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Assessment of Warehouse Relocations Associated with the South Coast Air Quality Management District Warehouse Indirect Source Rule

23 December 2020

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This report is in support of South Coast AQMD staff's development of a potential indirect source rule (ISR) to reduce mobile source emissions related to the operation of warehouses and distribution centers in the South Coast AQMD's four-county region (Los Angeles, Orange, Riverside, and San Bernardino counties).[1] Diesel truck traffic, largely related to the transport of goods passing through the Ports of Los Angeles and Long Beach and regional warehouses and distribution centers, makes up a large share of local NO_x emissions. A warehouse ISR, if adopted, may help with reducing emissions from trucks servicing warehousing facilities located within its jurisdiction.

Compliance costs to the warehousing sector could vary depending on the design of an eventual rule. If these costs are significant, the implementation of an ISR could potentially precipitate the relocation of warehousing operations outside the region—with the associated truck fleets continuing to travel to and from facilities in the South Coast AQMD jurisdiction. In the worst case scenario, the associated air quality benefits from such a rule might be greatly diminished. Accordingly, South Coast AQMD is interested in identifying and understanding the factors affecting whether warehousing operations are likely to relocate as a result of the potential rule.

Consistent with this objective, Industrial Economics, Inc. (IEc) performed an assessment of the warehousing sector in the South Coast AQMD jurisdiction and outlying markets and, based on this assessment, performed an analysis of potential warehouse relocations under varying levels of potential ISR compliance costs. This document presents the findings of IEc's analysis, as well as the data and methods applied.

ES.2 WAREHOUSE REAL ESTATE MARKET IN THE SOUTH COAST AQMD JURISDICTION AND OUTLYING MARKETS

To inform the analysis of potential warehouse relocations from the South Coast AQMD jurisdiction, IEc assessed the warehouse real estate markets within the South Coast AQMD jurisdiction and in neighboring areas. Through analysis of a range of key market metrics and trends, we assess the capacity of neighboring areas to absorb warehousing operations that might consider relocation following the implementation of an ISR. Across all market areas, our analysis of the warehouse real estate market focuses on warehouses with at least 100,000 square feet of floor area, based on the square footage threshold in the October 6th, 2020, draft ISR text.

Using spatial information available on individual warehouses, we grouped properties into eight distinct real estate markets—the South Coast AQMD jurisdiction (or "District" in the graphics below) and seven

[1] The South Coast AQMD jurisdiction is comprised of all of Orange County and parts of Los Angeles, Riverside and San Bernardino Counties. The region is mapped and described in full in Exhibit 1 and the "Geographic Scope" section below.

neighboring areas in geographic proximity to the South Coast AQMD jurisdiction. In addition, we further sub-divided the South Coast AQMD jurisdiction into three areas, largely defined according to county boundaries. These markets, shown in the maps in Exhibit 1, are as follows:

- **Los Angeles:** The portion of Los Angeles County located within the South Coast AQMD jurisdictional boundaries, including all of the county except for the northeastern corner. This area includes the "megaports" of Los Angeles and Long Beach, the origin point for most goods passing through warehouses in the region and 40 percent of all container cargo traffic in the U.S.[2]
- **Orange County:** All of Orange County, which is completely contained within the South Coast AQMD jurisdictional boundaries.
- **Inland Empire:** The South Coast AQMD portions of Riverside and San Bernardino counties. This includes the most densely populated southwestern corner of San Bernardino County and all of Riverside County except for a small portion near the county's eastern border, near the Arizona state line.
- **North of District, Bakersfield:** All of Kern County and the non-South Coast AQMD portion of Los Angeles County, including Lancaster and Palmdale.
- **North of District, Coastal:** All of Ventura County, Santa Barbara County, and San Luis Obispo County. Contains the Port of Hueneme,[3] located in Ventura County.
- **East of District, Desert Areas:** All of Imperial County and the non-South Coast AQMD portions of San Bernardino County, including Victorville, and Riverside County.
- **South of District, San Diego:** All of San Diego County, which includes the Port of San Diego.[4]
- **Las Vegas:** All of Clark County, Nevada, which includes the city of Las Vegas.
- **Phoenix:** All of Maricopa County and Pinal County, Arizona.
- **Western Arizona:** All of the four Arizona counties to the west of Phoenix: Yuma, La Paz, Mohave, and Yavapai Counties.

Our primary data sources for the assessment of warehouse real estate markets in these areas is the CoStar Suite™ of data products developed and maintained by CoStar, a real estate analytics firm. The CoStar Suite™ includes information on existing properties as well as vacant parcels that may be developed.

The South Coast AQMD jurisdiction is the dominant warehouse market in the broader region. Despite relatively high rents for warehouse space, the South Coast AQMD jurisdiction's square footage of warehouse space is by far the highest in the region and has grown dramatically over the past several years.

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[2] "Industrial Warehousing in the SCAG Region – Final Report." (2018) Prepared for the Southern California Association of Governments by Cambridge Systematics, Inc. with Gill V. Hicks and Associates Inc. April 2018.

[3] The Port of Hueneme is substantially smaller than the Ports of L.A. and Long Beach, with annual container traffic of 84,000 containers in 2018, relative to Long Beach's 8.8 million containers and L.A.'s 8.9 million containers. American Association of Port Authorities. "NAFTA Container Port Ranking 2017." https://www.aapa-ports.org/unifying/content.aspx?ItemNumber=21048

[4] The Port of San Diego's annual container traffic is approximately 143,000 containers. American Association of Port Authorities. *Op cit*.

EXHIBIT ES-1A. REAL ESTATE MARKETS EXAMINED

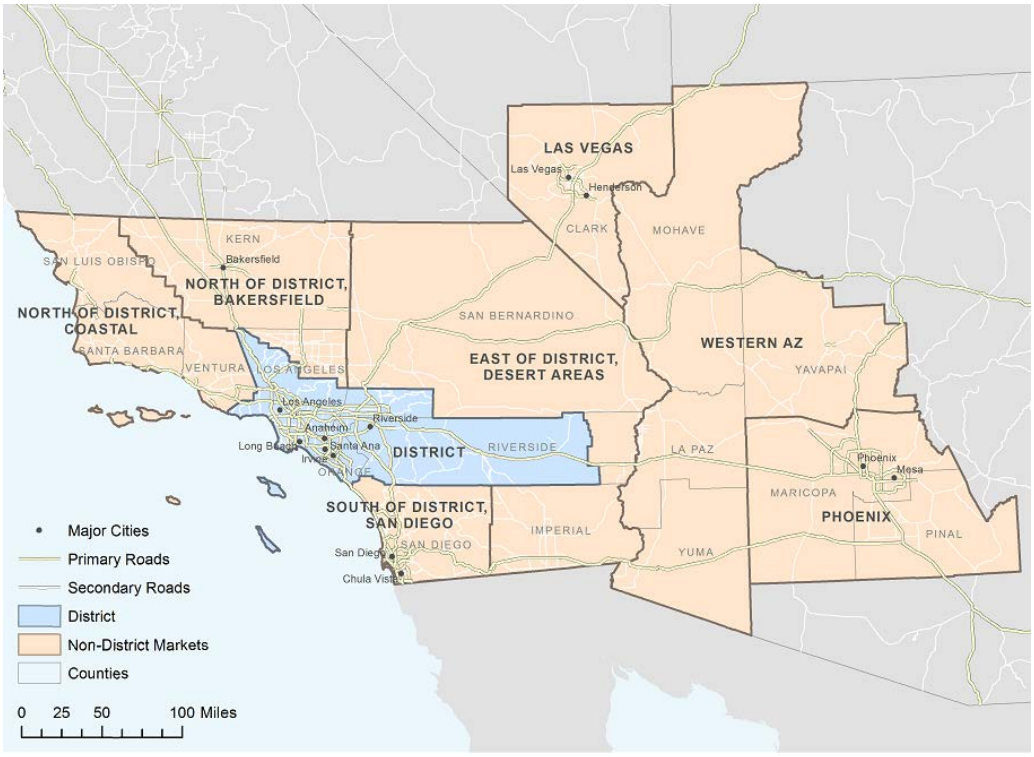


EXHIBIT ES-1B. REAL ESTATE MARKETS EXAMINED – SOUTH COAST AQMD MARKETS FOCUS

CURRENT MARKET SNAPSHOT

Our analysis of current market conditions in the warehouse real estate markets listed above includes assessment of the total warehouse inventory in each area, vacancy rates, pricing, and potential future development. Focusing on buildings used primarily as warehouses, we identified 2,638 warehouses within the South Coast AQMD jurisdiction and 975 in the outlying markets.[5] Similarly, we identified 662 million square feet of rentable building area within the South Coast AQMD jurisdiction and 226 million square feet in the outlying markets. Exhibits ES-2 and ES-3 show the distribution of these warehouses and square footage across market areas.

EXHIBIT ES-2. NUMBER OF WAREHOUSE PROPERTIES BY MARKET & WAREHOUSE TYPE- YEAR 2019

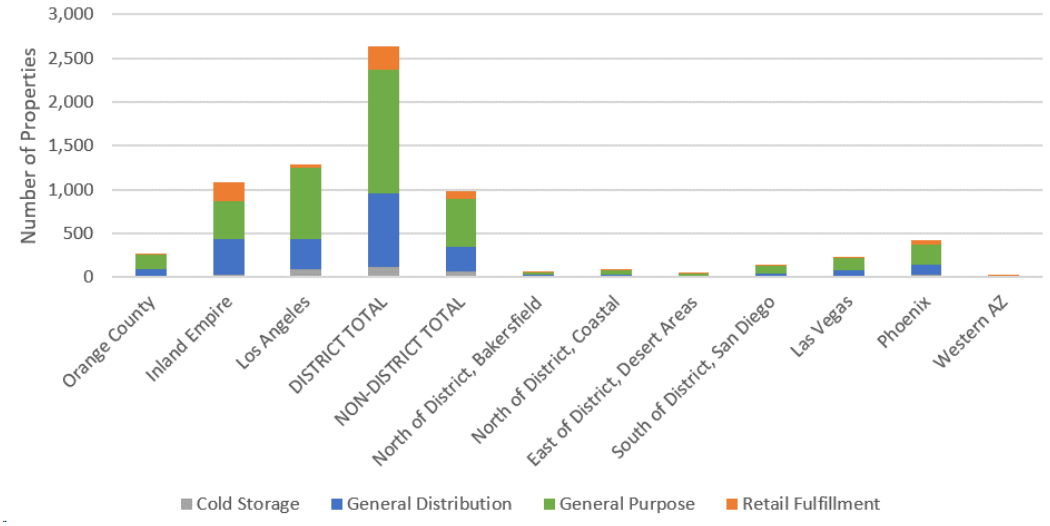
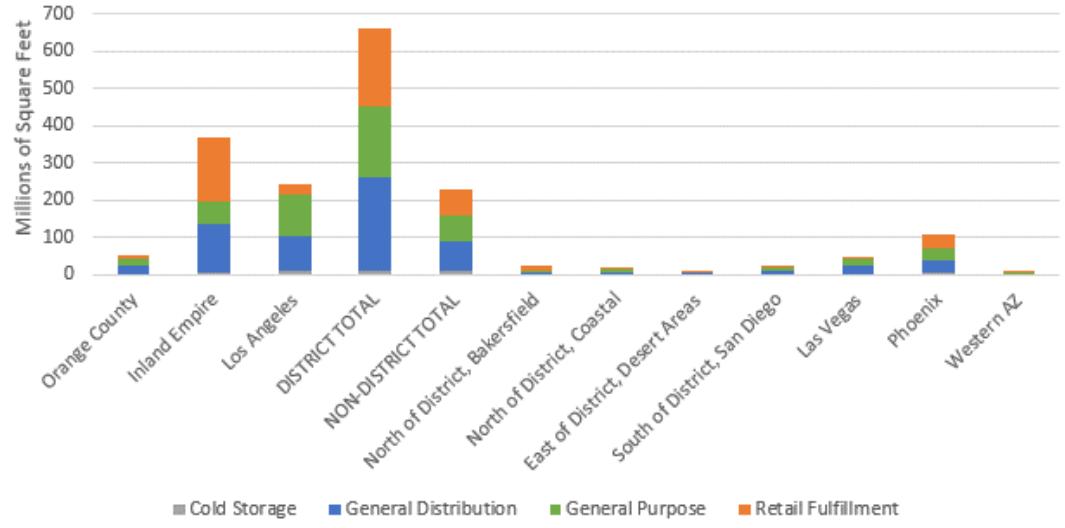


EXHIBIT ES-3. SQUARE FOOTAGE OF PROPERTIES BY MARKET & WAREHOUSE TYPE - YEAR 2019



[5] We also used the CoStar data to identify manufacturing facilities with warehouses. Based on our analysis of the CoStar data, there are 49 such facilities in the South Coast AQMD jurisdiction with an estimated 8.4 million square feet of warehousing space. Because manufacturing facilities require more specialized buildings and equipment, and would likely incur much higher moving costs, we assume manufacturing facilities will not relocate and therefore exclude them from the remainder of this analysis.

For each market area, Exhibit ES-4 presents the vacancy rates for warehouses with at least 100,000 square feet of floor space as of 2019. As shown in the exhibit, the non-South Coast AQMD vacancy rates are generally higher than the South Coast AQMD rates. These values, however, are sensitive to small samples within some of the defined markets, as evidenced by the high vacancy rates in the Western Arizona and San Diego markets. One out of the two retail fulfillment properties in both Western Arizona and San Diego has availability, resulting in the high rates seen in the table.

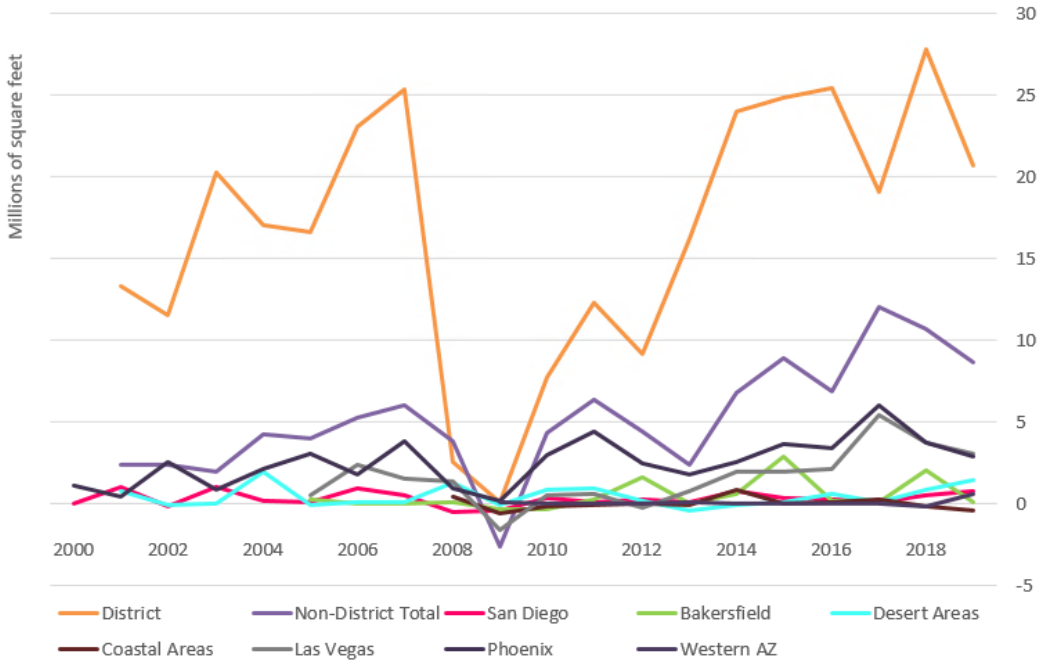
EXHIBIT ES-4. VACANCY RATES ACROSS MARKETS AND WAREHOUSE TYPE - YEAR 2019

GEOGRAPHIC AREA	GENERAL PURPOSE	GENERAL DISTRIBUTION	RETAIL FULFILLMENT	COLD STORAGE	TOTAL
District Total	4%	5%	5%	1%	4%
Orange County	4%	8%	14%	0%	7%
Inland Empire	5%	6%	5%	2%	5%
Los Angeles	3%	2%	4%	1%	2%
Non-District Total	7%	7%	11%	2%	8%
North of District, Bakersfield	6%	5%	4%	0%	4%
North of District, Coastal	3%	14%	0%*	0%	7%
East of District, Desert Areas	16%	8%	0%*	0%*	7%
South of District, San Diego	6%	7%	38%*	7%	7%
Las Vegas	3%	2%	5%	0%*	3%
Phoenix	9%	9%	15%	5%	11%
Western AZ	0%*	0%	39%*	0%	12%
Total	2%	5%	4%	7%	

* Categories with fewer than five properties.

To provide insights on the direction of each market, we also examine net absorption for warehouse space, defined as the total amount of space tenants moved into in a given time period less the amount of space tenants vacated during the same time period. Annual net absorption values in square feet are presented in Exhibit ES-5 for 2000 through 2019 for each market area. The non-District total line represents the sum of all outlying market net absorption, both positive and negative. Based on the data shown in Exhibit ES-5, the South Coast AQMD, Phoenix, and Las Vegas markets have steadily increased total occupied space year over year since 2009. The other outlying markets have less obvious growth patterns, with annual net absorption hovering around zero. At two points, in 2012 and 2017, growth in net absorption in the South Coast AQMD jurisdiction slowed relative to the prior years.

EXHIBIT ES-5. ANNUAL NET ABSORPTION ACROSS MARKETS - 2000-2019



Note: Due to data limitations, not all market areas have net absorption data extending back to 2000.

Exhibit ES-6 summarizes the pricing for warehouse space in the South Coast AQMD jurisdiction and outlying market areas, again focusing on properties with a building area of at least 100,000 square feet. At an average of $0.88 per square foot per month, the South Coast AQMD market overall has a higher rental price per square foot than its neighboring markets, with the exception of San Diego. This is driven by high prices in the Orange County and Los Angeles sub-markets, as rent in the Inland Empire is lower than in the other South Coast AQMD sub-markets. The Desert Areas and Coastal Santa Barbara, Ventura and San Luis Obispo (North of District, Coastal) follow closely behind the District average. Western Arizona, Bakersfield, and Phoenix have the lowest prices of $0.50 and below.[6]

Sale prices follow a similar trend to rental prices, with higher prices in urban areas. The non-District average is much lower than the South Coast AQMD value, which is more than three times higher at $1,087 per square foot.

[6] Small sample size is an issue in calculating average rent and sale price by market area. The average rents for the North of District, Bakersfield, East of District, Desert Areas, and Western AZ markets all rely on five or fewer properties in the calculation of these values. For average sale price, East of District, Desert Areas has fewer than five properties with data, while the Western AZ has no data. Focusing on the Non-District Average values in Exhibit 13 avoids this issue.

EXHIBIT ES-6. MONTHLY RENT AND SALE PRICES ACROSS MARKETS FOR WAREHOUSES WITH BUILDING AREA OF AT LEAST 100,000 SQUARE FEET - YEAR 2019

MARKET	AVERAGE RENTAL PRICE PER SQUARE FOOT	AVERAGE SALE PRICE PER SQUARE FOOT
South Coast AQMD Total	**$0.88**	**$1,087**
Orange County	$0.92	$503
Inland Empire	$0.70	$1,164
Los Angeles	$0.93	$1,173
Non-District Average	**$0.58**	**$344**
North of District, Coastal	$0.78	$100
North of District, Bakersfield^	$0.34	$105
East of District, Desert Areas*^	$0.81	$27
South of District, San Diego	$0.92	$225
Las Vegas	$0.63	$574
Phoenix	$0.50	$307
Western AZ*^	$0.32	No Data
Grand Average	**$0.71**	**$815**

*Denotes fewer than five properties with available sales data.

^Denotes fewer than five properties with available rent data.

MARKET TRENDS

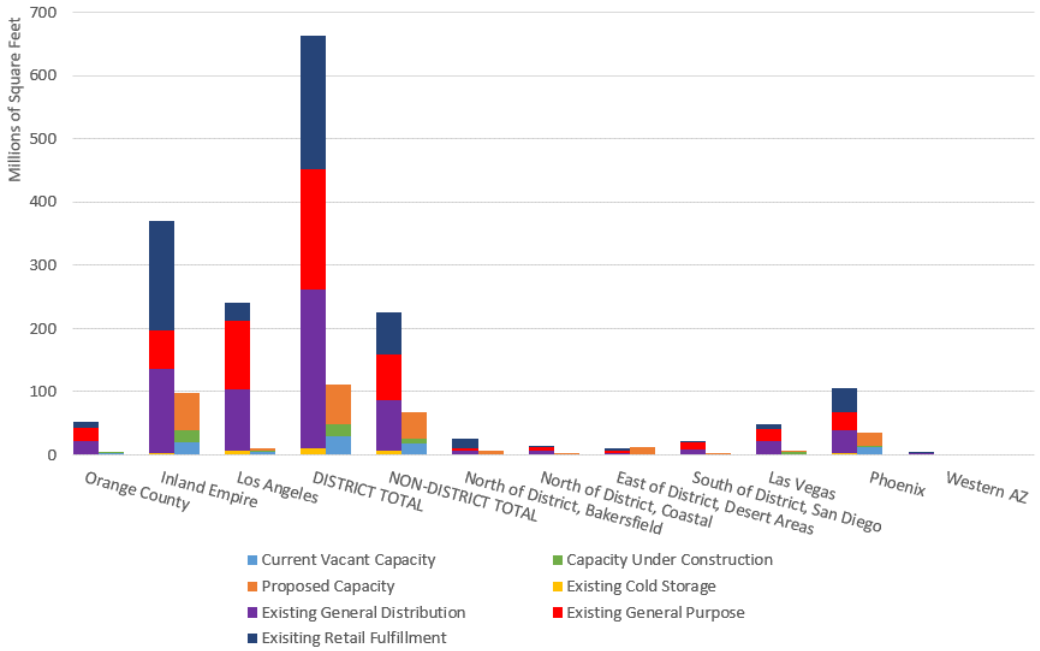
Using current property data as well as forecast data included with CoStar Analytics,™ we developed both medium- and long-term estimates of available capacity for warehousing operations. The long-term forecast estimates capacity additions and additional remaining development potential through 2028. The medium-term forecast considers capacity availability either available now or likely available within the next five years (assuming a five-year window for project approvals and construction). These estimates allow us to compare the projected capacity available in the non-South Coast AQMD areas to existing and projected inventory inside the South Coast AQMD jurisdiction.

To generate a **medium-term** capacity forecast, we examine current vacant capacity and new capacity proposed or currently under construction. Exhibit ES-7, which presents medium term available capacity alongside existing warehouse real estate capacity, shows most of the medium-term capacity available in the South Coast AQMD jurisdiction is in the Inland Empire, while most of the non-South Coast AQMD medium-term capacity is in the Phoenix; East of District, Desert Areas; Las Vegas; and North of District, Bakersfield markets.

Overall, Exhibit ES-7 shows current vacancies, new property under construction, and proposed construction are fairly limited relative to the current warehouse stock. The non-South Coast AQMD total of approximately 67 million square feet is only 10.1 percent of the size of the current capacity in the

SCAQMD jurisdiction: 662 million square feet. This indicates that in the medium term, the outlying real estate markets have the potential to absorb only a small piece of current South Coast AQMD warehousing operations.

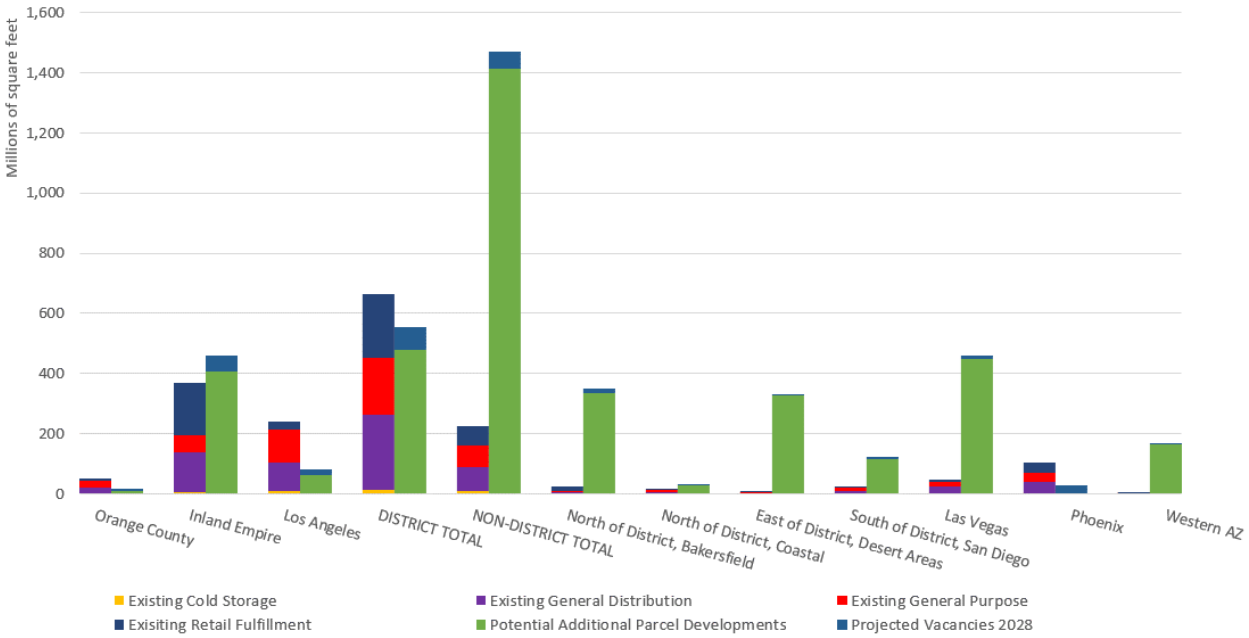
EXHIBIT ES-7. COMPARISON OF MEDIUM-TERM AVAILABILITY FORECAST WITH CURRENT 2019 INVENTORY



To assess capacity in the **long term**, we assess what we characterize as slack capacity. This metric reflects projected vacancies plus the square footage of warehouse space that could be developed on parcels zoned for industrial development and are within two miles of a major road. Exhibit ES-8 shows projected slack capacity and existing warehouse capacity for each market area. As shown in the exhibit, non-South Coast AQMD slack capacity is over twice as large as current South Coast AQMD capacity. The Las Vegas and Western AZ markets combined have enough slack capacity to theoretically absorb approximately all current warehousing operations in the South Coast AQMD jurisdiction, while the much closer East of District, Desert Areas and North of District, Bakersfield markets each have slack capacity larger than one-half of current warehousing capacity in the South Coast AQMD jurisdiction.

Overall, the comparisons in Exhibits ES-7 and ES-8 show projected developments alone would be insufficient to absorb a large portion of the warehouse space in the South Coast AQMD jurisdiction and any mass relocation would require significant warehouse development on currently vacant parcels.

EXHIBIT ES-8. COMPARISON OF ESTIMATED SLACK CAPACITY IN 2028 WITH CURRENT INVENTORY



ES.3 FACTORS AFFECTING WAREHOUSE LOCATION DECISIONS

To inform development of our analysis of potential warehouse relocation decisions, we obtained input from stakeholders on the factors affecting such decisions. We collected this information through a series of interviews with warehouse operators, beneficial cargo owners, manufacturers, and retailers. Key findings from this process were as follows:

- ***Regional Advantages:*** Multiple interviewees pointed to the transportation network within the South Coast AQMD jurisdiction as a major factor influencing their decisions to locate in the region. The many modes of transport within the region make it ideal for warehousing and goods movement. These include two major ports, two major railways, and extremely interconnected highways flowing through and out of California:
    - Ports: Port of Los Angeles, Port of Long Beach
    - Railways: Burlington Northern Santa Fe (BNF) Railway, Union Pacific Railway
    - Interstate Highways: I-5, I-10, I-15, and I-40.

  Interviewees also indicated labor is readily available in the area. Interviewees view this availability of labor as important for ensuring the smoothness of their operations. Finally, the proximity of customers receiving the goods (e.g., BCOs) and proximity of end consumers are clear regional advantages.
- ***Regional Disadvantages***: Despite the advantages above, industry stakeholders also identified several disadvantages associated with locating in the South Coast AQMD jurisdiction. They mentioned the burden state and local regulations put on smaller companies. Because margins in

the logistics sector are relatively small, absorbing additional regulatory costs arising along the supply chain is a challenge. Interviewees also indicated regulatory costs, combined with the costs of real estate and labor, make it difficult for them to remain in the region. One interviewee spoke of a customer moving their warehousing across the country because electricity is 1/6th of the cost as in Southern California.

- ***Locational Choices:*** We specifically asked interviewees about the factors that affect their location decisions. Their responses indicated the decision to move warehousing operations outside of the South Coast AQMD jurisdiction would be determined by the overall cost rather than by one factor alone. The main components affecting cost that interviewees mentioned were:
    - ***Transportation costs:*** If warehousing operations were moved outside the South Coast AQMD jurisdiction (farther from their customers), the transportation costs incurred by the industry would increase. Such costs include the cost of fuel, driver time, and wear and tear on vehicles.
    - ***Labor (cost & availability):*** Labor costs are high in Southern California, but labor is readily available here. Labor is scarcer outside the heavily populated South Coast AQMD jurisdiction, although the degree of scarcity outside the region varies by market. Stakeholders made specific mention of a shortage of truck drivers as baby boomers retire and are not replaced by younger drivers.
    - ***Real estate costs:*** Real estate costs are very high in this region and were a common concern across the stakeholders interviewed. Moving outside the region would reduce real estate costs but would increase transportation costs and finding labor may be more challenging.
    - ***Regulations***: As noted above, many interviewees indicated the regulatory burden associated with locating in the South Coast AQMD jurisdiction is high.

ES.4 OVERVIEW OF APPROACH FOR MODELING RELOCATION DECISIONS

To estimate the number of warehouses likely to relocate outside the South Coast AQMD jurisdiction as a result of the ISR, we compare the costs of relocation for a given warehouse with the costs of complying with the ISR and remaining in the South Coast AQMD jurisdiction. We assume a warehouse will relocate to an outlying market area if two conditions are met:

1. ***Cost condition:*** The annualized costs associated with relocating to at least one outlying market area are less than the annualized costs of ISR compliance, and
2. ***Capacity condition:*** In at least one of the market areas in which a warehouse would realize a cost savings relative to ISR compliance, sufficient capacity exists (measured in square footage of available warehouse space) to absorb the warehouse operation in question.

To determine whether the cost condition is met for a given warehouse, we consider ISR compliance costs for varying levels of stringency (as provided by South Coast AQMD staff) and the full costs associated with relocation to an outlying market area. Relocation costs include the following:

- changes in transportation costs;
- changes in rental costs for warehouse space;
- changes in labor costs;

- changes in electricity costs;
- moving costs; and
- development fees (applicable only for construction of new warehouse space in outlying markets).

We conduct the analysis based on ISR compliance costs and relocation costs annualized over 20 years, using both a four percent discount rate and one percent discount rate. We assume all costs are ultimately borne by warehouse operators.

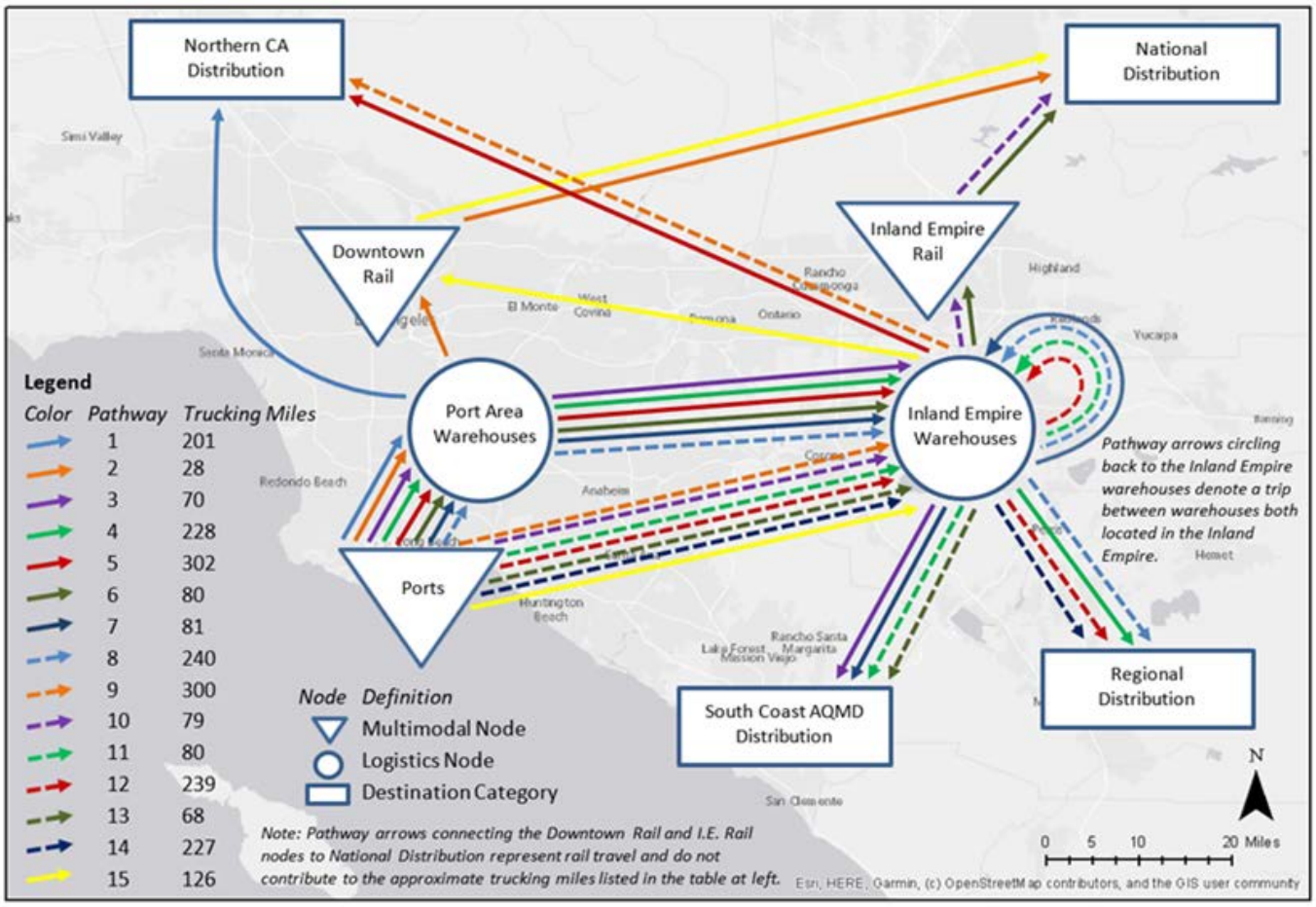
To determine whether the capacity condition described above is met, we rely on capacity data for each outlying market as obtained from CoStar and summarized in Exhibits ES-7 and ES-8 above. To ensure the analysis does not over commit capacity in the outlying markets (i.e., project relocations in an outlying market in excess of the capacity available prior to ISR implementation), our analysis simulates relocation decisions one warehouse at a time and updates the estimated capacity available in each outlying market based on these individual decisions. Thus the capacity available to the 100th warehouse examined reflects the relocation decisions of the first 99 warehouses.

Recognizing the complexity of the logistics industry and the uncertainty inherent in several key aspects of our analysis, we designed the analysis to generate low-end and high-end estimates of warehouse relocations. Specifically, our low-end and high-end estimates capture two sources of uncertainty. The first uncertainty relates to the routing of goods through the South Coast AQMD jurisdiction. Exhibit ES-9 shows the routes, or pathways, for the goods flow through the South Coast AQMD jurisdiction (excluding pathways that do not use warehouses). Although information is available on the aggregate distribution of goods across different routings through the South Coast AQMD jurisdiction, information on which warehouses serve which routes is not available. To account for this uncertainty, we conduct the analysis under two sets of routing assumptions (hereafter referred to as pathway scenarios):

1. ***Composite pathway scenario:*** Under this scenario, each individual warehouse is assumed to be representative of the warehousing sector in the South Coast AQMD jurisdiction as a whole, in terms of the goods routes (pathways) served. For example, if a given pathway accounts for five percent of the goods flow volume passing through the South Coast AQMD jurisdiction, five percent of the truck traffic through each individual warehouse is assumed to be on this pathway. Under this scenario, the change in transport distance associated with relocation to a given outlying market area is the same for all warehouses.
2. ***Specialized pathway sensitivity scenario:*** This scenario allows for the possibility that individual warehouses may specialize in pathways or serve a more limited number of pathways. Because we lack information on the specific pathway(s) a given warehouse is likely to serve, this scenario involves a series of iterative "what if" analyses. For nearly each iteration of the analysis, we assume all warehouses are on the same pathway. After running the analysis for each individual pathway, we calculate the weighted average of the resulting warehouse relocation estimates, using the goods volumes associated with each pathway as weights.[7]

[7] The exception to this approach is the Northern California pathways. For warehouses on these pathways, we assume that 40 percent of their goods are sent to Northern California, 30 percent remain in the South Coast AQMD jurisdiction, and the remaining 30 percent are distributed nationally. For additional detail, see Attachment 4 – Indirect Source Rule Relocation Model—Methodology.

EXHIBIT ES-9. FLOW OF GOODS THROUGH SOUTH COAST AQMD JURISDICTION



PATHWAY	SOUTH COAST AQMD LOGISTICS NODE 1	SOUTH COAST AQMD LOGISTICS NODE 2	SOUTH COAST AQMD LOGISTICS NODE 3	DESTINATION
1	Port Area	-	-	Truck to Northern California Distribution
2	Port Area	-	-	Downtown Rail to National Distribution
3	Port Area	Inland Empire	-	Truck to South Coast AQMD Regional Distribution
4	Port Area	Inland Empire	-	Truck to Non-District Regional Distribution
5	Port Area	Inland Empire	-	Truck to Northern California Distribution
6	Port Area	Inland Empire	-	Inland Empire Rail to National Distribution
7	Port Area	Inland Empire	Inland Empire	Truck to South Coast AQMD Regional Distribution
8	Port Area	Inland Empire	Inland Empire	Truck to Non-District Regional Distribution
9	Inland Empire	-	-	Truck to Northern California Distribution
10	Inland Empire	-	-	Inland Empire Rail to National Distribution
11	Inland Empire	Inland Empire	-	Truck to South Coast AQMD Regional Consumption
12	Inland Empire	Inland Empire	-	Truck to Non-District Regional Consumption
13	Inland Empire	-	-	Truck to South Coast AQMD Regional Consumption
14	Inland Empire	-	-	Truck to Non-District Regional Consumption
15	Inland Empire	-	-	Downtown Rail to National Distribution

Source: Derived from Robert C. Leachman, "Strategic Initiatives for Inland Movement of Containerized Imports at San Pedro Bay, University of California at Berkeley Institute of Transportation Studies, 2017.

The second source of uncertainty reflected in our low-end and high-end estimates is the capacity of outlying market areas to absorb warehouse space from the South Coast AQMD jurisdiction. Although information is available on the vacant capacity in each outlying market and new warehouse developments that have been approved, additional warehouses *could* be developed on undeveloped parcels of land zoned for industrial development. The degree to which such development will occur is uncertain. To account for this uncertainty, we conduct the relocation analysis under two capacity scenarios.

1. ***Medium-term capacity scenario***: Under this scenario, capacity available for relocation is limited to capacity projected to be available in the medium term. This includes current vacant capacity and new capacity proposed or currently under construction in the outlying market areas. This scenario assumes no new construction of warehouse space beyond what is already planned in the outlying market areas. It provides a reasonable representation of capacity until such time that new capacity developments can obtain approval and complete construction. This scenario specifies the lower-bound estimate of warehouse capacity in outlying markets. Exhibit ES-7 above shows the capacity values used under this scenario for each outlying market area.
2. ***Slack capacity scenario:*** This scenario reflects a more expansive view of the capacity that would be available for relocation. Such capacity includes projected warehouse vacancies as well as the warehouse space that could fit on all land that is (1) zoned for industrial development in the outlying market areas and (2) is within 2 miles of a major road. This measure of capacity represents an upper-bound estimate of warehouse capacity in outlying markets. The slack capacity values assumed for each outlying market area are illustrated in Exhibit ES-8 above.

Based on the methods summarized above and for each pathway and capacity scenario, we project the square footage of warehouse space likely to relocate from the South Coast AQMD jurisdiction. We convert this estimate to an estimated number of warehouses based on the average square footage per warehouse.

ES.5 ESTIMATES OF POTENTIAL WAREHOUSE RELOCATIONS

Following the approach outlined above, we estimated the number of warehouse relocations associated with a potential ISR under six compliance cost scenarios specified by South Coast AQMD staff, summarized in Exhibit ES-10.

EXHIBIT ES-10. ISR COMPLIANCE COST SCENARIOS ANALYZED

SCENARIO	COST PER SQUARE FOOT (YEAR 2019$)
Scenario 1	$0
Scenario 2	$0.50
Scenario 3	$1.00
Scenario 4	$1.50
Scenario 5	$1.75
Scenario 6	$2.00

Exhibits ES-11A through ES-11F summarize the estimated number of warehouse relocations for each of the ISR scenarios listed in Exhibit ES-10. For each ISR compliance cost scenario, the exhibits show the estimated number of relocations for each combination of pathway scenario and capacity scenario at a

discount rate of one percent.[8] The exhibits show the total number of relocations to all outlying markets, as well as the distribution of relocations across outlying markets. For example, Exhibit ES-11E shows 16 relocations when the ISR compliance cost is $1.75 per square foot under the specialized-pathway, slack-capacity scenario. Of the 16 relocations, six are to the North of District/Bakersfield market area.

The results in Exhibit 3ES-11 show we project up to 10 warehouse relocations when compliance costs are $0 per square foot, suggesting up to 10 warehouses in the South Coast AQMD jurisdiction may relocate in the absence of the ISR.

This result, in part, reflects the assumptions of the specialized pathway sensitivity scenario. For some iterations of this analysis we assume several warehouses are exclusively on pathways on which relocation is advantageous, even though they may not be on these pathways at all, or may simultaneously be on other pathways on which relocation is less advantageous. For this reason, we consider the specialized pathway sensitivity scenario results to be very conservative estimates of warehouse relocation.

In practice, the warehouses projected to relocate with $0/square foot in ISR compliance costs may be on multiple pathways that, when examined together, would not suggest warehouse relocation. This is borne out under the composite distance pathway scenario (i.e, when warehouses are assumed to serve all pathways in proportion to the goods flow on each pathway), as no warehouses are projected to relocate under this scenario when ISR compliance costs are $0 per square foot.

[8] We also conducted the analysis based on a discount rate of four percent, and the results, which are available upon request, are identical to those presented here.

EXHIBIT ES-11A. ESTIMATED WAREHOUSE RELOCATIONS - $0/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT 3 ES-11B. ESTIMATED WAREHOUSE RELOCATIONS - $0.50/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT ES-11C. ESTIMATED WAREHOUSE RELOCATIONS - $1.00/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT ES-11D. ESTIMATED WAREHOUSE RELOCATIONS - $1.50/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT ES-11E. ESTIMATED WAREHOUSE RELOCATIONS - $1.75/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	1	0	0	0	0	0	0	0
	Slack Capacity	1%	16	6	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT ES-11F. ESTIMATED WAREHOUSE RELOCATIONS - $2.00/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	1	0	0	0	0	0	0	0
	Slack Capacity	1%	16	6	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

While the 10 warehouse relocations projected under the $0 ISR compliance cost scenario may suggest several warehouses will find it advantageous to relocate in the absence of the ISR, we do not currently observe such relocations occurring. This reflects the fact that the results in Exhibits ES-11A through ES-11F likely overstate relocations under the $0 per square foot ICR compliance cost scenario as well as scenarios with costs greater than $0. This overestimation of relocations is likely due to several factors we are not able to capture quantitatively in our analysis, including, but are not necessarily limited to, the following:

- ***Labor availability***: In many of the outlying markets, the labor force is significantly smaller than in the South Coast AQMD jurisdiction. With a smaller labor pool to draw from, warehouse operators may be reluctant to commit to relocation. Thus, it might be more costly to find a capable workforce in the outlying markets.
- ***Proximity to customers:*** While our analysis captures the transportation cost impact of relocating, the value of proximity to customers may go beyond the change in transportation costs. For example, proximity is important for meeting customer expectations/demands with respect to delivery time.
- ***Risk of warehouse development in outlying markets:*** Most of the warehouse relocations projected by our analysis are under the slack capacity scenario, under which land zoned for industrial use may be developed into warehouse space. Although land is available in most outlying markets to develop warehouse space, warehouse developers may find such investments too risky to pursue.

  Other than potential demand from warehouse operators relocating from the South Coast AQMD jurisdiction, warehouse owners would have limited clientele to support significant growth in the warehouse sector in these outlying markets. If market conditions were to change in the South Coast AQMD jurisdiction after development of the ISR, warehouse operators may move back after their lease ends, leaving owners of newly constructed warehouses in the outlying markets with no source of revenue. Due to this risk, investors may be reluctant to build new warehouse space in these markets.
- ***Barriers to warehouse development in outlying markets:*** Large-scale warehouse developments in the outlying market areas may encounter resistance in obtaining project approval. Local planning boards and the residents who they represent may seek to limit the number of warehouse developments due to concerns about increased truck traffic, the aesthetic impacts of multiple warehouse developments, or other concerns.

Because relocations are projected under the $0 ISR compliance cost scenario, possibly due to the factors outlined above, we estimate relocations for each ISR compliance cost scenario as the difference between relocations for that scenario and relocations projected when ISR compliance costs are zero. For example, with ISR compliance costs of $1.75 per square foot under the specialized pathway sensitivity scenario and the slack capacity scenario, we estimate six warehouse relocations (16 relocations as presented in Exhibit ES-11E less 10 relocations as presented in Exhibit ES-11A). Applying this approach, Exhibit ES-12 presents the number of relocations incremental to those projected with an ISR compliance cost of $0 per square foot.

EXHIBIT ES-12. WAREHOUSE RELOCATIONS, INCREMENTAL TO RELOCATIONS WITH ISR COSTS OF $0 PER SQUARE FOOT

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
ISR Compliance Costs of $0.50 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.00 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.50 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.75 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	6	6	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $2.00 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	6	6	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

As shown in Exhibit ES-12, the incremental number of warehouse relocations varies from none when ISR costs are $0.50 per square foot to as high as six when ISR costs are $2.00 per square foot. Notably, no relocations are projected under the medium-term capacity scenario (when capacity in outlying markets is limited to current vacant capacity and new capacity proposed or currently under construction), incremental to the $0 per square foot ISR compliance cost scenario. This reflects the more limited capacity available under this scenario.

As context for the results presented in Exhibit ES-12, we estimate that 2,687 warehouses are likely to be affected by the ISR.[9] Thus, the projection of up to six warehouses relocating represents 0.2 percent of the universe of affected warehouses.

Our analysis also projects no warehouse relocations under the composite pathway scenario (i.e., when each warehouse is assumed to serve all 15 goods flow pathways). This finding is true both incremental to the $0 ISR compliance cost scenario (results in Exhibit ES-12) and for each scenario individually, prior to netting out the relocations projected when ISR compliance costs are $0 per square foot (results in Exhibits ES-11A to ES-11F).

The lack of relocations under the composite pathway scenario reflects the significant increase in transport distance for some pathways. Because the composite scenario models relocation based on the weighted average change in distance across all pathways, a significant increase in distance for a small number of pathways that account for a large portion of the goods flow drives up the weighted average change in transport distance such that the increased transportation costs associated with relocation outweigh any cost savings. For example, while relocation to the Bakersfield market area may reduce transport distance slightly for some pathways, transport distance increases by more than 130 miles one-way for pathway 2 and more than 245 miles for pathway 13; together these pathways account for approximately 39 percent of the goods flow volume.

Exhibit ES-12 shows most warehouse relocations, incremental to the $0 per square foot ISR compliance cost scenario, are concentrated in the Bakersfield area under the specialized pathway sensitivity scenario and the slack capacity scenario. This result is driven by the lower rental costs in the Bakersfield area ($4.03 per square foot per year) relative to the South Coast AQMD jurisdiction ($10.61 per square foot per year).[10] While transportation costs will increase if warehouses relocate to the Bakersfield area, the increase is small enough for one pathway that the rental cost savings are sufficient to yield a cost savings for this pathway.

This concentration of relocations in the Bakersfield area differs slightly from the results shown in Exhibits ES-11A through ES-11F, which are *not* incremental to the $0 per square foot ISR compliance cost scenario. Although those results show a significant concentration of relocations in the Bakersfield area, they show a greater number of warehouses relocating to the Desert Areas. Because the relocations to

[9] This figure reflects the sum of non-manufacturing warehouses and warehouses at manufacturing facilities as presented in Attachment 2 of this report.

[10] Rent values obtained from CoStar, as summarized in Attachment 2 of this report. Additional information on the costs considered in the analysis is available in Attachment 4 of this report.

the Desert Areas are projected when ISR compliance costs are $0 per square foot, they are netted out of the relocations reflected in Exhibit ES-12.

ES.6 LIMITATIONS AND UNCERTAINTIES

The results presented above provide a reasonable representation of the warehouse relocations that may occur in response to the ISR and reflect the best information available on the factors that are likely to affect relocation decisions. Nevertheless, we acknowledge the analysis is subject to several uncertainties, the most significant of which we are aware are summarized in Exhibit ES-13.

EXHIBIT ES-13. KEY UNCERTAINTIES AND IMPLICATIONS FOR RESULTS

DESCRIPTION OF UNCERTAINTY	IMPLICATIONS FOR RESULTS
Pathway uncertainty: This analysis relies on the concept of goods flow pathways to estimate the change in transportation distance associated with warehouse relocation. However, we do not know the pathways that individual warehouses serve. Absent such information, the pathway scenarios described above (i.e., composite pathway scenario and specialized pathway sensitivity scenario) provide a means of bounding the estimated number of relocations to account for this uncertainty.	Estimating the number of warehouse relocations under two pathway scenarios leads to a wide range of results. Whether the likely number of relocations is closer to the low end or high end of the range depends on the degree to which warehouse operations are more consistent with the composite scenario (warehouses serve all goods flow pathways) or the specialized pathway sensitivity scenario (warehouses specialize in individual pathways).
Unquantifiable factors: Our assessment of relocation decisions accounts for all factors that we are able to quantify with readily available data, specifically data related to the costs associated with remaining in the South Coast AQMD jurisdiction or relocating to an outlying market area. A number of factors that we are unable to quantify, however, may influence relocation decisions. These include (1) the degree to which labor availability in outlying markets affects the decisions of warehouse operators, (2) advantages of being in close proximity to customers, (3) financial risks associated with developing warehouse space in outlying markets, and (4) barriers to developing warehouse space in outlying market areas.	Many of these unquantifiable factors represent reasons why warehouse operators may want to remain in the South Coast AQMD. This suggests that our analysis may overestimate the number of warehouses that decide to relocate outside the area.
Assumption of no change in goods flow traffic: An implicit assumption of our analysis is that the volume of goods flowing through the South Coast AQMD jurisdiction would remain unchanged as a result of the rule. In practice it is possible the ISR could lead to a reduction in the volume of goods flowing through the region (e.g., through a reduction in import traffic at the Port of Long Beach). This reduction in volume could lead to warehouse relocation (e.g., to the port areas where goods are sent instead of the Port of Long Beach). Our analysis does not capture this effect.	To the degree goods are diverted away from the South Coast AQMD jurisdiction due to the ISR, we may underestimate the number of warehouse relocations.

DESCRIPTION OF UNCERTAINTY	IMPLICATIONS FOR RESULTS
Rents held constant: For the purposes of simulating the relocation decision-making process of warehouse operators, we held warehouse rents in the South Coast AQMD jurisdiction and in outlying markets constant at current levels. To the extent rent differences between the South Coast AQMD jurisdiction and outlying markets change over time, we may not accurately capture the relocation decisions of warehouse operators.	Absent knowledge of the degree to which relative rents are likely to change over time, we find it highly speculative to take a stance on whether the assumption of constant rents leads to underestimation or overestimation of relocations. However, the relocation of warehouses outside the SCAQMD jurisdiction could put upward pressure on rents in outlying markets and downward pressure on rents in the South Coast AQMD jurisdiction. Combined, these effects would narrow the difference between rent in the South Coast AQMD jurisdiction and less costly outlying markets, potentially limiting the number of warehouse relocations.

ATTACHMENT 1

TECHNICAL MEMORANDUM ON WAREHOUSING AND LOGISTICS INDUSTRY IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT JURISDICTION

MEMORANDUM | 30 November 2020

TO Ian MacMillan, Paul Stroik, Shah Dabirian, and Victor Juan, South Coast Air Quality Management District (SCAQMD)

CC Jason Price, Industrial Economics (IEc)

FROM Jasna Tomic and Kelly Leathers, CALSTART

SUBJECT Technical Memorandum on Warehousing and Logistics Industry in the South Coast Air Quality Management District Jurisdiction

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INTRODUCTION

This memorandum is in support of the South Coast Air Quality Management District (South Coast AQMD) staff's development of a potential indirect source rule (ISR) to reduce mobile source emissions related to the operation of logistics and warehousing facilities in the South Coast AQMD's four-county region (Los Angeles, Orange, Riverside, and San Bernardino counties, as shown in Exhibit 1).[1]

Diesel truck traffic, largely related to the transport of goods passing through the Ports of Los Angeles and Long Beach and regional warehouses and distribution centers, makes up a large share of local NO_x emissions. A warehouse ISR, if adopted, may help with reducing emissions from trucks servicing warehousing facilities located within its jurisdiction.

Compliance costs to the warehousing sector could vary depending on the design of an eventual rule. If these costs are significant, the implementation of an ISR could potentially precipitate the relocation of warehousing operations outside the region—with the associated truck fleets continuing to travel to and from facilities in the South Coast AQMD jurisdiction. In the worst-case scenario, the associated air quality benefits from such a rule might be greatly diminished. Accordingly, South Coast AQMD is interested in identifying and understanding the factors affecting whether logistics and warehousing operations are likely to relocate as a result of the potential rule.

The purpose of this document is to develop a better understanding of the logistics and warehousing sector in the South Coast AQMD jurisdiction. The first part of this document reviews the categories of warehouse and distribution center facilities found in the logistics industry and provides brief descriptions of the operations characterizing each category. The second part focuses on understanding the factors affecting the location decisions of these facilities and the trends affecting the logistics industry in this region. This information is based on interviews with several industry stakeholders identified by CALSTART and/or South Coast AQMD.

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[1] The South Coast AQMD jurisdiction is comprised of all of Orange County and parts of Los Angeles, Riverside and San Bernardino Counties. The region is mapped and described in full in Exhibit 1 and the "Geographic Scope" section below.

EXHIBIT 1: SOUTH COAST AQMD JURISDICTION

This assessment of the South Coast region's logistics and warehousing industry builds on the 2018 warehousing report released by the Southern California Association of Governments (SCAG). Similar to the SCAG report, the assessment in this document identifies and describes the various segments of the logistics and warehousing industry. This document's additional focus on the location decisions of logistics and warehousing facilities will help South Coast AQMD better understand the likelihood of logistics and warehousing operations relocating to neighboring regions as a result of an ISR.

This assessment builds upon the High-Cube Warehouse Vehicle Trip Generation Analysis prepared for South Coast AQMD and the National Association of Industrial and Office Properties, which describes characteristics of "high-cube warehouses" (HCW) and the trips generated at each facility type. The HCW study provides insights on the traffic associated with each type of HCW.

CATEGORIES OF WAREHOUSE AND LOGISITICS FACILITIES

We define warehouse categories primarily based on the SCAG 2018 report, supplemented with additional references and confirmed by information collected during interviews with industry stakeholders. The following are the main categories of facilities:

1) General Purpose Warehouse
    a. Port-Related
    b. Non-Port-Related
2) Transload Facility
3) Cross-dock Transload Facility
4) Truck Terminal for Less-Than-Truckload Trucks
5) General Purpose Distribution Center
6) Manufacturing & Distribution Facility
7) Retail Fulfillment Center
8) Cold Storage

All of these categories are listed in the SCAG 2018 report. Each warehousing facility is characterized by the operations that occur within that facility and size and layout of the facility, as summarized in Exhibit 2.

General Purpose Warehouse (GPW) is the most common type of facility used to store goods. The majority of general purpose warehouses are operated by logistics service providers or third-party logistics providers (LSP or 3PL), which offer a wide array of services. While the primary function of a GPW is to store goods that usually have not been sold yet, value-added services like barcode application and scanning, ticketing and labeling, and carton packing are also provided at these facilities. Goods can stay at a GPW anywhere from several weeks to several months.

> **Port-related General Purpose Warehouses** are in commercial and industrial clusters. Port-related import products include international manufactured or processed goods, such as textiles and apparel, footwear, electronics, and home and office supplies.
>
> **Non-Port-Related General Purpose Warehouses** tend to be dispersed throughout the region. They store domestic products, which may include domestically manufactured, harvested, or processed goods, such as chemicals, minerals, pharmaceuticals, agricultural products, and other food products.

Transload Facilities are special purpose port-related facilities that mainly deal with imported products. Transloading refers to the transfer of contents from marine containers (40 ft) into domestic rail or truck containers or trailers (53 ft) near a US gateway port for onward movement to an inland destination. Cargo is transferred based on the destination, specified by the beneficial cargo owner (BCO). Transloading reduces the per-unit cost of inland transportation for importers. The turnaround time for these facilities is usually up to one week.

Crossdock Transload Facilities are a special type of transload facility that handles cargo for export, import, or domestic cargo. While structurally similar to transload facilities, they differ from transload facilities in that they are pure distribution facilities, with no storage. In addition, time from receipt to shipment at crossdock facilities is less than 24 hours, and goods generally leave these facilities in full truckloads.

Truck Terminals for Less-Than-Truckload (LTL) Trucks are facilities used to transfer mainly domestic and imported cargo in small order quantities. They are operated by a motor carrier to transfer the less-than-truckload shipments from one truck to another. Sorting and segregation of inbound cargo takes place to make one outbound LTL truck and typically cargo is not stored for long at these facilities (up to 1 week). The outbound LTL trucks contain orders meant for multiple customers within a limited geographical area, while full truckloads are filled with cargo designated for one customer.

General Purpose Distribution Centers (DCs) are warehouses operated by BCOs, or outsourced to LSPs, to manage storage and distribution of inventory for their customers. Distribution centers store product for retailers and wholesalers to be redistributed to another location or directly to the consumer. DCs are positioned strategically to maximize the range of customers they can serve and keep delivery costs low. Turnaround time varies depending on cargo type and demand but is generally shorter than in a GPW, on

the order of weeks. The flow of product is very large, and each order may contain hundreds or thousands of items.

Retail Fulfillment Centers are special-purpose DCs that have become much more common in the supply chains of large retailers. Typically, DCs replenish store stock and ship to retailer stores, while retail fulfillment centers process individual consumer orders placed through catalogs and the internet, replenish store inventory from the stock on hand, and serve local retail customers.

Manufacturing and Distribution Facilities are more complex facilities consisting of onsite manufacturing, warehousing, and distribution. At least 50 percent of the area is dedicated to manufacturing. The smallest part of the facility is dedicated for office space, no more than 10 percent, and the remaining is taken up with warehouses and distribution facilities.[2] Separate warehouses are dedicated for incoming raw materials and for finished goods. The raw materials or products are stored in the warehouses from 2 weeks to 90 days.

Cold Storage Facilities are functionally identical to regular distribution centers, except with two important differences: all products must be either refrigerated or frozen, and the turnaround time is very short to ensure freshness. Refrigerated facilities will produce a substantial amount of emissions compared to other facility types due to the refrigeration units. Truck refrigeration units (TRUs) also produce a substantial amount of emissions. This type of distribution center uses the same strategy as regular distribution centers, and overall reduce the number of LTL trucks driving from a vendor to a retail store.

Several additional subcategories are worth mentioning that are specialized cases of the categories above or a hybrid solution.

Parcel Hubs are a unique hybrid of a transload facility and a distribution center. Starting with either a mail carrier or the company's retail store, small packages are sent to a regional parcel hub and sorted by destination. The parcels are consolidated onto a pallet and shipped to another parcel hub near the package's destination. The pallets may pass through a dedicated transloading facility near an airport or shipped directly via a class 8 truck.

E-commerce Fulfillment Center are specialized DCs that support online orders. The facilities process a large number of individual consumer orders placed through the internet. Orders are generally small (1-3 items) and are filled and shipped within hours. Proximity and easy access to highways is important to accommodate the large number of delivery vehicles accessing the facility. E-commerce fulfillment facilities have different operations inside the facility ("each picking" vs "case picking"). Costco and Sam's Club have extremely efficient operations because they don't have to break down pallets and ship them out, instead they just ship the whole pallet and then break the pallet down in the store. E-commerce fulfillment centers are breaking down cargo into tiny individual pieces of product and shipping them out.

[2] Yap and Circ (2003).

EXHIBIT 2: WAREHOUSING FACILITIES[3, 4, 5]

Warehouse Category	Description of Facility	Building Location
General Purpose Warehouse	The typical area is 25,000 to 50,000 sq. ft., with low-ceiling height, and varying width.	Not Specific
Transloading Facility	The typical area is 25,000 to 50,000 sq. ft., with low-ceilings, and a narrow rectangular shape with multiple doors on the long side. One side is meant for inbound containers and the opposite is meant for outbound containers.	Depends on Proximity to Ports
Crossdock Transload Facility	The typical area is 25,000 to 50,000 sq. ft., with low-ceilings, and a narrow rectangular shape with multiple doors on the long side. One side is meant for inbound containers and the opposite is meant for outbound containers.	Depends on Proximity to Ports
Parcel Hub	The typical area can be up to 500,000 sq. ft.	Depends on Proximity to Market
Truck Terminal for Less-Than-Truckload Trucks	The typical area is anywhere from 25,000 sq. ft. to 150,000 sq. ft., with low-ceilings. It's usually narrow and long with multiple doors to quickly and efficiently process cargo.	Not Specific
General Purpose Distribution Center	The building size can vary greatly depending on the distributer, ranging from 50,000 sq. ft. to 500,000 sq. ft. and are generally very tall.	Depends on Proximity to Market
Manufacturing & Distribution	The size can range from 200,000 sq. ft. to 1,000,000 sq. ft. or more depending if light or heavy manufacturing.	Not Specific
Retail Fulfillment Center	The area ranges from 500,000 sq. ft. to 1,000,000 sq. ft., with very high ceilings to accommodate the automated pick and pack technology.	Depends on Land Availability
E-commerce Fulfillment Center	Square footage varies.	Depends on Proximity to Market
Cold Storage Facility	The building size depend on demand and turn over time.	Depends on Proximity to Market

[3] SCAG Report (2018)

[4] UC Davis Sprawl Report (2017)

[5] High-Cube Warehouse (2016)

PRIORITIES AND TRENDS AFFECTING THE REGIONAL LOGISTICS INDUSTRY

To gather input from stakeholders on the factors affecting the location decisions of facilities as well as general trends affecting the industry, we conducted a series of structured interviews of various industry stakeholders. The following section details the interview process, which included identifying industry stakeholder contacts, preparing questions designed to obtain relevant information, and the input provided by stakeholders.

IDENTIFICATION OF STAKEHOLDERS

South Coast AQMD and CALSTART first developed a list of stakeholder contacts as interview candidates. The warehousing and logistics industry is an extremely complicated and multifaceted industry with diverse stakeholders. To ensure our understanding of stakeholder priorities reflected this diversity, we specified four classifications of stakeholders to interview.

The first category encompassed warehouse operators, third-party logistics companies, and freight forwarders, described as "3PL/Warehouse Operators" in Appendix A. These stakeholders specialize in goods movement and supply chain operations.

The second category are retailers, defined as individuals or organizations that purchase products from a manufacturer or distributor and resell the goods to consumers. Retailers encompass a wide array of businesses from small corner stores to Walmart and door-to-door companies to Amazon.[6]

The third category are beneficial cargo owners (BCO), a term that refers to an importer that takes control of the cargo at the point of entry and does not utilize a third-party source like a freight forwarder or 3PL. However, the term BCO is often used much more broadly to refer to the owner of the cargo in a container or trailer.

The fourth category is manufacturing facilities with warehouse space onsite. As goods come off the production line, most manufacturers temporarily store goods in warehouse space onsite.

Exhibit 3 lists the eleven companies we have interviewed to date. Note some of the contacts fall under multiple classifications. For example, some retailers handle each operation along the supply chain, while some retailers outsource each operation.

[6] Supply Chain and Logistics Terms and Glossary. International Warehouse Logistics Association. (2010)

EXHIBIT 3: INTERVIEWEE CLASSIFICATIONS

COMPANY NAME	3PL/ WAREHOUSE OPERATOR	RETAILER	BENEFICIAL CARGO OWNER	MANUFACTURER
Pacific Mountain Logistics	x			
NFI	x			
Dependable Highway Express (DHE)	x			
California Retailers Association		x		
PepsiCo/FritoLay	x		x	x
Walmart	x	x	x	
Sysco	x			
TForce	x			
UPS	x			
Allen Lund Company	x			
Snak King	x		x	x

DEVELOPMENT OF INTERVIEW QUESTIONS

The interview questions were developed with collaboration between CALSTART, IEc, and South Coast AQMD (see Appendix B). After the questions were completed, we contacted individual stakeholders via e-mail and/or phone to schedule interviews with the willing participants. The interview process consisted of a 30- to 60-minute conversation depending on the engagement of the interviewee.

FINDINGS

Stakeholders expressed concern with the costs associated with the location of their operations but were keenly aware of the advantages and disadvantages of remaining in the South Coast AQMD jurisdiction. They also made clear to us the term “warehouse” is not an all-encompassing term for all the facilities described above. They refer to each facility specifically by the names given. Warehouse operators/3PLs were our most responsive interviewees; only one retailer was able to speak with us; two of the interviewees were manufacturers, and we were unable to interview a stakeholder that acted exclusively as a BCO.

REGIONAL ADVANTAGES

Multiple interviewees pointed to the transportation network within the South Coast region as a major factor influencing their decisions to locate in the region. The many modes of transport within the region make it ideal for warehousing and goods movement. These include two major ports, two major railways, and extremely interconnected highways flowing through and out of California:

- Ports: Port of Los Angeles, Port of Long Beach
- Railways: Burlington Northern Santa Fe (BNF) Railway, Union Pacific Railway
- Interstate Highways: I-5, I-10, I-15, and I-40

Interviewees also indicated that labor is readily available in the area. Interviewees view this availability of labor as important for ensuring the smoothness of their operations. Finally, the proximity of customers receiving the goods (e.g., BCOs) and proximity of end consumers are clear regional advantages.

REGIONAL DISADVANTAGES

Despite the advantages above, industry stakeholders also identified several disadvantages associated with locating in the South Coast region. They mentioned the burden that state and local regulations put on smaller companies. Because margins in the logistics sector are relatively small, absorbing additional regulatory costs arising along the supply chain is a challenge. Interviewees also indicated regulatory costs, combined with the costs of real estate and labor, make it difficult for them to remain in the region. One interviewee spoke of a customer moving their warehousing across the country because electricity is $1/6^{th}$ of the cost as in Southern California.

LOCATIONAL CHOICES

As indicated in the interview questions shown in Appendix B, we specifically asked interviewees about the factors that affect their location decisions. Their responses indicated the decision to move warehousing operations outside of the Southern California region would be determined by the overall cost rather than by one factor alone. The main components affecting cost that interviewees mentioned were:

- ***Transportation costs:*** If warehousing operations were moved outside the South Coast AQMD jurisdiction (farther from their customers), the transportation costs incurred by the industry would increase. Such costs include the cost of fuel, driver time, and wear and tear on vehicles.
- ***Labor (cost & availability):*** Labor costs are high in Southern California, but labor is readily available here. Labor is scarcer outside of the heavily populated South Coast AQMD jurisdiction, though the degree of scarcity outside the region varies by market. Stakeholders made specific mention of a shortage of truck drivers as baby boomers retire and are not replaced by younger drivers.
- ***Real estate costs:*** Real estate costs are very high in this region and were a common concern across the stakeholders interviewed. Moving outside the region would reduce real estate costs but would increase transportation costs and finding labor may be more challenging.

- ***Regulations***: As noted above, many interviewees indicated the regulatory burden associated with locating in the South Coast jurisdiction is high.

The bottom line that determines moving is the total cost of operations ("it's all math", to quote one interviewee) and the costs weighed against the benefits of moving to a new location.

Benefits of staying in the region:

- Close to customers
- Access to highways, railways, and ports
- Readily available labor

Issues with staying in the region:

- Challenging regulatory climate
- Expensive real estate
- High labor costs

Benefits of leaving the region:

- Less regulation
- Lower real estate costs
- Lower labor cost

Issues with leaving the region:

- Higher transportation cost
- Less readily available labor
- Less attractive to customers because of the distance from region

3PL/GENERAL WAREHOUSE OPERATORS

The movement of goods is an extremely complicated process and is executed by many entities working together to move goods. Due to the complexity of modern logistics, some companies outsource goods movement to freight forwarders or third-party logistics firms. The operations of warehousing and logistics facilities vary depending on the:

- characteristics of the goods – number of products, their size, and turnover rates;
- customers' preferences;
- facility throughput and services provided; and
- type and size of facility.

Large 3PL firms offer every service along the supply chain, such as freight forwarding, delivery, storage, etc. Customers rarely choose one company to perform every service and instead look for diversity within their supply chain movement to ensure they receive the best prices.

3PLs/freight forwarders and warehouse facilities operators sometimes manage multiple types of facilities. If they have operations near the ports, they typically operate crossdock facilities. They may also have operations further inland, where they operate larger general-purpose warehouses (GPW). One interviewee described the warehouse sector as a 30 percent/30 percent/30 percent/10 percent mix of dry, refrigerated, frozen, and office space, respectively.

The 3PLs with whom we spoke indicated their decisions regarding location are complex. While location and costs are important factors when considering a warehousing facility, location requirements differ across facility types (i.e. crossdock/transloading facilities are typically near ports and railways). Facilities housing goods with longer turnover times

(*e.g.* goods that don't expire: electronics, toys, household items) can be farther away, but locations close to ports, highways, and railways are usually preferred. For handling imports, 3PLs typically prefer to be in Los Angeles because the goods will travel shorter distances and spend less time sitting in trucks or in warehouses. Consistent with the discussion above, 3PLs consider a variety of costs in addition to the cost of real estate (rent), such as labor costs and the costs of transporting goods.

BENEFICIAL CARGO OWNERS

As noted above, we were unable to interview any BCOs to support the development of this memo. However, because transportation costs are cited as the dominant factor accounting for more than half of total cost of logistics (followed by inventory costs at 20 percent),[7] BCOs may favor location of distribution facilities at a higher cost if they are in close proximity to intermodal facilities and will help decrease the overall transportation costs of goods.

MANUFACTURERS

We spoke to two manufacturers, both in the food and beverage industry. For manufacturing facilities, especially larger ones, the location is determined by the proximity of rail as some raw materials are shipped by rail. The proximity to retail stores and to mega warehouses is also very important. In the past, delivery went to big stores while more recently products are delivered to mega warehouses before reaching retail and end customers. Both manufacturing facilities have been in the same locations for several decades and moving was not under consideration, as relocation would involve moving specialized manufacturing equipment, which would pose many challenges. With respect to the space at manufacturing facilities, one facility indicated that much more than 50 percent of its space is dedicated to manufacturing. Of 220,000 square feet in total, 160,000 square feet is for the manufacturing floor, 30,000 square feet is a warehouse for finished product, 15,000 square feet is for a raw material warehouse, and 15,000 square feet is the corporate office.

RETAILERS

The retailers with whom we spoke emphasized that the retail industry is changing dramatically and that these changes will affect the warehousing landscape in the region. The rise of e-commerce is leading to a boom in online shopping. Online shopping primarily occurs in two ways: the consumer orders the product online, then they either have it shipped to their home or they pick it up in store. With the rise of e-commerce, many retailers are slowly transitioning from store fronts to warehouses. Warehouses allow retailers to hold more product for the consumers at a lower cost than the storefront. This gives the consumers more choice in product than if they were shopping in a store. This is not necessarily changing the amount of product sold but is instead changing the way products are sold and delivered.

Retailers have historically chosen warehouse locations based on proximity to their retail stores, but this is changing now with the rise of e-commerce. Retailers are not only shipping to their storefronts but also to mega warehouses -warehouses larger than 1

[7] The Geography of Transport Systems, Ch 11 – Applications and Case Studies, https://transportgeography.org/?page_id=6517

million square feet. These mega warehouses are operated by companies like Amazon, and retailers ship some of their goods to these warehouses to be sold by Amazon. Thus, retailers are now concerned not only about warehouse proximity to their retail stores, but also proximity to the "mega warehouses." In the context of an ISR affecting the warehousing sector, this suggests retailers' responses regarding warehouse location will depend, in part, on how mega warehouses respond to an ISR.

One stakeholder commented about regulations affecting retailers and the difficulties regulation poses for the siting and construction of warehouses in California. While the need for additional warehouse space exits, the stakeholder suggested the costs and delays associated with regulation are a significant impediment to warehouse development in the region. The stakeholder, however, did not provide details on the specific regulations that cause these costs/delays. Due to the high cost of operating in California, the stakeholder sees this industry growing in Reno.

TRANSFORMING INDUSTRY TRENDS

Multiple interviewees expressed that the industry is in flux and that over the next ten years significant changes to the logistics supply chain will occur. With the rise of e-commerce, automation, and the increased need for final mile delivery, companies are trying to plan for these changes. In addition, some of the bigger companies have sustainability goals in place, including fleet electrification and warehouse facility upgrades.

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APPENDIX A – INTERVIEWEES

Interviewed	Business Type	Company Name	Name
YES	3PL/General Warehousing	Pacific Mountain Logistics	B.J. Patterson
YES	3PL/General Warehousing	NFI	James O'Leary
YES	3PL/General Warehousing	Dependable Highway Express (DHE)	Troy Musgrave
YES	3PL/General Warehousing	Allen Lund Company	Ken Lund
YES	Retail/BCO	California Retailers Association	Rachel Michelin
YES	Retail/BCO/ Manufacturing	PepsiCo	Keshav Sondhi
YES	Retail/BCO	Walmart	Jennifer Wheeler
YES	Retail/BCO/ Manufacturing	Snak King	Jeffrey Forde
YES	3PL/General Warehousing	Sysco	Eddie Tantoco
YES	3PL/General Warehousing	TForce	Richard Boyd
YES	3PL/General Warehousing	UPS	Dale Morin
YES	3PL/ General Warehousing	Dependable Highway Express (DHE)	Tom Lentz
-	3PL/General Warehousing	SC Express	Sherry Hertel
-	3PL/General Warehousing	California Cartage Company	Bob Liveley
-	3PL /General Warehousing	XPO Logistics	Tim Demczyk
-	3PL/ General Warehousing	Lineage Logistics	Dominic Dicalo
-	Consultant	Clean Future	John A. Thorton
-	3PL/ General Warehousing	Dependable Highway Express (DHE)	Tom Lentz
-	3PL/ General Warehousing	Los Angeles Customs Brokers Freight Forwarders Association	Karen Quintana
-	3PL/ General Warehousing	Transportation Intermediaries Association	Chris Burrows
-	3PL/ General Warehousing	Fedex Express	Dustin Rice
-	3PL/ General Warehousing	DHL	Chris Wessel
-	Retail/BCO	IKEA	Adolfo Kurczyn
-	Retail/BCO	Albertson's/Vons	Tim Burke
-	Retail/BCO	Walmart	Randall Sanford
-	Retail/BCO	Retail Industry Leaders Association	Brian Rose
-	Retail/BCO	Aramark	Kevin Fisher
-	Retail/BCO	Tyson	Rob Lyall

APPENDIX B- INTERVIEW QUESTIONS

Questions for Warehouse Industry Stakeholders

Background

Please read the following to every interviewee

We are working with the South Coast Air Quality Management District on a project focused on the warehousing and logistics industry. As part of this effort, we would like to obtain background information on the logistics and distribution industry and particularly the warehousing sector in LA, Orange, San Bernardino, and Riverside Counties.

***If prompted:* South Coast AQMD has asked us to collect this information to inform the creation of a potential Indirect Source Rule. The rule development effort is ongoing, and we do not have information on what the eventual provisions of the rule will be.**

***From here, please read the appropriate set of questions for each type of interviewee. ***

Beneficial Cargo Owners (focused on non-retail activity).

*Is BCO classification correct?

1) **Please tell us about your company's role in goods distribution in Southern California. What is your role in moving goods from port to customer? What types of cargo do you typically deal with?**
   a) What are the other types of organizations that you interact/coordinate with in your goods distribution operations? Please describe your role in logistics/distribution relative to theirs.
   b) Where are your warehouses located?
   c) If warehouses are not operated by the BCOs: What warehouses are you contracted with?
   d) ***If motor carriers or warehouse operators not mentioned, ask about them specifically, including their involvement in motor carrier dispatching decisions. ***
2) **Tell us about how your cargo is moved out of the port. What factors determine your drayage operations?**
   a) What factors are important when selecting a warehouse for transloading operations or cargo storage? Does this vary across different types of cargo?
   b) How important is port proximity in selecting a transloading facility or cargo storage? Do you use transloading facilities/storage near the port, or a warehouse
   c) outside of LA and Orange county? Is there a strategic reason why your company chose this location?
   d) Is your cargo's final destination typically in Southern California or elsewhere? If both, do you select the warehouses differently based on the final destination?
   e) Is there a typical turnaround time for your cargo?
   f) How do you track your cargo? Do you rely on freight forwards and 3PLs, or do you use tools/software? What information do you track?
   g) What sort of truck or freight verification is conducted at the gate for entering/exiting vehicles?
   h) ***If the interviewee has its own fleet*** Use of telematics or geo fencing to track vehicles?

3) **Does your cargo require cold storage? If so:**
   a) How does this affect the process you described earlier, as far as location of transloading facilities?

   Question for BCOs that operate their own warehouse:
   b) What characteristics of a warehouse make it conducive to cold storage?
   c) Is refrigeration infrastructure easily relocated from one warehouse to another?
4) ***If relevant:* Who are your customers: Where are they in the supply chain in relation to you? (Possible answers could be retailers, trucking companies, third party logistics companies, or other?)**
   a) How important is the warehouse location for meeting your customer's needs?
5) **Have you ever considered using warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?**
   a) If so, what prompted your consideration? (Possible answer could be operational changes, warehousing cost, business expansion, etc.)
   b) *** If mentioning cost as a reason*** Do you have an idea of the cost threshold that would lead you to consider using warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?
   c) Did you eventually use warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties? If not, what were the principal constraints?
6) **Can you identify any current trends that are affecting your industry?**
   a) ***If relevant:* Are there any trends that may affect your decision to use warehouses within the urban LA, OC, Riverside, or San Bernardino Counties versus outside of these areas?
   b) Are there other aspects or challenges to your industry that you think may be relevant?
7) **How does online shopping impact your business?**
   a) How does this change the process you described earlier?
   b) What characteristics of a warehouse make it conducive to e-commerce?
8) **As we understand it, warehouses may provide a range of services, including transloading, cross dock transloading, terminal services for less-than-truckload trucks, general purpose warehousing/storage, cold storage, distribution center, and retail fulfillment.**
   a) Are there any other categories that you would recommend we add to this list? Also, do you have at least a rough sense of the distribution of warehouses across these services (e.g., approximately A to B percent of warehouses in the region have cold storage)? We're not expecting that you would have precise estimates but any input you can offer based on your experience would be helpful.

Retailers (Focus on distribution to individual stores)

*Is Retailer classification correct?

1) **Please tell us about your company and how products end up in your retail store(s). (Question for retailers who do not import the cargo/ take control of cargo at the port)**
   a) Roughly what share of your store products are shipped directly through the San Pedro ports vs. land transported from warehouses not related to port operations?

b) How do those products get transported from the vendor to your stores? Does this vary between different types of goods?
c) What's a typical delivery timeline from the regional distribution center to the store?

2) **Do you directly lease and operate warehouses, or do you hire third party logistics providers to manage aspects of your distribution? What about trucking operations?**
   a) What are the advantages and disadvantages of handling these operations within your company versus contracting for these services?
   b) Do you have an involvement in truck dispatching decisions? What are the advantages and disadvantages of handling these operations vs. contracting for these services?
   c) What sort of truck or freight verification is conducted at the gate for entering/exiting vehicles?
   d) ***If the interviewee has its own fleet*** Use of telematics or geo fencing to track vehicles?
3) **What kinds of warehouses do you use in Southern California?**
   a) Does this include distribution centers, long term storage centers, and import-related warehouses?
   b) In general, where are these warehouses located? Does the location vary between different types of cargo?
   c) What qualities make certain warehouses more desirable? Does this vary for different types of cargo?
4) **Does your cargo require cold storage? If so:**
   a) How does this change the process you described earlier?
   b) *If the respondent indicates that their company operates warehouses:*
      i) What characteristics of a warehouse make it conducive to cold storage?
      ii) Is refrigeration infrastructure easily relocated from one warehouse to another?
5) **How does online shopping impact your business?**
   a) How does this change the process you described earlier?
   b) What characteristics of a warehouse make it conducive to e-commerce?
6) **How important is warehouse proximity to your retail stores? Does this vary across warehouse types and functions, as well as products?**
7) **If your company contracts with others for warehousing, have you ever considered changing service providers based on their proximity to your retail stores?**
   a) How does your company balance transportation costs in cases where the warehouse is not in close proximity to your retail locations? Do those costs fall to you or does the contracted company accrue those costs?
8) **How do you handle freight tracking?**
9) **Can you identify any current trends that are affecting your industry? *If relevant:* Are there any associated effects on your decisions regarding where to warehouse your cargo?**
10) **Are there other aspects or challenges to your industry that you think may be relevant?**

Warehouse Operators (3PL, Freight Forwarders, general warehousing)

*Is warehouse operator classification correct?

1) **Please tell us about your company.**
    a) How many warehouses do you operate in the urban LA, OC, Riverside, or San Bernardino Counties?
    b) Where are they located?
    c) What kinds of warehouses or services do you provide?
    d) What kinds of customers do you serve?
2) **Tell us about how goods move in and out of your warehouse. Where are goods typically coming from and where are they going?**
    a) Are there specific warehouse characteristics that are important to this process?
    b) Does the process vary across different types of cargo? If so, how?
    c) What's a typical delivery timeline? Do you avoid times of high traffic?
    d) What are the other types of organizations that you interact/coordinate with in your goods distribution operations? Please describe your role in logistics/distribution relative to theirs.
    e) What sort of truck or freight verification is conducted at the gate for entering/exiting vehicles?
    f) ***If the interviewee has its own fleet*** Use of telematics or geo fencing to track vehicles?
3) **When selecting a warehouse, what qualities make certain warehouses more desirable? For example, available space, cost per square foot, or location?**
    a) Are there other facility amenities that are also important?
4) **Do you use cold storage? If so:**
    a) How does this change the process you described earlier?
    b) What characteristics of a warehouse make it conducive to cold storage?
    c) Is refrigeration infrastructure easily relocated from one warehouse to another?
5) **What services do you outsource to other companies? For example, trucking?**
    a) What are the advantages and disadvantages of handling these operations within your company versus contracting for these services?
6) **How important is the warehouse location for meeting your customer's needs?**
    a) How does the LA/OC area compare to further away in San Bernardino County?
    b) How do locations within in the urban LA, OC, Riverside, or San Bernardino Counties areas compare to cities outside the region, i.e. Barstow, Phoenix, and Las Vegas?
7) **Have you ever considered relocating outside the urban LA, OC, Riverside, or San Bernardino Counties?**
    a) If so, what prompted your consideration? (Possible answer could be operational changes, warehousing cost, business expansion, etc.)
    b) *** If mentioning cost as a reason*** Do you have an idea of the cost threshold that would lead you to consider moving to warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?
    c) What are the principle constraints on relocation?
8) **Can you identify any current trends that are affecting your industry? *If relevant:* Are there any associated effects on your decisions regarding the location of your operations?**

a) Are there other aspects or challenges to your industry that you think may be relevant?

9) **As we understand it, warehouses may provide a range of services, including transloading, crossdock transloading, terminal services for less-than-truckload trucks, general purpose warehousing/storage, cold storage, distribution center, and retail fulfillment**.
   a) Are there any other categories that you would recommend we add to this list? Also, do you have at least a rough sense of the distribution of warehouses across these services (e.g., approximately A to B percent of warehouses in the region have cold storage)? We're not expecting that you would have precise estimates but any input you can offer based on your experience would be helpful.

Manufacturing and Distribution Facility

1) **Tell us a bit about your company**
   a. What do you manufacture?
   b. Who are your customers?
2) **Tell us about your facility**
   a. How many square feet total?
   b. What percentage is dedicated to warehousing, manufacturing, and office space?
   c. What qualities make a space more desirable? (available space, cost per sq ft, location) Are there facility amenities that are important?
   d. Do you use cold storage? If so:
   e. What characteristics of a warehouse make it conducive to cold storage?
   f. Is refrigeration infrastructure easily relocated from one warehouse to another?
3) **Tell us about your operations**
   a. Where are goods typically coming from and where are they going?
   b. What percentage of goods that move through your facility are imports vs. exports?
   c. What's a typical delivery timeline?
   d. Do you try to avoid times of high traffic?
4) **We want to understand your place in the supply chain and how you interact with your customers and other contractors**
   a. What are the other types of organizations do you interact/coordinate within your goods distribution operations?
   b. What services do you outsource to other companies? For example, trucking?
   c. What are the advantages and disadvantages of handling these operations within your company versus contracting for these services?
5) **Please tell us about you fleet**
   a. Do you lease or own your vehicles? What percentage is leased vs. owned? And what are the benefits of leasing vs. owning?
   b. How many vehicles are in your fleet? And what classes are they?
   c. What is the average age of the vehicles in your fleet?
   d. What fuel technology do you use?
   e. If you operator forklifts or yard hostlers, what percentage are fossil fuel vs. electric? Are any of these fossil fuel vehicles operating indoors?

f. Is your fleet equipped with telematics? If so, do you rely on this to track fuel usage and mileage? Do you use geofencing?
g. What is a typical day operation for you fleet?
    i. Average number of miles
    ii. Average number of stops
h. Which of the following would best describe your fleet's operations?
    i. Regional Delivery
    ii. Drayage
    iii. Less than Truckload
    iv. Over the Road
    v. Other (please explain)
i. Which of the following warehousing facilities does your fleet typically service? And, what characteristics of your fleet makes it suitable to serve this specific type of facility?
    i. Distributions center
    ii. Cross-dock facility
    iii. Transload facility
    iv. General Purpose Warehouse
    v. Truck Terminal for Less than Truckload Trucks
    vi. Retail Fulfillment Center
    vii. Storage or Cold Storage

6) Please tell us about how vehicles interact with your facility

a. What is the typical process for vehicles entering and exiting the facility?
b. What information do you collect about vehicles entering and exiting the facility (i.e. vehicle type, fuel technology, model, US DOT, CA, MC #s, VIN, truck model, truck year)
c. What method do you use to track the number of vehicles visiting your facility (inbound and outbound)? What is the typical daily number of vehicles?
d. Do trucks need to be part of a truck registry to enter the facility? (i.e. Drayage Truck Registry OR TRUCRS)

7) We are also trying to understand how location plays a role in your business operations.

a. How important is the warehouse location for meeting your customer's needs?
b. How does the LA/OC area compare to further away in San Bernardino County?
c. How do locations within in the urban LA, OC, Riverside, or San Bernardino Counties areas compare to cities outside the region, i.e. Barstow, Phoenix, and Las Vegas?
d. Have you ever considered relocating outside the urban LA, OC, Riverside, or San Bernardino Counties?
e. If so, what prompted your consideration? (Possible answer could be operational changes, warehousing cost, business expansion, etc.)
f. *** If mentioning cost as a reason*** Do you have an idea of the cost threshold that would lead you to consider moving to warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?
g. What are the principle constraints on relocation?

8) We want to understand any trends you are seeing in the industry

a. Are there any aspects or challenges to your industry that you think may be relevant?

9) Plans for future sustainability

a. Do you have sustainability goals/plans? Please explain.
b. Have you thought about putting community benefit measures in place, in terms of air pollution?
c. Have you researched into the possibility of electric fleets and/or charging and refueling stations?

ATTACHMENT 2

TECHNICAL MEMORANDUM ON REAL ESTATE MARKETS NEIGHBORING THE SOUTH COAST AQMD JURISDICTION

IEc

MEMORANDUM | 12 DECEMBER 2020

TO Victor Juan, Ian MacMillan, Paul Stroik, and Shah Dabirian, South Coast Air Quality Management District (South Coast AQMD)

FROM Derek Ehrnschwender and Jason Price, IEc

SUBJECT Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction

INTRODUCTION

This memorandum is in support of South Coast Air Quality Management District (South Coast AQMD) staff's development of a potential indirect source rule (ISR) to reduce mobile source emissions related to the operation of warehouses and distribution centers in the South Coast AQMD's four-county region (Los Angeles, Orange, Riverside, and San Bernardino counties).[1]

Diesel truck traffic, largely related to the transport of goods passing through the Ports of Los Angeles and Long Beach and regional warehouses and distribution centers, makes up a large share of local NO_x emissions. A warehouse ISR, if adopted, may help with reducing emissions from trucks servicing warehousing facilities located within its jurisdiction.

Compliance costs to the warehousing sector could vary depending on the design of an eventual rule. If these costs are significant, the implementation of an ISR could potentially precipitate the relocation of warehousing operations outside the region—with the associated truck fleets continuing to travel to and from facilities in the South Coast AQMD jurisdiction. In the worst-case scenario, the associated air quality benefits from such a rule might be greatly diminished. Accordingly, South Coast AQMD is interested in identifying and understanding the factors affecting whether warehousing operations are likely to relocate as a result of the potential rule.

Consistent with this objective, this memo analyzes the warehouse real estate markets within the South Coast AQMD jurisdiction and in neighboring areas. Through analysis of a range of key market metrics and trends, we assess the capacity of neighboring areas to absorb warehousing operations that might consider relocation following the implementation of an ISR. To inform assessment of relocation potential over time, we also assess how these neighboring markets may change over the next ten years. The specific market statistics examined in this memo include the following:

- ***Total warehouse inventory:*** To help South Coast AQMD better understand the size of the local warehousing sector, we compile information on the inventory of warehouses within the region. Similarly, to gauge the potential capacity of neighboring areas to absorb warehouse operations from the South Coast AQMD jurisdiction, we also present the inventory of warehouses in these areas.

[1] The South Coast AQMD jurisdiction is comprised of all of Orange County and parts of Los Angeles, Riverside and San Bernardino Counties. The region is mapped and described in full in Exhibit 1 and the "Geographic Scope" section below.

- ***Vacancy rates:*** Complementing the inventory data, we examine vacancy rates in the South Coast AQMD jurisdiction and in neighboring areas. This information provides insight into the *current* capacity of neighboring markets to absorb warehousing operations located in the South Coast AQMD jurisdiction.
- ***Net absorption:*** We examine net absorption of warehouse space in each area, defined as the amount of space tenants moved into in a geographic area and time period minus the amount of space tenants vacated during that same time period. Because this metric reflects changes in inventory levels for a given period, it may provide insights into the direction of the market (e.g., the capacity or lack of capacity of neighboring areas to absorb warehousing operations from the South Coast AQMD jurisdiction).
- ***Pricing:*** Because decisions regarding the relocation of warehouse operations to neighboring areas will depend on the associated cost impacts, we compile data on warehouse pricing in each market—rent per square foot for properties for lease, and sale price per square foot for properties that were bought and sold.
- ***Parcels available for warehouse development:*** To gauge the potential for expansion of the warehouse market in each area to accommodate operations currently located in the South Coast AQMD jurisdiction, we present data on vacant land in each market area with the appropriate zoning for warehouse space.

We begin the real estate market analysis by describing the data sources relied upon and outlining the structure of the analysis. Building on this information, we then present our analysis of the key market metrics identified above. Finally, we conclude with a synthesis of our key findings.

DATA SOURCES AND ANALYTIC STRUCTURE

The primary data sources for this document are contained in the CoStar Suite™ of data products developed and maintained by CoStar, a real estate analytics firm. As described in further detail below, the CoStar Suite™ includes information on existing properties as well as vacant parcels that may be developed. These data are flexible in terms of how they may be spatially aggregated, and include information on the attributes of individual properties allowing for identification of different types of warehouse space.

COSTAR DATA

The CoStar Suite™ contains a variety of databases, of which we use CoStar Property® and CoStar Market Analytics™. CoStar Property® contains a regularly maintained comprehensive list of commercial real estate properties and vacant lands, with an extensive list of descriptive fields. CoStar Market Analytics™ contains a range of historical data, metrics, and forecasts relevant to identifying trends.

For the purposes of this analysis, we limit our scope to properties meeting the following criteria:

- Properties with status labeled as existing or undergoing renovations.
- Properties within CoStar's Industrial and Flex (Industrial with some office space) categorizations.

- For buildings within the CoStar Industrial and Flex categorization, properties with secondary categorizations of Distribution, Light Distribution, Refrigeration/Cold Storage, Truck Terminal, or Warehouse.[2]
- Properties with a minimum 100,000 square foot rentable building area.[3]
- Properties with a minimum ceiling height of 15 feet.[4]

Based on these criteria, we identify 2,638 properties in South Coast AQMD's jurisdiction and 975 properties in the neighboring areas examined in this analysis (further details below).[5]

This analysis also incorporates CoStar's information on vacant land parcels for the purposes of assessing potential new additions to the supply of warehouses in outlying markets. We limit our scope to parcels classified for industrial use and with a minimum footprint of 200,000 square feet. We use a 200,000 square foot minimum based on our 100,000 square foot minimum building area and an assumption (based on the CoStar property data) that an acceptable lower-bound for the ratio of property area to building area is two-to-one.

GEOGRAPHIC SCOPE

For each property, the CoStar database includes detailed spatial information. Specifically, the database includes (1) latitude and longitude coordinates, (2) mailing address, and (3) size of the building footprint. Using the spatial information in the database, we grouped properties into eight distinct real estate markets—the South Coast AQMD jurisdiction (or "District" in many of the graphics below) and seven neighboring areas in geographic proximity to the South Coast AQMD jurisdiction. In addition, we further sub-divided the South Coast AQMD jurisdiction into three areas, largely defined according to county boundaries. These markets, shown in the maps in Exhibit 1, are as follows:

- **Los Angeles:** The portion of Los Angeles County located within the South Coast AQMD jurisdictional boundaries, including all of the county except for the northeastern corner. This area includes the "megaports" of L.A. and Long Beach, the origin point for most goods passing through warehouses in the region and 40 percent of all container cargo traffic in the U.S.[6]

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[2] Facilities with the secondary type Manufacturing are also discussed in this document. Because manufacturing facilities' decision-making processes regarding relocation are likely to differ from the decision-making process for facilities whose primary function is warehousing, these facilities are captured in a stand-alone section below rather than in the primary analysis presented in this document.

[3] An earlier version of this document limited the scope of this analysis to properties greater than 25,000 square feet. Due to revisions to the proposed ISR limiting its applicability to properties 100,000 square feet and greater, this draft amends its scope and warehouse classification to focus on this group.

[4] An exception to this is that we include properties for which building area was available but ceiling height was not in order to capture the most complete picture of the real estate landscape in each area.

[5] Consistent with the note above, these figures do not include manufacturing facilities.

[6] "Industrial Warehousing in the SCAG Region – Final Report." (2018) Prepared for the Southern California Association of Governments by Cambridge Systematics, Inc. with Gill V. Hicks and Associates Inc. April 2018.

- **Orange County:** All of Orange County, which is completely contained within the South Coast AQMD jurisdictional boundaries.
- **Inland Empire:** The South Coast AQMD portions of Riverside and San Bernardino counties. This includes the most densely populated southwestern corner of San Bernardino County and all of Riverside County except for a small portion near the county's eastern border, near the Arizona state line. Driving times from both ports to destinations within the South Coast AQMD jurisdiction vary depending on traffic, but an hour and a half is expected for crossing Los Angeles and accessing the centrally located cities of Riverside and San Bernardino.[7]
- **North of District, Bakersfield:** All of Kern County and the non-South Coast AQMD portion of Los Angeles County, including Lancaster and Palmdale. Bakersfield, the largest population center in Kern County, is roughly two hours and 45 minutes from the Port of L.A.
- **North of District, Coastal:** All of Ventura County, Santa Barbara County, and San Luis Obispo County. Contains the Port of Hueneme,[8] located in Ventura County. Driving times from the Port of L.A. to the cities of Santa Barbara and San Luis Obispo are approximately two hours and 30 minutes and four hours and 15 minutes, respectively.
- **East of District, Desert Areas:** All of Imperial County and the non-South Coast AQMD portions of San Bernardino County, including Victorville, and Riverside County. Driving times from the Port of L.A. vary from one to four hours.
- **South of District, San Diego:** All of San Diego County, which includes the Port of San Diego.[9] The drive time to San Diego from the Port of L.A. is roughly two hours and 30 minutes.
- **Las Vegas:** All of Clark County, Nevada, which includes the city of Las Vegas. It takes roughly five hours to drive from the Port of L.A. to Las Vegas.
- **Phoenix:** All of Maricopa County and Pinal County, Arizona. The drivetime from the Port of L.A. to Phoenix is approximately six hours.
- **Western Arizona:** All of the four Arizona counties to the west of Phoenix: Yuma, La Paz, Mohave, and Yavapai Counties. Driving times from the Port of L.A. vary from four to six hours.

[7] We calculate driving times based on expected departures from the Port of L.A. at 6:00 AM on a weekday, a time with relatively low traffic.

[8] The Port of Hueneme is substantially smaller than the Ports of L.A. and Long Beach, with annual container traffic of 84,000 containers in 2018, relative to Long Beach's 8.8 million containers and L.A.'s 8.9 million containers. American Association of Port Authorities. "NAFTA Container Port Ranking 2017." https://www.aapa-ports.org/unifying/content.aspx?ItemNumber=21048

[9] The Port of San Diego's annual container traffic is approximately 143,000 containers. American Association of Port Authorities. *Op cit.*

EXHIBIT 1-A. REAL ESTATE MARKETS EXAMINED

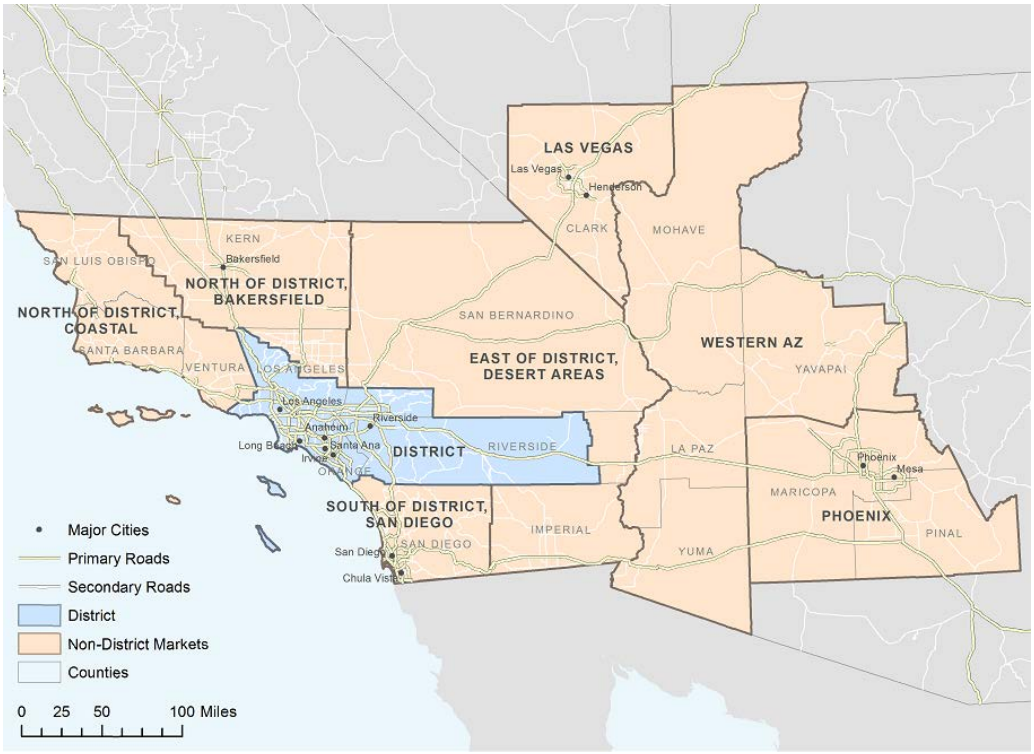

EXHIBIT 1-B. REAL ESTATE MARKETS EXAMINED – DISTRICT MARKETS FOCUS

WAREHOUSE CLASSIFICATION

Our analysis of warehouse real estate markets in the areas identified above distinguishes between different types of warehouses. We make this distinction because different types of warehouses (or warehousing operations) may respond differently to an ISR. As a starting point for defining warehouse categories, we examined the Southern California Association of Governments' (SCAG's) 2018 report on warehousing activity in Southern California.[10] As summarized in Exhibit 2, the SCAG report identifies eight categories of warehouses, the definitions for which include building area and ceiling height.[11]

While useful, the SCAG classification system in many cases describes warehousing *services* rather than physical warehouse *structures*. Because a given warehouse may be suitable for more than one type of warehousing service, the full SCAG classification system may not be appropriate for this analysis. For instance, there is no structural difference between warehouses that provide port-related general purpose warehousing services and those that provide non-port-related general purpose warehousing services. Similarly, warehouses that perform transload services are physically similar to warehouses that perform crossdock services.

Thus, for the purposes of segmenting the warehousing real estate market in this analysis, we specify warehouse categories based on the suite of warehousing services that a warehouse may provide or on its capacity to accommodate a warehousing service with specific needs (e.g., refrigeration). We also define the classification scheme so that it fully captures and categorizes the property data from CoStar. Additional considerations in our classification of warehouses include the following:

- We exclude ceiling height as a parameter in our classification scheme. Because ceiling height is missing for many properties in the CoStar data, the exclusion of these properties would provide an incomplete picture of the market.
- Our classification is unable to account for the "long and narrow" building shape unique to transload and crossdock facilities due to data limitations. For this reason, we combine transload and crossdock warehouses with the general purpose category, due to similarities in building size.
- We find properties with the CoStar secondary classifications of Refrigeration/Cold Storage and Truck Terminal have a wide variety of building areas and do not fit neatly into one building category. We therefore identify cold storage facilities as a separate category due to their unique facility characteristics. We fit truck terminals into all of the other categories as their building area can range considerably from 25,000 to 330,000 square feet.

Based on the above, Exhibit 3 outlines our classification scheme for the market analysis.

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[10] "Industrial Warehousing in the SCAG Region – Task 4: Understanding Facility Operations." (2018) Prepared for the Southern California Association of Governments by Cambridge Systematics, Inc. with Gill V. Hicks and Associates Inc. April 2018.

[11] Two additional categories of warehouses—parcel hubs and e-commerce facilities—are included in the warehousing and logistics technical memorandum prepared in support of this analysis. Due to limitations in the specificity of the CoStar secondary classification field, we do not identify these categories in this analysis. These facilities, depending on their respective size, are captured within the categorization we outline in Exhibit 3. For the characterization of parcel hubs and e-commerce facilities, see Jasna Tomic and Kelly Leathers, "Technical Memorandum on Warehousing and Logistics Industry in the South Coast Air Quality Management District Jurisdiction," prepared for South Coast AQMD, November 30, 2020.

EXHIBIT 2. SCAG WAREHOUSE CLASSIFICATION

WAREHOUSE TYPE	TYPICAL BUILDING AREA	TYPICAL BUILDING WIDTH	TYPICAL CEILING HEIGHT	SITE COVERAGE (BUILDING FOOTPRINT/PROPERTY SIZE)	CARGO TURNAROUND TIME
Port-Related General Purpose Warehouse	25,000-50,000 sq. Ft.	Not specific	>22 ft.	0.5	Varies
Non-Port-Related General Purpose Warehouse	25,000-50,000 sq. Ft.	Not specific	>22 ft.	0.5	Varies
Trans-load Facility	>25,000 sq. Ft	Long and narrow	>22 ft.	0.5	Up to one week
Cross-dock Facility	>25,000 sq. Ft	Long and narrow	>22 ft.	0.5	1-2 days
Truck Terminal for Less-Than-Truckload Trucks	25,000 to 150,000 sq. Ft.	Not specific	<25 ft.	0.3	Up to one week
General Distribution Center	50,000 to 500,000 sq. Ft.	Not specific	<25 ft.	0.4	Varies
Retail Fulfillment Center	500,000 to 1,000,000 sq. Ft.	Not specific	>28 ft.	0.4	Up to one week
Cold Storage	>25,000 sq. Ft.	Not specific	>22 ft.	0.5	Up to one week

EXHIBIT 3. WAREHOUSING REAL ESTATE CLASSIFICATION SCHEME

PROPERTY CLASSIFICATION	APPLICABLE SCAG WAREHOUSE CATEGORIES	BUILDING AREA	COSTAR PRIMARY CATEGORIZATION	COSTAR SECONDARY CATEGORIZATION
General Purpose	General Purpose, Transload, Crossdock	100,000-200,000 sqft	Industrial or Flex	Distribution, Light Distribution, Truck Terminal, Warehouse
General Distribution	General Distribution Centers	200,000-500,000 sqft	Industrial or Flex	Distribution, Light Distribution, Truck Terminal, Warehouse
Retail Fulfillment	Retail Fulfillment Centers	500,000+ sqft	Industrial or Flex	Distribution, Light Distribution, Truck Terminal, Warehouse
Cold Storage[1]	Refrigeration/Cold Storage Facility	25,000+ sqft	Industrial or Flex	Refrigeration/ Cold Storage

Notes:
1. In addition to cold storage warehouses greater than 100,000 square feet, we include cold storage warehouses between 25,000 and 100,000 square feet for additional insights on these facilities.

In addition to the warehouse types shown in Exhibit 3, which apply to buildings whose main function is warehousing, we also examine warehousing space at manufacturing facilities in the South Coast AQMD jurisdiction. For these facilities, however, decisions regarding relocation are likely to differ from the decision-making process for warehouse facilities. As supported by conversations with manufacturing warehouse operators for the technical memo on the warehousing and logistics industry, manufacturing facilities often have specialized equipment that would be more costly to move.[12] In addition, the pool of buildings to which manufacturing facilities could relocate may differ from the buildings that warehouses would consider. Due to these differences, our assessment of manufacturing warehouses in the South Coast AQMD jurisdiction is presented separately from our assessment of other warehouses.

ANALYSIS

Our analysis of the real estate markets in the South Coast AQMD jurisdiction and neighboring areas examines the current state of these markets and recent projections extending 10 years into the future. This analysis will help South Coast AQMD better understand the capacity of neighboring markets to absorb warehousing operations from its jurisdiction.

CURRENT MARKET SNAPSHOT

In this section, we compile a set of market metrics from the CoStar property database to compare warehousing real estate in the South Coast AQMD jurisdiction with real estate

[12] Jasna Tomic and Kelly Leathers, "Technical Memorandum on Warehousing and Logistics Industry in the South Coast Air Quality Management District Jurisdiction," prepared for South Coast AQMD, November 30, 2020.

in outlying markets. We compare the markets according to total inventory, vacancy rates, tenancy growth rates, net absorption, pricing, and potential future development.

Total Inventory (Warehousing Facilities)

We assess the total inventory of warehousing properties along two metrics: the number of total properties and the rentable building area of those properties, measured in square feet. Exhibits 4, 5, and 6 present these values by market area and property type. We identify 3,613 properties with the CoStar categorizations of Industrial and Flex (Industrial with some office space), the CoStar secondary categorizations of Distribution, Light Distribution, Refrigeration/Cold Storage, Truck Terminal or Warehouse, and with a minimum rentable building area of 100,000 square feet. Of these properties, 2,638 (73 percent) are located within the South Coast AQMD jurisdiction, while 975 (27 percent) are located in the outlying markets. Similarly, we identify 888 million square feet of rentable building area meeting the same criteria, with 662 million square feet (75 percent) located within the South Coast AQMD jurisdiction, and the remaining 226 million (25 percent) located in the outlying markets. The South Coast AQMD jurisdiction contains more warehousing space across each of the real estate categories, as highlighted in Exhibits 4 and 6. These exhibits also show the distribution of warehousing space across warehouse categories is fairly consistent across the geographic areas examined.

EXHIBIT 4. TOTAL BUILDING AREA – YEAR 2019: DISTRICT AND NON-DISTRICT

PROPERTY CLASSIFICATION	DISTRICT AREA	SHARE OF TOTAL DISTRICT AREA	NON-DISTRICT AREA	SHARE OF TOTAL NON-DISTRICT AREA
General Purpose	191.4 million sq. ft.	28.9%	72.6 million sq. ft.	32.1%
General Distribution	249.7 million sq. ft.	37.7%	79.5 million sq. ft.	35.2%
Retail Fulfillment	209.6 million sq. ft.	31.7%	66.9 million sq. ft.	29.5%
Cold Storage	11.5 million sq. ft.	1.7%	7.3 million sq. ft.	3.2%
Total	662.2 million sq. ft.	100%	226.3 million sq. ft.	100%

EXHIBIT 5. NUMBER OF WAREHOUSE PROPERTIES BY MARKET AND REAL ESTATE CLASSIFICATION - YEAR 2019

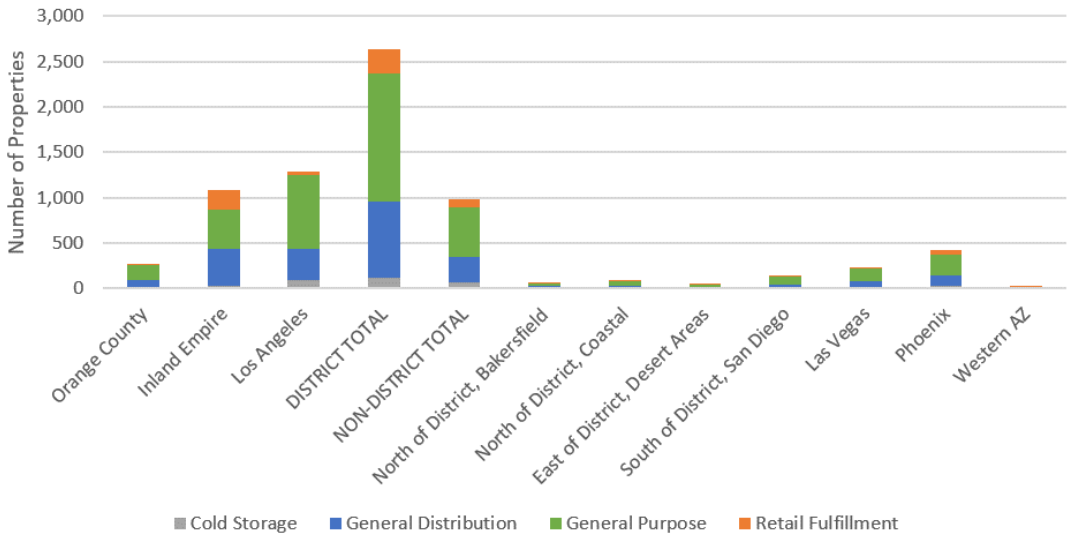


EXHIBIT 6. SQUARE FOOTAGE OF PROPERTIES BY MARKET AND REAL ESTATE CLASSIFICATION - YEAR 2019

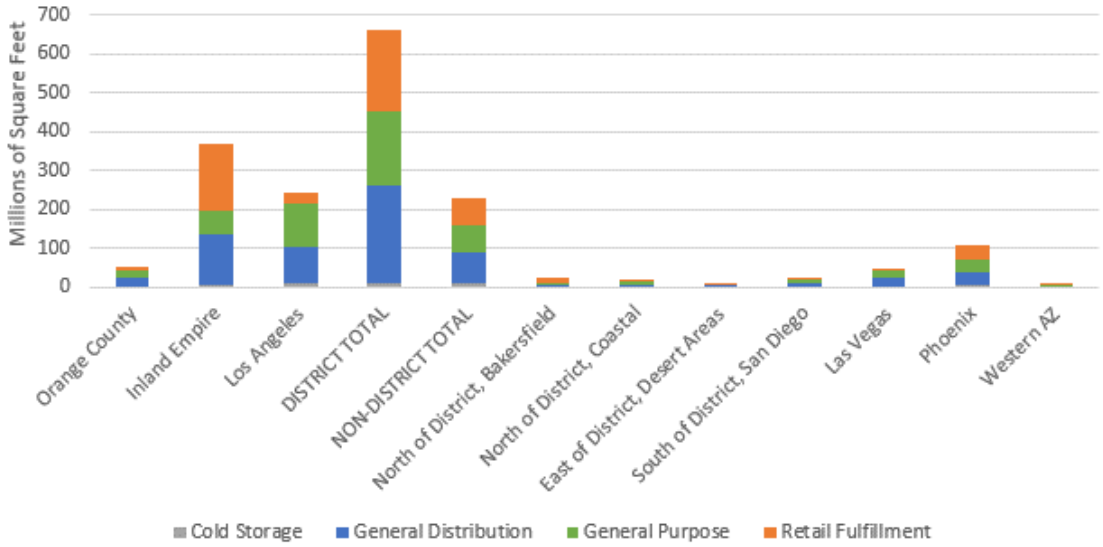


Exhibit 7 compares the growth of warehouse property capacity within the South Coast AQMD jurisdiction and in the surrounding market areas over time. Because these historical data are from the CoStar Market Analytics™ module, they may present slight differences relative to the data in Exhibits 4-6, which are based on data from CoStar Property™.[13] Over the last decade, capacity has increased by approximately 170 million

[13] The historical data from the CoStar Market Analytics™ module are filtered using the same four industrial secondary classifications used to identify warehouses from the CoStar Property™ data: Warehouse, Distribution, Light Distribution, and Truck Terminal. Cold Storage facilities are not included in the historical data. Additionally, the filter for ceiling height was not possible to apply in the historical data. For these reasons, as well as slight differences in the vintage of the respective

square feet in the South Coast AQMD jurisdiction and 70 million square feet in the surrounding market areas. From 2009-2019, average annual capacity additions within the South Coast AQMD jurisdiction were 16.7 million square feet per year, while the average annual additions for all outlying market areas combined was less than half that amount, at 6.9 million square feet per year.

EXHIBIT 7. HISTORICAL SQUARE FOOTAGE OF WAREHOUSE PROPERTIES GREATER THAN 100,000 SQUARE FEET WITHIN THE SOUTH COAST AQMD JURISDICTION AND SURROUNDING MARKET AREAS

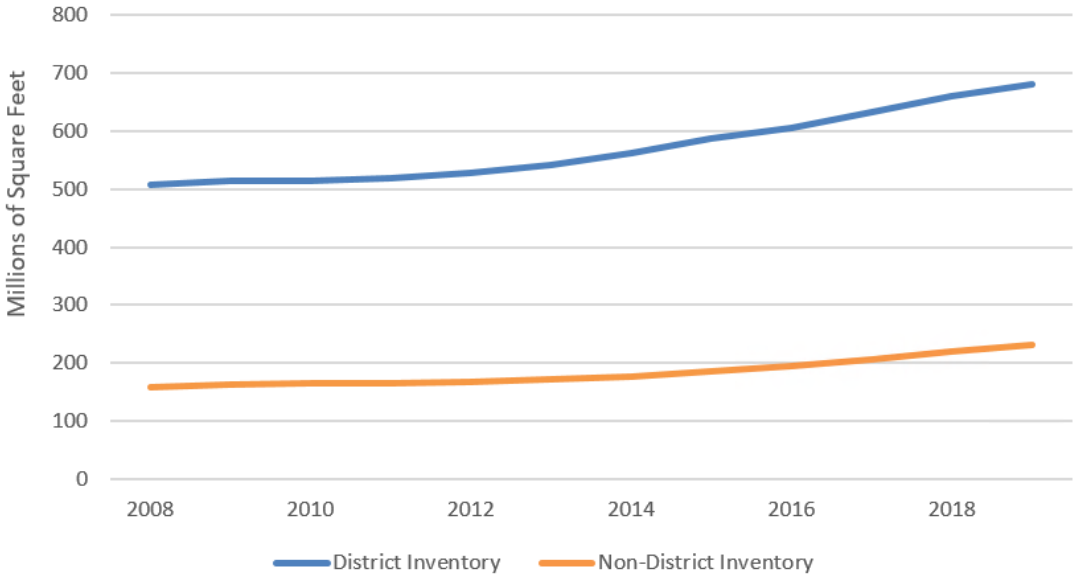


Exhibit 8 compares the growth of warehouse property capacity between the surrounding market areas over time. Similar to the data in Exhibit 7, the historical data in Exhibit 8 are from the CoStar Market Analytics™ module and may differ somewhat from the data reflected in Exhibits 4-6. As shown in Exhibit 8, growth in recent years is most significant in the Las Vegas and Phoenix markets. Of the markets closer to the South Coast AQMD jurisdiction, the Bakersfield market shows the largest increase in capacity. Data are not available for all market areas prior to 2008.

We assess properties based on their distance from major roads, defined as either a primary or secondary road. These roads include interstate highways, U.S. routes, state routes, and major urban streets. Distances were calculated along a straight line from property location to the nearest major road point.

underlying property data, there may be slight differences in the historical data as compared with the values reported from the CoStar Property™ module.

EXHIBIT 8. HISTORICAL SQUARE FOOTAGE OF WAREHOUSE PROPERTIES GREATER THAN 100,000 SQUARE FEET WITHIN THE SOUTH COAST AQMD JURISDICTION AND SURROUNDING MARKET AREAS - ADDITIONAL DETAIL

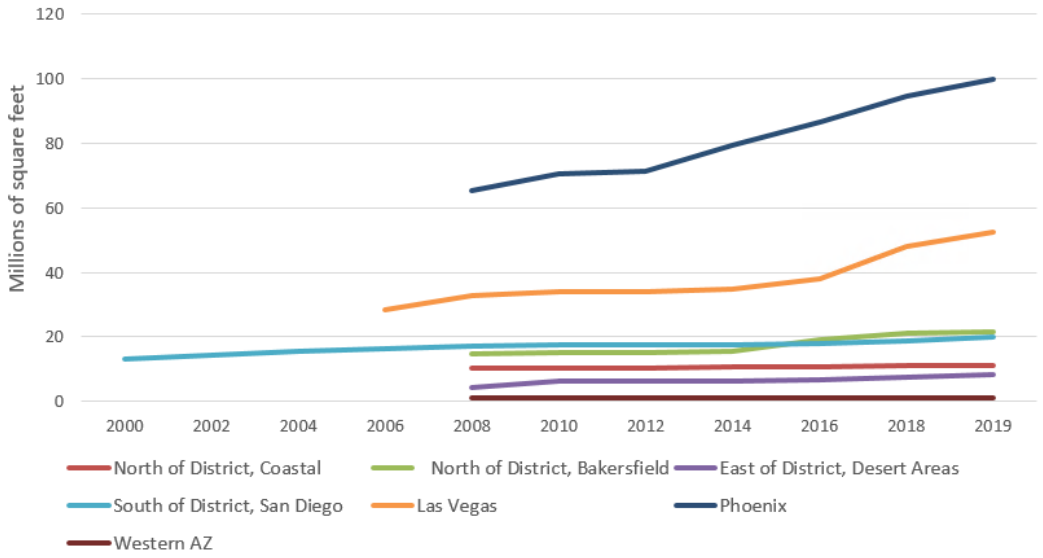
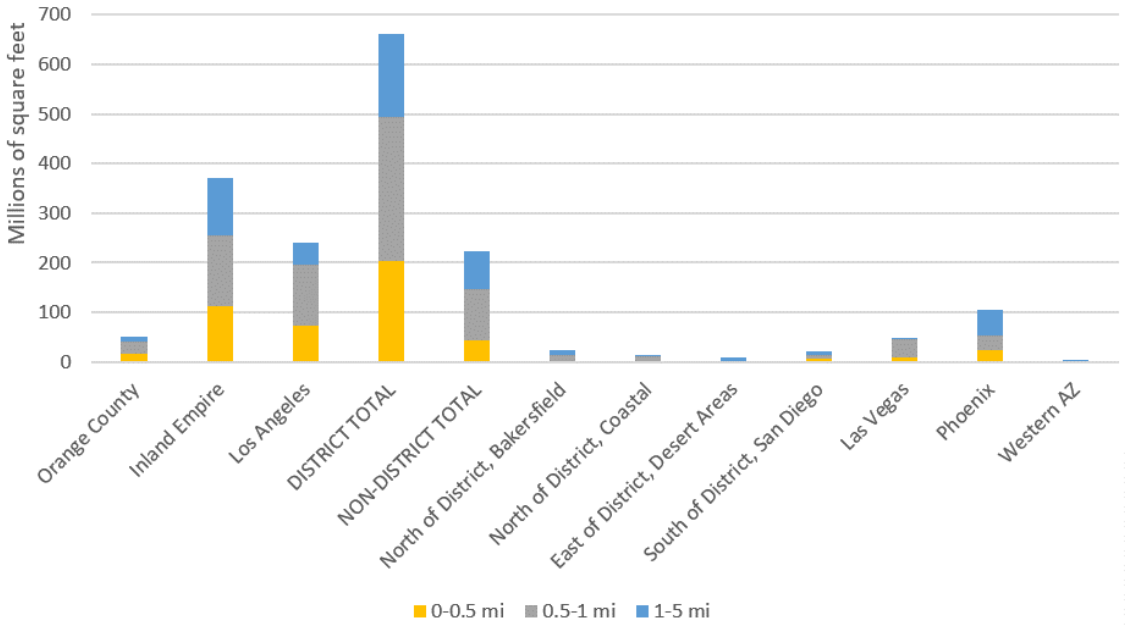


Exhibit 9 shows the square footage of property at different distances from major roads (e.g., 0 to 0.5 miles from a major road). As shown in the exhibit, roughly one-third of warehousing square footage in the South Coast AQMD jurisdiction is located within a half mile of a major road, while the share is closer to one-fifth for the outlying markets. Less than one percent of warehousing real estate is located farther than five miles from a major road.

EXHIBIT 9. SQUARE FOOTAGE OF PROPERTIES BY DISTANCE FROM MAJOR ROAD (MILES) - YEAR 2019



Inventory (Manufacturing Facility Warehouses)

As noted above, manufacturing facilities may include warehousing space in addition to assembly/manufacturing space. To complement the profile of warehousing facilities included in this document, we also examine the scale of relevant manufacturing facilities in the South Coast AQMD jurisdiction using CoStar data.

Assuming an average of 25 percent of a manufacturing facility's floor area is devoted to warehousing, we limit the scope of properties considered to those greater than 400,000 square feet, resulting in 100,000 square feet of warehousing space.[14] Based on the CoStar categorizations of Industrial and Flex (Industrial with some office space) and secondary categorizations of Manufacturing and Light Manufacturing, we identify 49 manufacturing properties in the South Coast AQMD jurisdiction that may have 100,000 square feet or more of warehousing space. The total warehousing space across these facilities is 8.4 million square feet. This represents an additional 1.3 percent increase over the 662 million square feet of warehousing space identified within the South Coast AQMD above.

Because manufacturing facilities require more specialized buildings and equipment, and would likely incur much higher moving costs, we exclude manufacturing facilities from the remainder of this analysis. As we show in our memo estimating potential warehouse relocations due to a possible warehouse ISR for non-manufacturing warehouses,[15] few warehouses are expected to relocate. Thus, we expect manufacturing facilities with warehouses on site to be highly unlikely to relocate due to a possible ISR.

Vacancy Rates (Warehousing Facilities)

We calculate vacancy rates as the percentage of total rentable building area currently vacant and available for lease (Exhibit 10). These rates are sensitive to small samples within some of the defined markets, as evidenced by the high vacancy rates in the Western Arizona and San Diego markets. One out of the two retail fulfillment properties in both Western Arizona and San Diego has availability, resulting in the high rates seen in the table. The non-South Coast AQMD totals for vacancy rates are generally higher than the South Coast AQMD rates.

[14] Manufacturing space takes up an average of 70 percent of floor space in properties classified as manufacturing. The remaining space is taken up by warehousing space and office space (though office space is rarely larger than 10 percent of the total, and often less in larger facilities). For this reason, we select 25 percent as a simplified estimate of total warehousing space within manufacturing facilities. Figures from: Yap, Johannson L., and Rene M. Circ. *Guide to classifying industrial property*. Urban Land Institute, 2003.

[15] Jason Price, Derek Ehrnschwender, and Nick Manderlink, "Results of ISR Warehouse Relocation Analysis", prepared for South Coast AQMD, December 12, 2020.

EXHIBIT 10. VACANCY RATES ACROSS MARKETS AND REAL ESTATE CLASSIFICATION - YEAR 2019

GEOGRAPHIC AREA	GENERAL PURPOSE	GENERAL DISTRIBUTION	RETAIL FULFILLMENT	COLD STORAGE	TOTAL
District Total	4%	5%	5%	1%	4%
Orange County	4%	8%	14%	0%	7%
Inland Empire	5%	6%	5%	2%	5%
Los Angeles	3%	2%	4%	1%	2%
Non-District Total	7%	7%	11%	2%	8%
North of District, Bakersfield	6%	5%	4%	0%	4%
North of District, Coastal	3%	14%	0%*	0%	7%
East of District, Desert Areas	16%	8%	0%*	0%*	7%
South of District, San Diego	6%	7%	38%*	7%	7%
Las Vegas	3%	2%	5%	0%*	3%
Phoenix	9%	9%	15%	5%	11%
Western AZ	0%*	0%	39%*	0%	12%
Total	2%	5%	4%	7%	

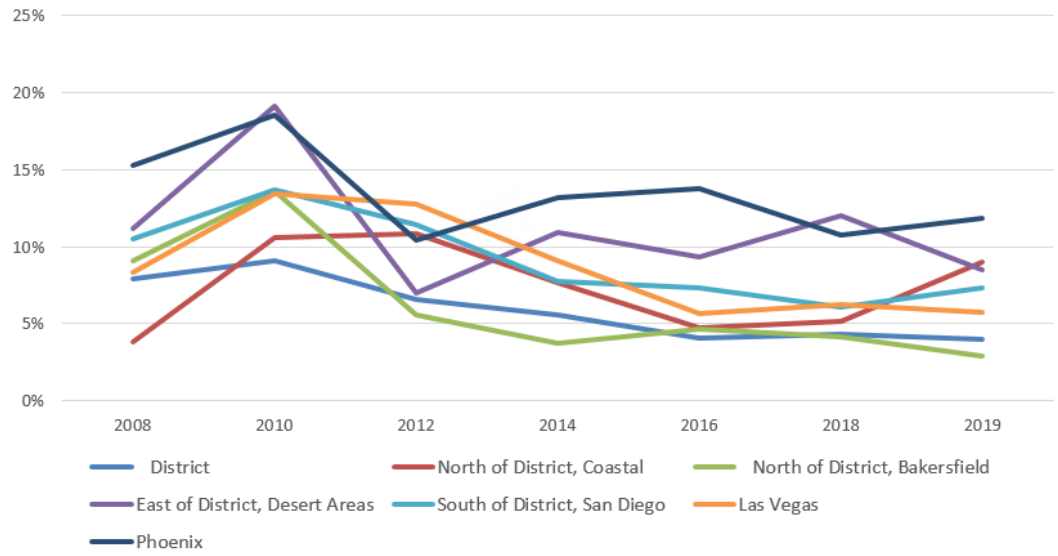
* Categories with fewer than five properties.

In addition to the data presented in Exhibit 10, we examined the difference in vacancy rates for properties closer and farther from major roads, as grouped into three bins: properties within a half mile, a half mile to one mile, and greater than one mile from a major road. Based on this analysis, we did not identify a systematic relationship between vacancy rates and property distance from a major road.[16]

Exhibit 11 shows historical vacancy rates across market areas from 2008 to 2019. Because these historical data are from the CoStar Market Analytics™ module, they differ somewhat from the data snapshot in Exhibit 10, which is based on the CoStar Property™ data. Western AZ is excluded from Exhibit 11 due to a small sample of properties. The vacancy rate in the South Coast AQMD jurisdiction is consistently among the lowest throughout the timeframe, while the Phoenix market tends to have the highest vacancy rate.

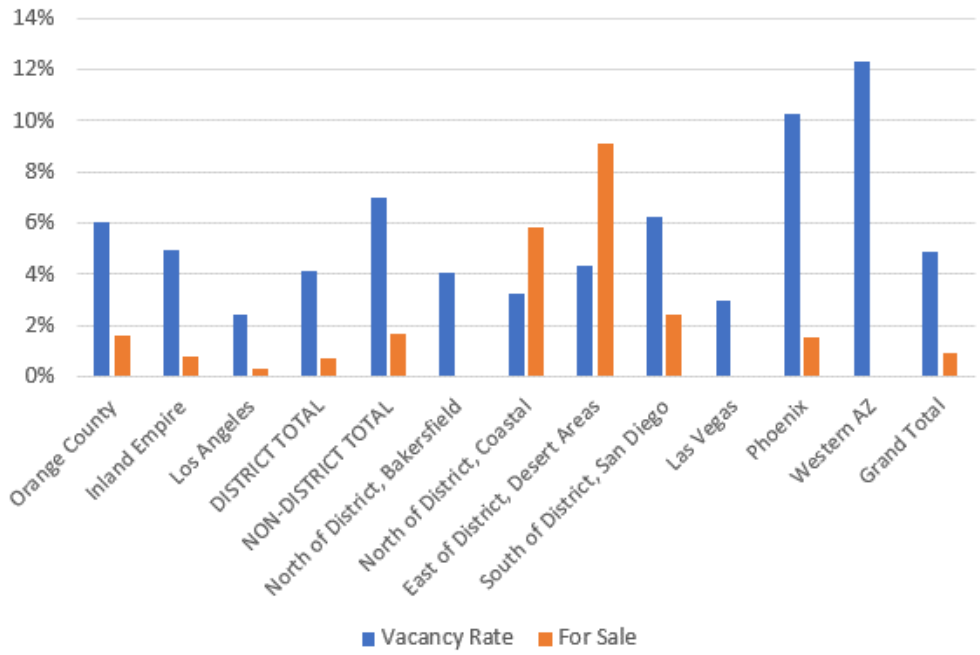
[16] We do note the average vacancy rate for retail fulfillment properties located between one and five miles from a major road is much higher outside the District (25 percent) than in the District (five percent). This difference is driven entirely by properties within the Phoenix market.

EXHIBIT 11. HISTORICAL VACANCY RATES ACROSS MARKETS - 2008-2019.



We also compare vacancy rates with the percentage of property for sale across the markets. To avoid double counting, when a property is both vacant and for sale, we include it only in the for-sale category. Due to this, the vacancy rates shown in Exhibit 12 are slightly lower than those listed in Exhibit 10. For the most part, the share of property area listed for rent exceeds the percentage for sale, with the exception of the East of District, Desert Areas and North of District, Coastal markets.

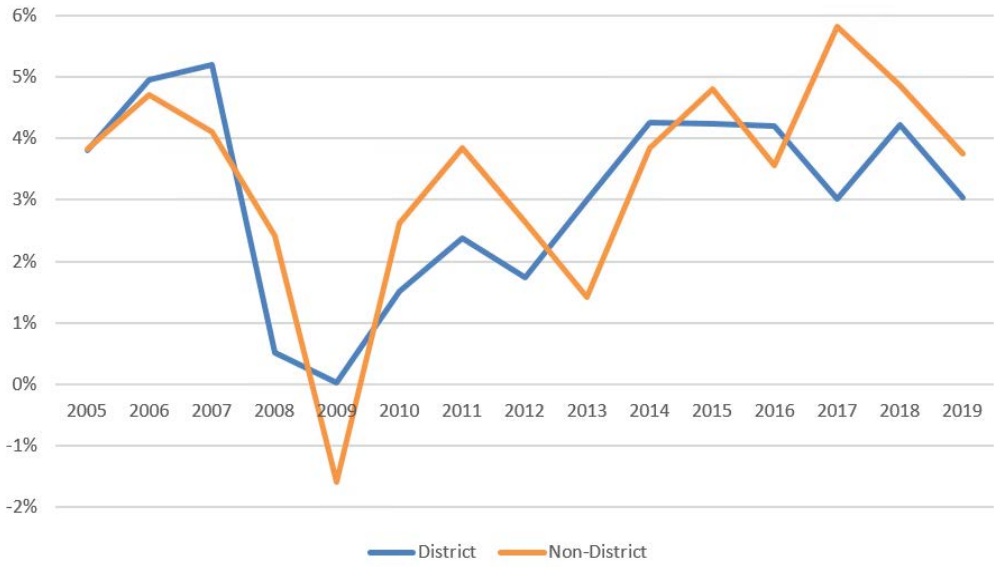
EXHIBIT 12. VACANCY AND FOR SALE RATES ACROSS MARKETS - YEAR 2019



Net Absorption

To provide insights on the direction of each market, we also examine net absorption for warehouse space, defined as the total amount of space tenants moved into in a given time period less the amount of space tenants vacated during the same time period. Exhibit 13 shows annual net absorption as a share of total capacity has been positive and, for the most part, growing in both the South Coast AQMD jurisdiction and outlying markets since 2010.[17] Annual net absorption values in square feet are presented in Exhibit 14 for 2000 through 2019 for each market area. The non-District total line represents the sum of all outlying market net absorption, both positive and negative.

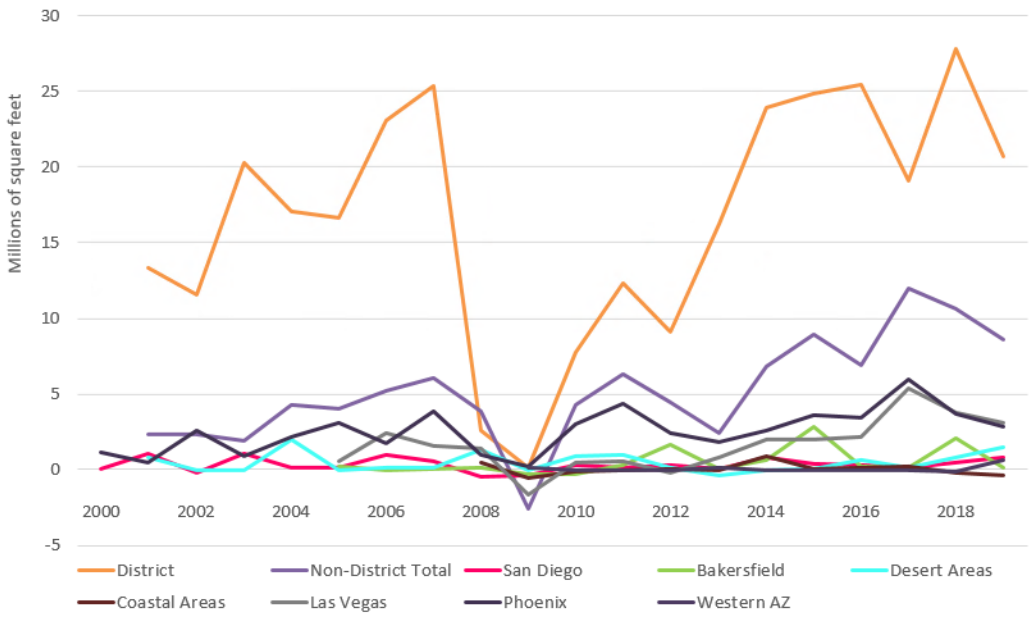
EXHIBIT 13. NET ABSORPTION AS A PERCENT OF OVERALL CAPACITY - 2010-PRESENT



Note: Due to data limitations, the Non-District total does not include net absorption totals for the Coastal Areas and Western AZ markets prior to 2007 and 2008, respectively.

[17] The net absorption and historical rents (Exhibit 17) analyses rely on the same outputs from the CoStar Market Analytics™ module. While the historical rents analysis relies on slightly revised market areas (defined in that section) due to incomplete data, the net absorption analysis uses the same market area geographies as defined in Exhibit 1-A and used elsewhere in this memo.

EXHIBIT 14. ANNUAL NET ABSORPTION ACROSS MARKETS - 2000-2019



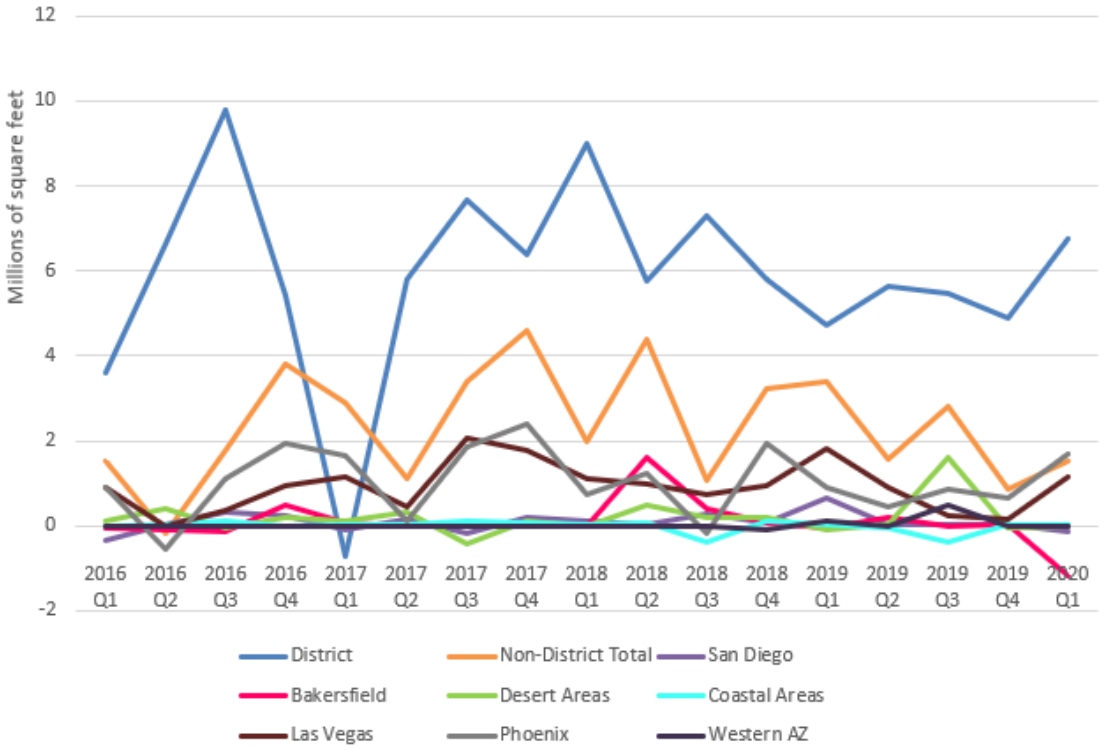
Note: Due to data limitations, not all market areas have net absorption data extending back to 2000.

Based on the data shown in Exhibit 14, the South Coast AQMD, Phoenix and Las Vegas markets have steadily increased total occupied space year over year since 2009. The other outlying markets have less obvious growth patterns, with annual net absorption hovering around zero. At two points, in 2012 and 2017, growth in net absorption in the South Coast AQMD jurisdiction slowed relative to the prior years. Reduced net absorption growth in 2017 in the South Coast AQMD jurisdiction, however, is offset with an increase in non-District growth, particularly in the Phoenix and Las Vegas markets. This provides suggestive evidence that warehousing activity may shift between the South Coast AQMD jurisdiction and these outlying areas.

Exhibit 15 examines this activity from 2016 to the present in quarterly timesteps. Time periods such as Q4 2016, Q1 2017, Q4 2017, Q2 2018, and Q1 2019 indicate dips in the growth of South Coast AQMD tenant occupancy directly coincide with increases in the Phoenix and Las Vegas markets' net absorption. Conversely, growth in net absorption in the South Coast AQMD jurisdiction in Q2 2016, Q2 2017, Q1 2018, Q3 2018, and Q2 2019 align with reduced growth in the non-District markets.

For the most part, non-District growth appears to be focused in the Phoenix and Las Vegas markets, though in some instances Bakersfield (Q2 2018) and Desert Areas (Q3 2019) see spikes in net absorption coinciding with declines in net absorption the South Coast AQMD jurisdiction. In recent years, the quarterly data indicate all markets do not see simultaneous increases or decreases in growth of tenant absorption. Tenant absorption instead appears to shift, a finding not captured as clearly in the annual data in Exhibit 14. Whether this reflects actual competition between markets or other factors, such as differences in the typical leasing calendar across geographies, is unclear.

EXHIBIT 15. RECENT QUARTERLY NET ABSORPTION ACROSS MARKETS, 2016-PRESENT



Pricing

Our assessment of the pricing for warehousing space in the South Coast AQMD jurisdiction and outlying areas considered both monthly rental prices and sale prices, focusing on properties with a building area of at least 100,000 square feet. For rental prices in each area, we calculated the average monthly triple net rent values for the advertised rent per square foot as reported in the CoStar data.[18] The data has available rents for 212 properties, or six percent of the total 3,613 warehousing properties greater than 100,000 square feet and fitting the other criteria for the sample of properties.

We used values reported in the CoStar data to calculate the average sale price per square foot. We limited our scope to sales that occurred from 2017 to the present to avoid underestimating this value due to appreciation in property values over time. We dropped the lowest and highest five percent of sales prices that occurred within this timeframe to avoid outliers due to coding errors or sales intentionally below market value (e.g., transfers of property between members of the same family). This resulted in a sales data sample of 338 properties, or nine percent of the total 3,613 warehousing properties greater than 100,000 square feet and fitting the other criteria for the sample of properties. Exhibit 16-A tabulates the rental and sale price per square foot across markets. Exhibit 16-B illustrates the differences in monthly rent across market area.

At an average of $0.88 per square foot per month, the South Coast AQMD market overall has a higher rental price per square foot than its neighboring markets, with the exception

[18] CoStar reports triple net rent values, which exclude property taxes, building maintenance, and insurance premiums. On a triple net lease, these expenses are typically paid by the tenant in addition to rent.

of San Diego. This is driven by high prices in the Orange County and Los Angeles sub-markets, as rent in the Inland Empire is lower than in the other South Coast AQMD sub-markets. The Desert Areas and Coastal Santa Barbara, Ventura and San Luis Obispo (North of District, Coastal) follow closely behind the District average. Western Arizona, Bakersfield, and Phoenix have the lowest prices of $0.44 and below.[19]

Sale prices follow a similar trend to rental prices, with higher prices in urban areas. The non-District average is much lower than the South Coast AQMD value, which is more than three times higher at $1,087 per square foot.

EXHIBIT 16-A. MONTHLY RENT AND SALE PRICES ACROSS MARKETS FOR WAREHOUSES WITH BUILDING AREA OF AT LEAST 100,000 SQUARE FEET - YEAR 2019

MARKET	AVERAGE RENTAL PRICE PER SQUARE FOOT	AVERAGE SALE PRICE PER SQUARE FOOT
South Coast AQMD Average	**$0.88**	**$1,087**
Orange County	$0.92	$503
Inland Empire	$0.70	$1,164
Los Angeles	$0.93	$1,173
Non-District Average	**$0.58**	**$344**
North of District, Coastal	$0.78	$100
North of District, Bakersfield^	$0.34	$105
East of District, Desert Areas*^	$0.81	$27
South of District, San Diego	$0.92	$225
Las Vegas	$0.63	$574
Phoenix	$0.44	$307
Western AZ*^	$0.32	No Data
Grand Average	**$0.71**	**$815**

*Denotes fewer than five properties with available sales data.

^Denotes fewer than five properties with available rent data.

[19] Small sample size is an issue in calculating average rent and sale price by market area. The average rents for the North of District, Bakersfield, East of District, Desert Areas, and Western AZ markets all rely on five or fewer properties in the calculation of these values. For average sale price, East of District, Desert Areas has fewer than five properties with data, while the Western AZ has no data. Focusing on the Non-District Average values in Exhibit 16 avoids this issue.

EXHIBIT 16-B. MONTHLY RENT AND SALE PRICES ACROSS MARKETS FOR WAREHOUSES WITH BUILDING AREA OF AT LEAST 100,000 SQUARE FEET - YEAR 2019

We also examined recent historical rents across the geographic markets. In order to examine these prices, we relied on data from the CoStar Analytics™ module's quarterly reporting filtered for Industrial properties greater than 100,000 square feet. The markets defined in this tool differ slightly from those we define for the purposes of this analysis, in that they at times follow county lines while ours account for South Coast AQMD's more idiosyncratic jurisdictional boundaries. Additionally, for some areas data are not available in this module. We describe below the resulting altered markets and any methods we used to reconcile the differences with the markets used in Exhibit 16 and elsewhere in this memo.

- ***North of District, Bakersfield:*** Data is not available for the portion of Los Angeles County located outside of the District. We use historical rent data for Kern County, which accounts for 84.0 percent of the current existing square footage considered in this analysis.
- ***East of District, Desert Areas:*** Data is available at the county level for both Imperial County and the non-District portions of Riverside and San Bernardino Counties. We calculate weighted average historical rents by applying the current share of property square footage for Imperial County (19.3 percent) and the non-District portions of Riverside and San Bernardino counties (80.7 percent).
- ***North of District, Coastal:*** The historical rent we estimate for this area is the weighted average of rents for San Luis Obispo and Santa Barbara counties. CoStar Analytics™ data are not available for Ventura County. Taken together, San Luis Obispo and Santa Barbara counties account for just 20.5 percent of the total relevant square footage in the North of District, Coastal market considered elsewhere in this document.
- ***South of District, San Diego; Las Vegas; and Phoenix:*** These markets, following county lines and with available data, are unchanged from those considered elsewhere in this document.

- ***Western AZ:*** Of the four counties included in the Western Arizona area examined elsewhere in this document, Yuma County, which contains 52.9 percent of the relevant properties considered in this market, is the only county for which historical rent data are available.

The pricing information in Exhibit 16 above reflects the 2019 snapshot of CoStar's property-level data filtered according to the criteria described earlier in this document.

Because CoStar's historical data does not allow for filtering by secondary type, the historical rent data for all properties are classified as Industrial (i.e., not only those with secondary categorizations of Distribution, Light Distribution, Refrigeration/Cold Storage, Truck Terminal, or Warehouse). Additionally, historical rent data is restricted to properties greater than 100,00 square feet. This difference results in discrepancies relative to the 2019 pricing information gathered from the property data.

Exhibit 17 shows the average monthly triple net rent price for each of the adapted markets described above at the end of the stated year. Following a dip in rents related to the 2008 financial crisis, we see prices steadily rise across markets, in most cases beginning in 2012. Similar to what we see above in the property data snapshot, prices are highest in California's coastal markets. Inland urban and rural markets form a second pricing tier significantly lower than the coastal markets.

EXHIBIT 17. RECENT HISTORICAL MONTHLY RENT PRICES ACROSS MARKETS – 2000-2019 (RENTAL PRICE PER SQUARE FOOT, 2019$[20])

MARKET	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2019
South Coast AQMD Jurisdiction	$0.55	$0.55	$0.55	$0.56	$0.57	$0.45	$0.49	$0.56	$0.59	$0.68	$0.80
North of District, Coastal Areas					$0.71	$0.60	$0.55	$0.52	$0.46	$0.63	$0.63
North of District, Bakersfield					$0.38	$0.28	$0.28	$0.33	$0.35	$0.43	$0.45
East of District, Desert Areas						$0.51	$0.30	$0.31	$0.35	$0.39	$0.36
South of District, San Diego	$0.79	$0.74	$0.81	$0.84	$0.84	$0.68	$0.70	$0.67	$0.76	$0.87	$0.92
Las Vegas				$0.57	$0.73	$0.51	$0.47	$0.48	$0.54	$0.50	$0.57
Phoenix					$0.51	$0.41	$0.39	$0.40	$0.44	$0.45	
Western AZ					$0.55	$0.43	$0.25	$0.34	$0.39	$0.37	$0.35

Note:
- Due to data limitations, historical rents are not reported for some market areas.
- Historical values are adjusted to 2019 dollars. See footnote 14 for indexing information.

Parcels

In order to capture the potential for future warehouse development, we assessed land parcels in the CoStar data tagged with CoStar's Industrial categorization. We limited our search to parcels located less than two miles from a major road and organized the parcels according to the classes in Exhibit 4 based on area, assuming a land parcel will be at a minimum twice as large in area as the building's square footage.[21] The resulting parcel size categories are 200,000 to 400,000 square feet, 400,000 to one million square feet, and parcels greater than one million square feet. We also examined the feasibility of grouping parcels according to their access or proximity to electric and water infrastructure, but such information was not available from CoStar or other data sources we consulted.

[20] We use annual gross domestic product implicit price deflators to inflate prices to the current dollar year (2019). These values were obtained from the Federal Reserve Bank of St. Louis Economic Research Division (FRED) and are indexed to 2012 (2012 = 100.00). The values are as follow: 2000=78.08, 2002=81.05, 2004=84.78, 2006=90.07, 2008=94.29, 2010=96.11, 2012=100.00, 2014=103.64, 2016=105.80, 2018=110.42, 2019=112.35.

[21] We arrive at this assumption from calculating the average ratio of rentable building area to land area for both District and non-District markets. For District properties this ratio was much higher, at 0.54, relative to 0.42 for non-District properties. We use a broader population of buildings to calculate this ratio than those included in this analysis.

Exhibits 18 and 19 show the number of properties and estimated building square footage that could be constructed for each of the parcel categories specified in the previous paragraph across the various markets. To estimate building square footage, we applied the average ratios of building area to land area in the South Coast AQMD and non-District markets, 0.54 and 0.42 respectively. Multiplying these values by parcel land area gave an estimate of potential building area. Exhibit 18 shows the number of parcels available while Exhibit 19 shows the square footage of parcels available.

EXHIBIT 18. NUMBER OF PROPERTIES ZONED FOR INDUSTRIAL DEVELOPMENT - YEAR 2019

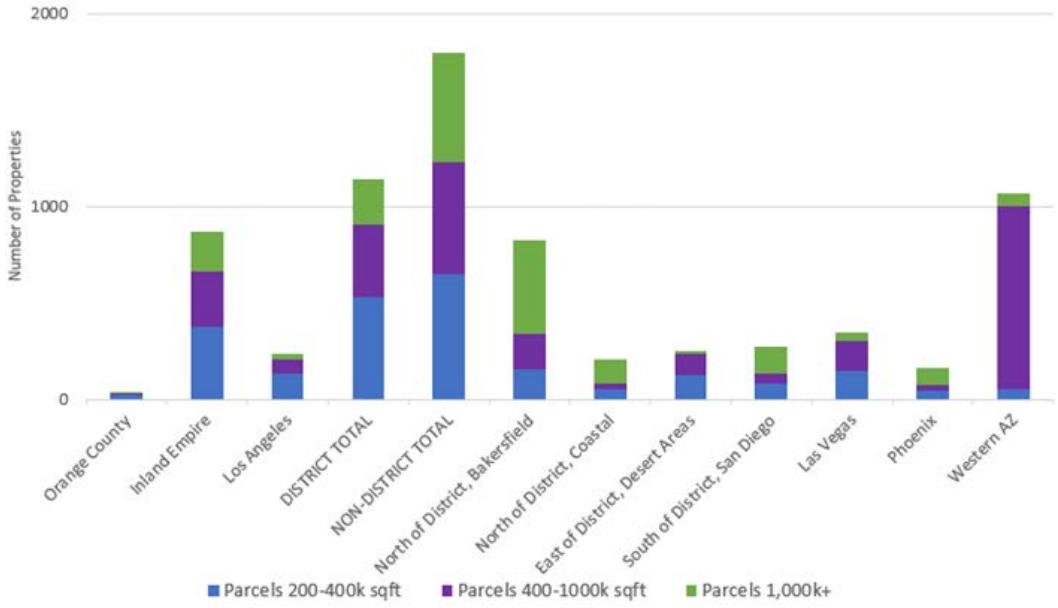


EXHIBIT 19. SQUARE FOOTAGE OF PROPERTIES PROPOSED, UNDER CONSTRUCTION, AND POTENTIAL BUILDING AREA OF PROPERTIES ZONED FOR INDUSTRIAL DEVELOPMENT - YEAR 2019

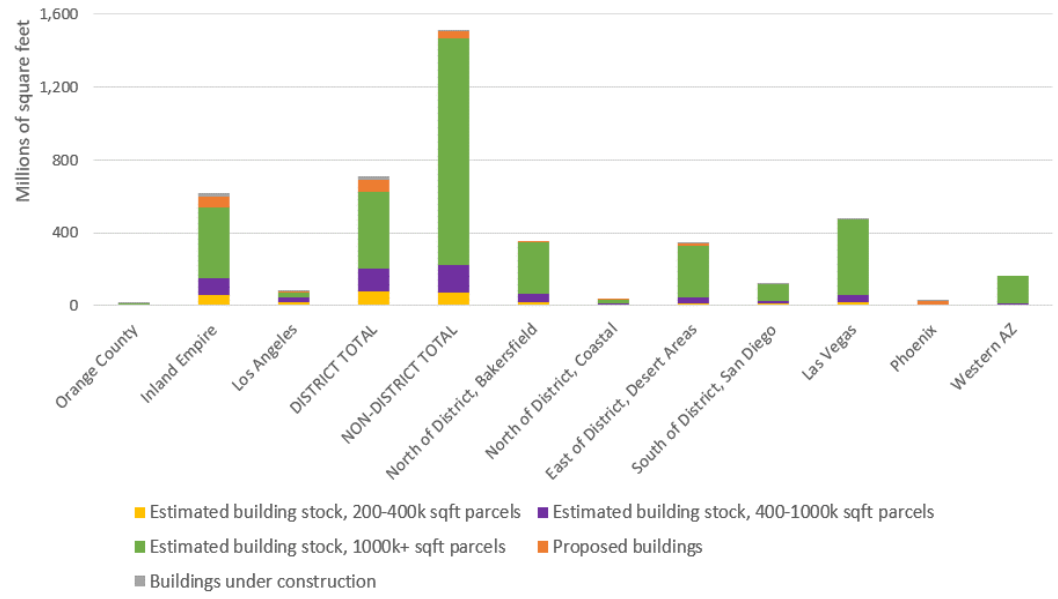


Exhibit 18 reveals a variety of property sizes spread across the various markets, while Exhibit 19 shows most of the total land area located in properties over one million square feet. Eventual parcel development could involve subdividing parcels or developing multiple smaller warehouse facilities on one larger parcel.

MARKET TRENDS

In this section we use current property data as well as the forecast data included with CoStar Analytics™ to identify both medium- and long-term estimates of available capacity for warehousing operations. The long-term forecast estimates capacity additions and additional remaining development potential through 2028. The medium-term forecast considers capacity availability either available now or likely available within the next five years (assuming a five-year window for project approvals and construction). These estimates allow us to compare the projected capacity available in the non-South Coast AQMD areas to existing and projected inventory inside the South Coast AQMD jurisdiction. These forecasts are not available by individual warehouse type, as CoStar's forecast data do not differentiate between differently sized properties.

Medium-term capacity forecast

To generate a medium-term capacity forecast, we examine current vacant capacity and new capacity proposed or currently under construction. Exhibit 20 shows that most of the medium-term capacity available in the South Coast AQMD is in the Inland Empire, while most of the non-South Coast AQMD medium-term capacity is in the Phoenix; East of District, Desert Areas; Las Vegas; and North of District, Bakersfield markets.

EXHIBIT 20. CURRENT VACANCIES, CAPACITY UNDER CONSTRUCTION AND PROPOSED CAPACITY – YEAR 2019

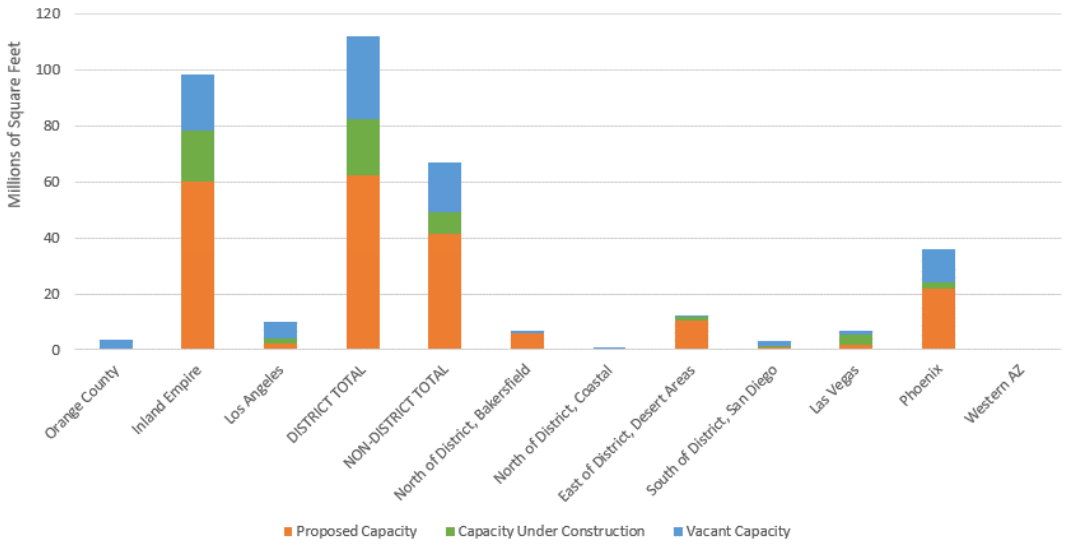
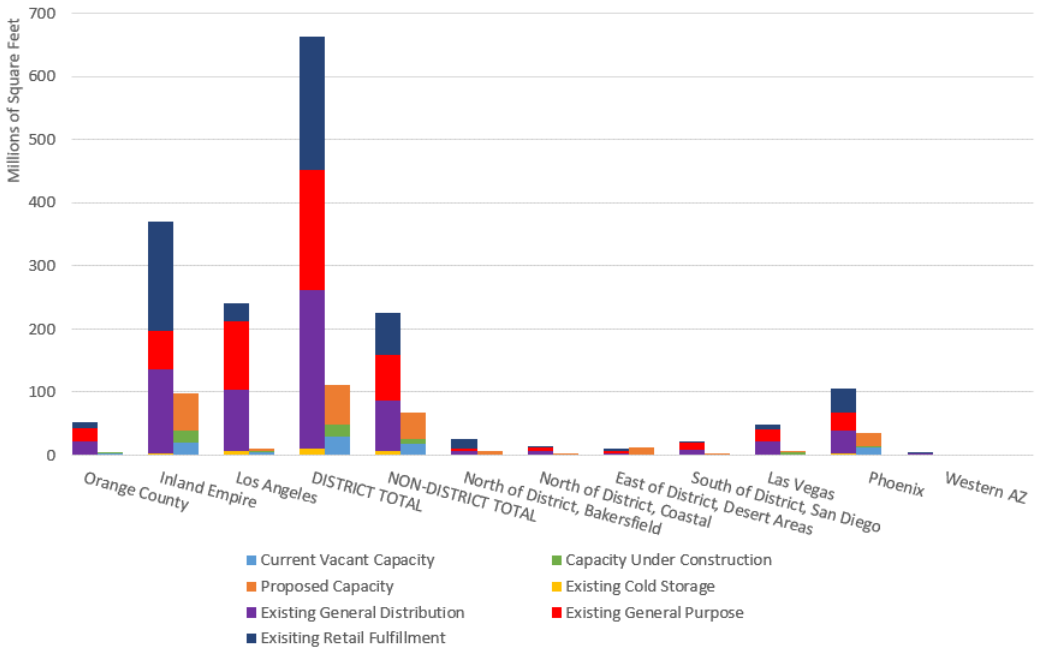


Exhibit 21 compares the medium-term forecast introduced in Exhibit 20 to existing warehousing real estate capacity. As shown in the exhibit, current vacancies, new property under construction, and proposed construction are fairly limited relative to the current warehouse stock. The non-South Coast AQMD total of approximately 67 million square feet is only 10.1 percent of the size of the current District capacity: 662 million

square feet. This indicates that in the medium term, the outlying real estate markets have the potential to absorb only a small piece of current South Coast AQMD warehousing operations.

EXHIBIT 21. COMPARISON OF MEDIUM-TERM AVAILABILITY FORECAST WITH CURRENT 2019 INVENTORY



Long-term capacity forecast

For a long-term forecast of available warehousing space, we identify two key metrics: expected developments and projected "slack" capacity. Expected developments are those projected under the CoStar real estate forecast associated with CoStar's Base Case economic scenario. The base case forecast reflects Moody's Analytics "Baseline" Scenario from July 2018, which assumes a conservative average 1.2 million job additions per year. The forecast applies the future economic estimates to the real estate market, which we limit to properties classified by CoStar as Industrial and falling under the Logistics secondary category.[22]

As with the information on historical rents, the CoStar forecasts of expected developments are, in many cases, based on different geographic markets than those we define above. Though CoStar's forecast areas are based on county boundaries, they do not always align with our market areas. This is largely due to the irregular boundary of the South Coast AQMD region. We reconcile these differences through the following methods,[23] which differ across our markets:

[22] CoStar's secondary classifications in their forecast tools are different than those used in the normal property data. It is not possible to narrow down to Warehouse, Refrigeration/Cold Storage, etc.

[23] Note that these methods are similar to those described for Exhibit 17 and the associated discussion on historical rents.

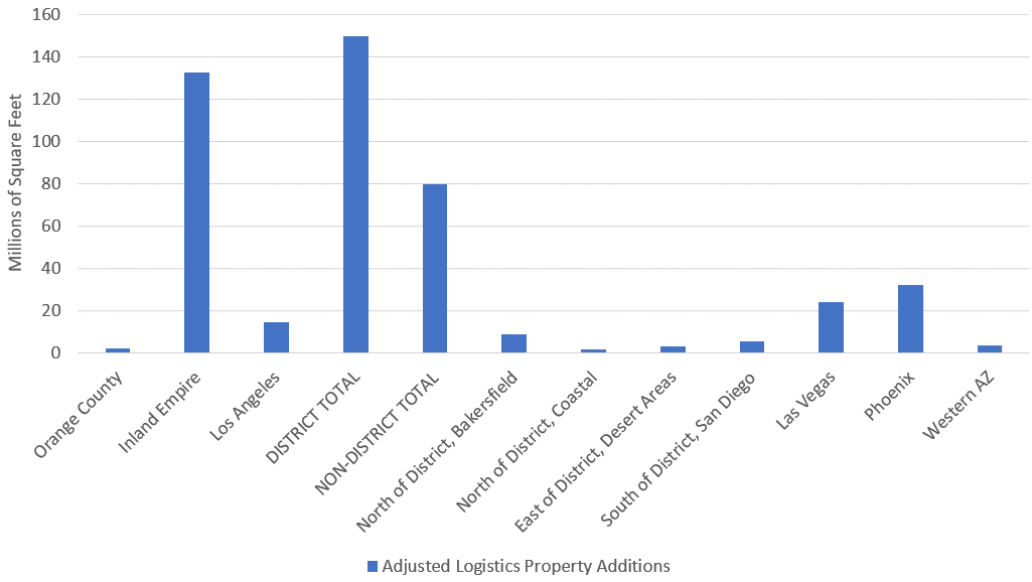
- ***District Markets:*** The CoStar forecast includes projections for all of Los Angeles County and the Inland Empire (i.e., all of Riverside and San Bernardino counties). We use the current snapshot of the relevant property data to determine the share of projected developments in Los Angeles, Riverside and San Bernardino counties located within and outside of the South Coast AQMD jurisdiction. We multiply those percentages by CoStar's estimated growth in properties for each of those counties, then sum the relevant portions within the South Coast AQMD jurisdiction to obtain the total for each of the Los Angeles and Inland Empire markets' projected developments. As mentioned below, Orange County's projections did not need any additional modifications.
- ***North of District, Bakersfield:*** This area includes the non-District portion of Los Angeles County as well as all of Kern County. Building on the approach described above for the South Coast AQMD markets, we use the remaining share of projected capacity growth in the Los Angeles County market added to the projection for Kern County.
- ***East of District, Desert Areas:*** This area includes the non-South Coast AQMD portions of Riverside and San Bernardino counties as well as Imperial County. Building on the approach described above, we use the remaining share of projected capacity growth in Riverside and San Bernardino counties not included in the South Coast AQMD jurisdiction. The CoStar projections, however, do not include data for Imperial County. In the absence of such data, we apply the forecasted ten-year growth rate for Riverside and San Bernardino counties to the existing stock in Imperial County, then sum the properties in the three counties to obtain an estimate for the whole East of District, Desert Areas market.
- ***North of District, Coastal:*** CoStar's forecast includes data for San Luis Obispo and Santa Barbara counties, but not Ventura County. We apply the average growth rate across the included two counties to Ventura County's current capacity, then sum across all three counties to obtain an estimate for the whole Coastal market.
- ***Western Arizona:*** Data are available only for Yuma County, but CoStar forecasts zero developments over the 2018-2028 time period in the base case scenario. We apply this growth rate of zero percent to Yavapai, La Paz, and Mohave counties, expecting no growth in capacity in the next ten years.
- The remaining markets (Orange County, San Diego, Las Vegas, Phoenix) all use the same forecast markets as our analysis, so no reconciliation is necessary.

Based on this spatial reconciliation between the CoStar forecasts and the market areas we defined for this analysis, Exhibit 22 shows expected warehousing real estate capacity developments. Because these forecasts do not distinguish between properties of different sizes, we multiply the values by the proportion of property stock greater than 100,000 square feet to estimate the share of developments relevant to warehouses considered in this analysis.[24] Developments in the South Coast AQMD market exceed those elsewhere,

[24] This ratio is 0.67 for the South Coast AWMD and 0.58 for the non-South Coast AQMD market areas, calculated as the share of warehousing square footage associated with properties greater than 100,000 square feet. This ratio is based on the scope

while the vast majority of non-South Coast AQMD developments are expected in the Phoenix and Las Vegas markets.

EXHIBIT 22. EXPECTED INDUSTRIAL-LOGISTICS DEVELOPMENTS, 2019-2028



Projected slack capacity reflects parcels available for development (as measured at present) as well as projected vacancies. However, because at least a portion of projected vacancies may be on parcels developed in the next several years, summing parcels available with vacancies would lead to overestimation of the total capacity available. To account for this we net out expected developments from the estimated parcels available. Based on this adjustment, we specify projected slack capacity as follows:[25]

$$S = [(P_i - F) * C_{iw}] + V$$

Where S is slack capacity (square feet);

P_i is the total area of land parcels currently available for industrial development (square feet);

F is the land area required to meet forecasted development of industrial land parcels (square feet);

of all properties we have access to via the CoStar database, which is limited to properties greater than 25,000 square feet. The forecasted property additions are with respect to all property sizes, but we expect the share attributable to properties smaller than 25,000 square feet to be small.

[25] This specification of slack capacity is similar but not identical to the long-term measure in the statement of work (SOW), which defines capacity as projected vacancies plus land available for the construction of warehousing facilities. For the reasons described here, the measure in the SOW likely overstates capacity because it does not account for the fact that some projected vacancies may be new construction on parcels now available for construction.

C_{iw} is the building area to land area ratio, as specified above (0.54 for properties in the South Coast AQMD jurisdiction, and 0.42 for non-District properties); and

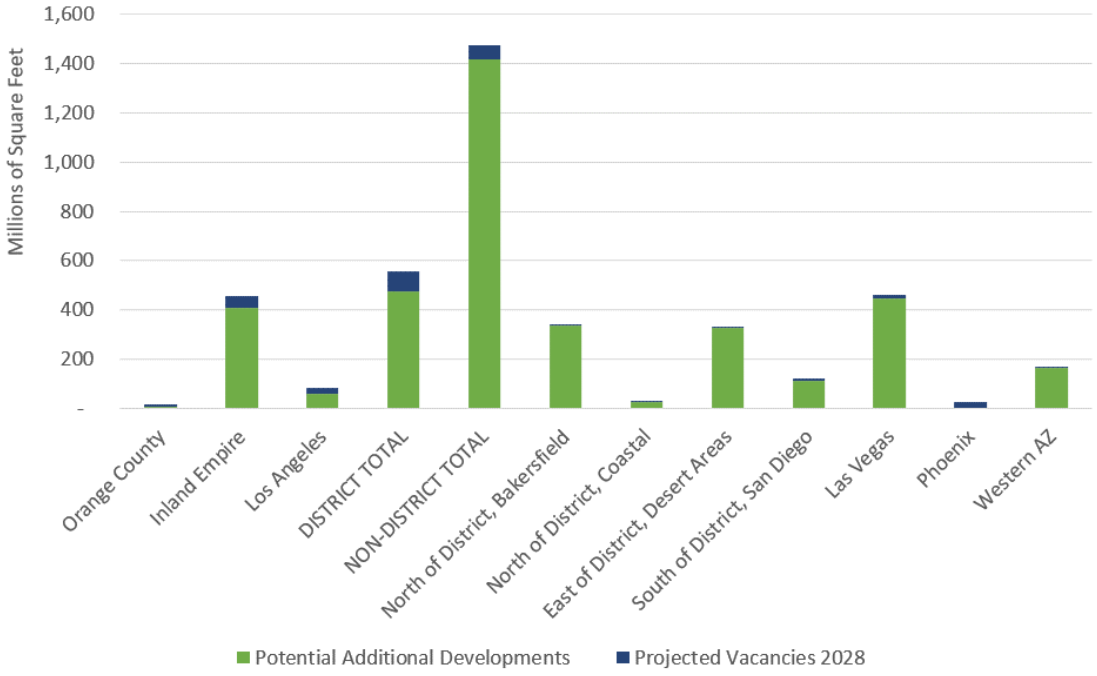
V is projected vacancies (square feet).

This equation, in effect, specifies slack capacity as the parcels expected to be undeveloped without an ISR plus projected vacancies. In applying this equation, we restrict again our search of available vacant land parcels to those larger than 200,000 square feet and those located less than two miles from a major road.

Exhibit 23 shows projected slack capacity, which we calculate following the same reconciliation of the markets' differing geography as above. Projected slack capacity, which may be interpreted as projected vacancies plus potential additional developments not currently forecasted, is approximately three times larger in the non-South Coast AQMD markets than in the South Coast AQMD market. Slack capacity in the South Coast AQMD market, however, is higher than in any single non-District market.

While the projected developments shown in Exhibit 22 reflect additions to total capacity, we expect most of this capacity to be filled in accordance with the base case economic scenario. For this reason, the estimates of slack capacity shown in Exhibit 23 are a more appropriate measure of the capacity available or developable over the next ten years than the projected developments shown in Exhibit 22.

EXHIBIT 23. ESTIMATED SQUARE FOOTAGE OF PROJECTED SLACK CAPACITY, 2028



Similar to Exhibit 21's comparison of the medium-term forecast of capacity additions with existing capacity, Exhibits 24 and 25 compare the long-term forecast's metrics with current capacity.

Forecasted developments in the non-South Coast AQMD markets represent approximately one-eight of current South Coast AQMD capacity, while forecasted developments within the South Coast AQMD jurisdiction are expected to be almost twice as large over the same ten-year time period. Non-South Coast AQMD slack capacity, on the other hand, is over twice as large than current South Coast AQMD capacity. The Las Vegas and Western AZ markets combined have enough slack capacity to theoretically absorb approximately all current warehousing operations in the South Coast AQMD jurisdiction, while the much closer East of District, Desert Areas and North of District, Bakersfield markets each have slack capacity larger than one-half of current warehousing capacity in the South Coast AQMD jurisdiction.

Because mass departures from the South Coast AQMD jurisdiction's warehousing capacity would inevitably drive down prices, we do not expect a largescale development of slack capacity to absorb all warehousing operations in the South Coast AQMD market. It is also unrealistic that all slack capacity would be developed specifically for warehousing capacity, as the Industrial property classification also includes other types of potential developments.

Overall, the comparisons in Exhibits 24 and 25 show projected developments alone would be insufficient to absorb a large portion of the warehouse space in the South Coast AQMD jurisdiction and any mass relocation would require significant warehouse development on currently vacant parcels. In addition, many vacant land parcels available for development may also need utility infrastructure improvements.

EXHIBIT 24. COMPARISON OF EXPECTED DEVELOPMENTS THROUGH 2028 WITH CURRENT INVENTORY

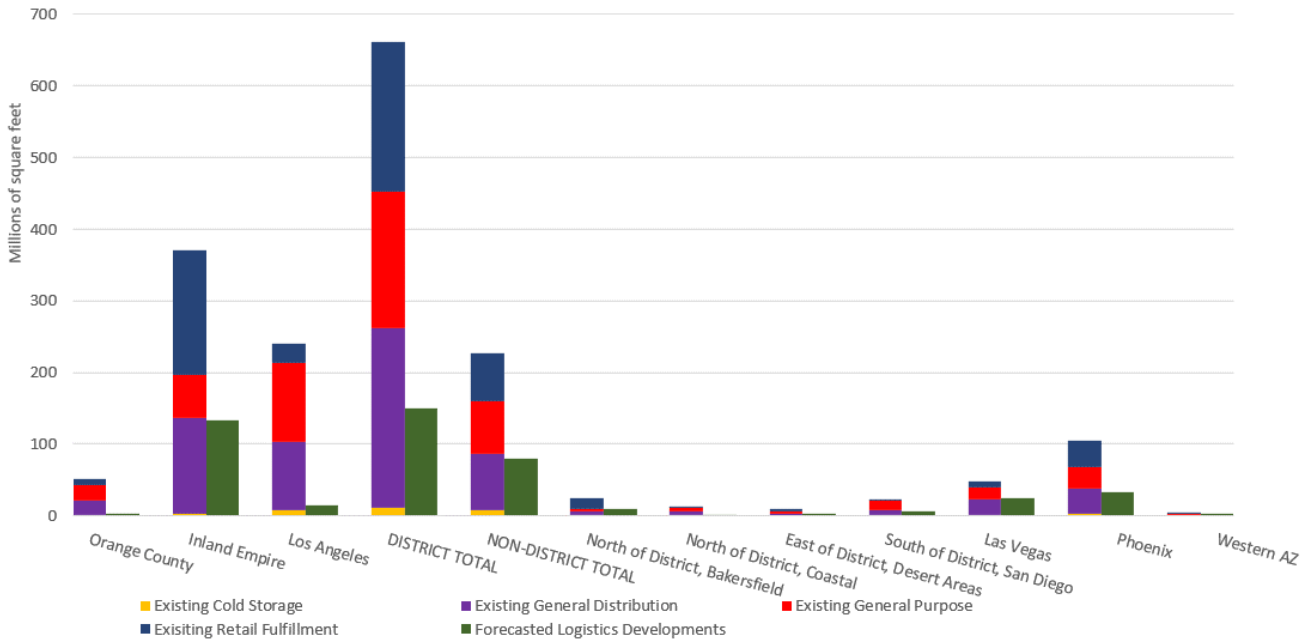
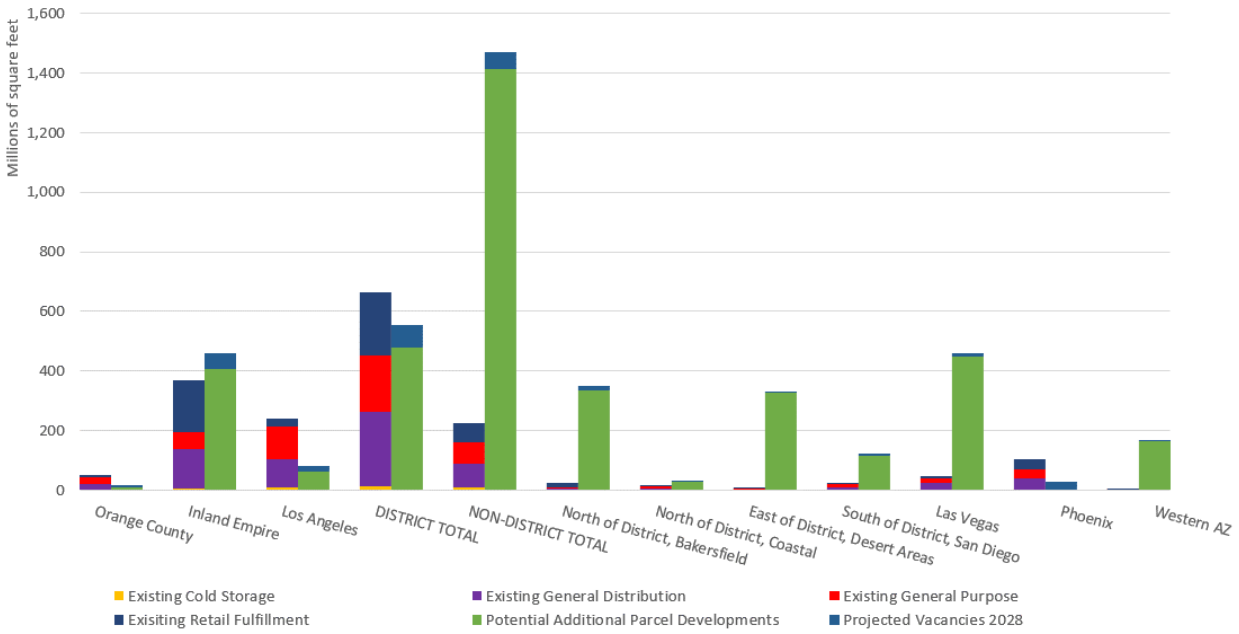


EXHIBIT 25. COMPARISON OF ESTIMATED SLACK CAPACITY IN 2028 WITH CURRENT INVENTORY



CONCLUSIONS

The analysis presented above provides several important insights related to the warehousing real estate markets in the South Coast AQMD jurisdiction and neighboring areas. Focusing on the potential for warehousing operations in the South Coast AQMD jurisdiction to relocate to neighboring areas, the main conclusions we draw from this analysis include the following:

- The market for warehousing within the South Coast AQMD jurisdiction is significantly larger than any of the surrounding market areas considered in this analysis. The South Coast AQMD jurisdiction currently has nearly three times as much warehousing capacity as the outlying markets, with 662 million square feet in the South Coast AQMD jurisdiction versus 226 million square feet across all outlying markets combined. In the last ten years, warehousing capacity additions within the South Coast AQMD jurisdiction are over two times the size of additions in all surrounding market areas combined.
- The outsized demand for warehousing capacity within the South Coast AQMD jurisdiction is despite significantly higher property prices. Rental prices per square foot are on average 34 percent lower in the non-South Coast AQMD markets than within the South Coast AQMD jurisdiction. Of the outlying markets, prices are highest in urban areas and lower outside of California.
- Annual net absorption tends to be much larger within the South Coast AQMD jurisdiction than the surrounding market areas, though the rates are similar when adjusted based on the share of total warehousing capacity. Based on the comparison of net absorption across markets, it appears changes in the growth in warehousing in the South Coast AQMD jurisdiction coincides with changes to growth in the opposite direction in the outlying markets. On at least one occasion,

the Phoenix and Las Vegas markets appear to have absorbed more warehousing growth when growth in the sector declined in the South Coast AQMD jurisdiction. This could suggest a willingness on the part of new or relocating warehouse operators to choose outlying areas over the South Coast AQMD jurisdiction, despite the locational advantages of the latter. We note, however, that the decline in net absorption in the South Coast AQMD jurisdiction (in 2017) may coincide with the increase in the Phoenix and Las Vegas markets due to several factors that we were unable to account for in this analysis (e.g., differential growth rates in state or city economies).

- Because the total warehousing capacity in the South Coast AQMD jurisdiction so exceeds available capacity in the surrounding market areas, additional developments would be necessary to absorb a significant amount of potential warehouse relocations from the South Coast AQMD. With the exception of the North of District, Coastal and Phoenix markets, the potential for significant warehousing capacity developments from vacant land parcels exists in the South Coast AQMD jurisdiction and outlying markets. The non-South Coast AQMD total for estimated potential capacity on undeveloped parcels is more than two times the amount in the South Coast AQMD jurisdiction, at over 1,500 million square feet.
- Focusing on our metric of medium-term capacity, current vacancies and near-term capacity additions are more than 25 percent larger in the South Coast AQMD jurisdiction than in outlying markets. The vast majority of non-South Coast AQMD near-term capacity is located in the Phoenix and Desert Areas markets. Total non-South Coast AQMD medium-term capacity developments represent less than 15 percent of current capacity in the South Coast AQMD jurisdiction.
- With respect to long-term capacity, forecasted capacity additions in the next ten years are around 150 million square feet in the South Coast AQMD jurisdiction and 80 million square feet across outlying markets. While total forecasted capacity additions are highest in the South Coast AQMD jurisdiction, the ten-year forecasted growth rate is higher outside of the South Coast AQMD jurisdiction. The potential for additional development and absorption, or "slack capacity," is over twice as large in the non-District markets as current capacity in the South Coast AQMD jurisdiction. Thus, in the long term, any significant shifts in warehousing operations from the South Coast AQMD jurisdiction to outlying areas will require much greater warehouse development than is currently expected.

ATTACHMENT 3

TECHNICAL MEMORANDUM ON TRUCK FLEETS THAT SERVE WAREHOUSES IN SCAQMD JURISDICTION

MEMORANDUM | 12 DECEMBER 2020

TO Ian MacMillan, Paul Stroik, Shah Dabirian, and Victor Juan, South Coast Air Quality Management District (SCAQMD)

CC Jason Price, Industrial Economics (IEc)

FROM Jasna Tomic and Kelly Leathers, CALSTART

SUBJECT Technical Memorandum on Truck Fleets that Serve Warehouses in South Coast AQMD Jurisdiction

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INTRODUCTION

This memorandum is in support of the South Coast Air Quality Management District (South Coast AQMD) staff's development of a potential indirect source rule (ISR) to reduce mobile source emissions related to the operation of logistics and warehousing facilities in the South Coast AQMD's four-county jurisdiction (Los Angeles, Orange, Riverside, and San Bernardino counties, as shown in Exhibit 1).[1] The purpose of this document is to develop a better understanding of the fleets that serve the logistics and warehousing sector in the South Coast AQMD jurisdiction.

In the first part of this document we review the characteristics of fleets serving the Ports of Los Angeles and Long Beach, the four counties that make up the South Coast AQMD jurisdiction, and the broader ten-county Southern California region. The second portion of this document provides insights on fleet characteristics and operations, as obtained from CALSTART interviews with industry stakeholders.

EXHIBIT 1: SOUTH COAST AQMD JURISDICTION

[1] The South Coast AQMD jurisdiction is comprised of all of Orange County and parts of Los Angeles, Riverside, and San Bernardino Counties. The area is presented in Figure 1.

TRUCK FLEET CHARACTERISTICS

In this section, we present summary data on the characteristics of fleets potentially affected by the ISR. We conduct this analysis for three categories of fleets at different spatial levels. We first examine fleets with access to the Ports of Los Angeles and Long Beach. We then expand the coverage of our assessment to include fleets in the four counties that make up the South Coast AQMD jurisdiction.[2] Finally, we assess the characteristics of fleets in California more broadly.

DATA SOURCES

In order to describe truck fleets and identify the number of trucks that operate in the region, we principally relied on IHS Automotive data from 2018 as well as data from the San Pedro Bay Ports (Port Drayage Truck Registry). The IHS database includes a record of trucks registered with the California Department of Motor Vehicles (DMV). Trucks that operate in California, however, can be registered in other states and operate under the International Registration Plan (IRP), which allows for interstate operation. These trucks are not included in the IHS database but may be important for understanding fleets operating in California, especially for larger companies that have a national presence. At the state level, we therefore examine both DMV registration data and IRP data, as reported in the California Vehicle Inventory and Use Survey (CA VIUS).

POPULATION OF TRUCKS SERVING THE SAN PEDRO BAY PORTS

SAN PEDRO BAY PORTS

We start with analysis of the Port Drayage Truck Registry, which includes the trucks registered to have access to the Ports of Los Angeles and Long Beach, collectively known as the San Pedro Bay Ports. These are generally Class 7 and 8 trucks. Exhibit 2 below presents the total number of trucks in the Port Drayage Truck Registry and the average number of active trucks per month at the San Pedro Bay Ports over the last three years. Exhibit 3 contains the total number of fleets as well as the number of small (less than 6 trucks), medium (6-10 trucks), and large fleets (more than 10 trucks).

EXHIBIT 2: NUMBER OF TRUCKS THAT ACCESS THE SAN PEDRO BAY PORTS

	2020	2019	2018
No. Trucks	18,556	18,280	18,188
Average Active Trucks Per Month	13,080	13,139	12,737

Source: Port Drayage Truck Registry, 2020.

EXHIBIT 3: NUMBER AND SIZE OF FLEETS ACCESSING SAN PEDRO BAY PORTS

	2020	2019	2018
Fleets	2,348	2,162	1,985
Small Fleets (<6 trucks)	1,006	949	854
Medium Fleets (6-10 trucks)	408	363	348
Large Fleets (>10 trucks)	943	850	783

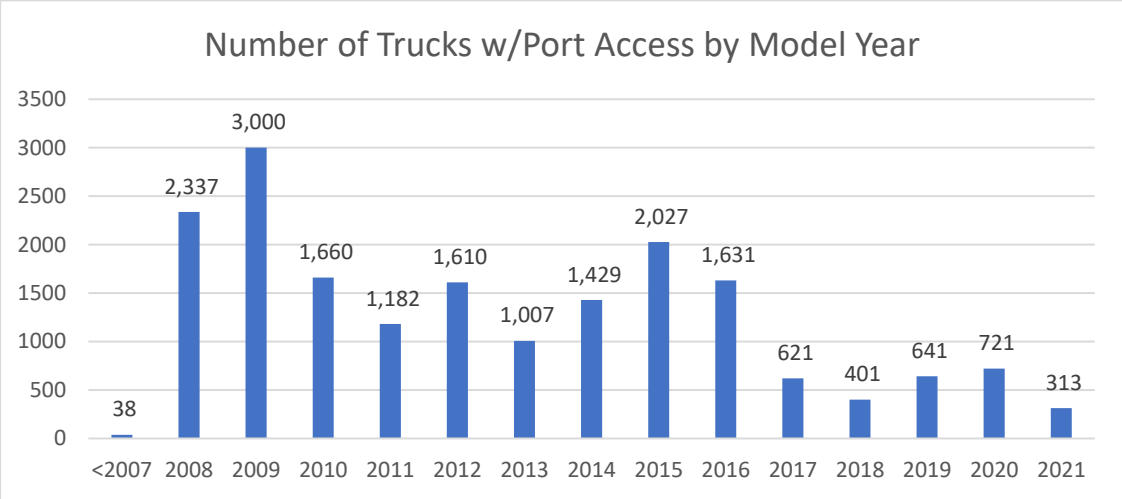
Source: Port Drayage Truck Registry, 2020.

[2] This includes fleets in all of Los Angeles, Riverside, and San Bernardino Counties, including portions of these counties not located in the South Coast AQMD jurisdiction.

The number of trucks in the Port Truck Registry has been steadily increasing over the last three years from 18,188 in 2018 to 18,556 in 2020. The number of average active trucks per month has increased as well. The small drop in 2020 (which included data through September 2020) may have been caused by the drop in goods movement from the ports during the COVID-19 pandemic. The second observation with respect to the size of the fleets is that, as of 2020, the largest proportion, or 43 percent, are small fleets, followed by 40 percent large fleets, and only 17 percent of medium-size fleets.

We analyzed the age of the trucks currently accessing the ports. Exhibit 4 shows the distribution of trucks by model year. Overall, 38 percent of trucks are MY 2010 or older, another 39 percent are MY 2011-2015, and 23 percent are MY 2016-2021.

EXHIBIT 4: AGE DISTRIBUTION OF TRUCKS ACCESSING THE SAN PEDRO BAY PORTS



Source: Port Drayage Truck Registry, 2020

POPULATION OF TRUCKS IN THE SOUTH COAST AQMD COUNTIES

TRUCK POPULATION IN LOS ANGELES, ORANGE, RIVERSIDE, AND SAN BERNARDINO COUNTIES

In this section we analyze the number of trucks in the four counties that make up the South Coast AQMD jurisdiction – Los Angeles (LA), Orange (OR), Riverside (RV), and San Bernardino (SB) Counties[3]. We relied on IHS Markit data which include registrations from the California Department of Motor Vehicles (DMV). Exhibit 5 summarizes these data by vehicle class (Class 3 – Class 8) and by vocation.

[3] These data include the full area of these four counties.

EXHIBIT 5: POPULATION OF TRUCKS BY CLASS IN LA, OR, RV, AND SB COUNTIES

TRUCK VOCATION	CLASS 8	CLASS 7	CLASS 6	CLASS 5	CLASS 4	CLASS 3	TOTAL
Long Haul Truck	63,299	1,550	0	0	0	0	64,849
Regional Truck	44,598	12,901	33,598	10,541	17,238	29,631	148,507
Drayage Truck	27,527	702	206	14	8	13	28,470
Terminal Tractor	794	86	0	0	0	0	880
Step Van	0	32	8,677	3,254	4,668	706	17,337
Cargo Van	0	0	0	0	0	5,439	5,439
Total	136,218	15,271	42,481	13,809	21,914	35,789	265,482

Source: IHS Automotive MD and HD Vehicle Data, 2018.

It should be noted that the vocation assignments in Exhibit 5 were made using codes available in the IHS Markit database and additional descriptions of the truck models. This approach introduces some uncertainty into the characterization of the truck population due to overlapping codes. One example is the relatively small number of drayage trucks observed as Class 3 trucks. Normally drayage trucks are only Class 7 and 8 trucks.

Drawing on the IHS data, Exhibits 6 and 7 include the distribution of the trucks by type and class owned by individuals and larger fleets respectively. In 2018 there were more than 265,000 trucks registered in LA, OR, RV, and SB counties, with 36 percent of those belonging to individuals and the remainder to larger fleets. The largest proportion of trucks (more than 50 percent) is Class 8 for both individual owners and for larger fleets.

EXHIBIT 6: NUMBER OF TRUCKS IN LA, OR, RV, AND SB COUNTIES ONWED BY INDIVIDUALS (OWNER-OPERATORS)

Truck Vocation	Class 8	Class 7	Class 6	Class 5	Class 4	Class 3	Total
Long Haul Truck	18,990	564	0	0	0	0	19,554
Regional Truck	21,492	3,635	9,271	2,976	5,780	15,491	58,645
Drayage Truck	11,839	184	115	0	1	11	12,150
Terminal Tractor	50	7	0	0	0	0	57
Step Van	0	14	327	306	1,630	55	2,332
Cargo Van	0	0	0	0	0	3,259	3,259
Total	52,371	4,404	9,713	3,282	7,411	18,816	95,997

Source: IHS Automotive MD and HD Vehicle Data, 2018.

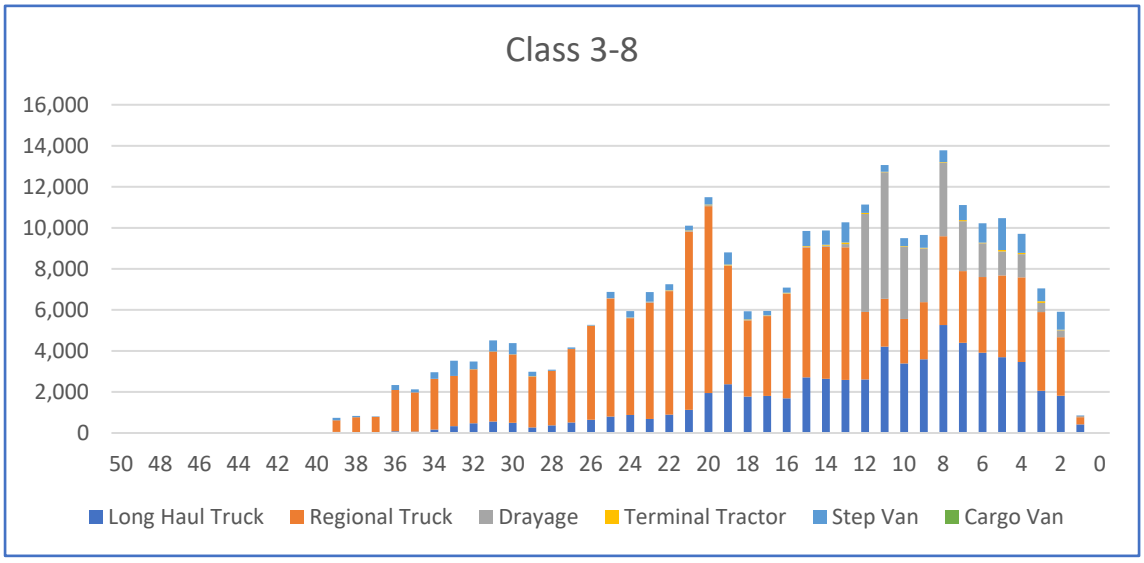
EXHIBIT 7: NUMBER OF TRUCKS IN LA, OR, RV, AND SB COUNTIES OWNED BY LARGER FLEETS

TRUCK VOCATION	CLASS 8	CLASS 7	CLASS 6	CLASS 5	CLASS 4	CLASS 3	TOTAL
Long Haul Truck	44,309	986	0	0	0	0	45,295
Regional Truck	23,106	9,266	24,327	7,565	11,458	14,140	89,862
Drayage Truck	15,688	518	91	14	7	2	16,320
Terminal Tractor	744	79	0	0	0	0	823
Step Van	0	18	8,350	2,948	3,038	651	15,005
Cargo Van	0	0	0	0	0	2,180	2,180
Total	83,847	10,867	32,768	10,527	14,503	16,973	169,485

Source: IHS Automotive MD and HD Vehicle Data, 2018.

We also analyzed truck ages, in years, and fuel types across the four counties that make up the South Coast AQMD jurisdiction. The age distribution of trucks in this area is presented in Exhibit 8 and 9. Exhibit 8 shows these data for Class 3-8 trucks, whereas Exhibit 9 focuses exclusively on Class 8. This age distribution represents a broader universe of trucks than the age distribution shown in Exhibit 4, which focuses only on trucks serving the San Pedro Bay Ports.[4] As shown in Exhibits 8 and 9, long haul and drayage trucks seem relatively younger compared to regional delivery trucks. The exhibits also show that drayage trucks in the area are less than 13 years old. This reflects the prohibition against pre-2007 trucks at the San Pedro Bay Ports.

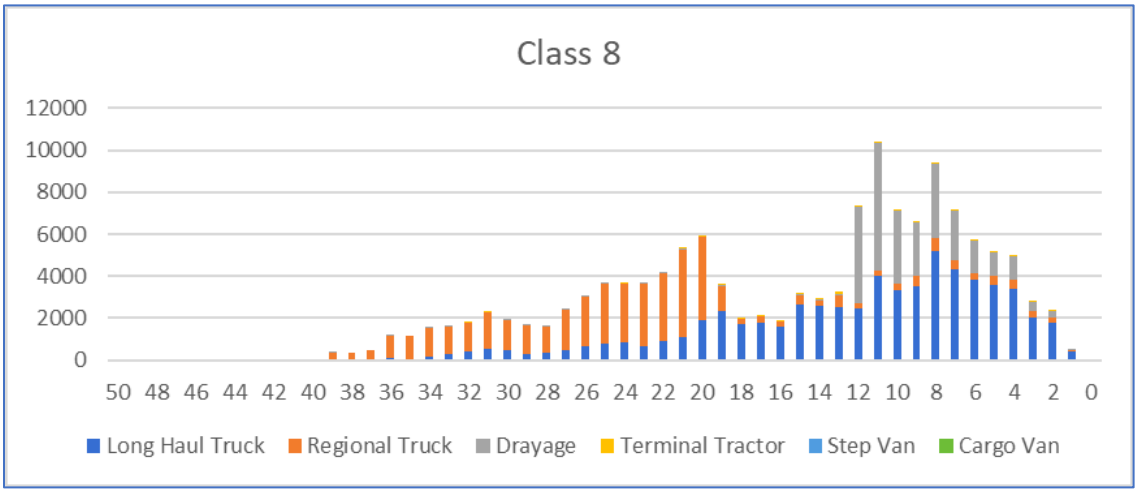
EXHIBIT 8: AGE DISTRIBUTION OF TRUCKS IN LA, OR, RV, AND SB COUNTIES



Source: IHS Automotive MD and HD Vehicle Data, 2018.

[4] This is observable in Exhibit 8 through drayage trucks being at most 12 years old.

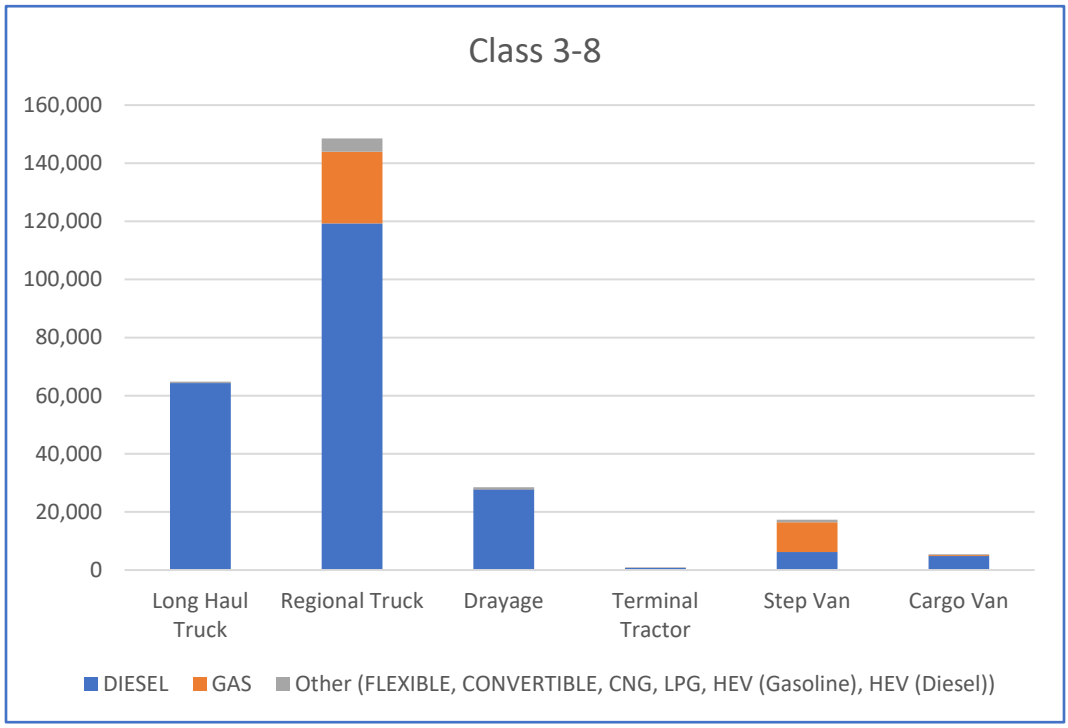
EXHIBIT 9: AGE DISTRIBUTION OF CLASS 8 TRUCKS IN LA, OR, RV, AND SB COUNTIES



Source: IHS Automotive MD and HD Vehicle Data, 2018.

Exhibit 10 shows the distribution of trucks across fuel types for each truck vocation - the data is also available in Appendix C. The dominant fuel type is diesel (84 percent) followed by gasoline (13 percent); all other alternative fuels add up to approximately 3 percent.

EXHIBIT 10: FUEL TYPES IN THE TRUCK POPULATION IN LA, OR, RV, AND SB COUNTIES



POPULATION OF TRUCKS IN GREATER SOUTHERN CALIFORNIA

TRUCK POPULATION IN THE GREATER SOUTHERN CALIFORNIA REGION

In this section we analyze and discuss the population of trucks in the ten counties making up the greater Southern California region. We conducted this analysis to include trucks domiciled and registered in the counties outside the South Coast AQMD jurisdiction but serve warehouse and distribution centers there. The ten counties include:

- Imperial
- Kern
- Los Angeles
- Orange
- Riverside
- San Bernardino
- San Diego
- San Luis Obispo
- Santa Barbara
- Ventura

Exhibit 11 presents the number of trucks by vocation and class size for the greater Southern California region. Overall, the total number of trucks in the region is approximately 31 percent greater than the corresponding population for LA, OR, RV, AND SB counties. The distribution among the different classes and different vocations however is very much the same, with Class 8 as the largest truck class.

EXHIBIT 11: POPULATION OF CALIFORNIA-REGISTERED TRUCKS BY CLASS AND VOCATION IN THE GREATER SOUTHERN CALIFORNIA REGION

TRUCK VOCATION	CLASS 8	CLASS 7	CLASS 6	CLASS 5	CLASS 4	CLASS 3	TOTAL
Long Haul Truck	86,048	2,249	0	0	0	0	88,297
Regional Truck	60,362	18,195	43,429	13,076	21,616	39,972	196,650
Drayage Truck	33,776	836	281	23	14	17	34,947
Terminal Tractor	818	93	0	0	0	0	911
Step Van	0	43	9,031	3,569	5,678	754	19,075
Cargo Van	0	0	0	0	0	8,151	8,151
Total	181,004	21,416	52,741	16,668	27,308	48,894	348,031

Source: IHS Automotive MD and HD Vehicle Data, 2018.

DMV AND IRP DATA

The analysis above relies on IHS Markit data based on California DMV registrations. These data, however, do not include other trucks that operate in the state. To obtain a more comprehensive view of trucks operating in California, we compiled data from the most recent (2018) California Vehicle Inventory and Use Survey (CA VIUS), which includes both DMV data and data from the International Registration Plan (IRP), the latter of which captures trucks registered outside California. Exhibit 12 includes the number of trucks operating in California that are in the DMV or IRP data.

EXHIBIT 12: NUMBER OF TRUCKS BY CLASS IN DMV AND IRP IN CALIFORNIA[5]

Class	DMV	IRP, NON-CALIFORNIA REGISTRATIONS	Total
Class 3	69,723	5,129	74,852
Class 4	47,505	2,167	49,672
Class 5	44,914	6,655	51,569
Class 6	73,170	10,644	83,814
Class 7	44,822	18,707	63,530
Class 8	192,297	243,965	436,261
Total	472,431	287,267	759,698

Source: California Vehicle Inventory and Use Survey, Volume I Truck Survey, 2018.

The total number of trucks reported by the CA VIUS truck survey for 2018 was just below 760,000. The majority of these trucks were identified in the DMV data for all truck classes, with the exception of Class 8. For Class 8 the number of IRP trucks is larger than DMV trucks. This is an important finding, as it indicates the DMV numbers for Class 8 trucks likely undercount the number of active Class 8 trucks operating in the state and potentially the South Coast AQMD jurisdiction.

STAKEHOLDER INTERVIEWS

To gather additional information on the fleets serving warehouses in the South Coast AQMD jurisdiction, we conducted a series of structured interviews of various fleet owners and operators. This section details the process for identifying industry stakeholder contacts, the questions designed to obtain relevant information, and the input provided by stakeholders.

IDENTIFICATION OF FLEET STAKEHOLDERS

South Coast AQMD and CALSTART first developed a list of fleet stakeholder contacts as interview candidates. The warehousing and logistics industry is a complicated and multifaceted industry with diverse stakeholders. To ensure our understanding of fleet stakeholder priorities reflected this diversity, we specified three classifications of stakeholders to interview. These categories included (1) organizations that operate both truck fleets and warehouse facilities, (2) organizations that operate fleets only, (3) and organizations that operate warehouse facilities but not the fleets that serve those facilities. Exhibit 13 includes additional details on the fleets and facilities operated by the stakeholders interviewed.

[5] California Vehicle Inventory and Use Survey, Volume I Truck Survey, Cambridge Systematics (2018).

EXHIBIT 13: INTERVIEWEE CLASSIFICATIONS

STAKEHOLDER INTERVIEWEE NUMBER	CATEGORY	FACILITY TYPE OPERATED	FLEET OPERATIONS
1	Fleet & Facility	General Purpose Warehouse	Drayage
2	Fleet & Facility	General Purpose Distribution Center	Regional Delivery Final Mile
3	Fleet & Facility	Truck Terminal LTL	Drayage, LTL, Over the Road
4	Fleet & Facility	Cold Storage	Regional Delivery Final Mile
5	Fleet & Facility	Cold Storage	Final Mile
6	Fleet & Facility	Transload	Drayage Regional delivery
7	Fleet & Facility	Crossdock Transload	Drayage
8	Fleet & Facility	Retail Fulfillment Center	Final mile logistics provider
9	Fleet	-	Drayage, mail
10	Fleet	-	Regional Delivery
11	Facility only	General Purpose Warehouse	-

DEVELOPMENT OF INTERVIEW QUESTIONS

The interview questions were developed with collaboration between CALSTART, IEc, and South Coast AQMD (see Appendix B). After the questions were completed, we contacted individual stakeholders via e-mail and/or phone to schedule interviews with the willing participants. The interview process consisted of a 30- to 60-minute conversation depending on the engagement of the interviewee.

FINDINGS FROM INTERVIEWS

Based on the interviews conducted, we describe the characteristics and operations of fleets that serve each of the warehouse categories previously described in CALSTART's Technical Memorandum on the Warehousing and Logistics Industry in the South Coast Air Quality Management District jurisdiction.[6] Exhibit 14 summarizes these findings.

[6] "Technical Memorandum on Warehousing and Logistics Industry in the South Coast Air Quality Management District Jurisdiction", prepared by Jasna Tomic and Kelly Leathers, CALSTART, for the South Coast Air Quality Management District, November 30, 2020.

EXHIBIT 14: FLEET CHARACTERISTICS AND OPERATIONS AT DIFFERENT WAREHOUSE FACILITIES

WAREHOUSE CATEGORY	FLEET CHARACTERISTICS AND OPERATIONS
General Purpose Warehouse (GPW)	Mostly Class 7 and 8 trucks that are either drayage or LTL. The drayage trucks operations are 50-100 miles per day with 4 stops. LTL operations make ~10 stops per day and serve warehouse and distribution centers across the region.
Transload Facility	The fleets at a transload facility are involved in drayage and regional delivery operations. Freight is moved into the facility in the morning by rail and the outbound operations start in the afternoon. The facility has about 50-60 Class 8 vehicles entering the facility each day. The fleet serves multiple types of locations throughout the region including, truck/container yards, distribution centers, crossdock transload facilities, and railroads. The vehicles serving the ports only log about 13,000 – 14,000 miles per year due to the proximity to the ports. These trucks make about 8 trips per day.
Crossdock Transload Facility	Exclusively served by Class 8 with 53 ft trailers. Freight leaving the facility goes to distribution centers, other crossdock facilities, and warehouses. Like the transload facility, outbound freight is taken in the morning and bound freight is brought in the evening and sorted. Congestion is a significant issue at these facilities and is addressed by requiring strict appointment times for pick-up and drop-offs. One of the interviewed fleets serving these facilities is involved in regional delivery, specifically final mile logistic operations. This fleet reports approximately 120-180 miles per day with 13-20 pickup locations.
Truck Terminals for Less-Than-Truckload Trucks (LTL)	Primarily a Class 8 LTL fleet which moves goods between drayage and other distribution centers in the region. Outbound freight leaves in the morning, and trucks return in the afternoon with all inbound freight. That freight is then broken down and organized based on the final destination. Daytime truck operations range from 50 to 200 miles. At night the trucks are used for longer haul. These facilities also have yard tractors and forklifts.
General Purpose Distribution Center	It is difficult to generalize the fleet operations at these facilities as they are serviced by many types of fleets. These distribution centers handle many types of products and goods coming from multiple companies. The fleets servicing these facilities are performing regional delivery, drayage, last mile delivery, and over-the-road operations. Trucks move product between the ports, other distribution centers, crossdock transload facilities, and warehouses.
Retail Fulfillment Center	These facilities are serviced by many types of fleets as well. The fleets interviewed move freight from LTL facilities where the product is broken down and then taken to retail fulfillment centers. From the fulfillment center, fleets also conduct last mile delivery using Class 4-6 trucks.
Cold Storage Facilities	Operate Class 5 – 8 trucks all equipped with truck refrigeration units (TRUs). These trucks drive about 150 miles per day making stops between the cold storage facility and final customers such as restaurants and grocery stores. The trucks make 10-15 stops on the route. Some deliveries are made to other cold storage facilities in the region as well. TRUs operate in the yard about 3 hours each day.

WAREHOUSE CATEGORY	FLEET CHARACTERISTICS AND OPERATIONS
Parcel Hubs	Fleet performs regional delivery operations, driving about 300-400 miles per day using Class 8 trucks. Each vehicle makes about 4-6 stops per day between the parcel hub and general-purpose warehouses. One interviewed fleet operator fuels its alternative fuel trucks (CNG) at an offsite fueling station.

In general, goods are delivered to warehouse facilities by Class 8 tractors by different fleets. Some of the vehicles may belong to the facility itself while others belong to fleets that the facility does not directly control. Verification of the vehicle, order, and trailer occurs at the point of entry. The carrier that delivers is sometimes known, but not always. Carriers that pick-up goods are always known in advance. The vehicle make and model are generally not tracked at entry. However, as most scheduling is done through brokerage firms, the brokerage firm does verify the vehicle requirements, for example, that the truck is pre-approved for Smart Way, satisfies emission standards, etc.

The types of trucks that depart from warehouse facilities varies depending on the facility type, and goods may leave on Class 8 or 7 trucks for regional delivery or smaller medium-duty Class 4-6 trucks. Trucks used by the fleet operators interviewed are primarily fueled by diesel and gasoline, with some fleets reporting a small proportion of CNG fueled trucks. In addition to the trucks, yard tractors, forklifts, and pallet jacks operate at warehouse facilities. Forklifts are often fueled by propane and are being replaced by electric units more recently. Similarly, few of the interviewees mentioned that they have or are obtaining electric yard tractors to replace the diesel units. Electric yard tractors have been commercially available since 2013. Information on available models can be found from the Clean Off-road Voucher Incentive Project (CORE).[7]

TRANSFORMING INDUSTRY TRENDS

As part of the interviews, we asked interviewees questions about trends that affect their operations and the industry more broadly, as well as how they might respond to the Indirect Source Rule when it is implemented.

Several interviewees mentioned a trend toward fleets using smaller trucks that will make more frequent deliveries to big box stores. This is a change from tractor trailers making big deliveries to multiple stores per trip. Relying on smaller trucks for more deliveries seems to be a response to customers wanting faster and more frequent deliveries.

The rise of e-commerce has increased both daily shipping requirements and the number of locations to which goods are shipped. Lead time is being changed by the e-commerce business. In the past, products may have stayed on warehouse shelves for a few weeks prior to delivery. Now product is arriving and leaving the facility within a few days. One interviewee described it as the effect of the "Amazon's conveyor system" – product coming in and being loaded on the truck rapidly after arriving. Relatedly, companies are looking for smaller facilities in metropolitan areas because they do not need a significant

[7] Eligible Equipment Catalog, Clean Off-road Voucher Incentive Project, CORE, 2020. https://californiacore.org/resources/#Equipment

amount of space for storage, and they want to be closer to the customers. Most final mile providers are looking for "cross-dock scenarios" where the residence time of the freight at the facility is short.

Interviewees' responses varied when asked about relocating their operations outside of the Southern California region. Some interviewees cited over-regulation and its effect on cost as reasons they might consider relocating, but none have considered it seriously. Interviewees whose customers are located in Southern California have not considered leaving. Drayage fleets are concerned with cargo being rerouted through other ports if the cost of operation at the San Pedro Bay Ports become sufficiently high to motivate companies to ship their goods to different ports.

We asked specifically about ISR and whether they would invest in WAIRE points (Warehouse Actions & Investments to Reduce Emissions) or pay the mitigation fee. [8] In response to this question, fleets indicated that they were concerned with the upfront cost of earning WAIRE points. A few, however, indicated they already have been investing in some of the menu items. Overall, responses on questions regarding the ISR suggest that larger firms are working on sustainability planning across their warehouse and fleet operations, or that firms (or BCOs) are passing on their sustainability goals to the fleets with whom they work and are collaborating to achieve these goals.

[8] WAIRE points are based on the menu-based system and proposed regulatory concept. See the draft ISR rule text dated 6 October 2020.

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(3) Warehousing and Distribution Center Facilities in Southern California: The Use of the Commodity Flow Survey Data to Identify Logistics Sprawl and Freight Generation Patterns, (2017). Jaller, M., and Pineda, L. UC Davis.

(4) Industrial Warehousing in the SCAG Region, Full Report, (2018), Southern California Council of Governments.

(5) California Vehicle Inventory and Use Survey, Volume I Truck Survey, (2018). Cambridge Systematics

APPENDIX A – INTERVIEWEES

Company Name	Name
Pacific Mountain Logistics	B.J. Patterson
DHE	Troy Musgrave
PepsiCo	Keshav Sondhi
Sysco	Eddie Tantoco
TForce	Richard Boyd
Ability Tri-Modal	Mike Kelso
True World Foods	MacKay Holmes
RDS Rally	Greg Stefflre
LA Harbor Grain Terminal	Dwight Robinson
MDB Transportation	Jack Khudikyan
AJR Trucking	Jack Khudikyan

APPENDIX B- INTERVIEW QUESTIONS

Questions for Fleet and Facility Industry Stakeholders

Background

Please read the following to every interviewee

We are working with the South Coast AQMD on a project focused on the warehousing and logistics industry. As part of this effort, we would like to obtain background information on the operations of fleets and how they interact with the warehousing sector in LA, Orange, San Bernardino, and Riverside Counties.

***If prompted:* South Coast AQMD has asked us to collect this information to inform the creation of a potential Indirect Source Rule. The rule development effort is ongoing, and we do not have information on what the eventual provisions of the rule will be. **

***From here, please read the appropriate set of questions for each type of interviewee. ***

Questions for Warehouse Operators that Operate Their Own Fleets

1. **Please describe the general operations at your facility.**
    a. What types of cargo do you typically deal with?
    b. How many off-road vehicles and what type are you operating at the facility?
    c. Can you estimate the number of vehicles entering and exiting the facility each day?
    d. Describe the vehicles entering and exiting by **type** (i.e. tractor trailer/step van)/class (i.e. 4-8)/**size** (GVWR)/**vocation** (i.e. regional delivery/drayage/LTL)
    e. How long do vehicles typically stay at the facility?
2. **What is the typical process for vehicles entering and exiting the facility?**
    a. What information do you collect about vehicles entering and exiting the facility (i.e. vehicle type, fuel technology, model, US DOT, CA, MC #s, VIN, truck model, truck year)
    b. What sort of freight or trailer number verification is conducted at the gate when entering/exiting?
    c. What method do you use to track the number of vehicles visiting your facility (inbound and outbound)? What is the typical daily number of vehicles?
    d. Do you operate multiple facility types? If so, how do the number of vehicles vary based on facility?
        i. Is this process different based on the facility type? If so, please describe some differences.
    e. Do trucks need to be part of a truck registry to enter the facility? (i.e. Drayage Truck Registry OR TRUCRS)
    f. What is the cost for the truck logging/tracking program?
3. **Can you describe your fleet based on the following criteria?**
    a. Total number of vehicles in fleet
    b. Describe your fleet's vehicles by **type** (i.e. tractor trailer/step van)/class (i.e. 4-8)/**size** (GVWR)/**vocation** (i.e. regional delivery/drayage/LTL)
    c. Average age of truck in fleet (and range oldest to newest)?
    d. Vehicle technology (diesel, NG, other fuel or technology and % each). If it's a mix, what is the approximate distribution across technologies?
4. **Information and data**
    a. Is your fleet equipped with telematics? If so, what is the product's name?

b. Do you use geofencing? If so, what is the product's name?
c. How do you track mileage and fuel use?
d. What is the typical lifetime of your vehicles? (i.e. miles and years)
e. What is the cost for this logging/tracking program?

5. **Do you lease or own the vehicles in your fleet?**
    a. What percentage is leased vs. owned? If leasing, how long are the typical leases?
    b. What are the benefits of leasing vs. owning?
    c. Do you have sustainability goals/plans? Please explain.
    d. Have you researched into the possibility of electric fleets and/or charging and refueling stations?
    e. If you operator forklifts or yard hostlers, what percentage are fossil fuel vs. electric? Are any of these fossil fuel vehicles operating indoors?
6. **Which of the following would best describe your fleet's operations?**
    a. Regional Delivery
    b. Drayage
    c. Less than Truckload
    d. Over the Road
    e. Other (please explain)
7. **Are all the vehicles registered in California?**
    a. If not, where are they registered?
8. **Which of the following warehousing facilities does your fleet typically service? And, what characteristics of your fleet makes it suitable to serve this specific type of facility?**
    a. Distributions center
    b. Cross-dock facility
    c. Transload facility
    d. General Purpose Warehouse
    e. Truck Terminal for Less than Truckload Trucks
    f. Retail Fulfillment Center
    g. Storage or Cold Storage
9. **Please describe a vehicle's typical daily operations.**
    a. Vehicle class (i.e. Class 4-8)
    b. Number of miles per day
    c. Number of destinations per day
10. **What region does your fleet typically serve?**
    a. Do the fleets go to multiple locations in a day to deliver goods?
    b. Does the facility provide or recommend any particular route?
11. **What percentage of your fleet is carrying inbound vs. outbound freight from warehousing facilities in the region?**
12. **What are your most common types of customers?**
    a. Please describe your relationship with your customers (i.e. long-term contracts, short term contracts)
13. **Have you ever considered relocating outside the urban LA, OC, Riverside, or San Bernardino Counties?**
    a. If so, what prompted your consideration? (Possible answer could be operational changes, warehousing cost, business expansion, etc.)

b. *** If mentioning cost as a reason*** Do you have an idea of the cost threshold that would lead you to consider moving to warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?
c. What are the principle constraints on relocation?
d. Have you thought about putting community benefit measures in place, in terms of air pollution?

14. Can you name some trends affecting the trucking industry?

a. What is affecting operations in the region?
b. In the next 5-10 years, what do you see on the horizon that will affect your operations?
c. Any obstacles your company is facing?
d. Any new requirements customers are asking for?

15. How will you respond to the indirect source rule when it is implemented?

a. Invest in menu items to upgrade your facility or pay the mitigation fee?

Exclusively Fleet Operator Questions

1. **Can you describe your fleet based on the following criteria? (all vehicles operating under your interchange)**
    a. Total number of vehicles in fleet
    b. Describe your fleet's vehicles by **type** (i.e. tractor trailer/step van)/class (i.e. 4-8)/**size** (GVWR)/**vocation** (i.e. regional delivery/drayage/LTL)
    c. Average age of truck in fleet (and range oldest to newest)?
    d. Vehicle technology (diesel, NG, other fuel or technology and % each). If it's a mix, what is the approximate distribution across technologies?
    e. If operating alternative fuel vehicles, how are you fueling them?
    f. If you operator forklifts or yard hostlers, what percentage are fossil fuel vs. electric? Are any of these fossil fuel vehicles operating indoors?
2. **Which of the following would best describe your fleet's operations?**
    a. Regional Delivery
    b. Drayage
    c. Less than Truckload
    d. Over the Road
    e. Other (please explain)
3. **Please describe a vehicle's typical daily operations by vehicle class.**
    a. Number of miles per day
    b. Number of stops per day
    c. Number of miles per year?
    d. How does that relate to your type of operations?
    e. Is this fixed?
4. **Which of the following warehousing facilities does your fleet typically service? And, what characteristics of your fleet make it suitable to serve this specific type of facility?**
    a. Truck/container yard
    b. Distribution Center
    c. Cross-dock facility
    d. Transload facility
    e. General Purpose Warehouse
    f. Truck Terminal for Less than Truckload Trucks

g. Retail Fulfillment Center
h. Storage or Cold Storage

5. **What region does your fleet typically serve?**
    a. Do the fleets go to multiple locations in a day to deliver goods?
6. **What types of moves does your fleets do? (Import vs export, % of each)**
7. **What are your most common types of customers?**
    a. Describe the types of customers your fleet serves (i.e. direct customers, freight forwarders, railroad carrier, ocean carrier, long-term contracts, short term contracts)
    b. Describe your fleet's relationship with its customers (term contract or spot rate)
8. **Information and data**
    a. Is your fleet equipped with telematics? If so, what is the product's name?
    b. Do you use geofencing? If so, what is the product's name?
    c. How do you track mileage and fuel use?
    d. If charging /fueling is available at the warehouse, how long do trucks usually stay?
    e. What is the typical lifetime of your vehicles? (i.e. miles and years)
    f. Can you provide the cost for the logging/tracking program?
9. **Do you lease or own the vehicles in your fleet?**
    a. What percentage is leased vs. owned? If leasing, how long are the typical leases?
    b. What are the benefits of leasing vs. owning?
    c. Do you have sustainability goals/plans? Please explain.
    d. Have you researched into the possibility of electrifying your fleet?
10. **Are all the vehicles registered in California?**
    a. If not, where are they registered and why?
11. **Can you name some trends affecting the trucking industry?**
    a. What is affecting operations in the region?
    b. In the next 5-10 years, what do you see on the horizon that will affect your operations?
    c. Do you plan on adopting alternative fuel vehicles? If so, what fuel(s)? Why? How do you plan on fueling them?
    d. Any obstacles your company is facing?
    e. Any new requirements customers are asking for?
12. **How would you respond if warehouses try to get fleets to use clean trucks for at least a portion of their trips to/from warehouses in the District?**

Exclusively Facility Operator Questions

1. **Which category best describes your facility?**
    a. Distributions center
    b. Cross-dock facility
    c. Transload facility
    d. General Purpose Warehouse
    e. Truck Terminal for Less than Truckload Trucks
    f. Retail Fulfillment Center
    g. Storage or Cold Storage
2. **Please describe the general operations at your facility.**
    a. What is the typical process for vehicles entering and exiting the facility? What types of cargo do you typically deal with?

b. Can you estimate the number of vehicles entering and exiting the facility each day? What classifications of trucks?
c. How long do vehicles typically stay at the facility?

3. **What is the number of off-road vehicles at the facility and the type? (i.e. yard tractor, forklift)**
    a. If you operator forklifts or yard hostlers, what percentage are fossil fuel vs. electric? Are any of these fossil fuel vehicles operating indoors?
4. **What is the typical process for vehicles entering and exiting the facility?**
    a. What information do you collect about vehicles entering and exiting the facility (i.e. vehicle type, fuel technology, model)?
    b. What sort of freight verification is conducted at the gate when entering/exiting vehicles?
    c. Is this process different based on the facility type? If so, please describe some differences.
    d. Do trucks need to be part of a truck registry to enter the facility? (i.e. Drayage Truck Registry OR TRUCRS)
5. **Do you have longer-term relationships or contracts with the fleets serving your facility?**
6. **Do you know if all the fleets/vehicles are registered in California?**
    a. If not, where are they registered?
7. **Have you ever considered relocating outside the urban LA, OC, Riverside, or San Bernardino Counties?**
    a. If so, what prompted your consideration? (Possible answer could be operational changes, warehousing cost, business expansion, etc.)
    b. *** If mentioning cost as a reason*** Do you have an idea of the cost threshold that would lead you to consider moving to warehouses outside the urban LA, OC, Riverside, or San Bernardino Counties?
    c. What are the principle constraints on relocation?
    d. Have you thought about putting community benefit measures in place, in terms of air pollution?
8. **Can you name some trends in the trucking industry? What's effecting operations in the region? In the next 5-10 years, what do you see on the horizon that will affect your operations?**
    a. Any obstacles your company is facing?
    b. Any requirements customers are asking for?
9. **How will you respond to the indirect source rule when it is implemented?**
    a. Invest in menu items to upgrade your facility or pay the mitigation fee?

APPENDIX C – DATA

TABLE 1: TRUCK FUEL TYPE IN LOS ANGELES, ORANGE, RIVERSIDE, AND SAN BERNARDINO COUNTIES

	GAS	DIESEL	FLEXIBLE	CONVERTIBLE	COMPRESSED NATURAL GAS	LIQUID NATURAL GAS	PROPANE	ELECTRIC AND GAS HYBRID	ELECTRIC AND DIESEL HYB	ELECTRIC	HYDROGEN FUEL CELL	UNKNOWN
Long Haul Truck	0	64,320	0	0	441	0	0	0	0	0	0	88
Regional Truck	24,702	119,268	2,566	330	688	0	4	0	743	0	0	206
Drayage	2	27,764	0	0	703	0	0	0	0	0	0	1
Terminal Tractor	9	804	0	0	18	0	0	0	0	0	0	49
Step Van	10,259	6,201	0	0	364	0	497	10	0	0	0	6
Cargo Van	333	4,845	248	0	0	0	0	0	0	13	0	0
Total, by fuel type	35,305	223,202	2,814	330	2,214	0	501	10	743	13	0	350
Fuel Type %	13.30%	84.07%	1.06%	0.12%	0.83%	0.00%	0.19%	0.00%	0.28%	0.00%	0.00%	0.13%

ATTACHMENT 4

INDIRECT SOURCE RULE RELOCATION MODEL – METHODOLOGY

IEc

MEMORANDUM | 12 DECEMBER 2020

TO Victor Juan, Shah Dabirian, Paul Stroik, and Ian MacMillan; South Coast Air Quality Management District

FROM Derek Ehrnschwender, Jason Price & Nick Manderlink, IEc

SUBJECT Indirect Source Rule Relocation Model – Methodology

INTRODUCTION

This memorandum is in support of South Coast AQMD staff's development of a potential indirect source rule (ISR) to reduce mobile source emissions related to the operation of warehouses and distribution centers in the South Coast AQMD's four-county region (Los Angeles, Orange, Riverside, and San Bernardino counties).[1] Diesel truck traffic, largely related to the transport of goods passing through the Ports of Los Angeles and Long Beach and regional warehouses and distribution centers, makes up a large share of local NO_x emissions. A warehouse ISR, if adopted, may help with reducing emissions from trucks servicing warehousing facilities located within its jurisdiction.

Compliance costs to the warehousing sector could vary depending on the design of an eventual rule. If these costs are significant, the implementation of an ISR could potentially precipitate the relocation of warehousing operations outside the region—with the associated truck fleets continuing to travel to and from facilities in the South Coast AQMD jurisdiction. In the worst case scenario, the associated air quality benefits from such a rule might be greatly diminished. Accordingly, South Coast AQMD is interested in identifying and understanding the factors affecting whether warehousing operations are likely to relocate as a result of the potential rule.

Consistent with this objective, Industrial Economics, Inc. (IEc) developed a model that estimates the number of warehouse operations likely to relocate outside the South Coast AQMD jurisdiction as a result of the ISR. For a given warehouse, this model weighs the costs of ISR compliance against the costs of relocation. Based on the lesser of these two costs and on the availability of warehouse space in other market areas, the model simulates the decision-making process related to relocation at the warehouse level. The analysis considers potential warehouse relocation to seven alternative market areas outside the South Coast AQMD jurisdiction in California, Nevada, and Arizona.

This memo is organized into three general sections. First we discuss the relocation decision-making process as represented in the model. Second we outline the estimation of costs associated with ISR compliance if warehouse operations choose to remain within the South Coast AQMD jurisdiction. And third we introduce the various costs associated

[1] The South Coast AQMD jurisdiction is comprised of all of Orange County and parts of Los Angeles, Riverside and San Bernardino Counties. The region is mapped and described in full in Exhibit 1 and the "Geographic Scope" section below.

with potential warehouse relocation, including both relocation to existing vacant properties and the development of new warehousing stock. While changes in transportation costs associated with relocation are a key element of these costs, we also account for a variety of other cost changes, including changes in rent, energy costs, labor costs, development fees (for new warehouse developments only), and the cost of moving.

OVERVIEW OF APPROACH FOR MODELING RELOCATION DECISIONS

To estimate the number of warehouses likely to relocate outside the South Coast AQMD jurisdiction as a result of the ISR, we compare the costs of relocation for a given warehouse with the costs of complying with the ISR and remaining in the South Coast AQMD jurisdiction. We assume a warehouse will relocate to an outlying market area if two conditions are met:

1. ***Cost condition:*** The annualized costs associated with relocating to at least one outlying market area are less than the annualized costs of ISR compliance,[2] and
2. ***Capacity condition:*** In at least one of the market areas in which a warehouse would realize a cost savings relative to ISR compliance, sufficient capacity exists (measured in square footage of available warehouse space) to absorb the warehouse operation in question.

We model the relocation decision based on these conditions for all warehouses affected by the rule, with two exceptions: cold storage warehouses and warehouses at manufacturing facilities. For these facilities, decisions regarding relocation are likely to differ from the decision-making process for more conventional warehouse facilities. Both of these facility types have specialized equipment that would be more costly to move. In addition, the pool of buildings to which these facilities could relocate may differ from the buildings that conventional warehouses would consider.

To determine whether the cost condition is met for a given warehouse, we consider ISR compliance costs for varying levels of stringency and the full costs associated with relocation to an outlying market area. Relocation costs include the following:

- changes in transportation costs;
- changes in rental costs for warehouse space;
- changes in labor costs;
- changes in electricity costs;
- moving costs; and
- development fees (applicable only for construction of new warehouse space in outlying markets).

[2] Our approach for assessing potential warehouse relocations considers potential changes in costs but not potential changes in revenues. Warehouse operations that relocate outside the South Coast AQMD jurisdiction might be able to pursue new revenue opportunities, but may also experience revenue losses if cargo owners prefer to work with warehouses in the South Coast AQMD jurisdiction. In addition, any pass through of increased costs associated with relocation would also affect revenues. Given the uncertainty related to all of these factors, our approach does not consider potential changes in revenues.

We conduct the analysis based on ISR compliance costs and relocation costs annualized over 20 years, using four percent and one percent discount rates.[3] We assume all costs are ultimately borne by warehouse operators.

To determine whether the capacity condition described above is met, we rely on capacity data for each outlying market as obtained from CoStar. In addition, to ensure the analysis does not over commit capacity in the outlying markets (i.e., project relocations in an outlying market in excess of the capacity available prior to ISR implementation), our analysis simulates relocation decisions one warehouse at a time and updates the estimated capacity available in each outlying market based on these individual decisions. Thus, the capacity available to the 100th warehouse examined reflects the relocation decisions of the first 99 warehouses.

Recognizing the complexity of the logistics industry and the uncertainty inherent in several key aspects of our analysis, we designed the analysis to generate low-end and high-end estimates of warehouse relocations. Specifically, our low-end and high-end estimates capture two sources of uncertainty.

The first uncertainty relates to the routing of goods through the South Coast AQMD jurisdiction. Although information is available on the aggregate distribution of goods across different routings through the South Coast AQMD jurisdiction, information on which warehouses serve which routes is not available. To account for this uncertainty, we conduct the analysis under two sets of routing assumptions (hereafter referred to as pathway scenarios):

1. ***Composite pathway scenario:*** Under this scenario, each individual warehouse is assumed to be representative of the warehousing sector in the South Coast AQMD jurisdiction as a whole, in terms of the goods routes (pathways) served. For example, if a given pathway accounts for five percent of the goods flow volume passing through the South Coast AQMD jurisdiction, five percent of the truck traffic through each individual warehouse is assumed to be on this pathway. Under this scenario, the change in transport distance associated with relocation to a given outlying market area is the same for all warehouses.
2. ***Specialized pathway sensitivity scenario:*** This scenario allows for the possibility that individual warehouses may specialize in pathways or serve a more limited number of pathways. Because we lack information on the specific pathway(s) a given warehouse is likely to serve, this scenario involves a series of iterative "what if" analyses. For nearly each iteration of the analysis, we assume all warehouses are on the same pathway. After running the analysis for each individual pathway, we calculate the weighted average of the resulting warehouse relocation estimates, using the goods volumes associated with each pathway as weights. Weighting by the goods volumes associated with each pathway ensures that the warehouse space projected to relocate for a given iteration does not

[3] We annualize costs to put them on a consistent temporal basis, given that some costs are annual and other costs are one-time expenditures. We chose a 20-year timeframe to minimize the annualized value of any one-time costs associated with relocation and ensure we do not overestimate relocation costs and underestimate the number of relocations.

exceed the amount of warehouse space that actually serves the pathway in question.[4]

The second source of uncertainty reflected in our low-end and high-end estimates is the capacity of outlying market areas to absorb warehouse space from the South Coast AQMD jurisdiction. Although information is available on the vacant capacity in each outlying market and new warehouse developments that have been approved, additional warehouses *could* be developed on undeveloped parcels of land zoned for industrial development. The degree to which such development will occur is uncertain. To account for this uncertainty, we conduct the relocation analysis under two capacity scenarios:

1. ***Medium-term capacity scenario***: Under this scenario, capacity available for relocation is limited to capacity projected to be available in the medium term. This includes current vacant capacity and new capacity proposed or currently under construction in the outlying market areas. This scenario assumes no new construction of warehouse space beyond what is already planned in the outlying market areas. It provides a reasonable representation of capacity until such time that new capacity developments can obtain approval and complete construction. This scenario specifies the lower-bound estimate of warehouse capacity in outlying markets.
2. ***Slack capacity scenario:*** This scenario reflects a more expansive view of the capacity that would be available for relocation. Such capacity includes projected warehouse vacancies as well as the warehouse space that could fit on all land that is (1) zoned for industrial development in the outlying market areas and (2) is within 2 miles of a major road. This measure of capacity represents an upper-bound estimate of warehouse capacity in outlying markets.

We estimate the square footage of warehouse space likely to relocate from the South Coast AQMD jurisdiction for each pathway and capacity scenario based on the methods summarized above. We convert this estimate to an estimated number of warehouses based on the average square footage per warehouse.

ISR COMPLIANCE COSTS

For the purposes of estimating the number of warehouse relocations, we rely on estimates of ISR compliance costs per square foot as provided by South Coast AQMD staff. As described in the 6 October 2020 draft rule text released to the public, the ISR will give warehouse operators flexibility in how they meet the requirements of the rule. Specifically, warehouse operators may choose from combinations of multiple emission reduction measures identified in the ISR or pay a mitigation fee that will finance efforts within the South Coast AQMD jurisdiction to reducing trucking-related NO_x emissions.

Due to the flexibility afforded by the ISR, the compliance strategy that would be implemented by a given warehouse is highly uncertain and would likely depend on warehouse-specific factors that we are not able to account for in this analysis. Such

[4] For example assume that all 2,518 warehouses modeled in this analysis are projected to relocate when examining a given pathway but that this pathway accounts for 1 percent of the goods flow. Under our approach, this pathway's contribution to the expected number of relocated warehouses is 2,518 × 1 percent, or 25 warehouses.

factors may include the physical configuration of a warehouse, space available for electric vehicle charging infrastructure onsite, or whether the warehouse operator owns its own fleet of trucks.

Due to our inability to account for these and other site-specific factors that may influence compliance decisions, we analyze compliance-cost scenarios specified as an annual cost per square foot of warehouse space. These values, which ranged from $0 per square foot to $2 per square foot, were provided to IEc by South Coast AQMD staff.

RELOCATION COSTS

As described above, the costs associated with relocation include (1) changes in transportation costs, (2) changes in rent, (3) changes in labor costs, (4) changes in electricity costs, (5) moving costs, and (6) development fees (when relocation involves the construction of new warehouse space). We describe our approach to estimating each of these costs in the following sections.

TRANSPORTATION COSTS

This analysis estimates the average increase in transportation costs for a warehouse relocating to each of the seven outlying market areas in Southern California, Southern Nevada, and Western Arizona described in our technical memo on regional warehouse real estate markets.[5]

The first step in this process is to estimate the increased distance per truck trip associated with relocating to each outlying market area. We then translate these increases in distance to increases in costs per truck trip. To obtain a *per-warehouse* expected increase in trucking costs, the increased cost per truck trip is applied to the expected number of truck trips for a warehouse, based on estimates of the number of truck trips per thousand square feet of warehouse area and the square footage of individual warehouses.

Because increased trucking distances may reduce the distance freight is shipped via rail (e.g., if warehouses sorting goods bound for distribution in the Eastern U.S. relocate to Arizona, those goods will be loaded for rail transport closer to their final destination than had they loaded in the L.A. area), our approach accounts for the reduction in rail shipment costs associated with warehouse relocation.

To estimate the change in transport distance, we rely on published data characterizing the flow of goods through the South Coast AQMD jurisdiction based on origin and destination pairs. These data include information on the following:

- The directional flow of goods through the South Coast AQMD jurisdiction (e.g., imports arriving at the San Pedro Bay Ports bound for national distribution versus

[5] Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction, prepared by Derek Ehrnschwender and Jason Price, Industrial Economics, for South Coast AQMD. December 12, 2020.

goods shipped into the South Coast AQMD jurisdiction for consumption by local households);[6] and

- Goods flow pathways, or routing, for goods entering the United States through the Port of Los Angeles (POLA) and the Port of Long Beach (POLB). These pathways outline the share of goods visiting different types of warehouses in different locations within the South Coast AQMD jurisdiction before heading to their final destinations.[7]

  For each pathway, we consider an alternate pathway with warehouse relocation from the South Coast AQMD jurisdiction to an outlying market area. While these pathways are specific to imports, we adapt them to characterize the flow of other goods transported through the South Coast AQMD jurisdiction.

We perform the same exercise for each pathway considering warehouse relocation to each of the outlying market areas. The transportation cost impacts associated with relocation depend on the pathway(s) a given warehouse serves. Some warehouses may serve a few pathways, while others serve several. In the absence of information on the pathway(s) associated with a given warehouse, we estimate the transportation cost impacts of warehouse relocation under two pathway scenarios: one in which each warehouse is assumed to serve all pathways and a second in which we examine relocation one pathway at a time and calculate the weighted average of the pathway-specific results.

The methodology presented here is designed to estimate the incremental change in travel costs resulting from the average warehouse's relocation. This estimate reflects the current warehouse environment and does not account for potential future trends in port use for imports or exports or changes in the final destination for goods entering the South Coast AQMD jurisdiction. As pointed out by a recent analysis by the POLA and POLB, more national distributors may begin to favor a "four corners" supply-chain strategy, increasing the share of goods entering the South Coast AQMD jurisdiction that are consumed locally or regionally.[8] This effect could alter the share of goods ascribed to each goods pathway, as discussed later in this memo.

Change in Trucking Distance

The estimated change in trucking distance is central to understanding the transportation cost implications of relocating warehouses from the South Coast AQMD jurisdiction to the outlying market areas. We estimate the change in trucking distance based on two data sources: the U.S. Bureau of Transportation Statistics Commodity Flow Survey and a goods flow pathways analysis published by Robert Leachman at the University of California, Berkeley. We describe our use of these data sources below.

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[6] Together, the Port of Los Angeles and the Port of Long Beach are referred to as the ports of the San Pedro Bay.

[7] These warehouse classifications are based on warehouse size and building categorization, as detailed in Exhibit 3 of: Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction, prepared by Derek Ehrnschwender and Jason Price, Industrial Economics, for South Coast AQMD. December 12, 2020.

[8] Port of Long Beach & Port of Los Angeles. 2019. "Economic Study for the Clean Truck Fund Rate."

U.S. Bureau of Transportation Statistics Commodity Flow Survey (CFS): The CFS includes multimodal freight flow data for shipments of goods within the U.S. We use the CFS to characterize (1) goods that originate in the South Coast AQMD jurisdiction and are transported outside the South Coast AQMD jurisdiction or to buyers within the South Coast AQMD jurisdiction and (2) goods that originate elsewhere but also travel through the South Coast AQMD jurisdiction.

Exhibit 1 defines these goods flow categories, according to their origin and destination, and the relative size of each category. To derive the size of each goods flow category shown in Exhibit 1, we relied on CFS data for retail, wholesale, and warehousing industries.[9]

The CFS data does not include a clear identifier for imported goods. Also, based on the CFS documentation, the data does not capture imports until they are shipped onward from the importer's initial domestic location. This suggests any imports reflected in the CFS would show a domestic location as the point of origin. To estimate the import volume separate from goods produced in the South Coast AQMD jurisdiction, we obtained the ratio of imports to exports, 1.97 for 2015, from the Los Angeles Almanac and multiplied it by the export-related tonnage derived from the CFS data.[10]

A key uncertainty with estimating import tonnage in addition to the captured CFS goods flows is whether the resulting import tonnage estimated is already reflected in the CFS (with a LA/Long Beach Metro area origin). While the CFS documentation suggests this is the case, the import estimate we derived would account for 94 percent of the tonnage of goods in the CFS originating from the LA/Long Beach metro area (i.e. that import tonnage would account for 94 percent of all tonnage flowing from the South Coast AQMD jurisdiction).[11] Given the size of the LA metro area economy, this value seems unrealistically high. We suspect some imports may not be captured by the CFS until their arrival in a different location. To address this issue, we have treated the derived import tonnage as additive with the CFS data.[12]

Of the six goods flow categories shown in Exhibit 1, we consider potential changes in distance for three. Specifically, we examine potential changes in transport distance for imports, goods produced in the South Coast AQMD jurisdiction and consumed locally, and goods produced in the South Coast AQMD jurisdiction and bound for national distribution.

We assume goods bound for export, regardless of whether produced inside the South Coast AQMD jurisdiction or at national origin points are shipped directly to transload and cross-dock warehouses located in the port vicinity for packing into marine containers.

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[9] A broader query of the CFS data across more industries would capture many shipments unlikely to rely on warehouses.

[10] "Waterborne Freight Tonnage in California Ports," (2015) The Los Angeles Almanac.

[11] While the South Coast AQMD jurisdiction and the L.A./Long Beach metropolitan area are not perfect matches, limitations in the CFS data require using the metro area as a proxy for the jurisdiction.

[12] We also conducted a sensitivity analysis in which we assumed the imports were fully reflective in the CFS data. Under this assumption the average change in trucking distance associated with warehouse relocation is approximately seven percent higher across the outlying market areas than presented in this document.

These warehouses, due to their location and function, are unlikely to relocate due to a potential ISR.

While it is possible goods bound for export may be sent to other warehouses in the South Coast AQMD jurisdiction prior to transload or cross-dock warehouses, the Southern California Association of Governments (SCAG) warehousing report notes limited warehousing capacity devoted to managing exports relative to imports (approximately one-tenth of total port-related warehousing space, despite the fact that the ratio of import to export tonnage is roughly two-to-one).[13] This suggests less intensive use of warehouse space in the South Coast AQMD jurisdiction for exports than for imports. For this reason, we assume the export-related goods flow relies on limited additional warehousing space beyond transload and cross-dock facilities that directly serve the ports.

EXHIBIT 1. GOODS FLOW CATEGORIES DEFINED BASED ON THE COMMODITY FLOW SURVEY[1]

GOODS FLOW CATEGORY	ORIGIN	DESTINATION	PERCENT OF TOTAL	PERCENT OF GOODS FLOW SUBJECT TO RELOCATION[2]
1	National	South Coast AQMD	5.61%	-
2	National	Export	3.23%	-
3	South Coast AQMD	Export	15.40%	-
4	Imports	All	36.68%	48.42%
5	South Coast AQMD	South Coast AQMD	26.43%	34.89%
6	South Coast AQMD	National	12.65%	16.70%

Notes:
1. The goods flow categories and percentage estimates in this table are derived from the Bureau of Transportation Statistics' Commodity Flow Survey (CFS) which includes freight flow data for retail, wholesale, and warehousing industries. The CFS does not appear to capture imports, so calculation of the relative share of imports relied on CFS export data and the ratio of imports to exports for the San Pedro Bay ports, as obtained from the following report: "Waterborne Freight Tonnage in California Ports," (2015) The Los Angeles Almanac.
2. The percent of affected goods flow was calculated by scaling the "Percent of Total" values for categories 4, 5, and 6 to sum to 100 percent.

We assume goods with national origin points (i.e., produced domestically but outside the South Coast AQMD jurisdiction) with destinations inside the South Coast AQMD jurisdiction (category 1 in Exhibit 1) are distributed directly to their final destination from outside the South Coast AQMD jurisdiction. The transportation costs for these goods would therefore be unaffected by warehouse relocation.

Goods Flow Pathways Study: To assess the change in trucking distance associated with goods flow categories 4 through 6 in Exhibit 1 (the assumed change in distance is zero for categories 1 through 3), we rely on a set of goods pathways derived from a 2017 paper by

[13] "Industrial Warehousing in the SCAG Region – Task 4: Understanding Facility Operations." (2018) Prepared for the Southern California Association of Governments by Cambridge Systematics, Inc. with Gill V. Hicks and Associates Inc. April 2018.

Robert Leachman,[14] which outlines the flow of goods entering the South Coast AQMD jurisdiction through the San Pedro Bay ports. This flow of goods is illustrated in Exhibit 2.

Goods entering the ports of San Pedro Bay are categorized into pathways depending on (1) their final destination (i.e., truck to Northern California, truck to distribution within the South Coast AQMD jurisdiction, truck to areas in the Southwest outside the South Coast AQMD jurisdiction, or rail transport for national distribution) and (2) the warehouses they make use of while traveling along each pathway. We use these pathways to estimate baseline trucking distances for imports (category 4 in Exhibit 1) as well as for goods that originate in the South Coast AQMD jurisdiction and are bound for local consumption or national distribution (Categories 5 and 6 in Exhibit 1).

Of the goods pathways illustrated in Leachman (2017), we derive 18 distinct geographic pathways, 15 of which make use of warehouses within the South Coast AQMD jurisdiction and are relevant to this analysis.[15] These pathways are listed in Exhibit 3. As shown in Exhibit 3, these pathways involve freight passing through one to three warehouses in the South Coast AQMD jurisdiction before shipment outside or distribution within the South Coast AQMD jurisdiction. To estimate the travel distance along each of these pathways, we calculate the driving distance between each pathway "node"—either warehouses, rail terminals, or approximate distribution locations—and sum for a total travel distance for each pathway.[16] The estimated distances, by pathway, are shown in the last column of Exhibit 3.

[14] Leachman, R. 2017. "Strategic Initiatives for Inland Movement of Containerized Imports at San Pedro Bay." Institute for Transport Studies, University of California, Berkeley.

[15] The three pathways that do not make use of warehouses in the South Coast AQMD jurisdiction are those that use direct inland point intermodal (IPI) handling from the ports to rail terminals (On-Dock at the ports, or at the port vicinity or Downtown terminals). IPI transport services leave goods intact in their marine containers for maximized speed in onward transport.

[16] We cut off travel distance to Northern California at Kettleman Station, California, along interstate highway 5. We do this because goods sent to Northern California from any origin market in this study all must travel through Kettleman Station. Thus, the distance between Kettleman, California and the Northern California locations would be the same under the baseline as under any relocation scenario to be considered in our analysis.

EXHIBIT 2. FLOW OF GOODS ENTERING THE SAN PEDRO BAY

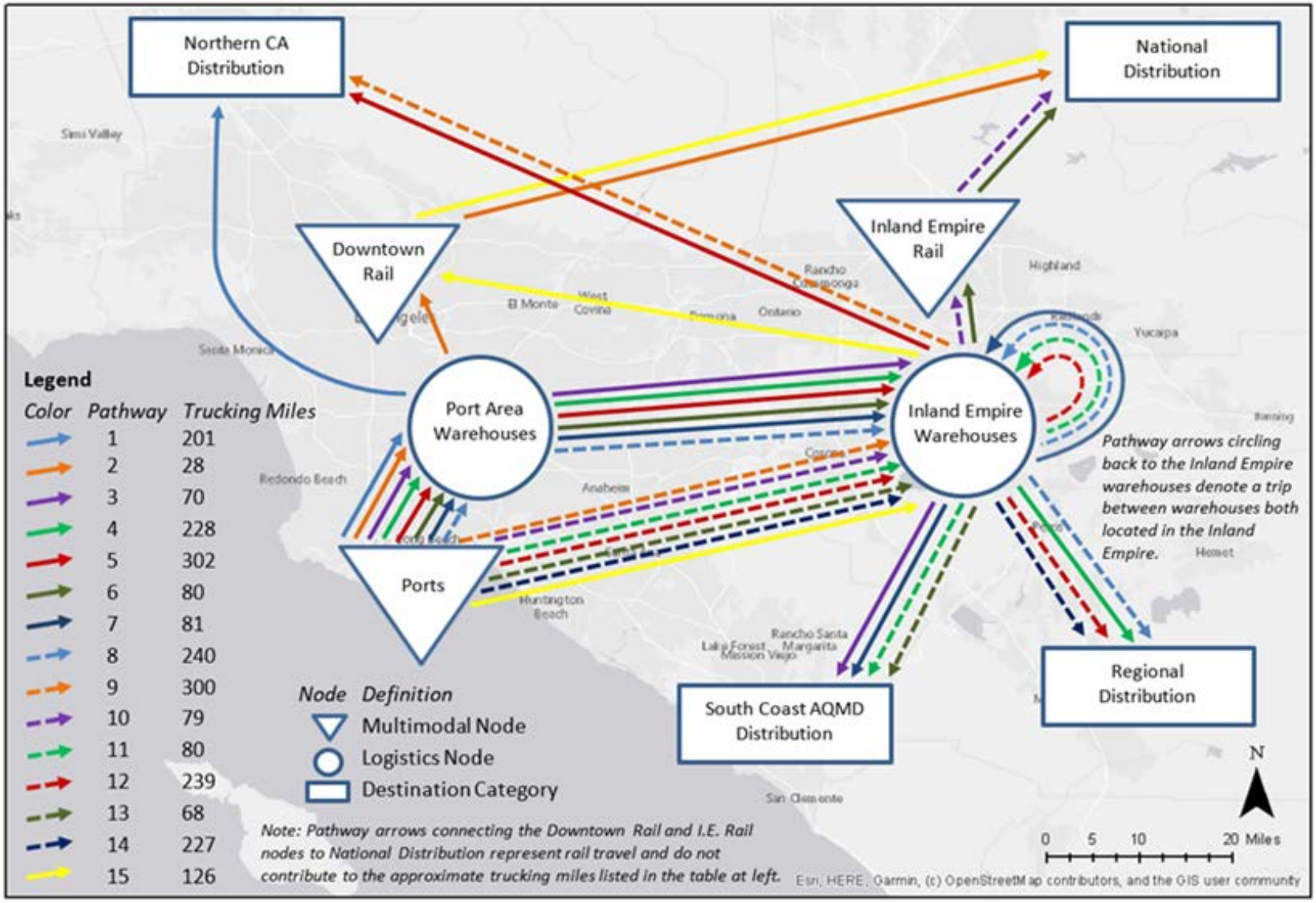


EXHIBIT 3. BASELINE GOODS PATHWAYS FOR GOODS SHIPMENTS SUBJECT TO RELOCATION

GOODS FLOW CATEGORY [A]	PATHWAY [B]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 1 [C]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 2 [D]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 3 [E]	DESTINATION [F]	GOODS SHARE WITHIN CATEGORY [G]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION [H]	TRUCK MILES [I]
Category 1: National Origin, Destination in South Coast AQMD Jurisdiction	*Pathways not modeled. Change in transport distance assumed to be zero.*					**100%**	**-**	**NA**
Category 2: National Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*					**100%**	**-**	**NA**
Category 3: South Coast AQMD Jurisdiction Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*					**100%**	**-**	**NA**
Category 4: Imports	1	Port Area	-	-	Truck to Northern California Distribution	2.99%	1.45%	201
	2	Port Area	-	-	Downtown Rail to National Distribution	20.16%	9.76%	28
	3	Port Area	Inland Empire	-	Truck to South Coast AQMD Regional Distribution	2.45%	1.19%	70
	4	Port Area	Inland Empire	-	Truck to Non-District Regional Distribution	2.57%	1.25%	228
	5	Port Area	Inland Empire	-	Truck to Northern California Distribution	0.61%	0.30%	302
	6	Port Area	Inland Empire	-	Inland Empire Rail to National Distribution	3.53%	1.71%	80

GOODS FLOW CATEGORY [A]	PATHWAY [B]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 1 [C]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 2 [D]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 3 [E]	DESTINATION [F]	GOODS SHARE WITHIN CATEGORY [G]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION [H]	TRUCK MILES [I]
	7	Port Area	Inland Empire	Inland Empire	Truck to South Coast AQMD Regional Distribution	0.59%	0.29%	81
	8	Port Area	Inland Empire	Inland Empire	Truck to Non-District Regional Distribution	0.63%	0.30%	240
	9	Inland Empire	-	-	Truck to Northern California Distribution	3.49%	1.69%	300
	10	Inland Empire	-	-	Inland Empire Rail to National Distribution	35.52%	17.20%	79
	11	Inland Empire	Inland Empire	-	Truck to South Coast AQMD Regional Consumption	3.39%	1.64%	80
	12	Inland Empire	Inland Empire	-	Truck to Non-District Regional Consumption	3.58%	1.73%	239
	13	Inland Empire	-	-	Truck to South Coast AQMD Regional Consumption	9.41%	4.56%	68
	14	Inland Empire	-	-	Truck to Non-District Regional Consumption	9.96%	4.82%	227
	15	Inland Empire	-	-	Downtown Rail to National Distribution	1.10%	0.53%	126
	Imported Goods Flow Pathways Total:					**100%**	**48.41%**	
Category 5: Origin and Destination of South Coast AQMD Jurisdiction	3	Port Area	Inland Empire	-	Truck to South Coast AQMD Regional Distribution	15.46%	5.39%	70
	7	Port Area	Inland Empire	Inland Empire	Truck to South Coast AQMD Regional Distribution	3.74%	1.30%	81
	11	Inland Empire	Inland Empire	-	Truck to South Coast AQMD Regional Consumption	21.38%	7.46%	80
	13	Inland Empire	-	-	Truck to South Coast AQMD Regional Consumption	59.42%	20.73%	68
	Goods with Origin and Destination in South Coast AQMD Jurisdiction Total:					**100%**	**34.89%**	

GOODS FLOW CATEGORY [A]	PATHWAY [B]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 1 [C]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 2 [D]	SOUTH COAST AQMD JURISDICTION LOGISTICS NODE 3 [E]	DESTINATION [F]	GOODS SHARE WITHIN CATEGORY [G]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION [H]	TRUCK MILES [I]
Category 6: South Coast AQMD Jurisdiction Origin and National Distribution Destination	1	Port Area	-	-	Truck to Northern California Distribution	3.56%	0.59%	201
	2	Port Area	-	-	Downtown Rail to National Distribution	23.96%	4.00%	28
	4	Port Area	Inland Empire	-	Truck to Non-District Regional Distribution	3.06%	0.51%	228
	5	Port Area	Inland Empire	-	Truck to Northern California Distribution	0.72%	0.12%	302
	6	Port Area	Inland Empire	-	Inland Empire Rail to National Distribution	4.20%	0.70%	80
	8	Port Area	Inland Empire	Inland Empire	Truck to Non-District Regional Distribution	0.74%	0.12%	240
	9	Inland Empire	-	-	Truck to Northern California Distribution	4.14%	0.69%	300
	10	Inland Empire	-	-	Inland Empire Rail to National Distribution	42.22%	7.05%	79
	12	Inland Empire	Inland Empire	-	Truck to Non-District Regional Consumption	4.26%	0.71%	239
	14	Inland Empire	-	-	Truck to Non-District Regional Consumption	11.83%	1.98%	227
	15	Inland Empire	-	-	Downtown Rail to National Distribution	1.31%	0.22%	126
	Goods with Origin in South Coast AQMD Jurisdiction and National Distribution Total:					**100%**	**16.70%**	
							Weighted Average Baseline Pathway Miles:	**95**

Notes:
1. The pathways shown in this exhibit reflect the goods flow pathways as represented in Leachman (2017).
2. This table shows pathways for each of the goods flow categories outlined in Exhibit 2. Because the categories with origin inside the South Coast AQMD jurisdiction are assumed to follow similar pathways to imported goods, they draw from the same pathways as the imported goods. The associated pathway share is scaled according to each goods category's share of the total analyzed goods, as shown in Exhibit 2.
3. Each pathway has 1-3 warehouses in its distribution chain, labeled by its location either near the ports of the San Pedro Bay or in the Inland Empire. To approximate the location of the average warehouse located in Los Angeles County near the ports, we use the location of the intermodal container transfer facility (ICTF). In the Inland Empire, we use a point halfway between the cities of Riverside and San Bernardino.
4. Because different warehouses fulfill different distributional functions, some goods visit multiple warehouses in the Inland Empire before leaving for their next destination.

To estimate the change in trucking distance associated with the relocation of a warehouse to an outlying market area, we follow an approach similar to the baseline. For each of the 15 pathways shown in Exhibits 2 and 3, we specify alternate pathways where a warehouse in that pathway relocates to each outlying market. Exhibit 4 maps the seven outlying markets considered in our analysis: North of District, Coastal Areas; North of District Bakersfield; South of District, San Diego; East of District, Desert Areas; Las Vegas; Western AZ; and Phoenix. For example, Exhibit 5 shows how pathways 1, 5 and 9 would change if warehouses on those pathways were to relocate from the South Coast AQMD jurisdiction to the Bakersfield area.

EXHIBIT 4. SOUTH COAST AQMD JURISDICTION AND RELOCATION MARKETS

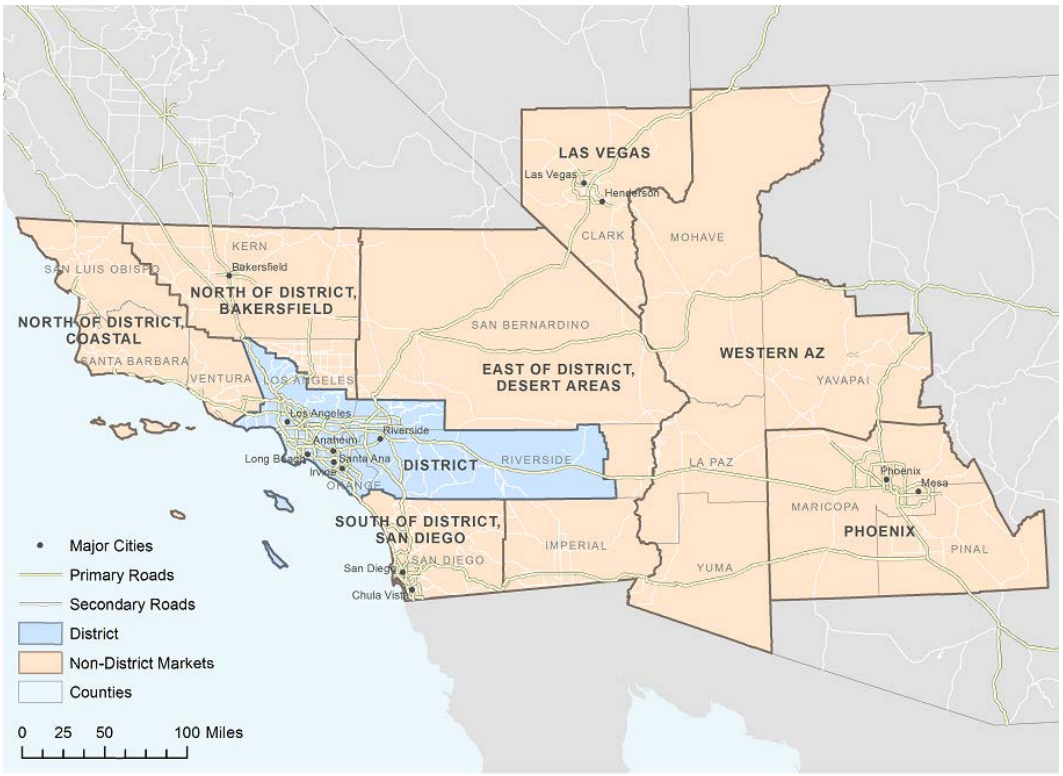
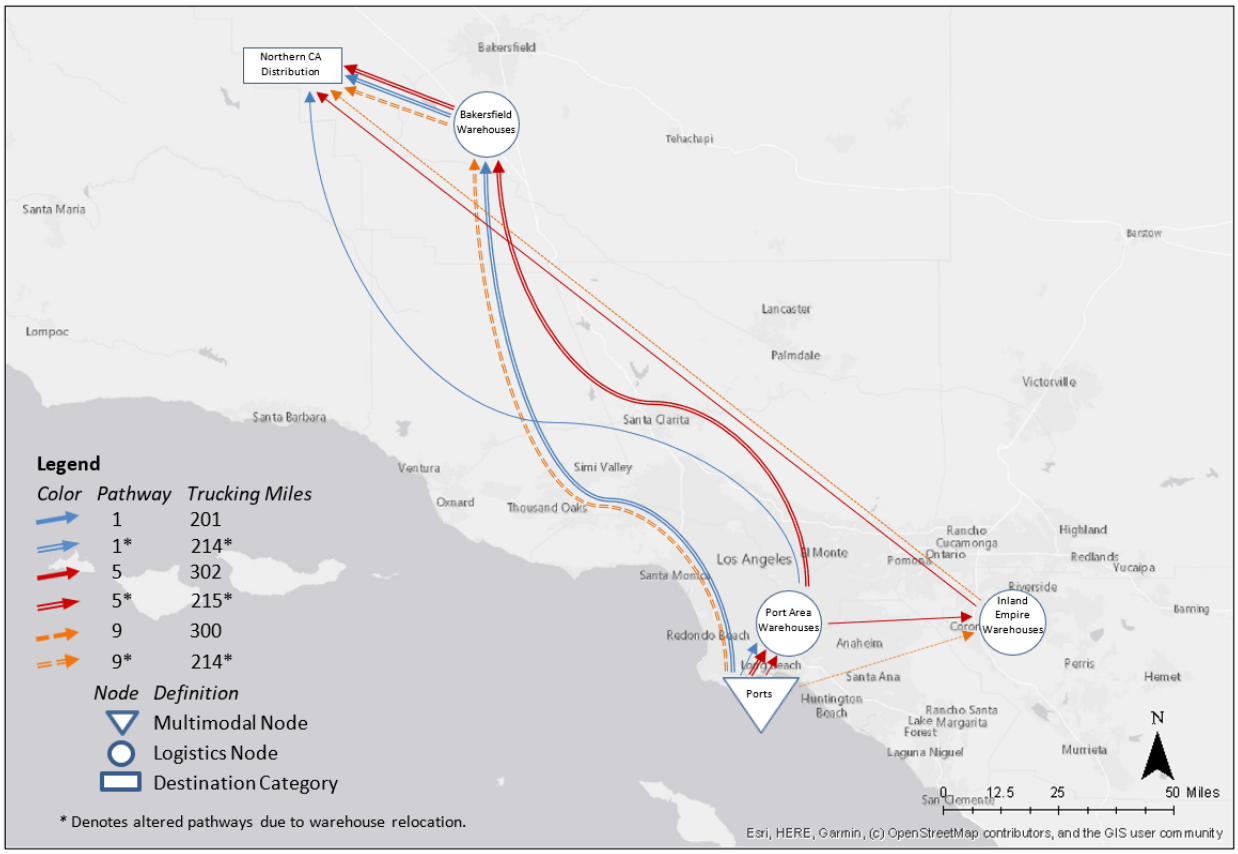


EXHIBIT 5. ILLUSTRATION OF PATHWAYS 1, 5, AND 9 GOODS FLOW WITH WAREHOUSE RELOCATION



Due to complexities inherent in the routing of goods through warehouses, we make several simplifying assumptions to estimate the trucking distance associated with relocation of a warehouse to each outlying market area. These include the following:

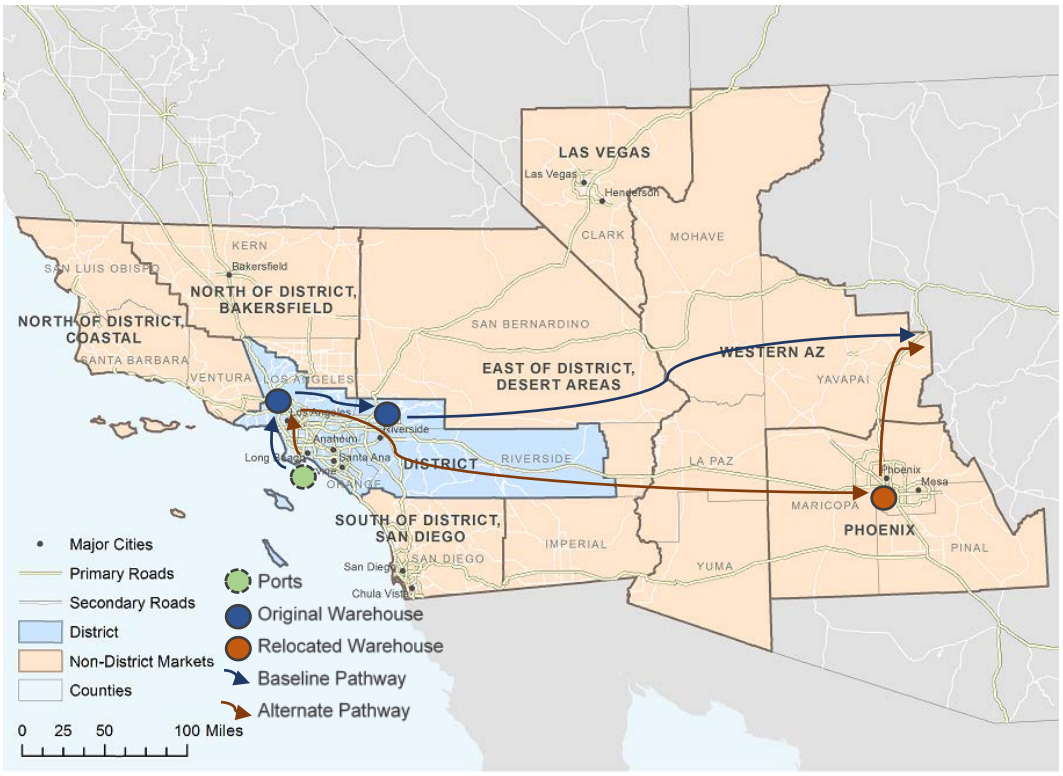
- ***Only final warehouse in pathway chain relocates:*** Estimation of travel distance associated with warehouse relocation is complicated since a given warehouse may represent one of many stops on a shipment's transit to its ultimate destination. Thus, the increase in distance associated with warehouse relocation may depend, in part, on where the warehouse sits along a pathway.[17]

  For example, it seems unlikely the first warehouse in Exhibit 6 (just north of the San Pedro Bay ports) would relocate to Phoenix, resulting in much higher transportation costs due to its goods routing from the San Pedro Bay ports to Arizona and then back to the Inland Empire, then back out for distribution outside the South Coast AQMD jurisdiction. It is more likely the *second* warehouse in the baseline pathway would relocate to Phoenix, having a more modest effect on total travel distance.

[17] Each warehouse's location within the supply chain may also affect whether it is likely to relocate. For example, warehouses serving transloading functions based on proximity to the port area may be unlikely to relocate.

For the purposes of estimating the distance associated with alternate good pathways for those pathways involving multiple warehouses, we only estimate the change in distance based on relocation of the last warehouse located inside South Coast AQMD jurisdiction in the pathway. This approach assumes it is unlikely goods would be trucked outside the South Coast AQMD jurisdiction to an intermediary warehouse and then back into the South Coast AQMD jurisdiction to another warehouse due to the increase this would have on transportation costs. For imported goods, warehouses earlier in the chain are more likely to serve functions directly relevant to goods processing from the ports or firm in the South Coast AQMD jurisdiction and would be less likely to relocate further from the ports.

EXHIBIT 6. SAMPLE GOODS PATHWAY WITH RELOCATION ALTERNATIVE



- ***Impact of multiple warehouses on a goods pathway relocating***: If multiple warehouses from a given pathway relocate to the same outlying market, the net change in distance traveled is not likely to be significantly different than one warehouse relocating. In each scenario, the goods are trucked from the South Coast AQMD jurisdiction to the outlying market one time, and distances between warehouses within each market area are assumed marginal. We do not consider how travel distance associated with one warehouse relocating is affected by the relocation of other warehouses on the same goods pathway.

- ***No splitting of pathways between multiple outlying market areas:*** We do not account for multiple warehouses from a given pathway relocating to different outlying markets because the transportation costs of doing so are likely to be prohibitive.
- ***Warehouse locations:*** To approximate the change in travel distance between the baseline and each alternate pathway, we make use of common warehouse locations to estimate transportation distances:
  - For goods pathways using warehouses in the ports vicinity, we use the intermodal container transfer facility (ICTF) as an approximate warehouse location.[18]
  - For goods pathways using warehouses in the Inland Empire, we use a point halfway between the cities of Riverside and San Bernardino as an approximate warehouse location.
  - For alternate goods pathways using warehouses in each outlying market area, we use the geographic centroid of existing warehouses in that market area as the approximate warehouse location.

  While these assumptions do not provide the most precise estimate of the change in distances for each individual warehouse, they provide a reasonably accurate representation of the magnitude of this change for a typical warehouse.
- ***Re-orientation of goods pathways:*** We do not consider any re-orientation of goods pathways (or the share of goods that follow each pathway) due to warehouse relocation or other effects resulting from implementation of the ISR.

Based on these assumptions, we estimated the distance associated with each combination of pathway and outlying market area, as presented in Exhibit 7. For example, consider pathway 10 in goods flow category 4 (imported through the ports) and category 6 (produced locally within the South Coast AQMD jurisdiction). In each instance, the baseline version of pathway 10 has the goods stop once at a warehouse in the Inland Empire, then trucked to the Inland Empire intermodal rail terminal where they are loaded for national distribution. In each alternate version of pathway 10, the Inland Empire warehouse is replaced with a warehouse in each outlying market area, and the goods are trucked onward to the appropriate local intermodal rail terminal from there. The net change in total truck miles traveled for each market area is captured in the row for pathway 10 in Exhibit 7 as the difference between the value for each outlying market and the baseline value.

[18] The ICTF is located approximately five miles north of the ports of the San Pedro Bay, near the intersections of the 405 and 710 Freeways at 2401 East Sepulveda Boulevard in Long Beach, California. 90810.

EXHIBIT 7. RELOCATION PATHWAYS, TRUCK TRAVEL DISTANCE

GOODS FLOW CATEGORY	PATHWAY	TRUCK TRAVEL DISTANCE WITH WAREHOUSE RELOCATION (MILES)								GOODS SHARE WITHIN CATEGORY[1]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION[2]
		BASELINE	SAN DIEGO	DESERT AREAS	COASTAL AREAS	BAKERSFIELD	LAS VEGAS	WESTERN AZ	PHOENIX		
Category 1: National Origin, South Coast AQMD Jurisdiction destination	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	**-**
Category 2: National Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	-
Category 3: South Coast AQMD Jurisdiction Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	**-**
Category 4: Imports	1	201	395	309	260	214	652	699	919	2.99%	1.45%
	2	28	124	136	178	160	298	371	384	20.16%	9.76%
	3	70	197	153	198	316	521	560	693	2.45%	1.19%
	4	228	317	291	304	411	566	592	669	2.57%	1.25%
	5	302	396	311	262	215	653	700	920	0.61%	0.30%
	6	80	125	138	180	161	299	372	385	3.53%	1.71%
	7	81	247	167	305	417	535	565	699	0.59%	0.29%

GOODS FLOW CATEGORY	PATHWAY	TRUCK TRAVEL DISTANCE WITH WAREHOUSE RELOCATION (MILES)								GOODS SHARE WITHIN CATEGORY[1]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION[2]
		BASELINE	SAN DIEGO	DESERT AREAS	COASTAL AREAS	BAKERSFIELD	LAS VEGAS	WESTERN AZ	PHOENIX		
	8	240	367	305	411	512	580	597	674	0.63%	0.30%
	9	300	395	309	260	214	652	699	919	3.49%	1.69%
	10	79	124	136	178	160	298	371	384	35.52%	17.20%
	11	80	245	165	303	415	533	563	697	3.39%	1.64%
	12	239	365	303	409	510	579	595	673	3.58%	1.73%
	13	68	196	151	196	315	520	559	692	9.41%	4.56%
	14	227	316	289	302	410	565	591	668	9.96%	4.82%
	15	126	124	136	178	160	298	371	384	1.10%	0.53%
Category 5: Origin and Destination of South Coast AQMD Jurisdiction	3	70	197	153	198	316	521	560	693	15.46%	5.39%
	7	81	247	167	305	417	535	565	699	3.74%	1.30%
	11	80	245	165	303	415	533	563	697	21.38%	7.46%
	13	68	196	151	196	315	520	559	692	59.42%	20.73%
Category 6: South Coast AQMD Jurisdiction Origin and National Distribution Destination	1	201	395	309	260	214	652	699	919	3.56%	0.59%
	2	28	124	136	178	160	298	371	384	23.96%	4.00%
	4	228	317	291	304	411	566	592	669	3.06%	0.51%

GOODS FLOW CATEGORY	PATHWAY	TRUCK TRAVEL DISTANCE WITH WAREHOUSE RELOCATION (MILES)								GOODS SHARE WITHIN CATEGORY[1]	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION[2]
		BASELINE	SAN DIEGO	DESERT AREAS	COASTAL AREAS	BAKERSFIELD	LAS VEGAS	WESTERN AZ	PHOENIX		
	5	302	396	311	262	215	653	700	920	0.72%	0.12%
	6	80	125	138	180	161	299	372	385	4.20%	0.70%
	8	240	367	305	411	512	580	597	674	0.74%	0.12%
	9	300	395	309	260	214	652	699	919	4.14%	0.69%
	10	79	124	136	178	160	298	371	384	42.22%	7.05%
	12	239	365	303	409	510	579	595	673	4.26%	0.71%
	14	227	316	289	302	410	565	591	668	11.83%	1.98%
	15	126	124	136	178	160	298	371	384	1.31%	0.22%
TOTAL WEIGHTED AVERAGE:		95	196	170	219	271	442	493	574	**TOTAL:**	**100%**
DIFFERENCE FROM BASELINE:		0	101	75	123	176	347	398	479		

Notes:

1. Each percentage value in this column represents a pathway's share of the goods flow for a given goods flow category. For example, pathway 1 accounts for 2.99 percent of the goods flow for goods flow category 1.
2. Each percentage value in this column represents that category and pathway's combined share of the goods flow across all goods subject to alternate routing to different warehouses under the ISR. For example, goods that are imported and follow pathway 1 make up 1.1 percent of the goods subject to potential re-routing.

Using the baseline distances in Exhibit 3 with the distances associated with outlying markets in Exhibit 7, it is possible to estimate the change in trucking distance associated with warehouse relocation. The change in distance for a given warehouse, however, would depend on the pathway(s) the warehouse in question serves. Some warehouses may serve a single pathway only, while others may serve several. Because warehouse-specific pathway information is unavailable, the change in distance for a given warehouse is uncertain. To account for this uncertainty, we specify two pathway scenarios designed to yield low-end and high-end estimates of the change in warehouse relocations associated with the ISR:

1. ***Composite pathway scenario:*** Under this scenario, we assume each warehouse is representative of the entire South Coast AQMD jurisdiction's warehousing sector and serves all 15 pathways shown in Exhibits 2 and 3 in proportion to the goods flow associated with each pathway. Thus the change in trucking distance associated with relocating to a given outlying market area is the difference between the weighted average of the weighted average trucking distance across all 15 pathways for the outlying market area in question (shown near the bottom of Exhibit 7) and the baseline trucking distance across all 15 pathways (shown in the bottom of Exhibit 3). For both the baseline and outlying markets, we weight the pathway-specific distances by the percentage share of goods volume as derived from Leachman (2017) (column H in Exhibit 3).[19] Following this approach, the weighted average baseline distance is 95 miles (see Exhibit 3), and the weighted average distance for the outlying markets ranges from 170 miles for the Desert Areas to 574 miles for the Phoenix area.

2. ***Specialized pathway sensitivity scenario:*** This scenario is designed to account for the possibility that some warehouses may specialize in any one pathway, with the exception of a limited number of pathways. Rather than using the weighted distance across all pathways for a given outlying area, we conduct the analysis iteratively one pathway at a time, assuming all warehouses are on a given pathway for each iteration of the analysis. After running the analysis for all pathways, we calculate the weighted average of the resulting warehouse relocation estimates, using the goods volumes associated with each pathway as weights. For example, based on the distances in Exhibit 7 associated with the Bakersfield market area, we conduct the relocation analysis iteratively based on one-way distances of 160 miles (pathway 2), 316 miles (pathway 3), etc. and calculate the weighted average of the resulting number of relocations.

   This scenario models specialization for most, but not all, pathways. A number of sources suggest warehouses in the South Coast AQMD jurisdiction are unlikely to specialize in the pathways that route goods to Northern California (pathways 1, 5, and 9 in Exhibits 2 and 3 above). Specifically, a 2013 survey of warehouses in the South Coast AQMD jurisdiction found among the warehouses that ship goods to Northern California, goods on this route accounted for no more than 40 percent

[19] This excludes goods included in categories 1 through 3 in Exhibit 1 since those goods flows are assumed to be unaffected by changes in warehouse relocation.

of the goods handled.[20] This 40 percent value represented the highest percentage among all survey respondents.

Furthermore, unlike the other outlying market areas considered in this analysis, Northern California is located in close proximity to another major port, the Port of Oakland. To minimize transportation costs, it is likely most cargo owners with goods bound for Northern California would ship them through the Port of Oakland rather than the San Pedro Bay ports in Southern California. This would suggest warehouses in the South Coast AQMD jurisdiction would not find specialization in Northern California goods pathways to be economically viable. The fact that most cargo ships that visit the San Pedro Bay ports also visit the Port of Oakland (see Exhibit 8) further supports this conclusion, as it suggests the costs of distributing goods to Northern California are lower via the Port of Oakland than through the San Pedro Bay ports.

EXHIBIT 8. OVERLAP BETWEEN VESSELS VISITING SAN PEDRO BAY PORTS AND THE PORT OF OAKLAND

YEAR	% OF SHIPS VISITING SAN PEDRO BAY PORTS THAT VISIT OAKLAND
2019	77%
2018	72%
2017	74%
2016	78%

Source: South Coast AQMD staff analysis of the IHS-Seaweb data.

Based on this information, we include a single Northern California composite pathway in the iterative analysis conducted for the specialized pathway sensitivity scenario. Drawing on the results of the South Coast AQMD warehouse survey described above, the specialized pathway sensitivity scenario assumes 40 percent of the goods flow handled by warehouses that serve Northern California are bound for Northern California. These are allocated across the Northern California pathways (1, 5, and 9) in proportion to the percentages shown in Exhibit 3 for these pathways.[21]

Of the remaining 60 percent of the goods handled by these warehouses, we assume 30 percent remains in the South Coast AQMD jurisdiction and 30 percent is distributed nationally. These figures are also based on the South Coast AQMD

[20] South Coast AQMD, SCAQMD High Cube Warehouse Truck Trip Study White Paper Summary of Business Survey Results, June 2014, available at http://www.aqmd.gov/docs/default-source/ceqa/handbook/high-cube-warehouse-trip-rate-study-for-air-quality-analysis/business-survey-summary.pdf?sfvrsn=2.

[21] For example, pathways 1, 5, and 9 cumulatively account for account for 4.84 percent of the goods flow potentially affected by the warehouse ISR in Exhibit 3 above. Pathway 1 accounts for 2.04 percent, which is 42.1 percent of the 4.84 percent across all three pathways (2.04/4.84=42.1 percent). Therefore, given that we assume 40 percent of the goods flow is on Northern California pathways under this scenario, we assume that 16.9 percent follows pathway 1 (0.421 × 0.40=16.9 percent).

warehouse survey. For those warehouses that reported more than 30 percent of goods distributed to Northern California, the highest percentage reported for out of state distribution was 23 percent. Because our modeling shows warehouses specializing in national distribution are more conducive to relocation than warehouses distributed locally, we view 30 percent for national distribution as a reasonable conservative estimate. This leaves the remainder, 30 percent for local distribution.

We allocate both the 30 percent distributed nationally and 30 percent distributed locally proportionately to the goods flow pathways associated with each category. Based on these assumptions, Exhibit 9 shows the assumed allocation across pathways for those warehouses that serve the Northern California market. Note that the pathways in Exhibit 9 are organized by destination region (i.e., Northern California, national distribution, and local distribution).

EXHIBIT 9. ALLOCATION OF GOODS ACROSS PATHWAYS FOR WAREHOUSES IN THE SOUTH COAST AQMD JURISDICTION THAT SERVE NORTHERN CALIFORNIA

PATHWAY	PATHWAY DESCRIPTION	PATHWAY REGION	PATHWAY PERCENT
1	Truck to Northern California Distribution	Northern California	16.9%
5	Truck to Northern California Distribution	Northern California	3.5%
9	Truck to Northern California Distribution	Northern California	19.7%
2	Downtown Rail to National Distribution	National	10.0%
6	Inland Empire Rail to National Distribution	National	1.8%
10	Inland Empire Rail to National Distribution	National	17.7%
15	Downtown Rail to National Distribution	National	0.5%
3	Truck to South Coast AQMD Regional Distribution	Local	3.7%
4	Truck to Non-District Regional Distribution	Local	1.0%
7	Truck to South Coast AQMD Regional Distribution	Local	0.9%
8	Truck to Non-District Regional Distribution	Local	0.2%
11	Truck to South Coast AQMD Regional Consumption	Local	5.1%
12	Truck to Non-District Regional Consumption	Local	1.4%
13	Truck to South Coast AQMD Regional Consumption	Local	14.1%
14	Truck to Non-District Regional Consumption	Local	3.8%

Within the framework of the specialized pathway scenario analysis, the iteration of the analysis conducted for warehouses that serve Northern California is given a weight equal to the sum of the goods flow percentages across the Northern California pathways, as presented in Exhibit 3 (or 4.8 percent).

Trucking Cost Impacts

The estimated change in trucking distance derived from the methods outlined above is a key input into our analysis of the trucking cost impacts associated with warehouse

relocation. The following equation details our approach for estimating these trucking cost impacts.

(1) $\Delta T_r = (2 \times \Delta D_r) \times cpm \times (p \times s) \times cf$

Where $\Delta T_{,r}$ is the change in trucking costs associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r;*

$\Delta D_{,r}$ is the change in one-way goods pathway trucking distance associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

cpm is the trucking cost per mile;

p is the number of truck trips per 1000 square feet of warehouse space;

s is the warehouse square footage divided by 1000;[22] and

cf is a conversion factor for converting warehouse truck trips to pathway trips.

Below we describe our approach for specifying each of these analytic elements.

Two-Way Trucking Distance

The change in trucking distance is critical in the estimation of the trucking cost impacts associated with warehouse relocation. The distance estimates presented in the previous section, however, reflect the one-way distance impacts associated with warehouse relocation. In practice, warehouse relocation would also increase the distance trucks travel going in the other direction (i.e., back toward the South Coast AQMD jurisdiction). To account for this effect, we multiply the one-way distances presented above to estimate the two-way trucking distance impact associated with warehouse relocation. This two-way distance is represented as $(2 \times \Delta D_{,r})$ in Equation 1.

Trucking Cost Per Mile

The results of the travel distance calculations are used in conjunction with per-mile costs for trucking transport. We use per-mile trucking costs for the West region from the American Transportation Research Institute's 2019 annual report on trucking costs.[23] This value is $1.84 per mile for Class 8 trucks, adjusted for inflation from 2018 to 2019 dollars using the GDP implicit price deflator.[24] To approximate the value for Class 4-7 trucks, we use the ratio of per-mile costs for straight trucks reported by ATRI in 2017 with the 2019 annual report's data. This value is $1.77 per mile for Class 4-7 trucks. As a

[22] The term $(p \times s)$ therefore represents the number of truck trips for a warehouse.

[23] Murray, D. & Glidewell, S. 2019. "An Analysis of the Operational Costs of Trucking: 2019 Update." American Transportation Research Institute.

[24] We use annual gross domestic product implicit price deflators to inflate prices to the current dollar year (2019). These values were obtained from the Federal Reserve Bank of St. Louis Economic Research Division (FRED) and are indexed to 2012 (2012 = 100.00). The values are as follow: 2018=110.42, 2019=112.35.

U.S. Bureau of Economic Analysis, Gross domestic product (implicit price deflator) [A191RD3A086NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/A191RD3A086NBEA, October 11, 2020.

sensitivity analysis on this value, we also consider data from Freightwaves (2020), which reports lower- and upper-bound estimates of $1.16 and $3.05 per mile, respectively.[25]

We note two caveats regarding these trucking cost values. First, we do not consider potential differences in traffic between driving inside and outside the South Coast AQMD jurisdiction. We apply the trucking costs per mile, which do not rely on driving time. Second, we do not account for changes in the number of truck trips possible in a single driver's day as a result of warehouse relocation. This exclusion could underestimate the true cost of warehouse relocation, as drivers would have more downtime that they would prefer to spend transporting goods.

Number of Trips

As shown in Equation 1 above, we calculate the number of trips relative to each warehouse by multiplying the trip rate (trips per 1,000 square feet) by the square footage of each warehouse. We use South Coast AQMD's trip rates per 1,000 square feet of warehousing space included as default rates in the current draft ISR text.[26] These values are presented in Exhibit 10.

EXHIBIT 10. TRUCK TRIP RATES PER 1000 SQUARE FEET OF WAREHOUSE SPACE

WAREHOUSE TYPE	CLASS 8	CLASS 4-7
High Cube Transload & Short-Term Storage (≥200k sf)[1]	0.33	0.12
Warehouse (100k – 200k sf)[1,2]	0.21	0.14
Cold Storage (≥100k sf)[1]	0.75	0.29

Trip rates adapted by South Coast AQMD based on the following studies:
[1] "Truck Trip Generation Study," 2003. City of Fontana, San Bernardino County.
[2] "High Cube Warehouse Vehicle Trip Generation Analysis," 2016. Prepared for South Coast Air Quality Management District and National Association of Industrial and Office Properties by the Institute of Transportation Engineers.

To apply the trip rates presented in Exhibit 10 in the relocation analysis, we adjust them in two ways. The first adjustment relates to the difference between a truck trip to or from a single warehouse versus a trip over an entire goods flow pathway. Because our analysis relies upon the distance along goods flow pathways, it must also use estimates of the total number of pathway trips (i.e., trips over the entire pathway). Because one full trip along a goods flow pathway may involve stops at several warehouses, a pathway trip may include truck trips to/from individual warehouses. In other words, one pathway trip may include more than one truck trip to/from warehouses. To convert the warehouse level truck trips

[25] Henry, C. "What is the Total Cost Per Mile for truckload carriers?" January 13, 2020. Freightwaves.com.

[26] "Draft WAIRE Menu Technical Report" March 3, 2020. South Coast Air Quality Management District.

in Exhibit 10 to pathway trips, we divide the number of truck trips by the number of warehouses per pathway.

The second adjustment reflects how truck trips are defined in the data presented in Exhibit 10. Specifically, a truck trip means the one-way trip a truck or tractor makes to or from a site with at least one warehouse to deliver or pick up goods stored at that warehouse for later distribution to other locations. Based on this definition, a truck or tractor entering a warehouse site and then leaving that site counts as two trips.

Putting this accounting practice in the context of a single warehouse situated along a goods flow pathway, the trip values in Exhibit 10 would lead to overestimation of the number of trips along a pathway. For example, consider a pathway that includes a single warehouse between the Port of Long Beach and the Inland Empire Rail Terminal. If a shipment of goods is transported to the one warehouse on this pathway and subsequently shipped from that warehouse to the rail terminal, the trip data for the warehouse in question would count that shipment as two separate truck trips: one inbound to the warehouse form the port and one outbound from the warehouse to the rail terminal. This results in double counting of trips through the warehouse. To avoid double counting, we divide the trip rates presented in Exhibit 10 by two.

These two adjustments together constitute the conversion factor *cf* shown in Equation 1 above. Specifically, the conversion factor is calculated as follows:

(2) $cf = \frac{1}{w_p} \times \frac{1}{2}$

Where *cf* is the factor converting warehouse truck trips to pathway trips; and

w_p is the number of warehouses along a given goods flow pathway.

Based on Equation 2, we derived the values of *cf* shown in the right-most column in Exhibit 11. The final row of the exhibit includes the weighted average value across pathways, using the proportion of the goods flow associated with each pathway as weights.

EXHIBIT 11. DERIVATION OF CONVERSION FACTORS

PATHWAY NUMBER [A]	PATHWAY DESCRIPTION [B]	NUMBER OF WAREHOUSES ON PATHWAY [C]	CONVERSION FACTOR [D]=1/(C×2)
1	Truck to Northern California Distribution	1	0.50
2	Downtown Rail to National Distribution	1	0.50
3	Truck to South Coast AQMD Regional Distribution	2	0.25
4	Truck to Non-District Regional Distribution	2	0.25
5	Truck to Northern California Distribution	2	0.25
6	Inland Empire Rail to National Distribution	2	0.25
7	Truck to South Coast AQMD Regional Distribution	3	0.17
8	Truck to Non-District Regional Distribution	3	0.17
9	Truck to Northern California Distribution	1	0.50
10	Inland Empire Rail to National Distribution	1	0.50
11	Truck to South Coast AQMD Regional Consumption	2	0.25
12	Truck to Non-District Regional Consumption	2	0.25
13	Truck to South Coast AQMD Regional Consumption	1	0.50
14	Truck to Non-District Regional Consumption	1	0.50
15	Downtown Rail to National Distribution	1	0.50
	Weighted Average Across Pathways	1.27	0.39

Rail Cost Impacts

In addition to changes in trucking costs, the cost of rail transport is also affected by alternate goods pathways involving warehouse relocation to outlying market areas. Our assessment of the change in rail costs is based on a similar equation as specified above for trucking costs:

$$(3)\quad \Delta R_r = \Delta D_r \times cpm_r \times (p \times s) \times cf$$

Where ΔR_r is the change in rail costs associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

ΔD_r is the change in rail goods pathway distance associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

cpm_r is the rail cost per mile;

p is the number of *truck* trips per 1000 square feet of warehouse space, and

s is the warehouse square footage divided by 1000.[27]

cf is a conversion factor for converting warehouse truck trips to pathway trips.

Although this equation is based on the number of *truck* trips (*p*), we use this equation because we derive the *rail* cost per mile from the ratio of rail costs per ton mile to

[27] The term ($p \times s$) therefore represents the number of truck trips for a warehouse.

trucking costs per ton mile, as reported by the Congressional Budget Office.[28] This source reports per-ton-mile freight costs for rail of $0.051 and corresponding per-ton-mile freight costs by truck of $0.156. Based on these values, we calculate a *rail* cost per mile using the following equation:

$$(4) \qquad cpm_r = \left(\frac{cptm_r}{cptm_t}\right) \times (cpm_t)$$

Where cpm_r is the rail cost per mile;

$cptm_r$ is the rail cost per ton-mile;

$cptm_t$ is the trucking cost per ton-mile;

cpm_t is the trucking cost per mile used in the Trucking Costs section, $1.84 per mile.

In effect, applying the estimate of cpm_r as specified in Equation 4 to the specification of costs in Equation 3 provides an estimate equivalent of scaling trucking costs estimated from Equation 1 by the ratio of rail costs per ton mile to trucking costs per ton mile, approximately one-third. This estimate excludes other costs relevant to rail travel, such as added time and changes in reliability.

Change in Rail Distance

Following the potential relocation of a warehouse to an outlying market, some goods pathways that result in rail transport for national distribution will make use of different rail terminals than they do currently within the South Coast AQMD jurisdiction. The result is a change in rail miles traveled for some goods pathways, in addition to the change in truck miles traveled.

For example, if a warehouse serving national distribution via rail were to relocate from the South Coast AQMD jurisdiction to Las Vegas, the result would be an increase in trucking miles and a decrease in total rail miles traveled. This is because goods trucked the initial stretch of the journey east would have been on a train in the baseline for that portion of their journey.

To accomplish this, we identify the relevant intermodal rail facilities in each outlying market area using maps from the National Transportation Atlas Database (NTAD) and the Burlington Northern Santa Fe Railway Company (BNSF), outlined in Exhibit 12 and mapped in Exhibit 13.

[28] Austin, D. 2015. "Pricing Freight Transport to Account for External Costs." Congressional Budget Office.

EXHIBIT 12. RELEVANT INTERMODAL FACILITIES

MARKET	CITY	STATE	INTERMODAL FACILITY NAME	ZIP CODE	LATITUDE/ LONGITUDE
North of District, Coastal	Santa Maria	CA	Yellow-Santa Maria-Ca Terminal	93454	34.97587/-120.43372
North of District, Bakersfield	Bakersfield	CA	BNSF-Bakersfield-Ca	93308	35.45047/-119.09855
District	Los Angeles	CA	BNSF-Los Angeles-Ca	90023	34.01267/-118.19678
East of District, Desert Areas	Barstow	CA	BNSF-Barstow-Ca	92311	34.89532/-117.04787
Inland Empire	San Bernardino	CA	BNSF-San Bernardino-Ca	92411	34.10644/-117.32037
South of District, San Diego	Chula Vista	CA	BNSF-San Diego-Ca	91911	32.59299/-117.08152
Las Vegas	Las Vegas	NV	Up-Las Vegas-Nv	89106	36.16162/-115.15788
Western AZ	Kingman	AZ	Lucky 7 Transportation, Inc.-Kingman-Az	86401	35.22756/-114.00087
Phoenix	Glendale	AZ	BNSF-Phoenix Intermodal Facility	85301	33.51873/-112.16439

Sources:
BNSF Railway, (2020). "BNSF 6003 Rail Miles Inquiry Tool." Accessed July 2020. http://www.bnsf.com/bnsf.was6/RailMiles/RMCentralController

Bureau of Transportation Statistics, (2020). "Layer: Intermodal Freight Facilities." National Transportation Atlas Database. Accessed July 2020. https://www.arcgis.com/home/item.html?id=88ebd67fdc3c4d8ba6f0ee9311960eec

EXHIBIT 13. MAP OF RELEVANT INTERMODAL FACILITIES

Exhibit 14 shows the baseline rail distance per relevant pathway, as well as the pathway-specific rail distance for each outlying market area. The difference between the pathway-specific values for each outlying market area and the pathway-specific values for the baseline are used for the specialized pathway sensitivity scenario described above. For the Composite pathway scenario, we use the weighted average of the rail distance values shown in Exhibit 14, using the proportion of the goods flow associated with each pathway as weights. The change in weighted average distance for each outlying market area is shown at the bottom of Exhibit 14. The weighted average change in rail distance is negative for some market areas and positive in others.

EXHIBIT 14. RELOCATION SCENARIOS, RAIL TRAVEL

GOODS FLOW CATEGORY	PATHWAY	RAIL TRAVEL DISTANCE (MILES)								GOODS SHARE WITHIN CATEGORY	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION
		BASELINE	SAN DIEGO	DESERT AREAS	COASTAL AREAS	BAKERSFIELD	LAS VEGAS	WESTERN AZ	PHOENIX		
Category 1: National Origin, South Coast AQMD Jurisdiction destination	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	**-**
Category 2: National Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	-
Category 3: South Coast AQMD Jurisdiction Origin, bound for export	*Pathways not modeled. Change in transport distance assumed to be zero.*									**100%**	**-**
Category 4: Imports	**2**	890	968	753	1283	893	1091	524	592	20.16%	**9.76%**
	6	830	968	753	1283	893	1091	524	592	3.53%	**1.71%**
	10	830	968	753	1283	893	1091	524	592	35.52%	**17.20%**
	15	830	968	753	1283	893	1091	524	592	1.10%	**0.53%**
	ELSE	0	0	0	0	0	0	0	0	39.69%	**19.21%**
Category 5: Origin and Destination of South Coast AQMD Jurisdiction	*No pathways affected by changes in rail travel.*									100%	-

GOODS FLOW CATEGORY	PATHWAY	RAIL TRAVEL DISTANCE (MILES)								GOODS SHARE WITHIN CATEGORY	GOODS SHARE OF TOTAL SUBJECT TO RELOCATION
		BASELINE	SAN DIEGO	DESERT AREAS	COASTAL AREAS	BAKERSFIELD	LAS VEGAS	WESTERN AZ	PHOENIX		
Category 6: South Coast AQMD Jurisdiction Origin and National Distribution Destination	**2**	890	968	753	1283	893	1091	524	592	23.96%	**4.00%**
	6	830	968	753	1283	893	1091	524	592	4.20%	**0.70%**
	10	830	968	753	1283	893	1091	524	592	42.22%	**7.05%**
	15	830	968	753	1283	893	1091	524	592	1.31%	**0.22%**
	ELSE	0	0	0	0	0	0	0	0	28.31%	**4.73%**
TOTAL WEIGHTED AVERAGE:		**350**	**399**	**310**	**528**	**368**	**449**	**216**	**244**	**TOTAL:**	**100%**
TOTAL DIFFERENCE FROM BASELINE:		**0**	**49**	**-40**	**178**	**18**	**99**	**-134**	**-106**		

Notes:

- The change in rail travel distance only affects the four pathways with national rail distribution as their destination, as listed in Exhibit 3. Rather than onloading the goods at either the Downtown Los Angeles or Inland Empire (San Bernardino) rail terminals, the warehouse relocation necessitates onloading goods at rail terminals in the outlying markets.
- We assume relocated warehouses in both the Coastal Areas and Bakersfield outlying markets will continue to use the in-District rail terminals due to the lack of alternate rail terminals. The resulting increase in truck travel distance is accounted for in the truck travel distance calculations.

Number of Trips

As with trucking, we use South Coast AQMD's trip rates per 1,000 square feet of warehousing space included as default rates in the current draft ISR text (see values in Exhibit 10).[29] We calculate the number of trips relative to each warehouse by multiplying the trip rate by the square footage of each warehouse. We also apply the conversion factor described in the trucking cost section above (*cf*) to convert warehouse level trips to pathway trips.

Total Transportation Cost Impacts

To obtain a value for the total effect on transportation costs due to warehouse relocation, we sum the effects on trucking costs and rail costs:

$$\Delta TC_r = \Delta T_r + \Delta R_r$$

Where $\Delta TC_{d,r}$ is the total change in transportation costs associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

$\Delta T_{d,r}$ is the change in trucking costs associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

$\Delta R_{d,r}$ is the change in rail costs associated with relocating a warehouse from the South Coast AQMD jurisdiction to outlying market area *r*;

This value represents the incremental effect on transportation costs resulting from relocating a warehouse to a given market.

Transportation Cost Impacts Limitations

While the data sources and methods described in this analysis provide reasonable estimates of the transportation cost impact associated with warehouse relocation from the South Coast AQMD jurisdiction, it is important to expand on several limitations which may affect the accuracy of the analysis:

- The goods pathway framework for the analysis is a parsimonious representation of a complex supply chain ecosystem, as exists in the South Coast AQMD jurisdiction. While analyzing the shipment of goods and the location of logistics nodes in this way was necessary to develop this analysis, it is important to note it does not capture every nuance of logistics in the South Coast AQMD jurisdiction.
- The CFS data used to estimate the allocation of goods across different goods flow categories (e.g., imports, locally source goods consumed locally, etc.) is ambiguous regarding the inclusion or exclusion of imports. For the purposes of this analysis, we assumed the CFS data does not reflect imports as they arrive at the San Pedro Bay ports. If we were to assume all imports are reflected in the CFS data upon their arrival at the San Pedro Bay ports, the estimated change in trucking distance would, on average, be seven percent higher than estimated here. To the extent that we underestimate the change in trucking distance, we may

[29] "Draft WAIRE Menu Technical Report" March 3, 2020. South Coast Air Quality Management District.

underestimate the costs of relocation and overestimate the degree to which warehouses relocate outside the South Coast AQMD jurisdiction.

- While the per-mile cost estimates we include for both trucking and rail are relatively comprehensive in what they include, they do not capture all cross-medium differences between the two methods. Differences in travel time or reliability between trucking and rail are not considered in these applications.
- This analysis is meant to capture incremental changes in travel cost due to the relocation of an individual warehouse. It does not capture other cost effects, e.g. a logistics company reorienting its business organization away from the San Pedro Bay ports, making changes to warehousing operations to decrease required floor space, or increasing full-truckload shipments.

RENTAL COSTS

This analysis estimates the average change in annual rents for a warehouse relocating to an outlying market area. Based on rental cost data from CoStar, we calculate an average annual rental price per square foot specific to warehouses likely to relocate (excluding cold storage facilities, which we assume will not relocate).[30] We then take the difference from the value for the South Coast AQMD jurisdiction to obtain the expected change in annual rent per square foot due to the typical warehouse relocating to each of the outlying market areas. Exhibit 15 illustrates the expected cost changes due to differences in rent.

EXHIBIT 15. DIFFERENCES IN RENTAL PRICES ACROSS MARKETS - YEAR 2019

MARKET	AVERAGE YEARLY RENTAL PRICE PER SQUARE FOOT	DIFFERENCE FROM DISTRICT BASELINE ($/SQUARE FOOT)
South Coast AQMD Jurisdiction Average	**$10.61**	-
Non-District Average	**$6.99**	($3.62)
Bakersfield	$4.03	($6.57)
Coastal Areas	$9.32	($1.29)
Desert Areas	$9.75	($0.86)
San Diego	$11.07	$0.46
Las Vegas	$7.54	($3.07)
Phoenix	$5.99	($4.62)
Western AZ	$3.84	($6.77)

[30] The CoStar data are summarized in "Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction", prepared by Derek Ehrnschwender and Jason Price, Industrial Economics, for South Coast AQMD. December 12, 2020.

LABOR COSTS

This analysis estimates the average change in warehouse labor costs associated with operating a warehouse in the outlying markets rather than in the South Coast AQMD jurisdiction. This analysis is based upon a cross-geographic comparison of the typical employment required for a distribution warehouse developed by The Boyd Company.[31]

This report measures differences in warehouse labor costs for several cities in the Southwestern U.S. for a model 500,000 square foot distribution warehouse. Where the cities considered in the Boyd report align with the market areas considered in this analysis, we rely on the labor cost values included in the report.

Some California market areas, specifically the South Coast AQMD jurisdiction, Coastal Areas, Bakersfield, and San Diego markets, do not align with the geographic areas captured in the Boyd report. In these cases, we use the Boyd estimate for the Inland Empire as a starting point and scale this value based on county-level wage rates available in California's 2014 Occupational Employment Statistics survey and the mix of occupational categories employed by a warehouse (as specified in the Boyd report).[32,33] For example, to derive an estimate for the Bakersfield area, we multiplied the Inland Empire cost value from the Boyd report by the ratio of the Kern County warehouse wage rate to the Riverside County warehouse wage rate. The estimated labor costs for each market area are captured in Exhibit 16. All labor rates have been adjusted to 2019 dollars.

EXHIBIT 16. DIFFERENCES IN COST OF LABOR ACROSS MARKETS – 2019$

MARKET	ESTIMATED ANNUAL LABOR COSTS, MODEL 500,000 SQUARE FOOT WAREHOUSE (2015)	ESTIMATED ANNUAL LABOR COSTS PER 1,000 SQUARE FEET	DIFFERENCE FROM DISTRICT BASELINE ($/1000sqft)
South Coast AQMD Jurisdiction*	$6,689,241	$13,378	$-
Bakersfield*	$6,733,087	$13,466	$87.69
Coastal Areas*	$6,690,483	$13,381	$2.48
San Diego*	$6,324,682	$12,649	$(729.12)
Desert Areas	$6,794,841	$13,590	$211.20
Las Vegas	$5,506,778	$11,014	$(2,364.93)
Phoenix	$5,707,995	$11,416	$(1,962.49)
Western AZ	$5,153,621	$10,307	$(3,071.24)

*Denotes market areas not fully captured in Boyd (2015). To obtain estimates for these market areas, we adjust the Boyd estimates using a representative sample of county-level labor rates available in California's 2014 Occupational Employment Statistics survey.

[31] The Boyd Company (2015). "Comparative Distribution Costs in Port and Intermodal-Proximate Cities: Distribution Warehouse Site Selection."

[32] State of California Employment Development Department (2015). Occupational Employment Statistics and Wages.

33 This mix of personnel includes one first-line supervisor of helpers, laborers, and material movers; one first-line supervisor of transportation and material-moving machine operators, two heavy and tractor-trailer truck drivers; one light truck or delivery service driver; and five laborers and freight, stock, and material movers.

POWER COSTS

We also consider differences in electricity cost across market areas. Boyd (2015) reports power costs for a model 500,000 square foot distribution warehouse across several cities in the Southwestern U.S. Boyd (2015) applies the same power costs to all of the California areas included in the report. We assume these values apply to all market areas in California, regardless of whether they are included in the Boyd report. These estimates are reported in Exhibit 17.

EXHIBIT 17. DIFFERENCES IN COST OF POWER ACROSS MARKETS - YEAR 2019

MARKET	ESTIMATED ANNUAL POWER COSTS, MODEL 500,000 SQUARE FOOT WAREHOUSE AS CONSIDERED IN BOYD (2015)	ESTIMATED ANNUAL LABOR COSTS PER 1,000 SQUARE FEET	DIFFERENCE FROM DISTRICT BASELINE ($/1000sqft)
South Coast AQMD Jurisdiction	$899,066	$1,798	$-
Bakersfield	$899,066	$1,798	$-
Coastal Areas	$899,066	$1,798	$-
San Diego	$899,066	$1,798	$-
Desert Areas	$899,066	$1,798	$-
Las Vegas	$825,234	$1,650	$(147.66)
Phoenix	$624,379	$1,249	$(549.38)
Western AZ	$703,039	$1,406	$(392.05)

MOVING COSTS

This analysis accounts for the costs of physically moving warehouse operations to a new site. We rely on a one-time moving cost of $160,000 per facility, derived from moving cost estimates from Petersen and Aase (2016).[34] This estimate takes into account several cost categories, including transportation, labor, and inventory storage costs, across one-week, two-week and three-week moving scenarios. We calculate the average of these three scenarios' costs to obtain our moving cost estimate.

DEVELOPMENT FEES

In the slack capacity scenario we account for the development of potential new warehouse capacity to meet potential new demand for warehouses relocated from the South Coast AQMD jurisdiction. Developers that undertake such projects will incur a number of one-time development or impact fees charged by the various jurisdictions in outlying market areas, including fire and rescue fees, transportation mitigation fees, etc. For the purposes of estimating the costs of relocation, we assume such costs will ultimately be borne by warehouse operators who pay rent to the building owner. We annualize these costs over the full 20-year time horizon of our analysis, using discount rates of 1 percent and 4 percent. Although development fees may be reflected in current

[34] Petersen, Charles G., and Gerald R. Aase (2016). "Issues in Distribution Center Relocation." Open Journal of Business and Management 4, No. 01.

rents for outlying markets where warehouse capacity could be developed, these fees may not be fully reflected in current rents if no warehouse development has occurred since the development fees were last revised.

Due to the lack of comprehensive data on impact fees related to development of warehousing properties in the Southwest, IEc conducted a review of applicable fees across the seven outlying market areas included in this analysis. This review relied on a selection of sources, including municipal government websites, reports commissioned by governmental associations, and city council ordinances. After compiling the relevant impact fees for each of the seven markets, IEc then converted the estimates to 2019 dollars per square foot. The results of this analysis, outlined in Exhibit 18, show a range of development fees per 1000 square feet by market area.

MODELING OF RELOCATION DECISIONS

Based on the costs of ISR compliance and the costs of relocation calculated, we estimate the number of warehouses that relocate from the South Coast AQMD jurisdiction to the outlying market areas. We develop estimates for different analytic scenarios designed to capture uncertainty regarding the capacity available in each outlying market area (i.e., the medium term capacity area and slack capacity scenario) and uncertainty regarding the goods pathways served by individual warehouses (i.e., the composite pathway scenario and specialized pathway sensitivity scenario).

For each scenario, our modeling of the preferences of an individual warehouse is based on the annualized cash flows associated with ISR compliance and the annualized cash flows associated with relocation, over a 20-year time horizon. For a given analytic scenario, we assume that a warehouse operator's square footage is relocated to an outlying market if the cost condition and capacity condition described in the overview section are met (i.e., if relocation costs for at least one outlying area are less than ISR compliance costs and the available capacity in that area is sufficient to absorb that warehouse's square footage).

Our modeling of this decision accounts not only for the capacity available in each outlying market area prior to introduction of the ISR but also how the relocation decisions of individual warehouses dynamically affect the capacity available in a specific market area and the ability of other warehouses to relocate to that area. The procedure that we follow to capture these dynamics and estimate the number of warehouse relocations is as follows:

- ***Step 1 - Identify the hierarchy of relocation preferences for each warehouse:*** Based on the costs of ISR compliance and relocation, the analysis determines not only whether a given warehouse operation would realize a cost savings by relocating, but also determines the ranking of outlying market areas in terms of the net cost savings that would be realized by relocating.

EXHIBIT 18. DEVELOPMENT IMPACT FEES

MARKET	IMPACT FEE CATEGORY									
	Transportation	Fire & Rescue	Police	School	Water & Sewer	Library	Park	Other	Total (Impact)	**Total ($/1000 sqft)**
Bakersfield	$0.09/sqt	$0.55/sqt	$0.14/sqft	$0.61/sqft	-	$0.13/sqft	-	$0.07/sqft	$1.59/sqft	**$ 1590**
Coastal Areas	$1.48/sqt	$0.43/sqt	$0.25/sqt	$ 0.63/sqft	-	$ 0.79/sqft	-	$0.44/sqft	$ 4.02/sqft	**$ 4020**
San Diego	$ 4.9/sqft	$ 0.1/sqft	$ 0.19/sqft	-	-	-	-	-	$ 5.19/sqft	**$ 5190**
Desert Areas	$0.16/sqt	$0.39/sqt	-	-	-	-	-	-	$ 0.55/sqft	**$ 550**
Las Vegas	$0.94/sqt	-	-	-	-	-	-	$0.01/sqft	$ 0.95/sqft	**$ 950**
Phoenix	$0.85/sqt	$0.22/sqt	$ 0.15/sqft	-	-	$ 0.02/sqft	$ 0.27/sqft	$0.38/sqft	$ 2.23/sqft	**$ 2230**
Western AZ	$0.26/sqt	$ 0.4/sqft	$ 0.14/sqft	-	-	-	-	$0.01/sqft	$ 0.81/sqft	**$ 810**

- ***Step 2 – Array warehouses from largest to smallest:*** To account for the degree to which the relocation decision of a given warehouse affects capacity in the outlying market areas and the potential capacity available for other warehouses considering relocation, we model the warehouses sequentially from largest to smallest. The rationale for this ordering is that the cost impacts of the ISR would likely be more significant for larger warehouses and they would therefore have the greatest motivation to relocate.
- ***Step 3 – Model relocations to most preferred outlying market area:*** Focusing on the most preferred outlying market area for each warehouse operation for which relocation would yield a cost savings, we model the relocation of warehouses in sequence from largest to smallest. The decision of the first warehouse wishing to relocate affects the capacity available in its chosen market area for the second warehouse. The decision of the second warehouse similarly affects capacity available in its chosen market area for the third, and so on. After modeling relocations to individual market areas, we tally the warehouse square footage relocated to each area. Exhibit 19 shows the assumed capacity available as the starting point for the analysis.
- ***Step 4 – Model relocations to second most preferred outlying market area:*** For those warehouses that were unable to relocate to their most preferred outlying market area due to capacity constraints, we move on to modeling relocations for the second most preferred market area. Starting with the largest of these warehouses, the decision of the first such warehouse affects the capacity available in its chosen market area for the second largest of these warehouses. The decision of the second largest of these warehouses similarly affects the capacity available in its chosen market area for the third largest, and so on. After modeling relocations to individual market areas, we tally the warehouse square footage relocated to each area.
- ***Step 5 – Repeat Step 4 for the third, fourth, and fifth most preferred outlying market areas:*** After modeling relocations to the second most preferred market area, we move on sequentially to the third, fourth, and fifth most preferred areas. After modeling relocations to individual market areas, we tally the warehouse square footage relocated to each area. Consideration of the sixth and seventh most preferred outlying market areas was not necessary to avoid capacity constraints.
- ***Step 6 – Sum warehouse square footage relocated to each market area:*** Based on the decisions modeled in the previous steps, we sum the total square footage relocated to each outlying market area.

The process outlined above yields the estimated square footage of warehouse space relocated to each outlying market area. To estimate the number of warehouse operations relocated to each market area, we divide these square footage values by the average square footage per warehouse modeled in this analysis (258,409 square feet). As noted above, the warehouses modeled include all warehouses affected by the ISR, excluding

cold storage warehouses and warehouses at manufacturing facilities. We follow this approach rather than reporting results for individual warehouses due to the uncertainties inherent in individual warehouse costs and relocation decisions. Because our analysis is based on average unit costs applied to all warehouses rather than costs data specific to individual warehouses and because relocation decisions at the individual warehouse level will be based on factors that we have not quantified here, results focused on relocations of individual warehouses would introduce a false sense of precision into the analysis.

EXHIBIT 19. AVAILABLE WAREHOUSE CAPACITY BY MARKET AREA AND CAPACITY SCENARIO (SQUARE FEET)

MARKET	CAPACITY SCENARIO	
	MEDIUM TERM	SLACK CAPACITY
Bakersfield	6,993,909	339,982,129
Coastal Areas	1,083,385	29,361,532
Desert Areas	12,469,835	328,554,568
Las Vegas	7,023,141	460,719,182
Phoenix[1]	35,764,196	28,756,628
San Diego	3,014,243	120,694,750
Western AZ	475,023	164,244,225

Notes:

1. Estimated medium term capacity for the Phoenix market exceeds slack capacity. This reflects CoStar's reporting of the square footage of parcels available for industrial development in the Phoenix area and CoStar's forecast of industrial development in the Phoenix area. As described in the source memo cited below, our slack capacity estimates are based on the former less the latter, plus projected vacancies. For the Phoenix area, the first part of this expression (i.e., the former less the latter) is a negative number, implying that future industrial developments exceed land zoned for industrial use. This could reflect an implicit assumption in the CoStar forecast that land not currently zoned for industrial development will be converted to industrial. It may also be due to the approach described in the source document below to adjust for the fact that CoStar does not distinguish between future developments on large parcels that can accommodate a 100,000 square foot warehouse and development on other parcels.

Source: Values derived from CoStar data, as analyzed and reported in Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction, prepared by Derek Ehrnschwender and Jason Price, Industrial Economics, for South Coast AQMD. December 12, 2020.

ATTACHMENT 5

RESULTS OF INDIRECT SOURCE RULE WAREHOUSE RELOCATION ANALYSIS

IEc

MEMORANDUM | 12 DECEMBER 2020

TO Victor Juan, Ian MacMillan, Paul Stroik, and Shah Dabirian, South Coast Air Quality Management District (South Coast AQMD)

FROM Jason Price, Derek Ehrnschwender, and Nick Manderlink; IEc

SUBJECT Results of Indirect Source Rule Warehouse Relocation Analysis

INTRODUCTION

This memo presents the results of IEc's analysis of potential warehouse relocations that might occur in response to the South Coast Air Quality Management District's (South Coast AQMD's) warehouse indirect source rule (ISR). The relocation results presented in this memo are based on the methods described in IEc's November 30, 2020 memo entitled "ISR Relocation Model – Methodology." Drawing on the approach presented in that memo, this analysis assumes a warehouse operator will relocate if the net costs of ISR compliance exceed the net costs of relocating outside the South Coast AQMD jurisdiction, as long as warehouse capacity is available in areas outside the South Coast AQMD.

The potential destination markets considered for warehouses located in the South Coast AQMD jurisdiction in this analysis include the following:

- **North of District, Bakersfield:** All of Kern County and the non-South Coast AQMD portion of Los Angeles County, including Lancaster and Palmdale.
- **North of District, Coastal:** All of Ventura County, Santa Barbara County, and San Luis Obispo County. Contains the Port of Hueneme, located in Ventura County.
- **East of District, Desert Areas:** All of Imperial County and the non-South Coast AQMD portions of San Bernardino County, including Victorville, and Riverside County.
- **South of District, San Diego:** All of San Diego County, which includes the Port of San Diego.
- **Las Vegas:** All of Clark County, Nevada, which includes the city of Las Vegas.
- **Phoenix:** All of Maricopa County and Pinal County, Arizona.
- **Western Arizona:** All of the four Arizona counties to the west of Phoenix: Yuma, La Paz, Mohave, and Yavapai counties.

SPECIFICATION OF ANALYTIC SCENARIOS

Our estimates of relocation depend on several factors, most significantly on our assumptions regarding the following:

- Each outlying market's capacity to absorb warehouses from the South Coast AQMD jurisdiction.

- The transportation distance implications of relocating to each outlying market.

To account for the uncertainty in these parameters, we estimate relocation under different analytic scenarios defined according to each of these parameters, as detailed below. Together these scenarios enable the estimation of low-end and high-end relocation estimates that bound our estimates of warehouse relocations. Scenarios that assume lower warehousing capacity in outlying markets will yield relocation estimates lower than scenarios that assume relatively high capacity availability. Similarly, scenarios that assume less specialization in the routing of goods will yield lower relocation estimates than scenarios that assume more routing specialization.

CAPACITY SCENARIOS

A key uncertainty in the relocation analysis is the capacity of outlying markets to absorb warehousing activity operating in the South Coast AQMD jurisdiction. Existing capacity in these outlying markets is fairly limited relative to the square footage of warehouse space in the South Coast AQMD jurisdiction, though warehouse space could be constructed on land zoned for industrial development in these areas. Whether and to what degree such development would occur in response to an ISR is a key question for the purposes of our analysis. To address this uncertainty, we estimate relocations under two capacity scenarios:

- ***Medium-term capacity***: This measure of capacity includes current vacant capacity and new capacity proposed or currently under construction in the outlying market areas. This scenario, in effect, assumes no new construction of warehouse space beyond what is already planned in the outlying market areas. It provides a reasonable representation of capacity until such time that new capacity developments can obtain approval and complete construction.
- ***Slack capacity:*** This measure of capacity includes projected warehouse vacancies and also assumes all land that is (1) zoned for industrial development in the outlying market areas and (2) is within 2 miles of a major road is developed into warehouse space. Because it is unlikely that all this land would be developed into warehouse space, this measure of capacity represents an upper bound estimate of warehouse capacity in outlying markets.

For both capacity scenarios, we account for capacity constraints such that the warehouse square footage relocated to a given area does not exceed available capacity in that area.

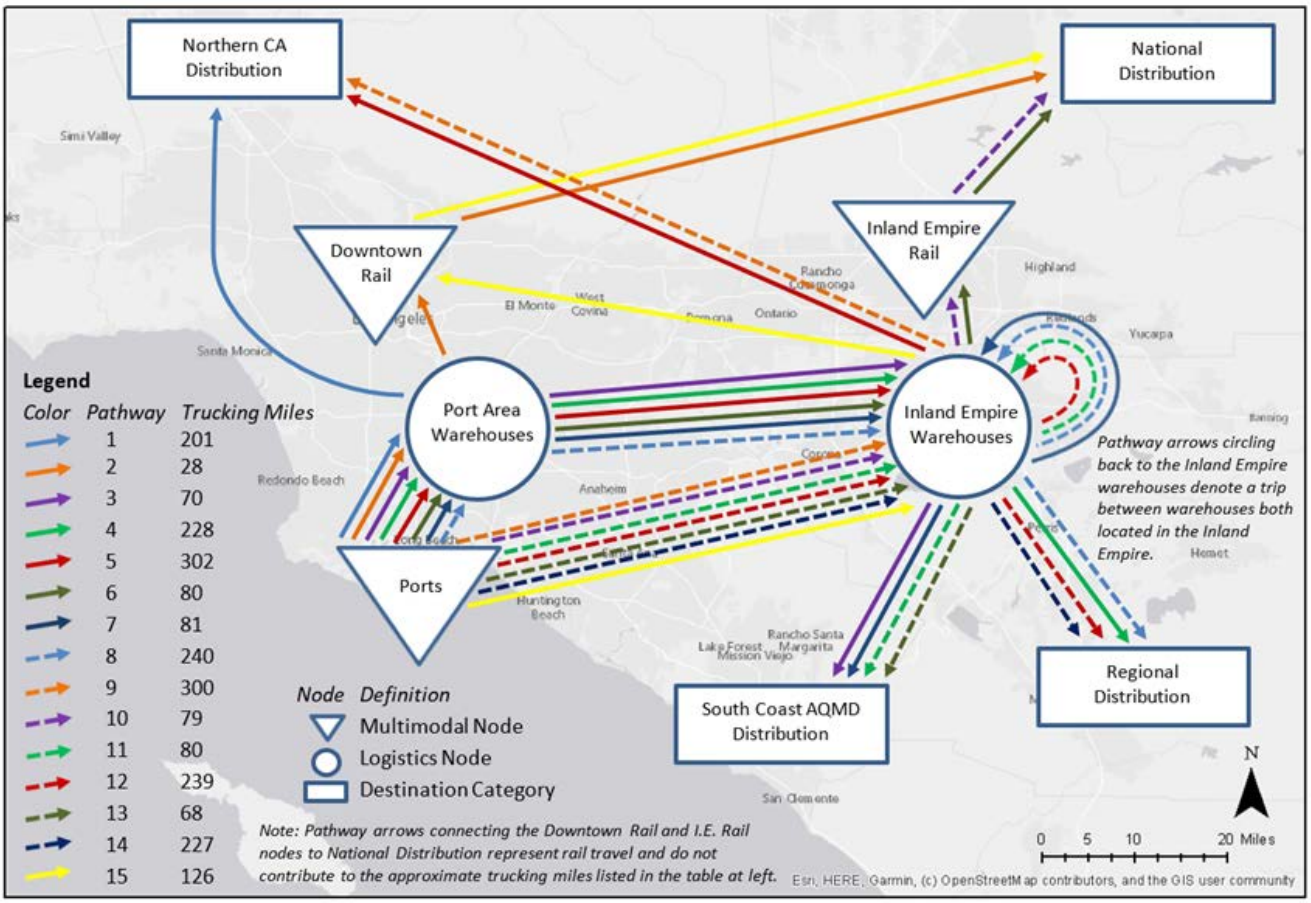
PATHWAY SCENARIOS

The single most important variable in estimating the transportation cost impacts of relocation is the change in transport distance. The change in distance depends on both the route goods follow through the South Coast AQMD jurisdiction and the specific outlying market area to which a warehouse might relocate. To account for the routing of goods, we rely on a series of goods flow pathways derived from Leachman (2017) and the Bureau of Transportation Statistics' Commodity Flow Survey.[1] Shown in Exhibit 1, each of these goods-flow pathways represents a routing of goods through the South Coast AQMD jurisdiction. If a warehouse were to relocate outside of the area, the flow of goods

[1] Leachman, R. 2017. "Strategic Initiatives for Inland Movement of Containerized Imports at San Pedro Bay." Institute for Transport Studies, University of California at Berkeley.

handled by that warehouse would deviate from one or more of the pathways shown in Exhibit 1, potentially leading to an increase in transport distance (and costs).

EXHIBIT 1. GOODS FLOW PATHWAYS



PATHWAY	SOUTH COAST AQMD LOGISTICS NODE 1	SOUTH COAST AQMD LOGISTICS NODE 2	SOUTH COAST AQMD LOGISTICS NODE 3	DESTINATION
1	Port Area	-	-	Truck to Northern California Distribution
2	Port Area	-	-	Downtown Rail to National Distribution
3	Port Area	Inland Empire	-	Truck to South Coast AQMD Regional Distribution
4	Port Area	Inland Empire	-	Truck to Non-District Regional Distribution
5	Port Area	Inland Empire	-	Truck to Northern California Distribution
6	Port Area	Inland Empire	-	Inland Empire Rail to National Distribution
7	Port Area	Inland Empire	Inland Empire	Truck to South Coast AQMD Regional Distribution
8	Port Area	Inland Empire	Inland Empire	Truck to Non-District Regional Distribution
9	Inland Empire	-	-	Truck to Northern California Distribution
10	Inland Empire	-	-	Inland Empire Rail to National Distribution
11	Inland Empire	Inland Empire	-	Truck to South Coast AQMD Regional Consumption
12	Inland Empire	Inland Empire	-	Truck to Non-District Regional Consumption
13	Inland Empire	-	-	Truck to South Coast AQMD Regional Consumption
14	Inland Empire	-	-	Truck to Non-District Regional Consumption
15	Inland Empire	-	-	Downtown Rail to National Distribution

The change in transport distance associated with relocating to each of the outlying market areas identified above depends on the distribution of goods (and truck trips) across each of the pathways shown in Exhibit 1. Thus, the transportation cost implications associated with a warehouse's relocation depend on the pathway(s) in Exhibit 1 that the warehouse serves. Any given warehouse could, theoretically, serve all 15 pathways, a single pathway, or any combination of the pathways shown in Exhibit 1.

To capture the uncertainty associated with the pathway(s) a given warehouse serves, we estimate relocation under two pathway scenarios:

- ***Composite pathway:*** Under this scenario, we assume each warehouse is representative of the warehousing sector as a whole in the South Coast AQMD jurisdiction and serves all 15 pathways shown in Exhibit 1 in proportion to the goods flow associated with each pathway. Under this approach the change in transport distance associated with relocating to a given outlying market area is the weighted average of the change in distance for all 15 pathways, using the goods volumes associated with each pathway as weights.
- ***Specialized pathway sensitivity:*** The specialized pathway sensitivity scenario allows for the possibility of pathway specialization, with the exception of a limited number of pathways. To assess relocations with specialization, we conduct the analysis iteratively one pathway at a time, assuming all warehouses are on a given pathway for each iteration of the analysis. After running the analysis for all pathways, we calculate the weighted average of the resulting warehouse relocation estimates, using the goods volumes associated with each pathway as weights.

  This scenario models specialization across most pathways. Based on a survey of warehouses conducted by South Coast AQMD, it is unlikely warehouses in the South Coast AQMD jurisdiction specialize in the pathways on which goods are routed to northern California. Among the surveyed warehouses that ship goods to northern California, goods on this route accounted for no more than 40 percent of the goods handled.[2] Given that Oakland is a major port city and that approximately 75 percent of the cargo ships that deliver goods to the San Pedro ports also stop at the Port of Oakland,[3] this finding is not surprising. Based on this information, the specialized pathway sensitivity scenario assumes that 40 percent of the goods flow handled by warehouses that serve northern California are bound for northern California and that the remaining 60 percent remains in the South Coast AQMD jurisdiction or is distributed nationally.

As indicated above, the pathway and capacity scenarios, together, yield varying estimates of warehouse relocations associated with the ISR. These scenario combinations, listed in increasing number of warehouse relocations, are as follows:

- Composite pathway, medium term capacity

[2] South Coast AQMD, SCAQMD High Cube Warehouse Truck Trip Study White Paper Summary of Business Survey Results, June 2014, available at http://www.aqmd.gov/docs/default-source/ceqa/handbook/high-cube-warehouse-trip-rate-study-for-air-quality-analysis/business-survey-summary.pdf?sfvrsn=2.

[3] South Coast AQMD staff analysis of the IHS-Seaweb data.

- Composite pathway, slack capacity
- Specialized pathway sensitivity, medium term capacity
- Specialized pathway sensitivity, slack capacity

The results below provide additional insights on the number of relocations associated with these scenarios.

ISR SCENARIOS ANALYZED

The scenarios analyzed by IEc represent different levels of rule stringency under a potential ISR. As described in the 6 October 2020 draft rule text released to the public, the ISR will give warehouse operators significant flexibility in how they meet the requirements of the rule. For example, warehouse operators may choose combinations of various emissions reduction measures to accumulate a required number of Warehouse Actions and Investments to Reduce Emissions (WAIRE) points, or they may pay a mitigation fee that will finance efforts within the South Coast AQMD jurisdiction to reduce trucking-related NO_x emissions. In both cases, the costs incurred by a warehouse operator will depend, in part, on the number of truck trips to and from the warehouse. If warehouse operators lack information on the number of trips to and from a warehouse, they may estimate the number of annual truck trips based on the warehouse's square footage and the truck trip rates stipulated in the rule itself.

Due to the significant flexibility afforded by the ISR, the compliance strategy that would be implemented by a given warehouse is highly uncertain and would likely depend on warehouse-specific factors that we are not able to account for in this analysis. Such factors may include the physical configuration of a warehouse, space available for onsite electric vehicle charging infrastructure, and whether the warehouse operator owns its own fleet of trucks. Because we are not able to account for these and other site-specific factors that may influence compliance decisions, we analyze scenarios specified as an annual cost per square foot of warehouse space, at different levels of regulatory stringency. These values, as provided to IEc by South Coast AQMD staff, reflect what the mitigation fee would potentially be at different levels of stringency, based on the truck trip rates included in the ISR. Exhibit 2 lists each of these scenarios. For each of the scenarios shown in Exhibit 2, we compare the costs of relocation to the costs of compliance to determine the number of warehouses likely to relocate.

EXHIBIT 2. ISR COMPLIANCE COST SCENARIOS ANALYZED

SCENARIO	COST PER SQUARE FOOT (YEAR 2019$)
Scenario 1	$0
Scenario 2	$0.50
Scenario 3	$1.00
Scenario 4	$1.50
Scenario 5	$1.75
Scenario 6	$2.00

RESULTS

Exhibits 3A through 3F summarize the estimated number of warehouse relocations for each of the ISR scenarios listed in Exhibit 2. For each ISR compliance cost scenario, the exhibits show the estimated number of relocations for each combination of pathway scenario and capacity scenario at a discount rate of one percent. We also conducted the analysis based on a discount rate of four percent, and the results, which are available upon request, are identical to those presented here. In addition, the exhibits show the total number of relocations to all outlying markets, as well as the distribution of relocations across outlying markets. For example, Exhibit 3E shows 16 relocations when the ISR compliance cost is $1.75 per square foot under the specialized pathway sensitivity, slack-capacity scenario. Of the 16 relocations, 6 are to the North of District/Bakersfield market area.

The results in Exhibit 3A show we project up to 10 warehouse relocations when compliance costs are $0 per square foot, suggesting up to 10 warehouses in the South Coast AQMD jurisdiction may relocate in the absence of the ISR.

This result, in part, reflects the assumptions of the specialized pathway sensitivity scenario. As described above, we examine warehouse relocation iteratively for individual pathways under the specialized pathway sensitivity scenario. For individual iterations of the analysis, all warehouses are assumed to be on just one of the pathways shown above in Exhibit 1. After estimating relocations associated with individual pathways, we calculate the weighted average of the warehouse relocations projected across each of the iterations of the analysis, using the volume of goods on each pathway as weights.

Therefore, for some iterations of the analysis, we assume several warehouses are exclusively on pathways on which relocation is advantageous, even though they may not be on these pathways at all, or may simultaneously be on other pathways on which relocation is less advantageous. For this reason, we consider the specialized pathway sensitivity scenario results to be very conservative estimates of warehouse relocation.

In practice, the warehouses projected to relocate with $0/square foot in ISR compliance costs may be on multiple pathways that, when examined together, would not suggest warehouse relocation. This is borne out under the composite distance pathway scenario (i.e, when warehouses are assumed to serve all pathways in proportion to the goods flow on each pathway), as no warehouses are projected to relocate under this scenario when ISR compliance costs are $0 per square foot.

EXHIBIT 3A. ESTIMATED WAREHOUSE RELOCATIONS - $0/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT 3B. ESTIMATED WAREHOUSE RELOCATIONS - $0.50/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT 3C. ESTIMATED WAREHOUSE RELOCATIONS - $1.00/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT 3D. ESTIMATED WAREHOUSE RELOCATIONS - $1.50/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	10	0	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT 3E. ESTIMATED WAREHOUSE RELOCATIONS - $1.75/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	1	0	0	0	0	0	0	0
	Slack Capacity	1%	16	6	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT 3F. ESTIMATED WAREHOUSE RELOCATIONS - $2.00/SQUARE FOOT ISR COSTS*

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			TOTAL - ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
Specialized Pathway Sensitivity	Medium Term	1%	1	0	0	0	0	0	0	0
	Slack Capacity	1%	16	6	0	10	0	0	0	0
Composite Distance	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

While the 10 warehouse relocations projected under the $0 ISR compliance cost scenario may suggest several warehouses will find it advantageous to relocate in the absence of the ISR, we do not currently observe such relocations occurring. This reflects the fact that the results in Exhibits 3A through 3F likely overstate relocations under the $0 per square foot ICR compliance cost scenario as well as scenarios with costs greater than $0. This overestimation of relocations is likely due to several factors we are not able to capture quantitatively in our analysis, including, but are not necessarily limited to, the following:

- ***Labor availability***: In many of the outlying markets, the labor force is significantly smaller than in the South Coast AQMD jurisdiction. With a smaller labor pool to draw from, warehouse operators may be reluctant to commit to relocation.
- ***Proximity to customers:*** While our analysis captures the transportation cost impact of relocating, the value of proximity to customers may go beyond the change in transportation costs. For example, proximity is important for meeting customer expectations/demands with respect to delivery time.
- ***Risk of warehouse development in outlying markets:*** Most of the warehouse relocations projected by our analysis are under the slack capacity scenario, under which land zoned for industrial use may be developed into warehouse space. Although land is available in most outlying markets to develop warehouse space, warehouse developers may find such investments too risky to pursue.

  Other than potential demand from warehouse operators relocating from the South Coast AQMD jurisdiction, warehouse owners would have limited clientele to support significant growth in the warehouse sector in these outlying markets. If market conditions were to change in the South Coast AQMD jurisdiction after development of the ISR, warehouse operators may move back after their lease ends, leaving owners of newly constructed warehouses in the outlying markets with no source of revenue. Due to this risk, investors may be reluctant to build new warehouse space in these markets.
- ***Barriers to warehouse development in outlying markets:*** Large-scale warehouse developments in the outlying market areas may encounter resistance in obtaining project approval. Local planning boards and the residents who they represent may seek to limit the number of warehouse developments due to concerns about increased truck traffic, the aesthetic impacts of multiple warehouse developments, or other concerns.

Because relocations are projected under the $0 ISR compliance cost scenario due to the factors outlined above, we estimate relocations for each ISR compliance cost scenario as the difference between relocations for that scenario and relocations projected when ISR compliance costs are zero. For example, with ISR compliance costs of $1.75 per square foot under the specialized pathway sensitivity scenario and the slack capacity scenario, we estimate 6 warehouse relocations (16 relocations as presented in Exhibit 3E less 10 relocations as presented in Exhibit 3A). Applying this approach, Exhibit 4 presents the number of relocations incremental to those projected with an ISR compliance cost of $0 per square foot.

EXHIBIT 4. WAREHOUSE RELOCATIONS, INCREMENTAL TO RELOCATIONS WITH ISR COSTS OF $0 PER SQUARE FOOT

PATHWAY SCENARIO	CAPACITY SCENARIO	DISCOUNT RATE	RELOCATIONS (NO. OF WAREHOUSES)							
			ALL MARKETS	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
ISR Compliance Costs of $0.50 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.00 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.50 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $1.75 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	6	6	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0
ISR Compliance Costs of $2.00 per Square Foot										
Specialized Pathway Sensitivity	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	6	6	0	0	0	0	0	0
Composite	Medium Term	1%	0	0	0	0	0	0	0	0
	Slack Capacity	1%	0	0	0	0	0	0	0	0

As shown in Exhibit 4, the incremental number of warehouse relocations varies from none when ISR costs are $0.50 per square foot to as high as 6 when ISR costs are $2.00 per square foot. Notably, no relocations are projected under the medium-term capacity scenario (when capacity in outlying markets is limited to current vacant capacity and new capacity proposed or currently under construction), incremental to the $0 per square foot ISR compliance cost scenario. This reflects the more limited capacity available under this scenario.

As context for the results presented in Exhibit 4, we estimate that 2,687 warehouses are likely to be affected by the ISR.[4] Thus, the projection of up to 6 warehouses relocating represent 0.2 percent of the universe of affected warehouses.

Our analysis also projects no warehouse relocations under the composite pathway scenario (i.e., when each warehouse is assumed to serve all 15 goods flow pathways). This finding is true both incremental to the $0 ISR compliance cost scenario (results in Exhibit 4) and for each scenario individually, prior to netting out the relocations projected when ISR compliance costs are $0 per square foot (results in Exhibits 3A to 3F).

The lack of relocations under the composite pathway scenario reflects the significant increase in transport distance for some pathways. Because the composite scenario models relocation based on the weighted average change in distance across all pathways, a significant increase in distance for a small number of pathways that account for a large portion of the goods flow drives up the weighted average change in transport distance such that the increased transportation costs associated with relocation outweigh any cost savings. For example, while relocation to the Bakersfield market area may reduce transport distance slightly for some pathways, transport distance increases by more than 130 miles one-way for pathway 2 and more than 245 miles for pathway 13; together these pathways account for approximately 39 percent of the goods flow volume.

Exhibit 4 shows most warehouse relocations, incremental to the $0 per square foot ISR compliance cost scenario, are concentrated in the Bakersfield market area under the specialized pathway sensitivity scenario and the slack capacity scenario. This result is driven by the lower rental costs in the Bakersfield Area ($4.03 per square foot per year) relative to the South Coast AQMD ($10.61 per square foot per year).[5] While transportation costs will increase if warehouses relocate to the Desert Areas, the increase is small enough for some northbound pathways that the rental cost savings are sufficient to yield a cost savings for these pathways.

This concentration of relocations in the Bakersfield market area differs slightly from the results shown in Exhibits 3A through 3F, which are *not* incremental to the $0 per square foot ISR compliance cost scenario. Although those results show a significant concentration of relocations in the Bakersfield area, they show a greater number of

[4] This figure reflects the sum of non-manufacturing warehouses and warehouses at manufacturing facilities as presented in "Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction", prepared by Derek Ehrnschwender and Jason Price of Industrial Economics, prepared for the South Coast AQMD, 12 December 2020.

[5] Rent values obtained from CoStar, as summarized in "Technical Memorandum on Real Estate Markets Neighboring the South Coast AQMD Jurisdiction", prepared by Derek Ehrnschwender and Jason Price of Industrial Economics, prepared for the South Coast AQMD, 12 December 2020. Additional information on the costs considered in the analysis is available in "Indirect Source Rule Relocation Model – Methodology", prepared by Derek Ehrnschwender, Jason Price, and Nick Manderlink of Industrial Economics, prepared for the South Coast AQMD, 12 December 2020.

warehouses relocating to the Desert Areas. Because all of these relocations to the Desert Areas are projected when ISR compliance costs are $0 per square foot, they are netted out of the relocations reflected in Exhibit 4.

RELOCATIONS BY GOODS PATHWAY

For additional insights on projected warehouse relocations under the specialized pathway sensitivity scenario, the appendix to this memo shows warehouse relocations by goods pathway and outlying market. The appendix presents these results individually by ISR compliance cost scenario, without netting relocations under the $0 ISR compliance cost scenario. As shown in the appendix pathway 15 accounts for all projected warehouse relocations (under the slack capacity scenario). On this pathway, good are trucked to an intermodal rail terminal for national distribution.

SENSITIVITY ANALYSIS

The results presented above reflect average trucking costs of $1.84 per mile for Class 8 trucks and $1.77 per mile for Class 4-7 trucks, based on costs data published by the American Transportation Research Institute.[6] To assess the sensitivity of our results to alternative trucking unit cost values, we also conducted sensitivity analyses based on truck cost data from Freightwaves, which reports lower- and upper-bound estimates of $1.16 and $3.05 per mile, respectively.[7]

For the composite pathway scenario, we project no warehouse relocations when using either of these alternative trucking cost values, consistent with the primary results presented above. When we assess potential warehouse relocations under the specialized pathway sensitivity scenario, however, we find the use of alternative trucking cost assumptions has a significant effect on the estimated number of warehouse relocations.

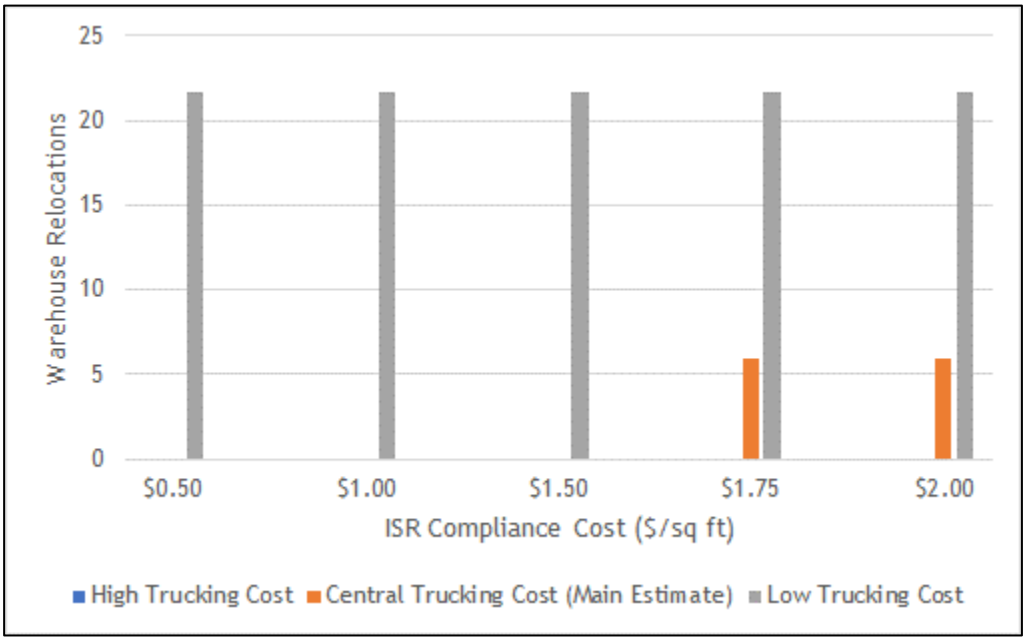
Focusing on relocations incremental to the $0 ISR compliance cost scenario, we project no relocations under the high trucking cost assumptions. This reflects the significant increase in transportation costs associated with relocating warehouses to the outlying market areas.

When using the low trucking cost assumptions, we project more relocations than when using the central trucking cost value. Across all five ISR compliance cost values, we estimate that 22 warehouses will relocate, compared to six warehouses based on our primary trucking cost assumptions. Exhibit 5 graphically illustrates the degree to which the assumed trucking cost affects the estimated number of warehouse relocations (under the specialized pathway sensitivity scenario).

[6] Murray, D. & Glidewell, S. 2019. "An Analysis of the Operational Costs of Trucking: 2019 Update." American Transportation Research Institute.

[7] Henry, C. "What is the Total Cost Per Mile for truckload carriers?" January 13, 2020. Freightwaves.com.

EXHIBIT 5. COMPARISON OF ESTIMATED WAREHOUSE RELOCATIONS UNDER ALTERNATIVE TRUCKING COST ASSUMPTIONS (SLACK CAPACITY, SPECIALIZED PATHWAY SENSITIVITY SCENARIO, 1% DISCOUNT RATE)



LIMITATIONS AND UNCERTAINTIES

The results presented above provide a reasonable representation of the warehouse relocations that may occur in response to the ISR and reflect the best information available on the factors that are likely to affect relocation decisions. Nevertheless, we acknowledge that the analysis is subject to a number of uncertainties, the most significant of which are summarized in Exhibit 6.

EXHIBIT 6. KEY UNCERTAINTIES AND IMPLICATIONS FOR RESULTS

DESCRIPTION OF UNCERTAINTY	IMPLICATIONS FOR RESULTS
Pathway uncertainty: This analysis relies on the concept of goods flow pathways to estimate the change in transportation distance associated with warehouse relocation. However, we do not know the pathways that individual warehouses serve. Absent such information, the pathway scenarios described above (i.e., composite pathway scenario and specialized pathway sensitivity scenario) provide a means of bounding the estimated number of relocations to account for this uncertainty.	Estimating the number of warehouse relocations under two pathway scenarios leads to a wide range of results. Whether the likely number of relocations is closer to the low end or high end of the range depends on the degree to which warehouse operations are more consistent with the composite scenario (warehouses serve all goods flow pathways) or the specialized pathway sensitivity scenario (warehouses specialize in individual pathways).
Unquantifiable factors: Our assessment of relocation decisions accounts for all factors that we are able to quantify with readily available data, specifically data related to the costs associated with remaining in the South Coast AQMD jurisdiction or relocating to an outlying market area. A number of factors that we are unable to quantify, however, may influence relocation decisions. These include (1) the	Many of these unquantifiable factors represent reasons why warehouse operators may want to remain in the South Coast AQMD. This suggests that our analysis may overestimate the number of warehouses that decide to relocate outside the area.

DESCRIPTION OF UNCERTAINTY	IMPLICATIONS FOR RESULTS
degree to which labor availability in outlying markets affects the decisions of warehouse operators, (2) advantages of being in close proximity to customers, (3) financial risks associated with developing warehouse space in outlying markets, and (4) barriers to developing warehouse space in outlying market areas.	
Assumption of no change in goods flow traffic: An implicit assumption of our analysis is that the volume of goods flowing through the South Coast AQMD jurisdiction would remain unchanged as a result of the rule. In practice it is possible the ISR could lead to a reduction in the volume of goods flowing through the region (e.g., through a reduction in import traffic at the Port of Long Beach). This reduction in volume could lead to warehouse relocation (e.g., to the port areas where goods are sent instead of the Port of Long Beach). Our analysis does not capture this effect.	To the degree goods are diverted away from the South Coast AQMD jurisdiction due to the ISR, we may underestimate the number of warehouse relocations.
Rents held constant: For the purposes of simulating the relocation decision-making process of warehouse operators, we held warehouse rents in the South Coast AQMD jurisdiction and in outlying markets constant at current levels. To the extent rent differences between the South Coast AQMD jurisdiction and outlying markets change over time, we may not accurately capture the relocation decisions of warehouse operators.	Absent knowledge of the degree to which relative rents are likely to change over time, we find it highly speculative to take a stance on whether the assumption of constant rents leads to underestimation or overestimation of relocations. However, the relocation of warehouses outside the SCAQMD jurisdiction could put upward pressure on rents in outlying markets and downward pressure on rents in the South Coast AQMD jurisdiction. Combined, these effects would narrow the difference between rent in the South Coast AQMD jurisdiction and less costly outlying markets, potentially limiting the number of warehouse relocations.

APPENDIX.

PROJECTED WAREHOUSE RELOCATIONS BY GOODS FLOW PATHWAY

EXHIBIT A1. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $0/SQUARE FOOT ISR COSTS*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A1. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $0/SQUARE FOOT ISR COSTS*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	10	0	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	10	**0**	0	10	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT A2. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $0.50/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A2. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $0.50/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	10	**0**	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	10	**0**	0	10	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT A3. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.00/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A3. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.00/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	10	0	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	10	0	0	10	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT A4. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.50/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A4. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.50/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	10	0	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	10	0	0	10	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT A5. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.75/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A5. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $1.75/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	16	6	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	**16**	**6**	**0**	**10**	0	0	0	0

**Values for individual market areas may not sum to total due to rounding.*

EXHIBIT A6. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $2.00/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
1	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
10	Inland Empire Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Medium Term	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Medium Term	1%	0	0	0	0	0	0	0	0
Weighted Average Across Pathways		**Medium Term**	**1%**	0	0	0	0	0	0	0	0
1	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
2	Downtown Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
3	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
4	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
5	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
6	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
7	Truck to South Coast AQMD Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
8	Truck to Non-District Regional Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
9	Truck to Northern California Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0

EXHIBIT A6. RELOCATIONS BY PATHWAY AND MARKET AREA (SPECIALIZED PATHWAY SENSITIVITY SCENARIO) - $2.00/SQUARE FOOT ISR*

PATHWAY	PATHWAY DESCRIPTION	CAPACITY SCENARIO	DISCOUNT RATE	COMPONENTS OF WEIGHTED AVERAGE RELOCATION (NO. OF WAREHOUSES)							
				PATHWAY TOTAL	BAKERSFIELD	COASTAL AREAS	DESERT AREAS	LAS VEGAS	PHOENIX	SAN DIEGO	WESTERN AZ
10	Inland Empire Rail to National Distribution	Slack Capacity	1%	0	0	0	0	0	0	0	0
11	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
12	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
13	Truck to South Coast AQMD Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
14	Truck to Non-District Regional Consumption	Slack Capacity	1%	0	0	0	0	0	0	0	0
15	Downtown Rail to National Distribution	Slack Capacity	1%	16	6	0	10	0	0	0	0
Weighted Average Across Pathways		Slack Capacity	**1%**	**16**	**6**	**0**	**10**	**0**	**0**	**0**	**0**

**Values for individual market areas may not sum to total due to rounding.*