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2-26-2016

# Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment?

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*Arizona State University*

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PRESENTATION TO:

Portland State University

26 February 2016

# Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment?

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ARIZONA STATE UNIVERSITY

[HTTP://WWW.TRANSPORTATIONLCA.ORG/LOSANGELESPARKING/](http://www.transportationlca.org/losangelesparking/)

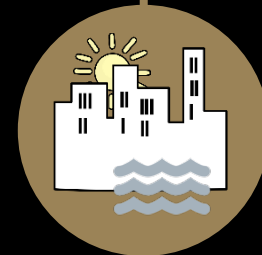
TRANSPORTATION  
LIFE-CYCLE  
ASSESSMENT



INFRASTRUCTURE  
& CLIMATE  
CHANGE

INFRASTRUCTURE  
GROWTH

ROADWAYS  
BUILDINGS  
PARKING





# TRANSPORTATION LIFE-CYCLE ASSESSMENT



# Life Cycle Assessment

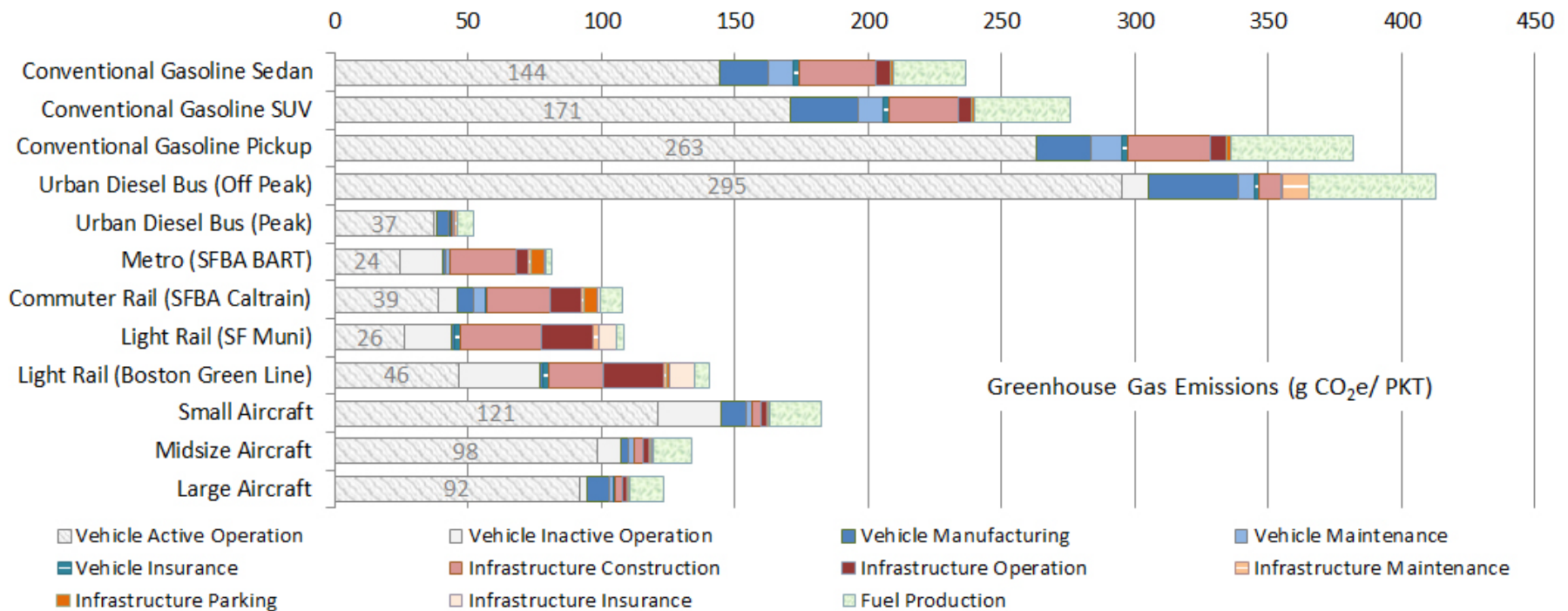
**VEHICLES**  
(Manufacturing &  
Maintenance)

**INFRASTRUCTURE**  
(Construction,  
Maintenance,  
Rehabilitation, &  
Operation)

**ENERGY  
PRODUCTION**  
(Primary fuel  
extraction,  
Processing, &  
Transport)

**SUPPLY CHAINS**

# Life-cycle Assessment



M Chester & A Horvath, 2009, Environmental Assessment of Passenger Transportation Should Include Infrastructure & Supply Chains, Environmental Research Letters 4, <http://dx.doi.org/10.1088/1748-9326/4/2/024008>



# US PARKING INFRASTRUCTURE





250 million vehicles in the U.S.

99% of trips start or end with free parking

Vehicles spend 95% of lives parked

# The U.S. Parking Space Inventory

## Scenario 1

+ known metered

**105 million**

## Scenario 2

+ known metered  
+ 1 home  
+ 1 work  
+ zoning ft<sup>2</sup>  
requirements

**730 million**

## Scenario 3

+ known metered  
+ 1 home  
+ 1 work  
+ zoning ft<sup>2</sup>  
requirements  
+ onstreet

**820 million**

## Scenario 4

+ 4 spaces/car  
(urban)  
+ 2.2  
spaces/car  
(rural)

**840 million**

## Scenario 5

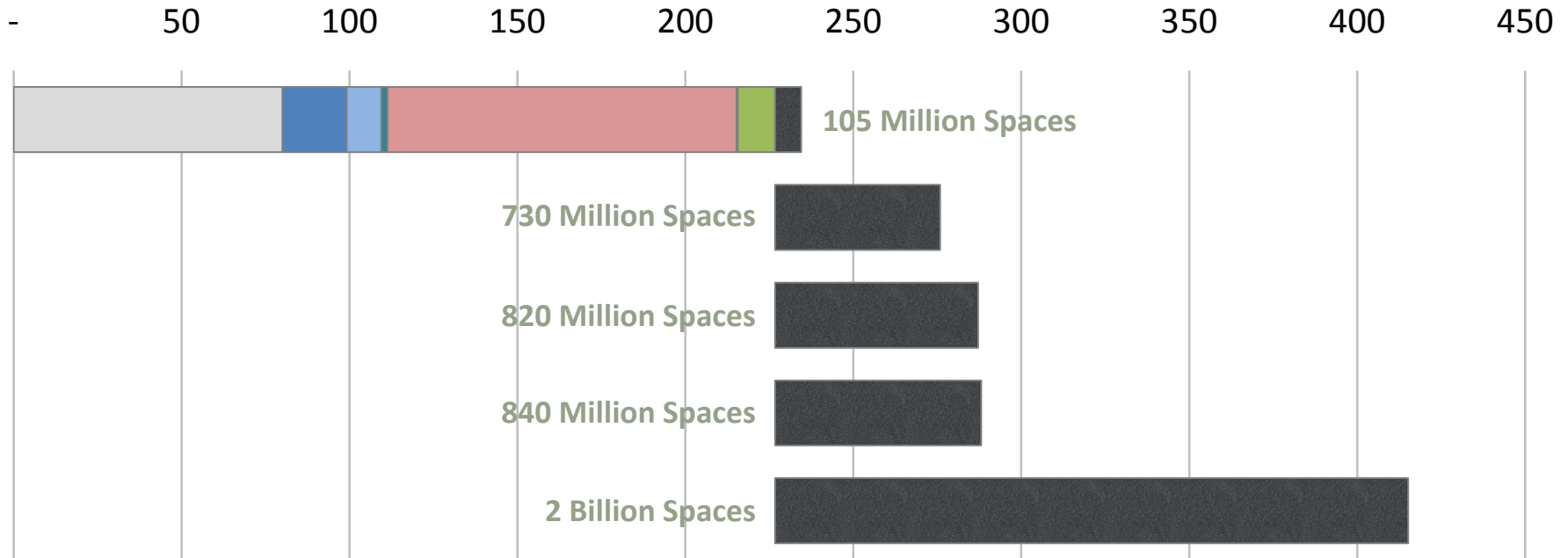
+ 8 spaces/car

**2 billion**

**1.4 billion**

# Embedded Air Emissions: PM<sub>10</sub>

## Sedan PM<sub>10</sub> Emissions in mg per Passenger Mile Traveled



- Vehicle Active Operation
- Vehicle Maintenance
- Infrastructure Operation
- Infrastructure Parking

- Vehicle Inactive Operation
- Vehicle Insurance
- Infrastructure Maintenance

- Vehicle Manufacturing
- Infrastructure Construction
- Fuel Cycle

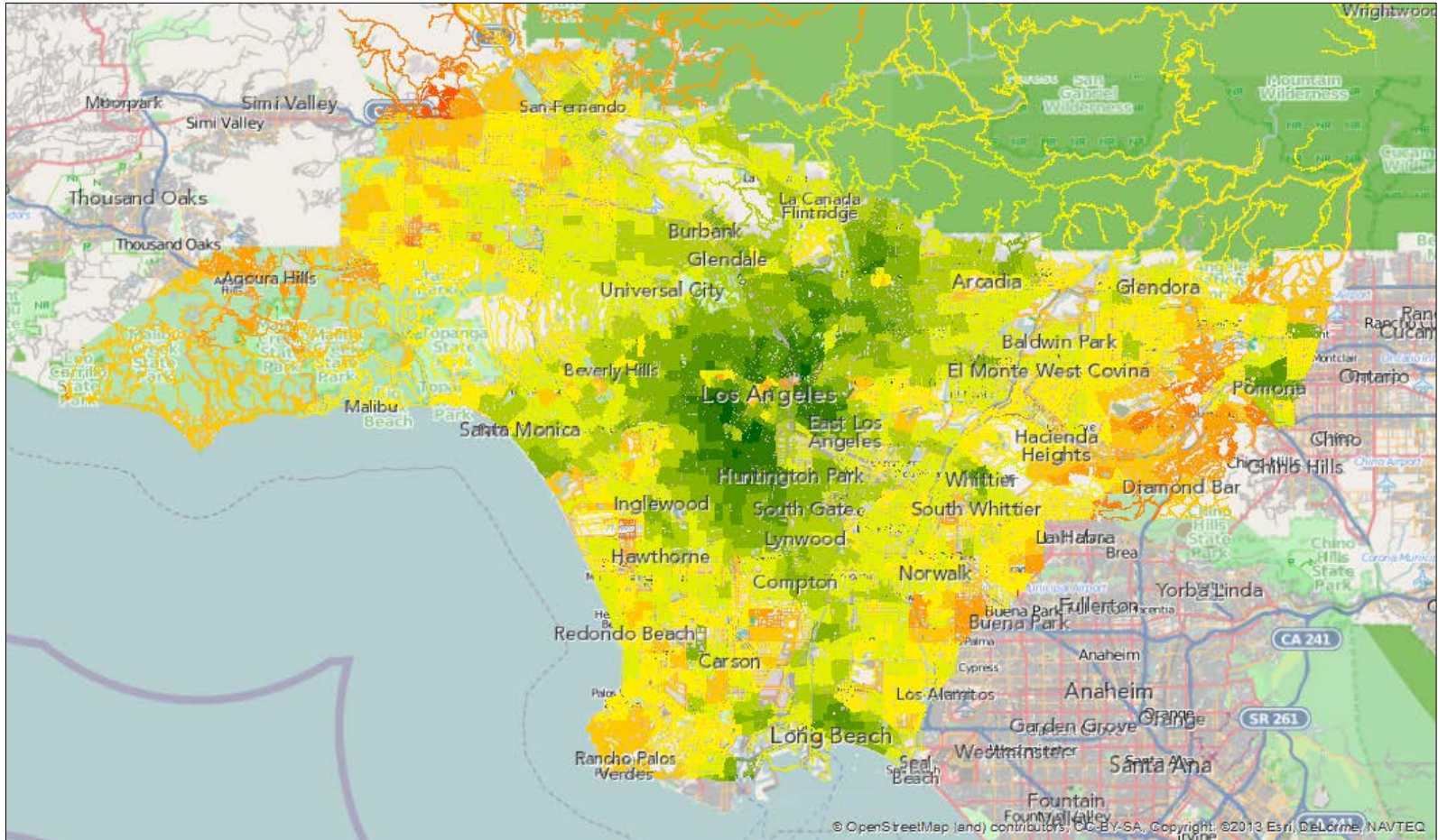




# INFRASTRUCTURE GROWTH



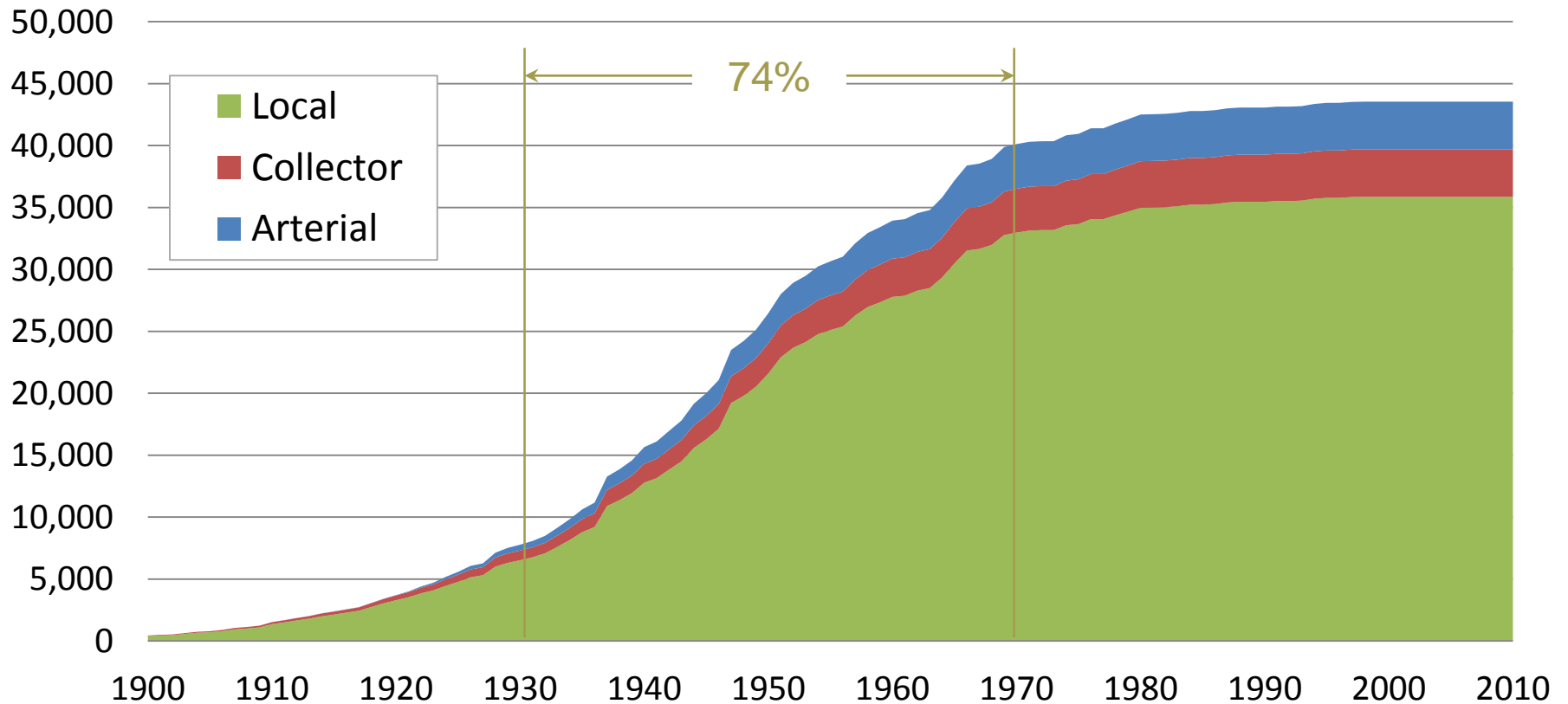
# Transportation: Network Growth



Environmental and Economic Consequences of Permanent Roadway Infrastructure Commitment: City Road Network Life-cycle Assessment and Los Angeles County, A Fraser and M Chester, ASCE Journal of Infrastructure Systems, Expected 2016, Volume and Issue Forthcoming, doi: 10.1061/(ASCE)IS.1943-555X.0000271



# Cumulative Roadway Kilometers



Environmental and Economic Consequences of Permanent Roadway Infrastructure Commitment: City Road Network Life-cycle Assessment and Los Angeles County, A Fraser and M Chester, ASCE Journal of Infrastructure Systems, Expected 2016, Volume and Issue Forthcoming, doi: 10.1061/(ASCE)IS.1943-555X.0000271



# PARKING INFRASTRUCTURE LOS ANGELES



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Civil, Environmental and Sustainable Engineering  
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**Juan Matute**

Associate Director  
UCLA Lewis Center and the Institute of Transportation Studies  
University of California Los Angeles



**Ram Pendyala**

Professor  
Civil and Environmental Engineering  
Georgia Institute of Technology

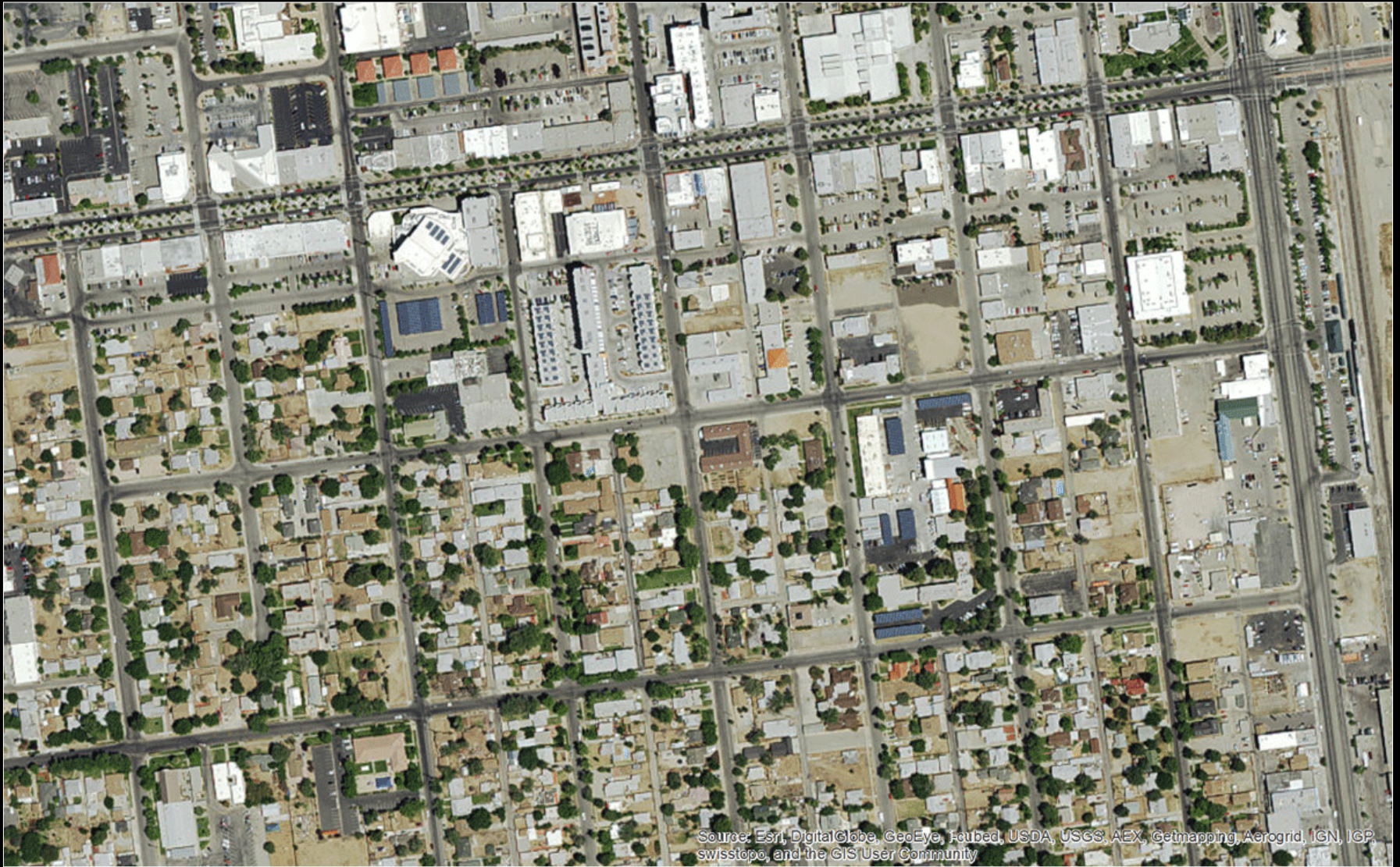


**Carolyn Flower**

Undergraduate Researcher  
Civil, Environmental and Sustainable Engineering  
Arizona State University



# OFFSTREET



Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

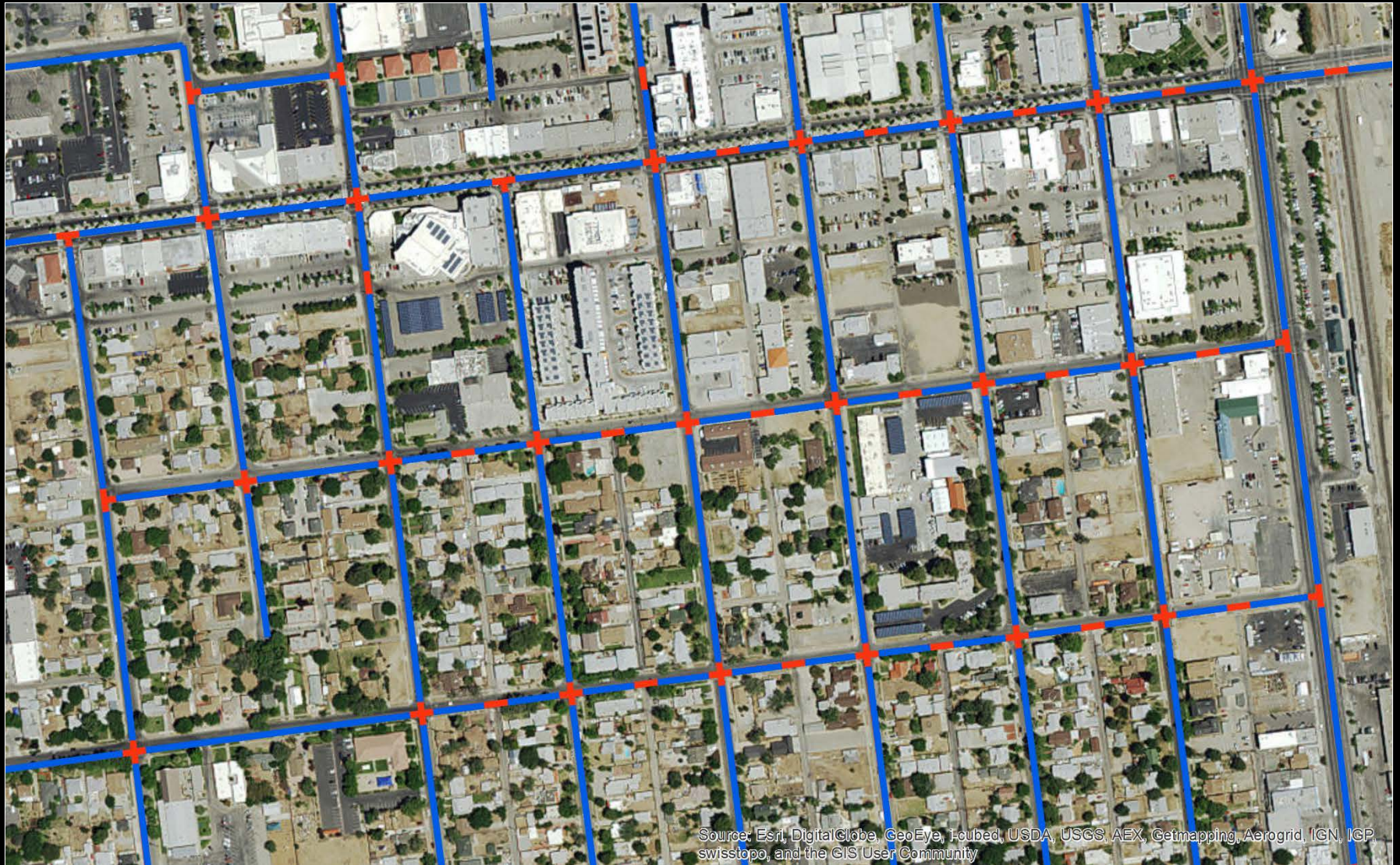


Property use	Pre-1936	1936–1960	Post-1960
<b>RESIDENTIAL</b>			
Single-family home	1 per DU	2 per DU	3 per DU
Condominium	0	DU≤10 then 1 per DU, DU>10 then 1.25 per DU	DU≤10 then 2 per DU, DU>10 then 2.5 per DU
Duplex (2 DU)	0	1 per DU	2 per DU
Duplex (3–4 DU)	1 per DU	1.5 per DU	2 per DU
Duplex (5+ DU)	0.5 per DU	1 per DU	1.5 per DU
Manufactured home	1.5 per DU	1.5 per DU	1.5 per DU
Mobile home	1 per DU	1.5 per DU	2 per DU
Apartment	0	1 per DU	2 per DU
<b>NONRESIDENTIAL</b>			
Animal kennel, auto service centers, banks and service shops, department store, supermarkets, miscellaneous commercial, mortuary, neighborhood shopping, regional shopping, retail store, service station, film/television/radio, nursery/greenhouse	1 per 500 sq. ft.	1 per 500 sq. ft.	1 per 250 sq. ft.
Art centers, museums, theatres, entertainment, library, churches, community facilities, social clubs	1 per 70 sq. ft.	1 per 70 sq. ft.	1 per 35 sq. ft.
Bowling center	30	30	45
Fast food	1 per 70 sq. ft.	1 per 70 sq. ft.	1 per 33 sq. ft.
Heavy industrial, light manufacturing, utility government building, hotels, motels, rooming house, senior car facility, hotels, motels, rooming house, senior car facility	1 per 1,000 sq. ft.	1 per 1,000 sq. ft.	1 per 500 sq. ft.
Office, high-rise office, wholesale outlet	1 per 800 sq. ft.	1 per 800 sq. ft.	1 per 400 sq. ft.
Medical facilities	1 per 400 sq. ft.	1 per 400 sq. ft.	1 per 200 sq. ft.
Parking lot/structure	1 per 330 sq. ft.	1 per 330 sq. ft.	1 per 330 sq. ft.
Restaurant, bar, skating rink	1 per 200 sq. ft.	1 per 200 sq. ft.	1 per 100 sq. ft.
Warehouse	1 per 2,000 sq. ft.	1 per 2,000 sq. ft.	1 per 1,000 sq. ft.
Golf course	90	90	180
Hospital	1 per 1,200 sq. ft.	1 per 1,200 sq. ft.	1 per 600 sq. ft.
Education	1 per 2,000 sq. ft.	1 per 2,000 sq. ft.	1 per 1,000 sq. ft.
Boat slips	0.15 per Slip	0.15 per Slip	0.3 per Slip
Open storage	4+1 per 12,000 sq. ft.	4+1 per 12,000 sq. ft.	4+1 per 6,000 sq. ft.

Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, Journal of the American Planning Association, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

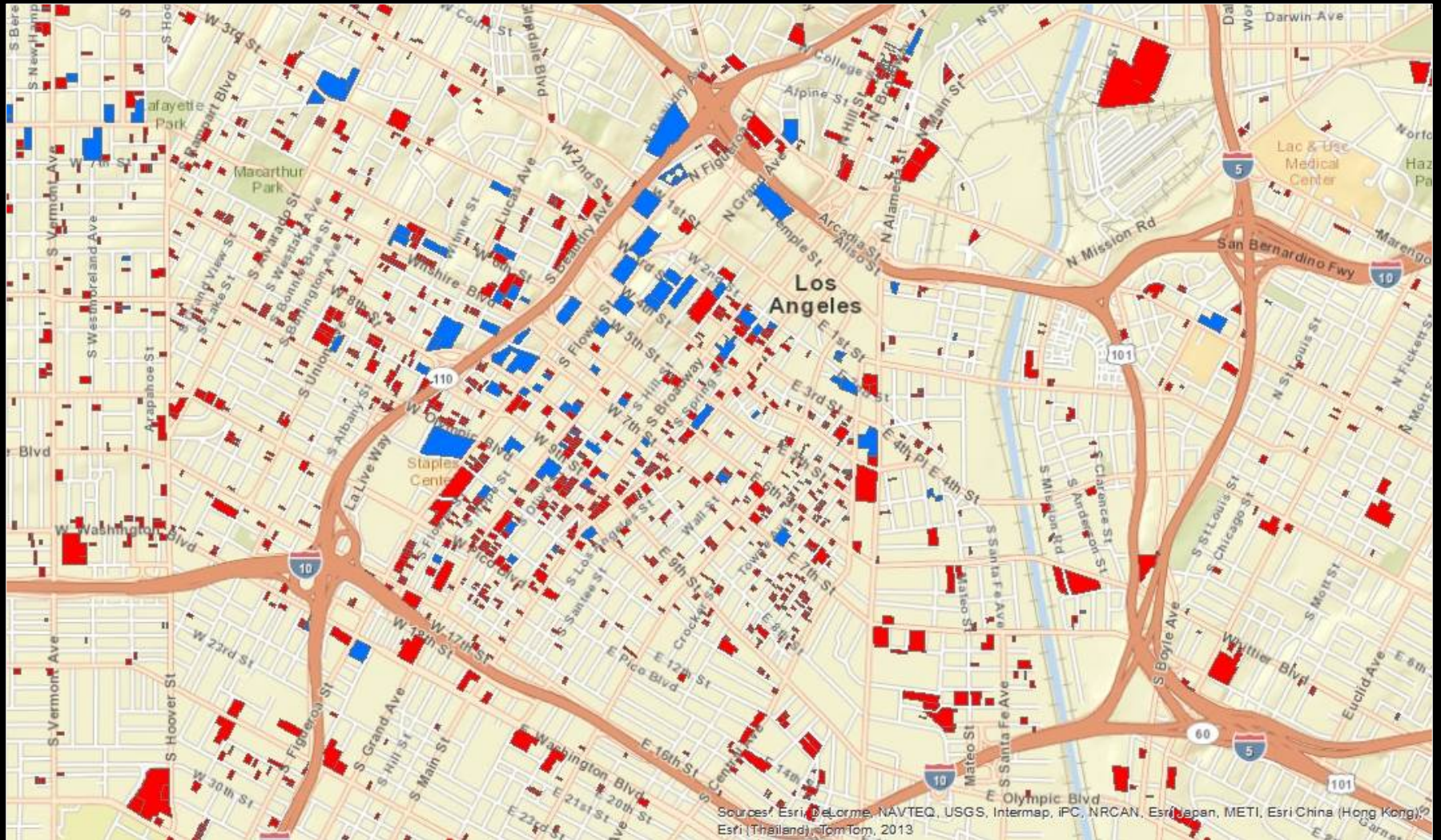


# ONSTREET

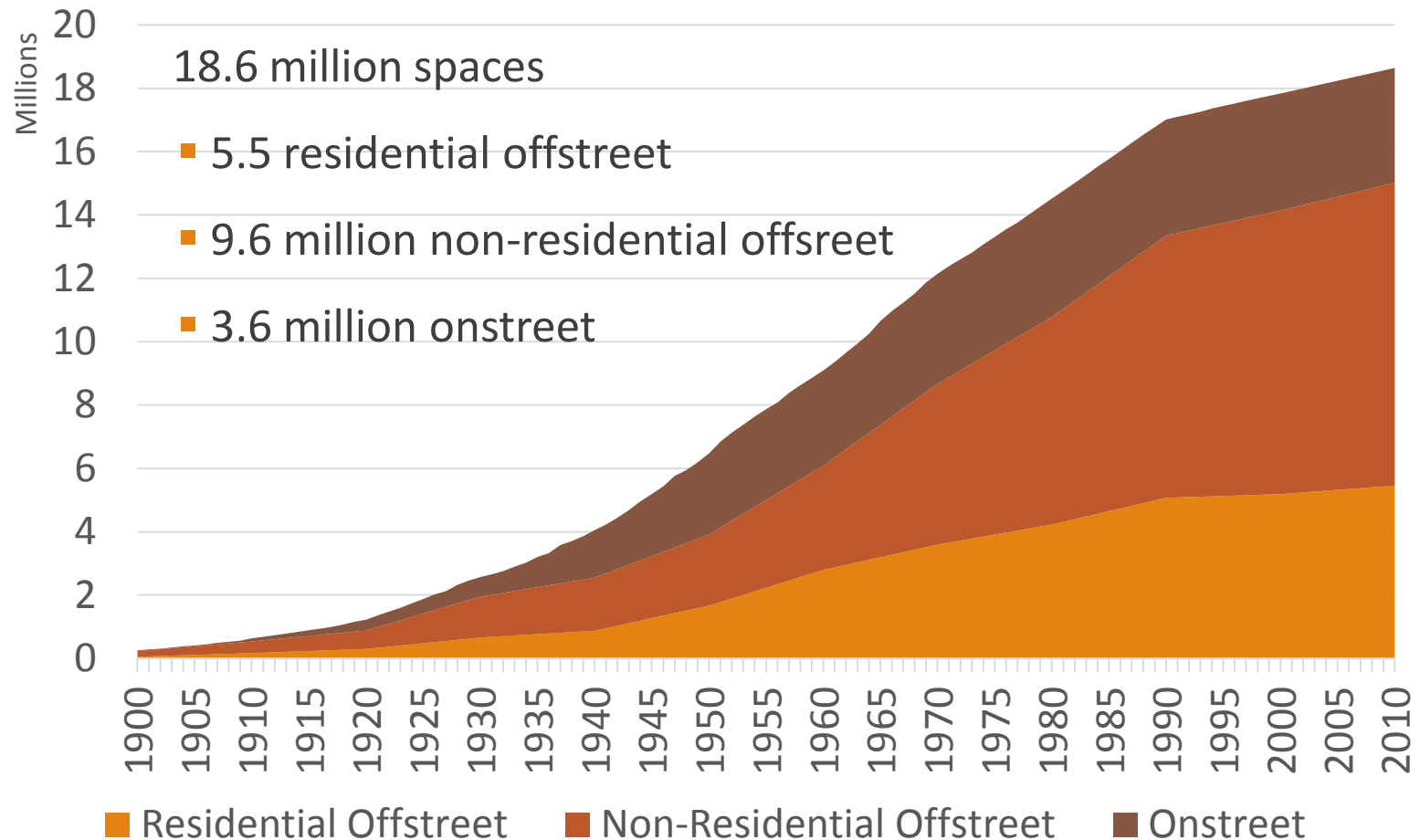




# SURFACE LOTS & STRUCTURES



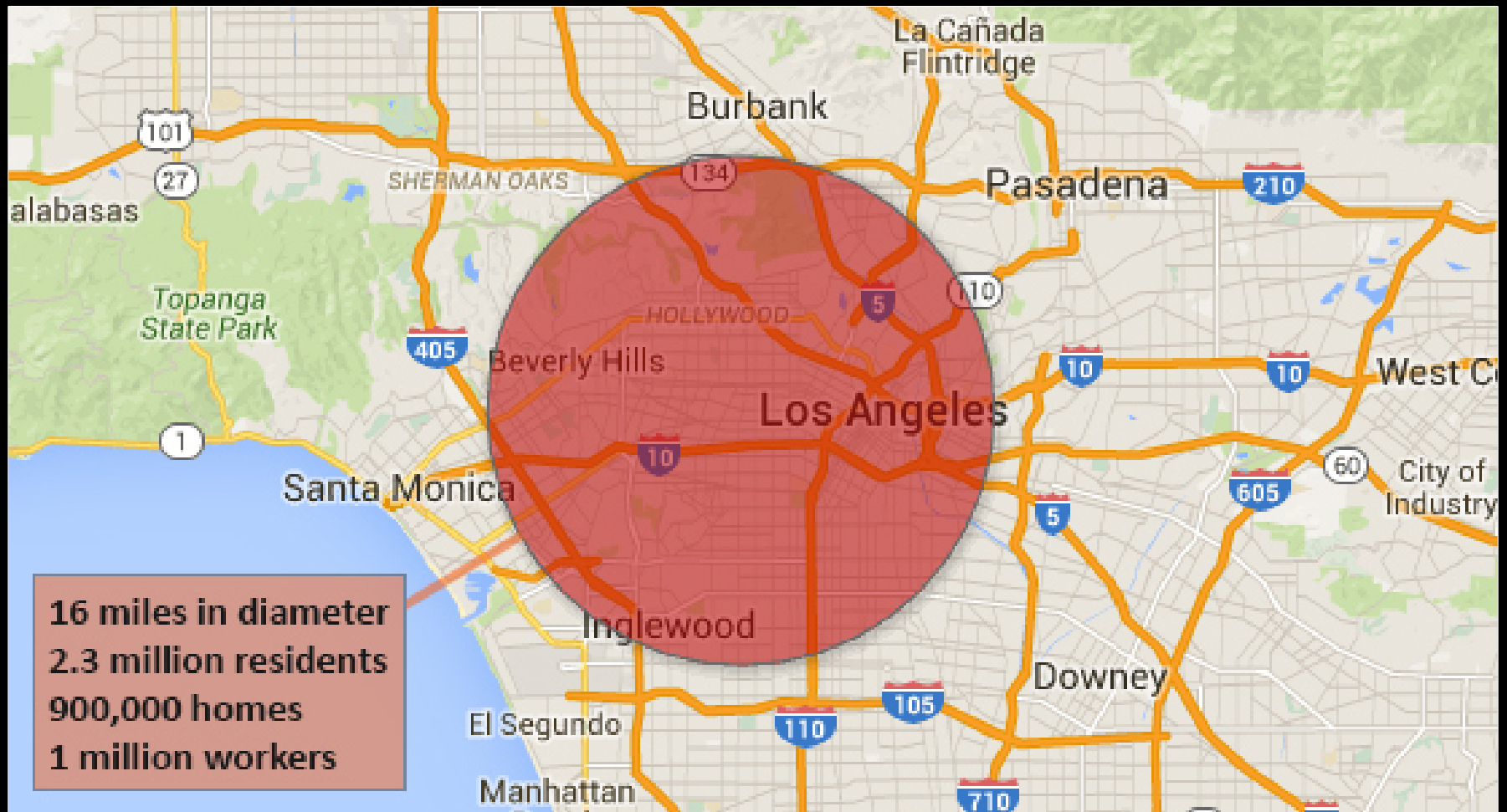
# Cumulative Spaces



Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, *Journal of the American Planning Association*, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

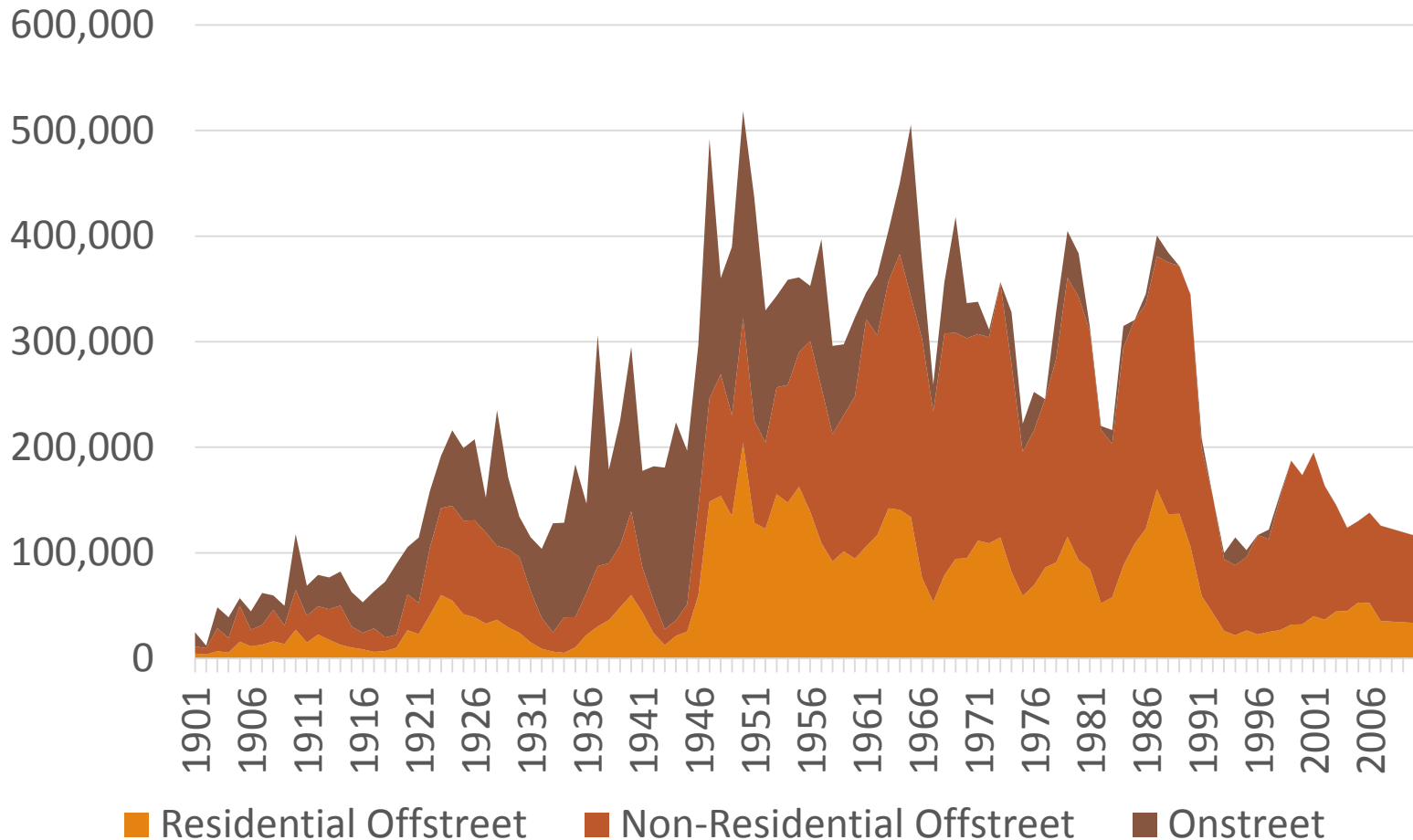


# 14% of incorporated land area



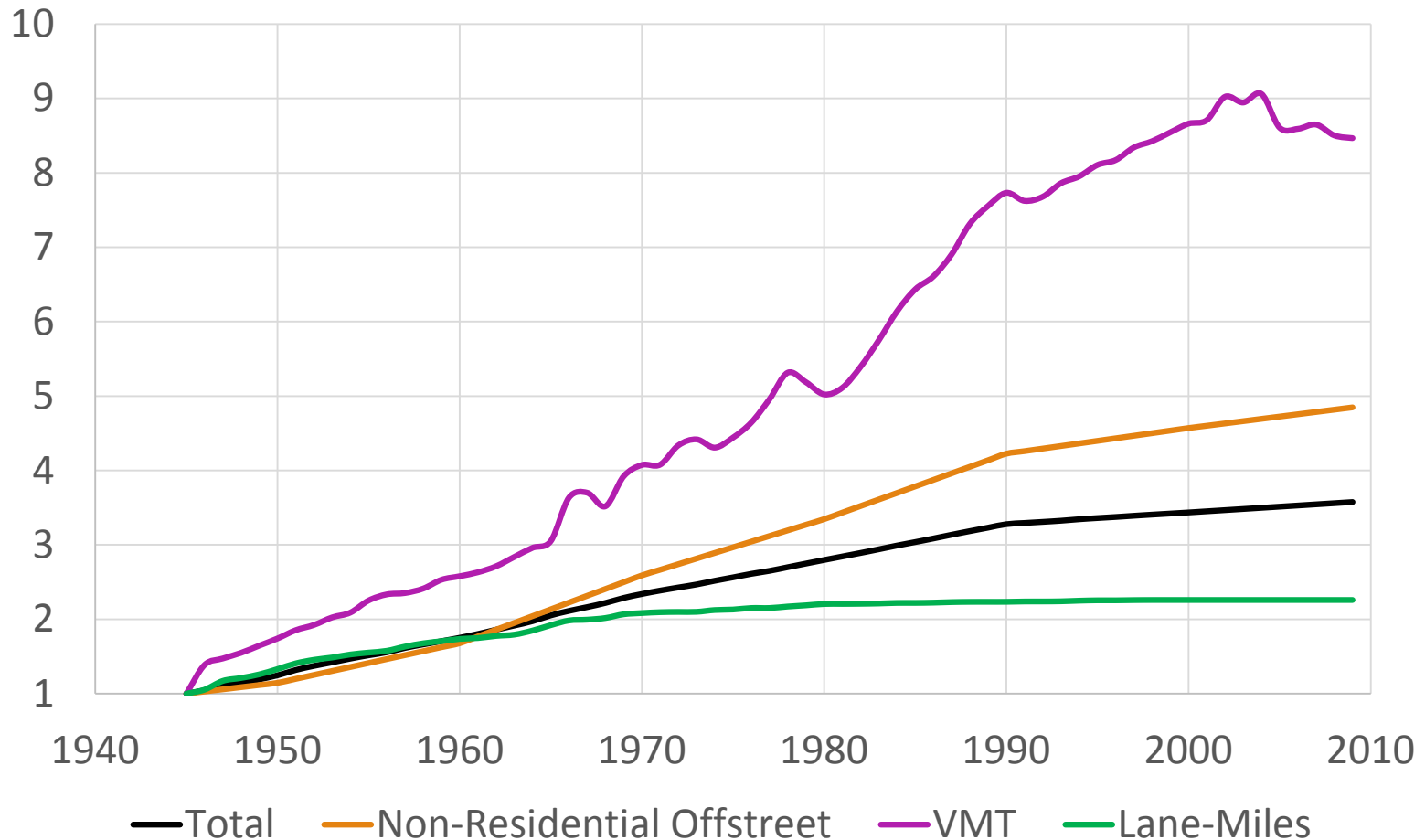
1.4 times larger than roadway area

# Annual Space Additions



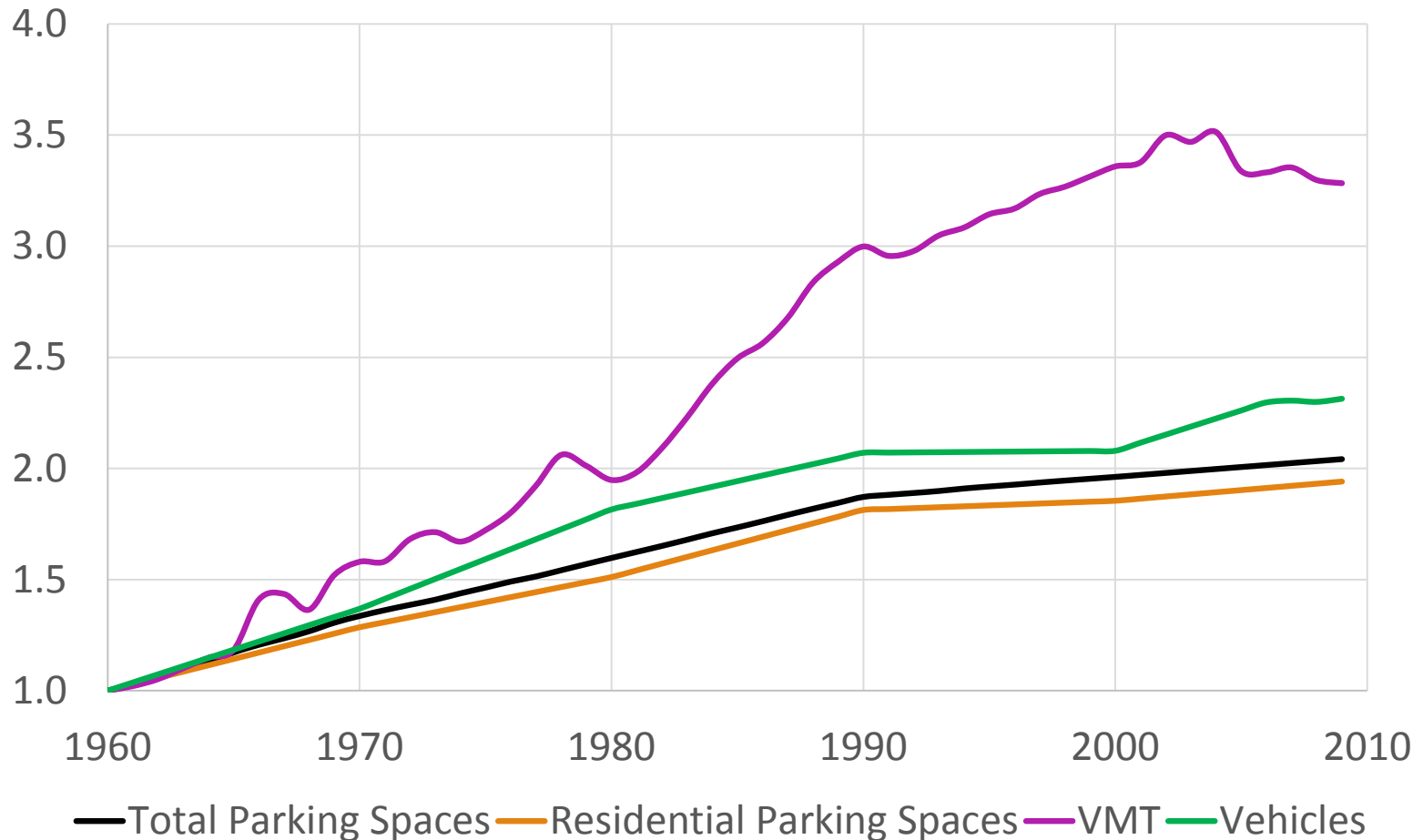
Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, *Journal of the American Planning Association*, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

# Growth Relative to Lane-Miles



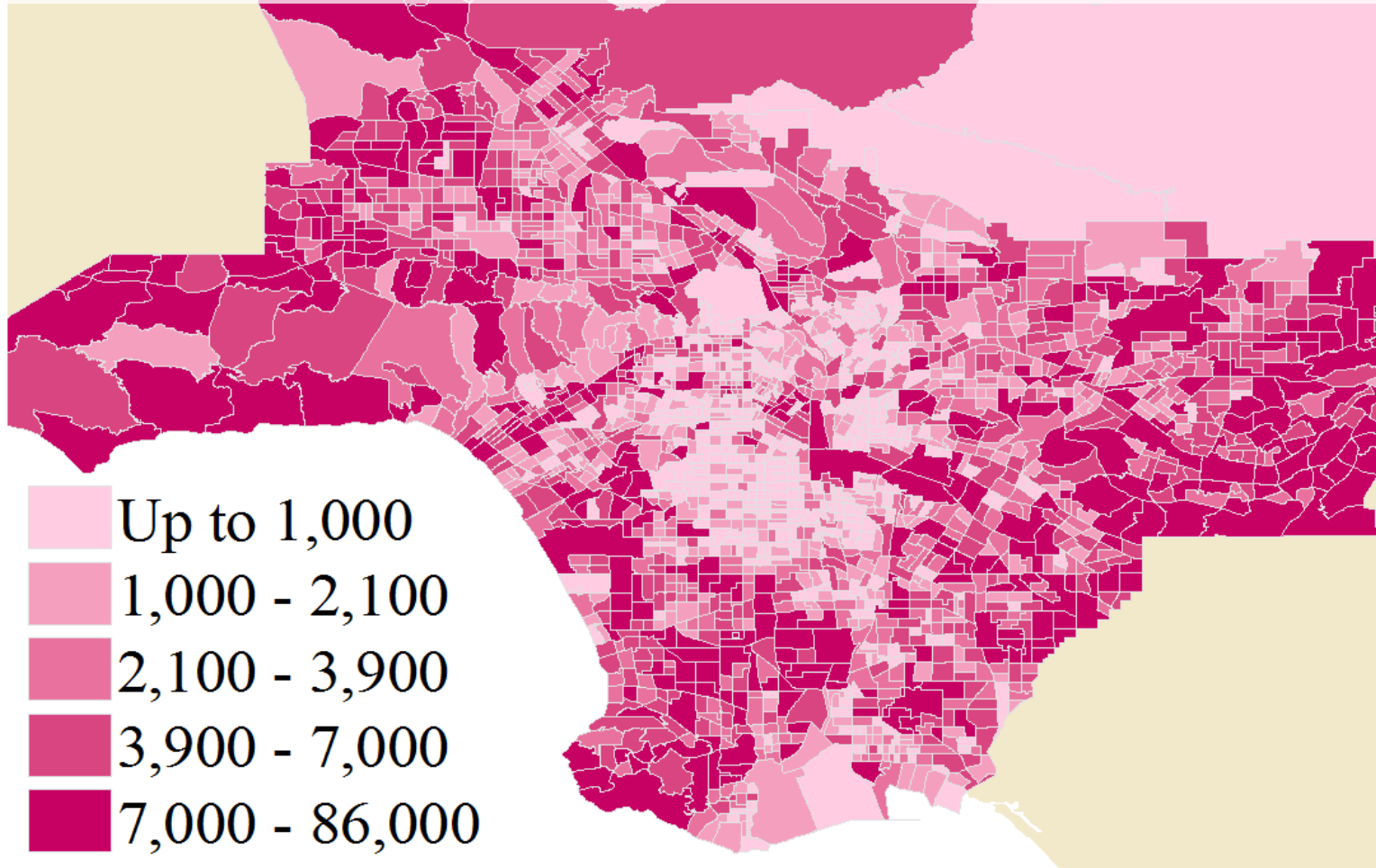
Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, *Journal of the American Planning Association*, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

# Growth Relative to Vehicles



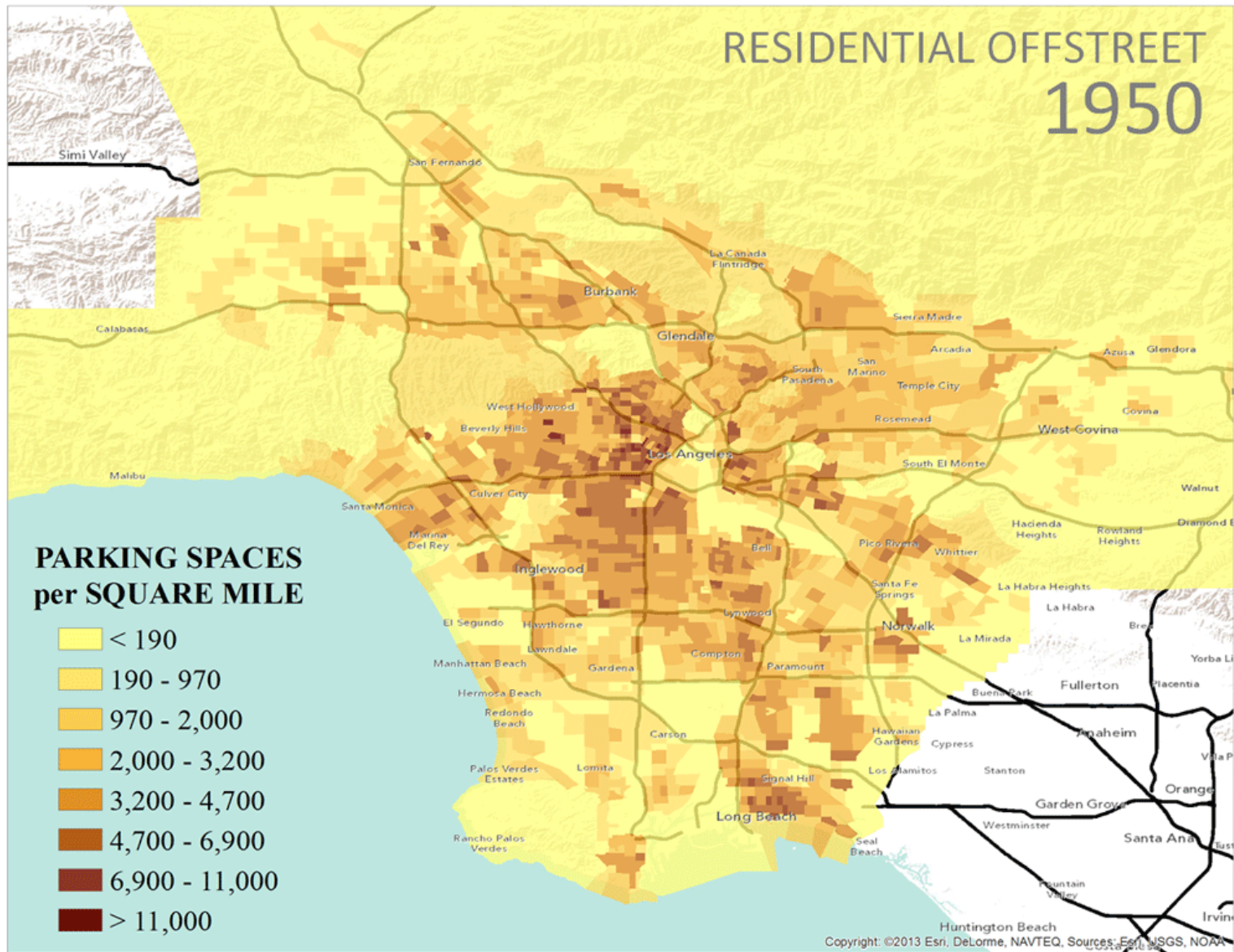
Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, *Journal of the American Planning Association*, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

# Changes in Spaces: 1950-2010



Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, M Chester, A Fraser, J Matute, C Flower, and R Pendyala, *Journal of the American Planning Association*, 2015, 81(4), pp. 268-286 doi: 10.1080/01944363.2015.1092879.

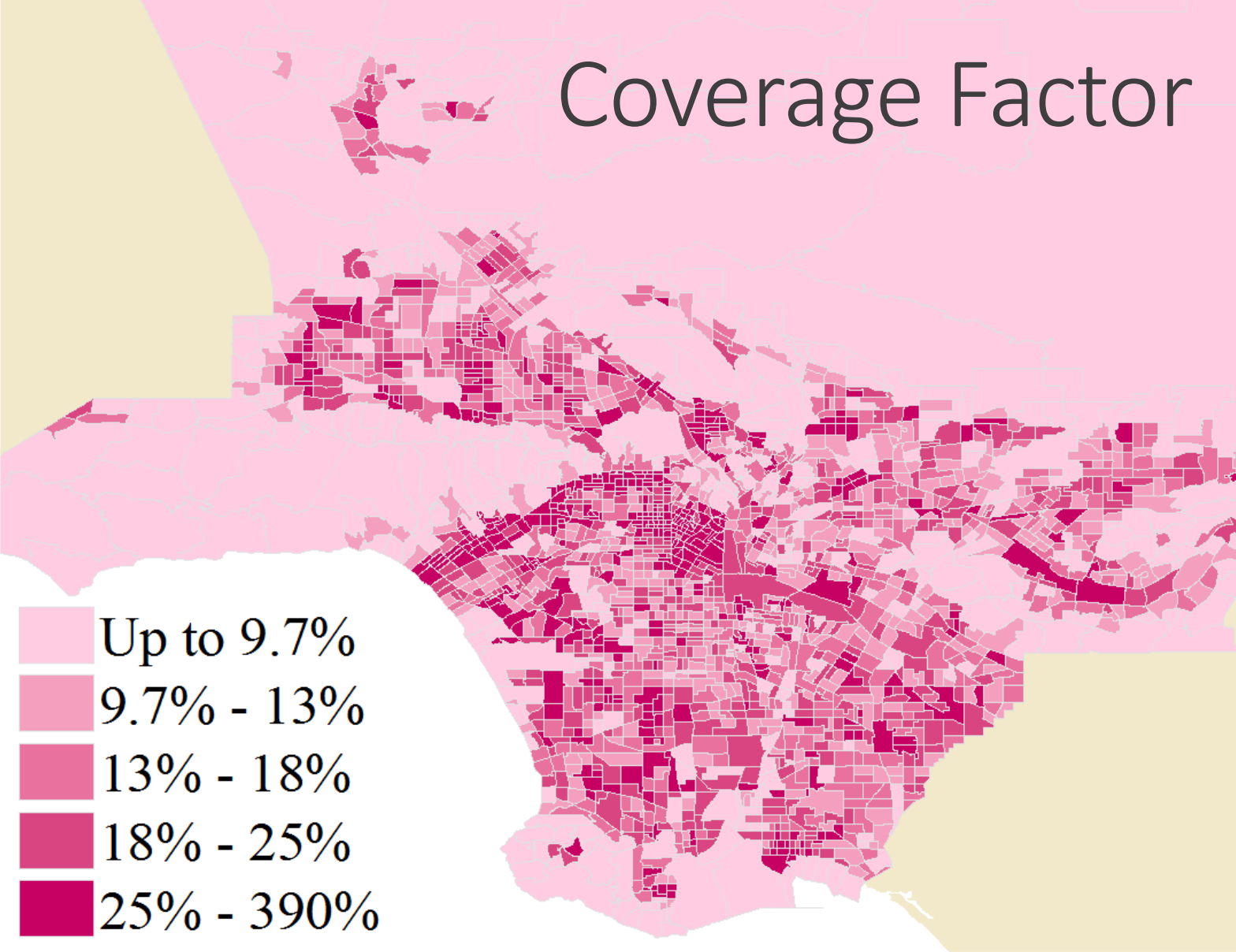
# RESIDENTIAL OFFSTREET 1950



Mikhail Chester, Andrew Fraser, Juan Matute, Carolyn Flower, and Ram Pendyala, 2015, Parking Infrastructure: A Constraint on or Opportunity for Urban Redevelopment? A Study of Los Angeles County Parking Supply and Growth, *Journal of the American Planning Association*, 81(4), pp. 268-286, doi: 10.1080/01944363.2015.1092879. Additional project information is available at [www.transportationlca.org/losangelesparking/](http://www.transportationlca.org/losangelesparking/)



# Coverage Factor



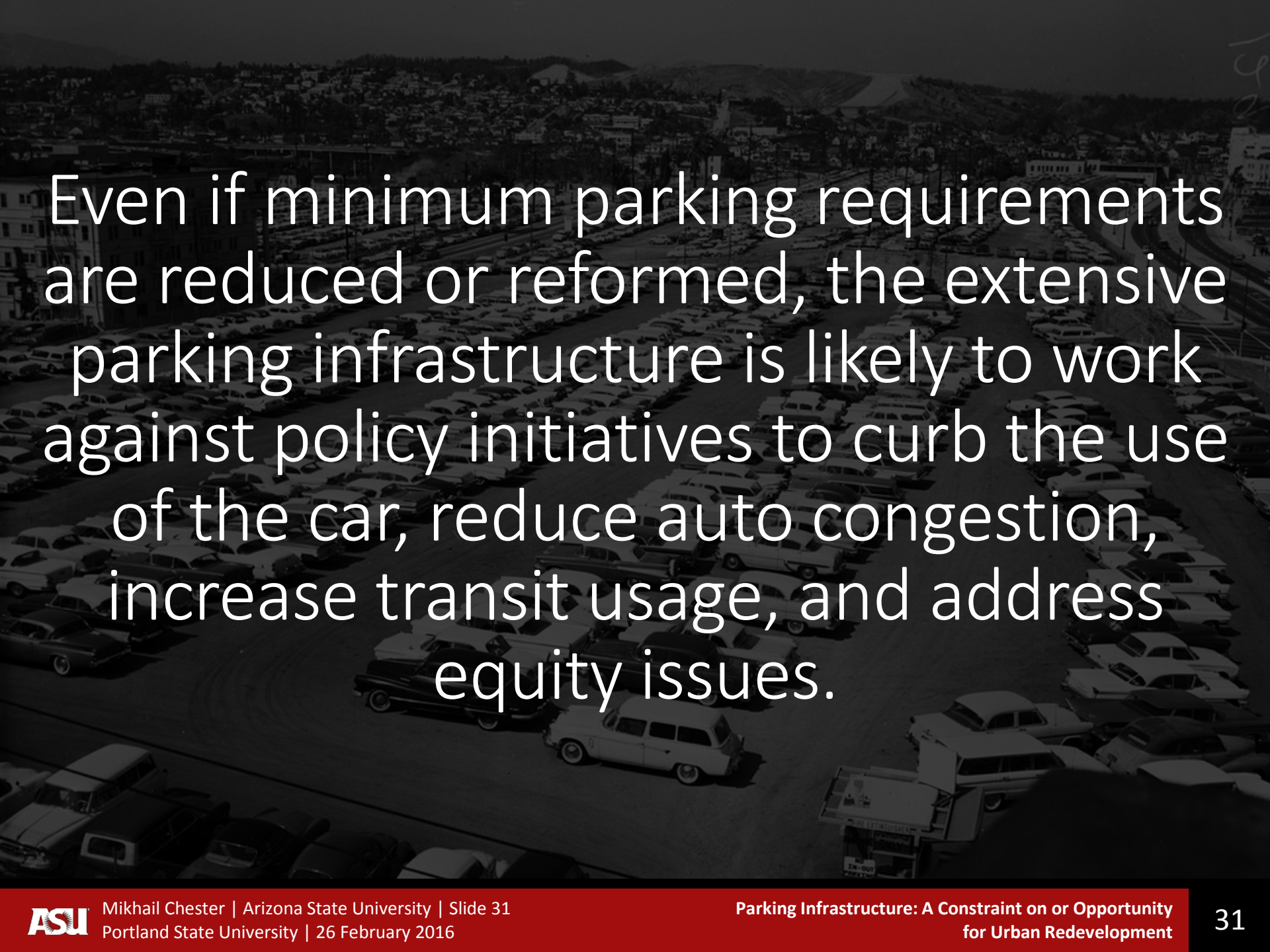


Minimum parking standards have been a success at encouraging greater automobility and probably a failure at lower traffic congestion.

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Before 1975, vehicle adoption accelerated to fill residential offstreet spaces; after 1975 the vehicle to residential offstreet space ratio has hovered around unity.





Even if minimum parking requirements are reduced or reformed, the extensive parking infrastructure is likely to work against policy initiatives to curb the use of the car, reduce auto congestion, increase transit usage, and address equity issues.

However, there is likely to be a “drag” from existing parking infrastructure.

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The current parking infrastructure may substantially reduce the positive impacts of major parking reforms

# Transitioning Parking Infrastructure

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- Conversion of parking to housing, small business, industrial and commercial use, and recreational facilities.
- Replace surface lots with buildings.
- Conversion of parking structures to alternative uses.
- Allow “bootlegged” apartments amnesty.
- Focus parking reform on areas with high quality transit access.





<http://www.citylab.com/cityfixer/2015/10/where-la-is-losing-parking-lots-to-transit-development/410590/>



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[www.transportationlca.org](http://www.transportationlca.org)



mikhailchester

# References

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Environmental and Economic Consequences of Permanent Roadway Infrastructure Commitment: City Road Network Life-cycle Assessment and Los Angeles County, Andrew Fraser and Mikhail Chester, ASCE Journal of Infrastructure Systems, **Expected 2016**, Volume and Issue Forthcoming, doi: 10.1061/(ASCE)IS.1943-555X.0000271.

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The Growth of Urban Building Stock: Unintended Lock -in and Embedded Environmental Effects, Janet Reyna and Mikhail Chester, Journal of Industrial Ecology, **2015**, 19(4), pp. 524-537, doi: 10.1111/jiec.12211.

Parking Infrastructure: Energy, Emissions, and Automobile Lifecycle Environmental Accounting, Mikhail Chester, Arpad Horvath, and Samer Madanat, Environmental Research Letters, **2010**, 5(1), doi:10.1088/1748-9326/5/1/014003

Environmental Assessment of Passenger Transportation Should Include Infrastructure and Supply Chains, Mikhail Chester and Arpad Horvath, Environmental Research Letters, **2009**, 4(2), doi:10.1088/1748-9326/4/2/024008