purchases, in turn, create additional jobs in the region which are classified as induced. To estimate these induced jobs, a regional personal earnings multiplier was developed from data provided by the Bureau of Economic Analysis, Regional Income Division. This personal earnings multiplier is used to estimate the total personal earnings generated in the Houston area as a result of the activity at the Port of Houston Authority's marine terminals and at private marine terminals. A portion of this total personal earnings impact is next allocated to specific local purchases (as determined from consumption data for Houston residents, as developed from the U.S. Bureau of Labor Statistics, Consumer Expenditure Survey). These purchases are next converted into retail and wholesale induced jobs in the regional economy.

Induced jobs are not estimated at lower levels of purchasing rounds (after the wholesale round) since it is not possible to trace with a sufficient degree of accuracy, geographically, where purchases at the remaining levels occur. However, about 80 percent of the consumption will likely occur at the first two rounds of purchases, which are most likely local retail and wholesale purchases.

3.4 Indirect Jobs

Indirect jobs are generated in the local economy as the result of purchases by firms that are directly dependent upon cargo and vessel activity at the marine terminals, including the shippers/consignees located along the Houston Ship Channel. These purchases are for goods and services such as office supplies and equipment, maintenance and repair services, communications and utilities, transportation services and other professional services. To estimate the indirect economic impact, local purchases, by type of purchase, were collected from each of the firms interviewed. These local purchases were then combined with employment to sales ratios in local supplying industries, developed from the U.S. Bureau of Economic Analysis Regional Input-Output Modeling System for the Houston Region. The indirect job ratios also account for the in-state spin-off effects from multiple rounds of supply chains that are required to provide the locally purchased goods and services.

3.5 Related Impacts

Related impacts measure the jobs with shippers and consignees moving cargo through the PHA's marine terminals and private terminals. These jobs are classified as related jobs, since the firms using the marine terminals for the movement of cargo can and do use other seaports and marine terminals. For example, firms importing or exporting containerized cargo typically select a steamship line rather than the seaport through which the cargo will move, and the port through which the containerized cargo moves is ultimately determined by the steamship line's port call rotation. Similarly, exporters of breakbulk cargo often use freight forwarders, who in turn choose the port of export. Importers of breakbulk cargo often use several ports for the import of cargo, based on market locations. Because of the proximity of other ports and the associated steamship service at these ports, such as Galveston, Corpus Christi, New Orleans, as well as West Coast Ports (competing for the Far East land bridge cargo) to the Port of Houston's marine terminals, importers as well as exporters of containers and breakbulk cargo have some flexibility in port choice. As a result, jobs with these exporters and importers cannot be counted as dependent upon the public and private marine terminals.

These jobs are estimated based on the value per ton of the commodities exported and imported via the Port of Houston and the associated jobs to value of output ratios for the respective producing and consuming industries located in the state. The value per ton of each of the key commodities moving via the Port of Houston was developed from the U.S. Department of Transportation, Maritime Administration. The average value per ton for each commodity moving over the PHA and private marine terminals was then multiplied by the respective tonnage moved in 2006. Ratios of jobs to value of output for the corresponding consuming and producing industries were developed by Martin Associates from the U.S. Bureau of Economic Analysis, Regional Input-Output Modeling System for the State of Texas. These jobs to value coefficients include the in-state, spin-off impacts that would occur in order to produce the export commodity or use the import commodity in production. The percent of each commodity that is produced or consumed in the State of Texas was next developed from the interviews, and the value of each commodity remaining in the

State of Texas was calculated. The ratios of jobs to value of export or import cargo were then combined with the in-state value of the respective commodities moving via the PHA terminals and private terminals to estimate related jobs and the spin-off jobs in-state to support the export and import industries. Similarly, using the respective income and output multipliers were used to estimate the related personal income impact as well as the total value of economic output and taxes generated by the Port of Houston public and private marine terminals. It is to be emphasized that care was taken to control for double counting of the direct, induced and indirect impacts.

4. COMMODITIES INCLUDED IN THE ANALYSIS

A major use of an economic impact analysis is to provide a tool for port development planning. As a port grows, available land and other resources for port facilities become scarce, and decisions must be made as to how to develop the land and utilize the resources in the most efficient manner. Various types of facility configurations are associated with different commodities. For example, containers require a large amount of paved, open storage space, while certain types of dry bulk cargo require covered storage and special dust removing equipment.

An understanding of the commodity's relative economic value in terms of employment and income to the local community, the cost of providing the facilities, and the relative demand for the different commodities is essential in making future port development plans. Because of this need for understanding relative commodity impacts, economic impacts are estimated for the following commodities handled at the public and private marine terminals.

- Containerized cargo;
- Iron and steel products;
- Autos;
- Bagged cargo;
- RO/RO;
- Forest products;
- Chilled breakbulk cargo;
- Miscellaneous breakbulk;
- Grain;
- Other dry bulk;
- Other liquid bulk;
- Petroleum.

It should be emphasized that commodity-specific impacts are not estimated for each of the five economic sectors described in the last section. Specific impacts by commodity could not be allocated to individual commodities with any degree of accuracy for the banking/insurance/law sector and marine construction sector. In addition, taxes have not been displayed by specific commodity since these tax impacts will reflect the same distribution over commodities as the employment impact.

II. EMPLOYMENT IMPACTS

In this chapter, the employment generated by maritime activity at the public and private marine terminals along the Houston Ship Channel is estimated. The chapter is organized as follows:

- First, the total employment that is in some way related to the activities at the public and private marine terminals is estimated.
- Second, the subset of total employment that is judged to be totally dependent (i.e., direct jobs) on port activity is analyzed as follows:
 - The direct job impact is estimated in terms of key economic sectors, i.e., surface transportation sector, maritime services sector, shippers/consignees sector, and Port of Houston Authority sector.
 - The direct job impact is estimated by detailed job category, i.e., trucking, ILA/dockworkers, freight forwarders/customhouse brokers, steamship agents, chandlers, warehousemen, stevedores and terminal operators, surveyors, etc.
 - The direct job impact is estimated for each of the key commodities/commodity groups.
 - The direct job impact is estimated on a per 1,000 ton basis for each commodity moving via the public and private marine terminals.
 - The direct job impact is estimated based on the residency of those directly employed.
- Induced and indirect jobs are estimated.
- Finally, jobs related to the marine activity at the public and private marine terminals are described.

1. TOTAL EMPLOYMENT IMPACT

It is estimated that 785,049 Texas jobs are in some way related to port activities at the public and private marine terminals along the Houston Ship Channel. Of the 785,049 jobs held by Texas residents:

- 58,142 jobs are directly generated by activities at the public and private marine terminals and if such activities should cease, these jobs would be discontinued over the short term.
- 61,714 jobs (induced jobs) are supported by the local purchases of the 58,142 individuals directly generated by port activity at the marine terminals. An additional 79,127 indirect jobs were generated due to \$5.9 billion of purchases in the local and regional economy by firms providing direct cargo handling and vessel services and by the directly dependent shippers/consignees located along the Houston Ship Channel.
- An additional 586,066 Texas jobs are related to cargo imported and exported via the public and private marine terminals. These jobs are with local and state steel fabrication companies, firms using and producing containerized cargo, breakbulk cargo and dry and liquid bulk cargo moving via the Port of Houston, and farmers producing grain and rice for export. These jobs are considered to be related to activities at the public and private marine terminals, but the degree of dependence on these terminals is difficult to estimate. It is to be emphasized that the level of employment with these exporters and importers is based on the demand for the final product, i.e., fabricated steel products, not by the use of the marine terminals along the Houston Ship Channel. However, if other terminals were used, it is likely that the costs of importing and exporting would increase, which could have long run implications on the level of employment with the related shippers/consignees. Finally, it is to be emphasized that there is no double counting of the directly dependent shippers/consignees in this related job estimate.

2. **DIRECT JOB IMPACTS**

In 2006, 240.9 million tons of domestic and foreign waterborne cargo moved via the public and private marine terminals². As a result of this activity, 58,142 full-time jobs were directly created³. In this section the jobs are analyzed in terms of:

- Distribution by economic sector;
- Distribution by job category;
- Distribution by commodity group;

2 Total tonnage is estimated based on actual 2006 tonnage data at the Port of Houston Authority terminals. For the domestic and international cargo handled at the Private terminals, a combination of sources was used to estimate the 2006 tonnage, including interviews with the private terminals, steel import data reported by the American Institute for Imported Steel, and projected tonnage levels based on the 1995-2004 growth rates as reported by the US Army Corps of Engineers Waterborne Commerce .

3 Jobs are measured in terms of full-time worker equivalents. If a worker is employed only 50 percent of the time by activity at the Port of Houston public and private marine terminals, then this worker is counted as .5 jobs.

- Distribution by 1,000 ton basis;
- Distribution by county and state of residency.

These distributions are developed in more detail below.

2.1 Job Impacts by Sector and Job Category

Exhibit II-1 presents the distribution of the 58,142 direct jobs by sector and job category. As this exhibit shows, the largest job impacts are with shippers and consignees dependent upon the cargo moving via the terminals along the Houston Ship Channel. Jobs with trucking companies moving cargo to and from the PHA marine terminals and the private marine terminals account for the next largest direct job impact. The movement of liquid bulk cargo generated 48 percent of the trucking jobs, while the movement of containerized cargo to and from the terminals, including truck moves to and from container freight stations (CFS) and to and from rail yards, generates 20 percent of the trucking jobs. Of the majority of the 3,995 terminal workers, nearly 1,800 jobs are employed by the marine terminal operations of petrochemical plants and refineries, followed by 985 jobs with stevedores and terminal operators handling iron and steel products, 650 jobs with terminal operators and stevedores moving breakbulk cargo (including forest products, ro/ro cargo and miscellaneous breakbulk cargo). The majority of warehousing jobs are created by containerized cargo and include jobs with CFS operations.

Exhibit II-1
Employment Impacts by Job Category

	TOTAL
SURFACE TRANSPORTATION	
RAIL	901
TRUCK	9,801
MARITIME SERVICES	
TERMINAL EMPLOYEES	3,995
ILA/DOCKWORKERS	2,404
TOWING	58
PILOTS	94
AGENTS	1,385
SURVEYORS/CHANDLERS	1,017
FORWARDERS	2,319
WAREHOUSEMEN	2,422
GOVERNMENT	249
MARITIME SERVICES	3,583
BARGE/BUNKERS	1,216
DEPENDENT SHIPPERS/CONSIGNEES	26,662
PORT OF HOUSTON AUTHORITY	553
BANKING/INSURANCE	1,480
TOTAL	58,142

Totals may not add due to rounding

2.2 Direct Job Impacts by Commodity

Most of the 58,142 jobs considered to be generated by port activity can be related to the handling of specific commodities or commodity groups. Certain employment categories such as government employees, employees with marine construction and ship repair, banking and insurance and admiralty law firms, and the miscellaneous maritime services firms cannot be identified with a specific commodity. As a result, employment in these groups (which totaled 5,755) was not allocated to commodity groups.

Exhibit II-2 presents the direct employment impacts in terms of commodity groups. This exhibit indicates that in 2006, crude petroleum handled at the private terminals generated the largest number of direct jobs, 17,271. The majority of these jobs, more than 15,463 jobs, were with refineries along the Houston Ship Channel directly dependent upon the shipment and receipt of petroleum and petroleum products via the Port of Houston. Liquid bulk cargoes (petrochemicals, petroleum products) generated the second largest number of direct jobs, 15,882 jobs, 9,559 of which were employed by the local petrochemical firms located along the Houston Ship Channel. Containerized cargo created the third largest direct job impact, accounting for 7,687 direct jobs. The majority of these jobs are with trucking firms, warehouse operators, dependent shippers/consignees, members of the International Longshoremen Association, and freight forwarders. The import of steel products generated 4,365 direct jobs, the majority of the jobs were generated with terminal operators, dependent shippers/consignees, trucking companies, ILA/dockworkers, freight forwarders and warehouse operators. Miscellaneous breakbulk cargoes created 2,784 direct jobs, the majority with freight forwarders, truckers and ILA/dockworkers. Dry bulk cargo generated 2,265 direct jobs, while Ro/Ro cargo created 859 direct jobs, the majority with dependent shippers/consignees handling heavy equipment, agricultural and road working machinery followed by jobs with terminal operators.

Exhibit II-2
Distribution of Direct Job Impact by Commodity

	DIRECT JOBS
CONTAINERS	7,687
STEEL	4,365
BAGGED GRAIN	239
AUTOMOBILES	256
OTHER BREAKBULK	2,784
GRAIN	362
DRY BULK	2,265
LIQUID BULK	15,882
PETROLEUM	17,271
RO/RO	859
FOREST PRODUCTS	354
CHILL	62
NOT ALLOCATED	5,755
TOTAL	58,142

Totals may not add due to rounding

2.3 Job Impacts Per Ton

The assessment of the job impacts on a per 1,000 ton basis provides a tool for port planners to use in evaluating the relative importance of different commodities as economic generators. Exhibit II-3 presents the job impacts per 1,000 tons for each commodity moving via the public and private marine terminals.

Exhibit II-3
Job Impacts per 1,000 Tons

CONTAINERS	0.48
STEEL	0.47
BAGGED GRAIN	0.31
AUTOMOBILES	2.23
OTHER BREAKBULK	0.64
GRAIN	0.06
DRY BULK	0.14
LIQUID BULK	0.13
PETROLEUM	0.27
RO/RO	1.77
FOREST PRODUCTS	0.41
CHILL	0.61

As this exhibit indicates, automobiles create the largest number of direct jobs per 1,000 tons due to the processing activity associated with the imported cars. The movement of roll on/roll off cargo such as agricultural equipment, some project cargo, and road working equipment generates the

next greatest number of direct jobs per 1,000 tons, followed by the movement of miscellaneous breakbulk cargo (palletized cargo), steel products and containerized cargo. On a per container basis, 7.8 direct jobs are generated per 1,000 container moves.

Despite the fact that petroleum and liquid bulk cargoes generated the largest direct job impact, on a per 1,000 ton basis, crude petroleum generate 0.27 jobs per 1,000 tons, while liquid bulk cargoes support 0.13 jobs per 1,000 tons. The finding that the liquid bulks and dry bulk cargoes, including bulk grains, generate relatively small direct jobs per 1,000 tons of throughput reflects the fact that the handling of bulk cargoes is much less labor intensive than handling Ro/Ro and automobiles, steel, bagged cargo, palletized and containerized cargo. Also, the supporting infrastructure of freight forwarders and customshouse brokers, warehousing and terminal operators is much greater for general cargo than for the dry and liquid bulk cargoes.

2.4 Distribution of Direct Jobs by Place of Residence

To underscore the geographic scope of the impacts generated by the public and private marine terminals, Exhibit II-4 presents the distribution of the 58,142 direct jobs by place of residence. The residence analysis is based on the results of the interviews 1,046 firms. As this exhibit indicates, nearly 80 percent of the direct jobs are held by residents of Harris County, including Houston.

Exhibit II-4
Distribution of Direct Jobs by
Place of Residency

JURISDICTIONS	SHARE	DIRECT JOBS
HOUSTON	33.73%	19,612
HARRIS (EXCLUDING HOUSTON)	44.04%	25,603
BRAZORIA	4.15%	2,414
CHAMBERS	1.18%	687
FORT BEND	0.77%	446
GALVESTON	8.21%	4,772
MONTGOMERY	6.27%	3,647
OTHER TEXAS	1.41%	823
OTHER US	0.24%	139
TOTAL	100.00%	58,142

3. INDUCED JOBS

The 58,142 directly employed individuals due to activity at the public and private marine terminals received wages and salaries, a part of which was used to purchase local goods and services such as food, housing, clothing, transportation services, etc. As a result of these local purchases,

61,714 jobs in the regional economy were supported. The majority of the induced jobs are with state and local government agencies providing school, health care, police and fire protection, other community and social services, as well as firms providing business and personal services. The next largest induced job impact occurs in the local food (restaurant and groceries), where about 12,700 jobs are supported.

4. INDIRECT JOBS

In addition to the induced jobs generated by the purchases of the 58,142 directly employed individuals, the firms providing the direct services and employing the 58,142 direct jobs make local purchases for goods and services. These local purchases by the firms dependent upon the public and private marine facilities generate additional local jobs -- indirect jobs. Based on interviews with the port service providers and terminal operators, these firms made \$5.9 billion of local purchases in 2006. These direct local purchases created an additional 79,127 indirect jobs in the local economy. These purchases include expenditures for equipment and parts, maintenance and repair services, office supplies, raw materials, fuel, utilities, and insurance. Care is taken to avoid any double counting of jobs already included in direct jobs.

5. RELATED JOBS

It is estimated that about 586,066 jobs with Texas companies using the Port to ship and receive waterborne cargo are classified as related to the public and private marine terminals. These jobs are with importers of steel, producers and consumers of containerized cargo and breakbulk cargo, producers and consumers of the liquid and dry bulk cargoes moving through the public and private marine terminals, and farmers producing grain and rice for export.

To estimate the related user impact of the Port of Houston, the types of containerized cargo moving via the Port were identified from Census. The average value per ton of each commodity type was then estimated using U.S. Bureau of Census, Foreign Trade Statistics. A weighted average dollar value per ton of containerized cargo moving via the Port of Houston was next developed from this data. The average value of the employment to output coefficients for manufacturing industries in Texas was then computed from data supplied to Martin Associates by the Bureau of Economic Analysis, RIMS II Division. An estimate of the percent of containerized cargo handled at the Port of Houston that is exported or imported by Texas companies was developed from the interviews and previously supplied data by the Port of Houston Authority using the PIERS Data. To estimate the related containerized cargo jobs, the average value per ton of containerized cargo was multiplied by the tons handled at the Port and the share of containerized cargo that was consumed and produced by firms located in Texas. The average job coefficient for Texas was next multiplied by the in-state value of the containerized cargo to estimate the related jobs (in Texas) supported by the containerized cargo. The majority of containerized cargo is related to consumption activity, and the retail job coefficient was used in the estimate of related user jobs.

A similar method was used to estimate jobs related to forest products, and liquid and dry bulk cargoes. The impact of imported steel in the local construction industry was estimated in a similar method, combining the value of the imported steel via the Port that is estimated to remain in Texas (determined through terminal interviews) with the construction employment to output coefficient developed from the U.S. Bureau of Economic Analysis.

It is to be emphasized that these are related jobs, and would not likely disappear if the marine terminals along the Houston Ship Channel were to close to marine cargo activity. Given a level of demand for the steel, containerized cargo, export grain and breakbulk commodities (mostly manufactured cargo), the cargo would be shipped through another port such as Galveston, Corpus Christi, New Orleans or Los Angeles/Long Beach. The directly dependent shipper/consignee impacts, as well as direct, induced and indirect jobs are not included in these related job estimates.

It is to be further emphasized that when the impact models are used for planning purposes, related jobs should not be used to judge the economic benefits of a particular project. Related jobs are not estimated with the same degree of defensibility as are the direct, induced and indirect jobs. Therefore, these three types of job impacts should be used in evaluating port investments. The purpose of the related jobs estimates is to provide a proxy for the magnitude of the more general economic development impact of the private and public port facilities.

III. REVENUE, INCOME AND TAX IMPACTS

The 241 million tons of cargo at the Port of Houston's private and public marine terminals generated revenue for firms in each of the four economic sectors. For example, revenue is received by the railroads and the trucking companies within the surface transportation sector as a result of moving export cargo to the marine terminals and distributing the imported commodities inland after receipt at the marine terminals. The firms in the maritime services sector receive revenue from arranging for transportation services, cargo handling, providing services to vessels in port and repairs to vessels calling the port facilities. The banking/insurance sector receives revenue from financial services provided to users of the marine terminals. The Port of Houston Authority receives revenue from terminal leases and port charges such as wharfage and dockage assessed on cargo and vessels calling the public terminals. In addition, revenue is received by shippers/consignees from the sales of cargo shipped or received via the marine cargo terminals and from the sales of products made with raw materials received through the terminals. Since this chapter is concerned with the revenue generated from providing maritime services, the shipper/consignee revenue (i.e., the value of the cargo shipped or received through the marine terminals) will be excluded from the remaining discussion.

The revenue generated by port activity consists of many components. For example, gross revenue is used to pay employee salaries and taxes, it is distributed to stockholders of the companies providing the vessel and cargo handling services, and it is used for the purchases of equipment and maintenance services. Of these components, only three can be isolated geographically with any degree of accuracy. These are the personal income component of revenue, which can be traced to geographic locations based on the residence of those receiving the income, the payment of state and local taxes, and the local purchases made by firms dependent upon the maritime activity. The balance of the revenue is distributed in the form of payments to firms located outside the Houston region providing goods and services to the maritime sectors and for the distribution of company profits to shareholders.

Since it is difficult to trace all the components of the revenue beneficiaries, an estimate of revenue is developed, but no conclusions are formulated as to how the revenue (other than personal income, taxes and local purchases) is distributed, geographically. It is more accurate to trace the distribution of personal income (which is a subset of revenue) through the geographic locations of individuals receiving the income.

1. REVENUE IMPACT—TOTAL ECONOMIC ACTIVITY

The revenue impact is a measure of the total economic activity in the State that is generated by the cargo moving via the marine terminals at the Port of Houston. In 2006, marine cargo activity at the public and private terminals generated a total of \$117.6 billion of total economic activity in the State of Texas. Of the \$117.6 billion, \$8.1 billion is the direct business revenue received by the firms directly dependent upon the Port and providing maritime services and inland transportation services to the cargo handled at the public and private marine terminals. An additional \$5.9 billion was spent on local purchases by the firms directly dependent on the Port activity (which supported the indirect jobs). The balance, \$103.6 billion represents the value of the output to the State of Texas that is created due to the cargo moving via the marine terminals at the Port of Houston. This includes the value added at each stage of producing an export cargo, as well as the value added at each stage of production for the firms using imported raw materials and intermediate products that flow via the public and private marine terminals at the Port of Houston and are consumed or produced by industries within the State.

The balance of this section focuses only on the \$8.1 billion revenue impact generated from the provision of transportation services in support of the cargo and vessel activity at the Port of Houston. It is important to emphasize that the direct business revenue does not include the value of the cargo moving via the marine facilities.

1.1 Direct Revenue Impacts by Economic Sector

In 2006, the cargo and vessel activity at the Port of Houston's public and private marine terminals generated \$14.0 billion of business revenue to the firms providing cargo handling and vessel services and supporting the firms directly dependent upon the Port of Houston.

Included in the \$14.0 billion revenue impact are \$8.1 billion received directly by the firms providing the vessel, cargo handling and cruise services at the Port of Houston and \$5.9 billion of local purchases by those firms directly dependent upon the marine terminals.

1.2 Direct Revenue Impacts by Economic Sector and Job Category

Exhibit III-1 presents the distribution of the \$8.1 billion of directly generated revenue across the various port sectors and job categories. This revenue includes the revenue received by firms providing services to the commodity and vessel activity at the PHA-owned terminals and private terminals, and includes revenue received by trucking firms, stevedores, the Port of Houston Authority, chandlers, cruise operators, vessel agents, pilots, towing companies, banking/insurance/law firms, etc.

Exhibit III-1
Revenue by Sector and Category

	TOTAL
SURFACE TRANSPORTATION	
RAIL	\$1,988,566
TRUCK	\$1,591,416
PIPELINE	\$594,975
MARITIME SERVICES	
TERMINAL EMPLOYEES	\$794,032
TOWING	\$29,359
PILOTS	\$32,883
AGENTS	\$11,838
SURVEYORS/CHANDLERS	\$82,870
FORWARDERS	\$351,297
WAREHOUSEMEN	\$1,061,151
GOVERNMENT	NA
MARITIME SERVICES	\$461,365
BARGE/BUNKERS	\$329,246
DEPENDENT SHIPPERS/CONSIGNEES	NA
PORT OF HOUSTON AUTHORITY	\$155,180
BANKING/INSURANCE	<u>\$600,502</u>
TOTAL	\$8,084,680

Totals may not add due to rounding

As this exhibit shows, the private terminals generated \$5.2 billion of the \$8.1 billion of revenue, while cargo and vessel activity at the public terminals generated about \$2.9 billion of revenue.

The majority of the direct revenue is received by the transportation sector, which accounts for 51.6 percent of the total revenue impact. Rail receives nearly \$2 billion of revenue, followed by \$1.6 billion received by the trucking industry.

The maritime services sector received about 40% of the direct revenue impact. The majority of the revenue was received by warehousing and container operations, followed by terminal operations, maritime services and barge/bunkering operations and freight forwarding.

The banking and insurance sector received about 7 percent of the direct revenue, and the Port of Houston Authority received the balance.

1.3 Direct Revenue by Commodity

Exhibit III-2 shows the total revenue impact by commodity and Exhibit III-3 shows the revenue per ton. It is to be emphasized that the revenue received by shippers/consignees from the sales of the products and (value of the commodities) moving via the marine terminals is not included, since product value is determined by the demand for the product, not the use of the marine terminals. The exhibits shows that:

- In terms of total revenue, other liquid bulk creates the largest revenue impact, followed by crude petroleum, containers and other dry bulk cargo.
- In terms of per ton revenue, bagged cargo generates the largest revenue impact per ton, reflecting the revenue associated with warehousing as well as with the bagging and handling process. Automobiles generate the next largest revenue per ton, as the result of the relatively high transportation cost per vehicle and the labor intensive loading, discharge, processing and pre-staging required for export and import. Other breakbulk cargo generates the next largest revenue per ton, followed by containerized cargo follows in terms of revenue generated per ton. Dry bulk cargo generates a relatively high revenue per ton impact for a bulk cargo, primarily because of the large percent of dry bulk cargo moving by rail at the Port of Houston.

Exhibit III-2
Revenue Impacts by Commodity*

	\$1,000
CONTAINERS	\$1,142,917
STEEL	\$440,286
BAGGED GRAIN	\$499,000
AUTOMOBILES	\$17,961
OTHER BREAKBULK	\$316,256
GRAIN	\$129,970
DRY BULK	\$923,015
LIQUID BULK	\$2,168,964
PETROLEUM	\$1,186,319
RO/RO	\$14,172
FOREST PRODUCTS	\$22,521
CHILL	\$4,142
NOT ALLOCATED	<u>\$1,219,158</u>
TOTAL	\$8,084,680

Note: The revenue per commodity excludes the revenue estimated for banking/insurance/law, marine construction, ship repair and Port of Houston Authority, which has not been allocated to the commodity groups.

Exhibit III-3
Revenue Impact Per Ton

CONTAINERS	\$71
STEEL	\$48
BAGGED GRAIN	\$645
AUTOMOBILES	\$156
OTHER BREAKBULK	\$73
GRAIN	\$20
DRY BULK	\$55
LIQUID BULK	\$18
PETROLEUM	\$19
RO/RO	\$29
FOREST PRODUCTS	\$26
CHILL	\$41

2. PERSONAL EARNINGS IMPACT

In the previous section of this chapter, the total revenue generated by port activity was identified. As described earlier, the personal income received by those directly dependent upon port activity along the Houston Ship Channel is paid from the business revenue received by the firms supplying direct services at the marine terminals.

The income impact is estimated by multiplying the average annual earnings (excluding benefits) of each port participant, i.e., truckers, steamship agents, pilots, towing firm employees, longshoremen, warehousemen etc., by the corresponding number of direct jobs in each category. The individual annual earnings in each category multiplied by the corresponding job impact resulted in \$2.8 billion in personal wage and salary earnings.

The impact of the re-spending of this direct income for local purchases is estimated using a personal earnings multiplier. The personal earnings multiplier is based on data supplied by the Bureau of Economic Analysis (BEA). The BEA estimates that for every one dollar earned by direct employees generated by activity at the marine terminals, an additional \$2.63 of personal income and consumption expenditures would be created as a result of re-spending the income for purchases of goods and services produced locally. Hence, a personal earnings multiplier of 3.63 was used to estimate the additional consumption and income impact due to re-spending – nearly \$7.5 billion. This additional re-spending of the direct income generates the 61,714 induced jobs, described in the previous chapter.⁴

⁴ It is to be emphasized that the re-spending impact of \$7.5 billion does not represent the earnings of the 61,714 induced jobs. The \$7.5 billion re-spending impact does include the direct earnings received by the employees holding the induced jobs, but the re-spending impact also includes the revenue received by the firms providing the goods and services to those directly employed.

In addition to the direct and induced personal income and consumption impact, wages and salaries were received by the 79,127 indirect employees. Using wage and salary data for these indirect employees as reported by the U.S. Bureau of Economic Analysis, RIMS II, it is estimated that nearly \$3.2 billion of indirect wages and salaries were created by port activity. Therefore, in 2006, the maritime activity at the Port of Houston created a total of \$13.4 billion of direct, induced and indirect wages and salaries.

In addition, the related job holders received \$25.8 billion of personal wages and salaries.

3. LOCAL PURCHASES

Each of the firms surveyed were asked to provide a breakdown of local expenditures for equipment, parts, office supplies, business services, utilities, raw materials, maintenance and repair, new construction, etc. Based on the reported expenditures, it is estimated that \$5.9 billion of local purchases were made by the firms directly dependent upon maritime cargo activity at the Port of Houston's public and private marine terminals. These firms also include the refineries and petrochemical firms located along the Houston Ship Channel that ship and receive cargo by barge or vessel. These \$5.9 billion of local purchases in turn supported the 79,127 indirect jobs in the State of Texas.

4. TAX IMPACTS

State and local tax impacts are based on state and local per capita income tax burdens developed by the Tax Foundation. The taxes include all state and local taxes collected divided by personal income in the State of Texas. Multiplying the tax/capita income burden to the total direct, induced and indirect personal income impact, it is estimated that activity at the PHA-owned marine terminals and the private terminals generated \$\$1.3 billion of state, county and local taxes.

In addition, the \$2.4 billion of state and local taxes were generated by the users of the Port of Houston.

IV. ECONOMIC IMPACTS OF THE PORT OF HOUSTON AUTHORITY-OWNED MARINE TERMINALS

In this chapter the economic impacts generated by the public marine terminals owned by the Port of Houston Authority are detailed. These impacts are a subset of the port-wide (public and private marine terminals) discussed in the previous chapters. The impacts discussed in this chapter are the jobs, revenue, personal income and taxes generated by the Port of Houston Authority-owned terminals -- Houston Public Grain Elevator #2, the Fentress Bracewell Barbour's Cut Container Terminal, the Bulk Materials Handling Plant, Jacintoport, the Care Terminal, the PHA terminals in the Houston Turning Basin, and the Woodhouse Terminal.

The same methodology has been used to estimate these PHA impacts as was used to estimate the total port-wide impacts of both public and private terminals, as discussed in the previous chapters. It is useful to have a separate estimate of the impacts generated by public port facilities, as these impacts can be used to demonstrate the value of public investment in port facilities. The resulting economic impact model can be used in port planning decisions, in evaluating capital projects and terminal expansions, as well as in justifying investment decisions.

In 2006, 40.6 million tons of cargo moved over the PHA-owned terminals located along the Houston Ship Channel. Exhibit IV-1 presents the tonnage by commodity and handling type. The primary commodities handled at the PHA-owned terminals are containerized cargo and liquid bulk cargo. Other key commodities handled include 5.4 million tons of iron and steel products and 5.4 million tons of other dry bulk cargo. Also, 1.6 million tons of grain moved via the Port, followed by about 1 million tons of miscellaneous breakbulk cargo were moved over the PHA-owned ports.

Exhibit IV-1
Tonnage at Port of Houston Authority Terminals

	PUBLIC
CONTAINERS	16,097
STEEL	5,391
BAGGED GRAIN	773
AUTOMOBILES	115
OTHER BREAKBULK	1,043
GRAIN	1,606
DRY BULK	5,365
LIQUID BULK	9,898
PETROLEUM	0
RO/RO	76
FOREST PRODUCTS	105
CHILL	<u>101</u>
TOTAL	40,570

Totals may not add due to rounding

The economic impacts generated by the cargo moving via the PHA-owned terminals are summarized in Exhibit IV-2.

Exhibit IV-2
Summary of Texas Impacts Generated by PHA-Owned
Marine Terminals

	PUBLIC TERMINALS
JOBS	
DIRECT	20,021
INDUCED	20,516
INDIRECT	28,024
RELATED JOBS	<u>324,586</u>
TOTAL	393,147
PERSONAL INCOME (1,000)	
DIRECT	\$932,308
RE-SPENDING/CONSUMPTION	\$2,450,850
INDIRECT	\$1,116,043
RELATED INCOME	<u>\$8,842,088</u>
TOTAL	\$13,341,289
ECONOMIC VALUE (1,000)	
DIRECT REVENUE	\$2,925,739
LOCAL PURCHASES	\$2,084,502
RELATED OUTPUT	<u>\$66,448,319</u>
TOTAL	\$71,458,560
STATE & LOCAL TAXES (1,000)	
DIRECT, INDUCED AND INDIRECT	\$422,925
RELATED STATE AND LOCAL TAXE	<u>\$831,156</u>
TOTALS	\$1,254,081

Totals may not add due to rounding

1. EMPLOYMENT IMPACTS

In total, 393,147 jobs in Texas are in some way related to the 40.6 million tons of cargo moving via the PHA marine terminals. It is to be emphasized that these 393,147 jobs in Texas are a subset of the 785,049 total jobs in Texas in some way related to cargo moving over all marine terminals at the Port of Houston.

Of the 393,147 total jobs in Texas associated with the PHA-owned marine terminals, 20,021 direct jobs were generated by the cargo handled at PHA terminals. As the result of purchases by these 20,021 direct jobs, an additional 20,516 induced jobs were supported in the local economy. Local purchases totaling \$2.1 billion by firms dependent upon the maritime activity at the PHA terminals generated an additional 28,024 indirect jobs. An additional 324,586 related jobs in Texas are also associated with the movement of containers, steel, breakbulk cargo, autos, liquid bulk cargo, etc. via the public terminals.

In the remainder of this section the direct employment impact is discussed in terms of job category and commodity.

1.1 Direct Job Impacts by Job Category

Exhibit IV-3, on the following page, shows that 44 percent of these 20,021 direct jobs are with maritime services sector firms. The majority of the marine service sector jobs are with warehousing/CFS operations, dockworkers/ILA, terminal and stevedoring operations, freight forwarders, and jobs in maritime services. The majority of the warehousing impacts and impacts with the ILA are generated by containerized cargo.

About 17 percent of the 20,021 direct jobs are held by trucking companies and railroads. Within the surface transportation sector, the majority of the direct jobs are held by trucking companies. About 60 percent of the 3,311 trucking jobs are generated by the movement of containerized cargo to and from the PHA terminals, as well as to and from CFS and warehouse locations. This trucking impact also includes drayage impacts between the marine terminals and railyards.

Another 35 percent of the direct PHA generated jobs are with the dependent shippers/consignees using the PHA-owned terminals, while the remaining 2.8 percent of the PHA impact is with the Port of Houston Authority.⁵

⁵The Port of Houston Authority employees do not include casual ILA labor hired by the PHA for terminal work. These ILA members are included with ILA/Dockworkers category.

Exhibit IV-3
 Direct Jobs by Category
 Generated by Cargo at PHA-Owned
 Marine Terminals

PUBLIC TERMINALS	
SURFACE TRANSPORTATION	
RAIL	154
TRUCK	3,311
MARITIME SERVICES	
TERMINAL EMPLOYEES	1,368
ILA/DOCKWORKERS	1,688
TOWING	20
PILOTS	32
AGENTS	961
SURVEYORS/CHANDLERS	145
FORWARDERS	1,322
WAREHOUSEMEN	1,884
GOVERNMENT	125
MARITIME SERVICES	1,021
BARGE/BUNKERS	190
DEPENDENT SHIPPERS/CONSIGNEES	6,998
PORT OF HOUSTON AUTHORITY	553
BANKING/INSURANCE	<u>249</u>
TOTAL	20,021

1.2 Direct Job Impacts by Commodity Group

About 38 percent of the 20,021 direct jobs are generated by the 16.1 million tons of containerized cargo moving via the Port of Houston Authority's facilities. Nearly 26 percent of these jobs generated by containerized cargo are with trucking firms, while another 20 percent are with warehousing, CFS and container repair operations. About 20 percent are with the ILA. Of the 2,115 jobs generated by iron and steel cargo, about 26 percent of the jobs are with terminal operations, followed by 25 percent with trucking firms. About 16 percent of the steel jobs are with terminal operations. The liquid bulk handled at the PHA-owned terminals created 5,581 jobs, primarily with local shippers/consignees. Exhibit IV-4 shows the direct jobs by commodity

Exhibit IV-4
Distribution of Direct Jobs by Commodity Group

	DIRECT JOBS
CONTAINERS	7,687
STEEL	2,115
BAGGED GRAIN	239
AUTOMOBILES	256
OTHER BREAKBULK	763
GRAIN	110
DRY BULK	858
LIQUID BULK	5,581
PETROLEUM	0
RO/RO	408
FOREST PRODUCTS	131
CHILL	62
NOT ALLOCATED	<u>1,811</u>
TOTAL	20,021

Totals may not add due to rounding.

2. REVENUE IMPACT—TOTAL ECONOMIC ACTIVITY

The revenue impact is a measure of the total economic activity in the State that is generated by the cargo moving via the public marine terminals at the Port of Houston. In 2006, marine cargo activity at the public terminals generated a total of \$71.5 billion of total economic activity in the State of Texas. Of the \$71.5 billion, \$2.9 billion is the direct business revenue received by the firms directly dependent upon the Port and providing maritime services and inland transportation services to the cargo handled at the public terminals. An additional \$2.1 billion was spent on local purchases by the firms directly dependent on the Port activity (which supported the indirect jobs). The balance, \$66.4 billion represents the value of the output to the State of Texas that is created due to the cargo moving via the public marine terminals at the Port of Houston. This includes the value added at each stage of producing an export cargo, as well as the value added at each stage of production for the firms using imported raw materials and intermediate products that flow via the public and private marine terminals at the Port of Houston and are consumed or produced by industries within the State.

The balance of this section focuses only on the \$2.9 billion revenue impact generated from the provision of transportation services in support of the cargo and vessel activity at the Port of Houston. It is important to emphasize that the direct business revenue does not include the value of the cargo moving via the marine facilities.

Exhibit IV-5 shows the revenue generated by commodity handled at the PHA-owned terminals. Containerized cargo generated the largest revenue impact, \$1.1 billion, and 40 percent of the revenue generated by containerized cargo is received by warehousing, CFS operations and container repair operations, followed by trucking companies and terminal operations. Bagged grain operations created \$499 million (the majority of the revenue received by the railroads), and dry bulk

handled at the PHA-owned terminals generated \$296.5 million, followed steel products and liquid bulk cargoes.

Exhibit IV-5
Business Revenue Generated by PHA-Owned Terminals

	\$1,000
CONTAINERS	\$1,142,917
STEEL	\$257,984
BAGGED GRAIN	\$499,000
AUTOMOBILES	\$17,961
OTHER BREAKBULK	\$76,126
GRAIN	\$32,710
DRY BULK	\$296,515
LIQUID BULK	\$175,372
PETROLEUM	\$0
RO/RO	\$2,203
FOREST PRODUCTS	\$2,749
CHILL	\$4,142
NOT ALLOCATED	<u>\$418,062</u>
TOTAL	<u>\$2,925,739</u>

3. PERSONAL EARNINGS IMPACT

The 20,021 direct employees received \$932.3 million of wages and salary earnings. Based on the re-spending impact described in the previous chapter, it is estimated that an additional \$2.5 million of local income and purchases were created, supporting the 20,516 induced jobs in the local economy. The 28,024 indirectly employed workers supported by the purchases made by the firms dependent upon the PHA-owned facilities received \$1.1 billion of indirect wages and salaries. In total, the cargo activity at the PHA-owned terminals created \$4.5 billion of wages and salaries in the Houston regional economy.

The 324,586 related users received another \$8.8 billion of wages and salaries.

4. STATE AND LOCAL TAXES

The activity at the PHA-owned marine terminals generated \$422.9 million of state and local taxes. In addition, \$831.2 million of state and local taxes were created by the users of the Port of Houston Authority's terminals.

V. ECONOMIC COST OF LOSS OF CHANNEL DEPTH

As part of the 2006 Port of Houston Economic Impact Study, Martin Associates evaluated and quantified the economic cost to shippers/consignees using the marine terminals along the Houston Ship Channel of the loss of one foot increments of channel depth. Currently the Houston Ship Channel is maintained at varying depths, ranging from 45 ft. to 36 ft. To quantify the impact of a loss of channel depth Martin Associates used the US Army Corps of Engineers Vessel Entrances and Clearances data base for the Houston Ship Channel. The most recent data base available is for calendar year 2004. This data base identifies the vessel arrivals and departures, previous port called, date of transit, deadweight tonnage and net registered tonnage of the vessel, type of vessel, flag of registry, vessel name, and arrival/departure draft.

The deadweight tonnage of each vessel was then matched to a prototype vessel contained in the US Army Corps of Engineers (USACE) Deep Draft Self Propelled Vessel Cost Data Base. These prototype vessels are classified by type of vessel, flag of registry, as well as by DWT within a vessel category.

The next step in the analysis was to identify the operating costs of each type of vessel at the recorded arrival and departure drafts presented in the Vessel Entrances and Clearances database for the Houston Ship Channel. Vessel cost models were developed by type, size and flag of registry of each of the vessel calls. The vessel operating costs for the prototype ships were identified from the US Army Corps of Engineers Deep Draft Self Propelled Vessel Cost Data Base (2004). This data base provides typical operating costs for specific types of vessels (container, breakbulk, liquid bulk/tanker and dry bulk) and size classes within each vessel type category, as well as by flag of registry (US vs. foreign). Cost data is provided for such items as crew costs, insurance, annualized capital costs, fuel consumption at sea and at port, ship stores, and maintenance and repair. Other vessel characteristics included in the data base are operating draft and speed. Also, for each vessel type and size, the TPI rate is identified. Simply stated, the TPI rate is used to calculate the tonnage lost per each inch of restricted draft, which is in turn used in the estimate of increased shipping costs per ton of cargo, as the load of the vessel is restricted in accordance with the TPI at specific channel depths. These factors were used to calibrate the Martin Associates' vessel cost models, which essentially translate sailing distance into voyage time and hence voyage costs. The models also include assumptions as to load and discharge rates (which impact time at port), routings involving the use of the Panama Canal, Suez Canal or the St. Lawrence Seaway, and probable delay days on specific routes.

The Vessel Entrances and Clearances data base provided the last port of call for each vessel arriving at the marine terminals along the Houston Ship Channel. Using this information, the one way mileage associated with each vessel call was estimated using the Distances Between Ports, Lighthouse Press, Publication 151, published by the US Defense Mapping Agency. These mileages were used as inputs to each vessel cost model corresponding to each of the 5,346 cargo vessel calls.

The third step in the process was to develop a relationship between channel depth and vessel draft, using the TPI rate published for each of the prototype vessel models as contained in the USACE Deep Draft Self Propelled Vessel Cost Data Base.

Martin Associates then calculated the vessel shipping cost per ton of each of the 5,346 vessel calls. The voyage costs were first calculated under the actual sailing drafts recorded in the data base, and then under a declining 1-foot incremental draft reduction. Under the varying drafts, the costs were recalculated under assumed light loading operations for the vessels.

An average shipping cost per ton was then calculated for each of the vessel types (container, crude tanker, Ro/Ro, product tanker, dry bulk, breakbulk, reefer, etc.) under the current average sailing draft, and then under restricted drafts of one foot declining increments. The average shipping cost at the baseline and one foot increments of draft reductions for each vessel type was then multiplied by the estimated tonnage, by cargo type, associated with each type of ship.

It is to be noted that for each one foot less of sailing draft, the vessels would experience a loss of tonnage (or the tonnage would be diverted to another vessel call) based on the TPI for that specific type and size of ship. As the tonnage per ship call is restricted, the cost per ton increases. The difference between the total voyage costs of shipping the 240.9 million tons of cargo moving on the Ship Channel at the current recorded vessel drafts, and the total cost of shipping the cargo at the restricted drafts represents the economic benefits (NED benefits) of maintaining the Ship Channel at its current depths versus losing channel depths at a decreasing 1-foot incremental rate.

Exhibit V-1 shows the cost penalty (or conversely the NED economic benefit) of the loss of one foot of channel depth. At the current sailing drafts, the one way cost of moving the 240.9 million tons of cargo on the Houston Ship Channel is \$1,094,006.53. If each vessel were to lose one foot of sailing draft, the total voyage cost would increase by \$73.4 million tons per year. If two feet of draft were lost, the cost of calling the marine terminals along the Houston Ship Channel would increase to nearly \$1.3 billion per year, an increase of \$159.5 million annually over the baseline cost. If five feet of draft were lost on the Ship Channel, the cost to importers/exporters using the Ship Channel would increase by \$582.4 million annually over the baseline cost.

Exhibit V-1

Baseline Voyage Depth	Voyage (\$1,000)	Cost (\$1,000)
	\$1,094,006.53	
1 ft.	\$1,167,448.23	\$73,441.70
2 ft.	\$1,253,525.18	\$159,518.65
3 ft.	\$1,360,011.70	\$266,005.17
4 ft.	\$1,494,047.05	\$400,040.52
5 ft.	\$1,676,410.41	\$582,403.88

VI. COMPARISON WITH 2000 ECONOMIC IMPACTS

Between 2000 and 2006, total cargo handled at the public and private terminals at the Port of Houston increased from 191.4 million tons in 2000 to 240.9 million tons in 2006. This growth in activity has resulted in an increase in the economic impact generated by the Port of Houston in the local and state economies. In this chapter the change in the direct economic impact generated by the Port of Houston is documented. The methodology used by Martin Associates to estimate the economic impacts generated by seaport activity in 2000 is, for the most part, the same as the methodology used to measure the current 2006 economic impacts. However, there are some key differences, which are addressed in the following section.

1. METHODOLOGICAL CHANGES

The basic methodology used to measure the 2000 economic impacts is the same as that used by Martin Associates for this current study, with the following exceptions. In 2006, the personal income multiplier used to estimate the re-spending impact has been updated by the U.S. Bureau of Economic Analysis for the Houston metropolitan area -- in 2000, the income multiplier was estimated by the Bureau of Economic Analysis for the entire transportation sector in the region. As of 2006, the Bureau of Economic Analysis now provides an estimate of the personal income multiplier for the water transportation sector of the metropolitan region, which more accurately reflects the higher wages and re-spending impact associated with port generated jobs compared to the transportation sector in total, which also includes mass transit, taxis, air and surface transportation sectors. In 2000, the personal income multiplier was 2.237 while in 2006, the income multiplier for the water transportation sector is 3.626, reflecting the higher wages in this sector. As a result, for a given dollar of income, the updated multiplier will generate a much larger induced job impact and greater re-spending impact.

Also included in the 2006 study is an estimate of the total economic impact associated with the cargo moving via the Port. In past studies, only the related job impacts with port users were estimated.

The focus on the comparisons should, therefore, be on the direct job impacts, since the same methodology to measure the direct impacts was used both in estimating the impacts in 2000 and in this current study.

2. **COMPARISON OF TONNAGE HANDLED AT THE PORT OF HOUSTON
PUBLIC AND PRIVATE MARINE TERMINALS**

Total tonnage handled at the Port of Houston's public and private marine terminals in 2000 and 2006 is presented in Exhibit VI-1. As this table indicates, total tonnage increased by nearly 50 million tons over the 2000-2006 period.

Exhibit VI-1
Comparison of Tonnage Handled at the Port of Houston
Public and Private Terminals, 2000 and 2006
(1,000 Tons)

	2006	2000	CHANGE
CONTAINERS	16,097	9,858	6,239
STEEL	9,200	6,876	2,324
BAGGED GRAIN	773	533	240
AUTOMOBILES	601	271	330
OTHER BREAKBULK	5,291	4,511	780
GRAIN	6,383	7,318	(935)
DRY BULK	16,701	12,779	3,922
LIQUID BULK	<u>185,876</u>	<u>149,247</u>	<u>36,629</u>
TOTAL	240,923	191,393	49,530

Totals may not add due to rounding

The most significant tonnage changes are summarized as:

- Liquid bulk cargoes including petroleum and petroleum products grew by 36.6 million tons;
- Containerized cargo grew by 6.2 million tons;
- Dry bulk cargo grew by 3.9 million tons;
- Iron and steel cargoes grew by 2.3 million tons;
- Other breakbulk cargo grew by 0.8 million tons;
- Automobiles and Ro/Ro cargo grew by 330,000 tons;
- Bagged grain grew by 240,000 tons;
- Grain exports fell by nearly 1 million tons.

3. COMPARISON OF JOB IMPACTS

Exhibit VI-2 presents a comparison of the total impacts generated by both public and private terminals.

Table VI-2
Comparison of Direct Economic Impacts: 2000-2006
Public and Private Marine Facilities
(State of Texas)

	2006	2000	CHANGE
JOBS			
DIRECT	58,142	54,730	3,412
INDUCED	61,714	34,980	26,734
INDIRECT	<u>79,127</u>	<u>53,203</u>	<u>25,924</u>
TOTAL	198,983	142,913	56,070
PERSONAL INCOME (1,000)			
DIRECT	\$2,833,500	\$2,274,306	\$559,194
RE-SPENDING/CONSUMPTION	\$7,448,705	\$2,813,771	\$4,634,934
INDIRECT	<u>\$3,148,069</u>	<u>\$2,124,843</u>	<u>\$1,023,226</u>
TOTAL	\$13,430,274	\$7,212,920	\$6,217,354
DIRECT REVENUE (1,000)	\$8,084,680	\$6,872,322	\$1,212,358
LOCAL PURCHASES (1,000)	\$5,912,995	\$3,992,811	\$1,920,184
STATE AND LOCAL TAXES (1,000)	\$1,262,446	\$649,163	\$613,283

Between 2000 and 2006, direct jobs increased by 3,412 jobs. As shown in Exhibit VI-3, the largest employment gains, about 1,200 jobs, were recorded with freight forwarders, reflecting the growth in containerized cargo and steel. Other large employment gains occurred with longshoremen and dockworkers, reflecting the growth in containerized cargo, steel and other breakbulk cargoes. Employment with port-dependent shippers/consignees, particularly those shipping and receiving liquid and dry bulk cargoes also increased. This growth in port-dependent shippers and consignees of liquid bulk cargoes corresponds to the more than 32 million ton increase in petroleum and liquid bulk cargo over the three year period. Other increases in direct jobs were recorded for jobs with marine construction and warehousing, reflecting the growth in containerized cargo and imported steel. Terminal jobs increased due to the growth in liquid bulk cargoes and steel. The largest job loss was due to the discontinuation of cruise operations at the Port of Houston.

Exhibit VI-3
Comparison of Direct Job Impacts

	2006	2000	CHANGE
SURFACE TRANSPORTATION			
RAIL	901	704	197
TRUCK	9,801	9,591	210
MARITIME SERVICES			
TERMINAL EMPLOYEES	3,995	3,437	558
ILA/DOCKWORKERS	2,404	1,565	839
TOWING	152	141	11
AGENTS	1,385	1,040	345
SURVEYORS	937	805	132
FORWARDERS	2,319	1,147	1,172
WAREHOUSEMEN	2,422	2,461	-39
GOVERNMENT	249	312	-63
MARITIME SERVICES	3,583	3,182	401
BARGE/BUNKERS/CHANDLERS	1,296	1,380	-84
CRUISE		325	-325
DEPENDENT SHIPPERS/CONSIGNEES	26,662	26,658	4
PORT OF HOUSTON AUTHORITY	553	482	71
BANKING/INSURANCE	<u>1,480</u>	<u>1,500</u>	<u>-20</u>
TOTAL	58,142	54,730	3,412

Totals may not add due to rounding

Exhibit VI-4
Comparison of Direct Jobs by Commodity

COMMODITY	DIRECT JOBS	DIRECT JOBS	CHANGE
	2006	2000	DIRECT JOBS
LIQUID BULK	33,153	32,338	815
CONTAINERS	7,687	5,120	2,567
STEEL	4,365	2,934	1,431
MISCELLANEOUS BREAKBULK	3,084	2,503	581
DRY BULK	2,265	2,005	260
AUTOS/RORO	1,115	1,906	-791
GRAIN	362	470	-108
FOREST PRODUCTS	354	251	103
NOT ALLOCATED	<u>5,755</u>	<u>7,203</u>	<u>-1,448</u>
TOTAL	58,142	54,730	3,412

Totals may not add due to rounding

On a commodity specific basis, the major employment gains were generated by the growth in containerized cargo and steel followed by growth in employment associated with liquid bulk (crude, petroleum products and chemicals) Also, growth in jobs with miscellaneous breakbulk cargoes was recorded and associated with the 2.8 million ton increase in breakbulk cargoes. The decline in jobs with autos and RoRo cargo reflects the allocation of a dependent shipper importing auto parts to

containerized cargo. In the 2000 study, these dependent consignees were assigned to the auto/RoRo commodity category. In fact the auto parts are moving in containers.

Induced jobs increased significantly due to the change in the multiplier, as described previously and as a result comparisons cannot be made with respect to induced jobs over the 2000-2006 period.

Indirect jobs increased by 25,924 jobs reflecting the growth of local purchases from \$4 billion in 2000 to nearly \$6 billion on 2006.

Related jobs increased significantly over time reflecting the growth in tonnage, particularly the growth in containerized cargo, breakbulk cargo and steel products.

4. COMPARISON OF REVENUE, INCOME AND TAX IMPACTS

Between 2000 and 2006, personal income grew by about \$559.2 million, reflecting the growth in direct employment, as well as an increase in the average salary received by the direct employees from \$41,560 to \$48,730. Business revenue received by firms providing services at the marine terminals grew by \$1.2 billion since 2000, reflecting the growth in tonnage.

State and local taxes generated by port activity nearly doubled over the 2000-2006 period, but this increase also reflects the change in the income multiplier, as described previously.

5. SUMMARY

The public and private marine terminals at the Port of Houston continue to be an economic engine for the Houston area, Harris County and the State of Texas. In the last six years the port activity has added 3,400 new direct jobs annually, and the salary of these job holders has increased from \$41,560 to \$48,730. The importance of the Port's public and private marine terminals to the State is underscored by the fact that the total value of the economic impact of the public and private marine terminals is measured at \$117.6 billion and 785,049 jobs in the State of Texas are related to the marine activity at the public and private terminals along the Houston Ship Channel.