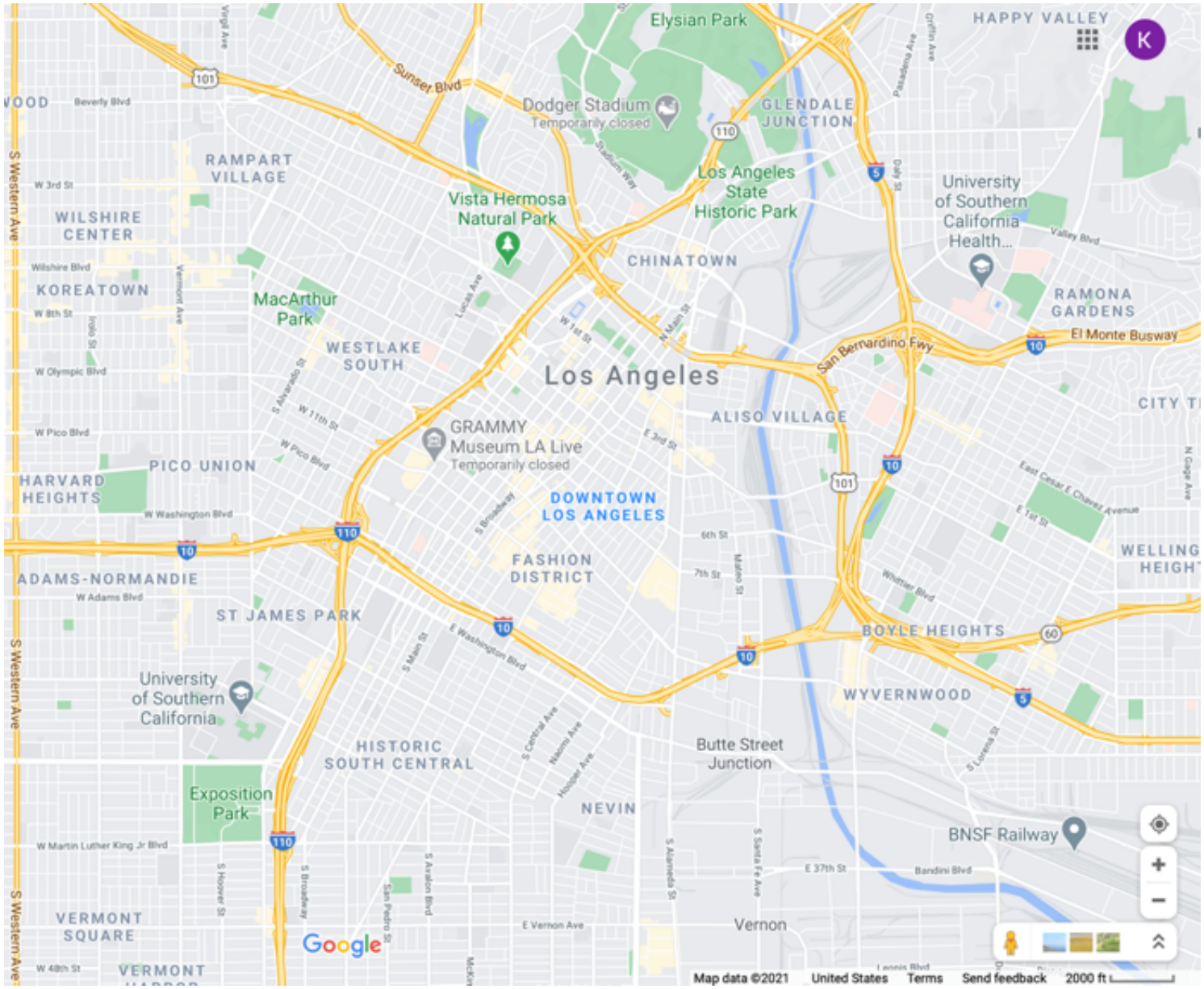
Regional Modeling and Simulation for Vertiport Location Assessment

Dr. Kapil Sheth
NASA Ames Research Center

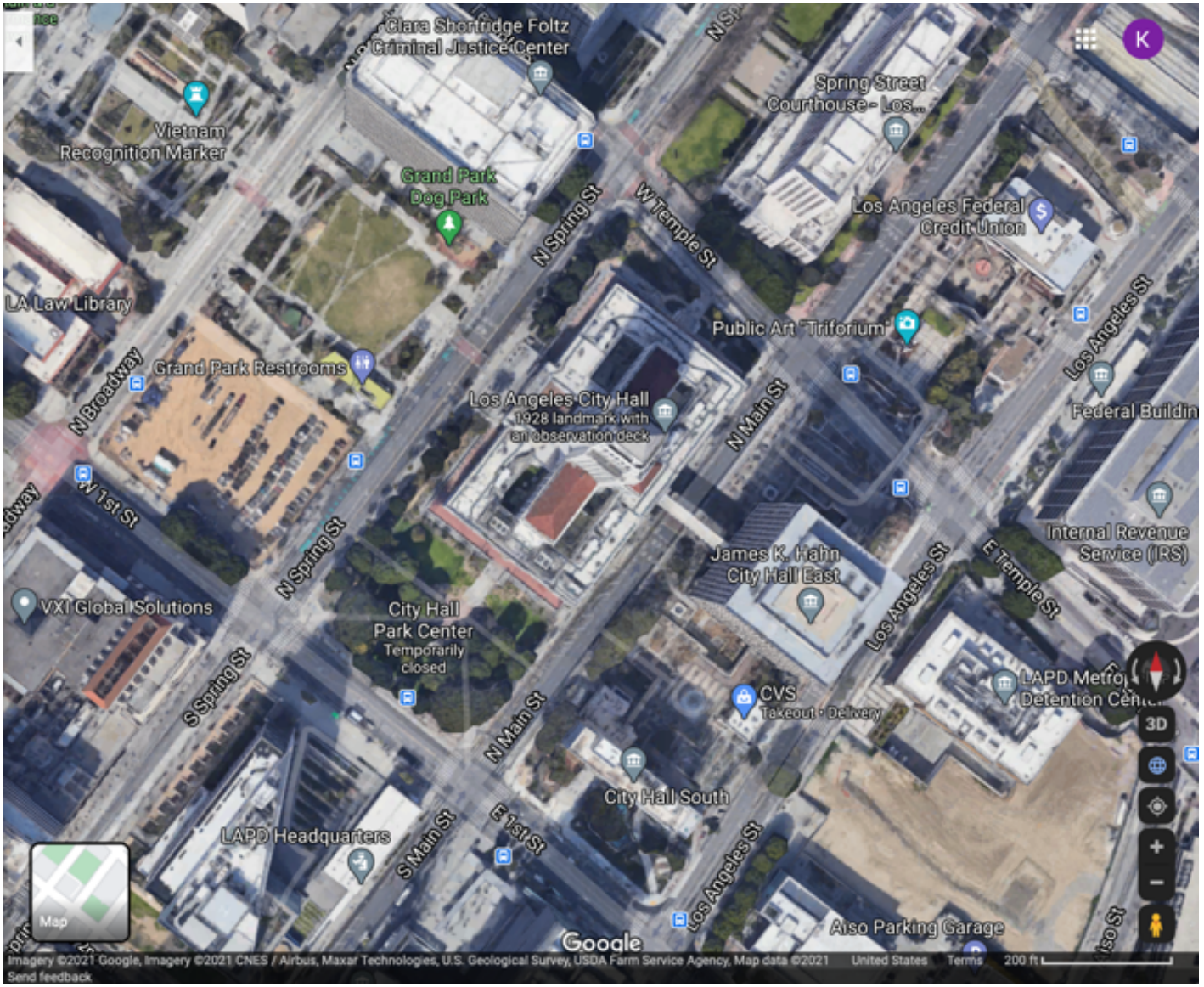
Presentation to TBARTA Board
September 24, 2021

Motivation



Where can a vertiport be placed near Downtown Los Angeles?

Motivation



Can we assess the suitability of a vertiport near Los Angeles City Hall?

Advanced/Regional/Urban Air Mobility

- Research objectives - safety and convenience, viability, infrastructure, scalability, traffic management, and public acceptance

- Benefits - mobility, commutes and deliveries, and decreased emissions and noise, and perhaps congestion

- NASA Activities

  - ATM-X and AAM Project, AMIO*

  - ConOps, Technical Challenges, Reference Implementations, Interoperability

  - Series of simulations for UAM airspace management, high-tempo information exchange, connecting partners, and preparation for flight tests

*ATM=Air Traffic Management, AAM=Advanced Air Mobility, AMIO=AAM Mission Integration Office

Why NASA?

- Need: Desire for an unbiased entity to help state and local entities with modeling and simulation
- Approach: NASA works with communities to help assess vertiport locations and transfer technology
- Benefit: Common attributes access and understanding across communities
- Competition: From industry and academia, with limited data access and more resources

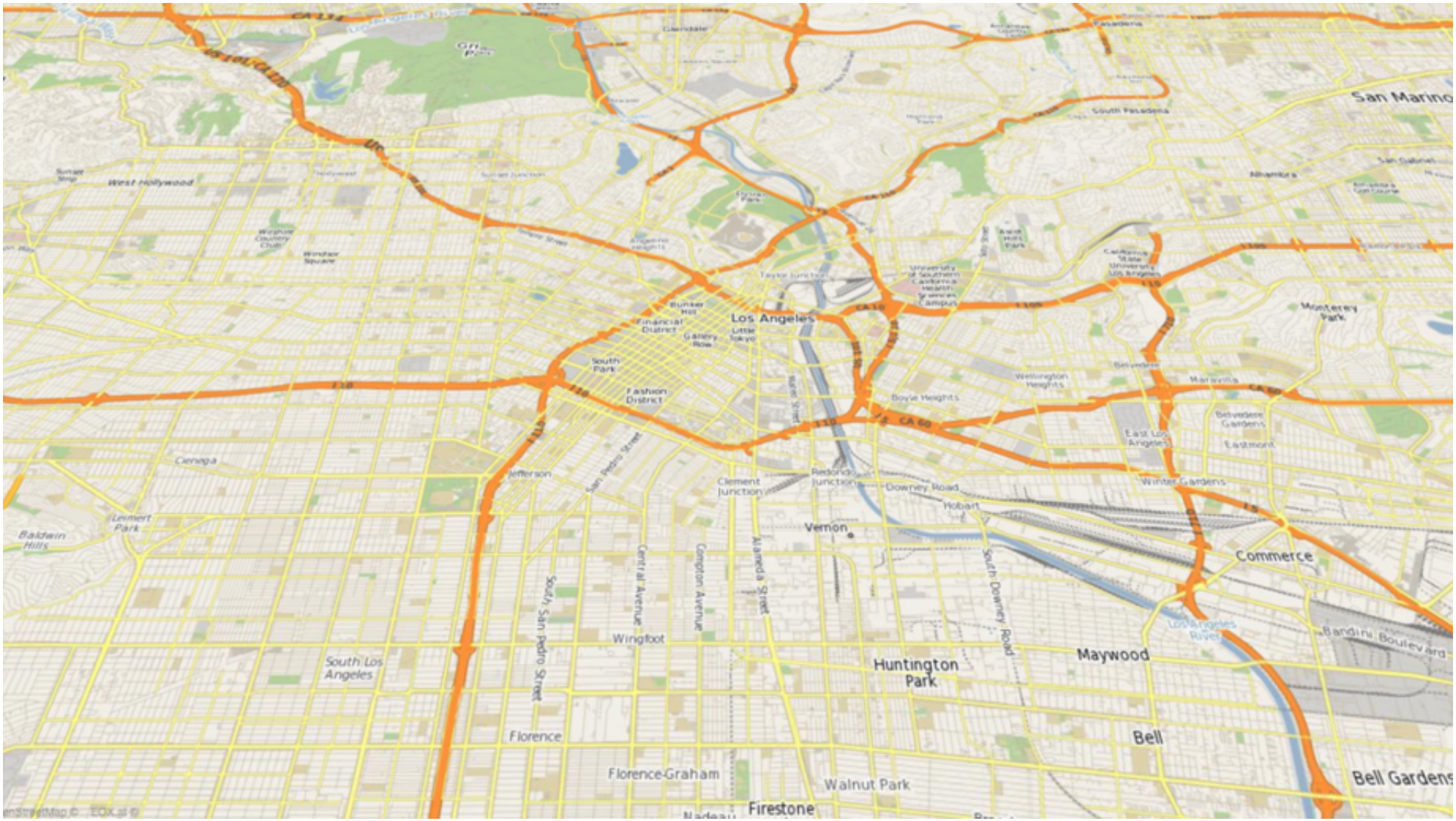


Regional Modeling Tool

Vertiport Suitability

- Region/city parameters
- Zoning, environmental impact, intermodal systems, etc.
- Importance of factors (rewards and penalties)
- Algorithmic aggregation and thresholding
- Location suggestions and vertiport selection
- Open architecture

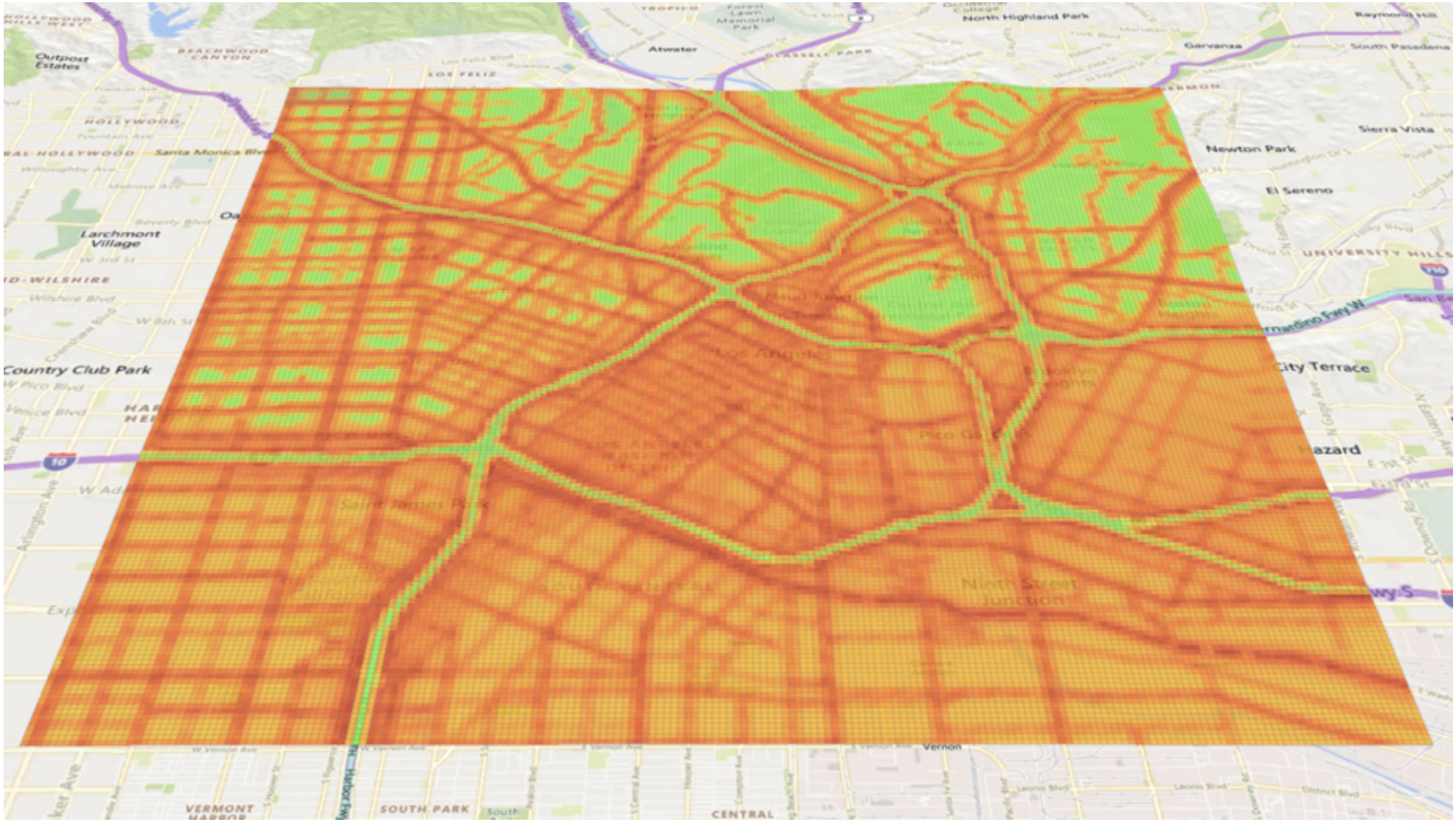
Los Angeles Region



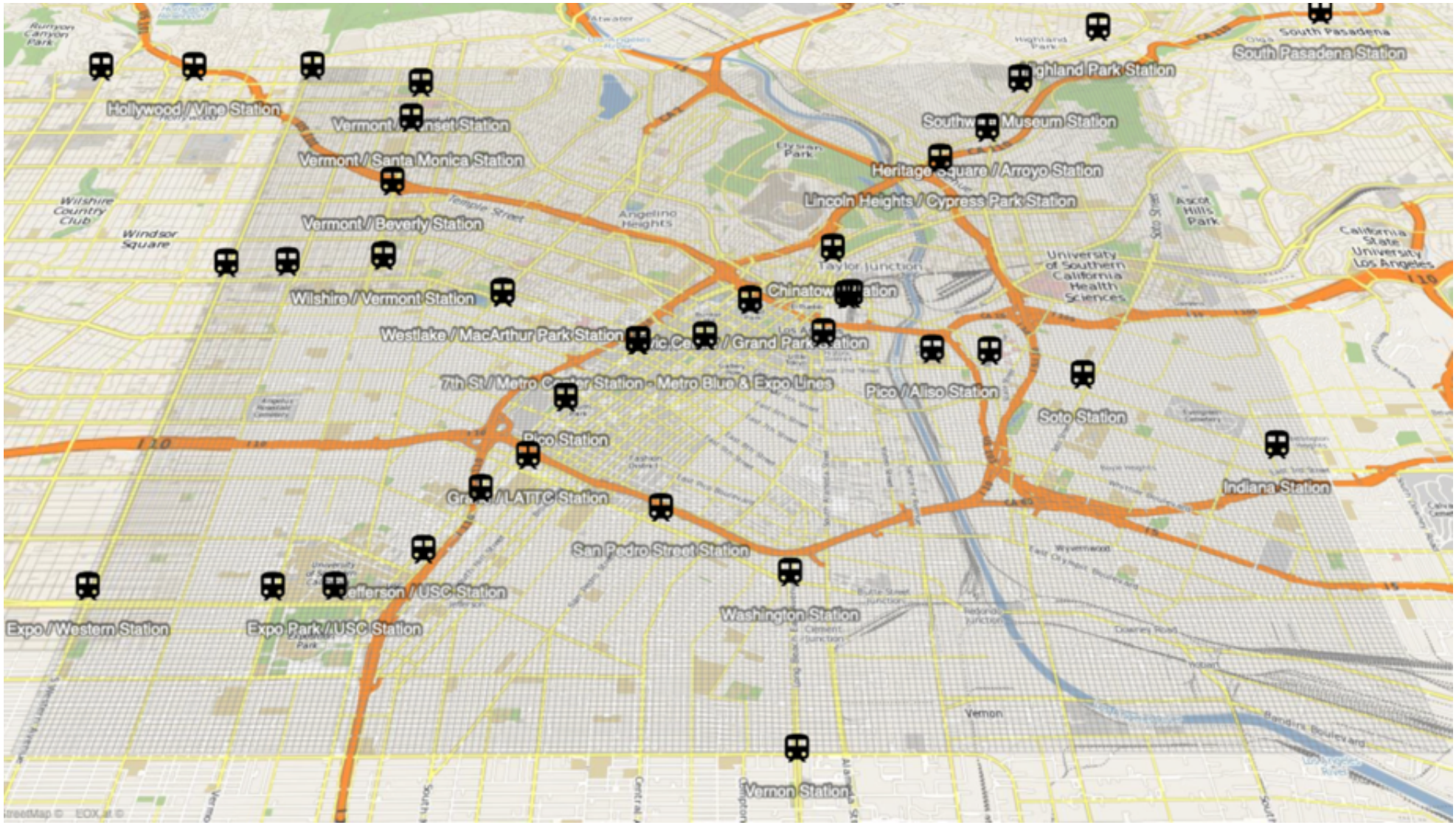
Zoning Attribute



Environmental Impact

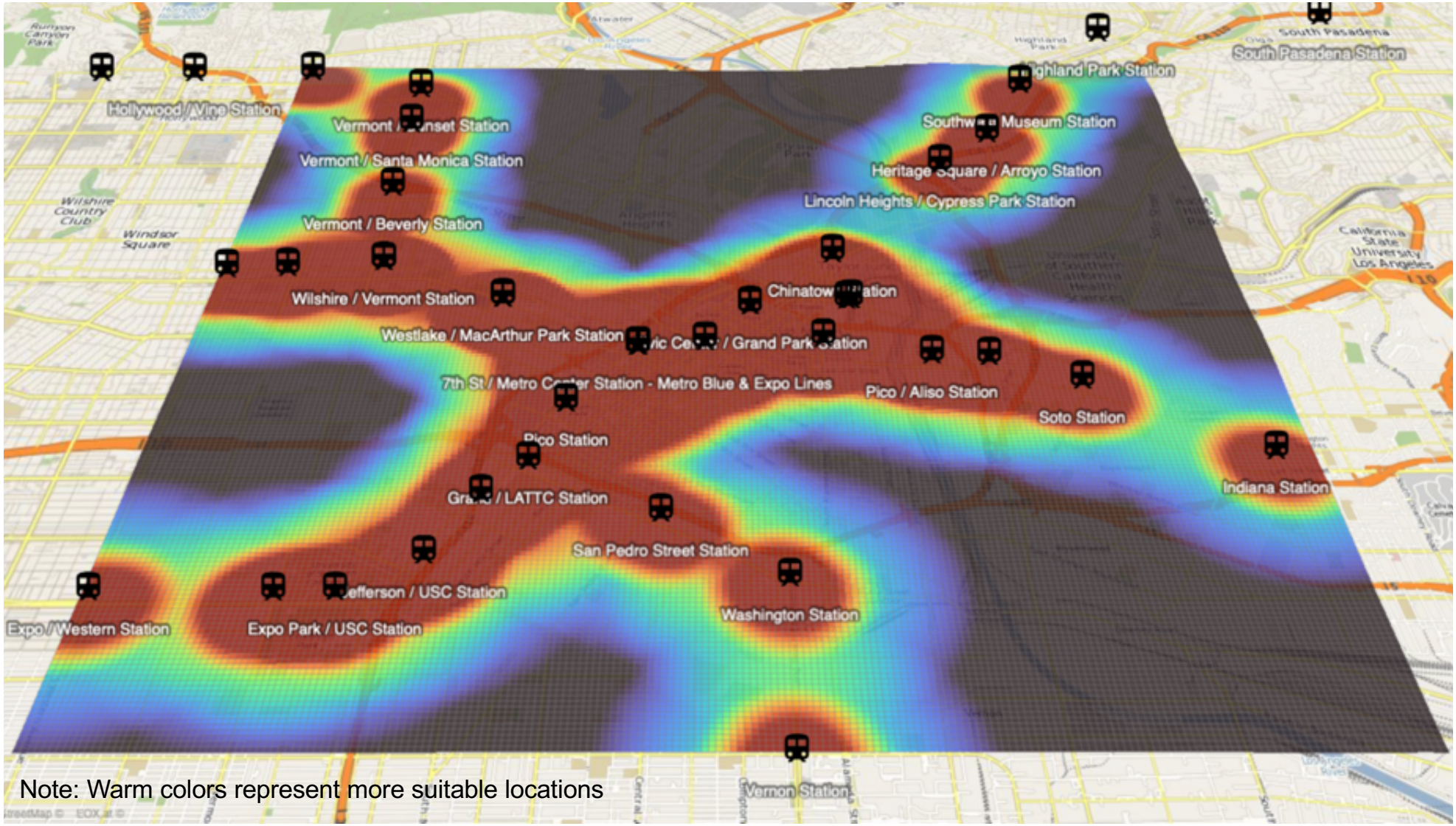


Intermodal Systems



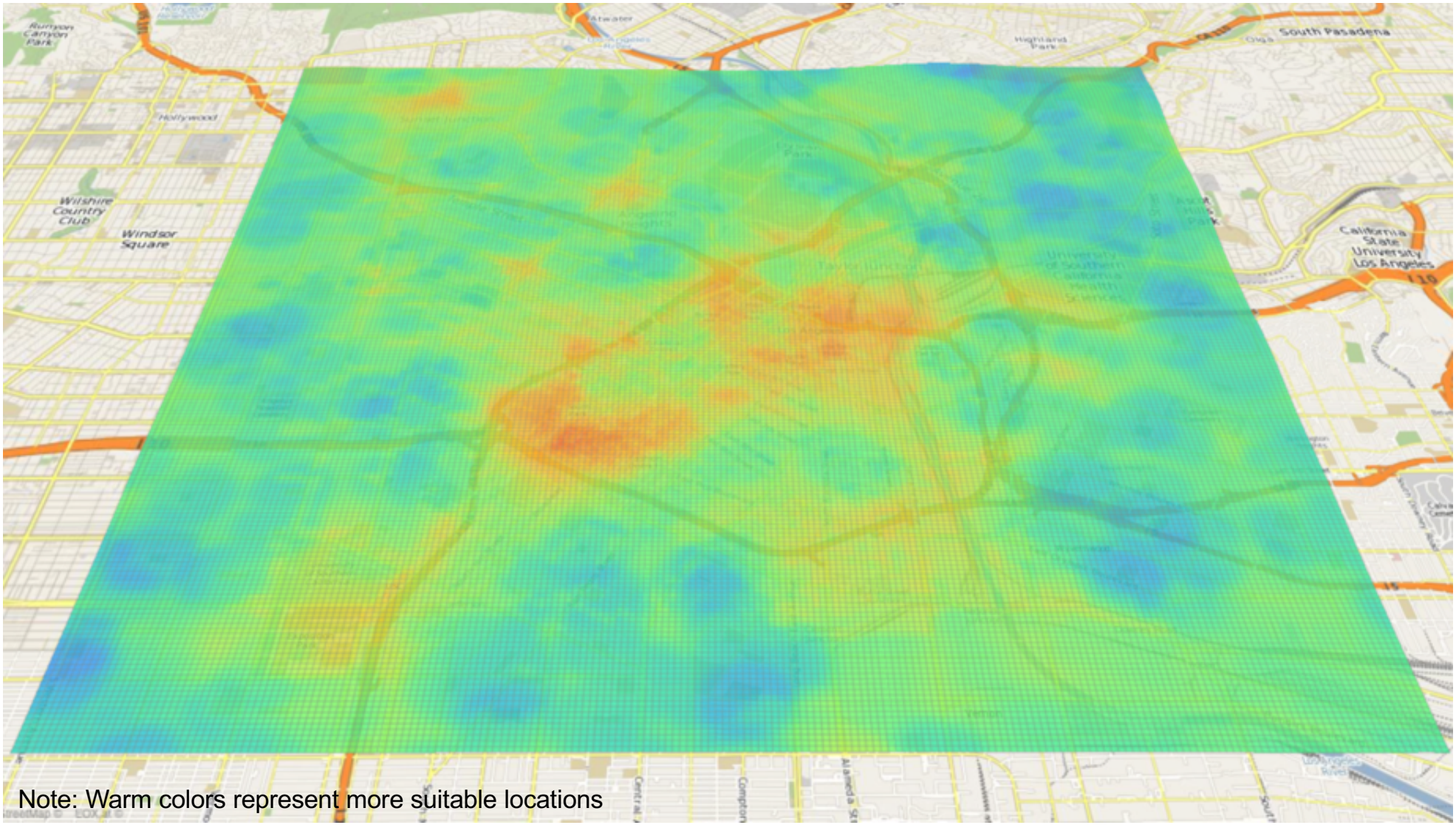
Grid (7x7 miles), each cell (~55 meters or ~185 ft)

Intermodal Systems



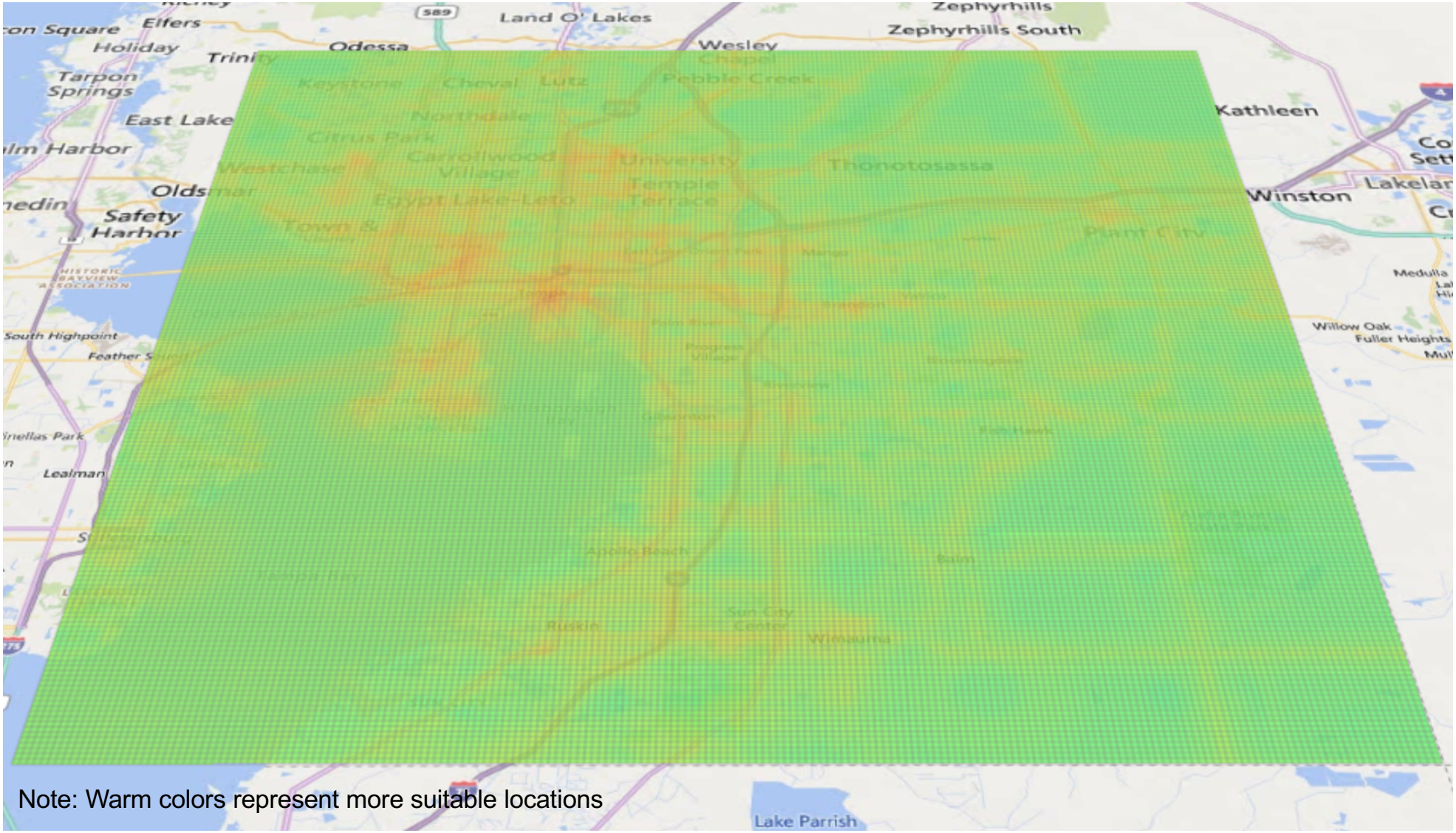
Note: Warm colors represent more suitable locations

Composite Suitability



Los Angeles, CA

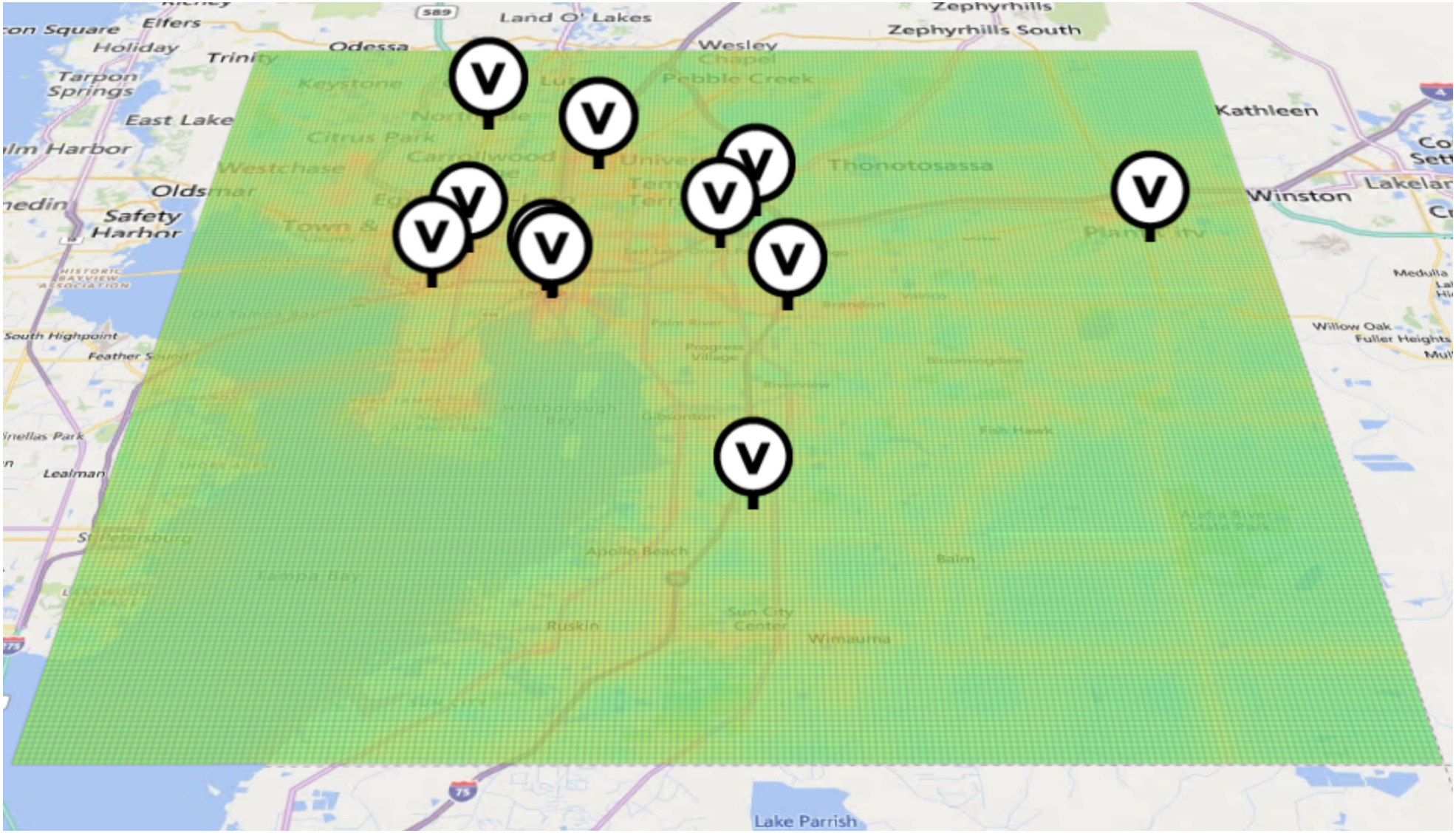
Composite Suitability



Note: Warm colors represent more suitable locations

Hillsborough County (HC), FL

Case Study



Eleven locations assessed with HC Transportation Planning Organization and Tampa Bay Regional Transit Authority.



Regional Modeling Tool (RMT)

Demo

Regional Simulation Tool

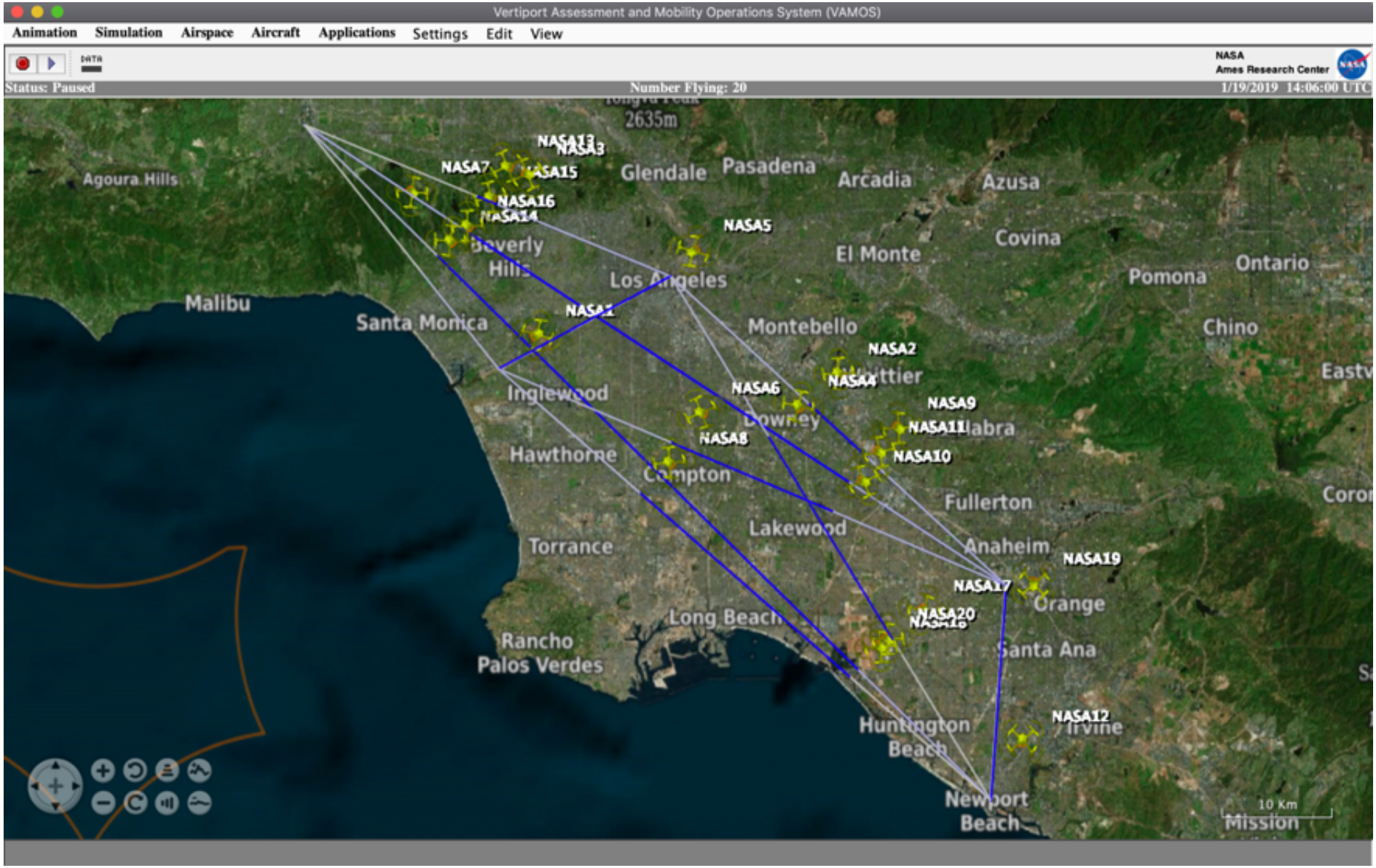
Vertiport Assessment and Mobility Operations System (VAMOS!)

Flight of UAM Vehicles



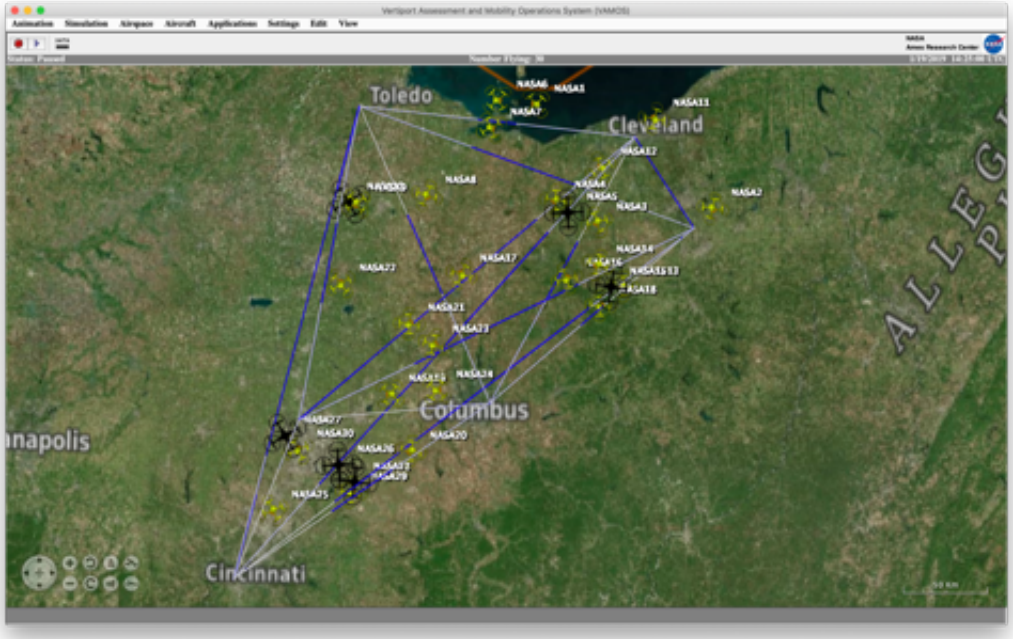
- Selected vertiport locations
- Intent to assess feasibility of flight
- Route structure between locations
- Simulation of vehicle flight (models, winds, etc.)
- Impact on environment (noise)
- Assess frequency and density across any part of the US
- Reiterate with modeling tool, as necessary!

Flights between Vertiports in Los Angeles

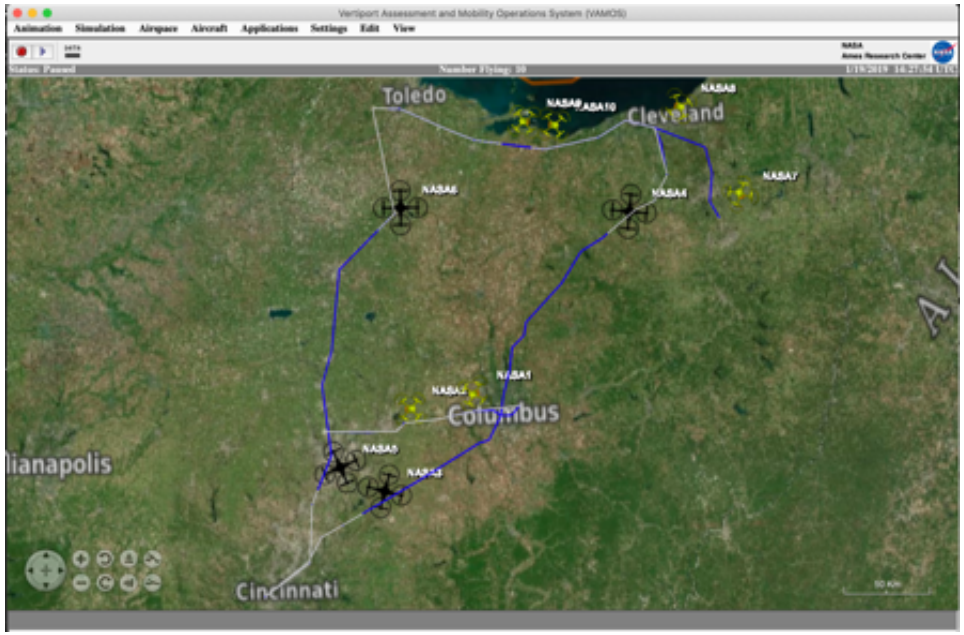


Modeling with WorldWind; Simulation can connect to TestBed

Flights between Vertiports in Ohio

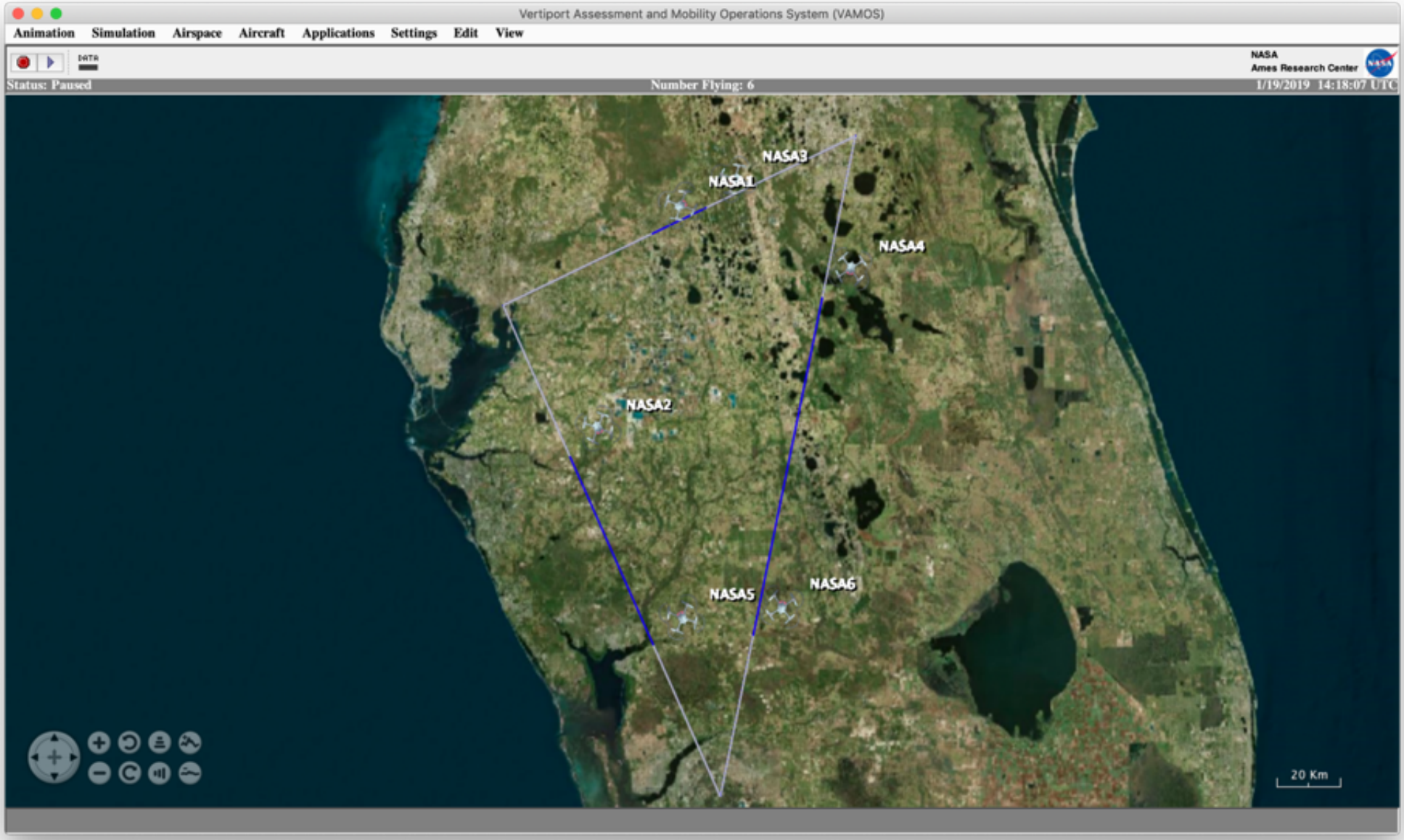


Direct routes



Along freeway corridors

Flights between Vertiports in Florida



Vertiports placed in Tampa, Orlando, and Fort Myers, FL



VAMOS!

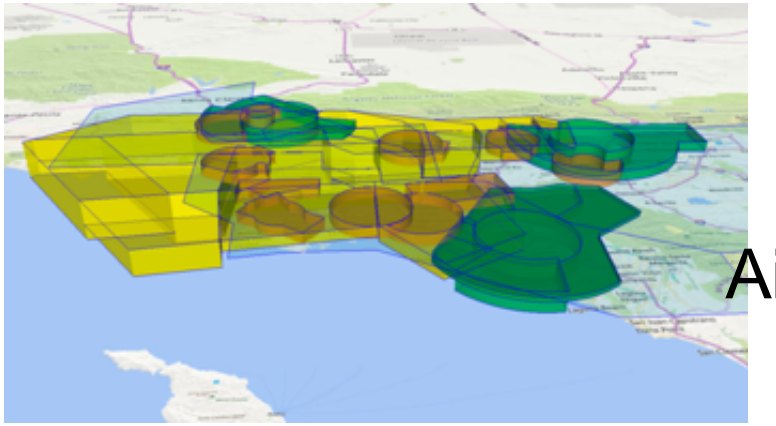
Demo

Additional Data Displays

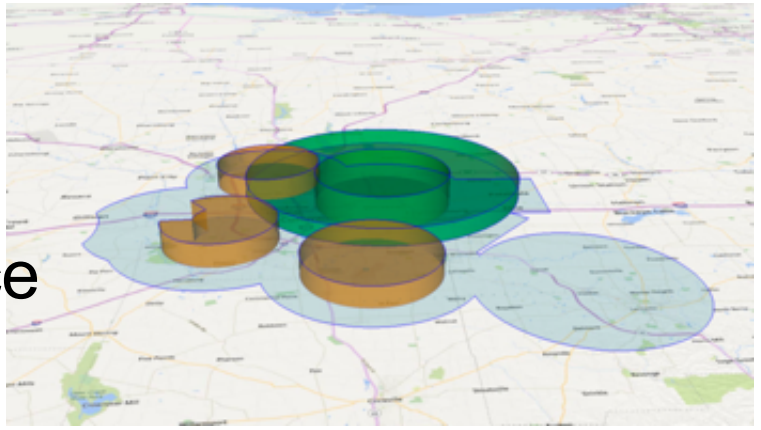


3D Buildings





3D Airspace





Arrival/Departure Surfaces



Ongoing work…

- CONUS-based experience
  - Go anywhere within the US
  - On-Demand data availability
- Temporal data handling
  - Specific data sets: road congestion, demand, etc.
  - Display and compute capability
- Iterative intelligence
  - Integration of modeling and simulation tools
  - User in the loop
- Patent pending…

Citations

- Slides 2 and 3 were captured using Google Maps

- Slides 8-15 and 23 were generated using OpenStreetMaps and EOX.at
  Underlying map data ©OpenStreetMap contributors www.openstreetmap.org/copyright, EOX.at https://maps.eox.at/#about / https://s2maps.eu/#license



Questions?

(Kapil.Sheth@nasa.gov)

Composite Suitability Threshold

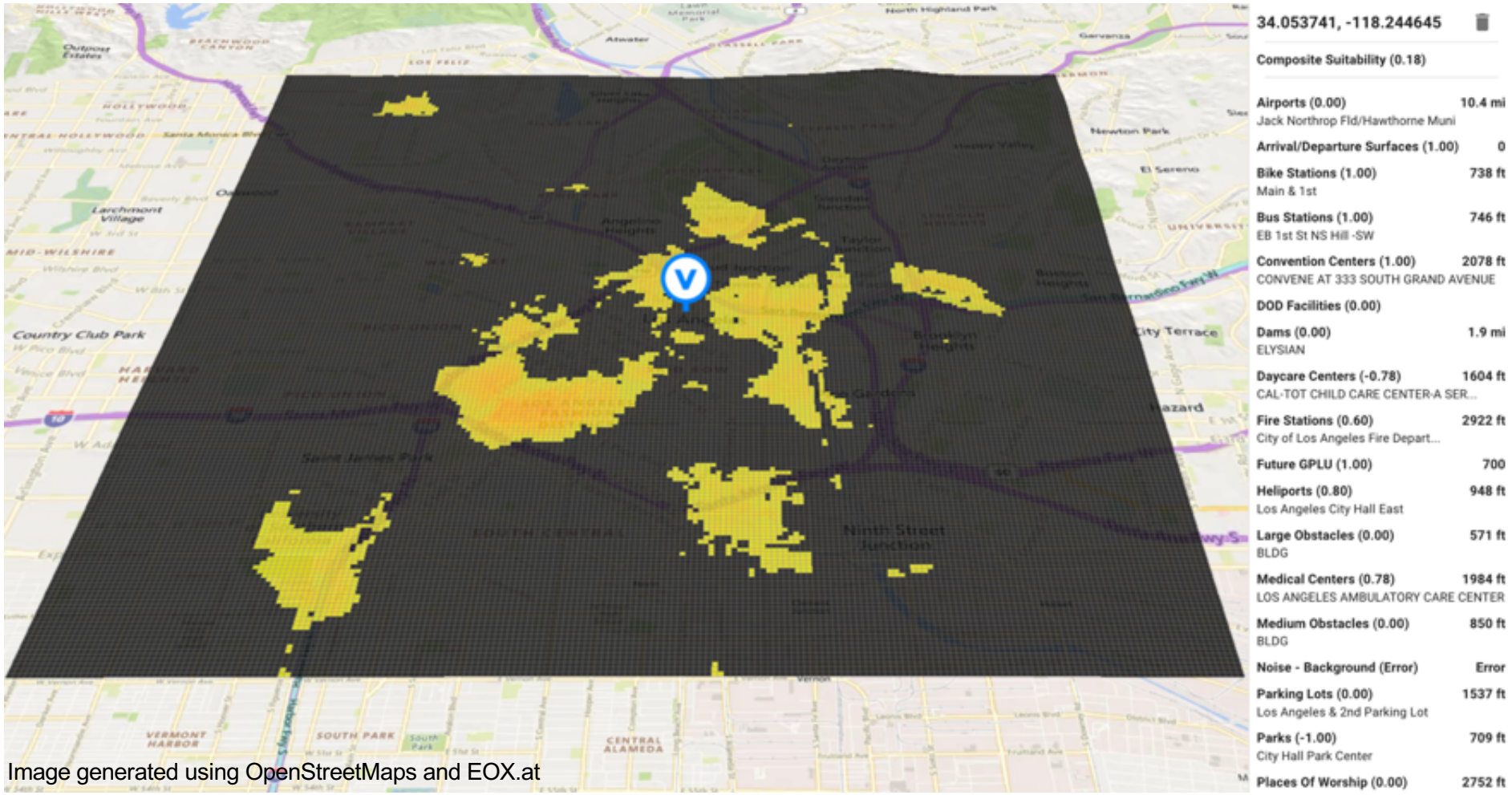


Image generated using OpenStreetMaps and EOX.at

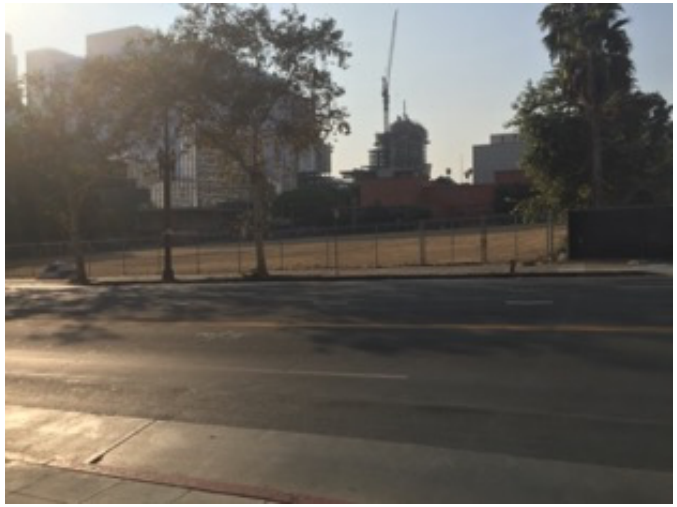
It is undesirable to place a vertiport between N. Spring St. and N. Broadway, downtown LA

Solution











It is not a good location for a vertiport

Top-left image was captured using Google Maps, other photos were captured by Kapil Sheth (NASA)

Current Interest

- Three types of entities
  - Regional, FAA
  - Vertiport developers
  - Vehicle manufacturers
- Researchers
  - Noise modeling
  - Surface mobility data
  - Ground congestion information
  - Vehicle flight route structure

Ongoing work…

- Partnership with Tampa Bay Area-Florida
  - Adaptations for Tampa, Temple Terrace, and Plant City
  - Possibly collaborate with St. Petersburg, Orlando as well
- New adaptations for
  - Cincinnati, Cleveland, Dayton, Canton-Akron, and Toledo
  - Exploring infrastructure for entire State of Ohio
- Detailed analysis of two potential locations for City of Los Angeles
- Implementing flight corridors (e.g., path along freeways) and noise footprints