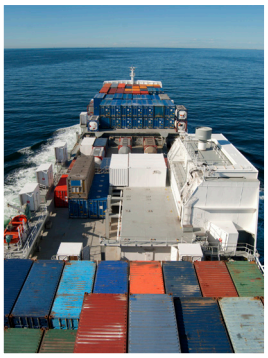
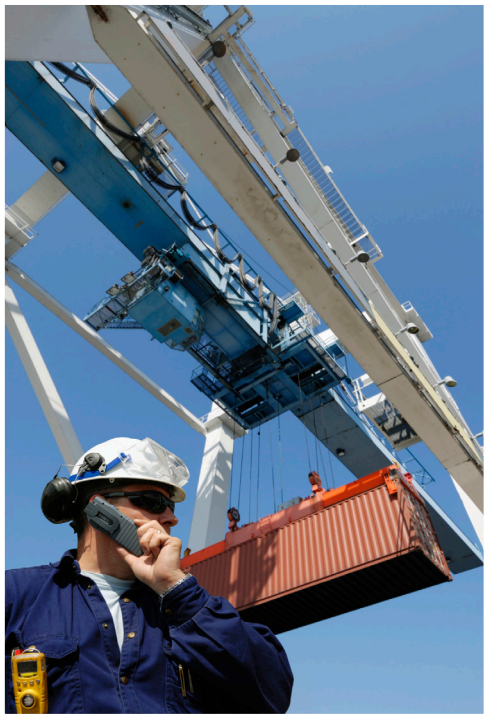
Port Planning and Investment Toolkit
MODULE 1: Planning





U.S. Department of Transportation

Maritime Administration

AAPA American Association of Port Authorities

Alliance of the Ports of Canada, the Caribbean, Latin America and the United States

Preface

The American Association of Port Authorities (AAPA) and the U.S. Department of Transportation (USDOT), Maritime Administration (MARAD) signed a cooperative agreement to develop an easy-to-read, easy-to-understand, and easy-to-execute Port Planning and Investment Toolkit. The goal of the project is to provide U.S. ports with a common framework and examples of best practices when planning, evaluating and funding/financing freight transportation, facility and other port-related improvement projects.

The analytical tools and guidance contained in this comprehensive resource are designed to aid ports in developing "investment-grade" project plans and obtain capital for their projects in a variety of ways, including: (1) improve the chances of getting port infrastructure projects into Metropolitan Planning Organization (MPO) and state transportation programs to qualify for formula funding; (2) better position port projects for federal aid; and (3) assist ports in obtaining private sector investment.

Since each port investment project is unique with its own set of strengths and obstacles, the material in this Toolkit is not intended to address specific requirements of any single project, user or port; it is a resource for a diverse group of users to become familiar with port planning, feasibility and financing and to highlight opportunities for engagement and coordination throughout the project definition process. This document is not a replacement of existing policies or consultation handbooks and does not constitute a standard, specification or regulation. The exhibits, processes, methods and techniques described herein may or may not comply with specific national, state, regional and local regulatory requirements.

This Toolkit will be updated periodically as new regulations and policies are developed affecting port planning, feasibility and investment requirements related to the applicable laws discussed in the document. Additional information, updates, and resources of the Toolkit are available on the AAPA website at ***http://www.aapa-ports.org/empowering/content.aspx?ItemNumber=21263*** and the MARAD website at - ***https://www.marad.dot.gov/ports/strongports/port-planning-and-investment-toolkit/***

For all other queries regarding the Port Planning and Investment Toolkit, please contact Jean Godwin, Executive Vice President and General Counsel, AAPA at 703-684-5700.

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Planning Module

Ports play an important role in supporting global and domestic trade, regional economic development and technological advancement, so the planning of a port project should involve more than an analysis of demand and capacity. It also should take into account market forces and institutional structures and integrate business and environmental strategies and stakeholder needs.

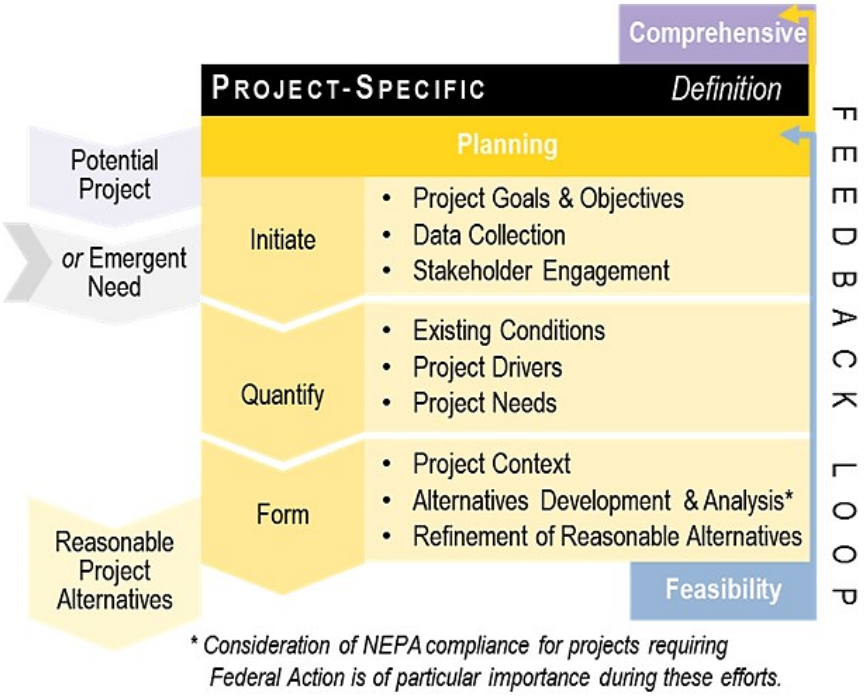
A "build it and they will come" strategy has little likelihood of success. The realization of any project hinges on having a well-defined plan that provides essential information for informed decision-making and successful financing. A ***comprehensive plan*** that communicates a port owner's vision and business objectives may be prepared prior to creation of a project plan. This Toolkit Module focuses on guiding Users through a common set of ***project-specific*** planning concepts and methods in the development of a project plan to maintain a highest and best use strategy for port owners' resources with regard to market, community, environment, land-use, economic and financial considerations.

The process shown in Exhibit 1-1 identifies the primary efforts involved in initiating and quantifying a potential port project and forming project alternatives. This general approach can be refined and customized to accommodate project specific requirements necessary to identify planning solutions that are practical and viable.

Few projects will require execution of all planning efforts so it is important to understand a project's requirements before committing significant resources. When identifying the relevant project planning efforts and level of detail required for each, consider whether the project plan will need to:

- Provide strategic clarity to increase industry and/or investor confidence
- Engage specific stakeholders including regulatory governance, neighbors, tenants, industry, communities
- Determine institutional, social, environmental, and/or economic impacts and mitigation approaches
- Integrate with local/ regional/ national regulations and transportation plans and policies
- Identify issues outside of the port's purview, such as a road and rail traffic /access to the port
- Provide quantities and schedules of implementing project attributes including permitting, design, construction, or acquisition

Exhibit 1-1 Project Definition: Planning Process



The planning stages and tasks described in the following sections, once adapted to a specific potential project, can be used to develop a project plan that has a logical, consistent and organized format and which decision makers and investors can quickly comprehend and evaluate.

1.1 Initiate

The initiate stage involves developing a thorough understanding of the objectives guiding the effort, as well as stakeholder perspectives that may affect the specifics of a potential project's direction. If there is a significant time lag between major project planning, feasibility and financing efforts, the elements of Initiation should be considered or undertaken at the outset of each effort. Similarly, certain efforts in the Initiation process may need to be repeated if the project goals, scope, schedule, budget, stakeholders or other conditions change during the project definition process.

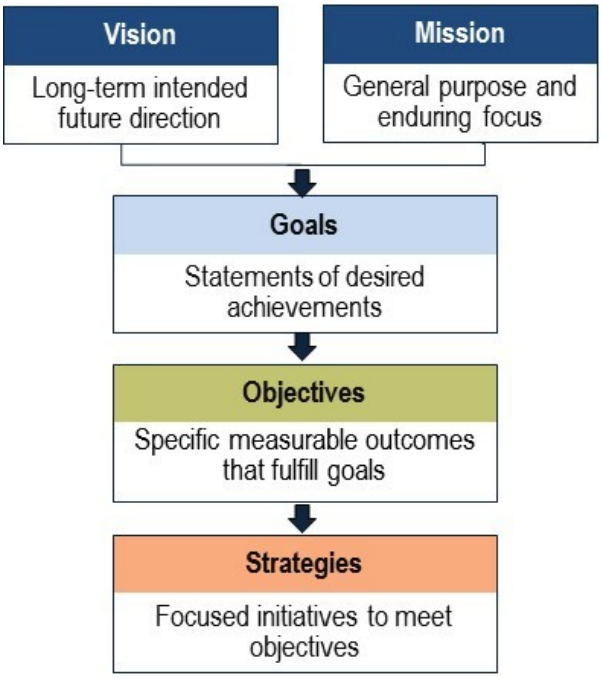
During project initiation, a series of kickoff meetings with key project members and stakeholders addresses the following items, at a minimum:

- Roles and responsibilities
- Project team and stakeholder points of contact
- Project quality control and communication protocols
- Sources of information
- Project goals and objectives
- Work program, milestones and schedule
- Key project issues and sensitivities, including outreach and other permitting and environmental requirements (if applicable)

1.1.1 Project Goals & Objectives

An initial draft of the project goals and objectives should be generated during the kickoff meetings and be presented during stakeholder engagement to incorporate constituent interests and needs. The project goals and objectives should be aligned with the port's vision and mission, and informed by stakeholders' values in pursuit of consensus. Strategic initiatives designed to attain the objectives may also be part of the project. Exhibit 1-2 illustrates the relationship between vision, mission, goals, objectives and strategies.

Exhibit 1-2 Guiding Elements of a Port and a Project



Project goals and objectives should be distilled through a comprehensive engagement and refinement sequence until they are concise and clearly articulated. Every project member should have a clear understanding of what the port owner hopes to achieve throughout the project definition process.

Keep the goals and objectives of the project at the forefront, acting as the continuing basis for developing new project elements, for prioritizing competing elements, and for comparing and contrasting alternatives as the project proceeds.

The project goals and objectives become the basis of the evaluation criteria in the Feasibility effort. Revisit project goals and objectives periodically to ensure the intent of the recommended project plan and strategies correspond with the port's vision and mission in view of evolving priorities.

1.1.2 Data Collection

Many port owners conduct ongoing data collection efforts to ensure that decision makers have sufficient information about port investments, performance, operations, and community priorities. For specific projects, data collection begins during the kickoff meetings and continues through the duration of the project definition process. The project team should develop an understanding of what information is available, the applicability of available data related to the project, and expected uses of the collected data.

Exhibit 1-3 provides a categorized list of data that could be needed for port projects. This data may be readily available from the port staff, project stakeholders, or from secondary sources such as web-based studies, reports and databases or from other public and private agencies. Some data may be obtainable only through interviews or operational observations, which should be handled with respect for confidentiality of sources.

1.1.3 Stakeholder Engagement

Port owners must constantly adjust and rebalance their actions to serve the varying needs of their community and customers. Stakeholder outreach is not only imperative in developing a port's overall vision; it supports the creation of project plans that can best serve a broad diversity of developmental requirements. Thus, identifying the project stakeholders and understanding their concerns is a critical element that must feed into any project definition process.

Stakeholders such as those listed in Exhibit 1-4 should be engaged early and often to avoid unexpected discoveries late in the process that could potentially derail a project. Stakeholder

Exhibit 1-3 Sample Types of Project Data

Strategic	Infrastructure	Operational	Market	Financial
Port Planning Documents	Site Boundaries and Adjacencies	Vessel Statistics	Historical Port Volumes	Life Cycle Costs
Land Use Studies	Facility Configuration Plans	Berth Operating Statistics	Market Forecasts	Revenue
Waterfront and Near - Waterfront Land Ownership Documents	Maps and Aerials of Existing Sites, Facilities and Infrastructure	Yard Operating Statistics	Freight Origins-Destinations Surveys and Statistics	Cost of Capital/ Evaluation Discount Rate
Port Business and Management Documents	Truck and Rail Access, Inland Rail and Highway Networks	Equipment Inventory	Customer Leases/Contracts	Asset Depreciation
Regional Economic and Business Data	Inspection/ Condition Assessment Surveys and Reports	Equipment Deployment Patterns and Productivities	Competitor Port Documents	Tariffs
Transportation Plans and Improvement Program Documents	Waterside Access	Labor Deployment Patterns	Carrier Schedules, Capacity and Fleet Sizes	Macroeconomic Forecasts (Consumer Price Index & Interest Rates)
State/Local Freight Plans	Environmental Site Assessment Reports	Labor agreements		Contracting Requirements

engagement may be performed in various forms as those shown in Exhibit 1-5. The timing and extent of the outreach effort and the forums used to communicate should be tailored to the specific needs of the port, project and stakeholders. The effort should focus on engaging relevant stakeholders with the appropriate level of knowledge, while balancing the need to keep stakeholders informed about the project.

Outreach should include engaging regulators and environmental agencies early in the project definition process to review the type of environmental assessment that may be necessary for a potential project. Environmental review can take a long time and resolving environmental issues is frequently the bottleneck in developing and completing a project. Even in cases where there is no negative environmental impact, it is very useful to identify and communicate the ways in which a future project will benefit stakeholders, specifically the community. Refer to the ***Environmental Impacts*** section (2.1.3.4) in the Feasibility Modules for additional information on the environmental review process.

Exhibit 1-4 Project Stakeholder Types

Terminal operators and tenants
Ocean carriers
Cargo owners
Stevedore/terminal labor
Community and neighbors
Inland transportation providers - truckers and rail lines
Logistics providers - warehousing suppliers, shippers
Financial/infrastructure investors
Local/tribal governments
Environmental agencies
Regulators
Metropolitan planning organizations (MPO)
Regional planning boards
State transportation authorities/departments
Non-governmental organizations

Exhibit 1-5 Forms of Stakeholder Engagement

Committee, Council, Working Group Meetings	Media Outreach	Internet Communications (Websites, Social Media)
Informal Private One-on-One Meetings	Stakeholder Interviews	Publications and newsletters
Public Meetings, Forums, Workshops, Seminars	Advisory Panel	Open or Invitation Only Focus Groups

The port owner should host public/community meetings and/or conduct workshops and small scale seminars to discuss the potential project direction and solicit feedback. Presenting draft versions of project documents, along with providing a well-defined comment period to gain further feedback, is essential to gaining support early in the process.

The creation of a project Advisory Panel is recommended to involve key stakeholders in the project definition process. Members of an Advisory Panel should include individuals who can enhance the project plan through their expertise and knowledge, such as facility owners and operators, community leaders and/or freight industry representatives. An Advisory Panel may have different roles depending on the project, which may include, but not be limited to:

- Helping to form project goals and objectives
- Identifying stakeholders
- Contributing insight on the regional landscape of port activity and freight movement with regard to the potential project
- Facilitating stakeholder connections and communication
- Securing community input and buy-in for the project
- Reviewing and evaluating the findings from interviews and analyses
- Providing validation and quality assurance on the draft and final documents and initiatives

The Advisory Panel should include a chair and vice chair to provide oversight and direction, as well as port staff to provide guidance. Plan on scheduled meetings with the Panel and the project team, and provide a summary of the meeting minutes to members of the Panel, who then can distribute to their constituents. Project staff should also perform site visits with members of the Panel for a better understanding of the potential project. Advisory panelists often have a responsibility to report out to their communities and then provide that community feedback to the project.

Throughout the project definition process, maintain regular communications with all parties. Appropriate project information and materials should be made available through the port's website, partner agency websites, regular publications and/or social media so that members of the public who are interested can review them. In addition, always have a means to provide input via diverse and accessible communications channels. A project website is useful for team members and stakeholders to check on the progress of the project and provide input, and to provide background materials available for reference.

If a stakeholder has a vested interest that may not align with the port's goals, identify conflict resolution strategies that will help establish common ground and maintain the port's positive relationship with its stakeholders.

Working with your MPO

Metropolitan Planning Organizations (MPO) are regional transportation planning bodies, made up of representatives from local governments and transportation authorities. Under federal law, any urbanized area with a population of at least 50,000 must have an MPO.

MPOs follow a continuing, cooperative, and comprehensive planning process (known as "3C principles") to produce their region's ***Long Range Transportation Plan*** (LRTP) and Metropolitan ***Transportation Improvement Program*** (TIP). These plans involve the planning and programming of transportation facilities, including ports, intermodal facilities, airports, and intercity and high-speed rail lines. MPOs are also responsible for distributing federal transportation funds to their region.

Port owners should partner with their MPOs to ensure that each agency's plans are complementary, and ports should involve their MPOs when planning projects that will impact the local transportation network. Certain port projects should also be incorporated into local, regional and state planning documents such as a city's capital improvement program, a TIP, a ***Statewide Transportation Improvement Program*** (STIP), and/or a LRTP. Incorporation of projects into these plans can be a first step in securing funding through the Federal-aid formula programs such as the National Highway Freight Program. You can find your MPO using USDOT's ***MPO database***. The following resources provide more information on the local, regional and state transportation planning process:

- ***Metropolitan Planning Focus Page*** - Provides resources about the metropolitan transportation planning process on the Transportation Planning Capacity Building Program website
- The ***Transportation Planning Process Briefing Book*** - Provides details on Federal transportation planning regulations and requirements at the statewide and metropolitan planning levels.

1.2 Quantify

Quantify the port's capabilities, demands, and needs that led to the identification of the potential project. Capabilities are derived from close examination of the physical and operational aspects of each element in the port's existing conditions, including navigation works, goods movement terminals, and external rail and road links. Port demands are derived from market, commercial, logistics and regulatory drivers. Project needs are derived by quantifying the gap between capabilities and drivers.

1.2.1 Existing Conditions

All project plans should include a foundational assessment of the port's current capabilities and condition of port infrastructure with respect to the proposed potential project. An inventory of assets and a record of the port's operations may be required depending on the project.

The effort may also involve investigating the port's historical performance, and researching the land use, regulatory, labor, environmental, and cultural setting at the port. Port flood hazard areas should be given consideration to ensure the project plans take into account resilience to extreme weather and sea level rise. The assessment should also determine how nearby road and rail infrastructure may impact the potential project.

The assessment can be conducted via web research, site visits, and interviews with tenants and port staff as appropriate. When completed, the assessment should form the foundation of the subsequent planning steps for the proposed potential project.

The effort may happen concurrently with the Initiate stage to save time and money. The assessment will serve as the basis for the development of an ***Opportunities and Constraints Document*** (O&CD) during the Form stage.

1.2.1.1 Assets

Document and visually-observe the condition of the relevant site(s), facilities, equipment and landside and waterside access by conducting site visits to each of the port locations related to the potential project. In certain circumstances, project stakeholders may be invited to participate so that discussions of specific issues and considerations can be conducted while on-site.

These site visits and data previously collected as part of the Initiate stage are used to inventory the assets and characteristics of each port resource related to the potential project. Exhibit 1-6 lists example inventory items.

Exhibit 1-6 Example Asset Inventory Items

Category	Asset Inventory Items
Site Characteristics	Boundaries, topography, bathymetry, geometry, flood hazard areas
Utility infrastructure	Installations, routes, access, and capacities for water, power, sewer, data, drainage
Waterside access	Berth characteristics, channel depth and geometry, turning basins, anchorages, distance to channel, air draft
Landside connectivity	Truck and rail access areas, connecting highway and roadways, height/width restrictions, estimated capacity and service level of each rail and roadway segment, road weight limitations, safe operating speeds, identifiable bottlenecks, nearby intermodal yards, airport locations, pipelines, etc.
Facility configurations and conditions	Gates, buildings, operating areas, parking areas, storage units, goods handling facilities, support facilities
Equipment types and characteristics	Operating equipment, cargo and/or passenger handling equipment
Environmental setting	Air quality, noise, light pollution, water quality, wetlands, pre-existing pollutants, cultural resources

1.2.1.2 Operations

Develop a profile of the operations at current facilities and potential project locations based on the site visits, interviews with operators and data collected on operating patterns. Process maps or system diagrams can be utilized to document the flow of current and expected operations, to assist in characterizing how a potential project may need to adapt to shifting operating patterns and evolving technologies. Exhibit 1-7 lists example operational profile components that should be considered for potential projects that involve cargo operations at a port.

Exhibit 1-7 Operational Profile Elements

Operating hours, shifts, start times, labor contractual elements
Port/facility logistics and circulation
Gate transactional and security patterns
Equipment deployment, productivity and years of service
Vessel patterns - schedule reliability, vessel sizes, discharge and load quantities
Cargo arrival and departure data
Cargo types and sizes, storage patterns and densities, and velocities
Stevedoring arrangements, gang size
Truck arrival and departure patterns and truck staging/parking
Intermodal rail patterns
Major water, rail, and road carriers, and their alliances and relationships
Dominant or prominent beneficial cargo owners
Traffic patterns – timing of traffic congestion and surges on near-port roadways
Distribution centers served by the port, proximity and operating hours

1.2.1.3 External Influences

A high-level review of land use, zoning, political, environmental and regulatory programs, policies and developments that may impact the potential project area is recommended for the planning effort. For example, it may be useful to review state and/or local government transportation plans or their current and proposed public policies. Is there a plan to lower the city's carbon footprint, which could restrict certain port initiatives? Is there a plan to increase coastal access, deepen the channel, add a foreign trade zone or build a grade separation at a nearby rail crossing? Is there an initiative to expand passenger service on mainlines shared with freight trains or to attract big box retailers? Do any facilities play important roles in defense or security? The answer to these questions could affect the potential project and may dictate the course of the planning efforts.

In dealing with external influences, port owners should work with their local governing bodies and other stakeholders to communicate how the project goals can assist in achieving wider regional goals, such as attracting new businesses, increasing middle-class jobs and promoting economic development.

1.2.1.4 Volumes and Trade Flows

The project plan should reflect a thorough understanding of the port's role in its wider marketplace. The research and analysis should combine statistically valid and verified data collected during the Data Collection effort to fully inform the planning process on port volumes, origins and destinations, commodity types and transportation modes.

A targeted survey of relevant shippers, carriers, logistics providers, and terminal operators can improve understanding of the port's current market within the port region, as well as any priorities, requirements and concerns.

This information will serve as a baseline from which market-driven forecast scenarios can be developed. Further details on the assessment of ***market dynamics*** and preparation of ***market forecasts*** are provided in the Project Drivers section (1.2.2).

1.2.1.5 Capacity

It is essential to understand the capacities and capabilities of existing port and near-port transportation systems, and to establish a common basis for judging the impact of the potential project on all components of a port's infrastructure and operational capabilities. For example, a potential project to develop a breakbulk facility adjacent to an existing

container terminal could impact the port's channel traffic, berth occupancy, equipment allocation, intermodal and gate operations, as well as nearby roadways.

Capacity is often defined as the maximum throughput that can be handled by a port or facility in a specific time period. Capacity reflects a complex interaction of physical, operational and commercial drivers. As such, facilities with similar physical systems may have very different capacities, and a facility with a fixed physical system can experience changes in capacity over time. For example, differences or changes in storage dwell time have a profound influence on capacity, but dwell time is independent of any physical system, and is strongly influenced by tariffs and logistics practices. Because capacity can change over time, port owners should monitor and update those key performance drivers that most influence capacity.

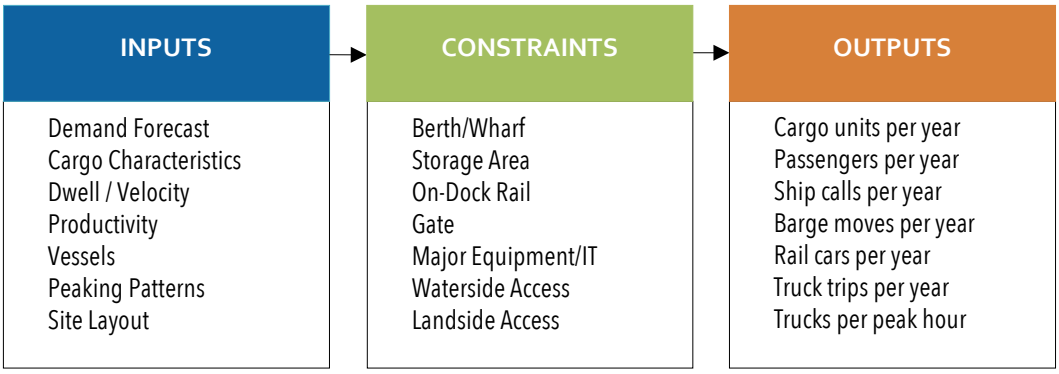
Ports may exceed estimated capacity during brief peak periods. However, operational costs may rise and service may degrade as they do so. Additionally, port facilities at capacity lose flexibility to respond to conditions that are outside the optimum condition, such as equipment breakdowns, vessel delays, or weather-driven interruptions. Finally, port facilities that must share assets – especially berths and cranes – may not always have access to the assets they need. In practical terms, it is usually difficult to operate at maximum capacity for extended periods. For this reason, planners often design facilities to a "sustainable capacity" or "practical capacity".

This Toolkit refers to ***capacity*** as maximum practical capacity, which is defined as that throughput which, if exceeded, would cause a disproportionate increase in unit operating cost or business delay, within the context of a facility's land use, layout, and uncontrollable commercial drivers.

Because throughput capacity is a primary variable used to justify project needs and to ultimately quantify project improvements/costs, a sound and defensible approach to estimate capacity is required. While there are numerous methods to estimate port capacity, the complex flow of cargo and/or passengers through a port will certainly require computerized analysis in the form of capacity models. Further details on models, tools and an example approach to estimate throughput capacity is provided in ***Appendix C***. Exhibit 1-8 illustrates a sample framework to perform static capacity analysis of port facilities.

Work collaboratively with terminal operators to develop realistic and measurable input data for a capacity model. Historical operating statistics from the data collection effort should underpin inputs into the model. Inputs include, but are not limited to, projected demand, throughput mixes, modal profiles, storage dwell times, arrival patterns, equipment productivity, and peaking factors.

Exhibit 1-8 Throughput Capacity Analysis Framework



1.2.2 Project Drivers

Project drivers are forces external to a port that impact a potential project and that may be the impetus behind a project. Identification of the project drivers allows the port owner to generate practical, effective project alternatives and strategies that will fulfill the project objectives. When considering all the reasons a port undertakes a project plan, consider that projects may have drivers in the following four categories:

- Regulatory Environment
- Market Dynamics
- Competitive Position
- Market Forecast

1.2.2.1 Regulatory Environment

Government agencies have the authority to promulgate regulations and requirements that affect port operations and port development, predominately in the following areas:

- Land use
- Transportation
- Community
- Health and Safety
- Environmental
- Labor
- Security
- Funding

For instance, a port owner may endorse a project to meet a state or local mandate; to achieve consistency with state, regional, or local government master and/or transportation plans; to connect stated public policy goals with port objectives, such as increasing employment in the community; or to qualify for state or federal grant matching funds.

One example of an environmental regulation that became a significant driver for port projects was the 2007 at-berth regulation set forth by the California Air Resources Board. This regulation mandates that cruise ships and container ships use shore power instead of running their auxiliary engines when calling at ports in California. The first compliance milestone was 50 percent of calls using shore power by January 1, 2014. The compliance rule gets progressively stricter over time, rising to 80 percent by 2020.

The shore power rule, or "cold ironing," led to port development projects at six different ports in California. Another example of regulations leading to port projects is the National (or state) Pollutant Discharge Elimination System, which requires stormwater pollution prevention plans (SWPPP) at ports. Each port needs a permit to discharge stormwater run-off into nearby waters. The SWPPP must be approved by the governing water board, and may include items such as drainage plans, bio-swales, slot drains, storm drain lines, stormceptor units, oil/water separator units, sediment separator units, and so on.

Port owners should maintain good relationships with the agencies that have authority over different aspects of their operation. For example, air boards or air management districts can regulate fuel use and emission controls for vessels, tugs, locomotives, cargo handling equipment, and drayage trucks. Water boards monitor storm water run-off and water quality. Fish and wildlife agencies oversee water quality and habitat conditions for fish, marine mammals, and benthic plants and creatures. Nearby airports can restrict the placement of tall cranes or otherwise inhibit operations. Local government and development agencies may have land-use regulations protecting the shore line or expanding public access to the water. Local ordinances may also dictate noise and light conditions at a facility, or may protect view corridors.

1.2.2.2 Market Dynamics

An assessment of ongoing regional and global trends and the nature of their impact on the port will help quantify future demand and define other marketplace drivers that may influence a project plan. Market factors include, but are not limited to, those shown in Exhibit 1-9.

It is important to consider major market groups by origin/destination, and identify likely drivers and competitive factors relative to the potential project. A market analysis comprises the following tasks, as applicable:

- Develop traffic flows that originate, terminate, pass through, or are in proximity to the market regions of the port.
- Determine potential changes in regional traffic flows due to changes in international and domestic trade and logistics patterns.
- Identify possible geographic markets and commodities that would obtain value from the realization of the potential project.

To identify the major freight flows relevant to the port, several sources of trade and transportation data are publicly available. The Federal Highway Administration's (FHWA) ***Freight Analysis Framework (FAF) database*** provides historic and forecast detail on freight trade flows between foreign trade regions, port regions and inland origins/destinations. Exhibit 1-10 shows a sample analysis of FAF data identifying freight flows originating in California and destined for states along the East Coast. ***U.S. Census Bureau international trade data*** provides more detailed commodity and port level information on imports and exports by foreign country.

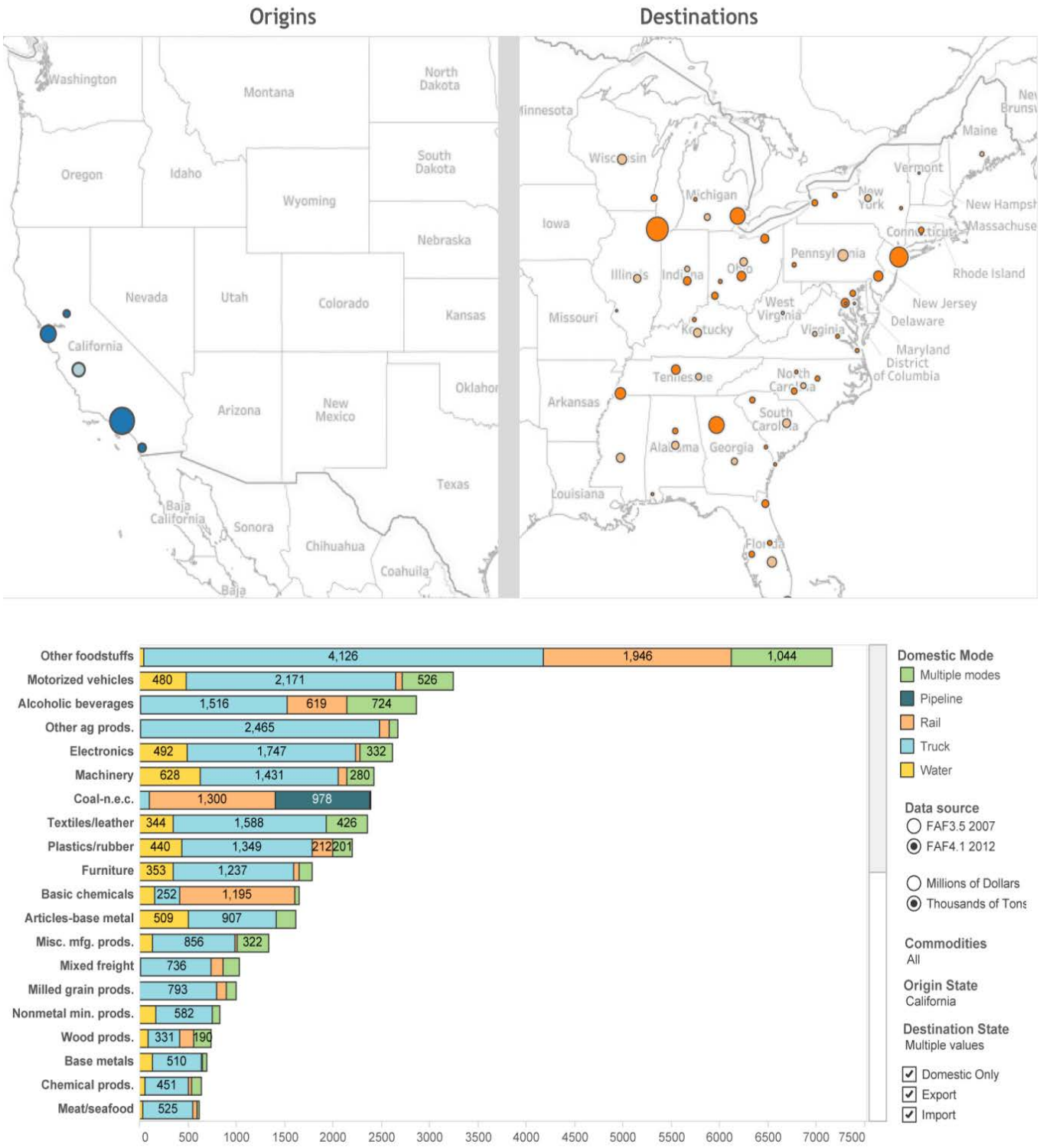
Exhibit 1-9 Sample Market Factors

Carrier alliances and consolidation
Liner / Alliance / Terminal operator relationships
Seasonal and yearly fluctuations in cargo/passenger composition
Deployment of larger ships
Global shifts in manufacturing and sourcing of goods
Major changes in transportation infrastructure-Canal expansions, port dredging, inland waterway development
Shifts in domestic production for exports
Altering distribution and shipping patterns
Advances in technology and automation
Trucking industry changes
Evolving rail infrastructure and train deployments
Variations in inland logistics and markets (discretionary cargo)
Labor developments-workforce availability
Progress in water quality standards
Increasing embedment in the community
Modifications in environmental protection
Shifting financial universe-business cycle/recession, cost of finance, investor interest

Other sources of data include statistics from the ***Bureau of Transportation Statistics***, including ***cross border freight data***; ***American Association of Port Authorities***, the ***Army Corps of Engineers***, the ***Surface Transportation Board***, and port and state transportation websites . This data can provide a useful view of aggregate and detailed historic commodity flows as well as long term forecasts from FAF. In addition to publicly available data, commercial data are available for international shipments and global forecasts of trade.

Customers' contracts and leases can also be reviewed to assess the potential for possible shifts in customer demands and volumes.

Exhibit 1-10 Sample Analysis of FAF Freight Flows



1.2.2.3 Competitive Position

Port owners often advance projects to improve the port's competitive position. Most port owners are expected to aggressively seek out opportunities to invest and improve its freight and passenger facilities ("driving economic vitality") and customer service capabilities ("providing unparalleled levels of service"), while being mindful and considerate of environmental concerns and community input. In addition, ports operate under conditions of constant change with respect to: market opportunities; customer requirements; transportation, operational, management, and environmental technologies and practices. Port owners often need to act quickly, or at least preposition themselves to act quickly, or risk losing a major business opportunity.

A competitive analysis may be performed to identify the relative position and market share of the port compared to other ports serving its existing and potential markets. The analysis should determine markets for which the port has realistic and sustainable competitive advantages that would support the development of the potential project.

The relevant comparative factors to utilize in such analyses will vary depending on the type of potential project, but in general should include those listed in Exhibit 1-11. The major drivers of a port's competitive positioning (i.e. features, services, costs, and financial strength) are considered across the major operations involving ports (i.e. shipping, terminals, and inland logistics).

Exhibit 1-11 Potential Competitive Assessment Factors

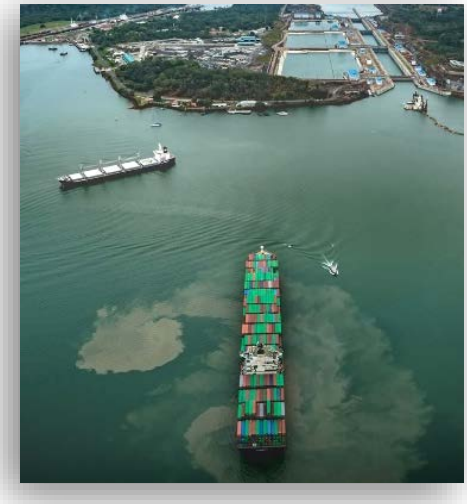
Port	Features	Services	Costs	Financial Strength
Shipping	• Channel depth and access • Turning basins • Transit distance • Tides • Congestion and delays • Air draft (bridges)	• No. of services by trade lane • Frequency and transit times • Geographic coverage • Port rotations • Feeder services	• Pilotage • Towing • User fees	• Business relationships • Operating agreement • Bargaining power
Terminals	• Quantity and size • Capacities and capabilities • Total and contiguous berth length • On/off-dock intermodal capability and access • On-site support facilities/ warehouses • Geographic proximity	• Cargo – Container – Bulk – Breakbulk • Cruise • Operations – Productivity – Technology – Turnaround • Labor relations	• Lease • Stevedoring • Wharfage • Dockage • Handling • Storage	• Governance structure • Operating arrangement • Profitability • Rating/debt position • Committed capital improvements • Fixed operating costs • Cost efficiency • Reserves
Inland	• Highway – Proximity – Travel distance/ time to market • Rail – Proximity – No. of railroads – Facilities/Yards – Travel distance/ time to market – Routes • Distribution centers	• Trucking – Truck/driver availability – Frequency – Geographic coverage • Rail – No. of Trains – Frequency – Geographic Coverage • Logistics	• Truck • Tolls • Rail • Drayage	• Business relationships • Operating agreement • Bargaining power

The cargo/customer base of competitive ports may also be examined to the extent possible, including interviewing industry representatives to determine if there are developments within the port hinterland that may influence the direction of the potential project. The market factors and a port's competitive analysis becomes the foundation upon which future demand forecasts are developed and project alternatives are prepared and evaluated.

1.2.2.4 Demand Forecast

A demand analysis serves to establish expected levels of throughput for the project and allows for the estimation of anticipated revenues over the project's life. Forecasting is, of course, an inexact art, and forecasts are subject to greater uncertainty over longer forecasting horizons. The use of scenarios, based on alternative economic outlooks and alternative assumptions about fundamental driving factors, can provide a sense of how much and why actuals may vary from forecasts.

Forecasting volumes can involve methodologies ranging from simple time trend extrapolation to detailed modeling and forecasting of specific product groups. In general, forecasts should take into account:



- Regional and national economic growth
- Historical trends in cargo/passenger growth
- Events identified during research and interview program as likely to influence future volumes
- Possible changes in the relative competitive position of the port and its facilities

Forecasting of imports may be best done by relating volumes to a range of projected levels of underlying domestic demand such as consumer spending, investment in buildings, and changes in inventories, best practice being to test sensitivities on each of these inputs to develop a risk adjusted forecast. A more detailed discussion of forecasting U.S. container imports is provided in ***Appendix D***.

For exports, more specific drivers of product volumes may be identified such as expected production of agricultural, energy, or other bulk exports, the expected position of such exports in world markets, and exchange rates and economic growth of importing countries.

Market projections should be prepared in a spreadsheet with notes that clearly indicate both the forecasting methodology and underlying assumptions for the forecasts. The market projections may be divided into the following categories, as applicable:

- Domestic Container/Trailer
- International Container
- Dry and Liquid Bulk
- Breakbulk
- Neo Bulk
- Project & Specialized Cargoes
- Daily Passengers
- Multi-day Passengers

Drawing on the information gathered during the interview process and examination of current modal usage patterns, baseline projections of rail and truck movements may also be established for the applicable origin / destination pairs within the port's market region.

To allow for testing of sensitivities, which will be required by financial investors and rating agencies in latter stages of the project definition process during finance efforts, the demand analysis should include not only a baseline forecast, but also high volume and low volume scenarios. The baseline forecast is typically used for the analysis and planning. The upside forecasts are used to identify the worst case environmental impact, while the downside is used for ***credit rating*** and financing purposes. Underlying factors affecting this range may include competition across terminals, within a port, or among ports. Associated with these local factors is the uncertainty around macroeconomic factors affecting international trade.

The low, high and medium projections for each cargo or passenger type should include explicit quantitative forecasts for the planning horizon in five-year increments at a minimum. Identify the underlying fundamental drivers of demand so that the forecasts can be most effectively communicated with, and understood by, the many external audiences that will be reviewing the potential project during the initial planning stages, as well as later review stages (such as project credit rating or environmental reviews).

A market forecast supporting a proposed potential project should answer the questions posed in Exhibit 1-12, but should also include three other aspects of demand:

- First, what are reasonable assumptions and ranges for projecting port demand? For economic drivers what are high and low scenarios for the major sectors?
- Second, what other downside risks or opportunities may affect the projections?
- Finally, how do demand projections relate to port capacity and how does this affect the timing of possible project development?

Exhibit 1-12 Basic Questions for Assessing Port Demand

- What markets/products could reasonably be attracted to the port?
- What are the projections for the fundamental drivers of these product volumes?
- What are the origins and destinations of the products?
- What advantages does the port have in serving these markets?
- Where does the port stand in relation to carriers' service rotations and how might this change in the future (e.g. as a result of evolving alliances or modifications in ship size)?
- What are "upstream" and "downstream" ports focused on?
- What are the port's advantages in terms of inland transportation for products, foreign origins or destinations?
- What share does the port have of volumes for those markets (products, foreign regions, inland regions) that it could realistically serve?
- What are competitive ports' shares of these markets?
- What advantages does the port have, or could potentially have, versus competitive ports in these markets (e.g. inland transportation time or cost)?

1.2.3 Project Needs

Before project alternatives can be created, define the project needs in terms of potential project elements such as infrastructure, equipment and/or operations. Gap analyses are used to identify the magnitude of project drivers that exceed the current conditions. Once the magnitude of the needs are quantified and defined, approaches to addressing those needs should be considered.

1.2.3.1 Gap Analysis

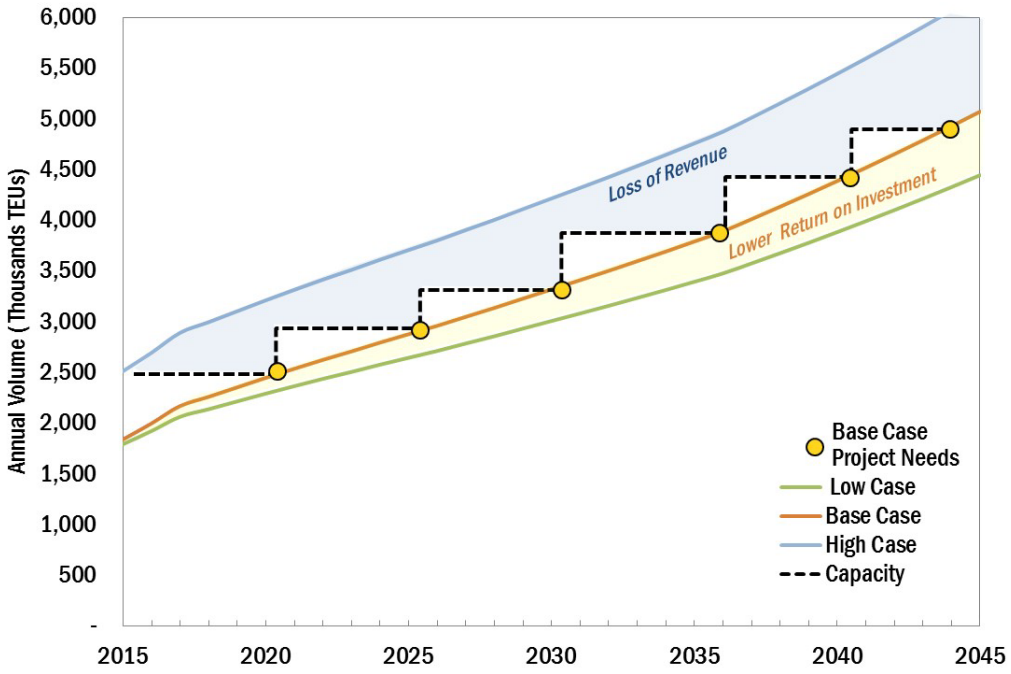
Determine project needs by performing a gap analysis that assesses the differences between a port's capabilities and performance and its opportunities and objectives relative to the potential project.

Quantify capacity gaps by comparing current capacity against the forecasted demand ranges for each cargo type and facility as needed. Project impact gaps should also be considered. There may, for example, be perceived or documented gaps between existing and desired road congestion conditions, or air emissions, or worker safety, which need to be addressed to bring the project objectives in line with the port's mission, vision and goals.

The quantified gaps are translated into project needs, which may include changes to infrastructure, equipment and/or operations required to address the project drivers. When determining project needs, take into account the variability of the gaps between project drivers and existing capabilities along with the potential risk factors, which can impact the timing of development and the project's return on investment.

For example, the purchase of additional cranes to handle the larger vessels projected to call at a port in the future may result in a lower return on investment if the carrier alters its service route and eliminates the port call. Similarly, a port may lose revenue awaiting the completion of a terminal expansion if market demand outpaces the port's projections and the additional cargo is shifted to another regional port. Exhibit 1-13 shows the potential impacts of the variability of forecasted demand volumes and capacity when determining project needs.

Exhibit 1-13 Project Needs – Demand and Phase Capacities



1.3 Form

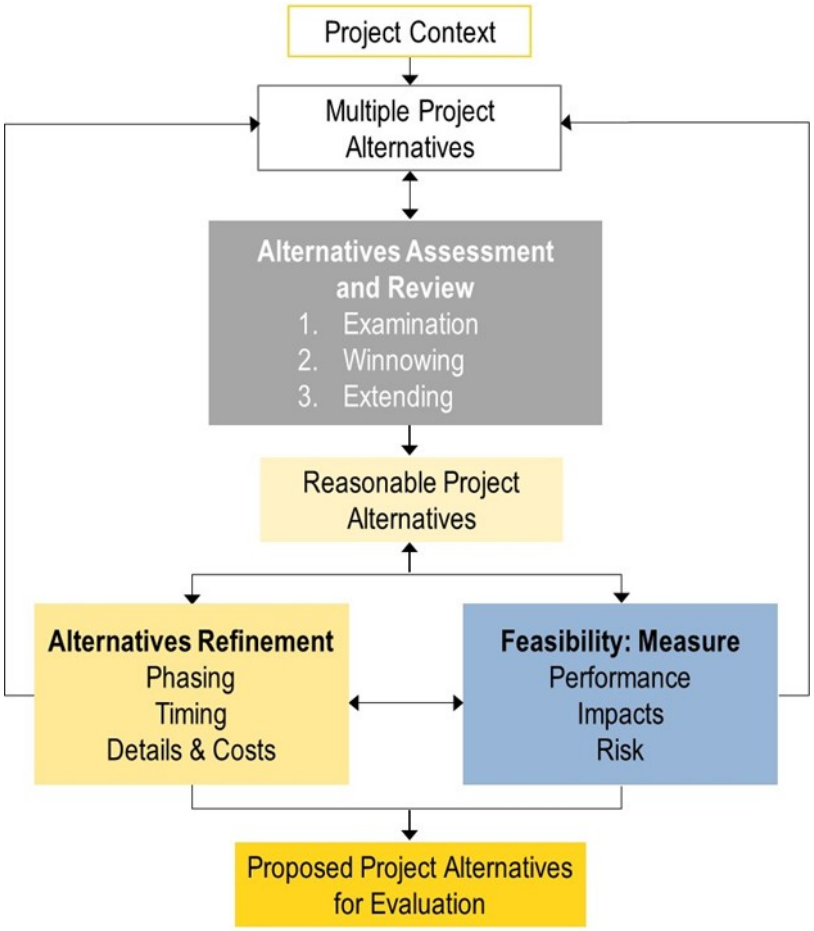
Once the existing conditions, projected demands, and gaps have been identified, prepare a range of project alternatives that can be undertaken to meet the project needs while minimizing project impacts. In forming project alternatives, provide sufficient detail to facilitate the measurement of impacts and performance of each alternative later in the project definition process. In many cases, the outcome of the Feasibility analysis (Module 2) will feed back into this Form stage, leading to iterative adjustments and refinements to the alternatives. The ultimate goal of the Form process is to identify a small number of highly-refined and reasonable plan alternatives for further analysis and assessment of feasibility.

1.3.1 Project Context

An early step in the Form stage is to understand the context in which project alternatives need to be formulated. At any given time, a port owner will perceive a range of opportunities and constraints for project formation and execution. Characterize these at the outset, and track new opportunities and constraints throughout the project alternative development process.

The project context generally takes the form of an Opportunities and Constraints Document (O&CD). The O&CD summarizes the conditions that may provide physical opportunities and constraints within the geographic environment. The document is typically in the form of a map of the potential project area, to identify any on-site and adjacent facilities and infrastructure that cannot be easily relocated and/or may constrain development, such as wharf areas, power substations, utility vaults, security buildings, rail infrastructure, and access roadways, tunnels, and bridges.

Exhibit 1-14 Alternatives Development Process and Connection with Feasibility



The map should show neighboring properties, identifying space that may be available for purchase. Other opportunities may include underutilized resources, or switching land from one use to another or major equipment such as ship to shore cranes, conveyors, gangways and cargo storage area/passenger processing equipment. An example of a basic O&CD is shown in Exhibit 1-15.

On the constraints side, identify any nearby land use which may be perceived to restrict expansion opportunities on the O&CD. This includes easements, power lines, or utilities, such as stormwater outfalls, that cannot be easily relocated. Neighboring uses such as military facilities, air fields or power plants may come with their own specific set of restrictions which should be included.

Additionally, some locales may have community concerns such as protected view corridors or public access points, which should be indicated on the document. To the extent possible, also identify sensitive environmental areas such as wetlands, floodplains, sensitive or protected fish and wildlife habitat and take into consideration the unique needs associated with these types of areas.

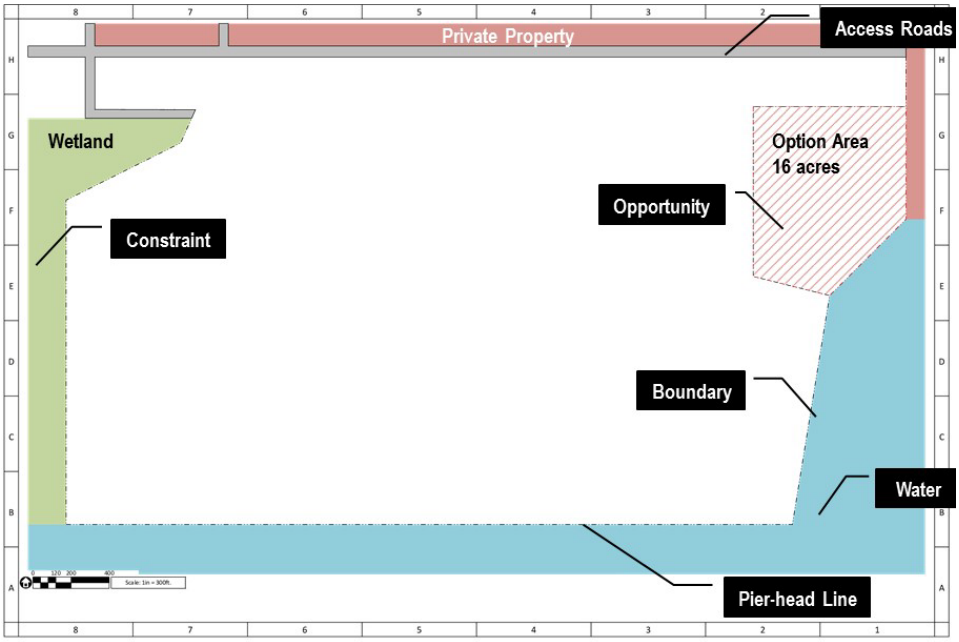
Regularly review, revise and refine the O&CD over the course of the project definition process, and use it as the common foundation on which all project alternatives are developed, judged, compared, and qualified.

1.3.2 Alternatives Development and Analysis

The process of forming project alternatives is iterative, and with each round of alternatives development and analysis, new alternatives are proposed and improvements and new ideas are generated.

During the process, the number of alternatives "in play" may shrink, grow, and shrink again. Alternatives may be discarded, then later be resurrected in the face of changes to the project context, refinements to the project goals and objectives, and/or measurements of feasibility. Additional alternatives may also be identified at any time during the planning process. The number of iterations necessary to achieve closure is difficult to predict with absolute certainty, so some flexibility in the schedule for this stage in the planning process is advisable.

Exhibit 1-15 Illustrative Basic O&CD



1.3.2.1 Alternatives Creation

Enter the planning effort with multiple project alternatives in mind. Recognize that "No-Change" or "No-Build" is a project alternative and often considered a base case. Pursuit of a single project alternative generally leads to "tunnel thinking", and prevents the port owner from rationally addressing the viability of alternative development strategies, and constrains planners from considering the interests of the broadest range of port stakeholders.

Develop project alternatives based on the project context and directed by the project goals and objectives. For example, for a cargo facility, the objective might be to increase storage capacity by a determined percent, and the planner would prepare a range of site configurations to serve that objective, considering different geometries, technologies, equipment, circulation patterns, or operating rules. It is not unusual for the first iteration of project alternatives to present a dozen ideas at a very conceptual, low-resolution level, in order to spur creative consideration of various possibilities.

Be mindful of the provision of public benefits and impacts (e.g., safety, sustainability, environmental, etc.) and community input when creating the alternatives. For those projects involving federal action, NEPA requires multiple alternatives with public engagement occurring prior to settling on a final alternative.

1.3.2.2 Alternatives Assessment and Review

Review and gauge each proposed project alternative in relation to the project context, goals and objectives with each planning iteration. The focus of this effort includes:

- **Examination**: Understanding, at a high-level, the physical and institutional elements of each alternative, and how those elements relate to existing conditions and to elements in other alternatives.
- **Winnowing:** Eliminating alternatives that do not sufficiently align with project goals and objectives, such as providing inadequate capacity or having the potential to generate unacceptable impacts.
- **Extending**: Identifying new alternatives that should be considered or alterations to proposed project alternatives that might provide a better balance of performance capabilities and impacts.

The review should be done by all members of the project team, and the set of reviewers should be the same for each iteration, so that each reviewer's understanding of the history of the process is identical and complete. The reviewers may not always agree on how to achieve the project goals and objectives with respect to the project alternatives. Some may favor certain elements of one project alternative over others. Some may not be convinced that an alternative will succeed in achieving a particular objective. Some may have significant environmental, legal, policy, or technical concerns about a project alternative.

Engage the community and other interested stakeholders to seek their perspectives on the various alternatives, and use those engagements to remind the stakeholders of the potential benefits of the proposed potential project. Ask stakeholders to identify areas of concern, including scheduling of the work, site layouts, and possible short and long-term changes in near-port traffic as a result of the potential project. Incorporate community feedback and ideas where it is feasible and document all the engagement efforts that take place.

Strive to build consensus among the diverse parties by forming or restructuring the project alternatives to accommodate various reviewers' and stakeholders' perspectives and concerns. Thoroughly document the review results, and distribute across the project team for review and correction, so that a thorough record of the planning process is established and maintained. This will likely save the port owner from having to re-examine alternatives that have already been discarded for good and salient reasons.

At the end of this review effort, the project team should have a select number of reasonable alternatives that can be refined and subjected to a higher level of scrutiny and assessment of feasibility.

1.3.3 Refinement of Reasonable Alternatives

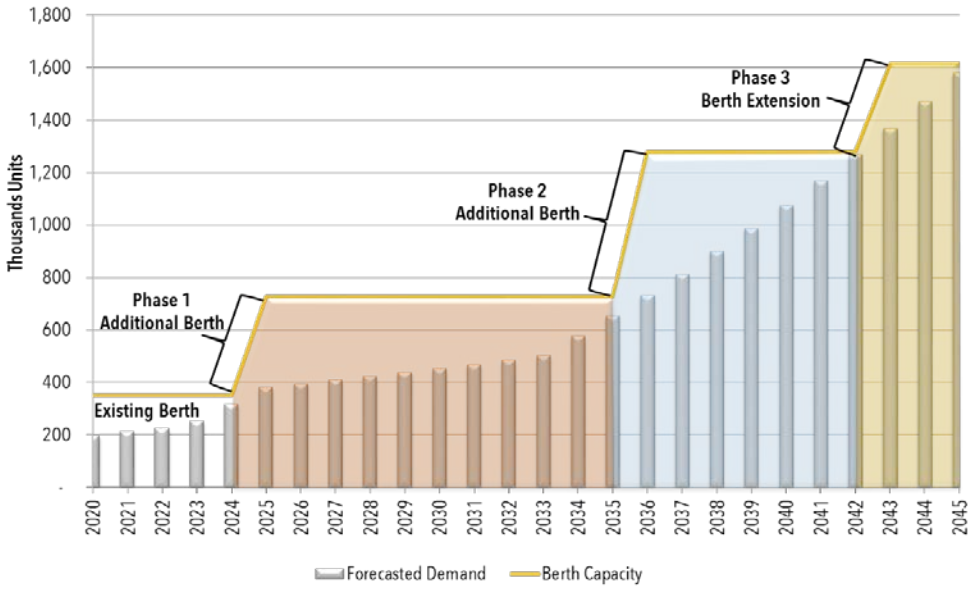
Refinement of the reasonable alternatives should focus on identifying, in logical, discrete steps, how the port would move from the existing conditions to the final project, within the project context. In order to have an understanding of performance and impacts at each step of project implementation including timing of capital investments, elements of this stage will often take place simultaneously to measuring feasibility efforts.

1.3.3.1 Phasing

A project plan should incorporate the ability to divide a project's development program into major discrete steps that can be implemented over time. These phases (Exhibit 1-16) may entail demolition, construction, equipment procurement, operational enhancements, or a combination of some or all of these elements. The project may also include elements or phases that require work on infrastructure outside the port owner's control, such as nearby roadways or rail infrastructure, and these elements should be clearly identified.

The first phase of each alternative should be based on the existing conditions, and each subsequent phase should clearly demonstrate all changes from the prior phase. Delineate the precise order of project element implementation as part of the phasing of each project alternative.

Exhibit 1-16 Phased Development Example



Conceptual phasing documents for the development of a project should show the orderly progress of capital improvements and equipment acquisition. Prepare phasing documents to allow for port construction or acquisition of major assets with minimum disruption of existing operations or forecasted demand.

For a redevelopment project, phasing analysis is essential in understanding the financial and operational impacts of decommissioning equipment and/or a portion of a port facility. If it is likely that implementation of a phase will temporarily reduce capacity or cause negative impacts,

prepare a construction or "decommissioning" phase that shows the port during that phase. The phasing of a project may consist of a sequence of alternating decommissioning and operational phases, as shown in Exhibit 1-17.Phasing also allows the evaluation of temporary routing patterns for internal and external operating equipment, and helps the terminal operator visualize clearly how the port will evolve over time.

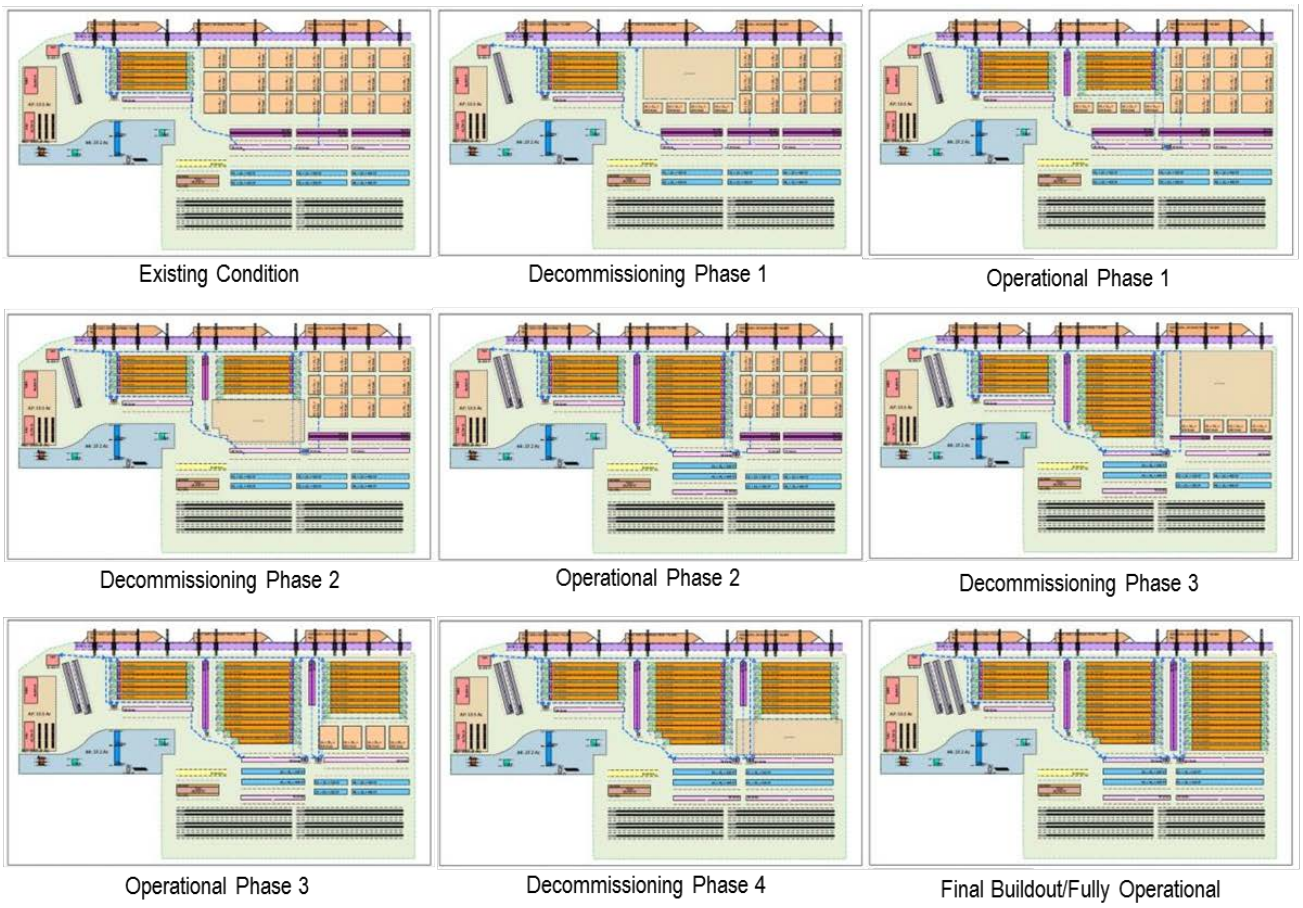
The port owner should coordinate with its state DOT and MPO to determine whether any projects scheduled for construction might impact port access routes. Incorporate this information into the phasing documents such that any reduction in capacity as a result of a port project may be aligned with the disruption period of the transportation project(s).

Phasing analysis ensures that the location and routing of any major infrastructure, buildings, and utilities remains coherent and compatible, and avoids costly reconstruction of poorly located facilities. These physical characteristics should be summarized, throughput capacities should be calculated, and possible impacts should be reported in the phasing documents for each reasonable alternative. This will provide insight into the fluctuation of each alternative's financial and service performance over time.

1.3.3.2 Timing

Once the phasing of each project alternative is determined, the sequence and timing of phased improvements should be considered in relation to the market forecast(s) of demand and the availability of funds for capital expenditure.

Exhibit 1-17 Decommissioning and Operational Phases

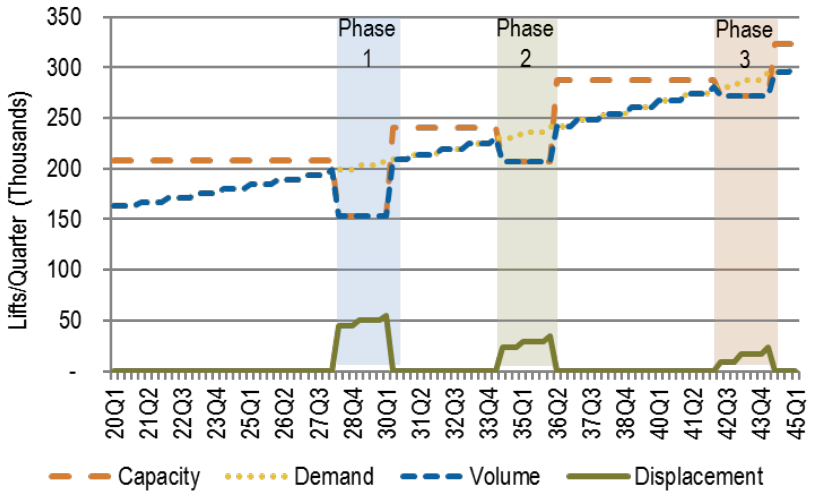


A comparison of the phased timing of the project alternatives and the demand forecast will allow the port owner to understand the date ranges by which each phase would need to be completed to minimize impacts on market potential.

In parallel with identifying the timing of improvements and demand intersections, estimate the time required to implement each phase, as shown in Exhibit 1-18. This will be essential in determining the start and end date for each phase, and will inform calculation of potential financial impacts of any displacement of capacity that may occur during each phase of a project alternative's implementation. It is likely that this examination of timing will alter the nature of the phases, so that phase overlaps do not cripple a port's operation for an extended period. This may well be sensitive to market timing: rapid market growth may require the use of small, closely-spaced phases, each aimed at improving port performance with minimal disturbance.

The timing of development or acquisition phases will also be influenced by the capital finance plan. When funding will be available (whether from the proceeds of public or private financing or from public grant funds) will dictate when money can be spent on the project.

Exhibit 1-18 Phased Timing and Displacement of Capacity



1.3.3.3 Details

Examine, at least at the conceptual level, some of the critical details associated with each reasonable alternative. For example, in terminal development, conceptual drawings for electrical power distribution, water distribution, and site drainage may be merited. It is not uncommon for infrastructure elements to influence the order in which a site is developed or reconfigured, so as to minimize cost and eliminate redundant development. These details can vary widely depending on the project. For example the fire protection systems and stormwater drainage systems for dry bulk cement storage areas, cruise terminals, ferry terminals and petroleum facilities vary widely. These conceptual details will also drive the better definition of quantities that drive development costs.

1.3.3.4 Costs

Generate order-of-magnitude construction costs, environmental mitigation costs and equipment acquisition costs to correspond with the phasing documents for each reasonable project alternative. Quantities should be derived directly from the documents, and unit costs should reflect historic data from similar projects as well as local cost factors and escalation. If a port owner plans to finance or fund the project using federal government grants or loans, the cost estimates should take into account Buy America requirements. Ideally, a timed sequence of development sub-projects should be developed, each with its own cost and with start and end dates tied to the market-driven development calendar.

These high-level cost estimates are intended to support informed decision-making during the initial alternatives review and winnowing process. Detailed financial analysis of the project alternatives that enables the identification of a recommended project is discussed in the Feasibility Module.

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APPENDIX A Glossary of Terms

Additional Bonds Test - The financial test, sometimes referred to as a "parity test," that must be satisfied under the bond contract securing outstanding revenue bonds or other types of bonds as a condition to issuing additional bonds. Typically, the test would require that historical revenues (plus, in some cases, future estimated revenues) exceed projected debt service requirements for both the outstanding issue and the proposed issue by a certain ratio.[1]

Advance Refunding - For purposes of certain tax and securities laws and regulations, a refunding in which the refunded issue remains outstanding for a period of more than 90 days after the issuance of the refunding issue.[1]

Alternative Minimum Tax (AMT) - Taxation based on an alternative method of calculating federal income tax under the Internal Revenue Code. Interest on certain private activity bonds is subject to the AMT.[1]

Amortization - The process of paying the principal amount of an issue of securities by periodic payments either directly to bondholders or to a sinking fund for the benefit of bondholders.[1]

Arbitrage Rebate - A payment made by an issuer to the federal government in connection with an issue of tax-exempt or other federally tax-advantaged bonds. The payment represents the amount, if any, of arbitrage earnings on bond proceeds and certain other related funds, except for earnings that are not required to be rebated under limited exemptions provided under the Internal Revenue Code. An issuer generally is required to calculate, once every five years during the life of its bonds, whether or not an arbitrage rebate payment must be made.[1]

Asset - Any item of economic value, either physical in nature (such as land) or a right to ownership, expressed in cost or some other value, which an individual or entity owns. [2]

Asset-Backed Debt - Debt having hard asset security such as a crane lease or property mortgage, in addition to the security of pledged revenues.

Availability Payment - A means of compensating a private concessionaire for its responsibility to design, construct, operate, and/or maintain an infrastructure facility for a set period of time. These payments are made by a public project sponsor (a port authority, for example) based on particular project milestones or facility performance standards.[2]

Best and Final Offers (BAFO) - In government contracting, a vendor's response to a contracting officer's request that vendors submit their last and most attractive bids to secure a contract for a particular project. Best and final offers are submitted during the final round of negotiations.[3]

Bond Indenture - A contract between the issuer of municipal securities and a trustee for the benefit of the bondholders. The trustee administers the funds or property specified in the indenture in a fiduciary capacity on behalf of the bondholders. The indenture, which is generally part of the bond contract, establishes the rights, duties, responsibilities and remedies of the issuer and trustee and determines the exact nature of the security for the bonds. The trustee is generally empowered to enforce the terms of the indenture on behalf of the bondholders.[1]

Call Date - The date on which bonds may be called for redemption as specified by the bond contract. [1]

Capacity (Maximum Practical) - Throughput volume which, if exceeded, would cause a disproportionate increase in unit operating cost or business delay, within the context of a facility's land use, layout, and uncontrollable commercial drivers.

Capital Expenditure (CapEx) - Expenditure on capital items either at the commencement of the project or the cost of their renewal and replacement ("R&R") over the life of the project.

Capital Appreciation Bonds (CABs) - A municipal security on which the investment return on an initial principal amount is reinvested at a stated compounded rate until maturity. At maturity the investor receives a single payment (the "maturity value") representing both the initial principal amount and the total investment return. CABs typically are sold at a deeply discounted price with maturity values in multiples of $5,000.[1]

Capital Improvement Program (CIP) - A schedule, typically covering a period of less than ten years, which outlines expenditures for capital projects on an annual basis and corresponding funding sources.

Capital Structure - The mix of an issuer's or a project's short and long-term debt and equity, including the terms of such financing and repayment requirements.

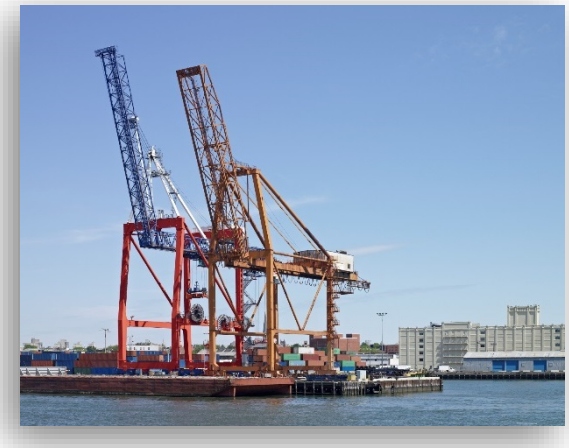
Capitalized Interest - A portion of the proceeds of an issue that is set aside to pay interest on the securities for a specified period of time. Interest is commonly capitalized for the construction period of a revenue-producing project, and sometimes for a period thereafter, so that debt service expense does not begin until the project is expected to be operational and producing revenues.[1]

Concession - An alternative method for a public sector entity to deliver a public- purpose project through long-term contracting with a private sector entity. A concession agreement typically covers the objectives of the asset concession, compensation, and duration of concession. A port concession is a contractual agreement in which a port owner conveys specific operating rights of its facility to a private entity for a specified period of time.

Convertible Capital Appreciation Bonds (CCABs) - CABs with a convertibility feature at a future date to CIBs. CCABs can be used to defer interest and principal payments, with conversion to Current Interest Bonds so that debt service requirements begin, thus reducing the cost of funds relative to traditional, non-convertible CABs.

Coupon - The periodic rate of interest, usually calculated as an annual rate payable on a security expressed as a percentage of the principal amount. The coupon rate, sometimes referred to as the "nominal interest rate," does not take into account any discount or premium in the purchase price of the security.[1]

Covenants - Contractual obligations set forth in a bond contract. Covenants commonly made in connection with a bond issue may include covenants to charge fees sufficient to provide required pledged revenues (called a "rate covenant"); to maintain casualty insurance on the project; to complete, maintain and operate the project; not to sell or encumber the project; not to issue parity bonds or other indebtedness unless certain tests are met ("additional bonds" or "additional indebtedness" covenant); and not to take actions that would cause tax-exempt interest on the bonds to become taxable or otherwise become arbitrage bonds ("tax covenants").[1]



Credit Rating - An opinion by a rating agency of the credit-worthiness of a bond.[1]

Current Interest Bonds (CIBs) - A bond on which interest payments are made to the bondholders on a periodic basis. This term is most often used in the context of an issue of bonds that includes both CABs and CIBs.[1]

Current Refunding - A refunding transaction where the municipal securities being refunded will all mature or be redeemed within 90 days or less from the date of issuance of the refunding issue.[1]

Debt Profile - A detailed description of an issuer's overall debt portfolio and credit profile that is updated as changes in capital structure occur. A debt profile typically includes all of the relevant information about an issuer's debt including but not limited to current ratings, debt service requirements, debt service coverage ratios and eligibility for refunding.

Debt Service Coverage Ratio - The ratio of available revenues available annually to pay debt service over the annual debt service requirement. This ratio is one indication of the availability of revenues for payment of debt service.[1]

Debt Service Reserve - A fund in which funds are placed to be applied to pay debt service if pledged revenues are insufficient to satisfy the debt service requirements. The debt service reserve fund may be entirely funded with bond proceeds at the time of issuance, may be funded over time through the accumulation of pledged revenues, may be funded with a surety or other type of guaranty policy (described below), or may be funded only upon the occurrence of a specified event (e.g. upon failure to comply with a covenant in the bond contract) (a "springing reserve"). Issuers may sometimes authorize the provision of a surety bond or letter of credit to satisfy the debt service reserve fund requirement in lieu of cash. If the debt service reserve fund is used in whole or part to pay debt service, the issuer usually is required to replenish the fund from the first available revenues, or in periodic repayments over a specified period of time.

Defeasance - Termination of certain of the rights and interests of the bondholders and of their lien on the pledged revenues or other security in accordance with the terms of the bond contract for an issue of securities. This is sometimes referred to as a "legal defeasance." Defeasance usually occurs in connection with the refunding of an outstanding issue after provision has been made for future payment of all obligations related to the outstanding bonds, sometimes from funds provided by the issuance of a new series of bonds. In some cases, particularly where the bond contract does not provide a procedure for termination of these rights, interests and lien other than through payment of all outstanding debt in full, funds deposited for future payment of the debt may make the pledged revenues available for other purposes without effecting a legal defeasance. This is sometimes referred to as an "economic defeasance" or "financial defeasance." If for some reason the funds deposited in an economic or financial defeasance prove insufficient to make future payment of the outstanding debt, the issuer would continue to be legally obligated to make payment on such debt from the pledged revenues.[1]

Demand & Revenue Study - A professionally prepared forecast and report of the market demand for a port's cargo, and the ensuing revenue as a result of charging rates/fees for such cargo moving through a port. Demand & revenue data is used as input in developing plans of finance and evaluating investment opportunities.

Design-Build (DB) - A project delivery method that combines two, usually separate services into a single contract. With design-build procurements, owners execute a single, fixed- fee contract for both architectural/engineering services and construction. The design-build entity may be a single firm, a consortium, joint venture or other organization assembled for a particular project.[4]

Design-Build-Finance-Operate-Maintain (DBFOM) - A method of project delivery in which the responsibilities for designing, building, financing and operating are bundled together and transferred to private sector partners.[4]

Design-Build-Operate-Maintain (DBOM) - An integrated partnership that combines the design and construction responsibilities of design-build procurements with operations and maintenance. These project components are procured from the private sector in a single contract with financing secured by the public sector.[4]

Enabling Act – Legislation by which port authorities and other governmental agencies are created and granted powers to carry out certain actions. While enabling acts for port authorities vary widely; key aspects generally include establishment of the port entity; governance and procedures; powers such as ability to enter into contracts, construct projects, transact business, and enter into financing agreements; and reporting requirements.

Equity - A funding contribution to a project having an order of repayment occurring after debt holders in a flow of funds per the bond indenture securing such funding contribution.

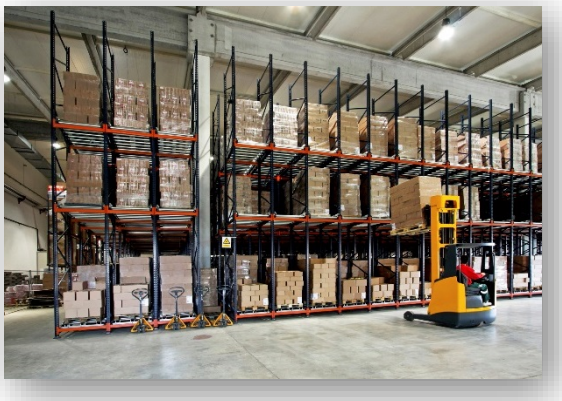
Escrow - A fund established to hold funds pledged and to be used solely for a designated purpose, typically to pay debt service on an outstanding issue in an advance refunding.[1]

Flow of Funds - The order and priority of handling, depositing and disbursing pledged revenues, as set forth in the bond contract. Generally, pledged revenues are deposited, as received, into a general collection account or revenue fund established under the bond contract for disbursement into the other accounts established under the bond contract. Such other accounts generally provide for payment of the costs of debt service, debt service reserve deposits, operation and maintenance costs, renewal and replacement and other required amounts.[1]

Forward Refunding - An agreement, usually between an issuer and the underwriter, whereby the issuer agrees to issue bonds on a specified future date and an underwriter agrees to purchase such bonds on such date. The proceeds of such bonds, when issued, will be used to refund the issuer's outstanding bonds. Typically, a forward refunding is used where the bonds to be refunded are not permitted to be advance refunded on a tax-exempt basis under the Internal Revenue Code. In such a case, the issuer agrees to issue, and the underwriter agrees to purchase, the new issue of bonds on a future date that would effect a current refunding.[1]

Independent Utility - A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility. (72 FR 47, p. 11196).

Intelligent Transportation Systems (ITS) - An operational system of various technologies that, when combined and managed, improve the operating capabilities of the overall system.

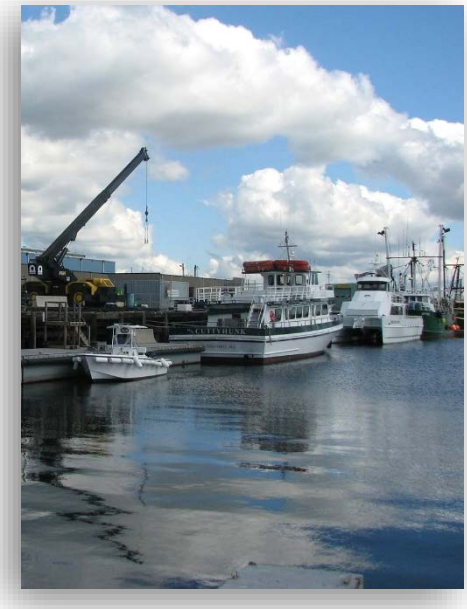


Interest Rate Swap - A specific derivative contract entered into by an issuer or obligor with a swap provider to exchange periodic interest payments. Typically, one party agrees to make payments to the other based upon a fixed rate of interest in exchange for payments based upon a variable rate. The swap contract may provide that the issuer will pay to the swap counter-party a fixed rate of interest in exchange for the counter-party making variable payments equal to the amount payable on the variable rate debt.[1]

Internal Rate of Return (IRR) - The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project.[3]

Investment-Grade - A security that, in the opinion of the rating agency, has a relatively low risk of default.[1] Alternatively, the level of comprehensiveness and market readiness for investment-grade security issuance in referring to a demand & revenue report or engineering report supporting such security issuance.

Letter of Credit - An irrevocable commitment, usually made by a commercial bank, to honor demands for payment of a debt upon compliance with conditions and/or the occurrence of certain events specified under the terms of the letter of credit and any associated reimbursement agreement. A letter of credit is frequently used to provide credit and liquidity support for variable rate demand obligations and other types of securities. Bank letters of credit are sometimes used as additional sources of security for issues of municipal notes, commercial paper or bonds, with the bank issuing the letter of credit committing to pay principal of and interest on the securities in the event that the issuer is unable to do so.[1]



Liquidated Damages - Present in certain legal contracts, this provision allows for the payment of a specified sum should one of the parties be in breach of contract.[3]

Liquidity - In the context project finance, the build-up of cash reserve balances which are viewed favorably given the ability to use such reserves to cover debt service and other obligations under a bond indenture should expected project cash flows not materialize for any given period.

Long Range Transportation Plan (LRTP) - A document resulting from regional or statewide collaboration and consensus on a region or state's transportation system, and serving as the defining vision for the region's or state's transportation systems and services. In metropolitan areas, the plan indicates all of the transportation improvements scheduled for funding over the next 20 years. The plan must conform to regional air quality implementation plans and be financially constrained.[2, 4]

Major Project Financial Plan - Under U.S. Department of Transportation (USDOT) guidance, transportation projects are required to submit a Major Project Financial Plan if any of the following apply: 1) recipient of Federal financial assistance for a Title 23 project with a minimum cost of $500 million, 2) identified by the USDOT Secretary as a major project and 3) applying for TIFIA assistance.

Master/Land-Use Plan - Port documents that guides a port's planning, development and management of land, infrastructure and facilities, with the goal of accommodating future growth and supporting the regional economy. These plans often include information on port owners' goals and policies; survey of existing conditions/facilities; stakeholder outreach activities; land use data; environmental considerations; analysis of future

demand, capacity, and capacity requirements; CIP; and operating and financial performance of the port.

Maximum Annual Debt Service - Maximum annual debt service refers to the amount of debt service for the year in which the greatest amount of debt service payments are required and is often used in calculating required reserves and in additional debt tests.[1]

Negative Arbitrage - Investment of bond proceeds and other related funds at a rate below the bond yield.[1]

Net Present Value (NPV) - The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project.[3]

Net Revenue - The amount of money available after subtracting from gross revenues such costs and expenses as may be provided for in the bond contract. The costs and expenses most often deducted are O&M expenses.[1]

Off-Balance Sheet - Assets or liabilities that do not appear on a company's balance sheet but that are nonetheless effectively assets or liabilities of the company. Assets or liabilities designated off balance sheet are typically ones that a company is not the recognized legal owner of, or in the case of a liability, does not have direct legal responsibility for. Off-balance-sheet financing may be used when a business is close to its borrowing limit and wants to purchase something, as a method of lowering borrowing rates, or as a way of managing risk. This type of financing may also be used for funding projects, subsidiaries or other assets in which the business has a minority claim. An operating lease, used in off balance sheet financing, is a good example of a common off balance sheet item.[3]

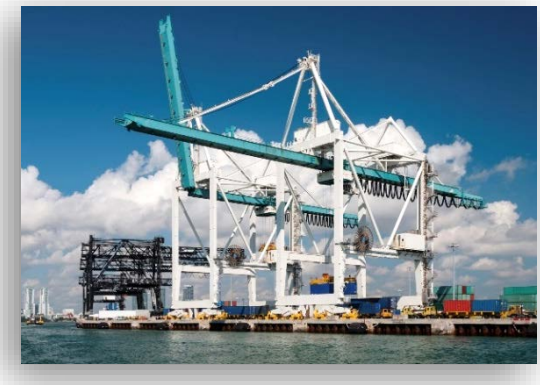
Operating & Use Lease Agreement - A contract that allows for the use of an asset, but does not convey rights of ownership of the asset. An operating lease is not capitalized; it is accounted for as a rental expense in what is known as "off balance sheet financing." For the lessor, the asset being leased is accounted for as an asset and is depreciated as such. Operating leases have tax incentives and do not result in assets or liabilities being recorded on the lessee's balance sheet, which can improve the lessee's financial ratios.[3]

Operating Expenditure (OpEx) - Expenditure on operating and routine maintenance costs.

Operations & Maintenance (O&M) - Refers to expenses incurred for operating and maintaining a project asset. O&M is a key input in determining project cash flows, often placed after gross revenues in the flow of funds of a bond indenture.

Payment Bond - Deposit or guaranty (usually 20 percent of the bid amount) submitted by a successful bidder as a surety that (upon contract completion) all sums owed by it to its employees, suppliers, subcontractors, and others creditors, will be paid on time and in full.[5]

Performance Bond - A written guaranty from a third party guarantor (usually a bank or an insurance company) submitted to a principal (client or customer) by a contractor on winning the bid. A performance bond ensures payment of a sum (not exceeding a stated maximum) of money in case the contractor fails in the full performance of the contract. Performance bonds usually cover 100 percent of the contract price and replace the bid bonds on award of the contract. Unlike a fidelity bond, a performance bond is not an insurance policy and (if cashed by the principal) the payment amount is recovered by the guarantor from the contractor.[5]



Port - A single- or multiple-facility entity that facilitates the transfer of cargo and/or passengers between logistically-linked transport modes.

Port Authority - State or local government that owns, operates, or otherwise provides wharf, dock, and other investments at ports.

Port Owner - Port authorities, terminal operators, private companies, and project sponsors that own and/or operate a port.

Price - The amount to be paid for a bond, usually expressed as a percentage of par value but also sometimes expressed as the yield that the purchaser will realize based on the dollar amount paid for the bond. The price of a municipal security moves inversely to the yield.[1]

Private Activity Bonds (PABs) - A municipal security of which the proceeds are used by one or more private entities. A municipal security is considered a PAB if it meets two sets of conditions set out in Section 141 of the Internal Revenue Code. A municipal security is a PAB if, with certain exceptions, more than 10 percent of the proceeds of the issue are used for any private business use (the "private business use test") and the payment of the principal of or interest on more than 10 percent of the proceeds of such issue is secured by or payable from property used for a private business use (the "private security or payment test"). A municipal security also is a PAB if, with certain exceptions, the amount of proceeds of the issue used to make loans to non-governmental borrowers exceeds the lesser of 5 percent of the proceeds or $5 million (the "private loan financing test"). Interest on private activity bonds is not excluded from gross income for federal income tax purposes unless the bonds fall within certain defined categories ("qualified bonds" or "qualified PABs"). Most categories of qualified PABs are subject to the AMT.[1]

Private Placement - A primary offering in which a placement agent sells a new issue of municipal securities on behalf of the issuer directly to investors on an agency basis rather than by purchasing the securities from the issuer and reselling them to investors. Investors purchasing privately placed securities often are required to agree to restrictions as to resale and are sometimes requested or required to provide a private placement letter to that effect. The term Private Placement is often used synonymously with the term "direct loan," which more specifically is a loan to a municipal issuer from a banking institution or another lender. Such obligations may constitute municipal securities.[1]

Project - A port owner's acquisition, development, expansion or renovation of a single site, facility, infrastructure element, or operational resource to meet an identified or emergent need.

Project Financing - A non-recourse or limited recourse financial structure where project debt and equity used to finance the project are paid back from the cash flow generated by the project. While the loan structure relies primarily on the project's cash flow for repayment; the project's assets, rights and interests are held as secondary security or collateral.[3]

Project Funding - A financial structure where internal reserves, user charges and/or government investments are used to finance the project without a direct requirement for repayment.

Project Sponsor - The entity that provides financial resources to support the project.

Public-Private Partnership (P3) - A generic term for a wide variety of financial arrangements whereby governmental entities agree to transfer any risk of, or substantial management control over, a governmental asset to the private entity in the port sector this is typically in exchange for upfront or ongoing payments though those may only be sufficient to pay for the capital improvement.[1]

Publicly Issued - The sale of bonds or other financial instruments by an organization to the public in order to raise funds for infrastructure expansion and investment (contrast with privately placed financial instruments including directly placed loans with a financial institution/lender).

Put Bond - A bond that allows the holder to force the issuer to repurchase the security at specified dates before maturity. The repurchase price is set at the time of issue, and is usually par value.[3]

Railroad Rehabilitation & Improvement Financing (RRIF) - Under this program the Federal Railroad Administration Administrator is authorized to provide direct loans and loan guarantees up to $35.0 billion to finance development of railroad infrastructure. Up to $7.0 billion is reserved for projects benefiting freight railroads other than Class I carriers. The funding may be used to (a) acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings and shops; (b) refinance outstanding debt incurred for the purposes listed above; and (c) develop or establish new intermodal or railroad facilities. Direct loans can fund up to 100% of a railroad project with repayment periods of up to 35 years and interest rates equal to the cost of borrowing to the government. Eligible borrowers include railroads, state and local governments, government-sponsored authorities and corporations, joint ventures that include at least one railroad, and limited option freight shippers who intend to construct a new rail connection.[6]

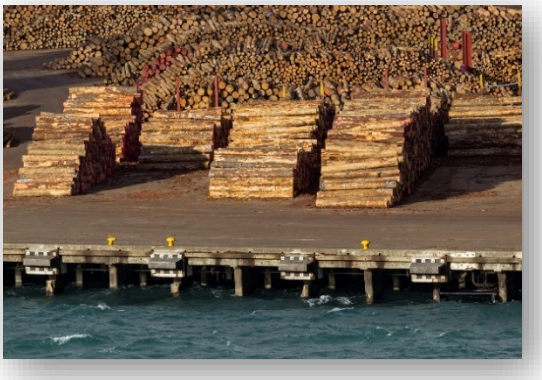
Rate Covenant - A covenant to charge fees sufficient to provide required pledged revenues.[1]

Renewal & Replacement (R&R) - Funds to cover anticipated expenses for major repairs of the issuer's facilities or a project whose revenues are pledged to the bonds or for R&R of related equipment.[1]

Return on Investment (ROI) – A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. ROI measures the amount of return on an investment relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio.[3]

Request for Letters of Intent (RLOI) - Document used to solicit Letters of Intent, an interim agreement that summarizes the main points of a proposed deal, or confirms that a certain course of action is going to be taken. Normally, it does not constitute a definitive contract but signifies a genuine interest in reaching the final agreement subject to due diligence, additional information, or fulfillment of certain conditions. The language used in writing a letter of intent is of vital importance, and determines whether it is only an expression of intent or an enforceable undertaking.[5]

Request for Proposals (RFP) - Document used in sealed-bid procurement procedures through which a purchaser advises the potential suppliers of (1) statement and scope of work, (2) specifications, (3) schedules or timelines, (4) contract type, (5) data requirements, (6) terms and conditions, (7) description of goods and/or services to be procured, (8) general criteria used in evaluation procedure, (9) special contractual requirements, (10) technical goals, (11) instructions for preparation of technical, management, and/or cost proposals or in the case of P3s, a full P3 contract. RFPs are publicly advertised and suppliers respond with a detailed proposal, not with only a price quotation. They provide for negotiations after sealed proposals are opened, and the award of contract may not necessarily go to the lowest bidder.[5]



Request for Qualifications (RFQ) - Document used in a procurement process to solicit qualifications of professional providers of goods or services for a given project. The objective of the RFQ is to pre-qualify bidding teams based on well- defined criteria.

Security for Debt - The specific revenue sources or assets of an issuer or borrower that are pledged or available for payment of debt service on a series of bonds, as well as the covenants or other legal provisions protecting the bondholders.[1]

Senior Lien Debt - Bonds having the priority claim against pledged revenues superior to the claim against such pledged revenues or security of other obligations.[1]

Special Purpose Facility Bonds - Bonds issued by a governmental entity to finance facilities supporting private sector activity, and secured by payments of special purpose rent received by the port or the trustee pursuant to an agreement with lessee/ concessionaire. Such bonds are issued by the governmental entity as the conduit issuer to achieve tax-exempt (or AMT) status on the bonds.

State Infrastructure Bank (SIB) - A state or multi-state revolving fund that provides loans, credit enhancement, and other forms of financial assistance to transportation infrastructure projects.[2]

State Transportation Improvement Program (STIP) - A short-term transportation planning document covering at least a three-year period and updated at least every two years. The STIP includes a priority list of projects to be carried out in each of the three years. Projects included in the STIP must be consistent with the long-term transportation plan, must conform to regional air quality implementation plans, and must be financially constrained (achievable within existing or reasonably anticipated funding sources). [2]

Strategic Plan - Port document outlining a port's market positioning and strategic direction. Strategic plans may include, among other topics, a competitive assessment relative to other ports; trends in regional, national and global economies; cargo/passenger analysis; growth strategies; and capital investment recommendations.

Subordinate Lien Debt - Bonds that have a claim against pledged revenues or other security subordinate to the claim against such pledged revenues or security of other obligations.[1]

Terminal Operator - A port authority or private company that operates a port facility and manages the movement of cargo and/or passengers.

Transport Modes - For each mode, there are several means of transport. They are: a. inland surface transportation (rail, road, and inland waterway); b. sea transport (coastal and ocean); c. air transportation; and d. pipelines.

Transportation Improvement Program (TIP) - A short-term transportation planning document, approved at the local level, covering at least a four-year period for projects within the boundaries of a Metropolitan Planning Organization (MPO). The TIP must be developed in cooperation with state and public transit providers and must be financially constrained. The TIP includes a list of capital and non-capital surface transportation projects, bicycle and pedestrian facilities and other transportation enhancements. The TIP should include all regionally significant projects receiving FHWA or FTA funds, or for which FHWA or FTA approval is required, in addition to non-federally funded projects that are consistent with the MPO's LRTP.

Transportation Infrastructure Finance and Innovation Act (TIFIA) - The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) authorized the USDOT to provide three forms of credit assistance - secured (direct) loans, loan guarantees and standby lines of credit - to surface transportation projects of national or regional significance. A specific goal of TIFIA is to leverage private co-investment. Because the program offers credit assistance, rather than grant funding, potential projects must be capable of generating revenue streams via user charges or have access to other dedicated funding sources. In general, a project's eligible costs must be reasonably anticipated to total at least $50 million. Credit assistance is available to: projects eligible for assistance under title 23 or chapter 53 of title 49; international bridges and tunnels; intercity passenger bus or rail facilities and vehicles, including those owned by Amtrak; public freight rail projects; private freight rail projects that provide public benefit for highway users by way of direct highway-rail freight interchange (a refinement of the SAFETEA-LU eligibility criterion); intermodal freight transfer facilities; projects providing access to, or improving the service of, the freight rail projects and transfer facilities described above; and surface transportation infrastructure modifications necessary to facilitate direct intermodal interchange, transfer and access into and out of a port. The TIFIA credit assistance is limited to 49 percent of eligible project costs.[4]

Transportation Investment Generating Economic Recovery (TIGER) - USDOT TIGER discretionary grants are awarded on a competitive basis for capital investments in surface transportation projects that will have a significant impact on the nation, a metropolitan area or a region.

Value for Money (VfM) - A technique used to evaluate and quantify project risks. VfM "prices" risk by producing a discounted net present value amount that represents the aggregate impact of various sensitivities applied to the variable inputs of a project. An assessment of VfM for P_3 procurements is a comparative concept, and as such most delivery agencies seek to use a "public sector comparator" approach to evaluating VfM.

Yield - The annual rate of return on an investment, based on the purchase price of the investment, its coupon rate and the length of time the investment is held. The yield of a municipal security moves inversely to the price.[1]

Yield Restriction - A general requirement under the Internal Revenue Code that proceeds of tax-exempt bonds not be used to make investments at a higher yield than the yield on the bonds. The Internal Revenue Code provides certain exceptions, such as for investment of bond proceeds for reasonable temporary periods pending expenditure and investments held in "reasonably required" debt service reserve funds.[1]

Note: Sources for the glossary include (1) www.msrb.org, (2) www.transportation-finance.org, (3) www.investopedia.com, (4) www.fhwa.dot.gov, (5) www.businessdictionary.com, and (6) www.fra.dot.gov.

APPENDIX C Estimating Throughput Capacity Example

The models used to estimate port throughput capacity are either linear static models using spreadsheets or more sophisticated, dynamic simulation models that can show the impact of system dynamism and random events.

Static models support equation-based analyses to estimate throughput capacity and equipment requirements as a function of the site layout, physical characteristics, and current/anticipated operating practices. Spreadsheet models can also be used to examine isolated facility functions or specific demand versus capacity issues. A dynamic simulation model can be developed to gain a better understanding of the complexity and integrated multi-modal aspects of the entire port operation. These models should take into account many operational variables and random variations to analyze specific project alternatives.

Although some project challenges require the use of simulation models, static models often provide results sufficient to readily examine a broad range of factors that influence port capacity. Regardless of the various spreadsheet and simulation models that are available or can be useful for port projects, capacity models should support basic computations and have a structure that allows for increasing level of details as the planning process progresses, and that are transparent in their assumptions and algorithms.

The throughput capacity of a facility is a function of the physical assets of the facility and the rate at which those assets are used. Physical assets can be identified from drawings or other resource descriptions. The rate of asset use generally has two components: physical space and time. With regard to physical space, the analysis must recognize that, in addition to physical space actually in use, the facility operators must reserve empty space that maintains fluidity and allows the facility to operate at adequate productivity. Operators must also allocate sufficient space to sustain accessibility to objects that must be handled or processed. With regard to time, the analysis must recognize that demand is uneven over time, and that physical space must be reserved to allow efficient service of peak conditions.

For example, in the context of a freight terminal, analysis of the berth must allow for the physical lengths of vessels, as well as the gaps between vessels required for mooring and maneuvering. The berth analysis must also reflect the need to have berths available when vessels arrive, even if their schedule reliability is low. The berth analysis also needs to reflect seasonal variations in call durations caused by changes in vessel exchange rates. With this example, it can be seen that there is physical length, plus access space, plus reserve space, as well as physical call duration, plus variability reserve, plus peaking reserve.

This appendix includes an example of a robust approach and tools that can be prepared using a static model to estimate berth and storage yard capacity in a container terminal. Similar approaches can be used for auto/ro-ro, dry/liquid bulk, break bulk and passenger terminals.

Berth-Constrained Capacity

A berth throughput capacity models typically contain the following major components:

Terminal Parameters:
- Specification of values for all terminal berths

Vessel Parameters:
- Specification of values for each class of vessel being considered
- Calculation of the relationship of each class of vessel to the berth space

Vessel Performance:
- Specification of vessel operating performance parameters

Calculation of vessel performance for each class of vessel

Berth Performance:

Calculation of overall berth productivity for each class of vessel

Mixed Fleet Performance:

Specification of the mix of vessels across the classes

Capacity for each Class:

Calculation of each class's contribution to the capacity of the berth

Calculation of berth throughput capacity

Berth Occupancy Graphics:

A tool for visualizing and confirming how the fleet fits on the berth at capacity

Exhibit C-1 shows the general equation used to establish berth-constrained capacity of a terminal. Berth capacity is calculated by multiplying the maximum number of vessel calls in a week by the maximum cargo/passenger units transferred per call, annualizing the results, and then dividing by seasonal peaking factor. Seasonal peaking is the ratio of peak to mean month of vessel throughput. For cargo terminals, the maximum number of calls in a week is based on berth utilization, crane productivity, crane assignment, and unproductive time.

Exhibit C-1 Essential Mathematics of Berth Capacity

$$C_B = Berth\ Capacity = \frac{C_W \times T_C \times 52\ {}^{wk}/_{yr}}{P_S}$$

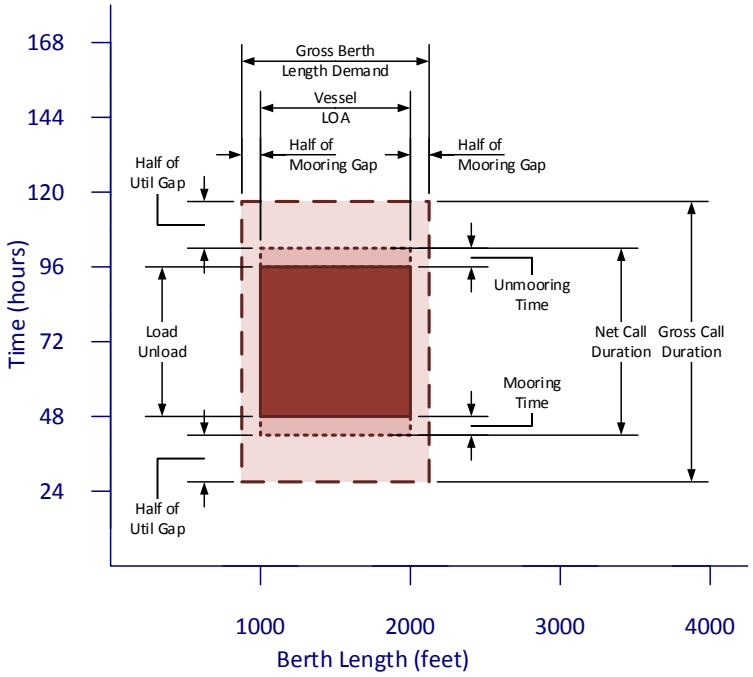
In which:

C_W = maximum number of calls in a week

T_C = maximum transfers per vessel call

P_S = seasonal peaking factor, the peak monthly volume divided by the mean monthly volume

Exhibit C-2 Net and Gross Vessel Demand



Berth utilization is limited by the need to allocate berth length in increments sufficient to accommodate variable vessel lengths, and by the need to assure that a berth space is available when a vessel calls, even if its arrival time is somewhat random. Given these constraints, the full gross capacity of a berth is never used. For instance, if a berth is 100 percent full and a vessel leaves, a vessel of exactly the same length would need to be standing by to take that space, in order to sustain 100 percent utilization. Berth utilization is expressed as net call duration demand multiplied by the gross berth length demand, as berth foot-hours or meter-hours.

Gross berth length demand consists of: 1) the vessel overall length (LOA); 2) the necessary gap between vessels to accommodate mooring lines. The mooring gap is applied evenly to either end of the vessel length.

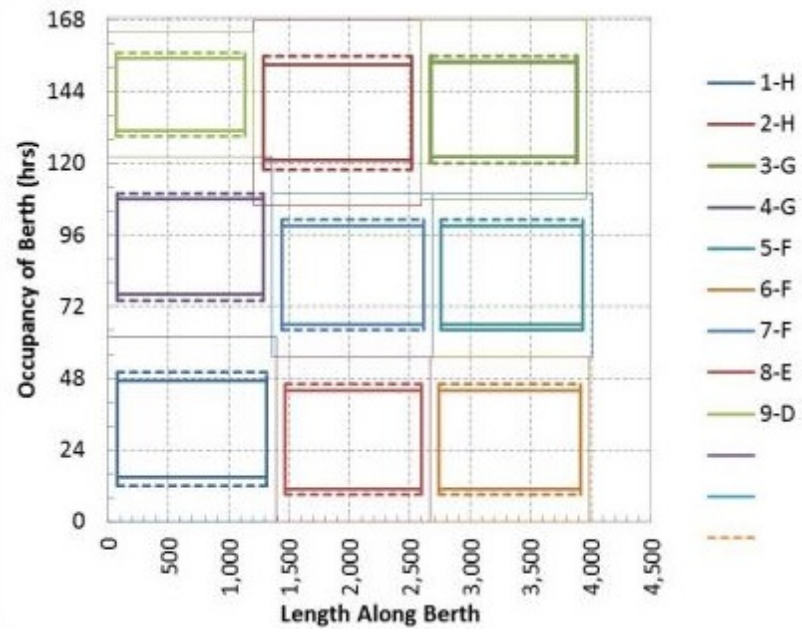
Net call duration demand consists of: 1) time to moor the vessel; 2) time to unload and load the vessel; 3) time to unmoor the vessel and free the

berth. The sum of these values is converted to gross call duration demand by dividing by allowable berth utilization. The gap between net and gross call duration is applied evenly to either end of the net duration.

Exhibit C-2 depicts these relationships between net and gross berth occupancy in space and time. With this approach, each vessel takes up an appropriate portion of the total space-time capacity of the berth.

A berth model should allow the modeler to consider a mix of vessel classes, each with its own potential impact on demand and capacity. For each vessel class, the model should calculate gross occupancy demand in terms of berth length and call duration. The number of vessels of each class that the berth can accommodate should be calculated based on total berth length and the gross berth length occupancy of the class. As such, the number berths in the available berth length is a function of classes of vessels that call at the berth. A sample output of berth occupancy demand is shown in Exhibit C-3.

Exhibit C-3 Berth Occupancy



Storage-Constrained Capacity

To calculate the capacity constraint imposed by a storage yard, a model typically includes the following major components:

Throughput Mix, for each Market:
- Specification of the mix of movements processed by the yard
- Specification of movements not directly tied to terminal throughput

Mean Dwell Times, for each Market & Movement:
- Specification of the mean storage dwell times
- Calculation of dwell times for key movement groups

Tactical Peaking Factors, for each Market & Movement:
- Specification of the ratio of peak to mean storage during a peak week

Storage Modes for each Market, Movement & Technology:
- Specification of the storage mode for key movement groups
- Specification of the technology deployed for key movement groups

Static Storage for each Market:
- Establishment of the maximum practical storage area available
- Establishment of the maximum practical stacking height

Capacity for each Layout & Market:
- Calculation of each class's contribution to the capacity of the yard
- Calculation of yard throughput capacity

Exhibit C-4 shows the general equation used to establish yard-constrained capacity of a terminal. Storage capacity for each movement is calculated by multiplying the static storage of the specific yard area with the mean dwell days, annualizing the results to determine storage turns per year, and then dividing by seasonal and tactical peaking. The capacity of the storage yard is the sum of the capacity of all flows passing through the storage yard per year. Static storage is based on maximum physical stacking area and stacking height, multiplied by storage utilization factors that depend on storage mode for each movement.

Exhibit C-4 Essential Mathematics of Storage Yard Capacity

$$C_S = Storage - Constrained\ Capacity = \frac{S_S \times 365\ {}^{d}/_{yr}}{T_D \times P_S \times P_T}$$

In which:

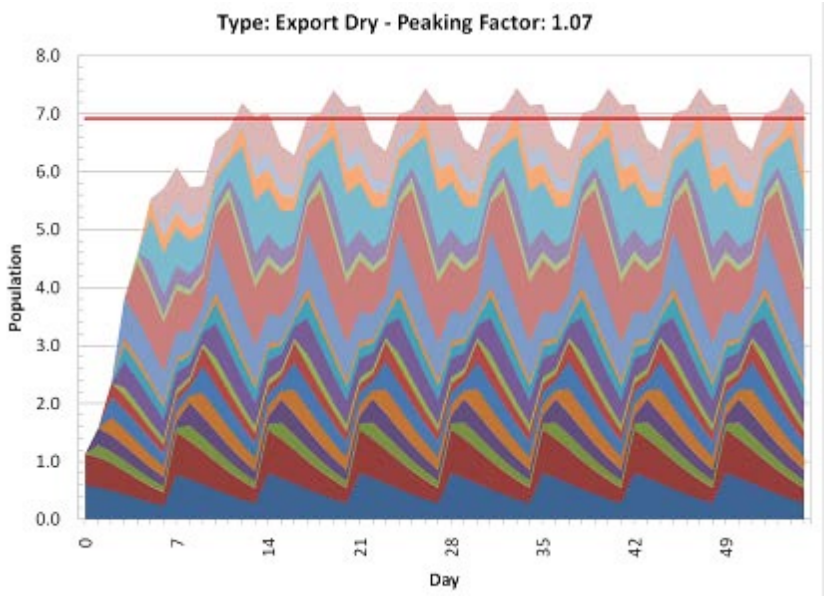
S_S	=	static storage capacity
T_D	=	mean dwell (days)
P_S	=	seasonal peaking factor
P_T	=	tactical peaking factor

The component with the least capacity is the 'bottleneck' or the component limiting the capacity of the terminal as a whole. The analysis should establish the overall capacity of each component at the terminal and identify which components are constraining the throughput.

A capacity model should take into account day-to-day flexibility to address peak occurrences, while allowing for long-term flexibility so plans can evolve over the life of the facility. A static capacity model can be used to analyze the short-term utilization of Port resources using a Tactical Peaking Factor (TPF or P_T) Tool. The TPF identifies the relationship between peak inventory and mean inventory over the course of the typical work week. During this period, rapid changes in inventory – gains for inflows, losses for outflows– reflects a high TPF. However, as inventories from ships in multiple weeks are superposed, peaking patterns may be dampened.

Exhibit C-5 shows an example of a modeled variation in inventory over a multi-week span using a distribution of dwell times and vessel schedules. In the Exhibit, the horizontal axis is time, in days. Each colored area, plotted against the left axis, represents the relative inventory generated by a particular vessel service based on its pro forma arrival schedule and the mix of storage dwell times for the given movement type.

Exhibit C-5 Sample Tactical Peaking Factor Tool Output



While the model can estimate the gate and equipment requirements, these components are usually not considered constraining elements. For example, gate operating hours can be extended or lanes can be reconfigured, and additional equipment can be purchased in response to increased demand. The peak gate lane demand at each station is calculated from the mean gate flow for each transaction type, augmented by seasonal and tactical peaking factors, and divided by the maximum practical lane velocity. Similarly, the peak equipment demand is calculated from the mean berth and storage flow for each cargo type, augmented by the peaking factors, and divided by the maximum practical equipment productivities and utilization. Equipment quantities (quay cranes, storage yard cranes, chassis, yard trucks, etc.) can be estimated for each capacity level.

While certain capacity factors can be controlled by a port, such as terminal configuration and layout, equipment deployed, and capital resources invested; capacity is also strongly influenced by external factors such as trade volumes, shipping patterns, throughput mixes, dwell times, the size and type of ships, rail/highway access, union work rules, customs regulations, and security.

As these factors evolve over the life of the facility, the planning effort should be able to take into account different capacity scenarios. This is particularly important since a facility's capacity can increase or decrease at any point in time without any changes to land use or infrastructure as a result of different external influences.

Exhibit C-6 shows an example of how varying factors can change throughput capacity based on future containership deployment patterns. As the planning effort advances to subsequent phases of the project, the scenarios can be blended to reflect intermediate states in a phased development.

The capacity analysis will identify the probability, magnitude, and timing of potential shortfalls in port capacity by comparing the existing practical capacities, calculated by the model, to forecasted projections. The comparison will provide a guide of future needs for the port.

Exhibit C-6 Sample Scenarios in a Capacity Model

Var	Variable	Unit	S1	S2	S3
L_C, C_V	Lifts per call	Lifts / vessel call	1,145	1,527	1,908
P_S	Seasonal peaking factor	Peak week / Mean week	1.07		
R_W	Weekly work rate	Hours / week	140		
U_B	Berth utilization	%	65% for multiple berths		
C_C	Average vessel size	TEU / vessel	6,000	8,000	10,000
R_{CA}	Crane assignment ratio	Lifts / crane / call	360	400	440
N_C	Mean cranes per ship	Cranes/ship	4.0	4.2	4.4
C_B	Berth capacity	Ship lifts/year	**1,130,000**	**1,286,000**	**1,399,000**

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APPENDIX D Forecasting Trade Demand Example

Multiple approaches to forecasting trade demand are available. In order of complexity, these generally include:

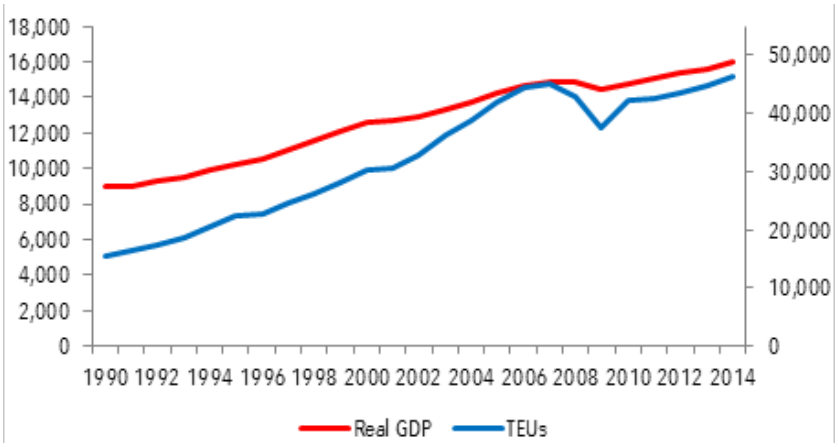
- **Regression and Trendline Analysis**. A simple, common and generally useful technique for short-term projections and easily prepared by port staff.
- **U.S. Economic Indicator-Driven Forecasts**. Based on changes in key U.S. economic indicators. May be reasonably well suited for general cargo – particularly containerized consumer goods – but are less well suited for commodities where trade volumes are less dependent on U.S. economic forces, and have some important limitations.
- **Macroeconomic Forecasts**. Address changes in global production and consumption by country and commodity, and are generally purchased from third-party economic modeling firms. They provide excellent detail but typically do not address port infrastructure or competitiveness issues.
- **Supply Chain-Adjusted Macroeconomic Forecasts**. Provide the benefits of macroeconomic forecasts but additionally consider factors such as vessel sizes and carrier services, port infrastructure constraints, inland truck and rail connections and costs, and other competitiveness factors. This approach provides the best possible forecasts, but can be complex and costly.

U.S. economic indicator-driven forecasts, used properly, may provide useful information and can be developed relatively easily and inexpensively. They can meet near-term forecasting needs, bridging gaps between major forecasting efforts or suggesting whether more intensive forecasting efforts are warranted. However, there are some important considerations and limitations to this approach.

The most commonly cited U.S. economic indicator for port forecasts is Gross Domestic Product (GDP). It has been postulated by many in the past that increases in U.S. container volumes can reasonably be viewed as a multiple of GDP growth. As shown in Exhibit D-1, container trade volumes grew more rapidly than real GDP from 1990 through 2006, and this growth difference accelerated from 2001 through 2006. Container trade volumes grew at nearly twice the rate of real GDP from 1992 through 2001 and 2.8 times real GDP growth in 2002 to 2006.

This postulated relationship offers an appealing proposition, reducing the container trade volume forecasting process to simply taking real GDP forecasts available from a number of sources and applying an appropriate multiplier to produce a container volume forecast. Unfortunately, this simple approach has two fundamental shortcomings.

Exhibit D -1 U.S. Real GDP ($Billions, left scale) and Containers (000, right scale)



Sources: U.S. Bureau of Economic Analysis, AAPA, port websites and Parsons Brinckerhoff analysis.

- First, the history of the past ten years shows that the previously suggested relationship is not valid (or has expired). Comparing the pre-recession container volume levels of 2006 to the volumes of the years during and since the Great Recession shows that volumes have not increased at a positive multiple of GDP. This suggests that a new theory of causal relationships between container volumes and real GDP is required.
- The second shortcoming of the postulated container trade/GDP multiplier is that there has been no causal relationship offered to explain it.

While there are certainly fundamental causal relationships between container volumes and real GDP, they are not with GDP as a single aggregate indicator. In particular, container trade volumes are closely correlated with, and directly related to, one of the major components of GDP, U.S. real import value. Container trade is heavily unbalanced, with imports significantly exceeding exports (imports were 2.8 times exports in terms of 2014 value and 1.4 times exports in weight). The strong correlation between container trade volumes and U.S. real import value can be seen in Exhibit D-2.

U.S. real import value is a subtraction in the GDP computation, representing the supply of goods and services sourced from outside the U.S. that are used by the demand components of GDP including personal consumption, investment, government and exports (C+I+G+X, in macroeconomic accounting). Therefore, attempting to positively correlate container trade volumes to the total of real GDP when volumes are so closely and logically tied to a large negative value in GDP suggests that the simple relationship between container volumes and real GDP requires a better formulation.

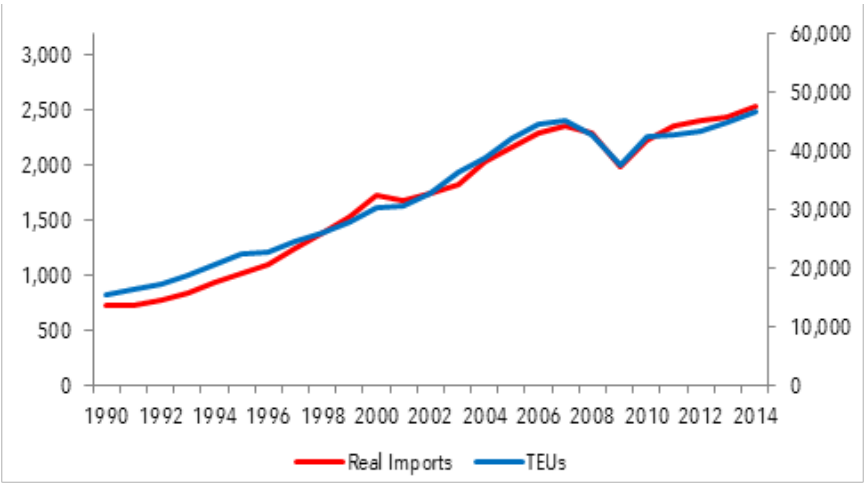
One simple solution would be to use forecasts of real imports as a way of projecting container trade. Unfortunately, this simple solution also has a fundamental limitation. Total real import value includes very large portions unrelated to container trade despite the apparent relationship.

These unrelated GDP components include:

- Imports of services (22% of import value in 2014)
- Imports of many goods that are carried in vessels but not in containers such as U.S. imports of oil and other bulk goods (18% of imported goods value).
- High-value imports of goods by air (23% of imported goods value)
- Very large volumes of imported goods by other than vessels or air, largely overland from major trading partners Canada and Mexico (27% of imported goods value in 2014)

After the above exclusions, containerized imports represented about 31% of total imported goods value in 2014 and about 25% of total import value.

Exhibit D-2 U.S. Real Imports ($Billions, left scale) and Containers (000, right scale)



Sources: U.S. Bureau of Economic Analysis, AAPA, port websites and Parsons Brinckerhoff analysis

Major shifts in these categories' shares of real import value in the future (as have occurred in the past) would call into question any container volume forecast based on total real import value.

For U.S. container volume forecasts to be based on projections of U.S. real GDP, container volumes should be related to the demand components of GDP rather than GDP as a whole or to imports. This makes sense as many imports of goods can be directly related to goods consumed, used in physical investments or used in U.S. based production.

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