Planning Level
Industrial Warehouse Space Modeling for Southern California

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Track 4-4 Logistics Model

presented by

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Presentation Outline

- Introduction
- Study Objectives
- Data Used
- Warehouse Space Model
- Results
- Conclusions
- Ongoing and Future Works
**Introduction**

**Planning Needs for Warehousing in SCAG Region**

» Population growth from 18 million (2014) to 22 million (2035)

» Freight dependent industries contribute 35% of Gross Regional Product, and contribution (in $) to double between 2014-2040

» Container ports handle more than 15 million TEUs (2014), and expected to reach 36 million TEUs by 2040

**Planning Challenges for Warehousing in SCAG Region**

» Limited supply of suitably-zoned land

» Ability to adequately service warehouses in the region given existing and future roadway congestion

» Competing interests of different land uses for a limited land supply
Study Objectives

- Understand supply chain trends impacting Southern California’s warehousing supply and demand
- Develop a warehouse space model to forecast regional warehouse space and allocate space to submarket areas.
- Identify alternate scenarios based on key logistics trends and stakeholder inputs and evaluate them using warehouse space model.
- Develop and evaluate warehousing related policies and associated effects on the transportation system for the SCAG region
Data Used

- CoStar Property® data product for SCAG Region
- REMI based National Gross Domestic Product forecasts
- Developable lands for future industrial warehousing information in the 2013 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
- San Pedro Bay Ports TEU forecasts
- Regional and Local Study Reports, and Real-Estate Market Reports
<table>
<thead>
<tr>
<th>Submarket</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Long Beach Area Ind</td>
<td>43 Submarket Areas, 8 Cargo Markets</td>
</tr>
<tr>
<td>02 Carlsbad/Rancho Bernardo Ind</td>
<td>Port-related cargo markets</td>
</tr>
<tr>
<td>03 Lynwood/Paramount Ind</td>
<td>1 Import loads to cross-dock facilities</td>
</tr>
<tr>
<td>04 Nrd County-LA Ind</td>
<td>2 Import loads to import warehouses</td>
</tr>
<tr>
<td>05 Vernon Area Ind</td>
<td>3 Import loads to smaller DCs (&lt; 750,000 sq. ft.)</td>
</tr>
<tr>
<td>06 Commerce Area Ind</td>
<td>4 Import loads to larger DCs (&gt;= 750,000 sq. ft.)</td>
</tr>
<tr>
<td>07 Southwest SDG Ind</td>
<td>5 Local export loads</td>
</tr>
<tr>
<td>08 Lemon SDG Ind</td>
<td>Non-port related cargo markets (as Difference between total inventory and port-related)</td>
</tr>
<tr>
<td>09 Southeast SDV Ind</td>
<td>6 Non-port loads to warehouses</td>
</tr>
<tr>
<td>10 East San Bernardino County Ind</td>
<td>7 Non-port loads to smaller DCs (&lt; 750,000 sq. ft.)</td>
</tr>
<tr>
<td>11 Ontario Airport Area Ind</td>
<td>8 Non-port loads to larger DCs (&gt;= 750,000 sq. ft.)</td>
</tr>
<tr>
<td>12 East San Bernardino County Ind</td>
<td>Source: CoStar Property® Data Product</td>
</tr>
<tr>
<td>13 Garden Grove-Costa Mesa Ind</td>
<td>CAMBRIDGE SYSTEMATICS</td>
</tr>
<tr>
<td>14 Central LA Ind</td>
<td>SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS</td>
</tr>
<tr>
<td>15 El Segundo-Hermosa Ind</td>
<td></td>
</tr>
</tbody>
</table>
Warehouse Space Model

Overview

Source: Cambridge Systematics and GVH & Associates’ Analysis
Warehouse Space Model
Relationship of National GDP & Occupied Space

Future demand for warehouse space is “driven” by REMI model forecast of GDP growth.

Source: CoStar Property® Data Product, and REMI TranSight
SCAG, CA, US v3.6.5
In SCAG Region, each import load that requires warehousing, on average, stops 1.33 warehouse stops per load.
# Warehouse Space Model

## Regional Level Calculations for Unconstrained Occupied Space

### Avison-Young Formula:

\[
W = L \times f \times r \times d \times e \times \left( \frac{1}{u_1 \times u_2 \times t \times h} \right)
\]

where,

<table>
<thead>
<tr>
<th>(W) = Warehouse space (sq. ft.) needed</th>
<th>(e) = Percentage of container filled with cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>(L) = Equivalent loaded local TEUs per year</td>
<td>(u_1) = Warehouse cubic space utilization percentage at full capacity (i.e., percentage of cubic space available for storage)</td>
</tr>
<tr>
<td>(f) = Percent of cargo needing warehouse space</td>
<td>(u_2) = Average percentage capacity utilization</td>
</tr>
<tr>
<td>(r) = Percent of cargo with origin or destination</td>
<td>(t) = Turnover rate of cargo per year</td>
</tr>
<tr>
<td>(d) = Weighted average cargo capacity of a TEU in cu. ft.</td>
<td>(h) = Ceiling height in feet</td>
</tr>
</tbody>
</table>
Year 2014 Warehouse Inventory Locations of Existing Buildings

Legend
- Existing Industrial Warehouse Building
- Submarket
- Major Hays

Source: CoStar Property® Data Product, and ESRI’s GIS data layers.
Year 2014 Warehouse Inventory
Warehouse Space by Submarket Area and Region

Source: CoStar Property® Data Product
Year 2014 Warehouse Inventory
Regional Existing Occupied Space by Cargo Market

Source: CoStar Property® Data Product
Year 2014 Warehouse Inventory
Illustrative Submarket Area Existing Occupied Space Allocation by Cargo Market

Zone 2: Carson/Rancho Dominguez

<table>
<thead>
<tr>
<th>Occupied</th>
<th>Vacant</th>
<th>Developable</th>
</tr>
</thead>
<tbody>
<tr>
<td>58.1</td>
<td>1.5</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Port Export Loads
- 4.9% Port Export
- 0.0% Port to Mega RDCs
- 3.7% Port to Small RDCs
- 31.1% Port to Warehouses
- 3.1% Port to Crossdock Facilities

Green = port related
Blue = non-port related

Non-port to Small RDCs 21.4%
Non-port to Mega RDCs 0.0%
Non-port to Warehouses 35.8%

Source: Cambridge Systematics and GVH & Associates’ Analysis
2015-2040 Preliminary Baseline Scenario
Warehouse Space Forecasts
Projected Regional **Constrained** and **Unconstrained** Occupied Space

![Graph showing warehouse space forecasts from 2015 to 2040 with unconstrained and constrained space projections.]

This gap represents unmet demand

Source: Cambridge Systematics and GVH & Associates’ Analysis
2015-2040 Preliminary Baseline Scenario
Warehouse Space Forecasts
Illustrative Projected Submarket Area **Constrained** Occupied Space

Zone 2: Carson/Rancho Dominguez

Source: Cambridge Systematics and GVH & Associates’ Analysis
### Identified Alternate Planning Scenarios

1. **Baseline Scenario with Replacement of Obsolescent Warehouses**
2. **Increased mega RDCs share.**
3. **Increased cross-docking share.**
4. **Increased e-commerce and fulfillment centers (distribution centers) share.**
5. **Shift in port related market to near-shoring or reshoring markets.**
6. **Increased developable industrial use land available.**
Conclusions

- Los Angeles and Inland Empire are and will remain important warehousing markets in the U.S. with growing challenges to supply-demand balance.

- Preliminary baseline scenario model results indicate
  - SCAG Region could have a shortfall in warehouse space as early as 2020, when:
    - There are no efficiency gains in warehousing operations;
    - There is no new land identified as developable for future industrial warehousing; and
    - The cargo market mix and cargo turnover rates remain as is today.
Conclusions

Preliminary baseline scenario model results indicate (contd.)

» Submarket areas that are in highly urbanized parts of the SCAG Region and with low vacancy and limited land supply may experience the shortfall sooner than 2020.

» Warehouse space developments will sprawl eastwards and northwards

Private sector and public policy makers in this region need to act now in a collaborative manner while leveraging the cargo market and submarket area level detail and scenario analysis capabilities of the model.
Ongoing and Future Works

**Ongoing Works**

- Evaluation of alternate scenarios
- A transportation system impact analysis under baseline and alternate scenarios
- Development of preliminary policies that would balance warehousing space supply and demand, and their impacts to the regional transportation system

**Future Works**

- Integrate results of warehouse space model into travel demand model to conduct a more robust transportation system impact analysis
Questions?