The Challenge

By the year 2020, U.S. port container volumes will have tripled as a result of increased global trade. To meet this demand, U.S. port authorities are faced with the challenge of increasing commercial cargo velocity without greatly increasing their operational footprint or costs.

An alternative to building additional infrastructure or expanding existing port facilities is an emerging industry concept called the "Agile Port System" (APS). APS proposes the use of Just-In-Time fulfillment processes combined with the capabilities of an inland intermodal facility to increase cargo velocity.

An APS demonstration program is currently underway to provide insight into the potential benefits of implementing an APS within the existing U.S. port infrastructure. This demonstration program uses discrete event simulation modeling as one of the primary methods of providing a comprehensive evaluation of the proposed concepts.

What is an Agile Port System (APS)?

There are numerous variations of the APS, but the general concept consists of marine terminals, inland intermodal facilities, and a dedicated freight corridor that connects the waterside with the inland facilities. The goal of the APS concept is to increase throughput capacity of marine terminals by moving the cargo storage and sorting components to an inland location where land development costs are less expensive and traffic congestion is reduced. Alternatively, by leveraging the advances in information technology, the APS concept enables direct transshipments containers to be removed from vessels and directly sorted, then transferred to the rail for immediate transport, thus eliminating any need for inland sorting.
The following schematic illustrates the general APS concept:

Figure 1: Agile Port System Concept

Why Simulation?

There are numerous regional versions of the APS and most are still in their conceptual stage. To move this program forward, it is important to demonstrate and quantify the level of system performance and gain approval from transportation industry leaders.

Simulation provides an analysis framework that represents the many system interactions and timings that need to be represented in order to accurately determine infrastructure requirements, assess capacity increases, quantify level of service, and potential operating cost savings. Additionally, it provides the ability to perform sensitivity analysis while considering the impact of real-world environmental variables such as vessel container volumes, rail operating schedules and intermodal splits.
Blair Garcia, Vice President & APS Program Manager for *TranSystems Corporation* says, “The simulation models built to support terminal operations analysis were instrumental in determining the capacity requirements and potential productivity increases. The ability to adjust critical parameters via the user interface and provide real-time animations was very useful to support demonstrations to potential APS initiative stakeholders.”

The design of the APS network model includes a relatively detailed depiction of the connecting freight rail corridors. The model allows for numerous terminal facilities to be represented (at waterside and inland locations), each with its own demand characteristics.

The model also makes it possible to test different regional configurations such as where terminal facilities are geographically located (near business centers, etc.) and also the type of containers (continental US versus regional units) that can be serviced at each.

It is designed so that it can represent systems of varying size—potentially spanning to hundreds or thousands of square miles. For example, the following rail network model was constructed for APS initiatives in the Pacific Northwest:
The modeling software used to construct both the terminal and network level models is based upon a customized suite created by Automation Associates, Inc. This simulation-based solution, the Transportation Modeling Studio™ (TMS), offers the ability to automatically configure a wide range of infrastructure layouts and freight transportation corridors with dimensional accuracy. For this project, TMS offers planning level analysis capabilities that include exploring innovative APS related operational strategies and different infrastructure designs.
Supporting Future Emerging Transportation Concepts

The APS is a concept that can be expanded and applied to many different regional configurations. For example, in Southern California, the nation’s largest cargo importer, marine terminals can be considered to be the aggregate of both the Port of Los Angeles and Long Beach complexes. Sorting, customs, and security activities could be transferred from waterside locations to “remote port sites” in regional high desert areas. Because of the large volume of container traffic, there is the concern that current rail infrastructure will need to be expanded. This is a challenge and potentially a huge expense due to upgrades through a heavily populated environment. Even if this investment is made, there are concerns that the level of service provided by rail within the region will still not be sufficient to support projected cargo volumes.

Conclusion

As projected figures show increases of triple the current container volumes by the year 2020, this industry must look to innovative transportation systems like the APS. This will require the cooperative backing from both industry and public participants including port operators, short and long haul railroads, truckers and regional government entities. Simulation is an excellent way to help industry stakeholders visualize and determine future innovative transportation concepts and configurations. With simulation comes an invaluable method for using real-world demand requirements to quantify the infrastructure necessary for providing desired levels of service.