

# **Executive Summary**

## **Suitability Analysis for a new Gas Station and Service Area Analysis for existing Gas Stations in California**

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**December 19, 2021**

### **Introduction**

This document provides a synopsis of the results of the study titled “Suitability and Service Area Analyses of Gas Stations in California using GIS Techniques.” In part, this was to determine where in California will be best suited for citing a new Exxon gas station, with the hope that, given the set criteria, the location will not be in Petaluma. Petaluma is a city that is determined to achieve its carbon neutrality target by 2030 and has consequently banned the construction of new gas stations in February 2021. This study also aimed to determine the service areas of 728 gas stations of California with specified impedance (driving time).

### **Research Questions**

- 1) Where in California will be best suited for citing a new Exxon gas station?
- 2) How does gas station accessibility vary with impedance and where are the “most-served” or “least-served/unserved” area within the state?

### **Methods and Data**

The questions were addressed using GIS techniques of business analysis/suitability analysis and network analysis with web map application used to publish and visualize study results.

The datasets used for this study and sources include:

- California County and Border states boundaries shapefiles (polygon layers).  
Source: CA Open Data Portal.
- Gas station businesses in California (point layer).  
Source: ESRI online Business data repository.
- Road network shapefile (polyline layer).  
Source: National Highway Planning Network Database.

Software: ArcGIS Pro 2.8.3

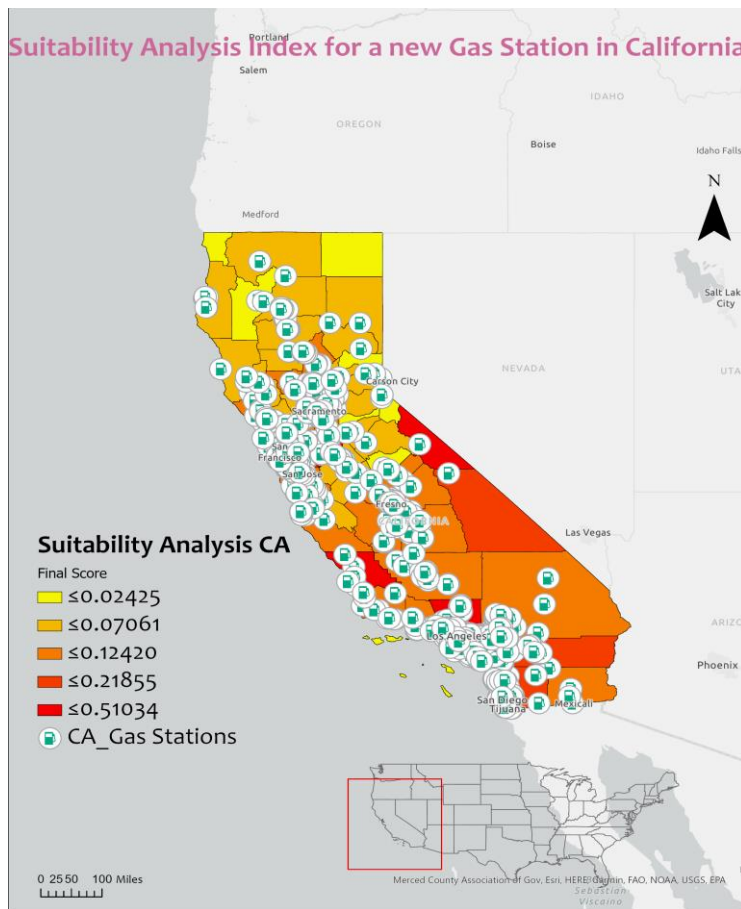
Suitability analysis was conducted to answer the first research question, by utilizing the necessary business analyst geoprocessing tools in ArcGIS Pro. California counties were compared and ranked based on their number of gas stations, sales volume, and 5-minute drive time to serve motorists in a neighborhood. Values were transformed to a common suitability scale within each (point-based) criterion/spatial requirement which was also weighted in relative importance (Count (20%), Weight [Avg Sales Volume/Assets (\$000)] (50%), and Minimal Distance with cutoff time = 5 minutes (30%)).

The overall suitability score is used to determine the best locations (highest suitability scores) for citing the new gas station.

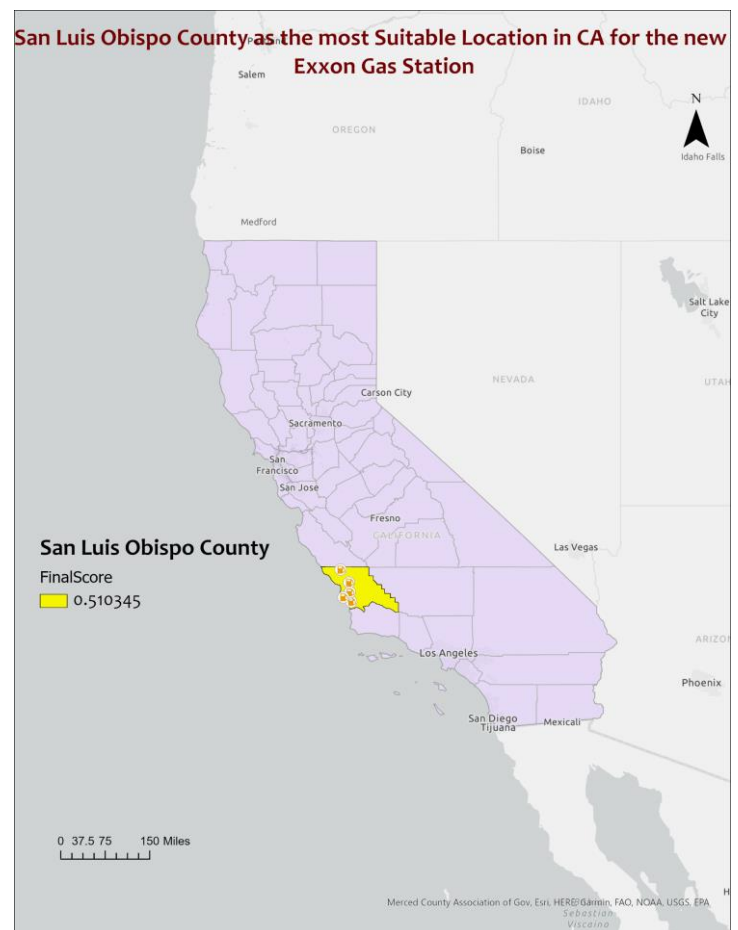
On the other hand, network analysis was conducted to determine the service areas of 728 gas stations of California with specified impedance (driving time). Using driving time by the road network, 3 zones of estimated travel time of 30, 60, and 90 minutes were created around each gas station. These multiple buffer zones/service areas reveal how accessibility varies with impedance, over-served, and under/served areas where 30 minutes of driving is not enough to access a station.

## Results:

Figure 1a below (available on web map) is the suitability analysis index map for a new gas station in California, and Figure 1b shows the most suitable location (San Luis Obispo County) with the highest suitability score (0.510345).

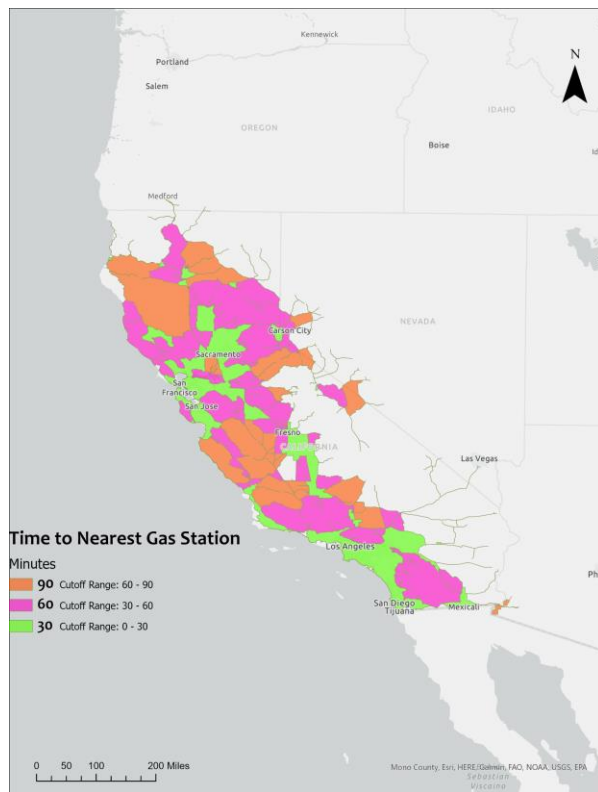


**Figure 1a:** Suitability Analysis Index Map

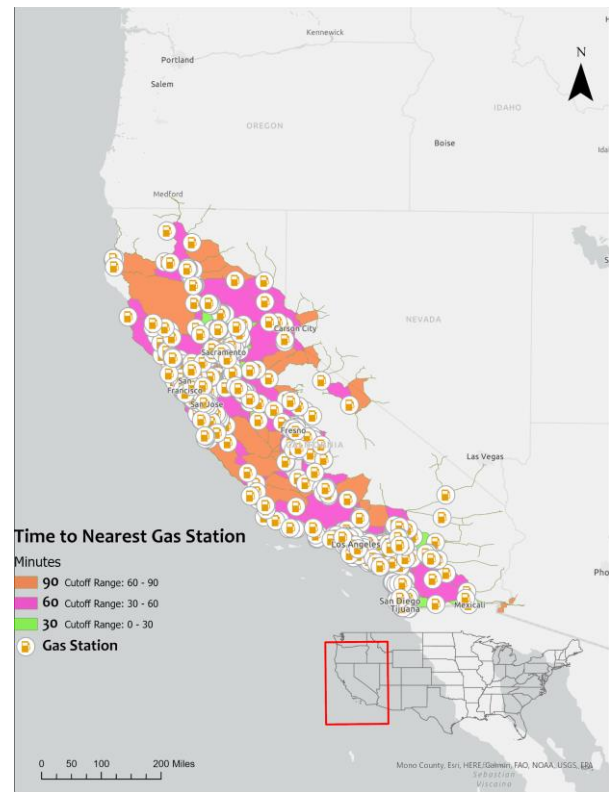


**Figure 1b:** Proposed Location of a new Exxon Gas Station

Figure 2 (a & b) shows the service area of each gas station based on the three buffer zones i.e., estimated driving time of 30, 60, and 90 minutes.



**Figure 2a:** Accessibility (Driving Time) Map



**Figure 2b:** Gas Station Accessibility Map

## Summary and Conclusion

Results of analysis shows that the most suitable location for citing the new Exxon gas station with an unsaturated gas station market and a considerable demand for refined petroleum products is in San Luis Obispo County. This also allays the fear of the location been within Sonoma County where Petaluma city is located.

In addition, the most serviced areas were within San Francisco, San Jose, Sacramento, Fresno, LA, San Diego, Carson City, Mexicali, and a few other places, and areas with no service stations, expectedly, were within the valley and most arid regions of the state.

## Recommendation and Potential Benefits

It is, therefore, recommended that based on the spatial requirements or criteria specified for the suitability analysis, San Luis Obispo County is the most suitable location for citing the new gas station. Further, additional decision support could be obtained from business intelligence by running a Huff Model. This will help determine how competitive the new gas station might be in attracting and retaining customer loyalty relative to other competitors. Similar business intelligence is possible to obtain by evaluating the market penetration potential of the proposed gas station.