



Resiliency in Transportation Systems Panel

Population Dynamics and Insights for Resilience

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U.S. DEPARTMENT OF
ENERGY

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“Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody.”

- Jane Jacobs, Urbanist, Author, Journalist



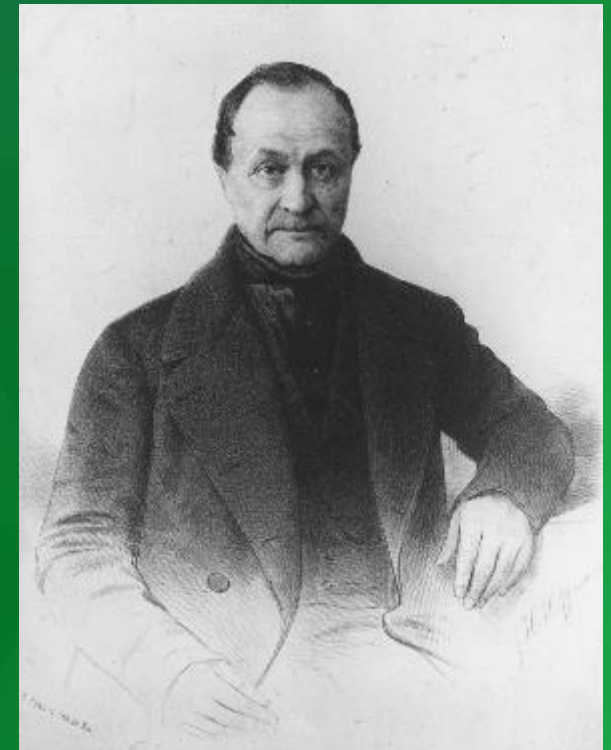
“To understand the world, you have to understand population statistics.”

- Hans Rosling, Professor, Geographer, Physician



“Demography is destiny.”

- August Comte, Founder of Sociology



Understanding Populations is Foundational to Establishing Resilient Transportation Systems



Where - Distribution



Who - Characterization



Why - Activities

But we have Census data...what else do we need?

United States[®] Census Bureau

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3394 Results **DPO5 | ACS Demographic and Housing Estimates** Notes Geos Topics Codes Dataset Year Columns Transpose More Tools

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Decennial Census
P1 RACE
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Population Estimates
PEPANNRES | Annual Estimates of the Resident Po...
2019: PEP Population Estimates

American Community Survey
DPO5 | ACS Demographic and Housing Estimates
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American Community Survey
S0101 | Age and Sex
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S0701 | Geographic Mobility by Selected Character...
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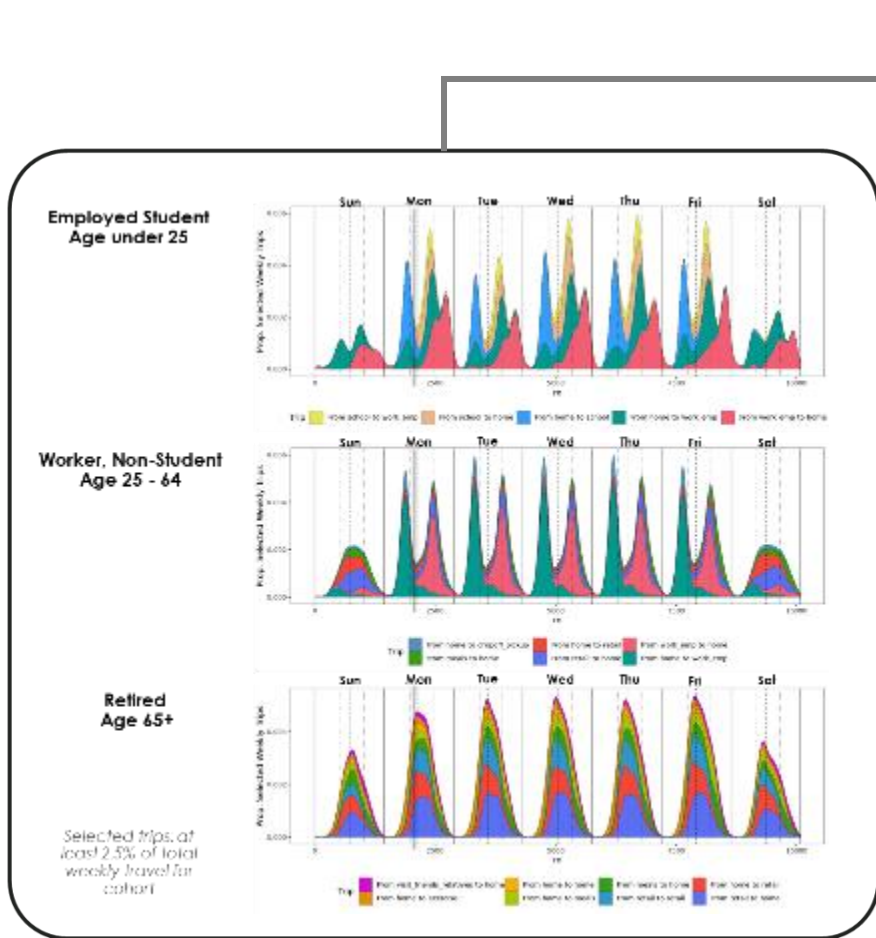
American Community Survey
S0801 | Commuting Characteristics by Sex
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American Community Survey

Please note that American Community Survey 1-Year estimates are published for geographies with a population of 65,000 or more. For more information, see the [guidance for when to use 1-year or 5-year estimates](#).

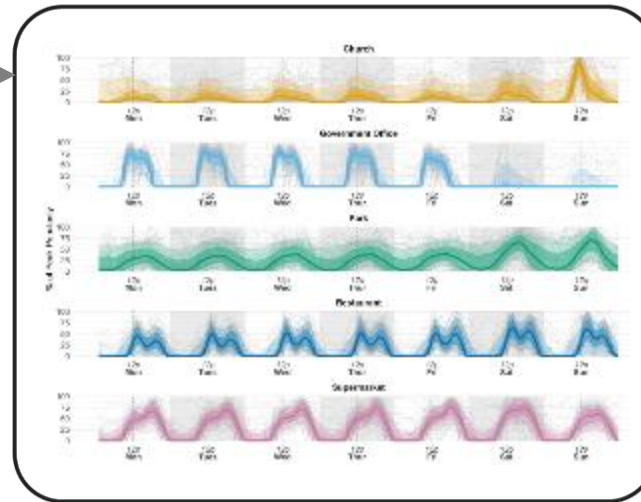
Label	Hamilton County, Tennessee			
	Estimate	Margin of Error	Percent	Percent Margin of Error
SEX AND AGE				
Total population	379,884	*****	379,884	(X)
Male	184,811	±1,522	48.7%	±0.4
Female	185,053	±1,522	51.3%	±0.4
Sex ratio (males per 100 females)	94.7	±1.5	(X)	(X)
Under 5 years	22,103	±89	5.8%	±0.1
5 to 9 years	23,137	±2,046	6.1%	±0.5
10 to 14 years	20,808	±2,051	5.5%	±0.5
15 to 19 years	21,871	±874	5.8%	±0.2
20 to 24 years	23,738	±839	6.2%	±0.2
25 to 34 years	53,723	±623	14.1%	±0.2
35 to 44 years	50,831	±1,176	13.4%	±0.3
45 to 54 years	44,988	±1,033	11.8%	±0.3
55 to 59 years	22,043	±1,832	5.8%	±0.5
60 to 64 years	24,751	±1,853	6.5%	±0.5
65 to 74 years	41,218	±620	10.9%	±0.2
75 to 84 years	23,457	±1,586	6.2%	±0.4
85 years and over	7,202	±1,330	1.9%	±0.4
Median age (years)	40.2	±0.5	(X)	(X)
Under 18 years	80,078	*****	21.1%	*****

Toward 24-hour high-fidelity synthetic populations



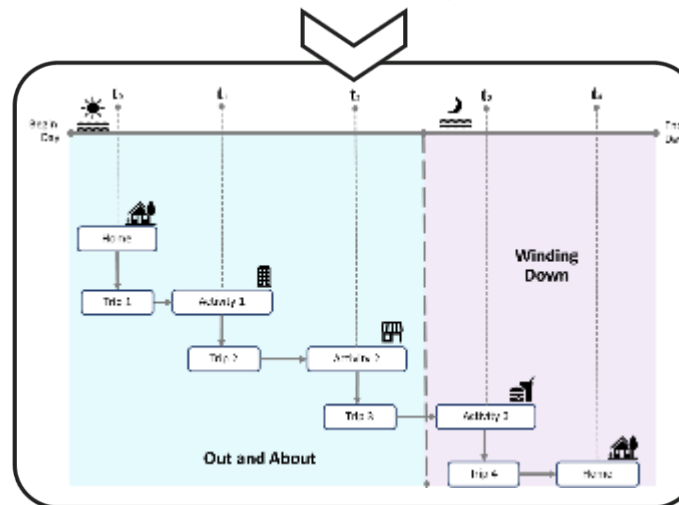
Time-Use and Travel Surveys

Tuccillo and Gaboardi (2023)



POI Popularity Curves

Thakur et. al (2015)

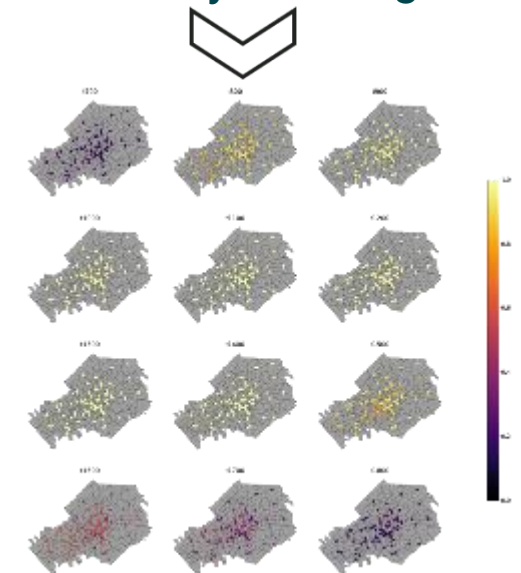


Activity Scheduling

Tuccillo and Gaboardi (2023)



Activity Modeling

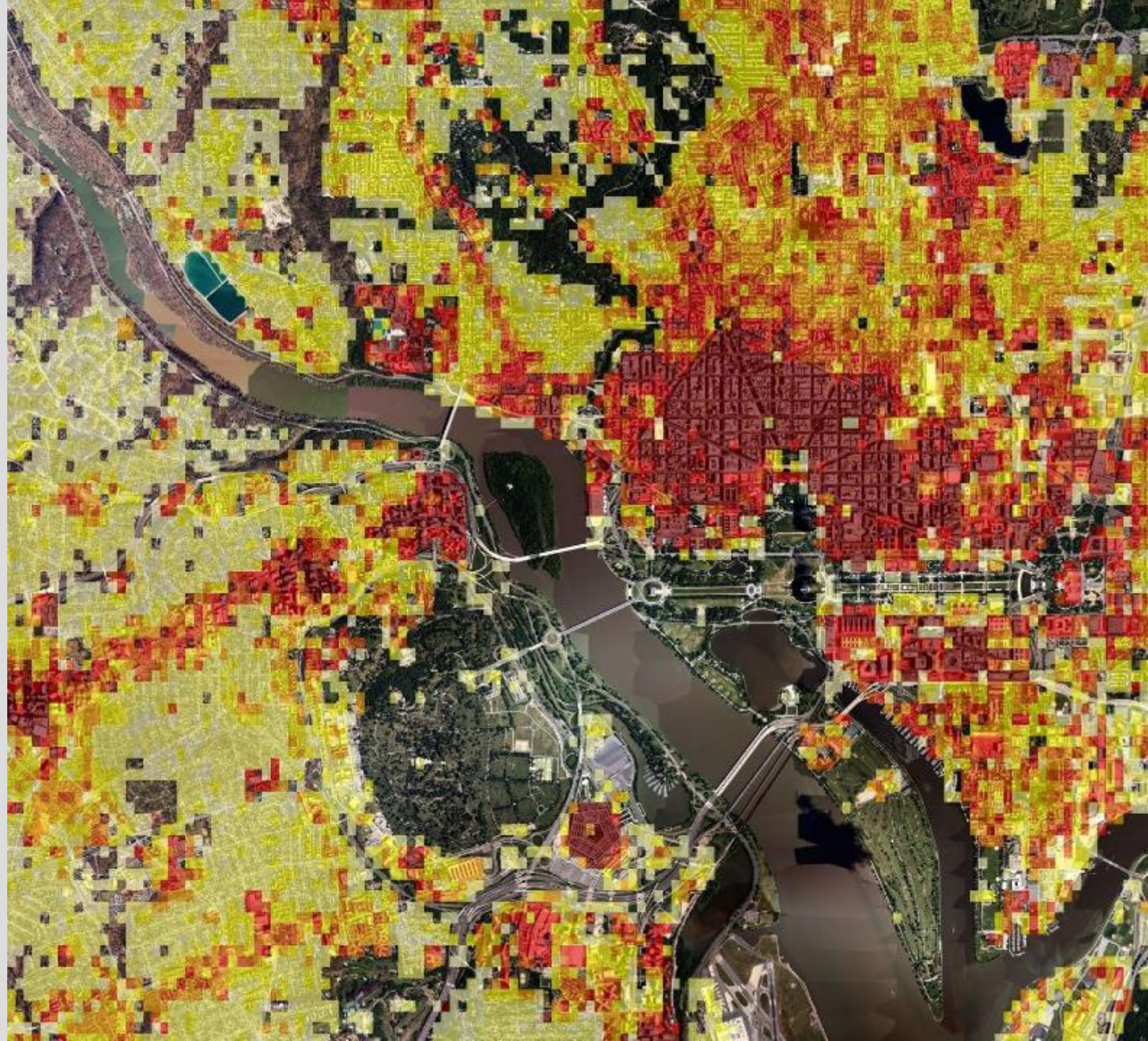


Population Distributions

Adding a fine-grained understanding of where

Gridded population datasets clarify with precise spatial detail where people occupy the space of the built landscape

Not constrained to survey locations or aggregate areas, these datasets decompose the population to model spatial and temporal clustering



Population Characterization

Enriching with socioeconomics
and demographics

Synthetic population datasets use
Census-level detail to create
representative populations that
can be emplaced in the built
environment.

Provides a much fuller
understanding of the
geodemographics of a place,
enabling identification of
communities and sub-
populations.

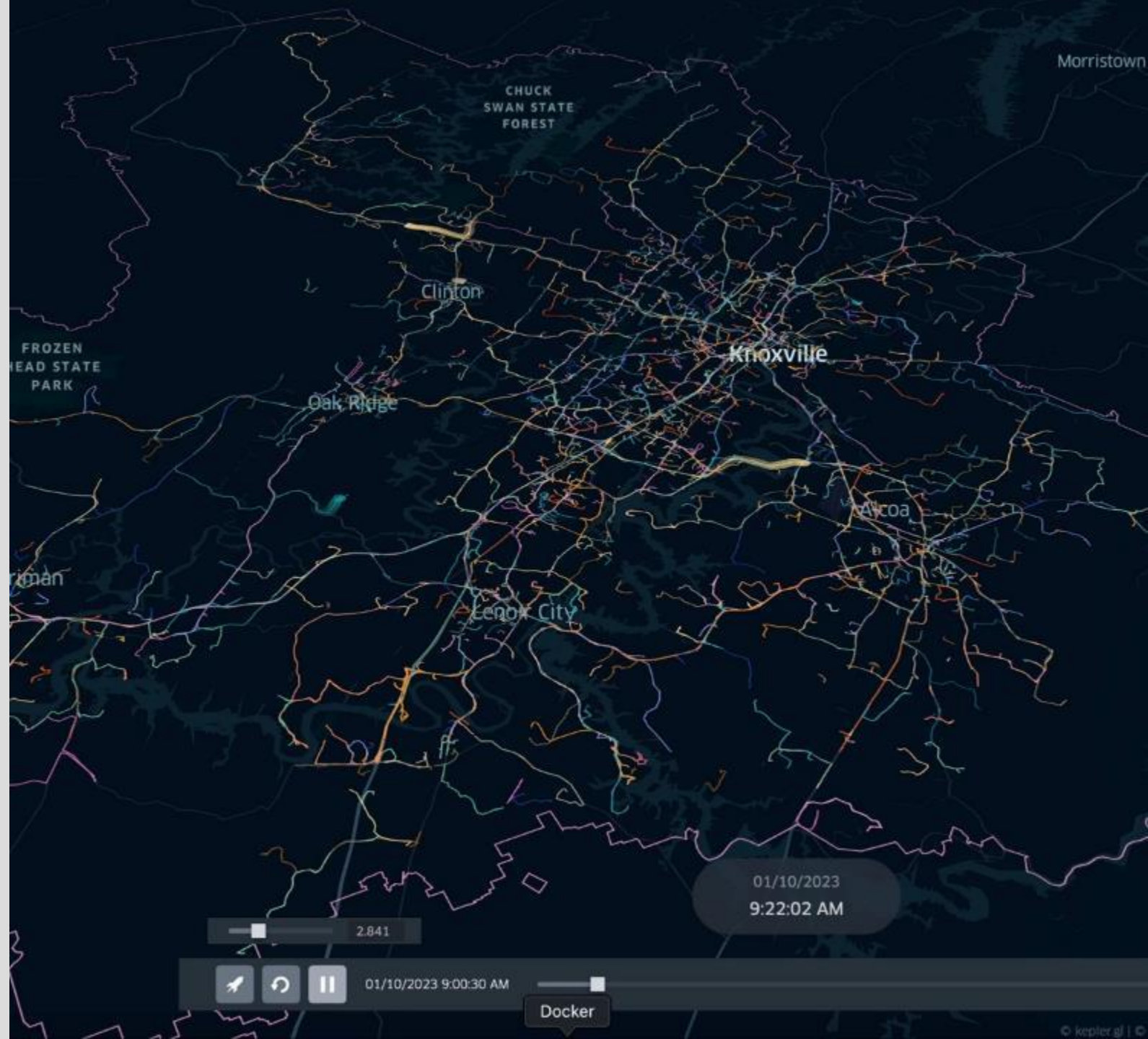


Population Activities

Enabling event-based knowledge of population dynamics

Patterns of life and activity profiles enabled a detailed understanding of the prevailing space-time behaviors within a geographic area.

Coupled with population distributions and characteristics, these datasets enable dynamic simulations of human movement for infrastructure planning and scenario



People are the drivers of infrastructure growth, utilization, and decline...we must understand people to ensure resilience

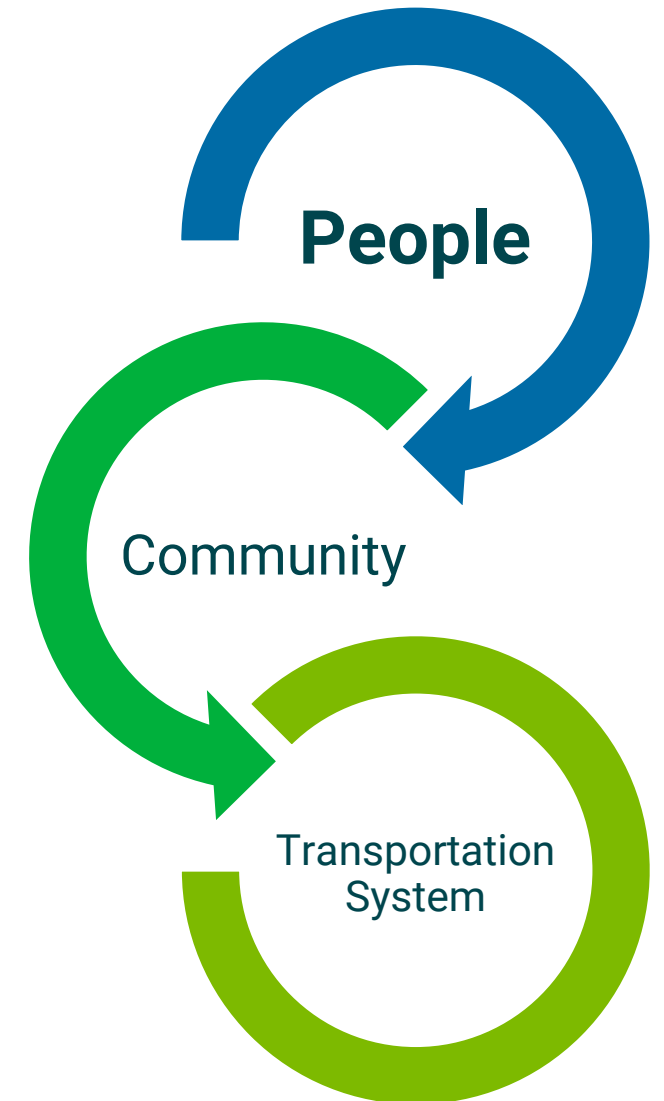
Resilience for what, and for whom?

Available – is it usable by the community?

Accessible – are all who can use it, able to access it?

Reliable – is it available when the community needs it?

Equitable – is it equitable usable, accessible, and reliable for all within the community, and by all communities?





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