

Generating detailed multimodal choice-sets using distributed parallel computing

Anson Stewart, PhD

Andrew Byrd

conveyal.com/analysis

Multimodal Choice Sets

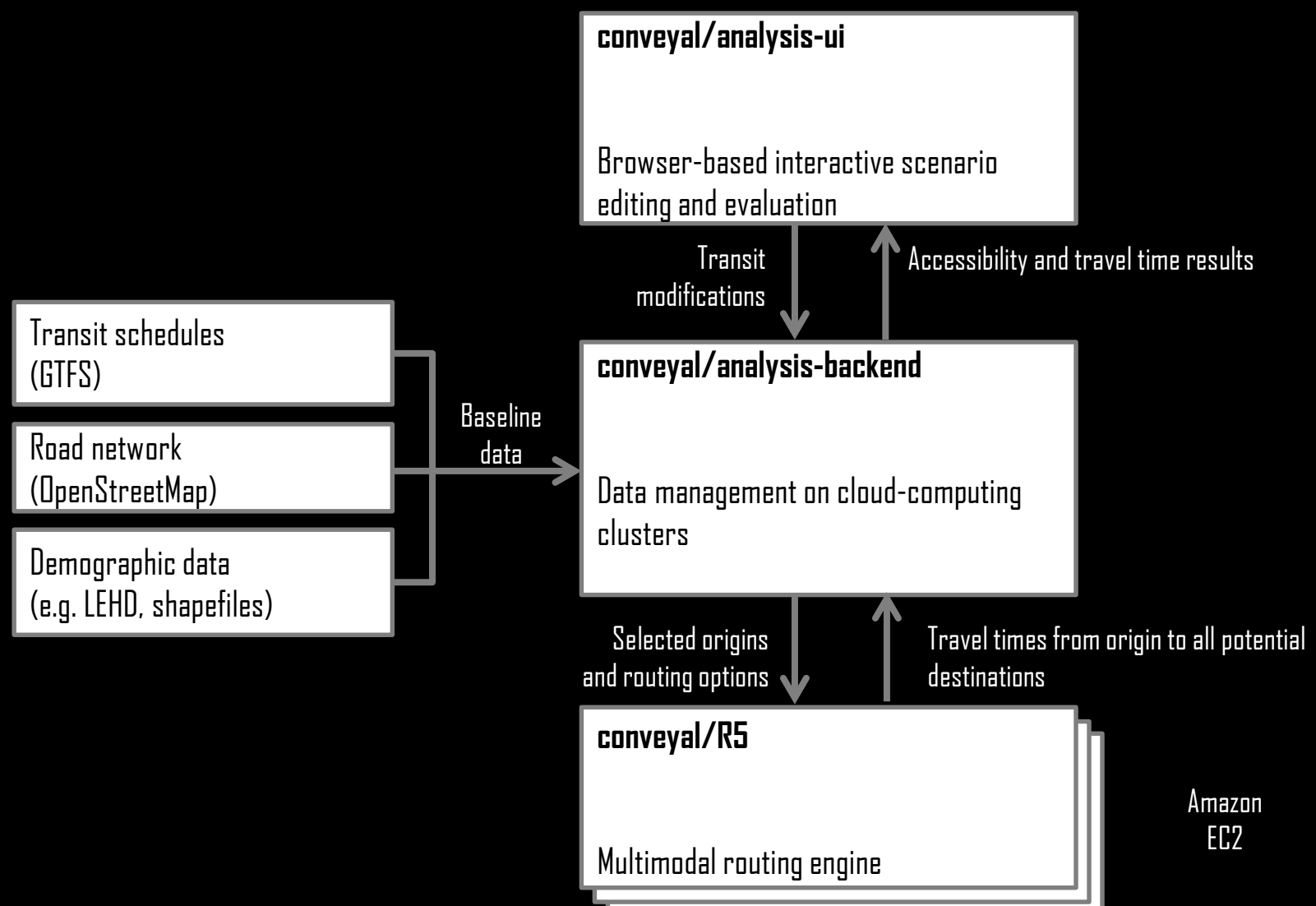
- Challenges

- Intractable to compute and store travel time and path data for large numbers of origin/destination pairs
- Geographic resolution may be too aggregate for proper modeling of access to transit (walk, car, scooter?)

- Innovations

- Handling mixed schedule- and frequency-based transit networks with a Monte Carlo approach (Conway, Byrd, and van der Linden 2017)
- Distributed computing, efficient storage
- Hosted web-based tool, configurable via online interface (Conveyal Analysis)
- Methods are documented and open-source

Open, cloud-based software for distributed parallel computing



Example Application

- Southern California
 - 71 GTFS feeds
 - 730k vertices, 2 million edges
 - 900k grid-cell origins (approximately 300m x 300m)
 - Walking along OpenStreetMap network from origins to transit stops
- Atlanta, Toronto, Tokyo, Netherlands...
 - See blog.conveyal.com

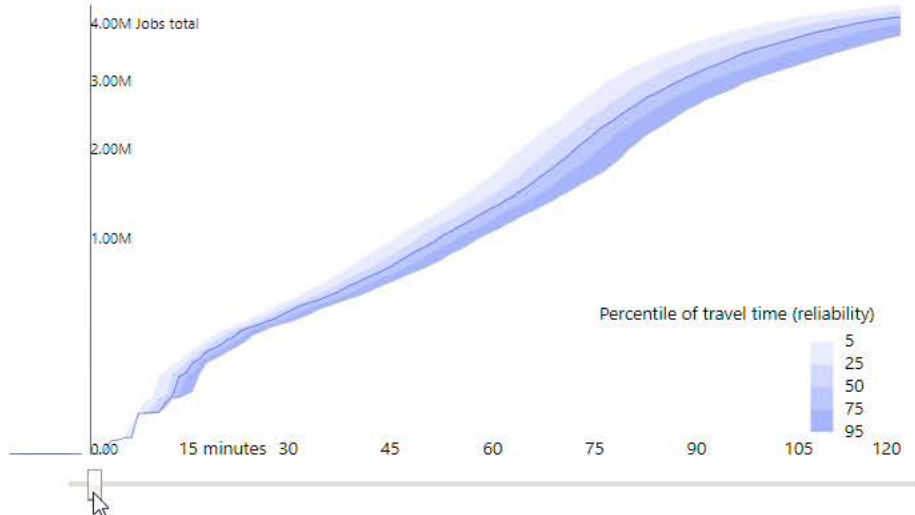
Aggregate accessibility to Jobs total within 1 minutes

Los 0

Los Angeles: 2017

No comparison selected

Comparison



Download buttons: Isochrone as GeoJSON, Comparison Isochrone as GeoJSON

Generate & Download GeoTIFFs

Bookmark

Select...

+ Create bookmark

Access modes

Icons for walking, cycling, driving, and parking (P)

Transit modes

Icons for bus, tram, train, and subway

Date

04/12/2017

From time

07:00 hh:mm

To time

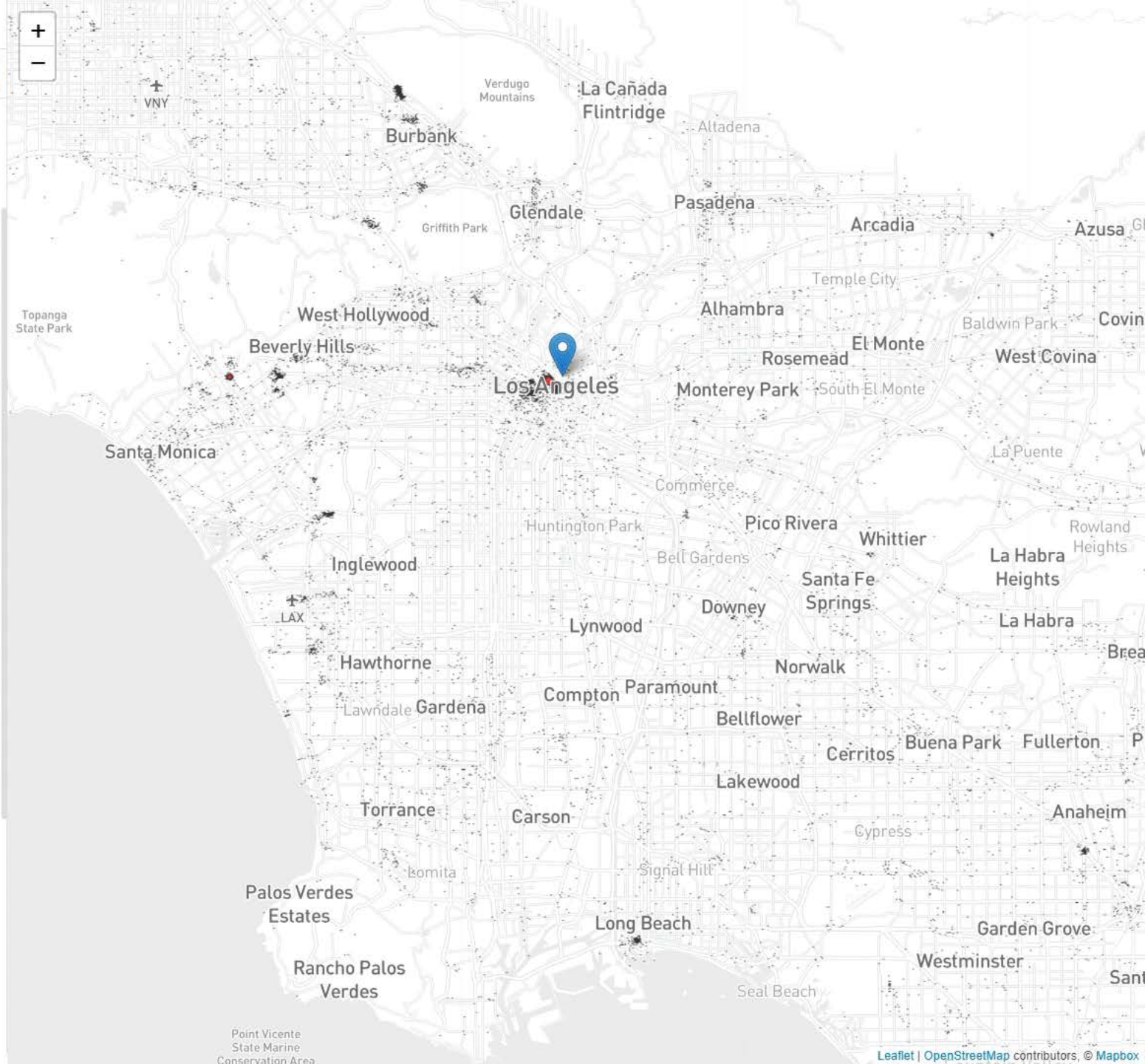
09:00 hh:mm

Routing engine

v4.1.0-2-gd1d3458

Percentile of travel time (reliability) (Regional only)

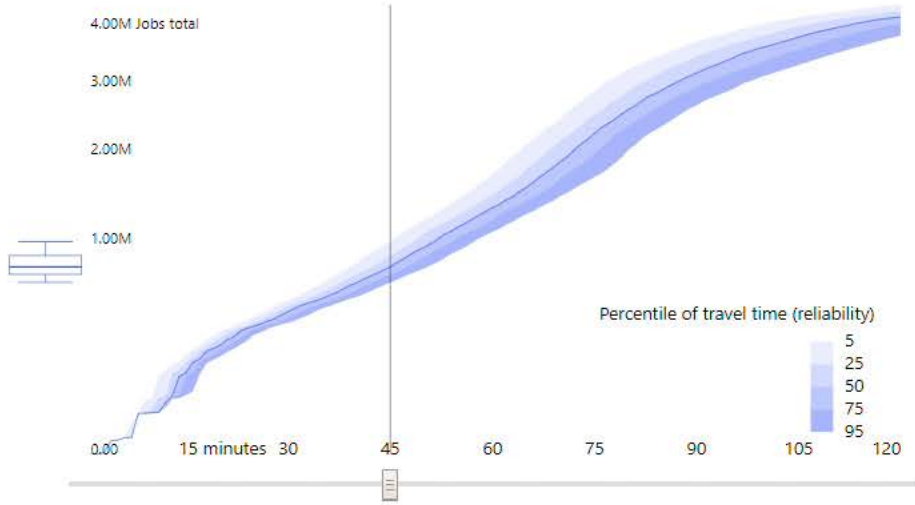
50.0



Aggregate accessibility to Jobs total within 45 minutes

Los Angeles: 2017 764,124

Los Angeles: 2017 No comparison selected Comparison



Download Isochrone as GeoJSON Comparison Isochrone as GeoJSON

Generate & Download GeoTIFFs

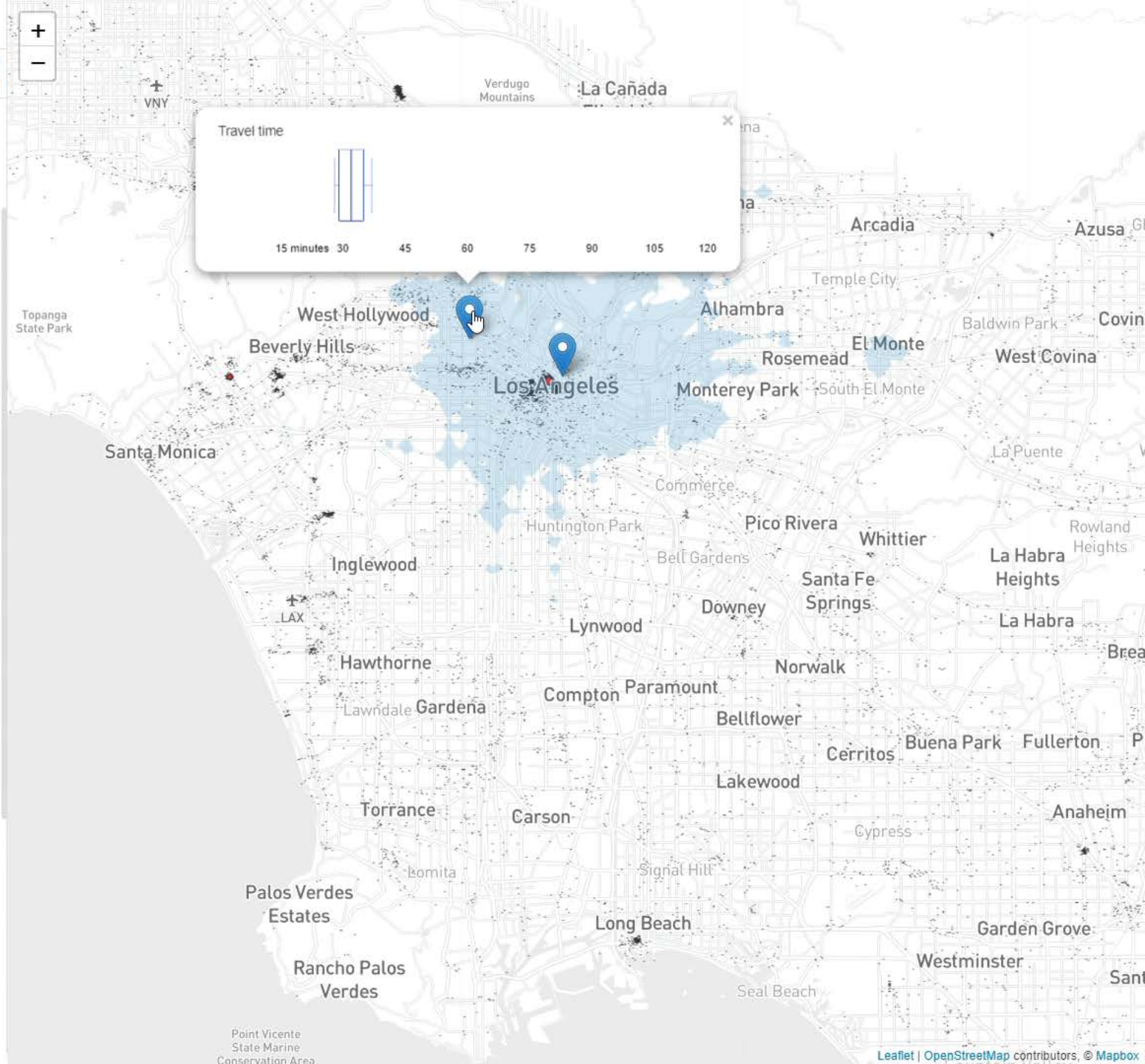
Bookmark Select... Create bookmark

Access modes Transit modes

Date 04/12/2017 From time 07:00 To time 09:00

Routing engine v4.1.0-2-gd1d3458

Percentile of travel time (reliability) (Regional only) 50.0



Los Angeles

Analysis + New regional analysis Fetch results

Scenario: 2017

Opportunity Dataset: lodes-data-2014: Jobs total

Comparison Project: Los Angeles

Comparison Scenario: SCORE

Aggregate accessibility to Jobs total within 1 minutes

Los 0

Los 0

Los Angeles: 2017 Los Angeles: SCORE Comparison

5.00M Jobs total

4.00M

3.00M

2.00M

1.00M

0.00

15 minutes 30 45 60 75 90 105 120

Percentile of travel time (reliability)

Los Angeles: 2017 25 75

Los Angeles: SCORE 25 75

Download Isochrone as GeoJSON

Download Comparison Isochrone as GeoJSON

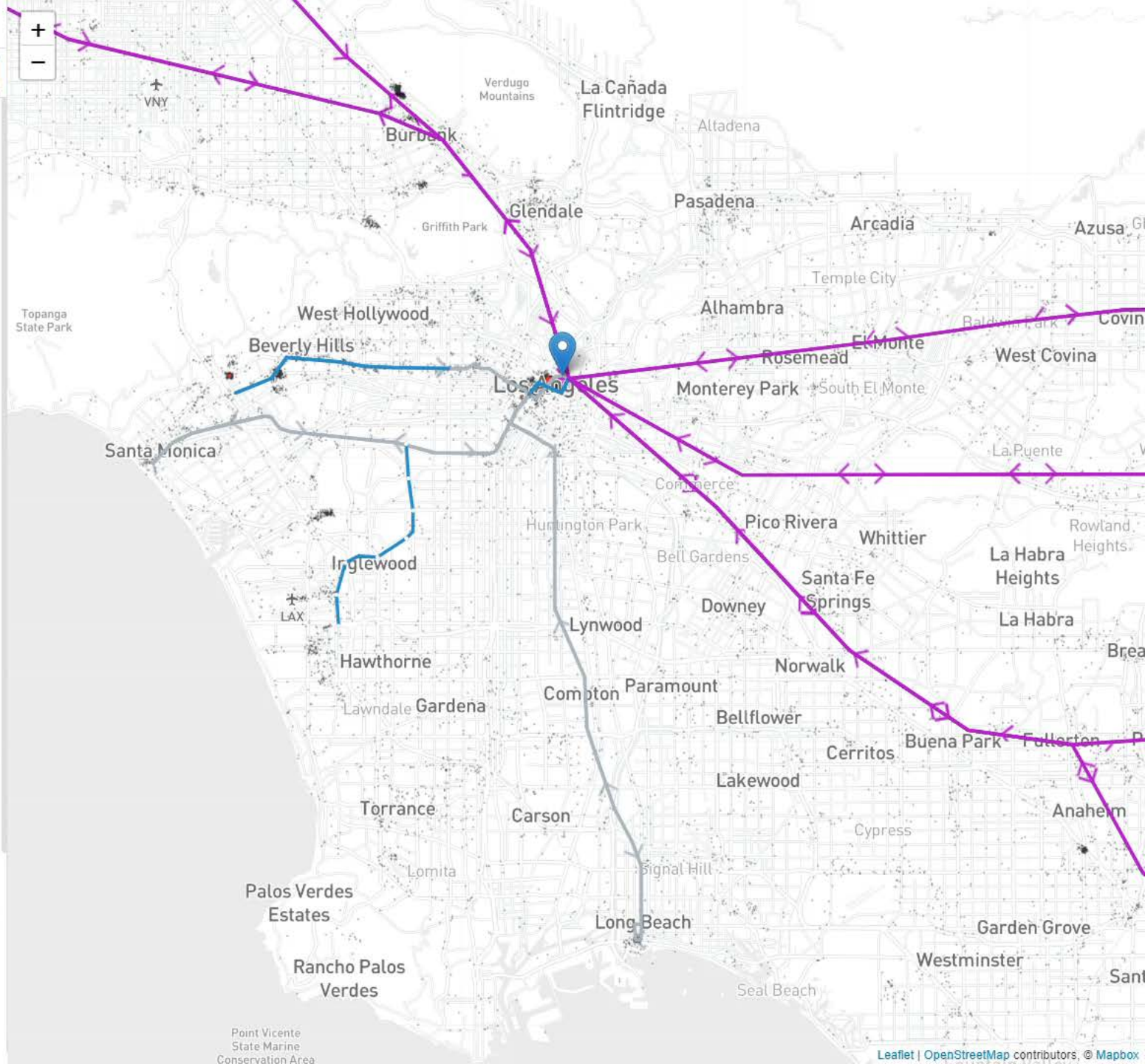
Generate & Download GeoTIFFs

Bookmark: Select... + Create bookmark

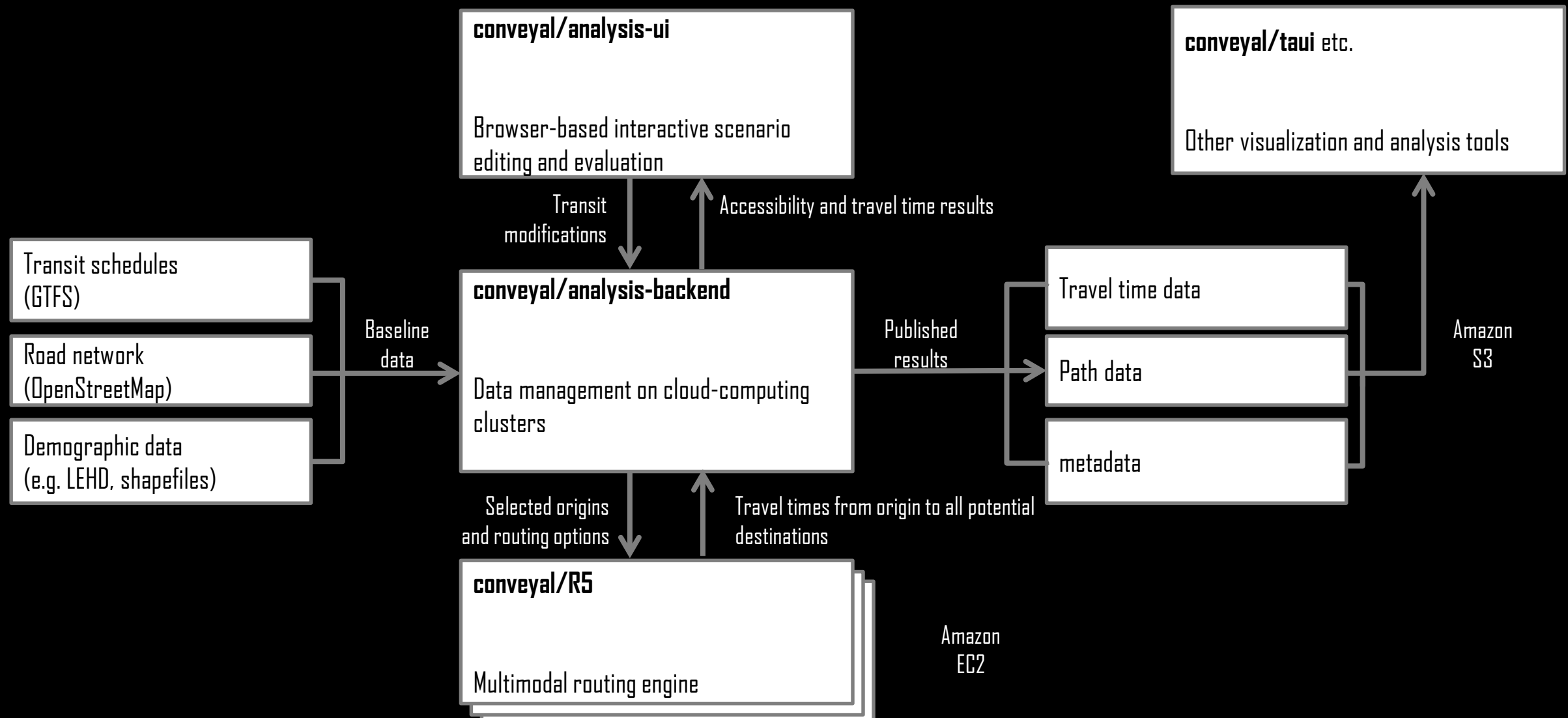
Access modes:

Transit modes:

Date: _____ From time: _____ To time: _____



Open, cloud-based software for distributed parallel computing



Custom binary formats for efficient storage

- Files can be fetched per origin as needed for downstream analysis
- Times: one file per origin (ex: 50 KB)
 - Travel times to all grid cells, in order
 - Selected percentiles (only median by default)
 - Delta encoding for high compression ratios
- Paths: one file per origin (ex: 300 KB)
 - For all grid cells, the transit segments of itineraries representative of the selected percentiles of travel time
 - Stored using indices for board stop, pattern, and alight stop
- Metadata: one file per region (ex: 1.3 MB)
 - Stop names and geographic coordinates, route names and colors

SoCal Rail Expansion

533 West 6th Street, Los Angeles, Califor... x

Choose destination, or click on the map

Show the area accessible within
60 minutes

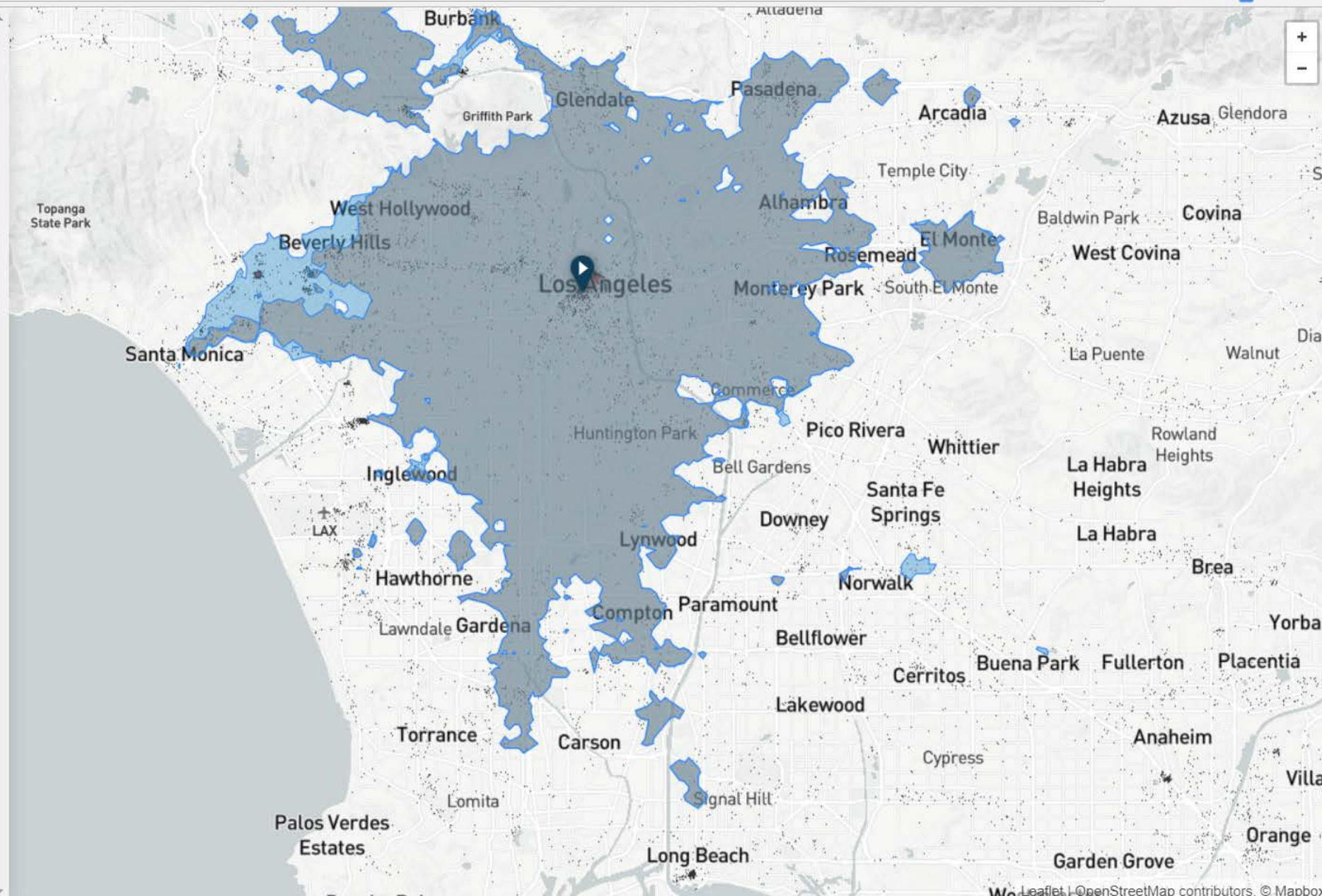
2028 Rail Expansion Option

Access to **1,818,577** jobs

2018 Baseline

Access to **1,628,254** jobs (-10.5% ↓)

site made by  conveyal



SoCal Rail Expansion

533 West 6th Street, Los Angeles, Califor... x
1755 Ensley Avenue, Los Angeles, Califor... x

Show the area accessible within
60 minutes

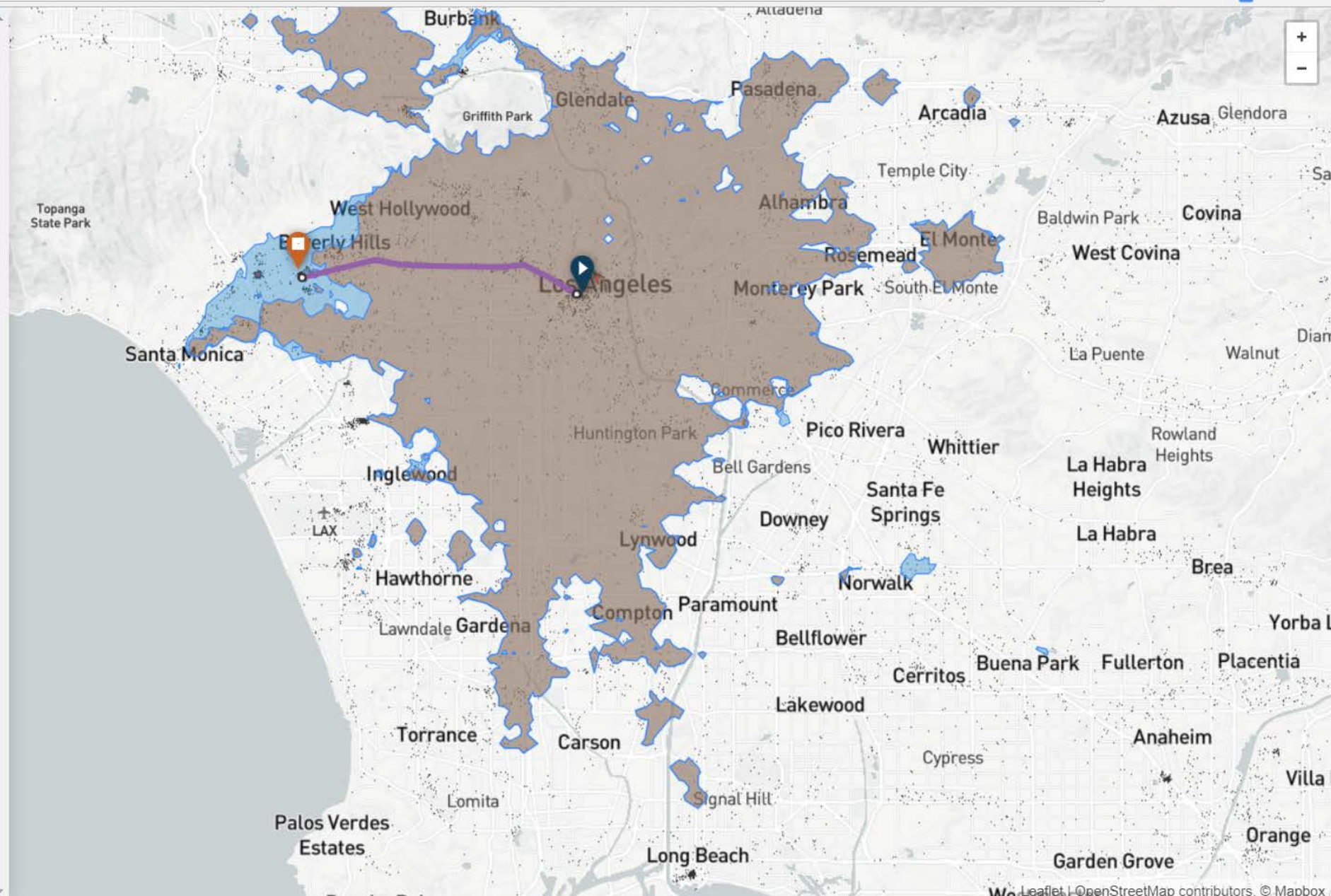
2028 Rail Expansion Option

Access to **1,818,577** jobs
Take **ME...** in **40** min

2018 Baseline

Access to **1,628,254** jobs (-10.5% ↓)
Take **ME...** in **65** min (62.5% ↑)

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SoCal Rail Expansion

533 West 6th Street, Los Angeles, Califor... x

12711 Imperial Highway, Santa Fe Spring... x

Show the area accessible within
60 minutes

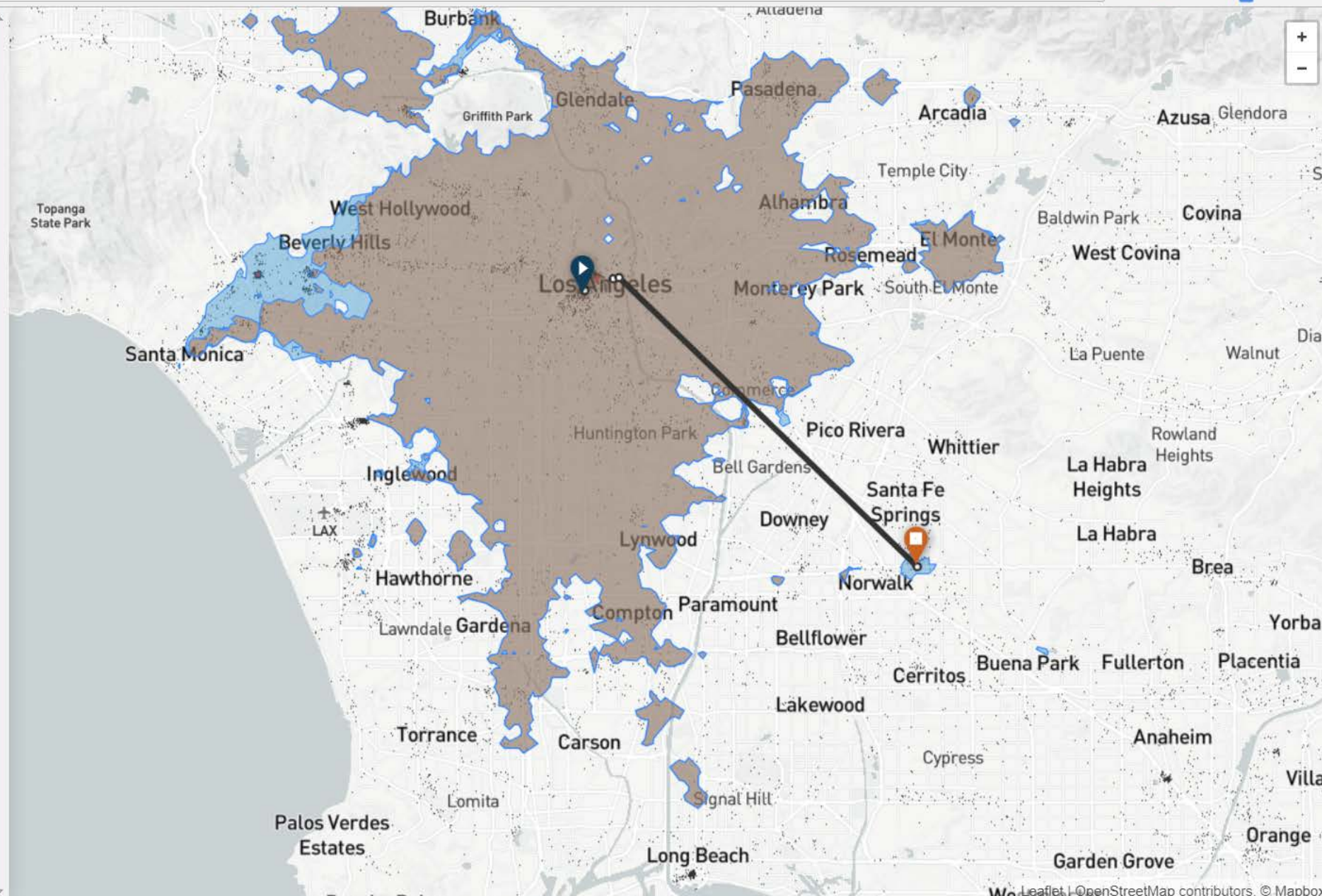
2028 Rail Expansion Option

- Access to **1,818,577** jobs
- Take DA... ME... in **54 min**
- Alternatively use ME... ME...

2018 Baseline

- Access to **1,628,254** jobs (-10.5% ↓)
- Take ME... in **79 min** (46.3% ↑)
- Alternatively use ME...

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SoCal Rail Expansion

533 West 6th Street, Los Angeles, Califor... x

Choose destination, or click on the map

Show the area accessible within
60 minutes

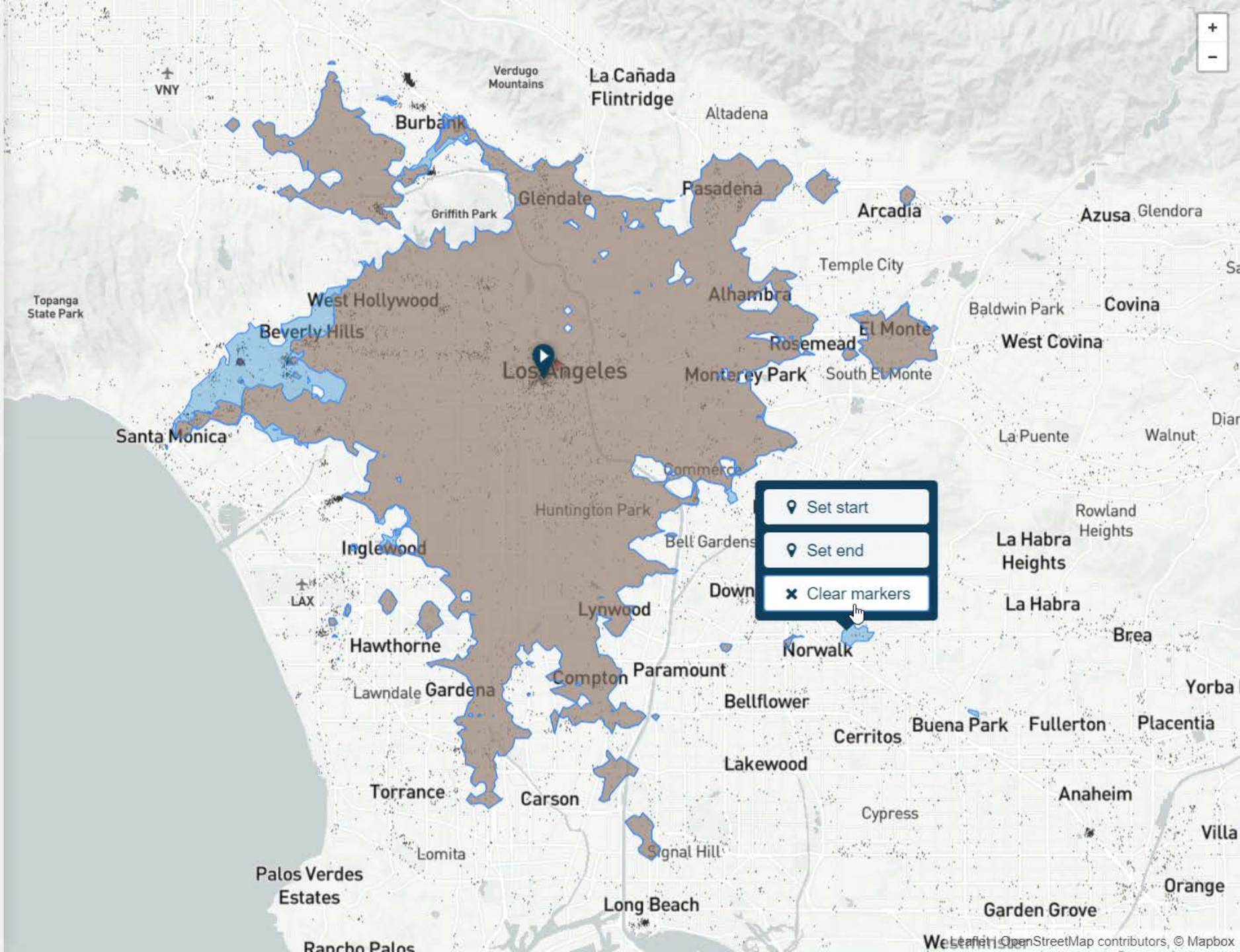
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