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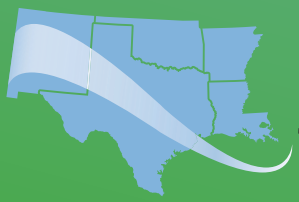
Overview: Characteristics, Benefits and Challenges of Inland Ports



SOUTHERN PLAINS
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16. Abstract This research offers a comprehensive overview of inland ports in the U.S. aiming to confirm a clear definition and understand their role as intermodal distribution centers. This work uses case studies and public data to establish contributions and strength of inland ports. It addresses the perspectives and challenges and reports on the infrastructure of four of the US inland port locations. This research is pivotal in enhancing our understanding of inland ports' contribution to transportation systems and their growth.		
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OVERVIEW: CHARACTERISTICS, BENEFITS AND CHALLENGES OF INLAND PORTS

FINAL REPORT

SPTC Project Number: CY1-TSU-01

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Executive Summary

Inland ports can be loosely described as being removed from deep water and serving an intermodal distribution function. The concept of an inland port may be intertwined with related terms like dry ports and intermodal terminals, making the boundaries and definition difficult to describe. Inland ports play various roles, ranging from reducing congestion at coastal ports to fostering regional economic development. Their functions and characteristics vary widely depending on geography, governance, and logistical needs. As the inland port takes its place as a long-term component of the transportation system, several questions arise relative to performance-based infrastructure, life cycle and extending the life of the inland port. There is a need for greater understanding of the contributions and functioning of inland ports, including consensus on nomenclature.

The team adopted the case study approach to conduct the assessment of four US inland ports. A body of literature provides rationale and appropriate circumstances for case study research. Case study locations represent a geographic distribution across the US with the identified locations as Port of Virginia (VIP – Front Royal), Port of Charleston (Ports Dillon and Greer), the International Port of Dallas (IIPOD) and the Port of Tucson.

This research confirmed the literature in that the case study ports had functions and characteristics that varied depending on geography, whether they were publicly or privately managed, and their logistical needs.

The team developed a framework that categorized the ports by characteristics, connectivity and infrastructure, strategic and developmental goals, and comparative operational strength. A summary of principal findings and recommendations follows.

- The port size or size of the metropolitan area is not a predictor of performance; that is, the capability to well-address freight distribution needs is not a reflection of city or port size.
- Economic benefits seem to accompany the implementation of an inland port. More work is needed to determine reasons or the many variables leading to this benefit.
    - As goods movements increase (as projected), the inland dry ports relieve coastal port congestion and may have more room for expansion than land constrained coastal ports.
    - Interstate highway and Class 1 rail access is foundational to desirable functioning; pipeline and air accessibility are optional.
- Adopt the term *Inland Dry Port* for locations that focus on ground intermodal connections and are not served by waterborne vessels.

Chapter 1. Introduction

Background

Inland ports have emerged as an increasingly important mode within the United States freight transportation system. Initially developed as extensions of coastal seaports to relieve vessel and landside congestion, today's inland ports function as multimodal logistics hubs that support freight mobility, industrial expansion, and regional economic development. Although widely recognized as essential components of domestic and international supply chains, inland ports' sizes, supportive infrastructure and operations vary widely. The term is often used interchangeably with "dry ports," "inland terminals," and "logistics hubs," resulting in inconsistent definitions within both academic and practitioner literature.

Inland ports play an essential role in modern logistics systems, particularly for regions distant from navigable deep-water ports. Inland ports facilitate transfer of goods via highway, rail, and occasionally pipeline. Roso, Woxenius, and Lumsden (2009) define inland ports as inland logistics centers directly connected to coastal seaports through high-capacity rail or highway corridors, functioning as extensions of maritime gateways. These inland facilities may be "distant," "midrange," or "close" depending on their distance and travel time to the seaport. Inland ports support operational goals by shifting containers from long-haul trucking to rail, reducing roadway congestion, impacts, and drayage costs (Roso, 2008). Roso notes that land use constraints, regulatory complexity, impact concerns, and infrastructure limitations all hinder the performance of dry ports and, consequently, overall freight mobility. They act as critical nodes connecting different modes of transportation—rail, road, and sometimes inland waterways—facilitating the seamless transfer of goods and improving network efficiency. Enhanced modal integration contributes to a more resilient and cost-effective supply chain.

Beyond their transportation function, inland ports can stimulate business development and employment opportunities. They often serve as anchors for urban planning initiatives and the growth of industrial or commercial complexes, thereby contributing to local and regional economic vitality.

This work is designed to show the nature and scope of functioning inland ports. It develops and applies an Inland Port Performance Matrix (IPPM)—a framework that assesses inland port performance across five key dimensions: multimodal connectivity, operational capacity, economic integration, infrastructure strength, and strategic alignment. The IPPM provides replicable criteria for reviewing port activities and operation described in this study as the inland port's capacity to support freight mobility, attract industrial activity, and integrate effectively into proximate transportation networks. This framework provides a first step in taking inland port assessment beyond descriptive synthesis toward assessment given their intended purpose.

Case Study Context and Problem Statement

This study evaluates four inland ports that represent various geographic, multimodal, and economic contexts within the U.S. freight network. These sites vary in scale, modal access, economic role, and spatial form, offering a robust basis for comparative evaluation through the IPPM framework. The case study locations:

- **Dallas, Texas**
- **Tucson, Arizona**
- **Greer/Charleston, South Carolina**
- **Front Royal, Virginia**

Although inland ports play a growing role in national supply chains, there is no standardized framework to assess their functioning. Most existing literature highlights their role as a deep-port reliever, modal shifts, and intermodal integration.

Chapter 2. Literature Review

Inland ports are increasingly recognized as critical nodes in the freight transportation system, enabling multimodal integration, supply chain efficiency, and regional economic development. Their functions, however, vary widely, and the literature reflects no universal definition or standardized performance framework (Witte et al., 2019). This chapter synthesizes scholarly research on inland ports, focusing on their evolution, multimodal roles, governance structures, economic effects, and contributions to supply chain resilience. The review identifies gaps that justify the development of the Inland Port Performance Matrix (IPPM) presented.

Definitions and Evolution of Inland Ports

The concept of inland ports originated as a strategy to extend seaport capacity inland, reducing congestion and facilitating container distribution. Inland or "dry ports" are defined as inland logistics centers connected to seaports via high-capacity rail or highway corridors and capable of container handling, customs processing, and intermodal transfer (Roso et al., 2009).

Roso (2008) emphasizes the importance of inland ports in shifting long-haul cargo from trucks to rail, improving impact performance, and reducing bottlenecks at coastal gateways. Rodrigue, Notteboom, and Slack (2017) further argue that inland ports function as part of expanded gateway systems that extend the reach of maritime ports. Although often used interchangeably, the terms "dry port," "inland port," and "inland terminal" differ across studies, creating conceptual ambiguity (Witte et al., 2019). This inconsistency complicates performance evaluation and comparison across facilities.

Inland Ports and Freight Mobility

A major theme in inland port literature is their role in enhancing freight mobility. Inland ports relieve congestion at coastal gateways by relocating sorting, warehousing, and container processing inland (Rodrigue & Notteboom, 2020). Heaver, Meersman, and Van de Voorde (2023) note that inland accessibility is increasingly central to port competitiveness, with inland terminals forming key nodes in freight corridors. Roso (2008) writes that inland ports can significantly reduce truck vehicle miles traveled (VMT), decrease drayage congestion, and improve supply chain efficiency by leveraging rail-based distribution. These benefits align with national freight strategies promoting modal diversification.

Intermodal Systems and Hinterland Connectivity

Intermodal connectivity is a defining characteristic of inland ports. Efficient inland ports rely on rail connectivity by Class I or Class II railroads and highway accessibility via the interstate system, which provides cross country travel and enables first/last-mile distribution. Intermodal terminals capable of handling containers, reefer cargo, and special goods and ancillary logistics infrastructure, such as yards, cranes, and storage facilities support the ports' operation.

Brooks and Pallis (2012) highlight that inland terminals serve as critical intermediaries in global supply chains, facilitating seamless modal transitions. Rodrigue et al. (2017) write that these

facilities strengthen distribution to more remote connections and expand interior reach from coastal gateways.

Economic Impacts, Land Value and Regional Development

Inland ports serve as engines of economic development, attracting warehousing, distribution, and manufacturing activity. Monios and Lambert (2013) demonstrate that inland ports stimulate regional clusters by creating logistics synergies and providing access to global markets. Although limited, some literature links inland ports to changes in land values. Logistics-oriented developments increase demand for industrial parcels near freight corridors, leading to rising property values (Cullinane & Wang, 2012). However, negative externalities such as noise and truck traffic may reduce values for nearby residential areas, illustrating the importance of zoning and land-use planning. Logistics-oriented developments increase demand for industrial parcels near freight corridors, leading to rising property values (Cullinane & Wang, 2012). Economic benefits associated with inland ports can include job creation in logistics, transportation, and industrial sectors, growth in warehousing, distribution centers and demand for land, increased tax revenue and enhanced regional competitiveness. Gonzalez-Aregall, Bergqvist, and Monios (2019) show that inland ports also support economic continuity during coastal port disruptions, making them important components of resilient regional economies.

Governance, Institutional Arrangements, and Public–Private Partnerships

Governance structures shape inland port performance. Witte et al. (2019) observe that successful inland ports often involve coordinated public–private partnerships (PPPs) among state governments, port authorities, railroads, and logistics firms. Monios and Lambert (2013) argue that governance determines port–hinterland alignment and investment strategies. Coordination between local and state governments, transportation providers and businesses is critical. Fragmented governance can hinder inland port development, reduce intermodal competitiveness, and limit integration with state freight plans.

Inland Ports and Supply Chain Resilience

Recent literature emphasizes inland ports as resilience-enhancing assets. Rodrigue and Notteboom (2020) found that inland facilities helped stabilize supply chains during major disruptions such as COVID-19 by providing alternative storage, distribution, and modal options. Inland ports diversify freight routes, reduce concentration risk at coastal gateways, and maintain continuity during labor disputes or weather-related events. Inland ports function as logistical base, as well as enhancing supply chain reliability.

Summary

The literature demonstrates the importance of inland ports in multimodal freight mobility, economic development, and supply chain resilience. However, it also reflects shortcomings in standardized methods and comparative analyses. There is no widely accepted method for assessing inland port performance using categorized indicators.

Chapter 3. Methodology

This chapter presents the methodological framework used to assess the characteristics of four inland ports in the United States. The work incorporates the case study approach to conduct the assessment. A body of literature provides rationale and appropriate circumstances for case study research. In essence, the opportunity allows for in-depth examination of a particular subject without the bounds of sameness required for quantitative analyses. In fact, the qualitative case study approach is best when multiple subjects are not expected to experience high degrees of sameness but are investigated for their uniqueness. Denzin and Lincoln (2004) write that qualitative research is multi-method in its focus, describing routine and unusual occurrences in the subjects. The case study locations represent a geographic distribution across the US. Locations focus on east coast sites in Virginia and South Carolina, one centrally located in Texas and one in the more westerly state of Arizona. The four inland ports identified are Port of Virginia Front Royal, Port of Charleston, the International Port of Dallas and the Port of Tucson. These ports differ in scale, modal connectivity, surrounding industrial ecosystems, governance, and functions, enabling comparative evaluation.

The report will detail the operational aspects of each port, including their functions, activities, and characteristics. Also, the report will examine how each port connects with various modes of transportation. The study employs a multiple criteria approach integrating general information from each port along with infrastructure and operational data.

Research Approach

Case studies are appropriate when the objective is to analyze complex, real-world systems that exhibit substantial variation (Yin, 2018). The study combines a qualitative assessment of operations and comparisons across ports. Specific tasks follow:

Task 1. Literature and Data Review

This task will investigate the existing literature about inland ports and conduct in-depth query re: the array of data available in publicly available sources. Data collection will include, but not be limited to:

- List of Inland Port locations according to
  - Distance to deep water port
  - Size of the port
  - Number of Class 1's serving
  - Number of Class 2's serving
  - Number of Class 3's serving
- Container and/or bulk break
- Annual Tonnage
- Inland Port purpose – local distribution or pass through to other regions

Task 2. Identify Case Study Locations

Per the collected data in Task 1, an assessment will be conducted to identify the locations for the case study analyses. Determination will include, but not be limited to geographical

locations, variance in distance to deep water port, size of facility. The Advisory Board will be constituted, provide input leading to consensus of the case study ports. Discussion will include conversation about the definition of inland ports (some literature includes dry ports that have no water access, and some literature considers only those connected by water).

Task 3. Conduct analyses of data list for the case study locations.
Characteristics will be organized to inform researchers of similarities or differences between the case study locations. This work will not in Year 1 try to indicate whether ports are successful but rather will rely on descriptive characteristics and reflect some of their contributions to local/regional freight mobility or economic perspective.

Task 4. Synthesize and Reduce Data
This task will amass the findings and information from Task 3 and organize in a summary manner to facilitate development of the framework.

Task 5. Prepare Inland Port Characteristics Framework
The framework will be designed to show the characteristics of Inland Ports that reflect in practice what is shown through the case studies.

Data Sources and Analytical Framework
Data were obtained from a combination of publicly available sources and official documents, including:

- State freight plans
- Port authority publications
- Economic development reports
- U.S. Department of Transportation freight datasets
- Rail industry reports
- Land appraisal databases
- Aerial imagery (Google Maps, ESRI Imagery)

Data categories included:

- Physical characteristics – Twenty-Foot Equivalent Units (TEUs), acreage, reefer capacity
- Connectivity indicators (rail classes, interstate access, air cargo proximity, pipeline presence)
- Economic indicators (local employment, industry clusters, industrial land uses)
- Infrastructure (yard design, automation, special cargo capacity)
- Governance and strategic alignment with state plans

The **Inland Port Performance Matrix (IPPM)** assesses port function described in this study as the ability of an inland port to efficiently facilitate goods movement, support regional economic

development, and align with multimodal freight strategies in a way that improves supply chain resilience and local economic outcomes. Inland Ports are widely variant and their lack of similarity is well known. That noted, the assessment of an Inland Port will be a function of its purpose and strategic location, its level of connectivity to railroads and roadways and its capacity and efficiency of operations. Each port is sited to improve distribution to interior US locations. The port's physical placement, proximate transportation infrastructure and its operational efficiency ideally combine to reduce logistics' travel times and costs. Also important are the port's effectiveness in relieving a coastal port, its economic contributions and its goals for future development. Improved efficiency and better logistical supply chain management are essential to a region's economic stability, at a minimum and desired growth. A port's economic goals might be for localized boosts and employment gains or international in scope improving global goods exchanges.

That Inland Ports are on-going and considerations around the country are to add more, they all can be presumed to have a level of success. If not, the private sector railroad, trucking companies and warehouses would not remain supportive. The IPPM views inland ports across six categories.

1. Strategic Location
2. Level of Connectivity: Rail and Roadway
3. Capacity Operational Hours
4. Proximity to Feeder Port
5. Economic Considerations
6. Future Goals

The ports will not be assessed as successful or less than so, rather will be viewed across the six categories as shown. A total lack of success would be reflected in a market response to disengage with an unsuccessful facility.

Significance of the Framework

- Facilitates evidence-based decision-making
- Provides consistent benchmarking across regions
- Turns descriptive assessment into comparable table
- Supports economic and freight policy alignment

Limitation

Despite the limitation that the availability of data and other information varies by port, the framework provides a structured, replicable approach to evaluating inland port activities.

Chapter 4. Findings

An examination of four inland ports provides data and insight into their defining characteristics and operational dynamics. The selected ports—the International Inland Port of Dallas, Port of Tucson, Port of Virginia (Front Royal), and Port of Charleston (Inland Ports Greer and Dillon)—represent the eastern coast, central United States, and western regions. This investigation strategically considers each port's roadway, rail, and pipeline networks, all of which enhance the efficiency of goods delivery and strengthen national supply chain connectivity.

Findings reflect the Inland Port Performance Matrix (IPPM) framework developed in Chapter 3, which evaluates inland ports across five major dimensions: connectivity, operational capacity, economic integration, infrastructure strength, and strategic alignment. Data are descriptive and based on publicly available sources, consistent with case-study methodology.

Operational Description of Inland Port Assessments

Inland port performance varies by geography, industry context, and modal design, this study assesses inland ports according to the demonstrated ability of an inland port to:

- support goods movement efficiently,
- strengthen multimodal connectivity,
- facilitate regional economic development, and
- align with statewide freight strategies.

Performance is viewed through qualitative and quantitative indicators organized under the IPPM dimensions.

Case Study: International Inland Port of Dallas (IIPOD)

The **International Inland Port of Dallas (IIPOD)**, also known as the **Alliance Global Logistics Hub**, serves as the central logistics and transportation hub for the Dallas–Fort Worth metroplex. Occupying approximately 18,000 acres, it possesses one of the largest capacities for distribution and intermodal operations in the nation, integrating air, rail, and truck services (Figure 1). The port handles between 2–3 million TEUs annually, moving a range of cargo including manufactured goods, technology products, and consumer items (North Central Texas Council of Governments, n.d.).

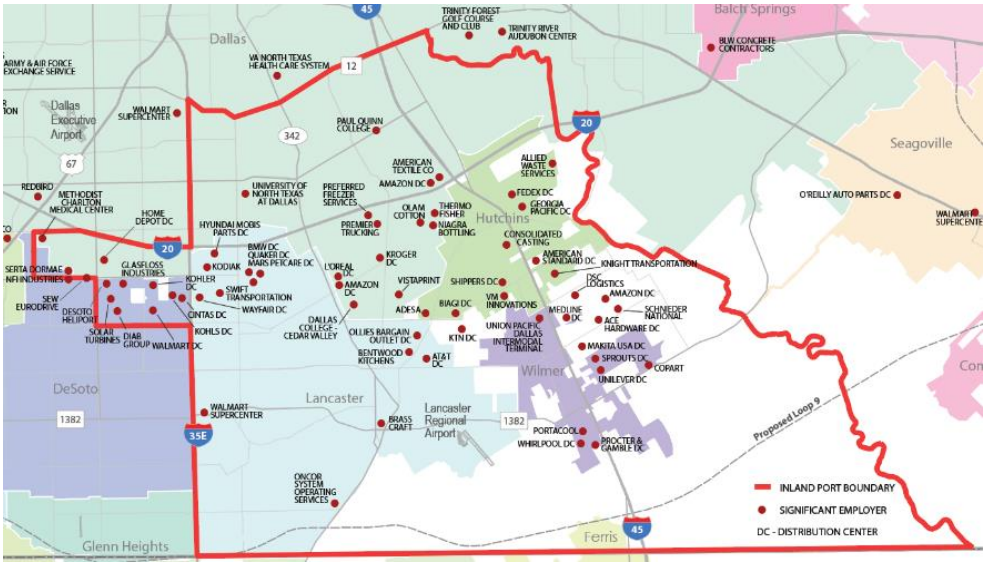

Figure 1. International Inland Port of Dallas

The orange boundary in Figure 1 shows port boundary; interstate highways are IH 20, IH 35, and IH 45. *Source:* https://inlandport.org/wp-content/uploads/2021/03/InlandPortMap.pdf

Strategically located near major interstate corridors, the IIPOD benefits from direct access to Interstate 35E (I-35E), Interstate 45 (I-45), and Interstate 20 (I-20). These highways connect the port to essential national and international trade routes. I-35E links Dallas northward to Canada and southward to Mexico, positioning it as a critical component of the NAFTA trade corridor (City of Dallas Office of Economic Development, 2016). I-45 provides direct access to the Port of Houston, one of the nation's largest maritime gateways, while I-20 serves as a major east–west route connecting Texas to adjacent states (DFW Inland Port, 2021).

These highway connections allow the port to reach 93% of the U.S. population within a 48-hour trucking radius, reinforcing its pivotal role in national logistics (Dallas Office of Economic Development, 2016). However, the port also faces infrastructure challenges. The Southern Dallas County Infrastructure Analysis Report (2015) identifies the need for expanded road networks and utilities to support continued growth. Impact concerns necessitate mitigation strategies (City of Dallas Office of Economic Development, 2016). To alleviate roadway congestion, Burlington Northern Santa Fe (BNSF) has acquired adjacent land for potential intermodal expansion (City of Dallas Office of Economic Development, 2016).

Case Study: Port of Tucson

The **Port of Tucson**, located in southern Arizona, has emerged as a vital multimodal logistics hub serving domestic and international trade. Its proximity to major transportation routes, particularly Interstate 10 (I-10) and Interstate 19 (I-19), enhances its connectivity across the United States, Mexico, and Asia (Figure 2). I-10 serves as a major east–west corridor linking Tucson to Los Angeles and other major markets, while I-19 connects the port directly to the Mexico border, supporting robust cross-border commerce. The Sonoran Corridor Project aims

to strengthen these links by connecting Tucson International Airport to both interstates via the Aerospace Parkway (ADOT, 2019; Pima County, 2018).

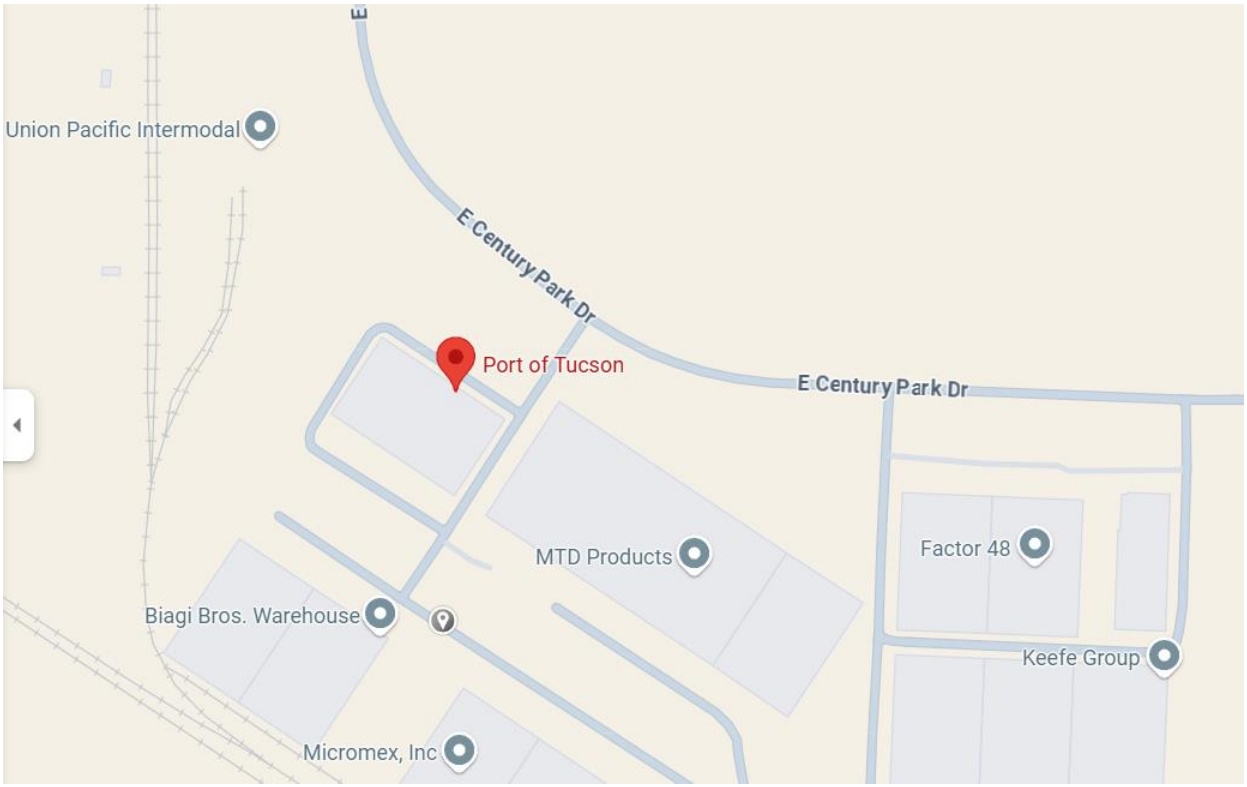

Figure 2. Port of Tucson

Figure 2 shows the Port of Tucson near I-10 E Century Park Dr. Union Pacific rail tracks to the left; adjacent businesses visible. Source: Google Maps

Rail infrastructure forms the backbone of the Port of Tucson's operations. The port lies along the Union Pacific Railroad's Sunset Corridor, a primary rail line linking Southern California ports to inland markets (Union Pacific, 2016). A $19 million investment in intermodal capacity has significantly increased freight throughput (ADOT, 2019). Designation as a Foreign Trade Zone (FTZ) enables reduced customs duties, further facilitating international trade (Arizona-Mexico Commission, 2020).

In addition to its rail and highway assets, the port benefits from robust pipeline infrastructure. The Sierritta Gas Pipeline, operated by Kinder Morgan, and the El Paso Natural Gas System (EPNG) provide vital natural gas connections to both U.S. and Mexican markets (Kinder Morgan, 2023). The port's proximity to Tucson International Airport further enhances multimodal efficiency. Planned runway and cargo facility expansions will increase freight handling capacity, supporting integration into global supply chains (Rico, 2019).

Case Study: Port of Virginia (Front Royal)

The **Virginia Inland Port (VIP)** in Warren County serves as an inland extension of the Port of Virginia, which is headquartered in Norfolk. Although located far from navigable waterways, the VIP forms an essential component of the port's multimodal logistics network (Figure 3).

Figure 3. Port of Virginia

Figure 3 shows the Port of Virginia showing driver entrance and gate (lower left), stacking area to the right. Source: https://tmtava.org/port-of-virginia-port-maps/

The VIP occupies 161 acres and has an annual handling capacity of 78,000 TEUs. Operating 24/7, it provides continuous container and logistics services, including 24 reefer plugs for temperature-controlled cargo. Norfolk Southern Railway provides exclusive service, linking the VIP with seaport terminals in Norfolk and Newport News, approximately 350 kilometers away (roughly a 12-hour transit). Surrounding land use is primarily commercial and industrial, hosting facilities such as food processors, plastics manufacturers, and energy producers. The Virginia State Freight Plan emphasizes the VIP's importance in multimodal connectivity and identifies rail infrastructure improvements as a priority. The port's operations and workforce span logistics, transportation, maintenance, IT, and management, contributing significantly to regional economic development.

Case Study: Port of Charleston (Inland Ports Greer and Dillon)

The South Carolina Ports Authority (SCPA) oversees the Port of Charleston and its two inland extensions—**Inland Ports Greer and Dillon**—which collectively support logistics across the South Carolina region. Together, these inland facilities occupy approximately 100 acres and handle around 180,000 TEUs annually (Figure 4).

Figure 4. Inland Port Dillon

Figure 4 shows the Inland Port Dillon with rail line to the left and trucks adjacent to container stacks. Source: pr.pricelocal.com

Located roughly 200 miles from the Port of Charleston, both facilities are connected via Norfolk Southern rail and major highways such as I-26 and I-95, ensuring efficient cargo movement between the seaport and inland regions. Reefer plugs enable handling of temperature-sensitive goods, serving industries such as automotive, agriculture, and manufacturing.

Operating continuously, the inland ports prioritize rail-based freight movement, aligning with goals by reducing reliance on long-haul trucking. The Port of Charleston, equipped with super post-Panamax cranes and deepwater access, supports large container vessels via Class I railroads CSX and Norfolk Southern. With extensive warehousing, U.S. Customs services, and Foreign Trade Zone designation, the port is a critical economic engine—one in nine South Carolina jobs is linked to port operations.

Key Comparisons and Synthesis

The first iteration of comparative analysis of the four inland ports was organized into four thematic categories:

1. General Characteristics,
2. Connectivity and Infrastructure,
3. Strategic and Developmental Goals, and
4. Comparative Operational Strengths (Tables 1–4).

The analysis shows significant variation in scale, cargo capacity, automation, and connectivity, yet consistent alignment in economic purpose and multimodal integration.

Table 1. General Characteristics of Inland Ports

Characteristic	Virginia Inland Port (VIP)	Dallas Inland Port (IIPOD)	Tucson Inland Port	Charleston Inland Ports (Greer and Dillon)
Size (Acres)	161 acres	~18,000 acres	~1,700 acres	~100 acres (Greer and Dillon combined)
Primary Purpose	Multimodal logistics, economic development	Logistics hub for distribution and manufacturing	Trade, manufacturing, intermodal transport	Support exports/imports for proximate locales
Annual TEUs Capacity	78,000	2–3 million (air/rail/road combined)	~500,000 (primarily via rail)	~180,000 (combined capacity)
Employee Base	Operations, logistics, IT, management	Thousands in logistics, manufacturing, tech	Growing workforce in logistics	Focused on port operations and logistics
Adjacent Industries	Food processing, plastics, energy	Warehousing, manufacturing, tech	Logistics, warehousing, manufacturing	Automotive, agriculture, manufacturing
Operating Hours	24/7	24/7 with automation	Limited	24/7

Table 2. Connectivity and Infrastructure

Aspect	Virginia Inland Port (VIP)	Dallas Inland Port (IIPOD)	Tucson Inland Port	Charleston Inland Ports (Greer and Dillon)
Distance from Feeder Port	Atlantic Ocean ~350 km (12-hour rail transit)	~240 miles (Port of Houston)	Port Guaymas (Sonora) ~400 miles (rail links)	Atlantic Ocean ~200 miles (Port of Charleston,)
Rail Connection	Norfolk Southern (Class I)	BNSF, Union Pacific (Class I, II, III)	Union Pacific, BNSF (Class I)	Norfolk Southern (Class 1)
Highway Access	IH 66, IH 81 State Route 522	IH 35, IH 20, IH 45	IH 10, IH 19	IH 26, IH 85; US 501, IH 95
Intermodal Capability	Rail, truck, pipeline	Air, rail, truck	Primarily rail	Rail, truck
Special Facilities	Reefer plugs for temperature-controlled cargo	Large, automated container yards	Rail-based intermodal activity	Reefer plugs for temperature-sensitive cargo

Table 3. Strategic and Developmental Goals

Goal	Virginia Inland Port (VIP)	Dallas Inland Port (IIPOD)	Tucson Inland Port	Charleston Inland Ports (Greer and Dillon)
Economic Considera-tion	Regional integration into global markets	Significant employment generator in logistics and manufacturing	Grow local workforce in logistics	Support South Carolina's export economy
Initiatives	Increased rail utilization, reduce congestion	Moderate due to highway reliance	Expand rail use	Focus on rail to reduce road congestion
Freight Network Priorities	Enhance multimodal access, address bottlenecks	Maintain efficient multimodal freight flow	Improve highway and rail connections	Strengthen rail connectivity for exports
Investment in Capacity	Upgrade container-handling capabilities	Expand warehousing and automated logistics	Improve intermodal handling facilities	Expand intermodal yard and facilities
State Freight Plan Alignment	Virginia State Freight Plan	Texas Freight Plan, DFW MPO	Arizona Freight Plan, Tucson MPO	South Carolina State Freight Plan

Table 4. Comparative Operational Strengths

Feature	Virginia Inland Port (VIP)	Dallas Inland Port (IIPOD)	Tucson Inland Port	Charleston Inland Ports (Greer and Dillon) (Greer and Dillon)
Automa-tion Level	Low	High (automated gates, container handling)	Low	Moderate
Freight Bottlenecks	Minimal (due to rail focus)	Moderate (congested highways)	Low (limited traffic infrastructure)	Minimal due to focus on rail
Expansion Potential	Limited by current acreage	High (ample land for development)	Moderate (space for growth in rail links)	Moderate
Specialized Cargo	Reefer (temperature-controlled goods)	General freight, specialized for tech and manufacturing	Rail-intermodal containers only	Reefer and intermodal containers

Tables 1-4 across the four inland ports show several key points. Though the ports differ in size, modal diversity, regional role, and infrastructure, common patterns emerge:

- All case-study ports play a critical role in extending the reach of coastal seaports through their strategic location.
- Each has a solid level of rail connectivity as a shared determinant. Ports with Class 1, II, and III rail companies exhibit stronger operational flexibility. Note that Dallas IIPOD is the only case study location that facilitates airport connections, but Tucson is planning to do so.
- Limited freight bottlenecks and hours of operation show attractiveness of the ports for shippers and industry receiving goods. Clustering of logistics and manufacturing industries and specialized cargo show economic strength.
- Expansion and integration with state freight plans reflect future potential for ports to maintain their role in supply chain movements.

Table 5 displays the second iteration of comparative assessment for the case study ports across the IPPM categories as follows:

- Strategic Location
- Level of Connectivity: Rail and Roadway
- Capacity Operational Hours
- Proximity to Feeder Port
- Economic Considerations
- Future Goals

Table 5. IPPM Comparative Assessment

Inland Port	Strategic Location	Level of Connectivity: Rail and Roadway (air/pipeline)	Capacity Operational Hours	Proximity to Feeder Port	Economic Considerations	Future Goals
Virginia Inland Port (VIP)						
Dallas Inland Port (IIPOD)						
Tucson Inland Port						
Greer/Dillon						

Key

Solidly Strong	Favorable	Acceptable

Notable observations are as follows:

- Port size varies substantially—from 161 acres (Virginia Inland Port) to 18,000 acres (Dallas Inland Port).
- Annual throughput ranges from 78,000 TEUs (VIP) to 3 million TEUs (Dallas).
- Three of the ports operate 24/7, reflecting high logistical efficiency, with IIPOD offering high levels of automation.
- All sites benefit from interstate and rail connectivity.
- Pipeline and air cargo infrastructure serve as supplementary assets for IIPOD and VIP.
- Each port contributes demonstrably to regional and statewide economic development and features prominently in respective State Freight Plans.
- Levels of automation correspond with port size, with Dallas exhibiting the highest operational automation.

Chapter 5. Results And Recommendations

Overview

This chapter presents the key results of the IPPM evaluation and offers recommendations for inland port planning, infrastructure development, and policy. The findings integrate insights from the four case study ports—Dallas, Tucson, Front Royal (Virginia), and Greer/Dillon—which collectively represent different geographic contexts, and modal configurations. The analysis moves provides a structured, comparative evaluation of inland port activities.

Results of the IPPM Analysis

Several important findings result from the assessments of the four case study ports.

- Inland ports strengthen U.S. freight mobility and inland market access.

All four case study ports demonstrated that inland facilities extend the reach of coastal ports into interior regions of the country. Inland ports reduce drayage distances, increase routing flexibility, and provide alternative hubs for container processing—ultimately enhancing the efficiency and resilience of national freight flows.

- Port scale is not a determinant of performance or "success."

The analysis found no direct relationship between port acreage, twenty-foot equivalent unit (TEU) capacity, or metropolitan size and inland port performance. Smaller inland facilities such as Front Royal and Dillon/Greer showed strong performance in connectivity, operational efficiency, and alignment with state freight strategies, while larger facilities such as Dallas excelled in multimodality and industrial clustering. Performance varies by functional specialization rather than size.

- Inland ports generate economic development, though magnitude varies by region.

Each port exhibited clear evidence of logistics-related growth, including warehousing expansion, manufacturing activity, and solid employee bases. However, economic impacts depend on regional industrial structures, workforce readiness, zoning, and local incentives. More empirical work is needed to isolate causal relationships between inland port development and economic performance metrics.

- Inland ports support coastal port capacity and congestion relief.

Consistent with literature and the IPPM results, inland ports reduce processing pressure at congested seaports by relocating container handling, storage, and value-added services inland. As cargo volumes continue to grow nationally, inland facilities offer expansion opportunities that coastal ports—limited by shorelines, nearby communities, and impact constraints—cannot accommodate.

- Multimodal connectivity is the strongest predictor of inland port performance.

The highest-scoring IPPI dimensions across all ports was their strategic location and contributions to the economic category. Pipeline access adds a modal dimension, but is not essential for overall inland port performance.

- Clarifying inland port terminology will improve analytical and planning consistency.

The case studies reinforced the need to distinguish between inland ports located on navigable waterways and those that function exclusively through land-based modes. To reduce ambiguity, this report recommends using the term, Inland Container Dry Port for facilities that:

- are not located on navigable waterways,

- rely solely on road–rail intermodal connectivity (pipeline), and
- serve as inland extensions of coastal or border ports.

All four case study ports meet the definition of Inland Container Dry Ports.

Interpretation of Findings

The Inland Port Performance Index provides a replicable and structured way of evaluating inland port performance across U.S. regions. The case study results confirm that inland dry ports play a crucial role in freight mobility and economic development by strengthening inland access to global supply chains, relieving coastal port congestion, and promoting regional industrial growth. Adoption of the Inland Dry Port terminology and use of the IPPI framework will support clearer planning, benchmarking, and decision-making for state agencies, port authorities, and policymakers.

Taken together, the results highlight the essential role that inland dry ports play in U.S. freight mobility, supply chain resilience, and regional economic competitiveness. Inland ports distribute functions across broader geographies, strengthen freight networks and promote more sustainable modal choices. Their performance is highly dependent on multimodal design, institutional coordination, and alignment with statewide freight priorities.

Recommendations

Based on the analysis and comparative findings, the following recommendations are proposed for practitioners, planners, agencies, and port authorities:

- Prioritize Class I rail access and intermodal terminal development.

Rail connectivity was the strongest contributor to higher performance and should anchor future inland port investment strategies.

- Integrate inland dry ports into statewide freight and economic development plans.

Ports aligned with state freight plans—such as Virginia and South Carolina—demonstrated clearer governance structures, stronger investment pipelines, and more consistent modal performance.

- Support targeted inland dry port development in strategic freight corridors.

Emerging logistics regions with growing e-commerce demand or limited coastal port capacity should consider inland dry port development to expand inland reach and enhance redundancy.

- Protect and designate industrial lands surrounding inland ports.

Local governments should adopt zoning frameworks and incentives that preserve logistics-appropriate land and prevent incompatible land uses from encroaching on freight corridors.

- Promote rail-based strategies.

Shifting freight movement from trucks to rail reduces roadway congestion and adverse impacts.

- Encourage investment in digitalization and automation.

Technologies such as automated gate systems, container tracking, and terminal management systems enhance efficiency and throughput, as demonstrated by the Dallas inland port.

Recommendations for Future Research

Future studies should explore:

- Additional economic analysis of land values, employment, and industrial growth

- GIS-based spatial modeling of inland port impacts
- Longitudinal evaluation
- Broader national or international comparisons of inland dry port models

These approaches would strengthen empirical understanding of how inland port development influences freight networks and regional economies.

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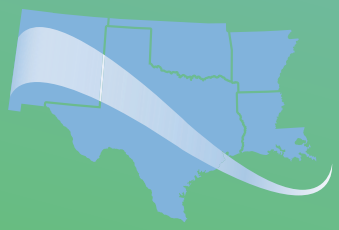

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