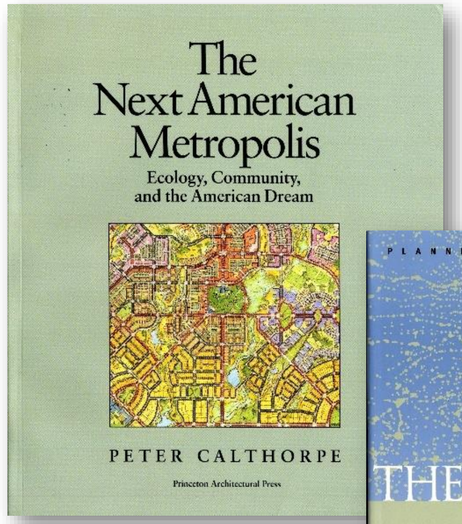
HDR/Calthorpe

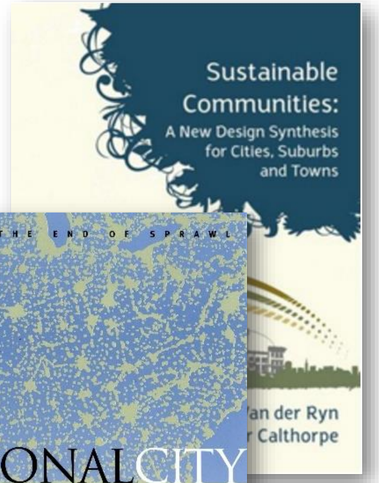
Regional Planning and Urban Design

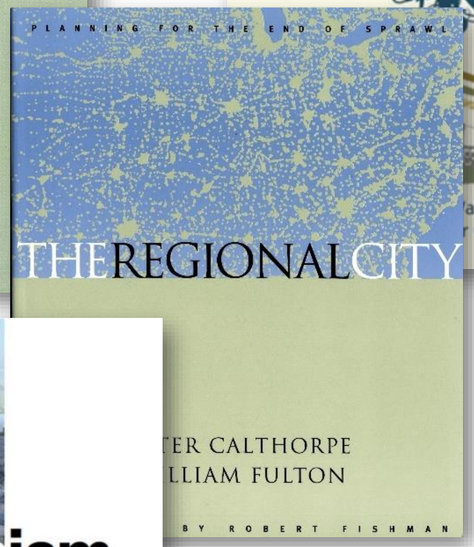
ENDING GLOBAL SPRAWL

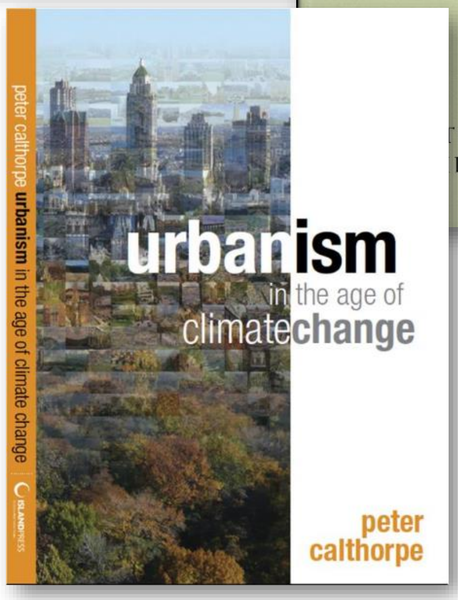
Urban Standards for Sustainable Development

Policies And Methods Adopted Internationally

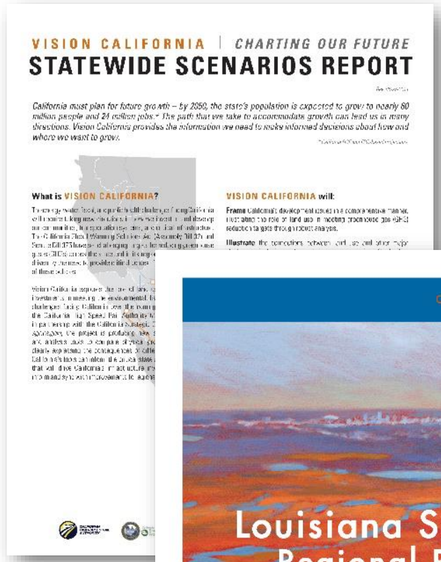


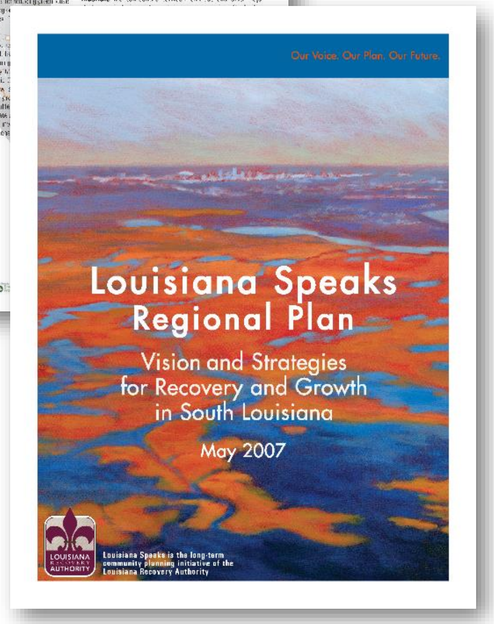


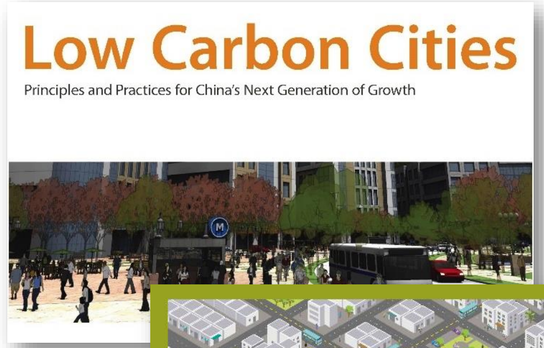


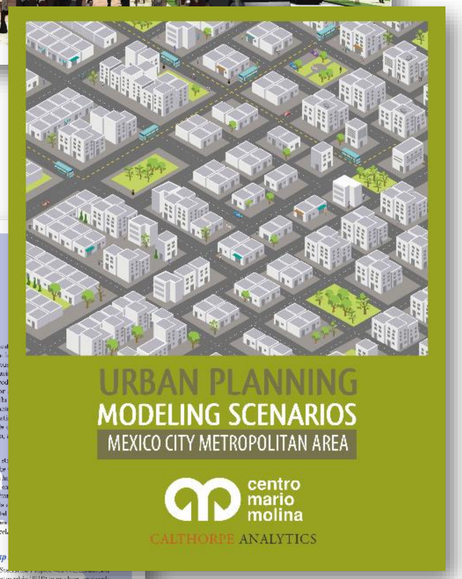


Thought leaders in planning and urbanism



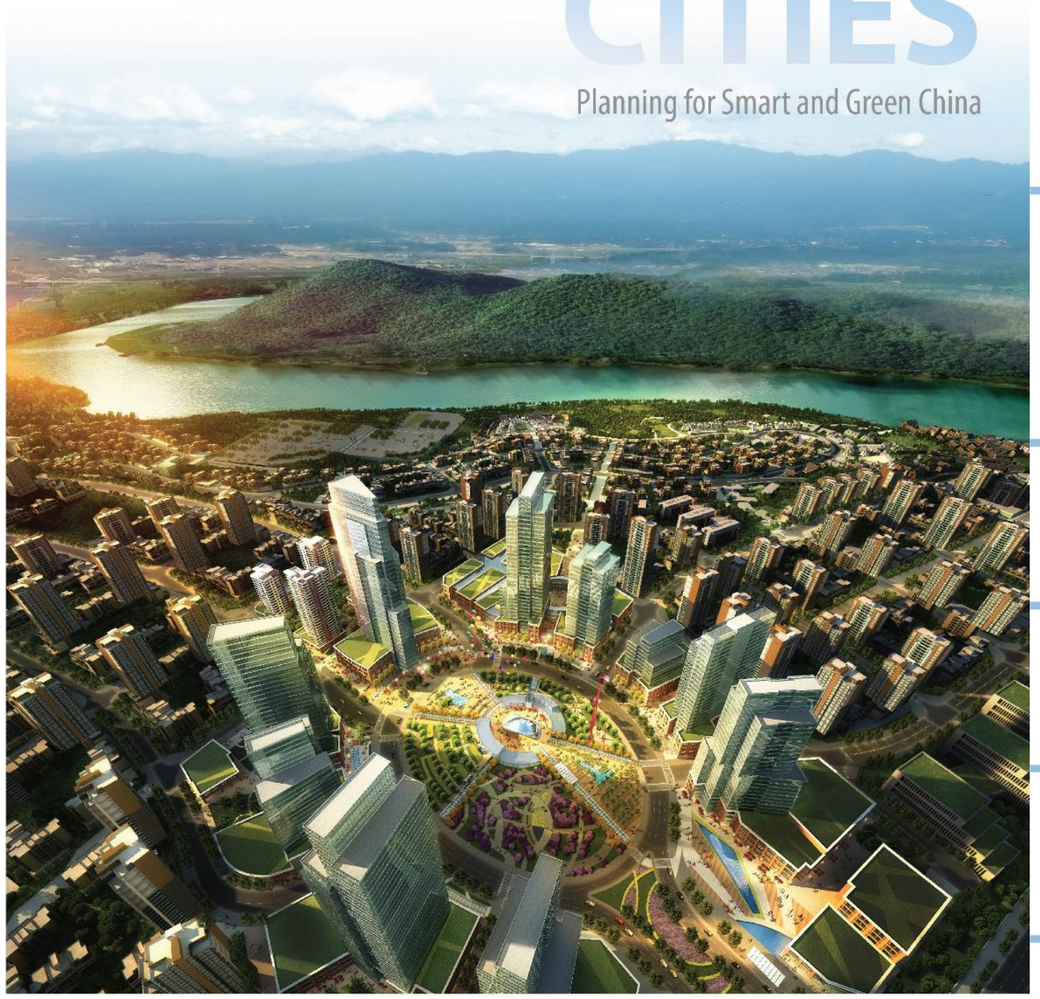






EMERALD CITIES

Planning for Smart and Green China



EMERALD CITIES

Planning for Smart and Green China

"This handbook should mark a turning point in China's urbanization. It describes, in detail, how to implement each of the key principles, and discusses how they each contribute to a great city.

I am convinced that this book, written by experts with great depth of experience, can help China's mayors and developers build truly beautiful, clean, and humane cities."

AL GORE
Chairman, The Climate Reality Project

"Establishment of the ten principles have provided measurable and practical strategy for the complex urban construction."

BAOJUN YANG
President of China Academy of Urban Planning and Design

"Let's make sure the China Dream is alive and healthy in our cities. Let's do this promptly. Emerald Cities gives the necessary detail for this crucially important project."

SHI WANG
Founder of Vanke Co. Ltd.; Chairman of Vanke Foundation

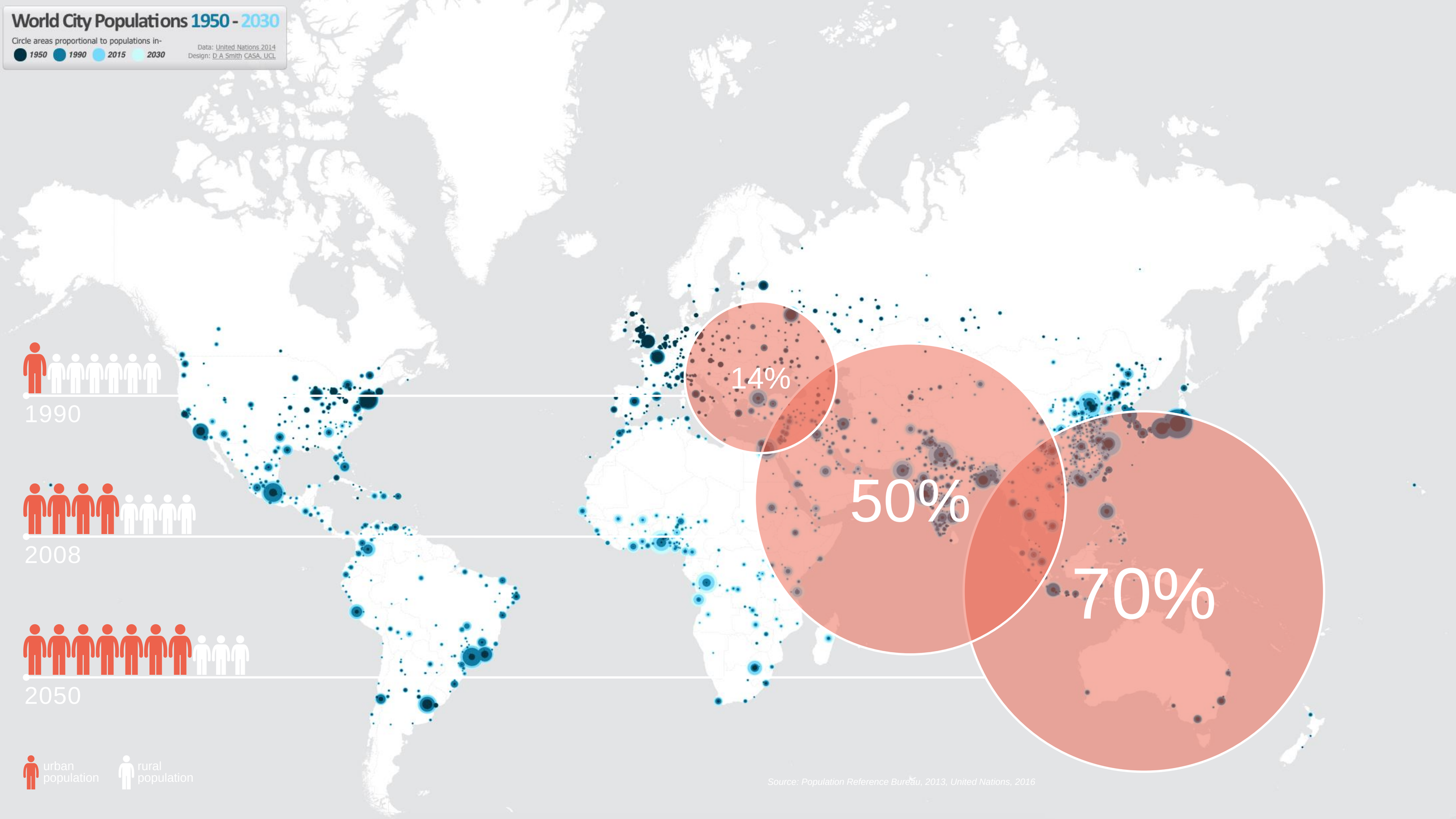
"The book has summarized and put forward pragmatic strategies and suggestions, which will offer a lot to us to facilitate our construction of green and smart cities based on the national realities."

YUAN XIN
General Manager, Tsinghua Tongheng Urban Planning and Design Institute

Foreword:
Al Gore
Baojun Yang
Shi Wang
Yuan Xin

Authors:
Calthorpe Associates - Principal Author
China Sustainable Transportation Center
Glumac

Funders:
Energy Innovation
Energy Foundation China


World City Populations 1950 - 2030
Circle areas proportional to populations in-
1950 1990 2015 2030
Data: United Nations 2014
Design: D A Smith CASA, UCL
1990
2008
2050
14%
50%
70%
urban population
rural population
Source: Population Reference Bureau, 2013, United Nations, 2016

Cities are home to society's toughest challenges – and greatest potential.

Today	2030	2050

Increase in average annual temperature

Shift compared to preindustrial climate

°C

0–0.5	0.6–1.0	1.1–1.5	1.6–2.0	2.1–2.5	2.6–3.0	3.1–3.5	3.6–4.0	4.1–4.5	4.6–5.0	5.1–5.5	5.6–6.0	6.1–6.5	6.6–7.0	>7.0

Extreme precipitation

Change of likelihood compared to 1950–81 of an 1950–81 50-year precipitation event

≤1x	1–2x	2–3x	3–4x	>4x

HIGH INCOME SPRAWL

USA

(Image source: Fast Company)

HIGH-DENSITY SPRAWL

China

(Image source: Flickr)

LOW-INCOME SPRAWL

Mexico

(Image source: Shiftr.pr)

1 PRESERVE

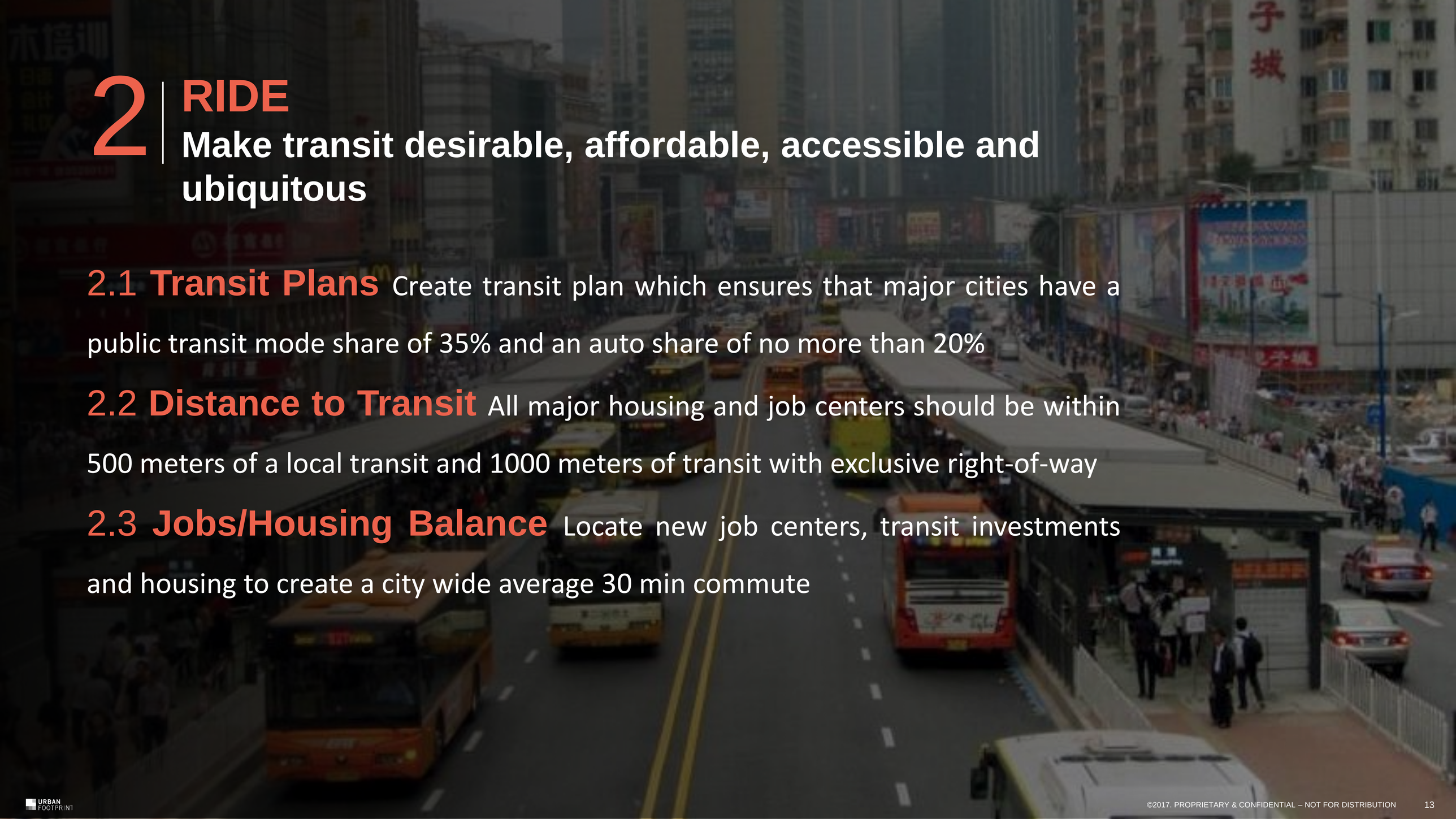
Plan for compact/resilient growth while preserving natural ecologies, agrarian landscapes, and cultural heritage sites

1.1 Urban Growth Boundary Establish 20 year Urban Growth Boundary with minimum density of 10,000 people per sq km citywide

1.2 Redevelopment Adopt citywide redevelopment strategy for areas of blight, TOD sites and economic revitalization sites

1.3 Resource Preservation Adopt preservation strategy for historic, cultural, agricultural, and ecological assets

1.4 Resilience Planning Adopt resilience strategy to avoid risk areas for future development and mitigate hazardous impacts in existing developed areas



2 RIDE

Make transit desirable, affordable, accessible and ubiquitous

2.1 Transit Plans Create transit plan which ensures that major cities have a public transit mode share of 35% and an auto share of no more than 20%

2.2 Distance to Transit All major housing and job centers should be within 500 meters of a local transit and 1000 meters of transit with exclusive right-of-way

2.3 Jobs/Housing Balance Locate new job centers, transit investments and housing to create a city wide average 30 min commute

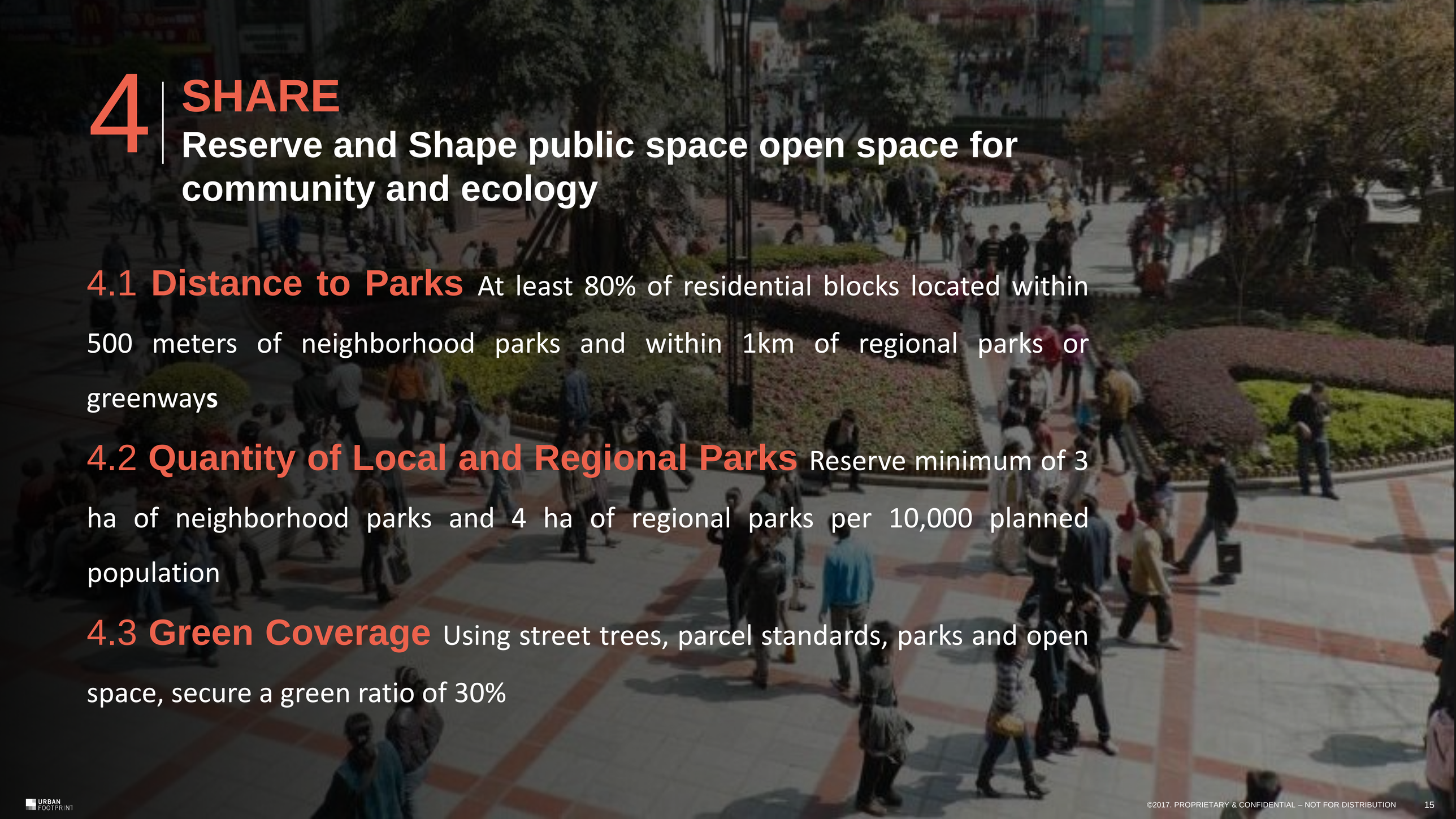
3 FOCUS

Match development density and mix to transit capacity in station areas

3.1 TOD Density Standards For each TOD type, meet the population and employment density guidelines as per table of TOD types

3.2 TOD Parking Parking ratio for TOD areas at most 80% or lower than average city standards

3.3 Parks in TOD Provide a minimum of 10% land area for parks and 5% for civic uses in each TOD



4 SHARE

Reserve and Shape public space open space for community and ecology

4.1 Distance to Parks At least 80% of residential blocks located within 500 meters of neighborhood parks and within 1km of regional parks or greenways

4.2 Quantity of Local and Regional Parks Reserve minimum of 3 ha of neighborhood parks and 4 ha of regional parks per 10,000 planned population

4.3 Green Coverage Using street trees, parcel standards, parks and open space, secure a green ratio of 30%

5 CONNECT

Increase density of road network, limit block size and add auto free streets

5.1 **Block Size** Ensure at least 70% of blocks in residential areas are 1.5 ha or less and commercial blocks in non-industrial areas are 3 ha or less

5.2 **Setbacks** Decrease setbacks to maximum of 1m for retail, 3m for commercial, and 5m for residential

5.3 **Street Size and Quantity** Reserve a minimum 20% land area for streets. For non-industrial districts no street should be more than 40m

5.4 **Auto-Free Streets** Create auto-free streets for any combination of pedestrian, bike or transit at an average spacing of 1km

6 MIX
Create mixed-use and mixed-income neighborhoods

6.1 Services Minimum High-density residential blocks of more that 50 du/acre must provide at least 0.15 FAR to publicly accessible shops and services

6.2 Commercial Destinations Cluster ‘shopping streets’ with civic uses and services within 800m of 80% of housing.

6.3 Commercial Mix Mixed-use blocks within commerical areas must provide at least 0.3 FAR to ground floor shops and public uses

6.3 Diverse Housing Minimum of 20% of housing in a neighborhood should be affordable

7 WALK/BIKE

Design walkable and bike friendly environments

7.1 Sidewalk Size Provide minimum of 4 meter-wide walkway on streets with 4 or more lanes, and a minimum 2 meters wide for two lane streets

7.2 Street Crossings Street crossings 16 meters maximum curb to curb without a refuge

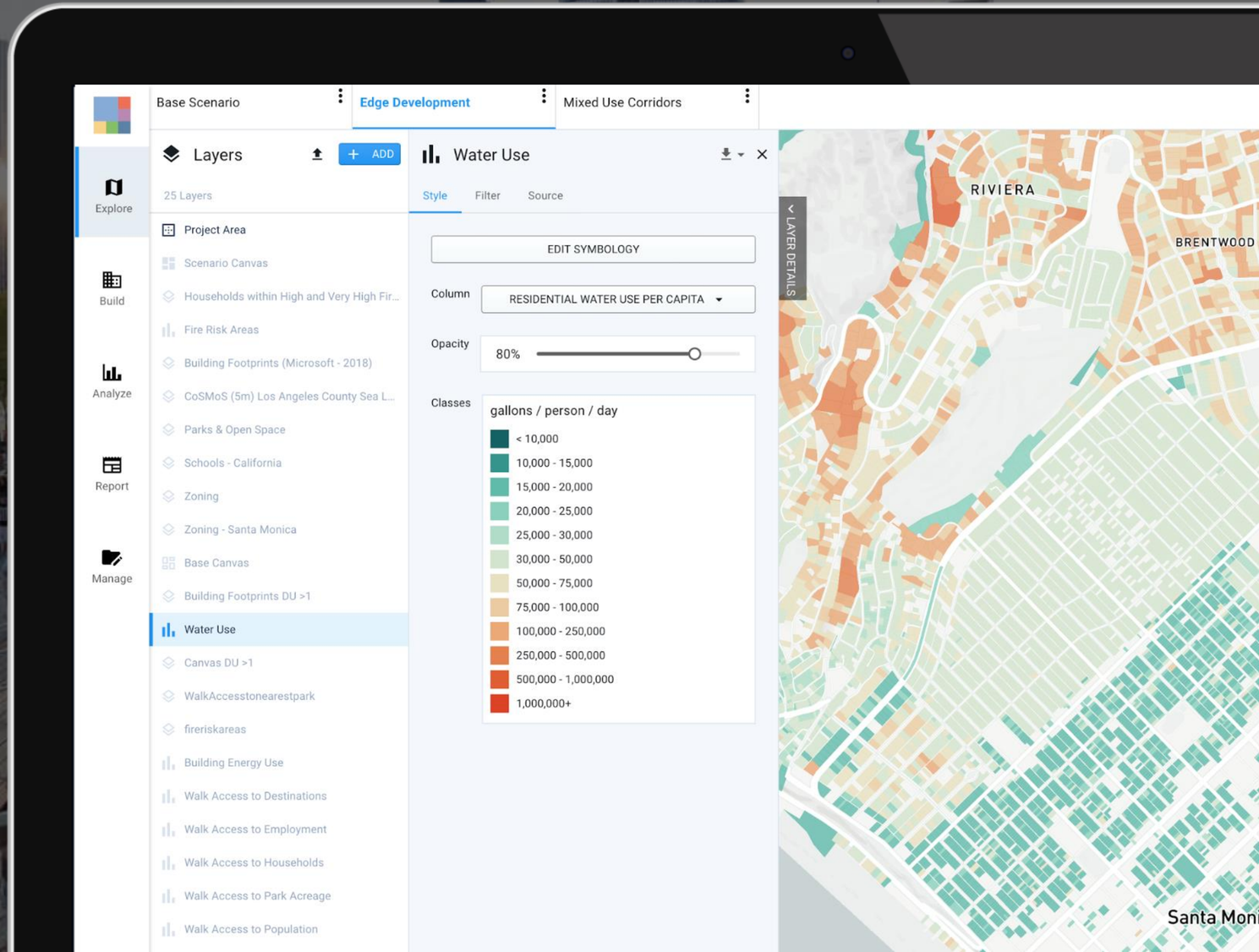
7.3 Active Street Frontage Provide minimum of 40% residential block perimeter dedicated to entryways, publicly accessible uses or lobbies

7.4 Bike Lanes Streets with 4 or more lanes must have protected bike lanes of at least 2m each direction

URBAN FOOTPRINT

Cities, Reimagined

Map, Measure, and Analyze
the Future of Place



Urban Intelligence: Scenario Planning

01 EXPLORE DATA

BASE DATA

FUTURE PLANS / SCENARIO DATA

Pre-loaded and curated data gets projects started faster. Easy to import and clean new geospatial datasets.

02 BUILD SCENARIOS

EXISTING PLAN TRANSLATION

PLACE & BUILDING TYPES

SCENARIO PAINTING / EDITING

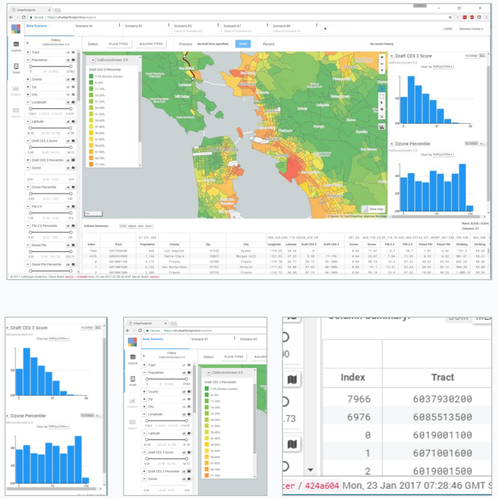
Simplify scenario development with a state of the art Design Toolkit and honed workflows.

03 ANALYZE MULTI-METRICS

- Local Fiscal Impacts
- Public Health
- Transportation
- Building Energy Use
- Building Water Use
- Greenhouse Gas Emissions
- Household Costs
- Land Consumption

Run sophisticated analytics across a growing range of metrics to support comprehensive decision-making

04 BUILD CONSENSUS



Create effective communications and graphics to inform the public and clients about tradeoffs

URBAN FOOTPRINT

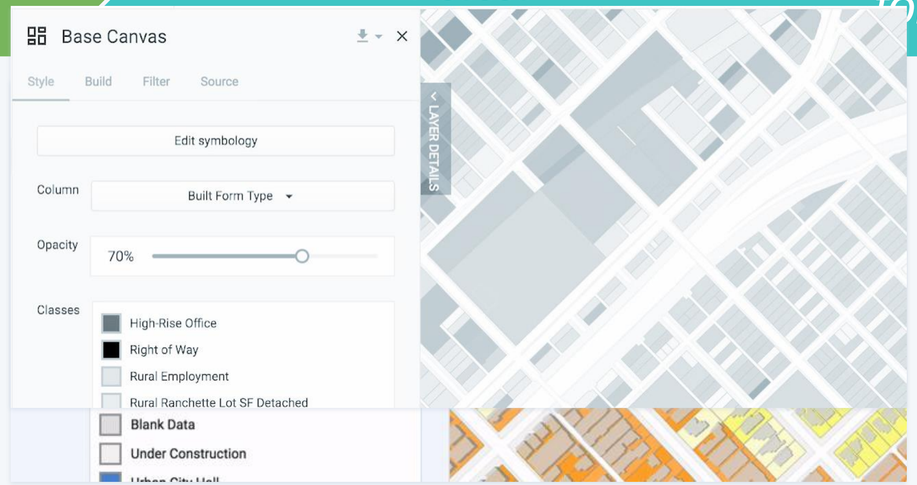
QUESTIONS

Data

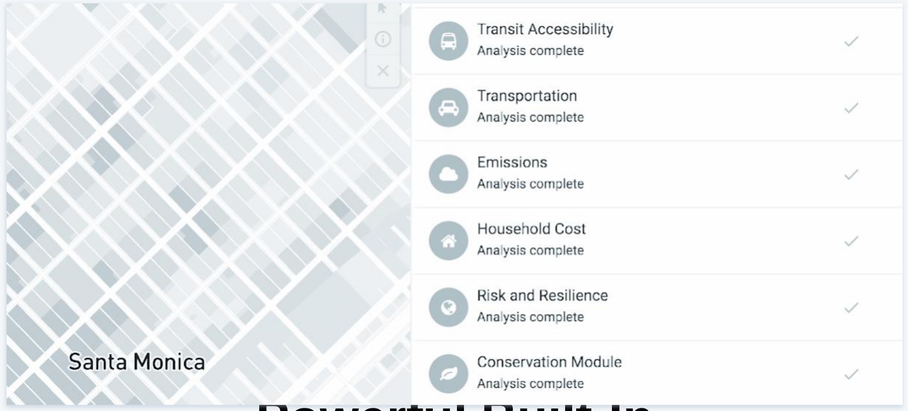
Urban Intelligence for Everyone

Insights

ANSWERS

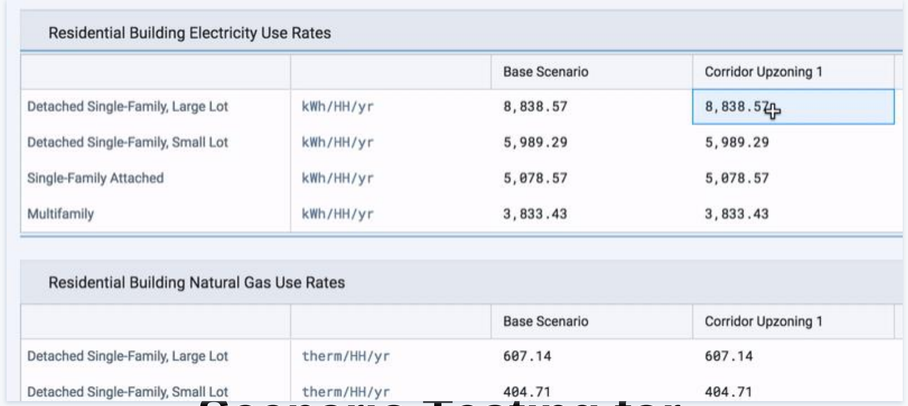


120 Million Parcels



Powerful Built-In Analysis

1000+ Datasets



Residential Building Electricity Use Rates

		Base Scenario	Corridor Upzoning 1
Detached Single-Family, Large Lot	kWh/HH/yr	8,838.57	8,838.57
Detached Single-Family, Small Lot	kWh/HH/yr	5,989.29	5,989.29
Single-Family Attached	kWh/HH/yr	5,078.57	5,078.57
Multifamily	kWh/HH/yr	3,833.43	3,833.43

Residential Building Natural Gas Use Rates

		Base Scenario	Corridor Upzoning 1
Detached Single-Family, Large Lot	therm/HH/yr	607.14	607.14
Detached Single-Family, Small Lot	therm/HH/yr	404.71	404.71

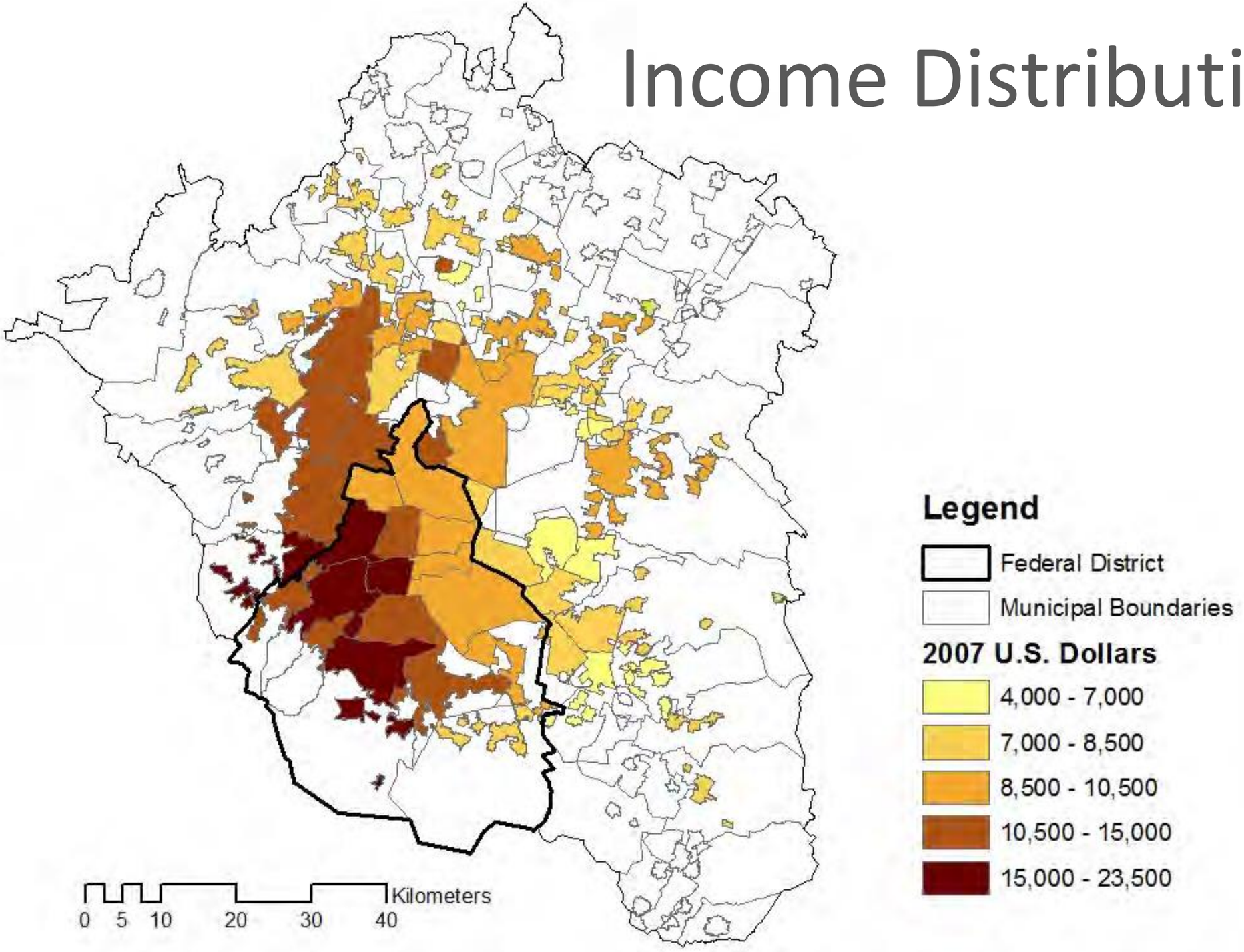
Scenario Testing for Mortals

LOW-INCOME SPRAWL

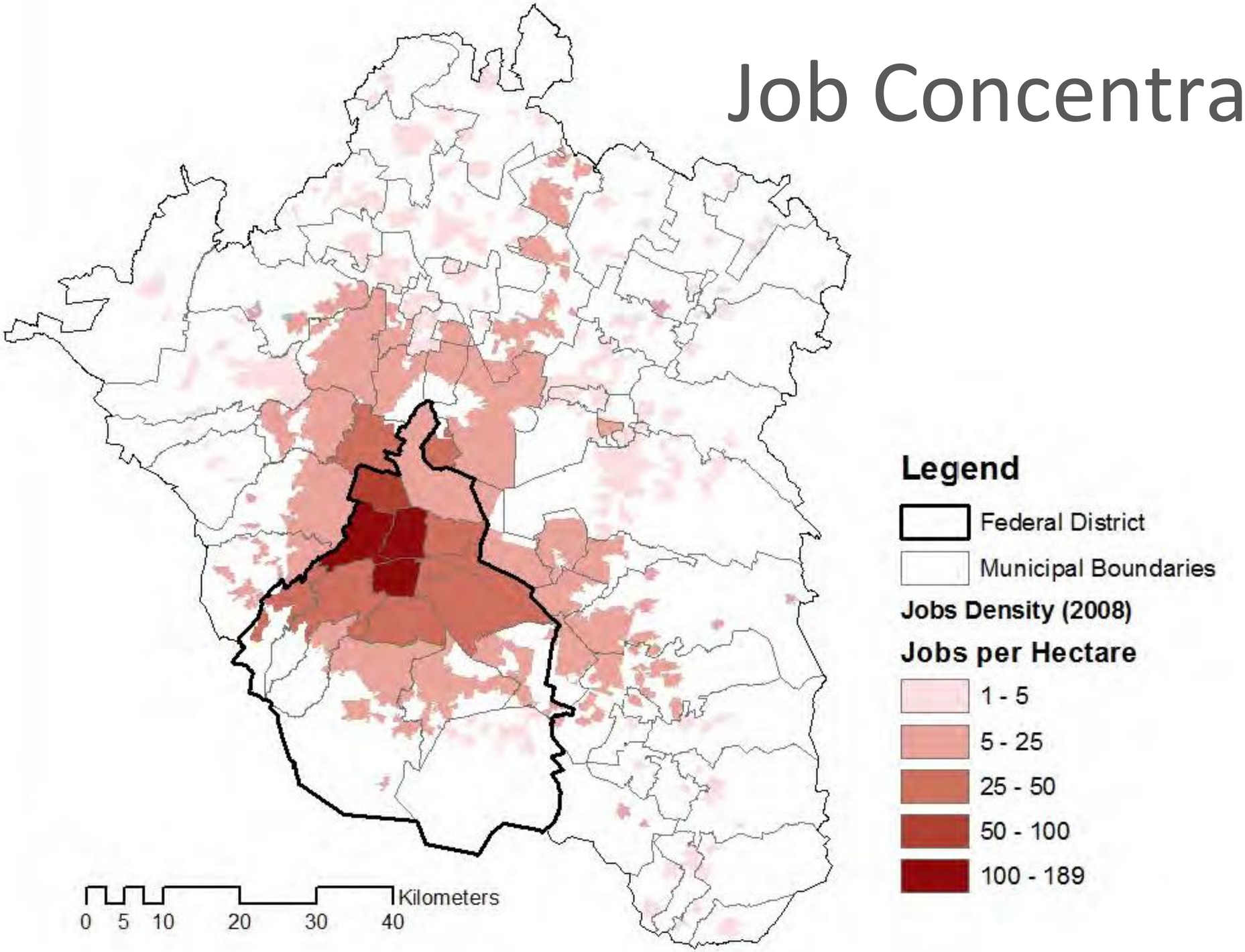
Mexico

(Image source: Shiftr.pr)

Income Distribution

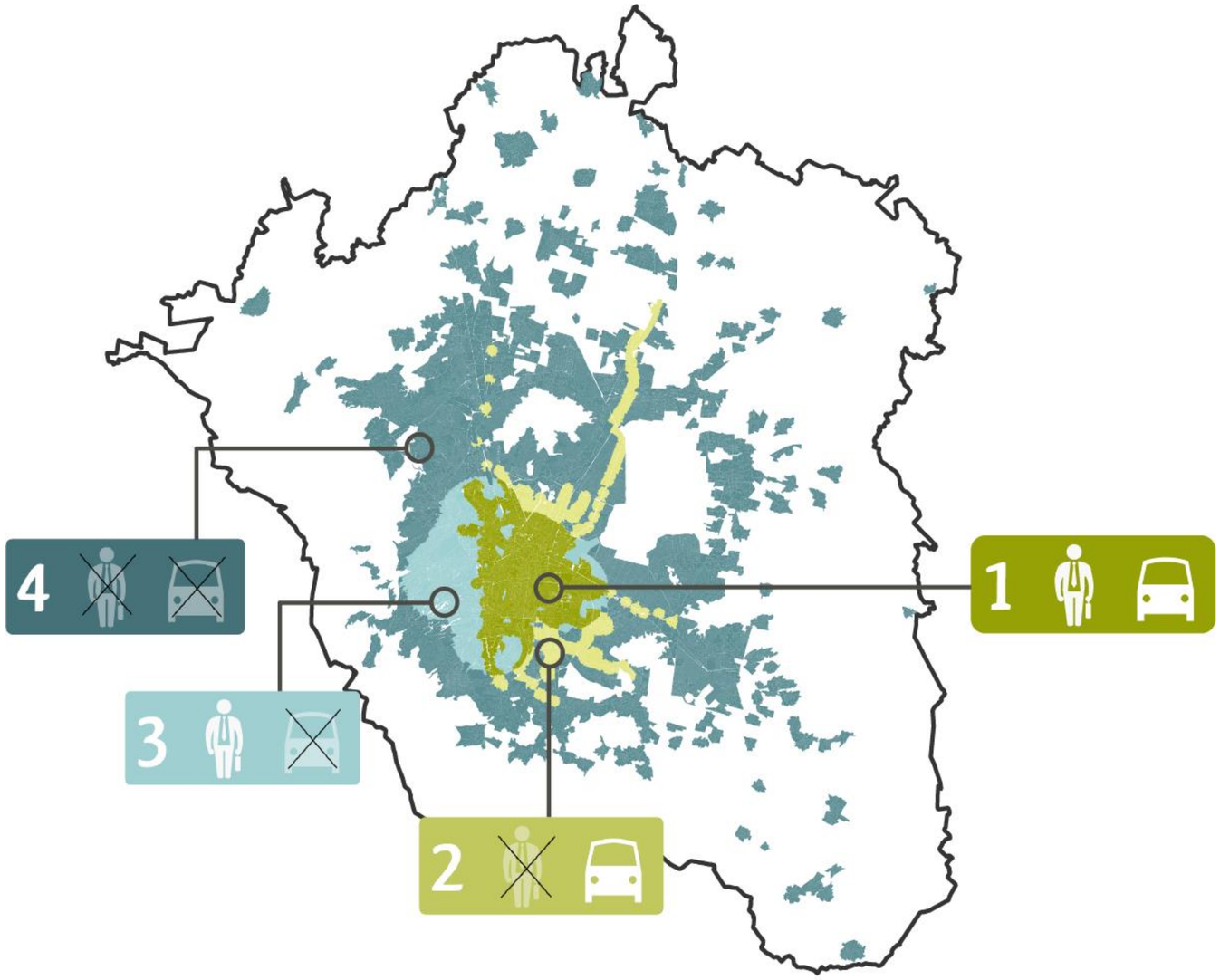


Job Concentrations



Modeling Framework

Regional location



Job proximity

Transit proximity

26% 9% 9% 67%

Metrics analysis

LAND CONSUMPTION

INFRASTRUCTURE COSTS

ENERGY CONSUMPTION

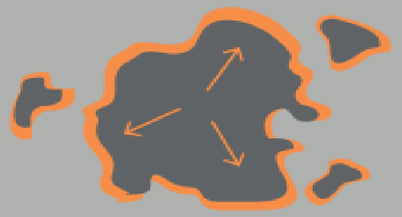
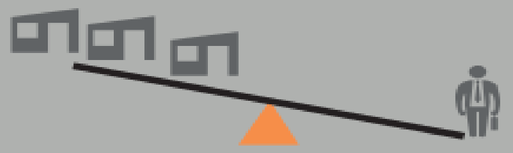
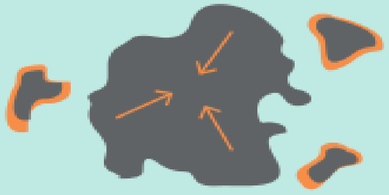
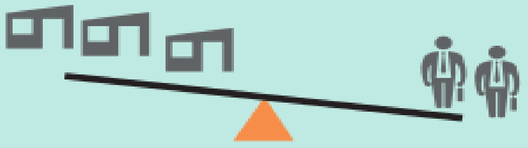
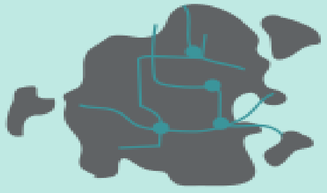
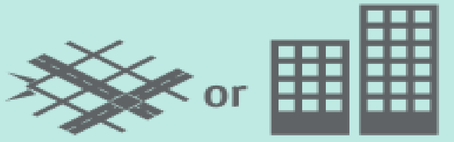
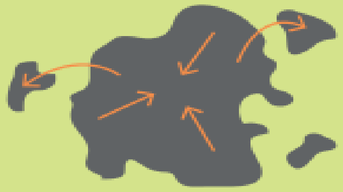
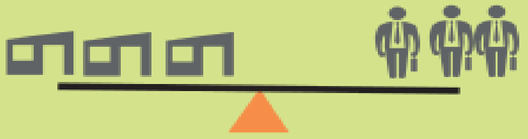
WATER CONSUMPTION

PUBLIC TRANSPORT

PRIVATE TRANSPORT

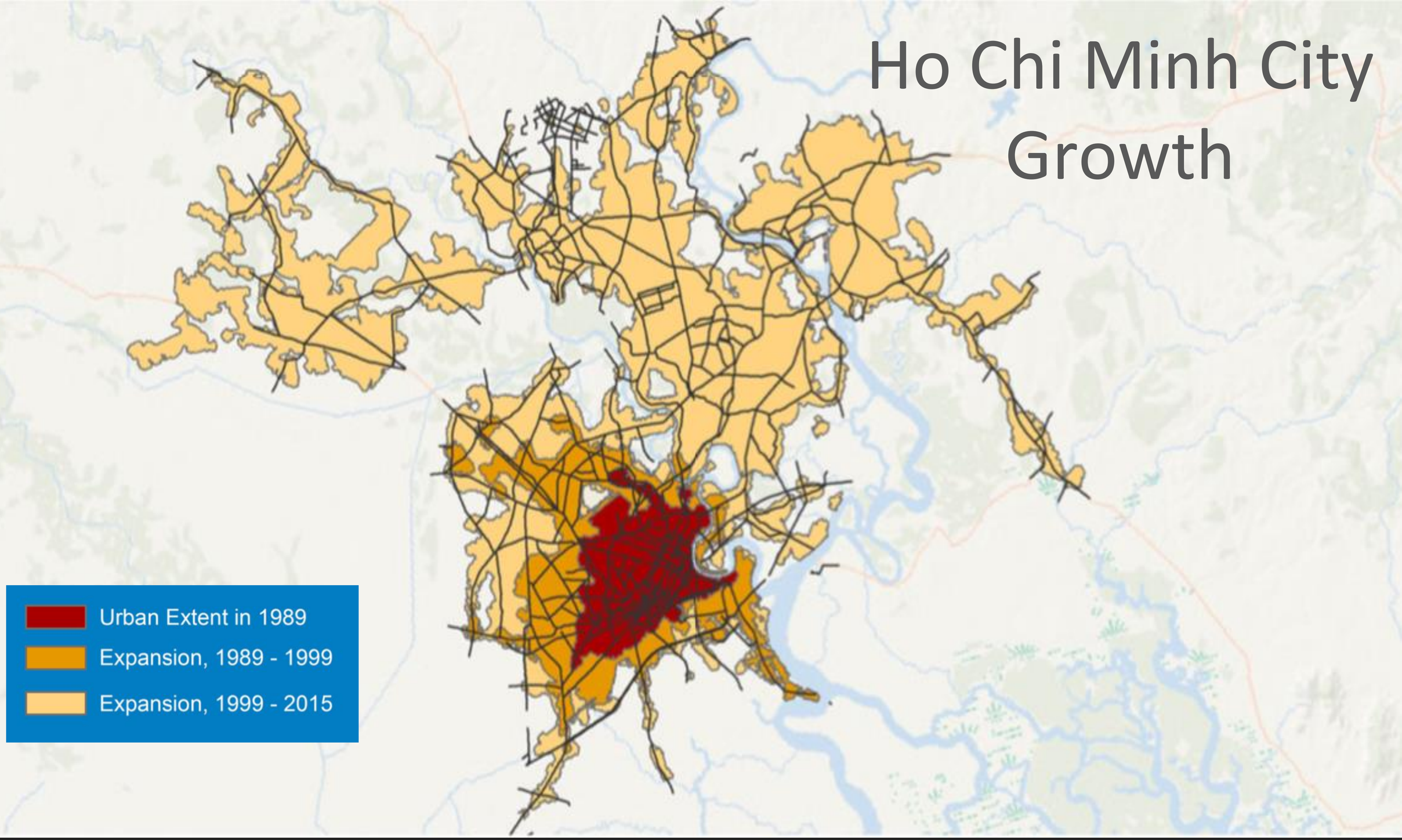
GHG EMISSIONS

COSTS PER HOUSEHOLD

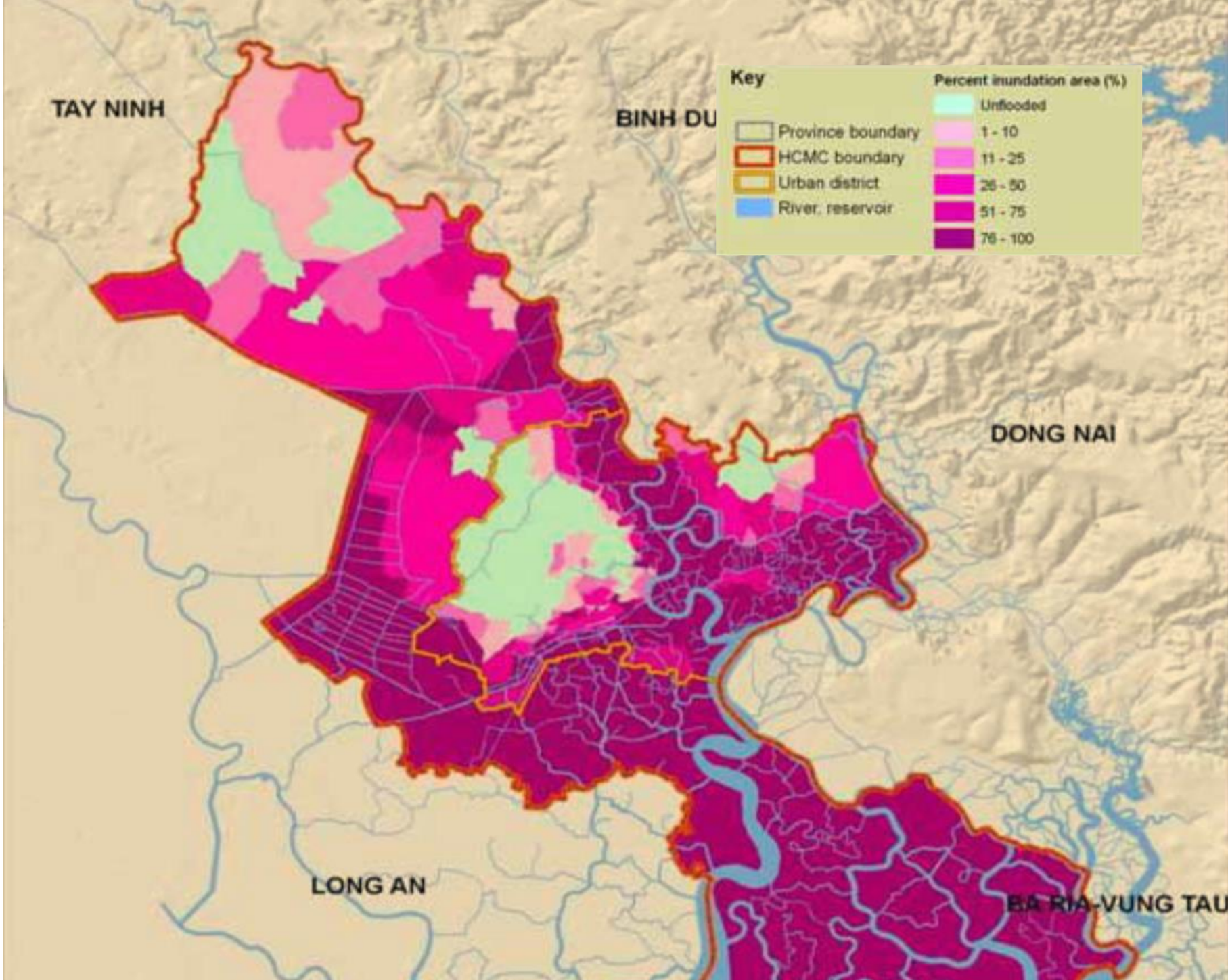
	LAND	EMPLOYMENT	TRANSPORT	URBAN CONFIGURATION	
TREND	Expansion 	Desproportionate housing (centralized) 	Moderate extension 	Without scale nor density 	INEFFICIENT LAND CONSUMPTION
MODERATE	Moderate infill 	Partially aligned with housing 	BRT & subway extension 	With scale or with density 	INVESTMENT IN TRANSPORT
VISION	Smart consolidation 	In proportion with housing 	Regional connectivity (megalopolis) 	With scale and density (complete communities*) 	BALANCED CONSOLIDATION

	LAND CONSUMPTION	INFRASTRUCTURE COSTS	ENERGY CONSUMPTION	WATER CONSUMPTION	TRAVELED KM (private)	TRAVEL TIME (public & private)	COSTS PER HOUSEHOLD (annualized)	GHG EMISSIONS (annualized)
TREND	640 km² (similar in size to Puebla)	$ 33,070 mill.	4,160 Quad. Btu	52,450 mill. m³	42,000 mill. vehicle km traveled	13,200 person hours traveled	$ 7,022 annual/household	26 mill. Ton CO_2
MODERATE	255 km² (similar in size to Toluca)	$ 11,338 mill. -$ 21,700 mill. 14 lines subway (line 12)	4,140 Quad. Btu -$ 867 mill.	52,200 mill. m³ -$ 116 mill.*	8% less vehicle km traveled -500,000 vehicles (2050)	15% less person hours traveled -½ hour PHT per day	$ 6,601 annual/household -$ 420 annual/household	24 mill. Ton CO_2 -6% emissions
VISION	140 km² (similar in size to Queretaro)	$ 6,983 mill. -$ 26,094 mill. 17 lines subway (line 12)	4,120 Quad. Btu -$ 1,799 mill.	45,900 mill. m³ -$ 123 mill.*	13% less vehicle km traveled -780,000 vehicles (2050)	23% less person hours traveled -1 hour PHT per day	$ 6,342 annual/household -$ 680 annual/household	23 mill. Ton CO_2 -9% emissions

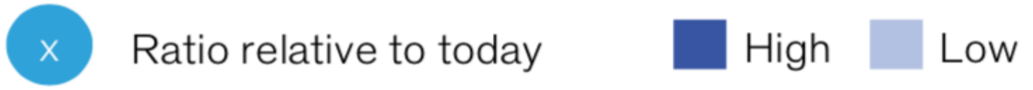
Ho Chi Minh City Growth

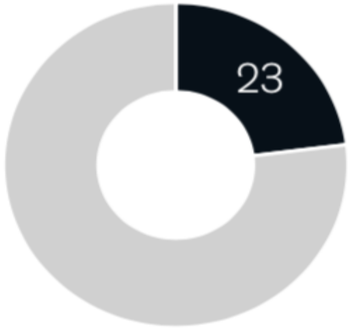
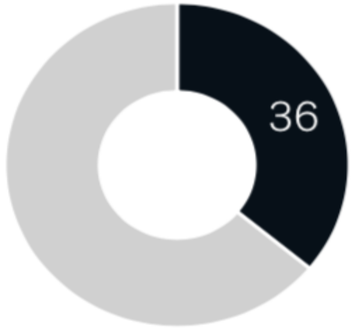
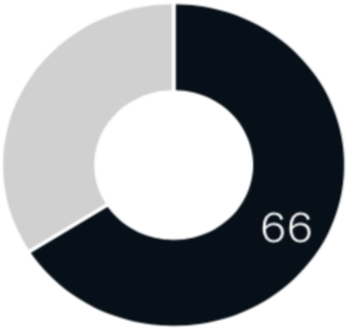


HCMC Inundation Map



100-year flood effects in Ho Chi Minh City[1]



		Today	2050		180cm sea-level rise scenario[2]	
Flooding	**Flooded area within modeled area** %			1.5x		3x
	Average flooded depth within modeled area Meters			2x		7x
Impacts $ billion	**Real estate damage and destruction**[3]			6x		13x
	Infrastructure damage and destruction[3]			3x		22x

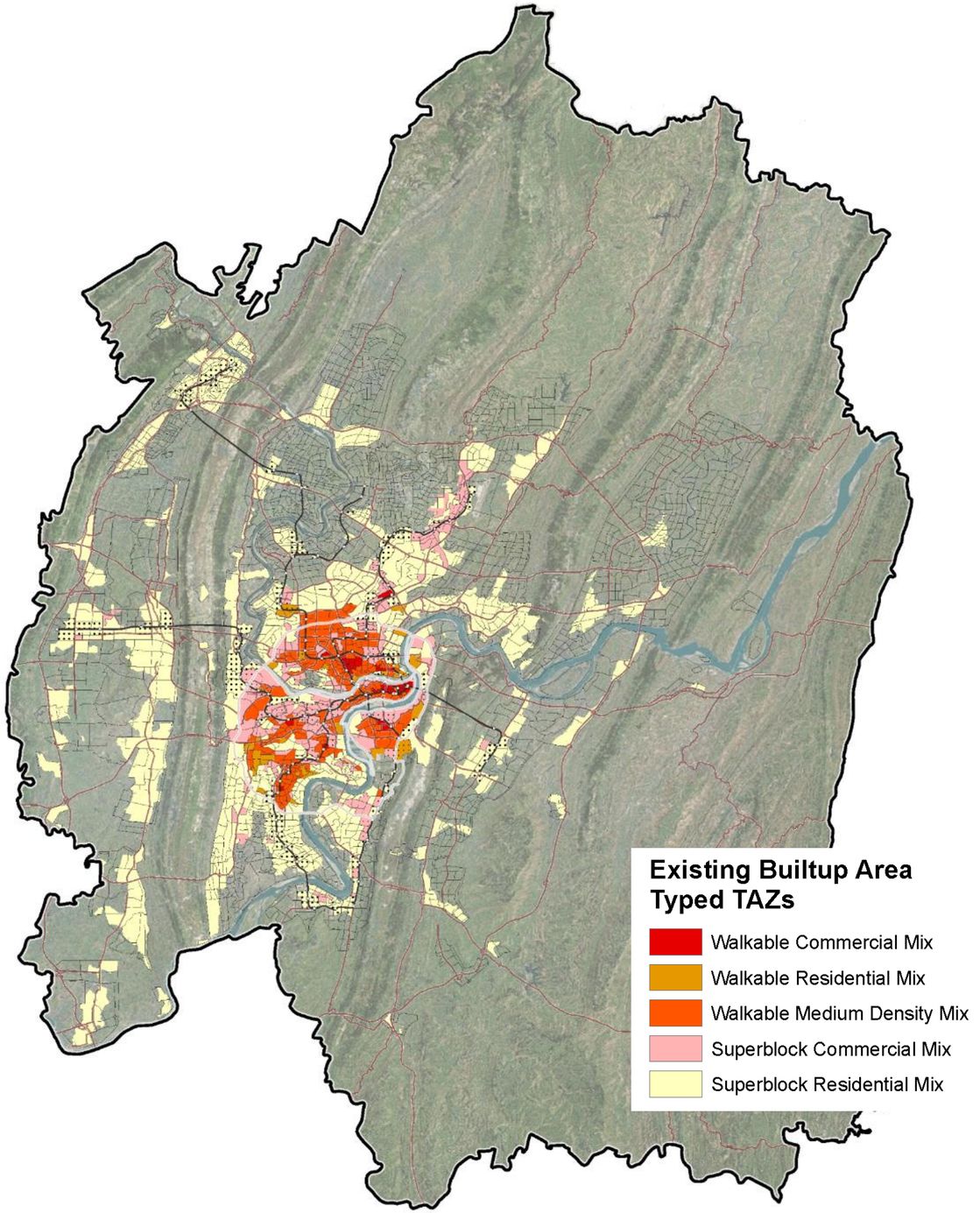
HIGH-DENSITY SPRAWL

China

(Image source: Flickr)

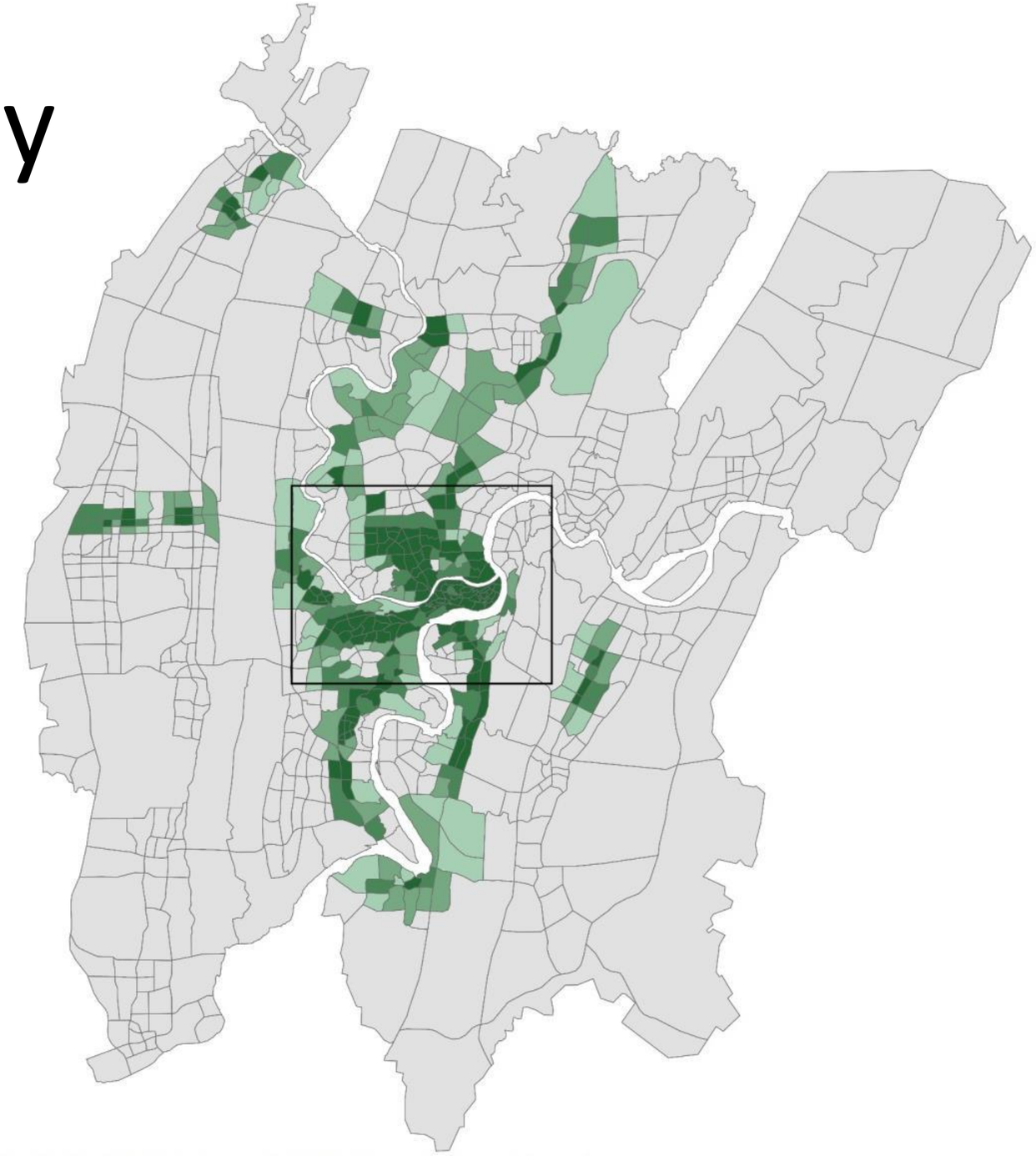
Chongqing
Existing Conditions

- Fragmented growth
- Limited walkable development outside Core
- Development potential around existing and new stations not maximized



Trasit Accessability

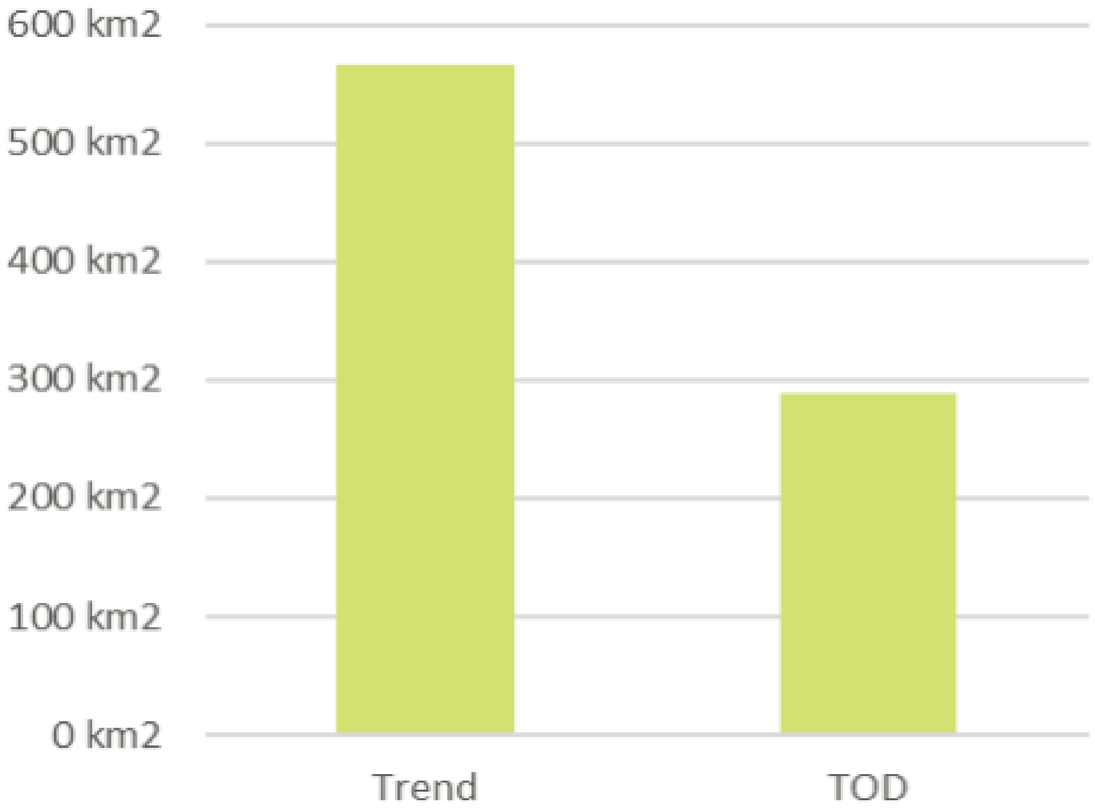
- Within 500-meter walking distance of metro stations
- Outside 500-meter walking distance



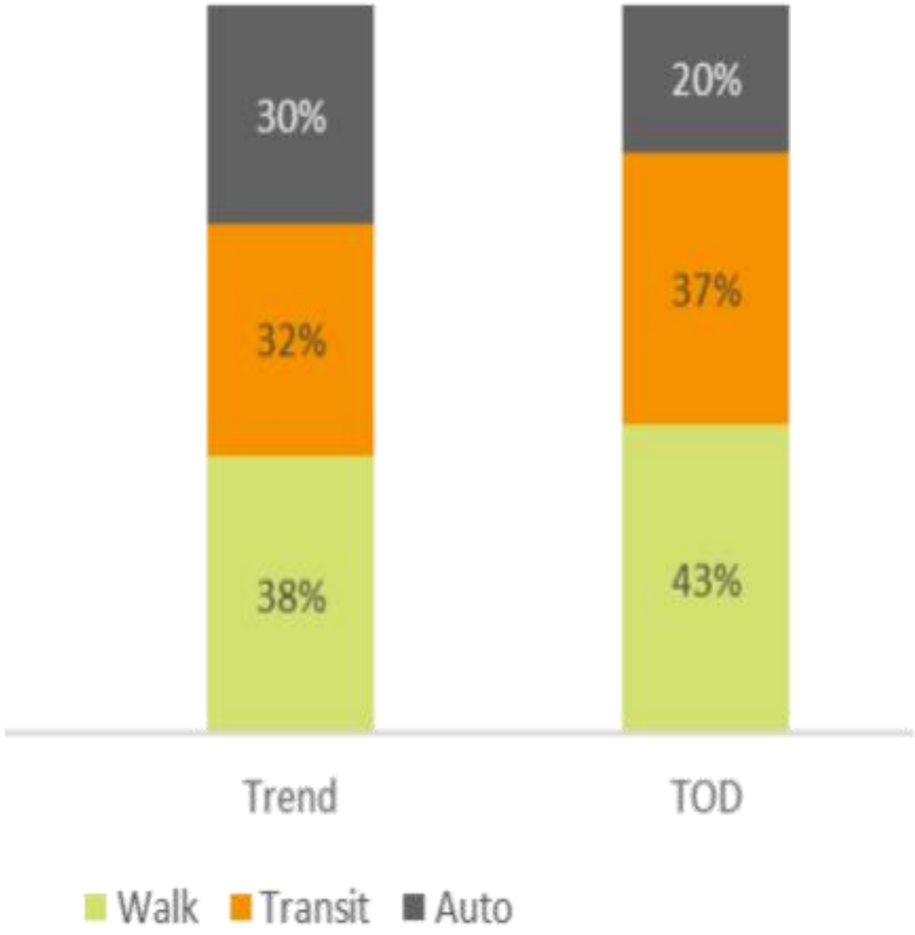
Employment Location

- Fractured locations
- Poorly served by transit
- Too much high density commercial in core

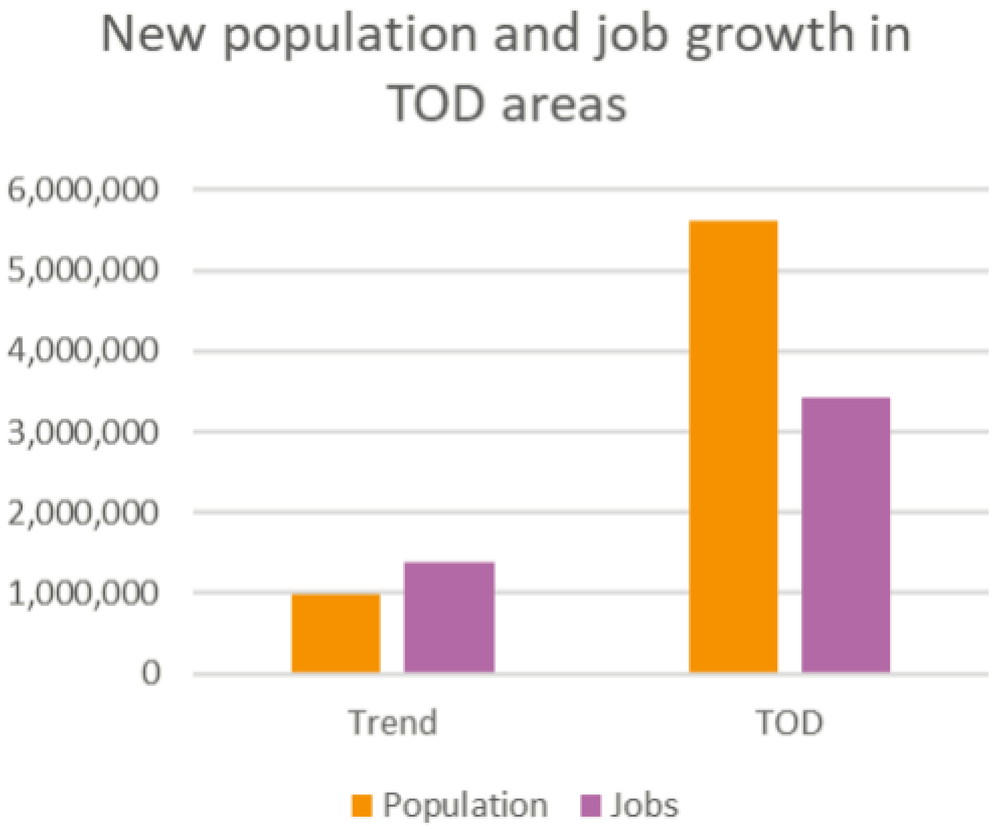
New Land Consumption

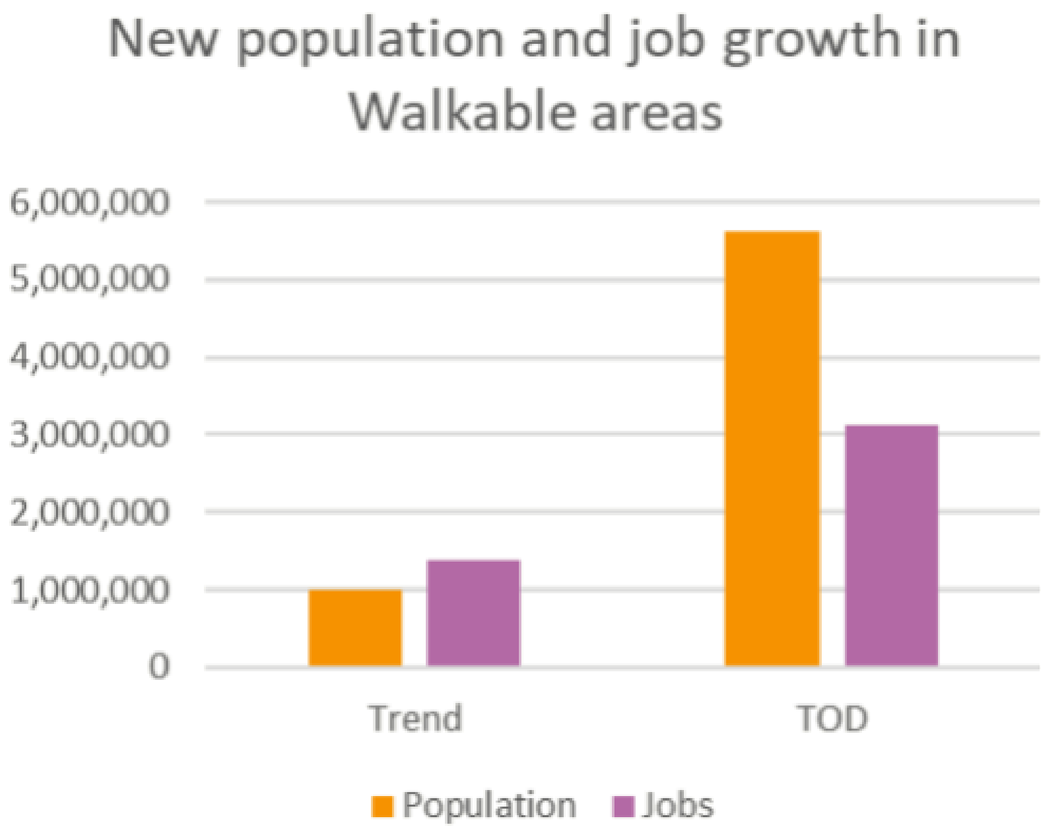


Transportation Mode Share

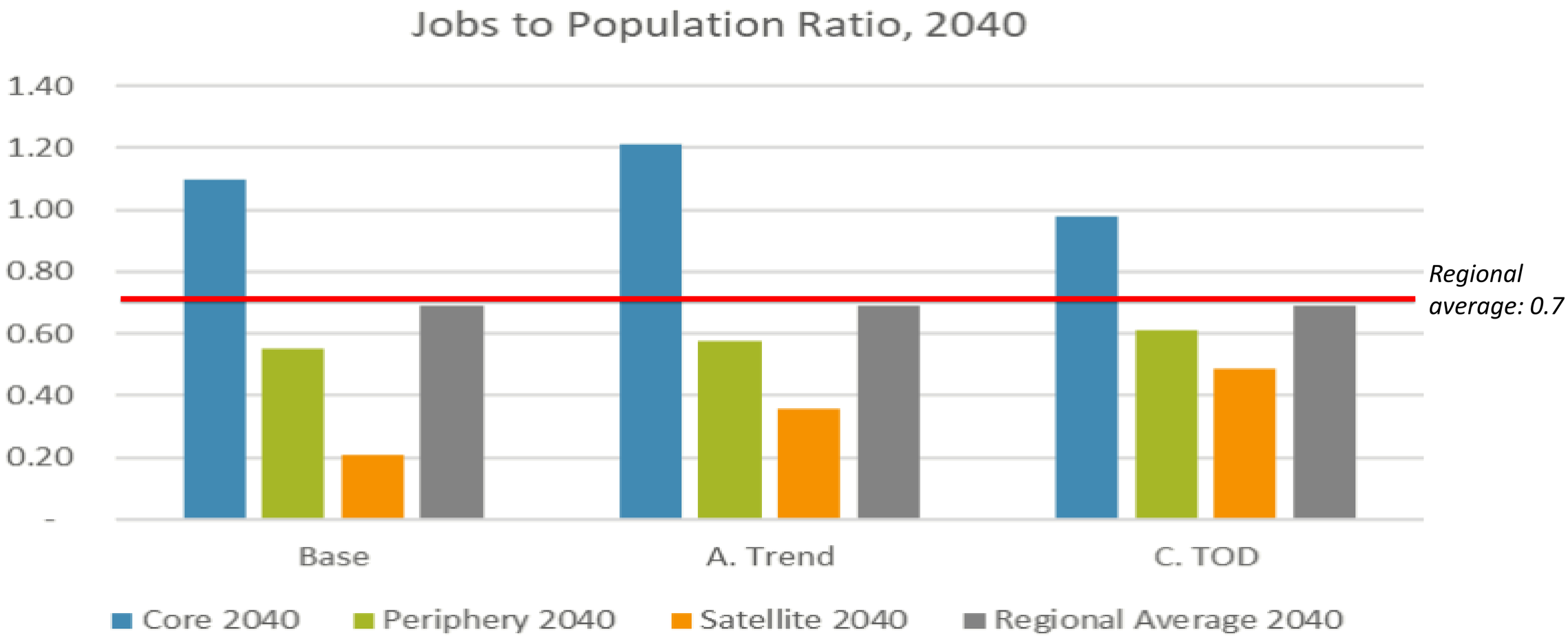


Growth in TOD and Walkable Areas

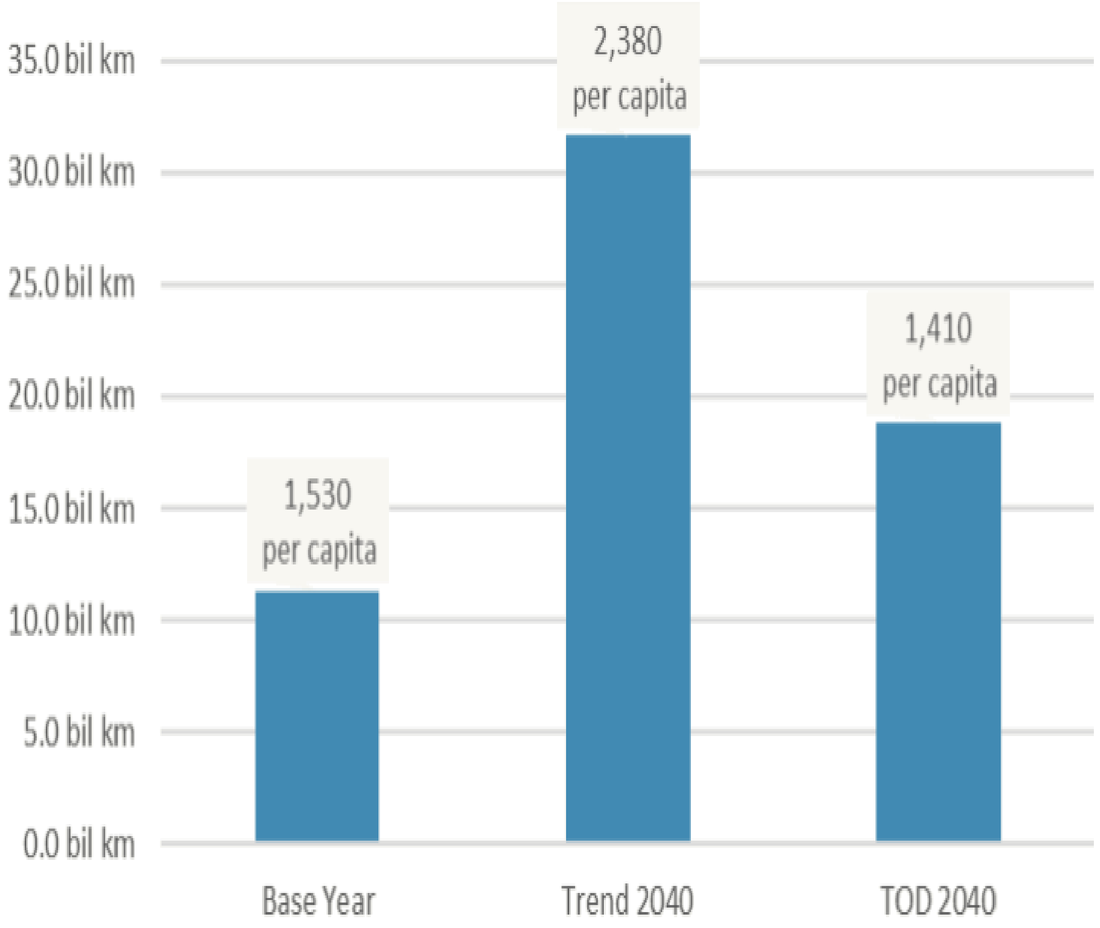




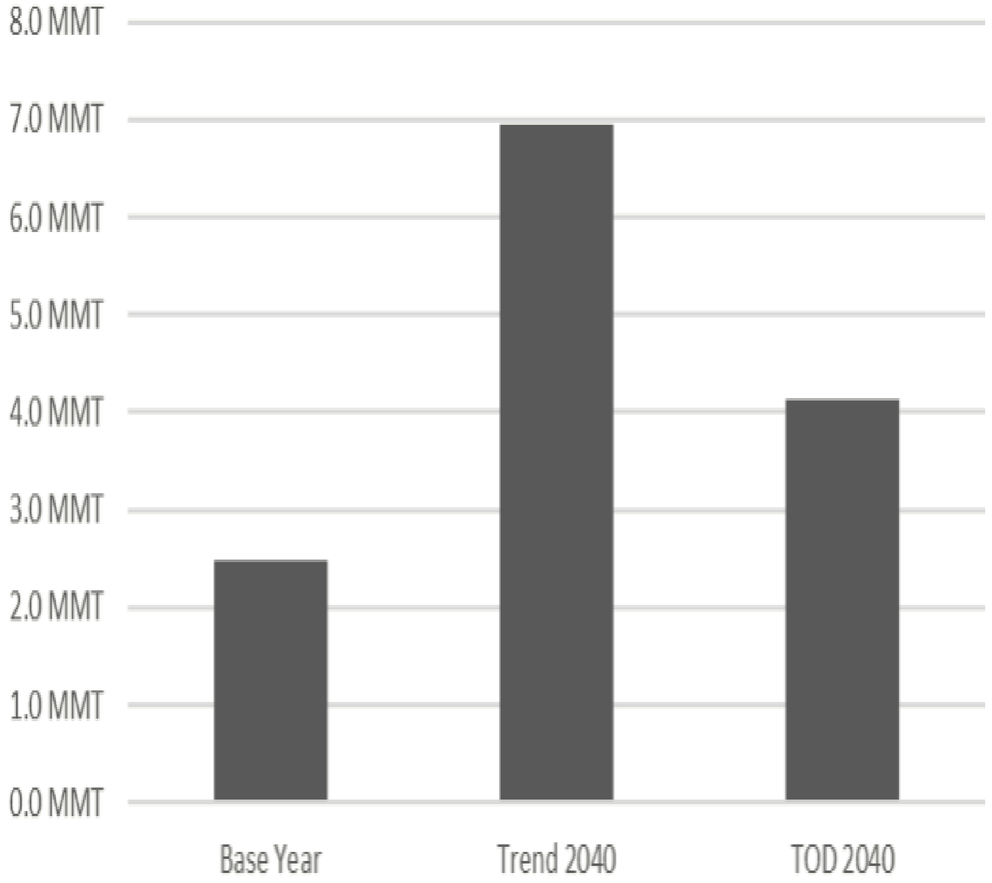
Jobs/Housing Balance



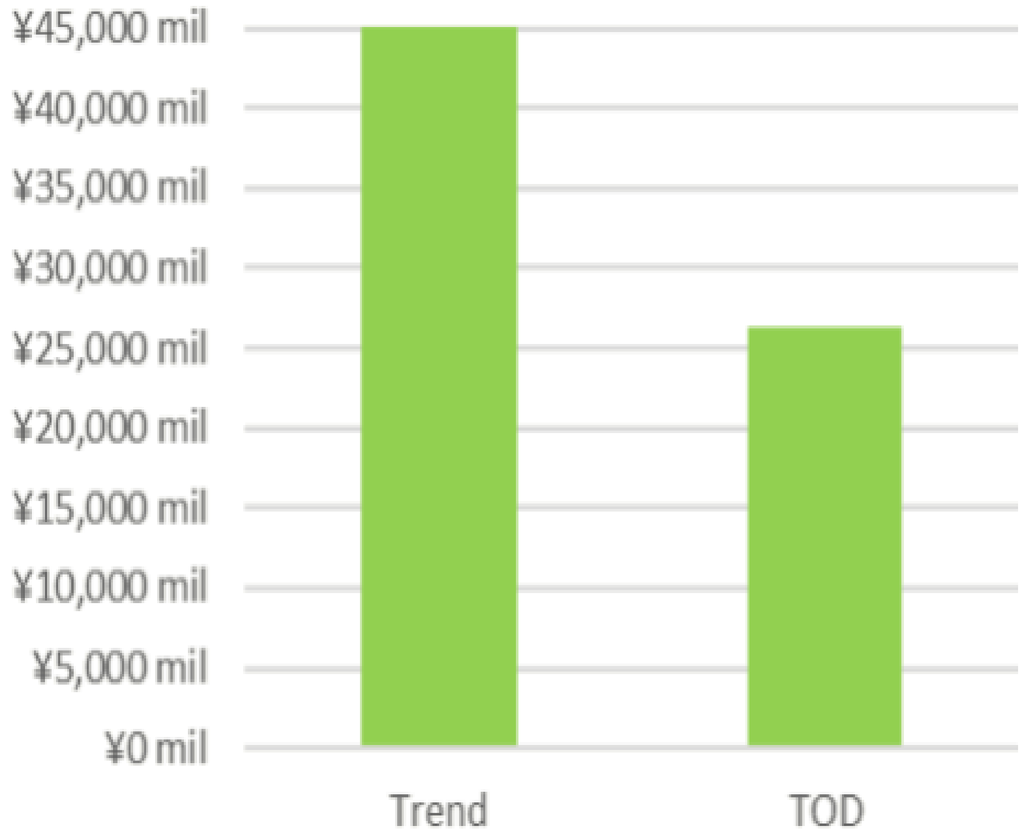
Auto Kilometers Traveled (VKT)



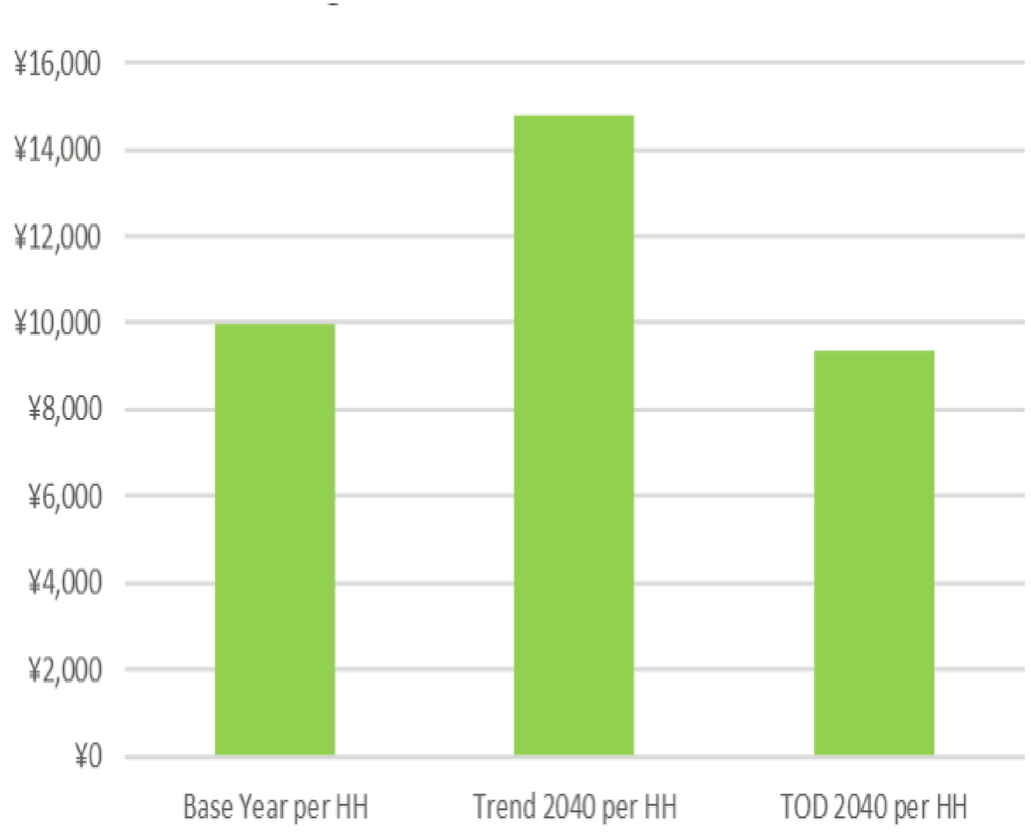
Auto Greenhouse Gas Emissions

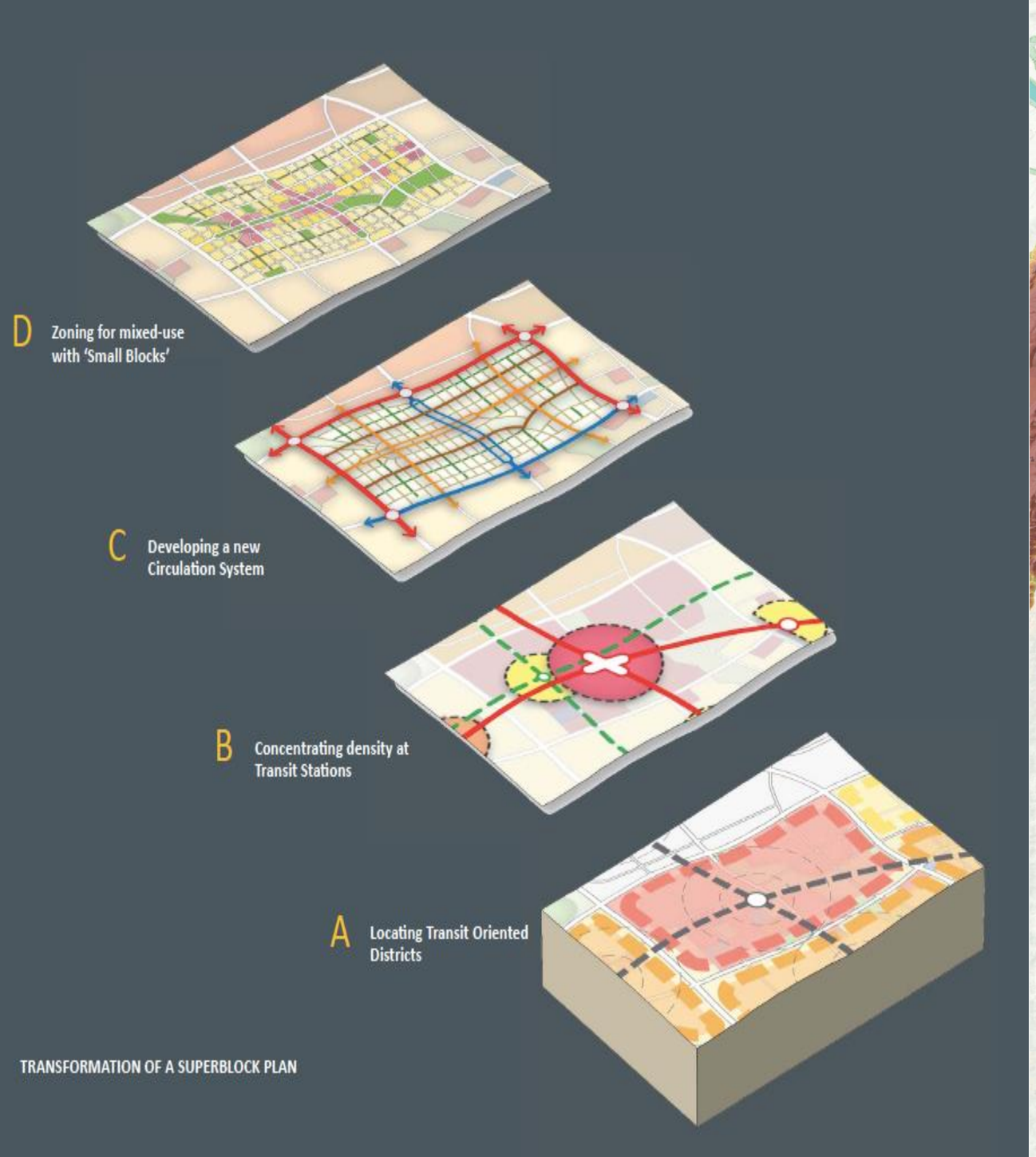


Infrastructure Costs

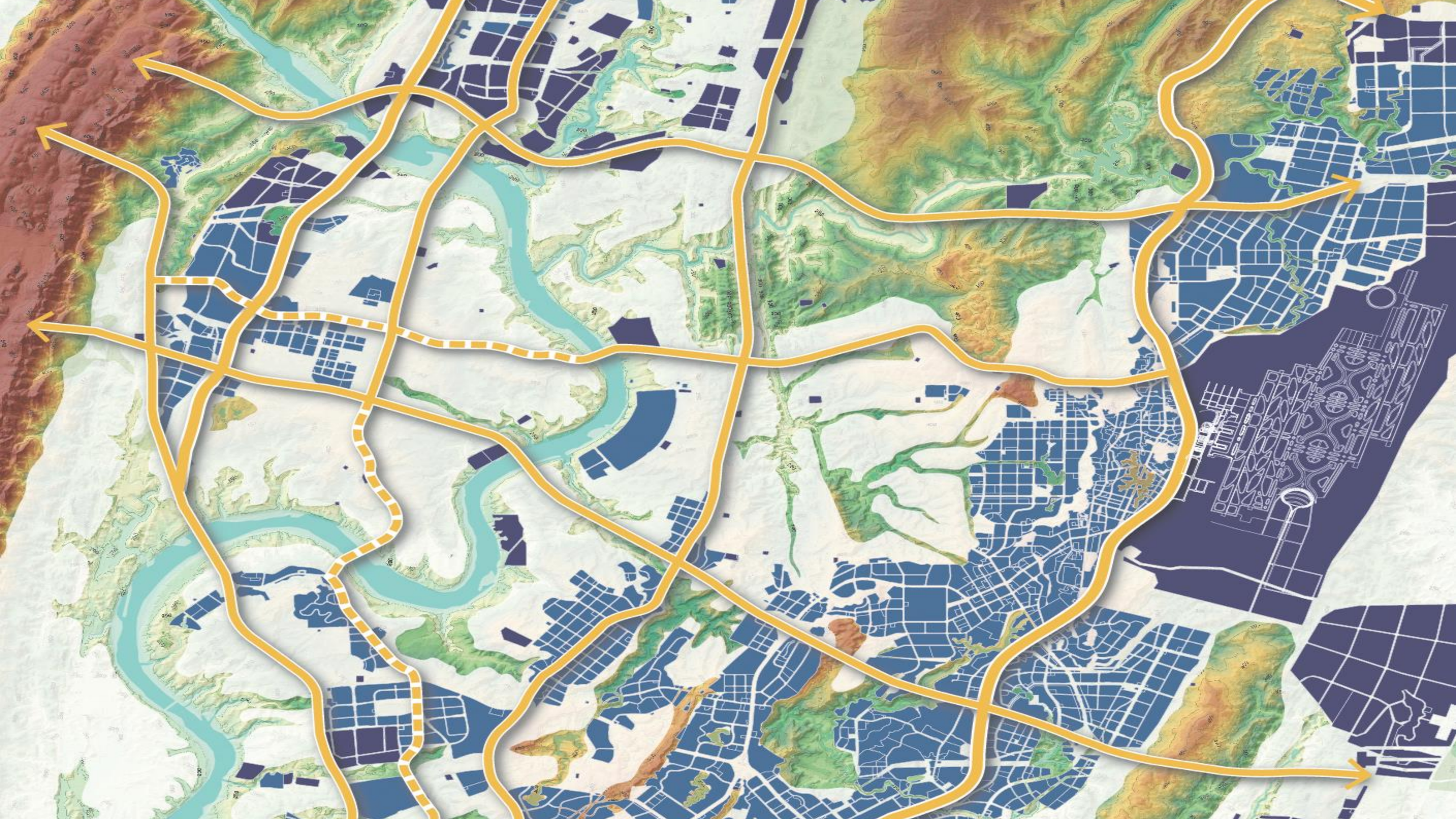


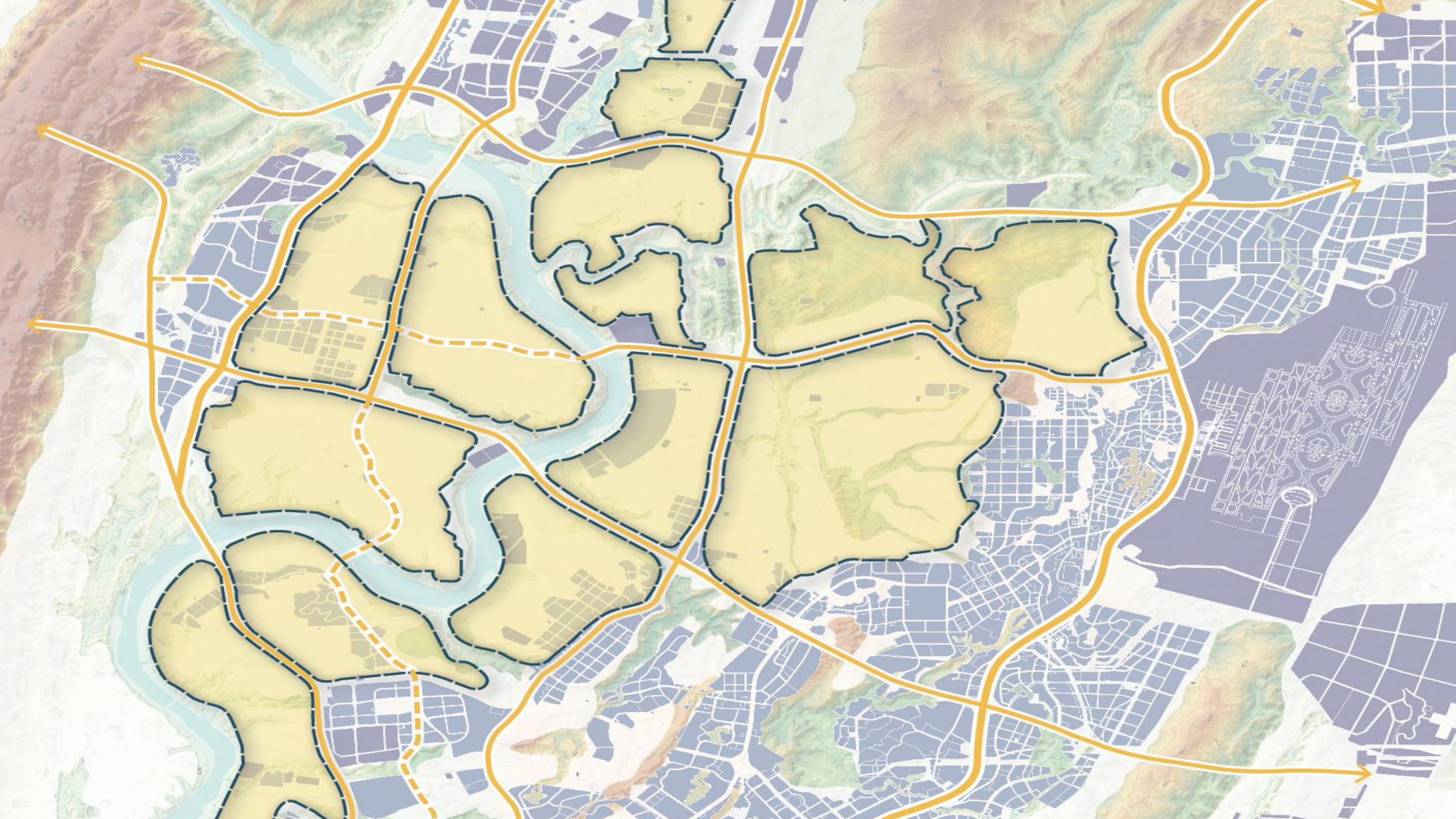
Household Costs

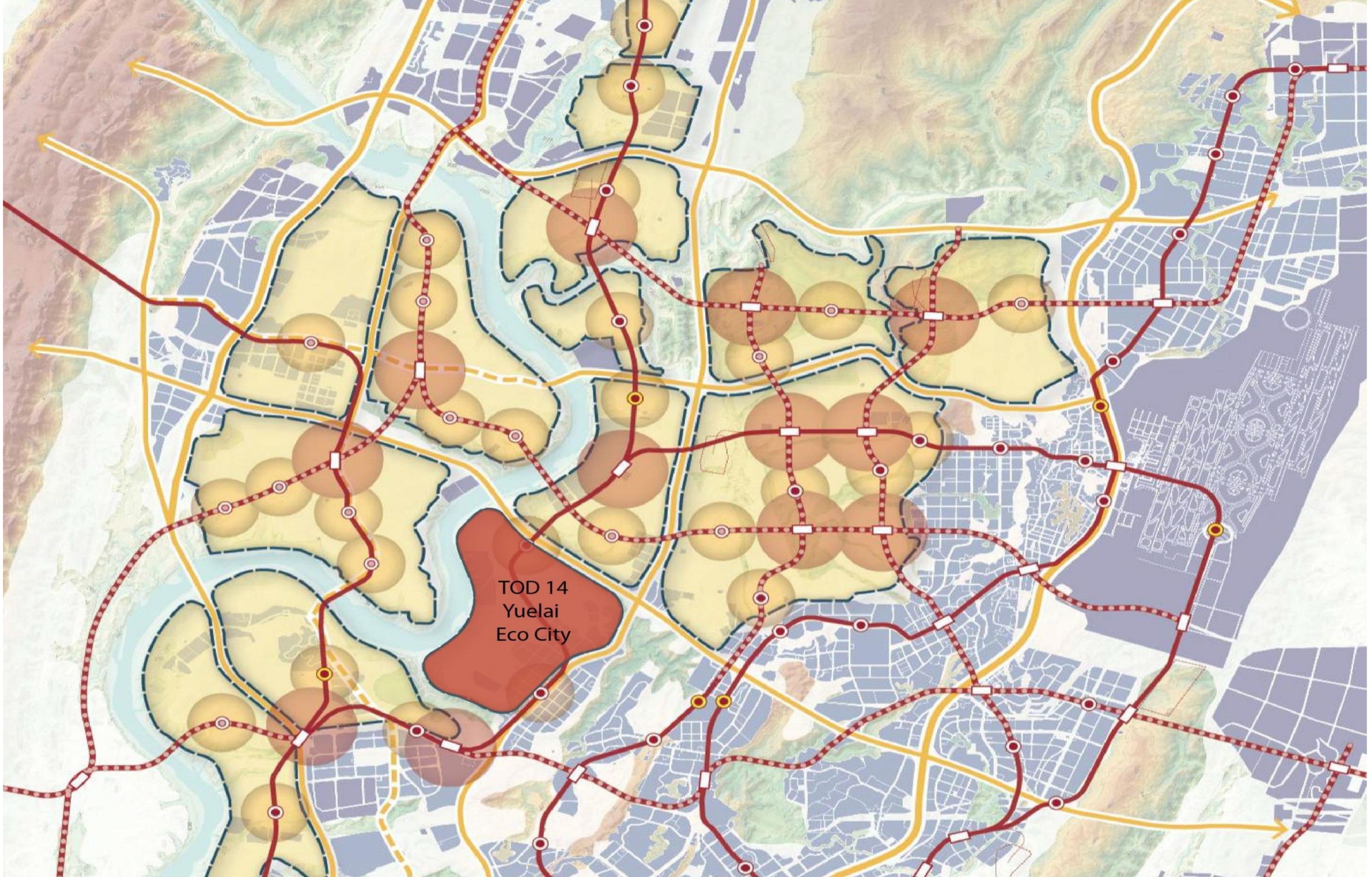


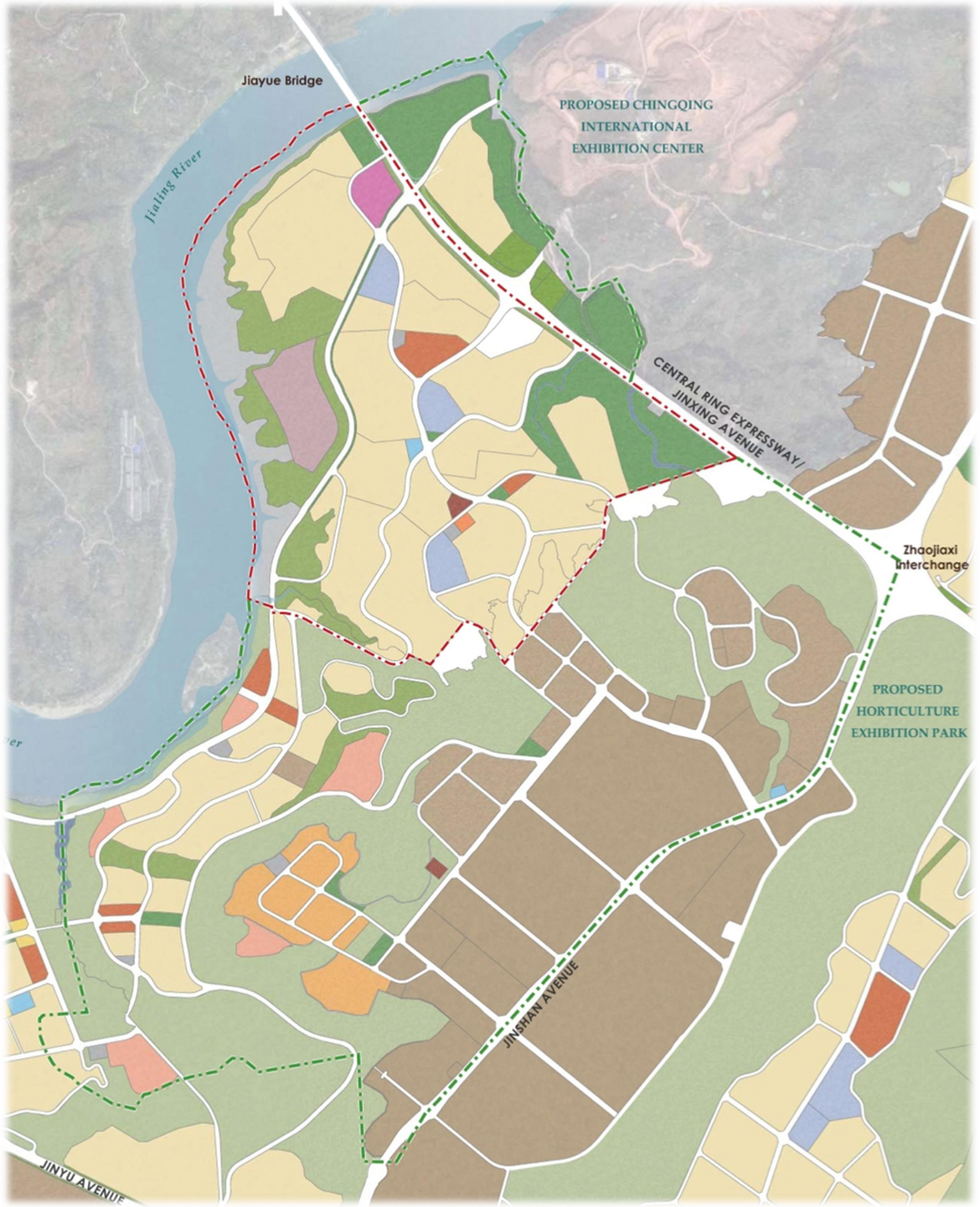

D Zoning for mixed-use with 'Small Blocks'
C Developing a new Circulation System
B Concentrating density at Transit Stations
A Locating Transit Oriented Districts
TRANSFORMATION OF A SUPERBLOCK PLAN

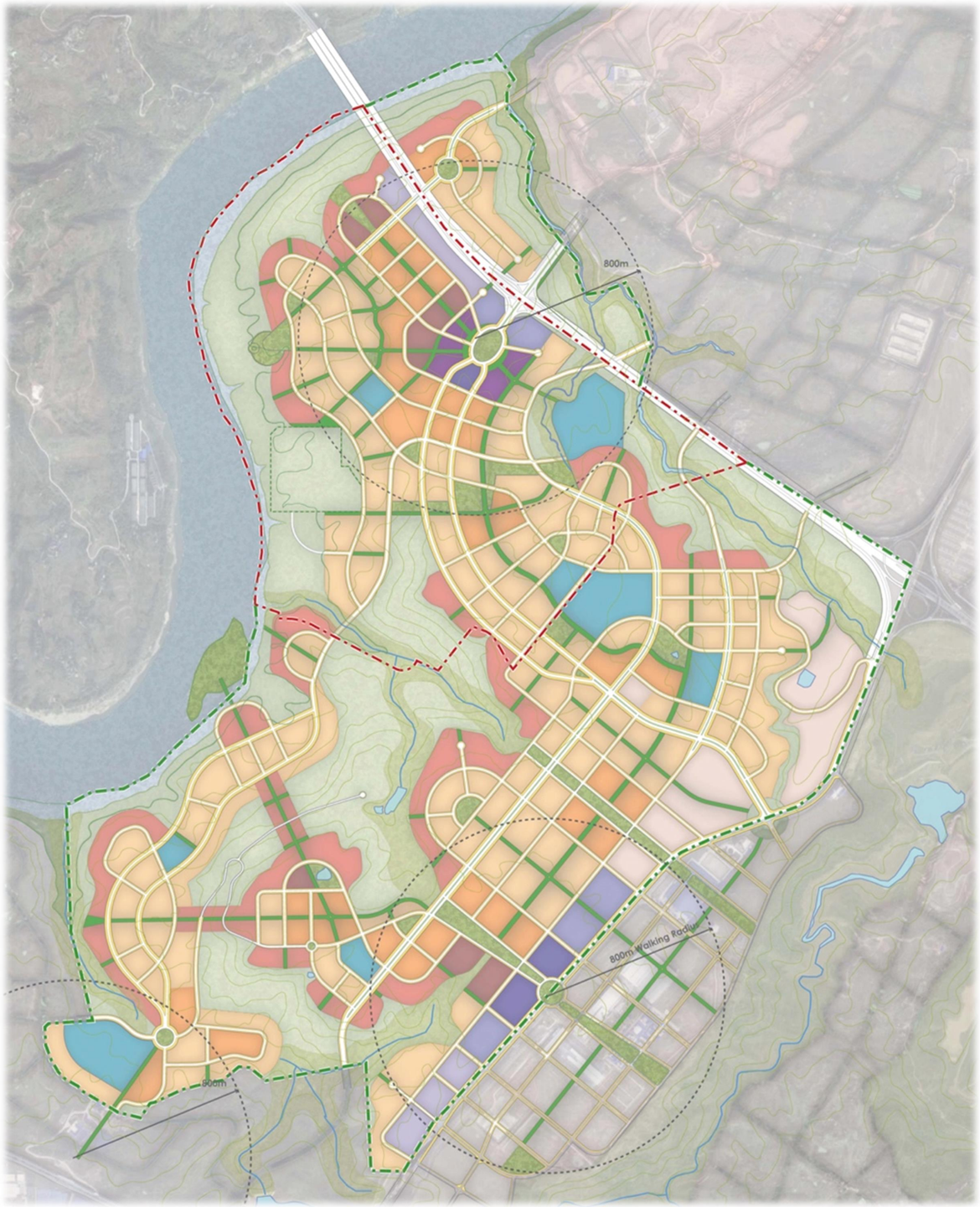

Study Area
研究区域






TOD 14
Yuelai
Eco City


Jiayue Bridge
PROPOSED CHINGQING
INTERNATIONAL
EXHIBITION CENTER
Jialing River
CENTRAL RING EXPRESSWAY/
JINXING AVENUE
Zhaojiaxi
Interchange
PROPOSED
HORTICULTURE
EXHIBITION PARK
JINSHAN AVENUE
JINYU AVENUE


800m
800m Walking Radius
800m

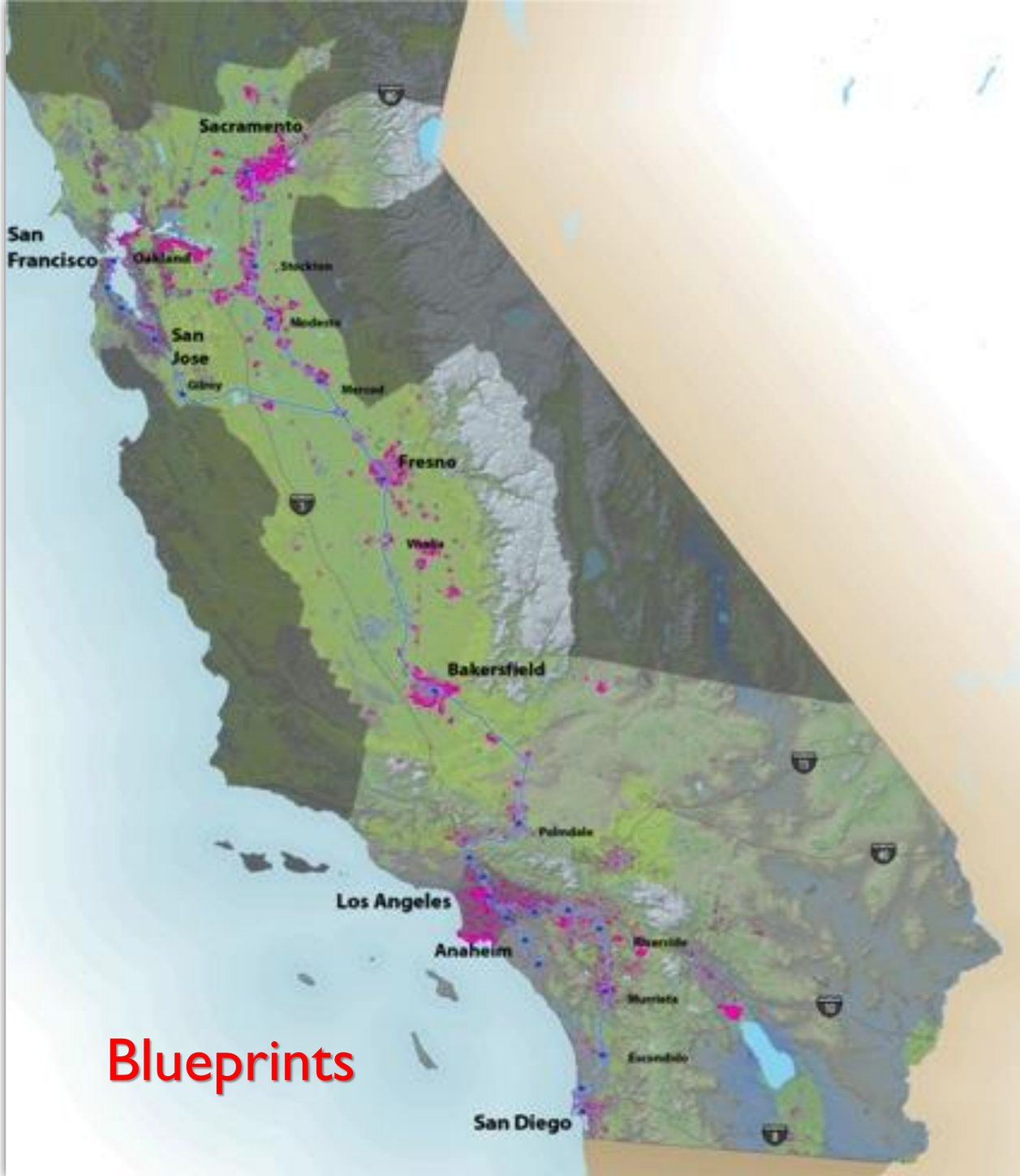
HIGH INCOME SPRAWL

USA

(Image source: Fast Company)

Vision California

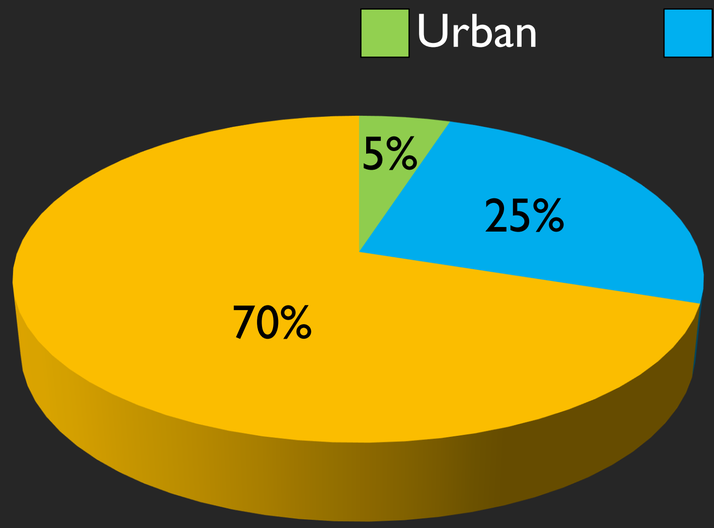
Trend



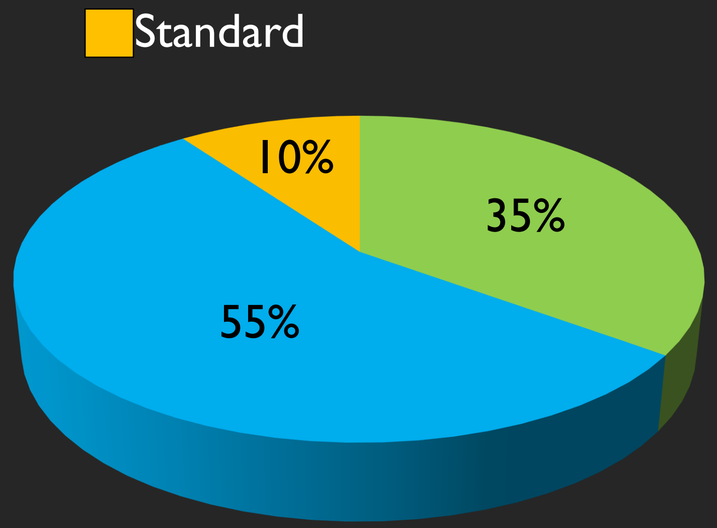
Blueprints

California Rapid Fire Scenarios

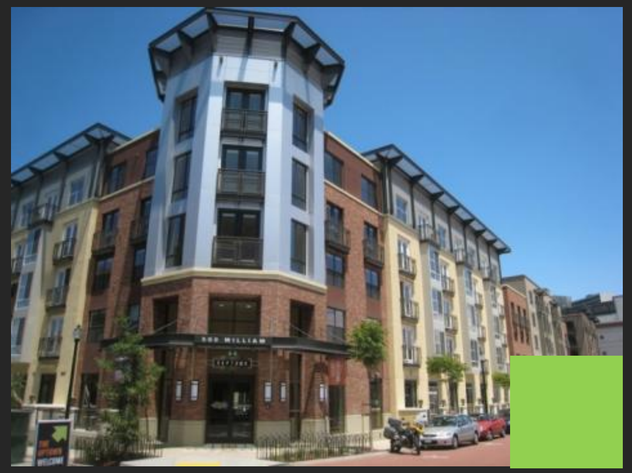
Land Use Mix for Growth Increment (2005-2050)



Business As Usual



Growing Smart



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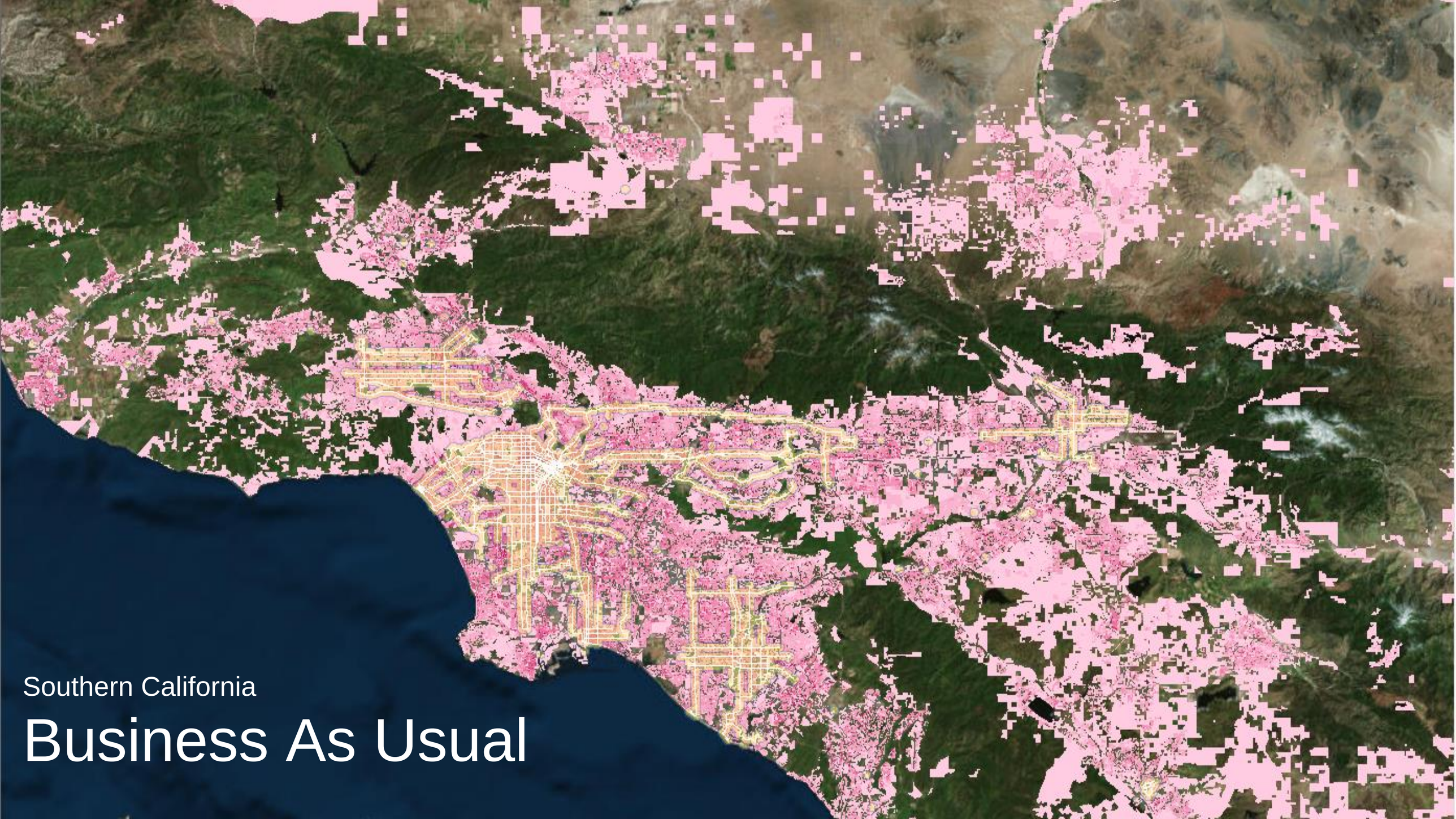
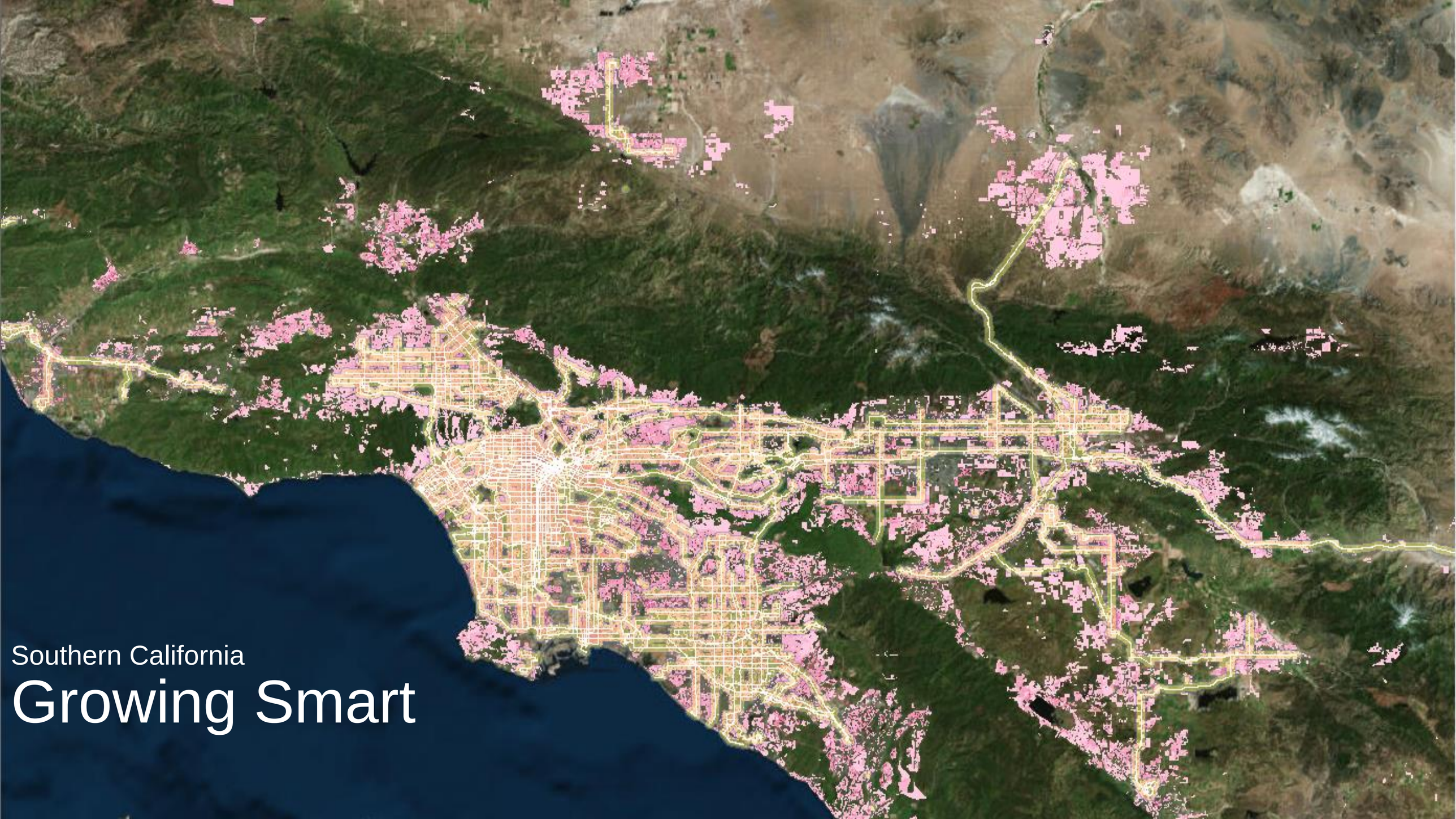


Southern California

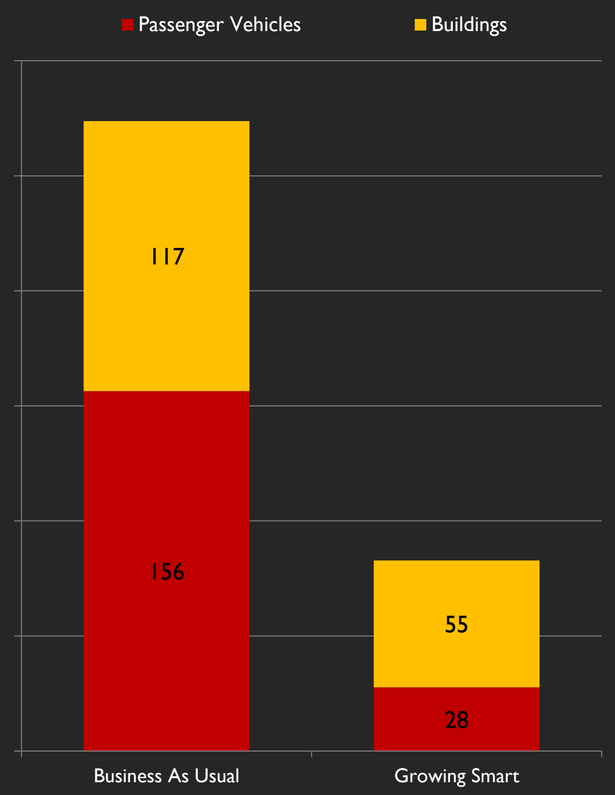
Business As Usual


Southern California
Growing Smart

Greenhouse Gas Emissions

Annual in 2050

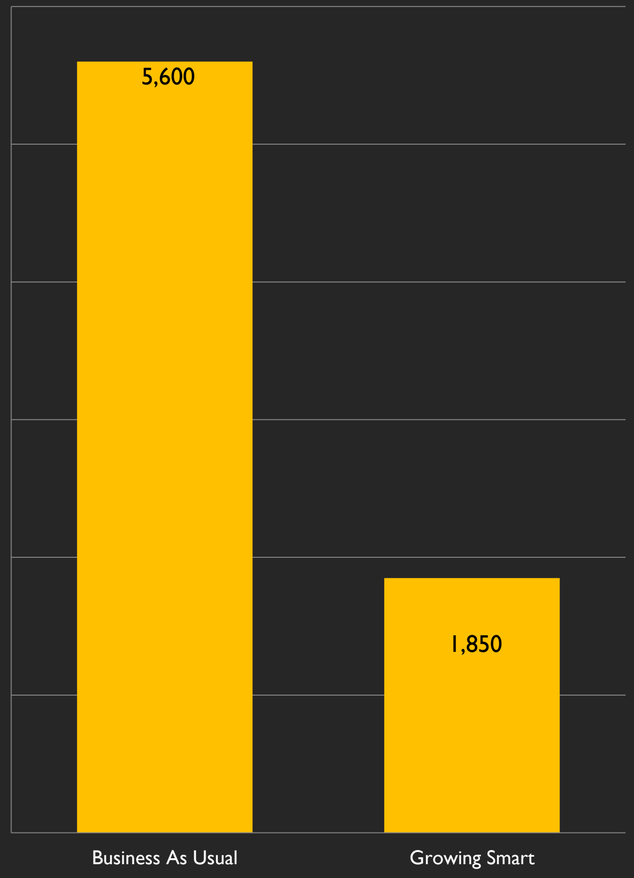
Equal to Emissions offset of a forest covering more than 1/2 of California.



Land Consumed

For New Growth to 2050 (mi²)

More land than Delaware and Rhode Island combined



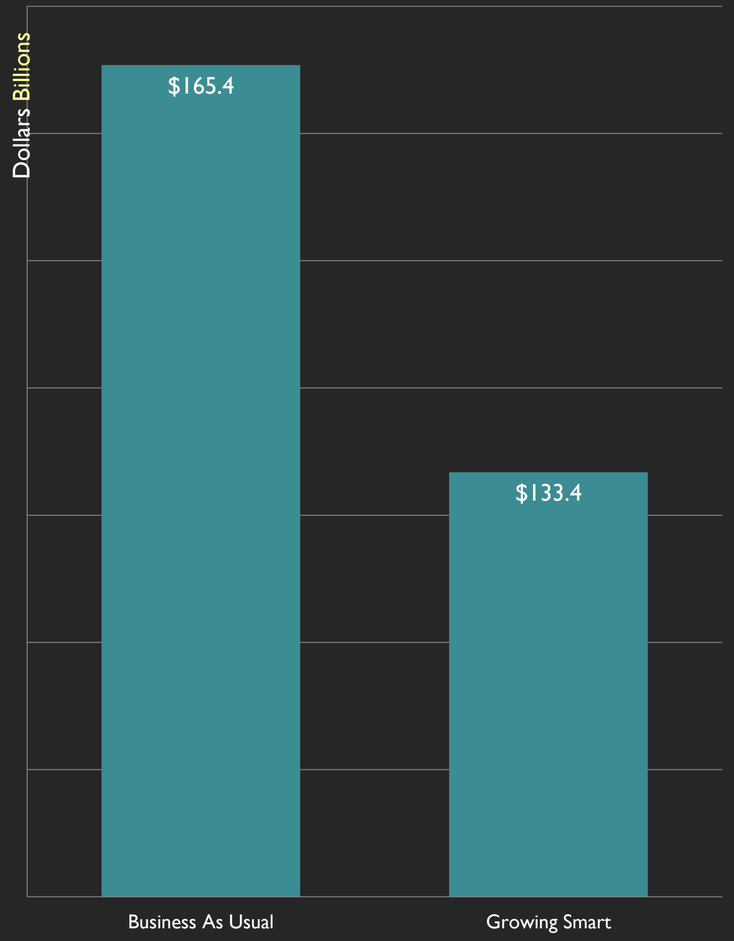
Infrastructure Cost for New Growth

Capital Costs for New Growth to 2050

$4,000 Saved per New Housing Unit : $710 Million/Year

Flickr: sl-engineer

*Includes local roads, waste water and sanitary sewer, water supply, and parks & recreation

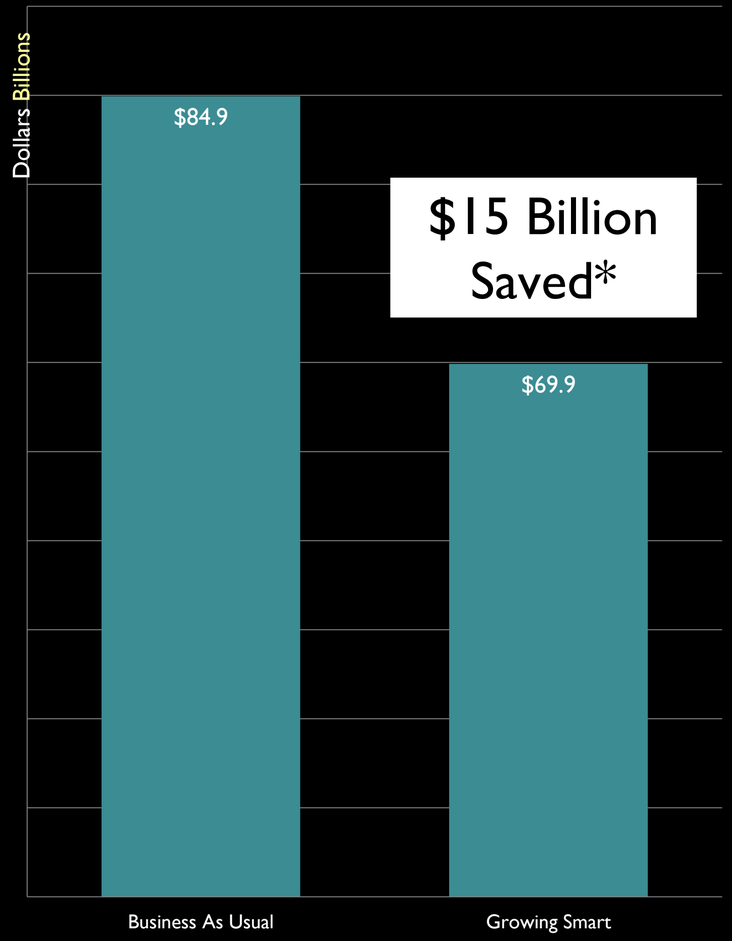


O&M Costs for New Growth

Engineering & Public Works Costs for New Growth to 2050

$15 Billion Saved : $334 Million Per Year

Flickr: watchlooksee



*Includes City General Fund engineering and public works functions

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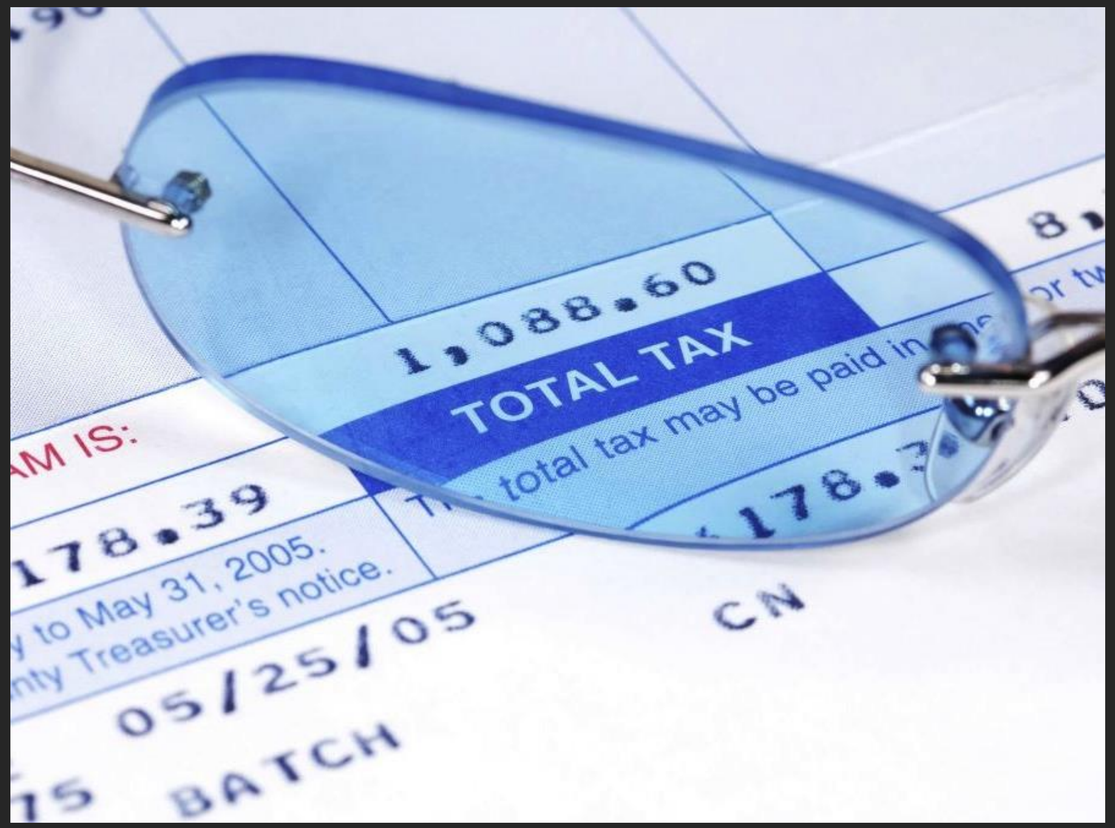
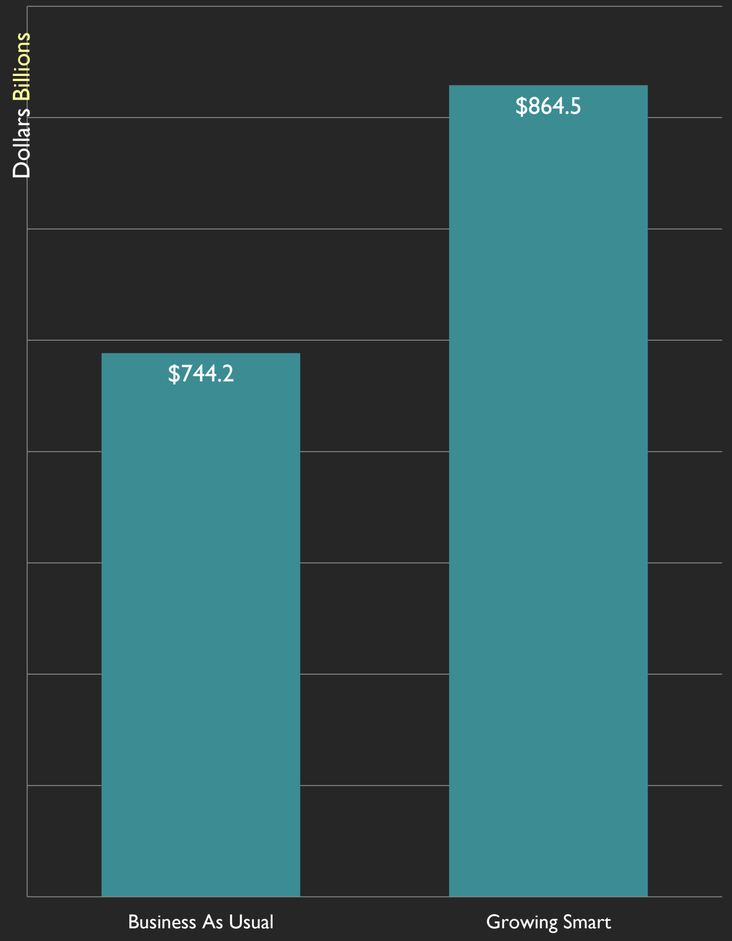
Revenues from New Growth

City Tax and Fee Revenue from New Growth to 2050

$2.7 Billion/Year in Additional Revenue to Cities



www.livinginplainfield.com



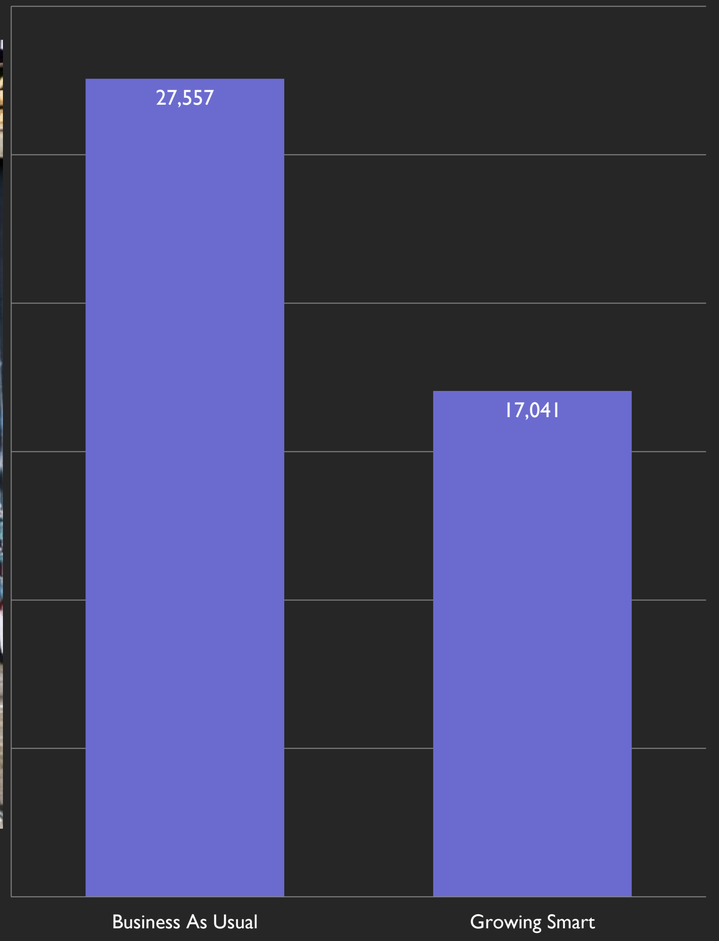
*Includes City revenues from Vehicle License Fees, Property Tax, and Sales Tax

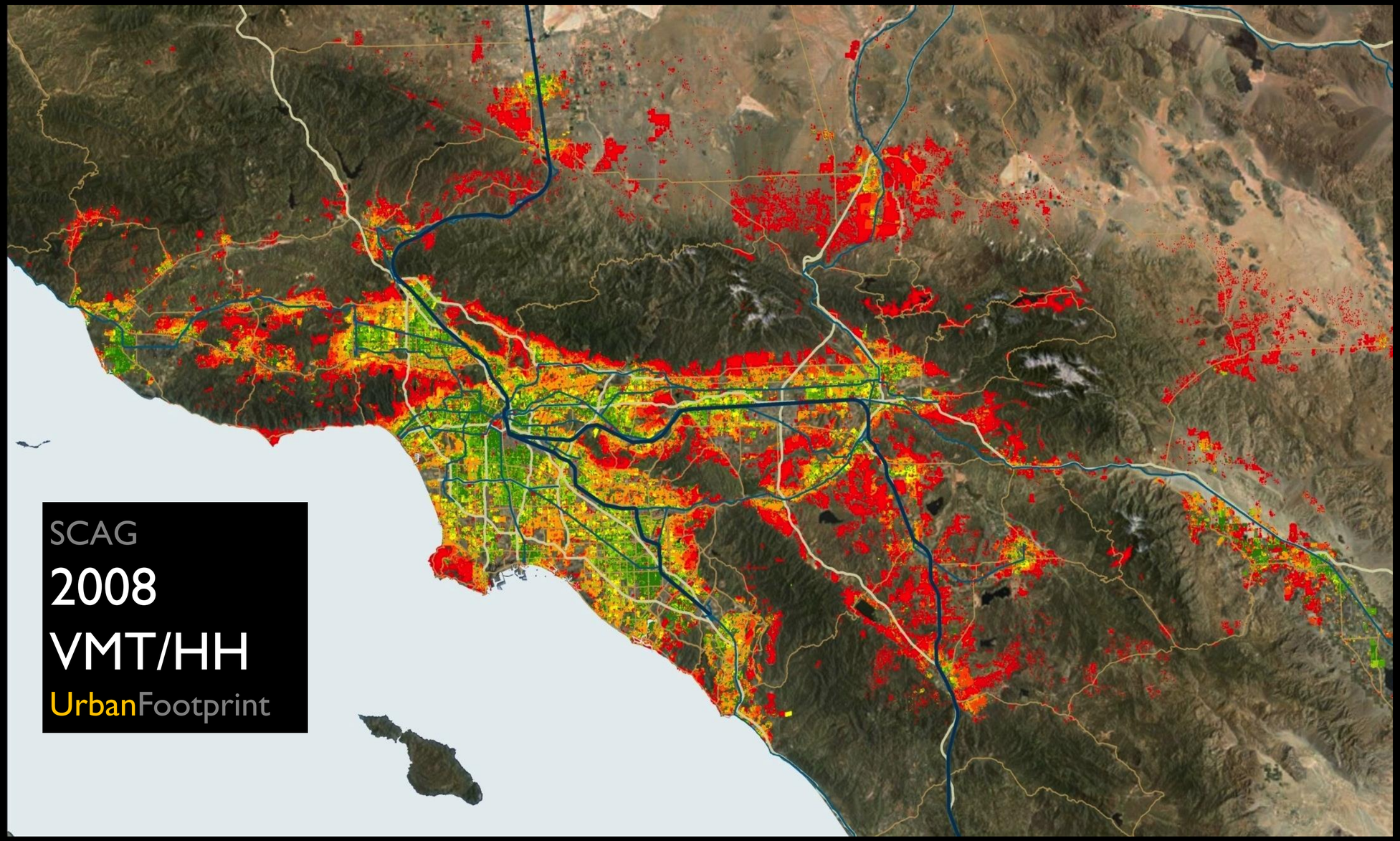
Vehicle Miles Traveled (VMT)

Miles Per Household in 2050

10,500 Fewer Miles Per Household

Flickr: trash-photography





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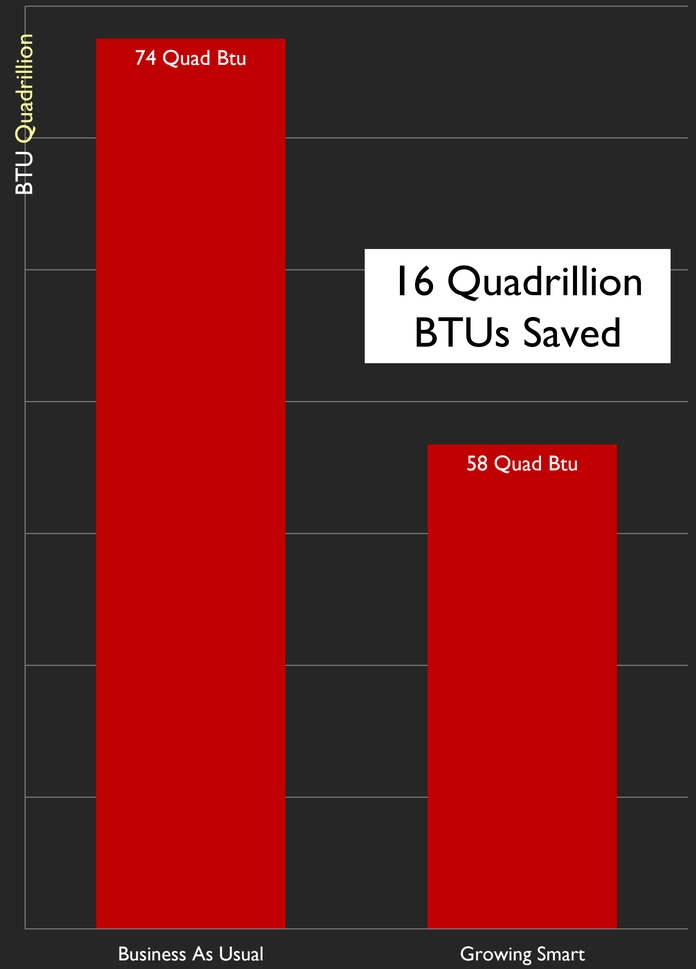
Building Energy

Cumulative to 2050

Would Power ALL Homes in California for 20 Years

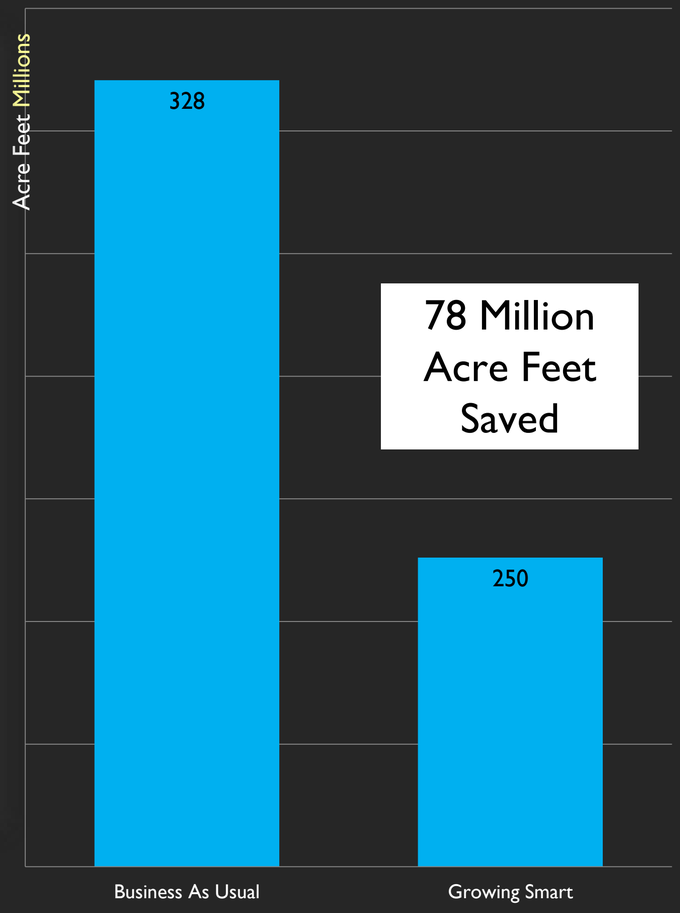
Flickr: arbyreed



Residential Water Use

Cumulative to 2050

Water Savings Could Fill the San Francisco Bay 15 Times

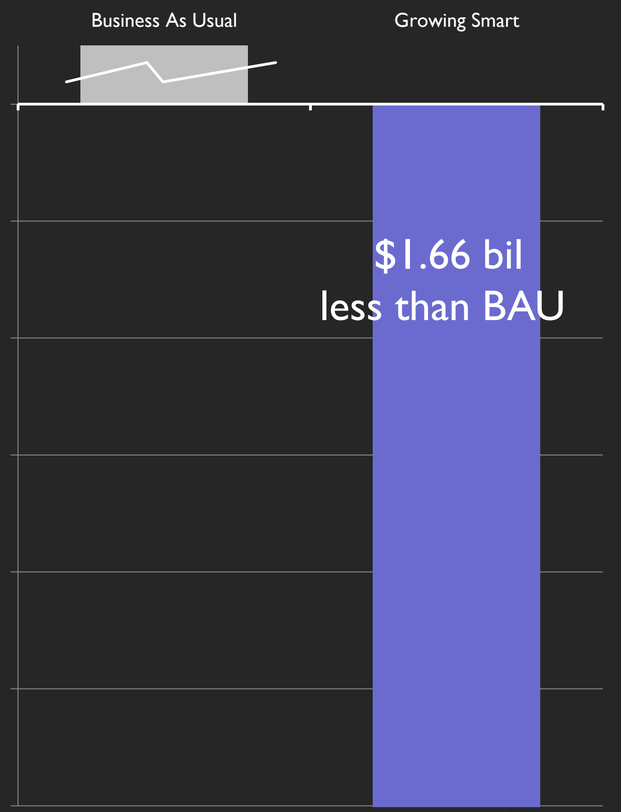


Respiratory Health Costs

Total Annual in 2035

Saves $1.66 billion annually by 2035

Flickr: Lance Page



Based on Analysis of Vision CA Results by TIAX, LLC

AMERICAN LUNG ASSOCIATION.
Fighting for Air

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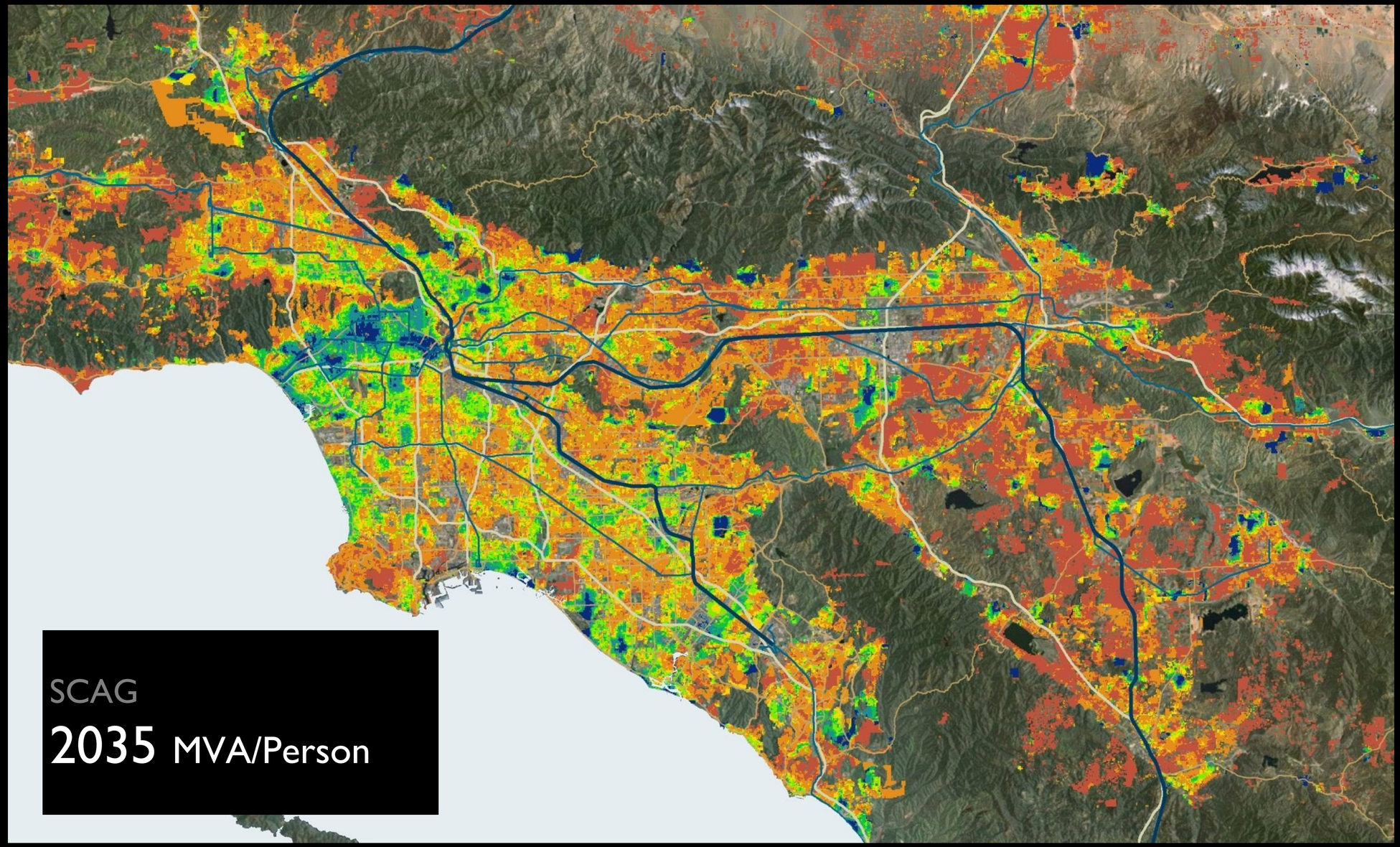
Activity-Related Health Indicators

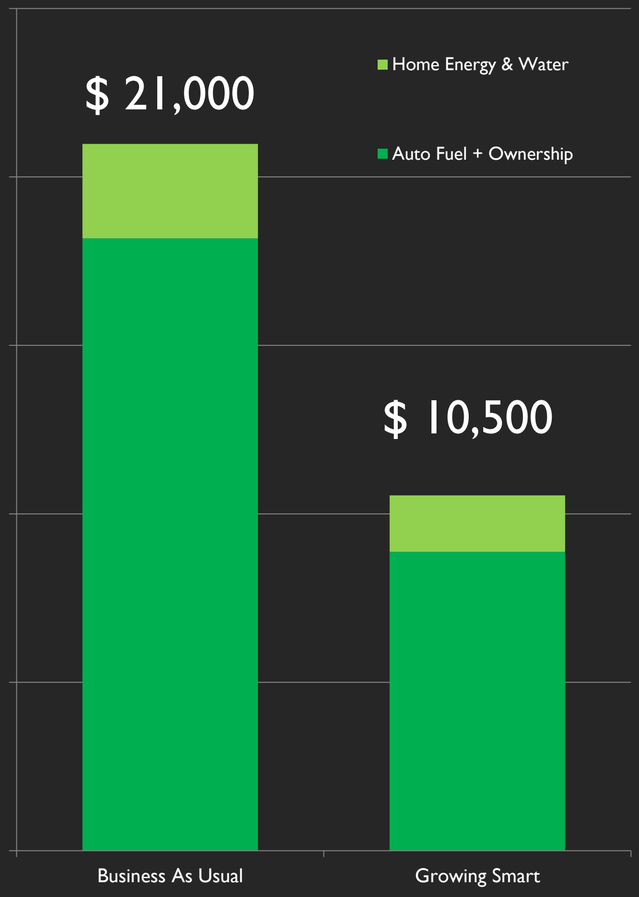


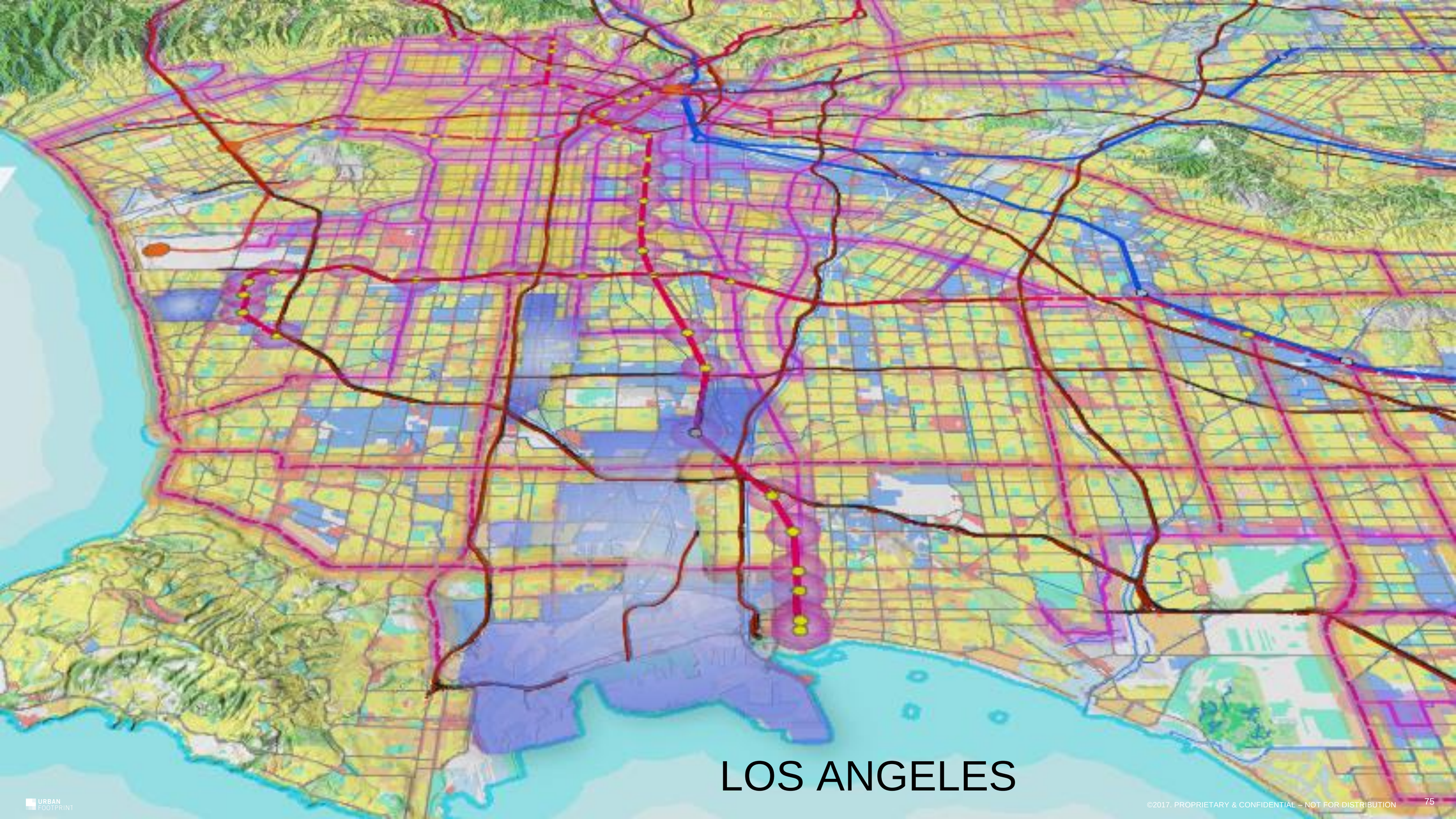
Annual Household Costs

Per Household Annual in 2050

$10,500 Savings Per Household in 2050

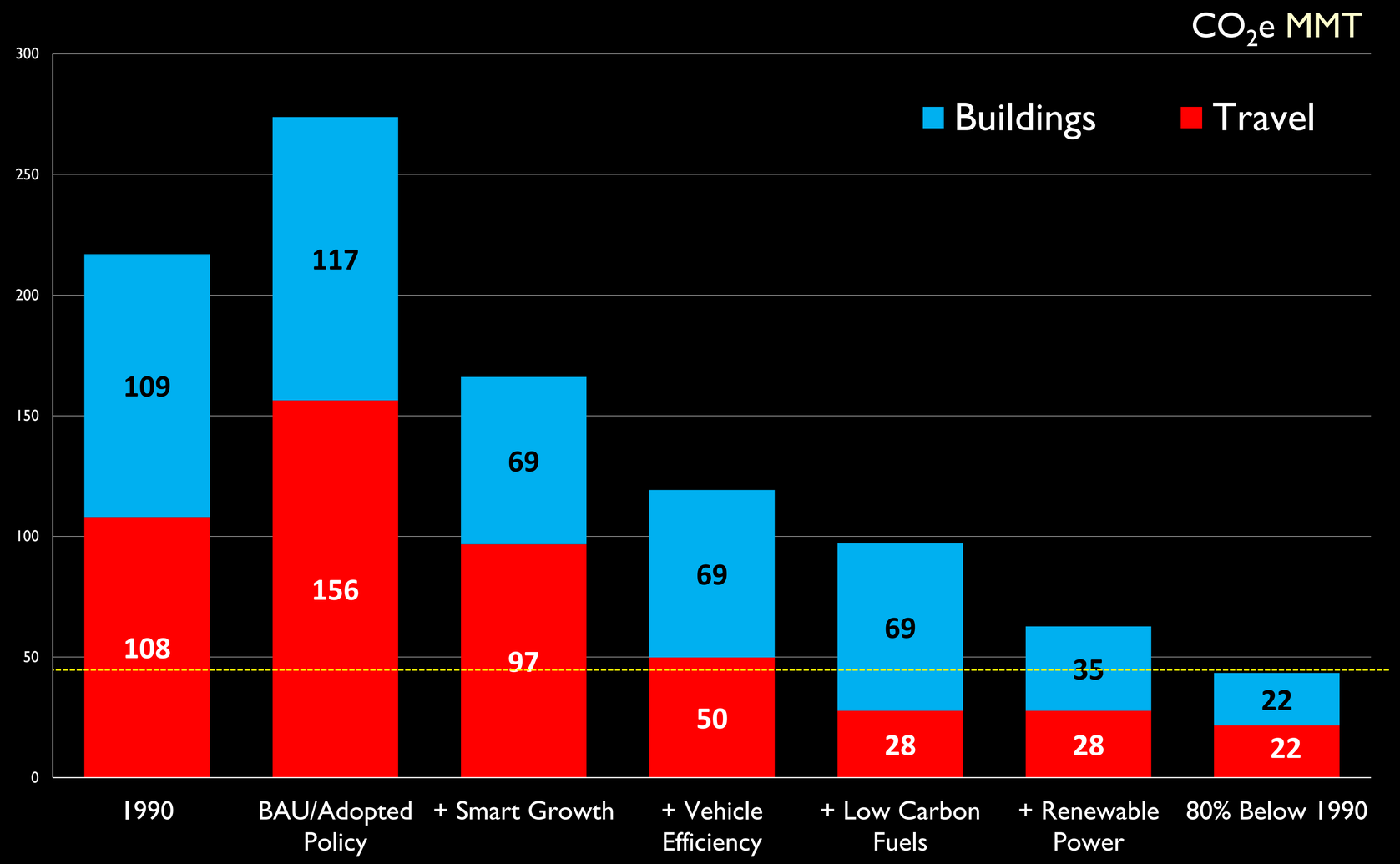
Flickr: Diablo_Solar





California 2050 GHG Emissions

Getting to 80% Below 1990



UF

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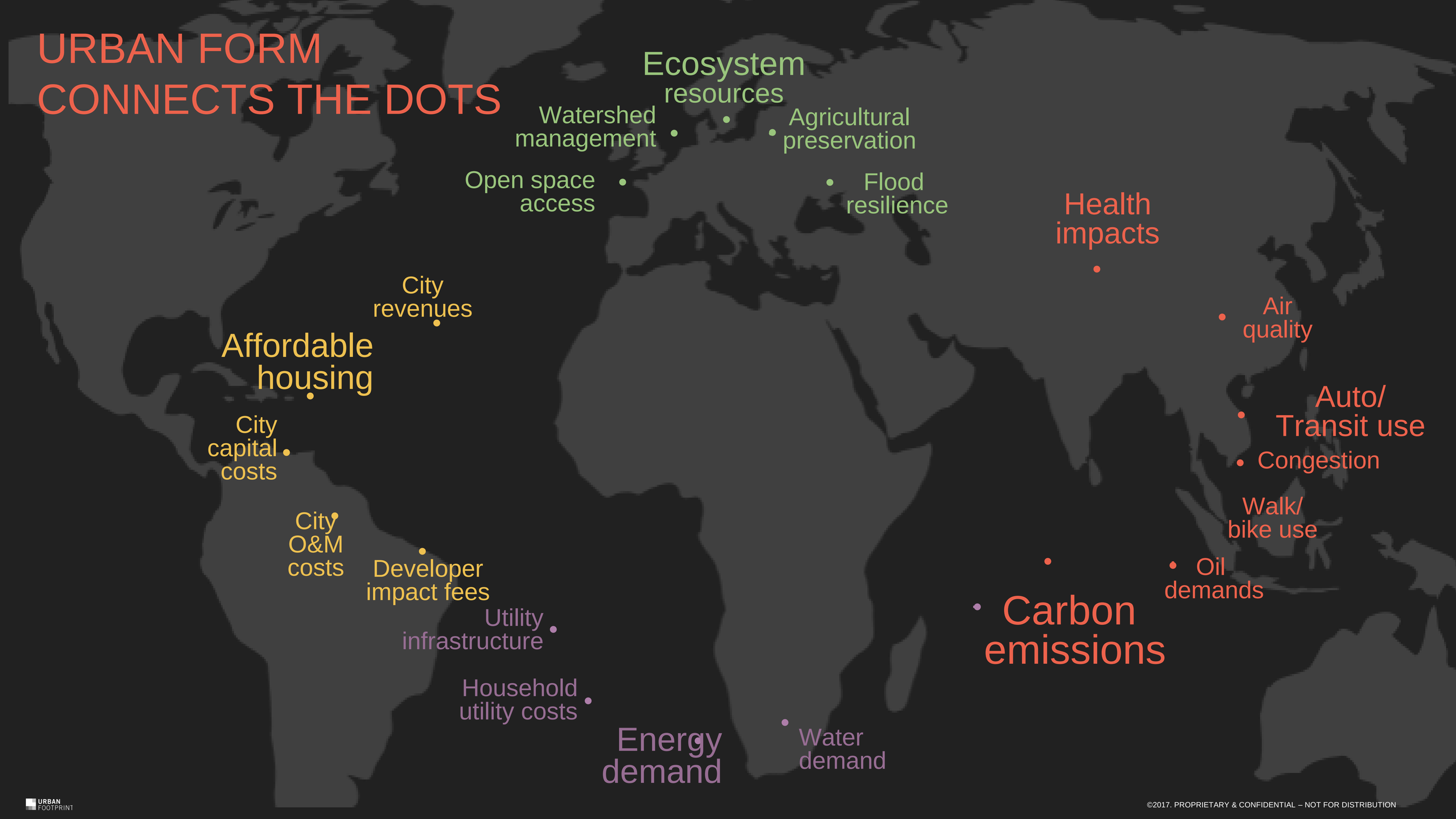
Data is Key to Intelligent Urban Futures

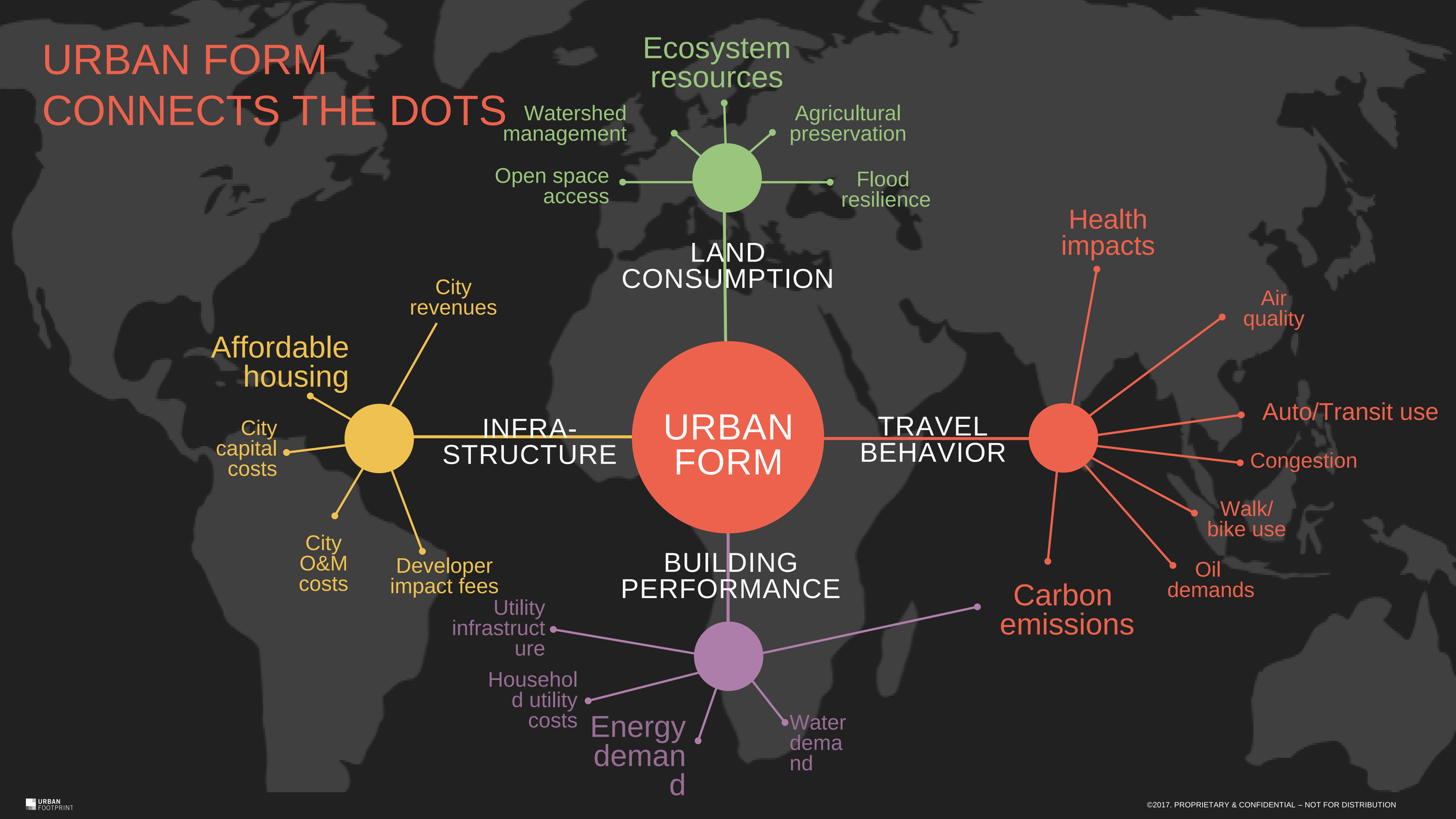
Multimeric Analytics Reveal Co-Benefits

URBAN FORM CONNECTS THE DOTS



URBAN FOOTPRINT

URBAN FORM CONNECTS THE DOTS



URBAN FOOTPRINT