

A REGIONAL SYSTEMS APPROACH TO LOGISTICS & WAREHOUSING IN SOUTHERN CALIFORNIA

DEC. 2024



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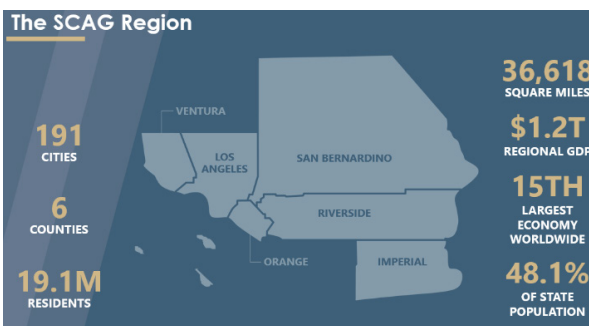
Executive Summary

The Southern California Association of Governments (SCAG) serves as the largest metropolitan planning organization (MPO) in the United States. The SCAG region is vast and economically diverse with respect to population, housing, employment, and industries throughout many urban, suburban, and agricultural lands, not to mention the region's diverse ecosystems. The SCAG region is a part of a much larger megaregion that includes San Diego County, Central California, Southern Nevada, Arizona, and Mexico, which affords many opportunities for an increasingly dynamic personal experience, while at the same time furthering economic growth. The growth and evolution of industrial facilities supporting distribution and consumption is increasingly impacting the growth and changes of the region's urban and suburban environments. **The primary purpose of this Whitepaper is to identify why a regional systems-based approach to industrial development is necessary and to identify key steps to guide the SCAG region in that direction.** This requires acknowledgement and understanding of the needs of local communities and those impacted by industrial activities, while also recognizing the economic benefits and local, regional, state, and national nature of how supply chains are organized and operate.

Key areas of focus and highlights within the Whitepaper include:

- Interdependency Relationships
- E-Commerce and Digital Shifts
- Supply Chain Considerations
- Trucking and Industrial Development Challenges
- Regional Strategies, Solutions & Recommendations

INTERDEPENDENCY RELATIONSHIPS



Source: SCAG

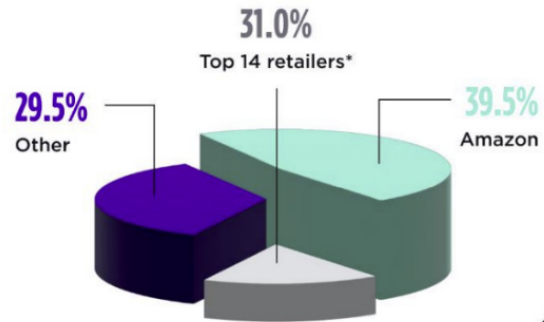
The SCAG region is home to 19 million people, 4 million households, and 11 million employees. When factoring for the SCAG region and San Diego County, total population reflects approximately 60 percent of the State's total. As the region has grown over the past decades, there has been a direct correlation with the increased consumption of products and services, notably leading to an increase in freight activities and industrial warehouse and distribution capacity.

When reviewing existing population, housing, and employment trends over varying periods of time, there is a clear correlation between the rate of growth for industrial distribution and fulfillment centers serving localized consumption. There is also a pattern of increasing regional gross domestic product and retail and food service sales per capita equating to increased spending over time. Localized consumption and historic market diversion away from the San Pedro Bay Ports necessitate further analysis to clarify the degree of freight consumed locally versus passing through, as the premise is that local consumption is growing at a faster rate.

E-COMMERCE AND DIGITAL SHIFTS

Smartphones and e-commerce have led to an increasing expectation among consumers that their digital purchases be delivered as soon as possible. In many cases, one-day deliveries have become increasingly available. This has led to a substantial shift in how major companies like Amazon, Walmart, Target, and Home Depot, orient their supply chains from the point of manufacturing and production to distribution and fulfillment. As an example, companies like Amazon and Walmart are focusing more heavily on third-party growth versus first-party traditional retail models. This has led to an increasing reliance on Asian imported goods as well as either additional industrial distribution/fulfillment centers or even more localized delivery centers to support consumer preferences for quicker delivery of goods. For traditional retailers like Walmart, Target, and Home Depot, the combined need to balance physical store stock-keeping units products as well as third-party services through distribution and fulfillment have led to reuse of existing industrial capacity and/or added capacity either directly or through other third-party companies offering value-added services. Further e-commerce penetration as a portion of total retail sales is anticipated to continue at a substantially higher rate versus physical retail sales suggesting a stronger focus on urban and suburban localized industrial facilities to support this demand.

BY COMPANY, 2022 (% OF TOTAL RETAIL ECOMMERCE SALES)



Source: eMarketer, Feb 2022
 *Walmart Inc., Apple, eBay, Target, The Home Depot, Best Buy, Carvana, Costco Wholesale, The Kroger Co., Chewy, Wayfair, Macy's, Etsy Inc., Lowe's

Source: <https://www.bigcommerce.com/articles/ecommerce/>. Accessed June 2023

SUPPLY CHAIN CONSIDERATIONS



Source: SCAG, CoStar Group, Inc.

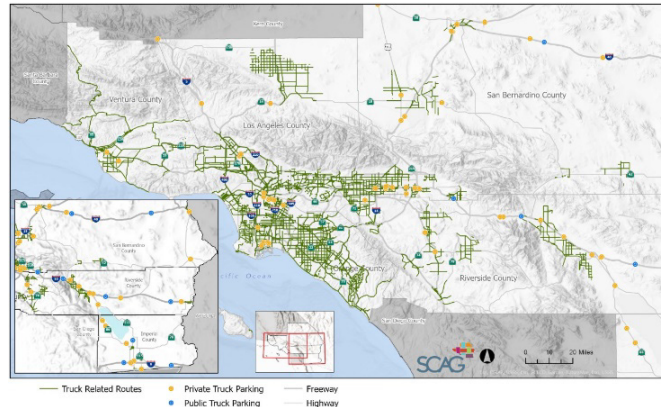
Considerations with respect to the supply chain cannot be disregarded. The SCAG region, as measured by seaports, airports, border crossings including San Diego County, industrial facility square footage, and interstates, highways, and local access roads, is the largest region in the nation from a goods movement system perspective. The population, housing, and employment attributes within and directly adjacent to SCAG serve as a major generator of freight activity both for localized and national consumption. When factoring for other regions throughout the United States

and based upon containerized cargo diversion trends from the San Pedro Bay Ports, localized consumption demand will likely be the highest driver for industrial development over the future. As adjacent areas surrounding the SCAG region continue to grow both due to local consumption and from national supply chain characteristics, it must be noted that other parts of the nation are witnessing similar patterns of metropolitan areas becoming larger megaregions. This phenomenon will further change the

dynamics of how goods enter and exit the SCAG region: pendulum swings related to variables outside of the control of the region (trade disputes, labor issues, pandemics, war, and other geopolitical concerns) will continue to shift trade across the West, Gulf, and East coasts, with megaregions being an important part of absorbing these swings.

TRUCKING AND INDUSTRIAL DEVELOPMENT CHALLENGES

With the increasing amount of industrial facility development, two core issues have surfaced. First, inconsistencies across local jurisdictions are often created by a lack of coordinated decision-making on policies regarding the siting and development of industrial facilities which can have significant unintended consequences for neighboring communities. Second, as trucking demand increases, first- and last-mile connections to these industrial facilities become increasingly problematic as congestion, parking, idling, noise, criteria pollutant, and other issues impact local communities. For a region as vast as SCAG, assessing this dilemma today and finding ideal solutions that address all issues appeasing all stakeholders is an unprecedented challenge. There is a need to better understand and orient how companies consider their existing supply chain capacity needs, how local jurisdictions think about framing policies for development, and how communities are impacted and what solutions are of the highest priority to reduce these impacts. Taking a regional perspective on these areas in aggregate will not seek to provide a set of fixed and inflexible approaches. Rather, the goal will be to bring greater transparency and collaboration to the existing process, with a path forward to achieve multiple stakeholder goals and objectives across the region.



Source: SCAG 2024

REGIONAL STRATEGIES, SOLUTIONS & RECOMMENDATIONS

Currently, there has not been a regional process developed to explicitly focus on industrial facility development in the SCAG region and throughout Southern California. The challenge of assessing the scale of the region with respect to local jurisdictions, relationships for industrial facility supply chain characteristics and trends, and truck routing information, among other factors, will require further organization, work, and analysis. The four keys to the development of a regional strategy are to:

1. **Establish a clear dialogue between stakeholders,**
2. **Create a regional baseline incorporating local jurisdiction policies and designations and industrial facility information that can serve as examples and best practices, and**
3. **Develop appropriate scenarios and planning tools to enable localities to make informed decisions supporting a regional systems-based approach to industrial development.**
4. **Build a stronger regional coalition to be more competitive in pursuing federal and state funds.**

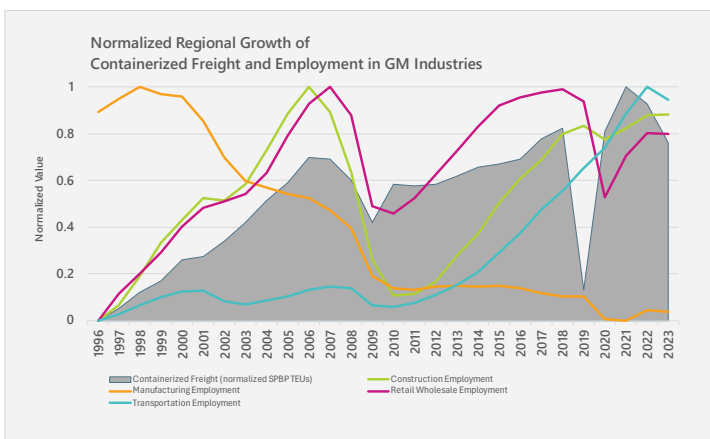
The recent completion of the Connect SoCal 2024 Regional Transportation Plan/Sustainable Communities Strategy and the upcoming Comprehensive Sustainable Freight Plan and other related programs and

studies, provide for opportunities to leverage the SCAG's work efforts to establish a regional baseline and further identify opportunities for systems-level scenario planning and tool development. This could include providing technical assistance to local jurisdictions on the development of truck routes that avoid sensitive areas, developing a regional freight transportation demand management strategy, supporting industrial growth scenario planning, and providing dynamic mapping of truck routes and truck parking. Additionally, establishing and convening a committee of stakeholders on a regular basis to guide the development of a regional process and building a stronger regional coalition to be more competitive in pursuing federal and state funds to support local jurisdiction needs is recommended.

Growth Trends

It is important to consider the drivers of industrial development throughout the SCAG region. Equally important is the need to draw correlations with how consumption is the ultimate force impacting the flow of freight and goods. One premise throughout this Whitepaper is that localized consumption is growing at a faster rate than pass-through freight to other parts of the nation, notably versus areas like the Midwest and East and Gulf coasts. The other premise is that large metropolitan areas like the SCAG region are becoming larger megaregions as the localized market gets bigger from adjacent areas. As an example, for the Inland Empire, impacts of freight activity might be driven by communities in Phoenix, Arizona, as much as beach communities in Southern California. Core indicators for consumption include population, housing, and employment, as well as the region's gross domestic product (GDP) and retail and food service sales. Core indicators for freight activity include containerized freight measured by twenty-foot equivalent container units and industrial facilities measured by square footage. All comparative information has been normalized to gauge growth trends and relationships.

CONTAINERIZED FREIGHT AND EMPLOYMENT



Source: California Employment Development Department, Port of Los Angeles, Port of Long Beach. Accessed April 2024.

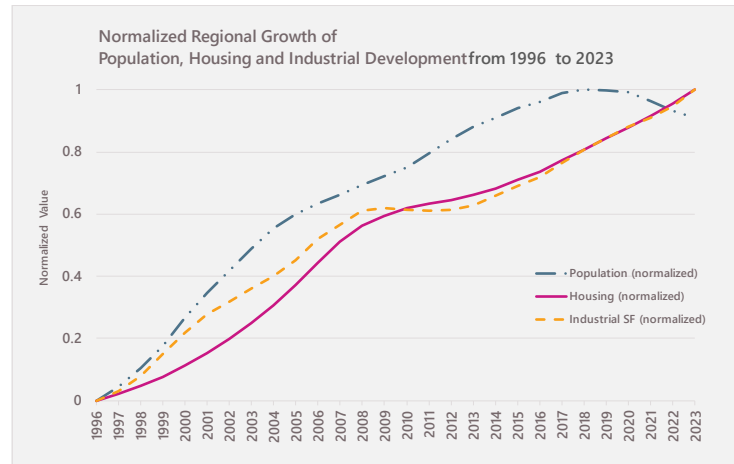
Most freight activity is driven by imported containers through the Ports of Los Angeles and Long Beach, or San Pedro Bay Ports (SPBPs). Employment correlation trends can be helpful in defining the types of industries that are most impacted by the expansion and contraction/recession cycles of freight. Clearly, the most volatile cycles have stemmed from the Great Recession, the 2019 freight recession/COVID-19 pandemic recession, and recent freight recession from the 2021 peak. While not all employment goods movement industries are strongly correlated with containerized freight, large employment

sectors including retail and wholesale and construction have followed similar trends during expansion and recession cycles, increasing steadily until 2006-2007 before the Great Recession of 2008/2009.

Manufacturing employment, in continuous decline, has clearly displayed the greatest inverse relationship to containerized freight employment. Transportation and warehousing employment trends have been much more robust during the rapidly increasing period for e-commerce sales growth (2012-current) and is now strongly correlated with containerized freight, retail and wholesale, and construction employment trends. Moving forward, the expectation is that the strongest correlations, between retail and wholesale, transportation and warehousing, and construction employment trends and containerized freight, will continue. Paying attention to the degree of correlation will help identify recessionary versus expansion cycles as containerized freight has typically served as a leading indicator for recession trends, while the three major employment industries are more likely to outperform during expansionary periods.

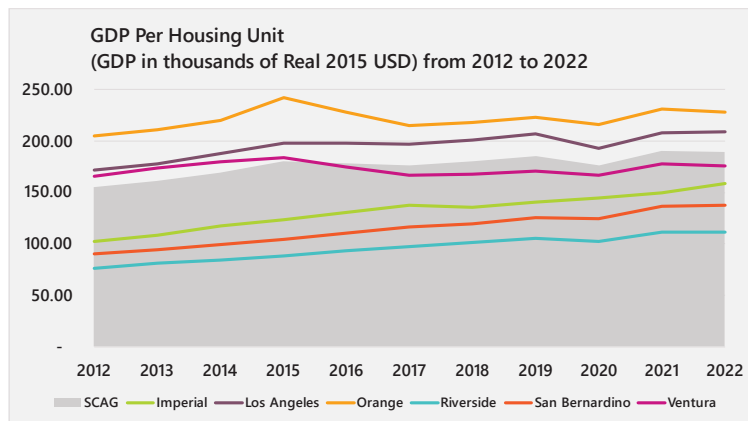
POPULATION, HOUSING, AND INDUSTRIAL SQUARE FOOTAGE

There is extremely high correlation between population, housing (total housing development), and industrial square footage growth. Only recently have both housing and industrial square footage growth crossed above population growth as household sizes have marginally declined from the region’s peak in 2013. The strong correlation with housing and industrial square footage growth is an important indicator of how tied housing growth and household consumer spending align with industrial support for distribution and fulfillment of these localized trends. This supports the premise that localized consumption is an important factor and contributor increasing industrial square footage. It is also an important factor to justify the need to further distinguish between the localized and national consumer trends driving this industrial growth, including the shifts of major metropolitan regions growing into megaregions.



Source: CA Department of Finance, CoStar Group, Inc. Accessed May 2024.

SCAG REGION GDP AND RETAIL AND FOOD SERVICES SALES

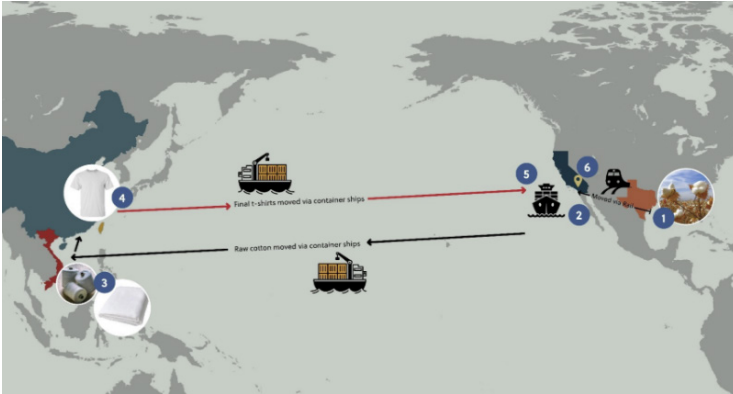


Source: United States Bureau of Economic Analysis. Accessed May 2024.

The SCAG region’s core economic indicators can be measured by both GDP and retail and food services sales. It is important to consider trends for retail and food services sales isolated from GDP, because retail and food services sales directly drive freight activity, notably truck origins and destinations from major trade gateways, like the SPBPs, to industrial distribution and fulfillment facilities. While the data sets do not go as far back as others, there is a clear trend over the past decade

where regional per capita GDP has continued to increase growing across all SCAG counties. At the same time, retail and food services sales have also displayed a growth trend over the past eight years at a rate exceeding overall GDP for the SCAG region during the same period. It is important to note as that both the unit growth of housing combined with the per capita GDP or retail and food services sales increases, the overall demand for freight activity multiplies. When there are housing units in the region and spending per household increases, localized freight supply chain capacity concurrently increases to support freight activity demand. This phenomenon is also occurring in adjacent areas to Southern California, including Central California, Southern Nevada, Arizona, and Mexico.

Supply Chains and the Economy



Source: SCAG 2024

In today's globally integrated economy, goods movement provides access to international gateways, supports local manufacturing activities, serves the needs of local businesses and residents, and supports a thriving logistics industry. In short, the movement of goods is an important driver of the economy and directly contributes to the needs for every business and resident. As the largest trade gateway in the United States, the SCAG region directly

connects global trade locally, regionally, statewide, and nationally. Goods movement encompasses a wide array of activities involved in moving products from producers to businesses and residents. On the production side, there are many different production and manufacturing facilities, equipment types, and services required to create and distribute these products. Changes in technology, both for purchasing and producing goods, has had a profound impact on supply chains, most clearly on the efficiencies of production and timing of delivery. These technological advancements have led to increasing just-in-time and e-commerce fulfillment services. Recognizing these factors, goods movement is fundamental to supporting the economy and quality of life in the SCAG region, Southern California, and other parts of the United States.

ESSENTIAL NATURE OF GOODS MOVEMENT

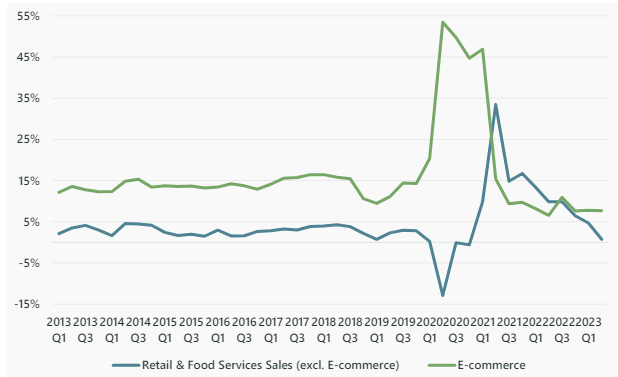
Multiple supply chain linkages distribute goods both locally and outside of the region. These linkages connect seaports via local drayage to warehouses and transload facilities, from transload facilities to railyards and distribution centers, as well as through drayage and on-dock rail moves supporting direct freight flows to destinations, with rail playing a primary role for trips entering and exiting the region. Goods movement interchange points and trade gateways in adjacent states and East and Gulf coast regions have a similar linkage and serve as a driver for products that come into the SCAG region to businesses and residents, and as exports through the region's key trade gateways. Consumption by local businesses and residents in the SCAG region supports economies of scale. The SCAG region's logistics industry is a direct result of these economies of scale supporting a goods movement systems and infrastructure that are highly competitive. Notwithstanding regulatory issues and changing dynamics outside the control of the region, localized consumption will continue to grow, thus increasing freight



Source: SCAG 2024

demand irrespective of how it flows globally into and across the U.S. to local destinations, including the SCAG region.

E-COMMERCE AND OMNICHANNEL SHIFTS



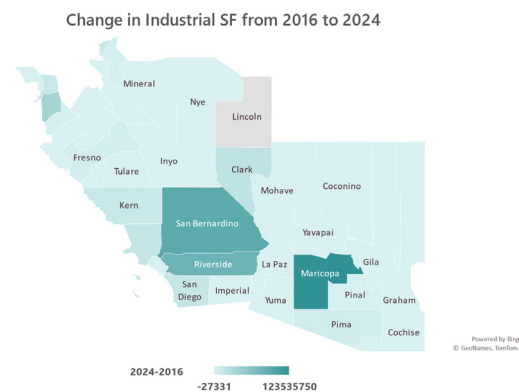
Source: United States Census Monthly Retail Trade – Quarterly E-Commerce

During the COVID-19 pandemic, there were substantial impacts to how consumers purchased goods both directly through e-commerce platforms, and through ordering online and picking up items purchased, also known as omnichannel. The COVID-19 impacts culminated in an extreme jump in the penetration of e-commerce sales with respect to total retail and food services sales during 2020. Government shutdowns placed a high dependence upon digital ordering for essential and all other items, which continued through 2021. E-commerce penetration has since flat-

lined over the past couple of years, as during 2021 and through 2023 the relationship between digital and physical retail and food services sales underwent much more volatility than in the past. Despite performance for e-commerce, versus physical retail, seeing more volatility over the past three years, the expectation is for digital purchases to continue to grow at a higher rate than traditional retail. Collectively, this demonstrates a continued shift in buying patterns, where business models are changing from physical retail to direct-to-consumer. Omnichannel commerce has introduced new seamless ways for a consumer to purchase products from multiple platforms on any device. Several cloud-based application programming interfaces (APIs) allow services at different stages of the transaction to communicate with each other, providing the consumer with real-time updates to pricing, shipping, and inventory information. APIs make it possible within minutes to verify card information, calculate and schedule delivery, and send a confirmation email with package tracking information. Such a model allows customers to buy while scrolling on social media platforms such as Instagram or TikTok, all without leaving the app, and being anywhere they prefer, whether within a store, mall, home, or any other location.

LOCALIZED VERSUS NATIONAL CONSUMPTION

A primary concern expressed by local communities is the frustration with absorbing freight activity in their neighborhoods while it is going to other parts of the country such as Chicago, Dallas/Fort Worth, or Tennessee. However, as population and housing trends and consumer spending have indicated, localized consumption patterns have continued to rise and there is strong correlation with these trends and freight activity. As diversion of discretionary cargo has been a constant the past couple decades, it is important to further dissect localized and regional growth trends. Equally important is major metropolitan areas becoming

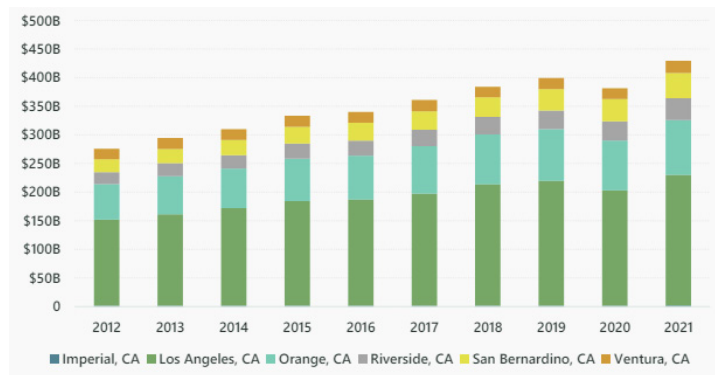


Source: CoStar Group, Inc. Accessed May 2024.

megaregions. To this point, even while Central California, Southern Nevada, and Arizona have all been witnessing industrial facility growth exponentially faster than Southern California (in line with respective localized population, housing, GDP, and retail and food service sales trends), Maricopa County in Arizona from 2020 through 2024 witnessed growth in industrial facility square footage exceeding that of both San Bernardino and Riverside counties combined. With trade further shifting to Mexico, even from Asia, the Southern California border is poised to see substantial growth as well. There is a strong nexus with these correlating socio-economic trends, and Southern California has a potentially much larger issue than is currently realized, much of which is outside of the region’s control.

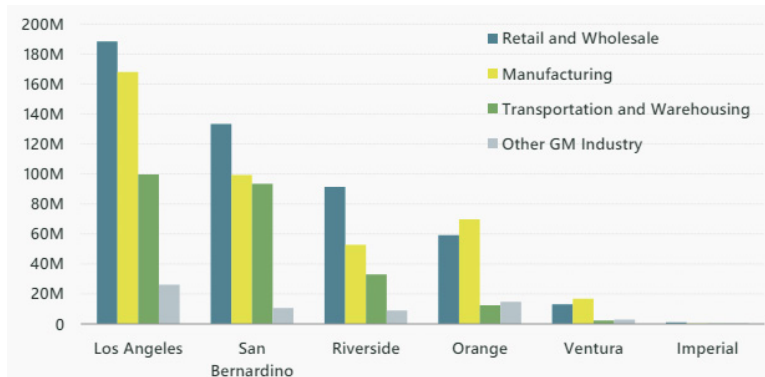
EMPLOYMENT TRENDS

In 2021, goods movement-dependent industries (manufacturing, construction, retail, wholesale, and transportation and warehousing) employed close to 2.4 million people in the SCAG region, or 29 percent of all employees. In the same year, goods movement-dependent industries contributed nearly \$430 billion to regional GDP—just below 40 percent of the region total and roughly 13 and 2 percent of GDP at the state and national level, respectively. These sectors provide well-paying jobs, adding diversity to workforce options, and serve as key components of the Southern California economy. With a substantial majority of retail and food services sales related to transportation, food, home goods, health, and other essential needs, there is a clear nexus between goods movement jobs and the delivery system infrastructure and facilities, especially during times of extreme duress.



Source: U.S. Bureau of Economic Analysis, “CAGDP2 Gross domestic product (GDP) by county and metropolitan area.” Accessed August 2023.

Industrial Facilities and Freight Operations



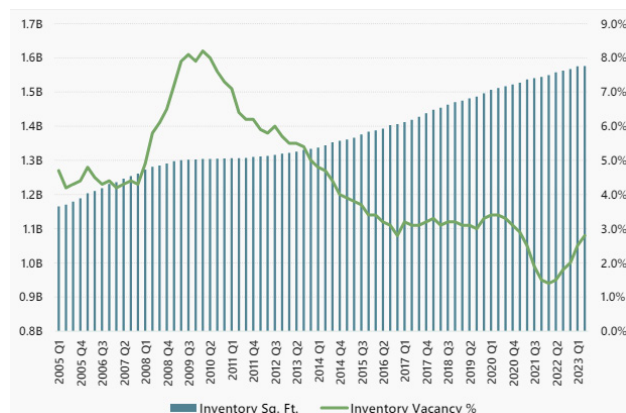
Source: CoStar Group, Inc. Accessed January 2023.

Manufacturing, and retail and wholesale trade are important drivers of economic competitiveness due to the globally integrated nature of supply chains. Industrial facilities provide the supply chain capacity to facilitate the import and export of goods for consumption locally, statewide, and nationally. Industrial facilities are fundamental to the goods movement system, as global

connections are made through seaports, border crossings, and airports for international trade, with air, rail, and trucking services supporting domestic local, regional, and national freight from these trade gateways. Industrial facility capacity supports freight flows through manufacturing, warehousing, distribution, and fulfillment to businesses and residents across the goods movement system. There are four major industrial categories: manufacturing, retail and wholesale trade, transportation and warehousing, with other goods movement industrial areas, like construction, being much more fragmented. At the end of 2022, the SCAG region encompassed greater than 2 billion inventory square feet for industrial facilities, or approximately 57 percent of California’s roughly 3.4 billion inventory square feet.

INDUSTRIAL FACILITY TRENDS

The majority of the SCAG region’s industrial footprint is connected to retail and wholesale trade distribution and transportation and warehousing facilities. Retail and wholesale trade reflects the largest amount of industrial square feet directly tied to the nearly 19 million residents and approximately 342,000 business establishments in the SCAG region. It should be noted this capacity also supports much of San Diego County, bringing the Southern California population total to greater than 22 million and over half of California’s total. These industrial categories grew at a much faster rate than manufacturing for the SCAG region, increasing inventory by 33 percent over the past 20 years. The industrial market is defined as either tight or loose. During times where vacancy percentages are very low, the market is tight, which typically leads to increasing rent per square foot and slowing inventory growth. Before the Great Recession, the SCAG



Source: CoStar Group, Inc. Accessed July 2023.

industrial warehouse and distribution market saw vacancy percentages in the 4-5 percent range. Since 2014, this percent dropped to a new-normal of 3 percent, and during the pandemic, hit extreme tightness below 2 percent. A return to the 3 percent level is underway.

TRUCKING MARKETS AND SERVICES



Source: U.S. Department of Transportation, SCAG

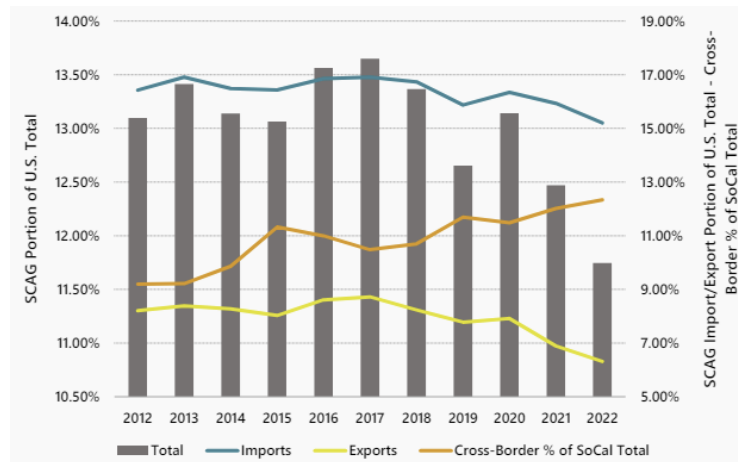
Southern California remains a leading manufacturing center in the United States. While the region provides many non-transportation advantages to manufacturers (such as access to a large consumer market), its access to efficient and reliable transportation, especially the regional roadway system, contributes to its attractiveness for certain types of manufacturing. Trucking connections to suppliers and markets are an important element in many manufacturing supply chains. These involve both intraregional connections to clusters of related businesses and long-haul

corridors. Significant amounts of regional manufacturing are located along key roadway corridors that facilitate connections to the Interstate system, intermodal rail facilities, and air cargo facilities. Another critical roadway function that supports regional manufacturing is the ability to make interregional connections. The Interstate highway system serves as the primary connection between the region, national markets, and suppliers, with significant support from several state routes. These interregional corridors are also important to regional and national distribution centers that are significant components of growing logistics activities in Southern California. Arterial highways throughout the region provide direct connections to commercial centers and residential areas, allowing for deliveries to stores, homes, construction sites, and service businesses. For this system to function effectively, it must rely on a core set of highways that facilitate east-west and north-south connections. This includes both routes that support regional manufacturing as well as roads serving population clusters.

SEAPORT SERVICES

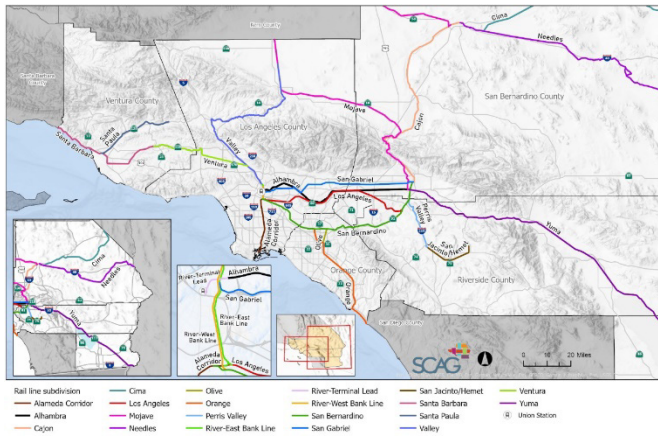
Seaports in the SCAG region serve as a major trade gateway connecting businesses and residents to their products. Import traffic at the SPBPs is organized into categories based on the mode and/or destination of the cargo. Inland Point Intermodal (IPI) is shipped intact in marine containers by rail from the ports to inland destinations, notably Chicago as a major lane example. This traffic can be segregated into on-dock IPI, including containers loaded and unloaded in the ports, and off-dock IPI, including containers moved to and from off-dock intermodal rail

yards. Import cargo transloaded to rail includes cargo unloaded from marine containers in the SCAG region, reloaded into 53-foot domestic containers or trailers, and then delivered to off-dock intermodal rail yards for rail shipment to inland destinations. Cargo may also be unloaded from marine containers in the region and reloaded to truck trailers and delivered to local destinations, typically including California, Oregon, Nevada, and Arizona. Local cargo is directly trucked from the SPBPs to these same destinations. Containerized trade between the United States and Asia constitutes most of the international cargo transiting the SCAG region. Southern California is critical to serving Asian markets, with East Asian trade accounting for over 90 percent of activity in and out of the San Pedro Bay port complex. Per the United States Census Bureau, Asia containerized trade value has increased by 17 percent over the past decade to just below \$360 billion as of 2022, supporting a wide variety of intermediary components and finished products. During the same time, non-Asia containerized trade value has increased by 42 percent to just below \$30 billion. Trade across Asia has shifted as China’s proportion of containerized imported trade has dropped from 57 percent to 49 percent as of 2022. Exports have remained stable, with China accounting for nearly 28.5 percent versus just below 30 percent back in 2012. Other southeast Asian countries have benefitted from shifts away from China.



Source: United States Census Bureau, USA Trade Online. Accessed June 2023.

RAIL SERVICES



Source: SCAG 2024

The SCAG region is served by an extensive freight railroad system. This infrastructure serves as a vital component of the goods movement system, facilitating the transportation of goods and commodities across the region and beyond, notably for IPI. Key rail facilities include intermodal rail yards, automotive facilities, and classification yards. As mentioned earlier, the SCAG region sees a substantial amount of import/export cargo through the SPBPs, with containerized shipments being the lion's share. This naturally translates to rail cargo being mostly focused on containerized services. There are

numerous industrial, distribution, and commercial sites in the region connected to the freight rail network through rail spurs or industrial sidings, which are frequently extended from the main rail lines. These extensions allow for direct access to the regional, national, and even international rail network while facilitating the seamless loading and unloading of goods and commodities at the facility itself. These locations are used to offer convenient and efficient means for industries to receive raw materials for their production processes. Manufacturers with direct rail connections benefit from the reduction of trucking operations, allowing goods to be directly transported by rail to and from industrial facilities. BNSF and Union Pacific intermodal rail performance has been challenged over the past decade, resulting from national tariff policies, freight recessions, the COVID-19 pandemic, and other geopolitical tensions. All business sectors have also felt the recent impacts from inflation, both for pricing of their products and for their operational costs. BNSF and Union Pacific have essentially witnessed flat intermodal performance from 2014 through 2022, with extreme cycles of volume fluctuations being the norm.

AIR CARGO SERVICES

Nine airports provide air cargo services in the SCAG region. In 2012, the region's air cargo services handled over 2.5 million tons. In 2022, cargo tonnage had increased by approximately 75 percent to nearly 4 million tons. The largest share of this cargo is handled by Los Angeles International Airport (LAX). LAX has a large cargo operation that includes over two million square feet of air cargo space comprising the 98-acre Century Cargo complex, the 57.4-acre Imperial Cargo complex, the Imperial Cargo Center, and a number of terminals on the south side of the airport. Combined, these facilities include 27 buildings, including distribution and sortation facilities, air cargo containers, ground equipment, and air freighter cargo loading and unloading spaces. Notably, these facilities range from 20 to 80 years old, with many approaching the end of their useful life. To address the aging facilities, Los Angeles World Airports (LAWA) is scheduled to start environmental review for the Cargo Modernization Program in the third quarter of 2024. Ontario International Airport (ONT) handles the next highest share of cargo in the SCAG region. ONT has almost three acres of cargo building and office space to support all cargo and air mail. The United Parcel Service has a 156-acre West Coast Distribution Center adjacent to the airport, including air freighter storage for loading and unloading, directly connected to the airport and warehouse and distribution facilities, and with direct service to China. Recent air cargo developments have included new

Air Prime cargo services operated by Amazon, and FedEx's \$100 million 251,000-square-foot complex on the northwest portion of the airport.

CLEANTECH AND AUTOMATION

The SCAG region supports accelerated deployment of existing and proven technologies to improve the region's air quality while aggressively pursuing investment to achieve the long-term goal of a zero-emission goods movement system. The region requires investment in charging and fueling infrastructure, further development of existing prototypes to bring down costs and address operational challenges, and incentives for the full commercial deployment of zero-emission vehicles. Similarly, the region requires support for near-term emission reductions through immediate deployment of existing near-zero-emission technologies and their supporting infrastructure. In addition to funding, policies that address the full life cycle impacts of new vehicles and their disposal, expedited permitting, and education and workforce development, among other actions, will be needed to holistically support a transition to zero-emission technologies.

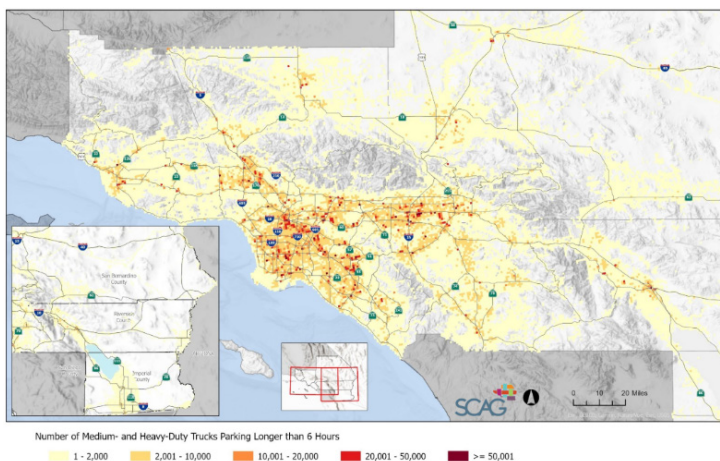
The advancement of automation is expected to have considerable impacts throughout regional supply chains. Warehouses are increasingly integrating automation to improve operational efficiencies in response to the dramatic surge in direct-to-consumer e-commerce. Continued developments and demonstrations of automated truck technologies will alter the goods movement environment with far reaching impacts ranging from employment to highway safety. The region will face serious labor challenges as many jobs may change or become redundant with increased automation playing a larger role in many facets of freight operations.

Industrial Capacity Growth Challenges

As the industrial sector continues to expand, the challenge of managing overlapping industrial and residential development has become increasingly apparent. This Whitepaper explores the complexities surrounding this issue, examining trends and projections, infrastructure considerations, community perspectives, and policy implications. By delving into these aspects, the aim is to provide insights into effective strategies for balancing industrial growth with community well-being. Industrial capacity growth projections from the SCAG "Industrial Warehouse Study" and further internal analysis using regional warehousing data project a continued rise in industrial development. Concurrently, projections of housing growth in Southern California and its surrounding regions underscore the pressing need to address the challenges created by overlapping industrial and residential areas.

TRUCK ROUTING PERSPECTIVES

Truck routing is a common strategy for managing truck traffic in communities. Many cities designate certain roads as truck routes, avoiding the routing trucks through residential zones due to concerns about traffic safety as well as air and noise pollution. Nevertheless, as land use, population, housing, and truck traffic patterns have evolved, these concerns continue to re-emerge, so there is a need to continually and comprehensively assess and refine truck routes to mitigate the impacts of truck traffic. Re-routing of truck traffic has been highly effective, as an example, in the Barrio Logan community in San Diego, California, where re-routing achieved an estimated reduction of vehicle miles traveled and particulate matter emissions by diesel trucks along the previously affected corridor by 87 percent and 99 percent, respectively (Karner et al., 2009). As industrial development has continued and supply chains have adjusted over time, there has been a disconnect with respect to impacts from traffic patterns and a gap for the regional nature of how many truck trips are served across the region, notably from the SPBPs to warehouse, distribution, and fulfillment centers across Southern California, and even to some extent adjacent areas to the region.



Source: SCAG

As truck routes have been established, there are still opportunities to further reduce the air pollution impacts of diesel trucks on communities by influencing their route choice. From the truck driver's perspective, routing involves determining a specific travel route to take from an origin (e.g., the current location) to a destination (e.g., delivery location). Over the past several years, there has been a rapid growth of navigation systems to assist truck drivers with that task. Some navigation systems can take truck-specific

restrictions such as truck routes and height clearance into consideration. These navigation systems primarily find routes with the shortest distance or the shortest time duration between an origin and a destination. Research and development in recent years has focused on new truck routing techniques that

find the route that would minimize truck fuel consumption or emissions (Scora et al., 2019), instead of finding the shortest distance or shortest time duration for the trip.

To help mitigate the near-road exposure to pollutant emissions from diesel trucks, it is possible to expand the emission-based routing technique to account for not only how many emissions would be generated by a diesel truck when it travels on the different roads in the community, but also the meteorological conditions that affect emission dispersion (e.g., wind speed and direction), number of population in different parts of the community, and locations of sensitive facilities (e.g., daycares, schools, senior facilities), among others. This exposure-based routing technique finds the route that would minimize or lower the total exposure of community members to the emissions from the truck for any given trip.

Per the AB 617/Community Air Protection Program (CAPP), there is a clear need for more collaborative designation of truck routes across communities that can generate co-benefits for communities and industry. There are concerns with respect to staffing capacity at the local level to address resource needs, to get started on land use actions, enforce ordinances, to develop and pursue grant applications for green funding opportunities, or to implement signage.

Based on initial research and the nature of existing truck routes across local jurisdictions throughout the region, there is a clear opportunity to collaborate and develop a more integrated regional truck routing system that orients supply chain characteristics to support operator needs and systems while serving local community preferences for how trips are connected at the local level.

LOCAL COMMUNITY PERSPECTIVES

The Southern California region, particularly the Inland Empire, has experienced a staggering increase in warehouse development over the past few decades, sparking concerns among residents and leaders over issues such as traffic congestion, air pollution, and community livability. Critics have called for government intervention, including a moratorium on new warehouse construction. Recent setbacks for the logistics industry and a shifting economic landscape have led to local governments to reconsider their approval of new warehouses. As the demand for delivered goods has waned post-pandemic, the logistics industry has faced further challenges, leading to job losses and economic uncertainty in the Inland Empire.

The goods movement sector, encompassing vessels, trucks, trains, and associated infrastructure, presents a substantial challenge to regional air quality. Emissions stemming from these activities contribute significantly to regional air pollution, prompting concerns for both public health and environmental wellbeing. Compliance with state and federal regulations is imperative to enhance overall quality of life in the region. Local regulatory authorities have responded by attempting to act, notably through the implementation of Rule 2305, also known as the Warehouse Indirect Source Rule (ISR), by the South Coast Air Quality Management District. The ISR seeks to reduce emissions through the Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program. The WAIRE Program is a menu-based point system that requires warehouse operators to earn WAIRE Points by completing actions off the WAIRE Menu, by implementing an approved Custom WAIRE Plan, or by paying a mitigation fee every year. Though there was litigation with the California Trucking Association, it has concluded with the South Coast Air Quality Management District prevailing on all points. The WAIRE Program is notably supported by AB 617 communities because the program addresses their local concerns including air quality impacts from truck traffic and other goods movement equipment. However, warehouse operators have faced increasing uncertainties ranging from the recent freight recession, slowing U.S. economy, and geopolitical tensions across the globe leading to a slowdown of industrial development. The WAIRE Program's initiation during

the COVID-19 pandemic and the significant ramp-up of industrial development stemming from heightened e-commerce purchases is also something that needs to be analyzed as post-pandemic trends become clearer moving forward. Meanwhile, environmental, labor, and community groups have called for a moratorium on warehouse construction in the Inland Empire, citing concerns about air quality and pollution. However, county officials argue that such bans fail to address the underlying demand for goods and the necessity of distribution centers to meet consumer needs.

Nationwide, communities have pushed back against warehouse construction, with California experiencing widespread action. Labor and business groups warn that restrictions could harm tax revenue and job creation. The Inland Empire's strategic location near major ports has made it a storage and sorting hub, leading to a surge in warehouse numbers more than doubling since 2000. While warehouse growth is demand-driven, efforts to regulate construction have emerged, including moratoria in cities like Riverside. Concerns about pollution, traffic, and proximity to residential areas have prompted calls for buffer zones and stricter regulations. However, opposition from labor and business groups highlights the complexity of balancing economic interests with community well-being.

On September 29, 2024, Governor Gavin Newsom signed Assembly Bill 98 into law, which imposes new design and build standards for new or expanded logistics uses across the state. In general, AB 98 would impose standards relating to warehouse design and location, parking, truck loading bays, landscaping buffers, entry gates, and signage. The type of requirements that would apply to a project will depend on the presence of sensitive receptors, the size of the project, and the existing zoning on the land. AB 98 is likely to have a substantial impact on how warehousing is built and sited across the state, not just for developers and operators, but also for local agencies and the South Coast Air Quality Management District through local planning and monitoring requirements.

While warehouses provide job opportunities, residents lament the loss of neighborhood cohesion, outdoor play spaces, and safety. However, for many, warehouse jobs are a source of livelihood. While activists continue to advocate for environmental justice and community well-being, while also recognizing the need for a balance between economic growth and quality of life.¹ Multiple challenges for warehouse jobs have been raised including:

- Wage concerns: "The typical annual salary in 2019 for transportation and material moving occupations in the Los Angeles area was \$31,328 – this income is below the living wage for one adult, and not sufficient to support a household with two adults (one working) without children in the same area."
- Geographical access to logistics jobs: According to Metro, "LA's increasing housing costs are pushing the logistics workforce farther away from the county's employment centers toward the outer reaches of the region. In LA County the average commute time has increased every year since 2013, with an average commute of 31 minutes in 2017. Mobility for the logistics workforce is challenging – only 3.3% of goods movement jobs are accessible within a one-hour transit trip." This is a particular concern for those with less income, as their job access potential may be disadvantageous compared to those with more disposable income, and they are the most in need of better compensation opportunities.
- Skill gaps and a need for multidisciplinary training among mid-level technicians: The industry is transforming its operations in pursuit of higher efficiency and productivity, and employers are

¹ <https://www.nytimes.com/2022/10/10/business/economy/warehouses-moratorium-california.html>

looking for individuals with the ability to supervise, produce, and communicate technical analyses, as well as manage compliance and contracting issues. Furthermore, as California transitions to zero-emission vehicle technologies, demand for entry and mid-level technicians with a foundational understanding of energy systems is also increasing.

- Large wave of retirements while demand for workers is expected to increase: More specifically, the industry estimates that 1.1 million new truck drivers will need to be hired over the next decade.

These issues present unprecedented challenges for the region to move forward, with clearly opposing stances among stakeholders. Addressing air quality issues requires more than just moratoria or fees; it necessitates incentives, grants, and education for consumers. Breaking the cycle of emissions requires a multifaceted approach that balances environmental concerns with economic realities and consumer demands.² Freight activity is a daily occurrence when people wake up each morning and go to work and live their lives in their homes. Many personal activities and behaviors of society are drivers for consumption and freight. Southern California will continue to be pressed to come up with highly innovative solutions that can accommodate diverging stakeholder needs and preferences, or the region risks pushing freight sprawl even further and impacting more communities inside and outside of the region.

² <https://www.nixonpeabody.com/insights/alerts/2023/02/14/southern-california-warehouses-face-proposed-moratoriums-and-pending-air-emission-mitigation>

Potential Solutions and Strategies

In recent years, the overlap between industrial and residential development has become a significant challenge for communities, posing potential conflicts in land use, environmental impact, and quality of life. As the demand for warehousing and industrial facilities continues to rise, it is imperative to establish proactive solutions and strategies to address these challenges effectively. The three keys to the development of a regional strategy will be to establish a clear dialogue between stakeholders, to create a regional baseline incorporating local jurisdiction policies and designations and industrial facility information that can serve as examples and best practices, and to develop appropriate scenarios and planning tools to foster and enable localities to make informed decisions supporting a regional systems-based approach to industrial development.

STAKEHOLDER ENGAGEMENT AND COLLABORATION

Establishing a clear dialogue through structured groups involving critical stakeholders is paramount in addressing the complexities of industrial-residential overlap. These forums, be they committees or working groups, will provide avenues for stakeholders to collectively develop solutions. By understanding the nuances of national and regional growth development and its implications on local communities, stakeholders can devise mitigation strategies. These strategies range from the strategic placement of industrial facilities and truck routes to fostering communication between developers, authorities, and residents. Importantly, these groups should seek to identify and promote best practices for successful industrial-residential coexistence, both within the region and beyond.

BEST PRACTICES AND POLICY EXAMPLES

Examining state and local policies and initiatives offers valuable insights into addressing warehousing land use conflicts. For instance, initiatives like the California Sustainable Freight Initiative Concept Paper and guidelines from State Attorney General Xavier Becerra outline feasible best practices and mitigation measures. Additionally, community-focused efforts, such as the AB 617/Community Air Protection Program and the Good Neighbor Policies implemented by various jurisdictions, showcase proactive approaches to mitigate environmental and social impacts. These examples underscore the importance of adopting policies that prioritize community well-being and environmental sustainability in warehousing development.

AB 617/Community Air Protection Program is a comprehensive initiative to reduce pollution in communities. It consists of several key components, including Community Air Monitoring Plans, Community Emissions Reduction Plans, and Community Air Grants. These components enable communities to identify major air quality concerns and outline actions to reduce pollution in collaboration with relevant agencies. The Community Air Grants Program supports community-based organizations in participating in AB 617 processes and implementing pollution reduction measures. Examples of funded activities include community engagement, hiring consultants for technical expertise, and supporting community-operated air monitoring. Other approaches and opportunities could include conducting studies that would help support the establishment of truck routes away from residential/school areas, or physical barriers to prevent truck traffic from entering a residential neighborhood; or developing methods and strategies to establish truck parking in areas that are lacking these needs.

The Western Riverside Council of Governments initiated the "Good Neighbor Guidelines for Siting New and/or Modified Warehouse/Distribution Facilities" to mitigate the impacts of diesel emissions from warehouses and distribution centers on nearby communities. These guidelines protect sensitive receptors such as residences, schools, and parks by outlining measures to minimize diesel emissions, such as reduced idling and new education programs for truck drivers. Riverside County and the city of Riverside have adopted similar policies to regulate warehouse projects, ensuring proper consideration of environmental impacts and community well-being.

The Riverside County Board of Supervisors approved the Good Neighbor Policy in November 2019, which applies to logistics and warehouse projects exceeding certain size thresholds. The policy is implemented during the land use review process and covers aspects such as studies/analysis, construction phase, siting and design, operations, signage, and community benefits. Similarly, the city of Riverside adopted the Good Neighbor Guidelines in November 2020, emphasizing considerations for air quality, noise, and neighborhood character in new industrial developments. Moreno Valley has also implemented modified guidelines tailored to the city's specific needs, focusing on minimizing diesel emissions and protecting sensitive receptors from the impacts of warehouse projects.

A case study³ of the experiences in New York City provided seven types of best practices, scaled from the system level down to the site level, as follows.

- Zoning for innovation as well as nuisance monitoring and mitigation
- Environmental policy for movement and place
- Supply chain awareness for citizens/consumers
- Blocks and buffers for neighborhood design
- Community conversation
- Sustainable transportation transition for goods as well as people
- Context-sensitive building design

Overall, mitigating the overlap between industrial and residential development requires a collaborative and multi-faceted approach. By establishing clear dialogue, incorporating buffer zones, and learning from successful case studies, communities can foster sustainable warehousing development that benefit both industrial stakeholders and residents. Proactive planning and effective implementation of policies and guidelines are essential to creating a balance between industrial growth and residential well-being. As a part of this process, there is an opportunity to have a regional perspective and context to ensure that a supply chain relationship from a systems-approach is considered.

MENU OF APPROACHES AND TOOLS

SCAG's SoCal Goods Movement Communities Opportunities Assessment⁴ study involved public engagement to understand their perspective on possible solutions. To address challenges related to truck speeds, following distances, and routing, community members recommended a range of solutions

³ <https://doi.org/10.1016/j.trip.2023.100823>

⁴ <https://scag.ca.gov/socal-goods-movement-communities-opportunities-assessment>

centered around increased enforcement of existing rules and regulations. Community members suggested various measures, including stricter enforcement of traffic laws, improved signage, and coordinated enforcement efforts across jurisdictions. They also recommended funding for enhanced truck enforcement, collaboration with the goods movement industry for driver training, and the promotion of responsible driving practices. Additionally, suggestions included improving public transit options, planning warehouses more thoughtfully, and implementing limits on warehouse growth near sensitive areas.

To support informed decision-making and sustainable development, it is crucial to establish regional data-driven tools and approaches. This includes developing scenario planning approaches, tools, and platforms that provide visibility for localities to understand the implications and opportunities of future industrial development. Supply chain visibility tools and scenario planning development can aid in assessing community impact, mitigation strategies, and economic growth potential. Leveraging data-driven insights through a regional systems-based approach will enable communities to proactively plan for sustainable warehousing development while minimizing negative impacts on residential areas and maximizing opportunities for growth and prosperity.

Recommended Actions

Based on the Whitepaper assessment, there is clearly a need and opportunity to promote and establish a regional systems-based approach to industrial development in the SCAG region. A regional systems-based approach should not supplant or further complicate the existing local process for developing land use. Rather, this approach would focus on connecting the local, regional, statewide, and national supply relationships to production and consumption throughout Southern California, with the goal to bring greater transparency and collaboration to the existing process, and a path forward to achieve multiple stakeholder goals and objectives across the region. While there is no single set of ideal solutions to this unprecedented challenge, from a regional context, a process should be developed to create transparency, facilitate coordination, and establish achievable goals and objectives. The following initial recommended actions are offered for consideration:

- Develop a regional steering team/committee.
 - Policy/technical
 - Regularly convene meetings semi-annual/quarterly/ depending on policy/technical items and direction.
 - Establish leads to coordinate stakeholder engagement.
 - Expand partnerships across other regional stakeholder groups/peers.
 - Other efforts to engage stakeholders further leveraging regional steering team/committee.
- Leverage work from SCAG’s comprehensive planning efforts including Connect SoCal 2024, the upcoming Comprehensive Sustainable Freight Plan, and other programs and studies.
 - Establish clear achievable goals and objectives to further develop and identify workable solutions and strategies.
 - Provide local technical assistance to cities to conduct studies and develop strategies supporting the establishment of truck routes away from residential/school/other sensitive areas, or design concepts to prevent truck traffic from entering residential neighborhoods.
 - Develop a regional freight transportation demand management (TDM) assessment including solutions and strategies.
 - Develop regional tools and resources to create an interactive truck route and parking interface and industrial growth scenario planning platform.
- Build a stronger regional coalition to be more competitive in pursuing federal and state funds.
 - Establish a regional framework that considers and incorporates local jurisdiction needs.
 - Identify programs and grants for the region’s consideration.
 - Pursue and organize resources to effectively develop grant applications and program and manage awarded funds.



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