URBAN CENTER FOR COMPUTATION AND DATA

An initiative of the Computation Institute of the University of Chicago and Argonne National Laboratory

Computation & Data-Enabled Urban Design, Planning, and Operation

November 6, 2013
ULI Fall Meeting
Chicago, Illinois

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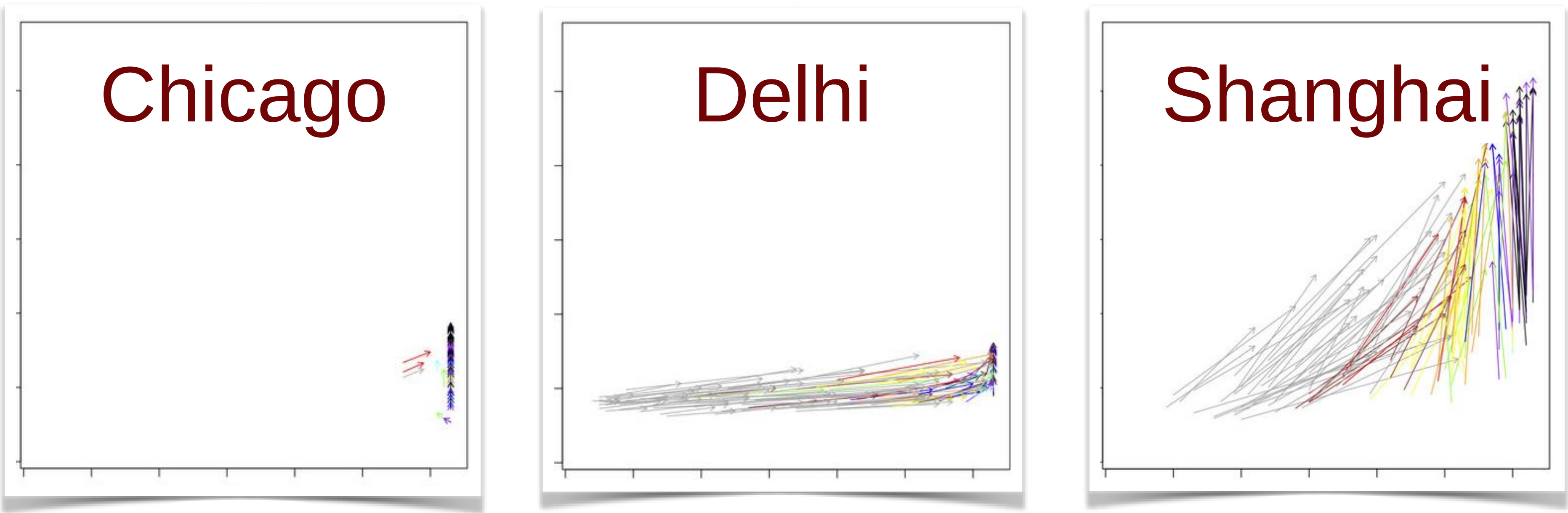
www.urbanccd.org



1999-2000 Land Area Increase

1999-2000 Building Height Increase

Cities in India and Southeast Asia are Growing at Unprecedented Rates

Frolking S, T Milliman, KC Seto, MA Friedl. 2013. A global fingerprint of macro-scale change in urban 2-D and 3-D structure from 1999 to 2009, Environ. Res. Lett.


Chicago Lakeside Development
Chicago, Illinois
2013

US Steel Plant
Chicago, Illinois
1945

Environment |Infrastructure| People

Chicago Lakeside Development
Chicago, Illinois
2040

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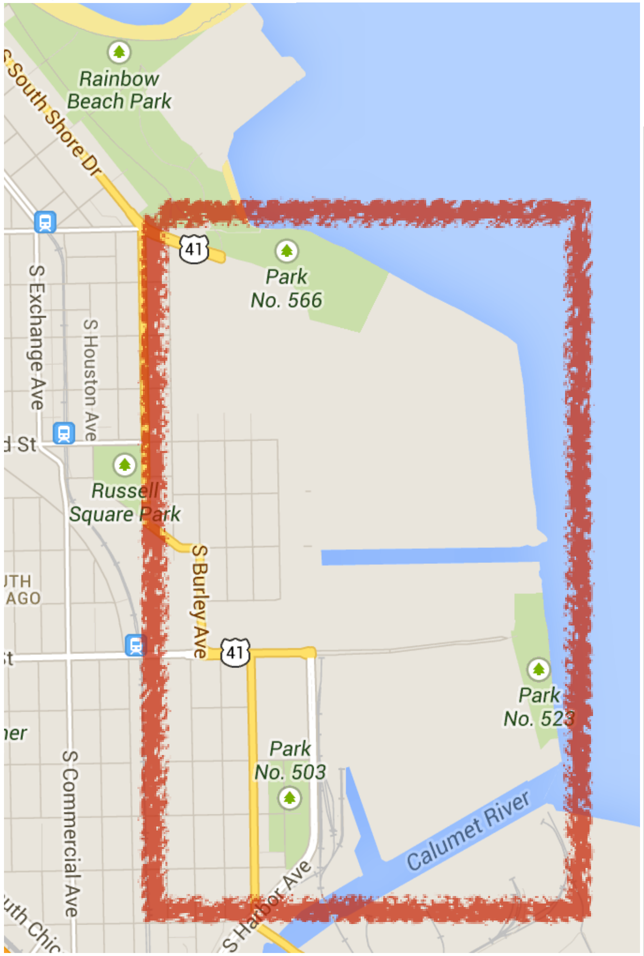

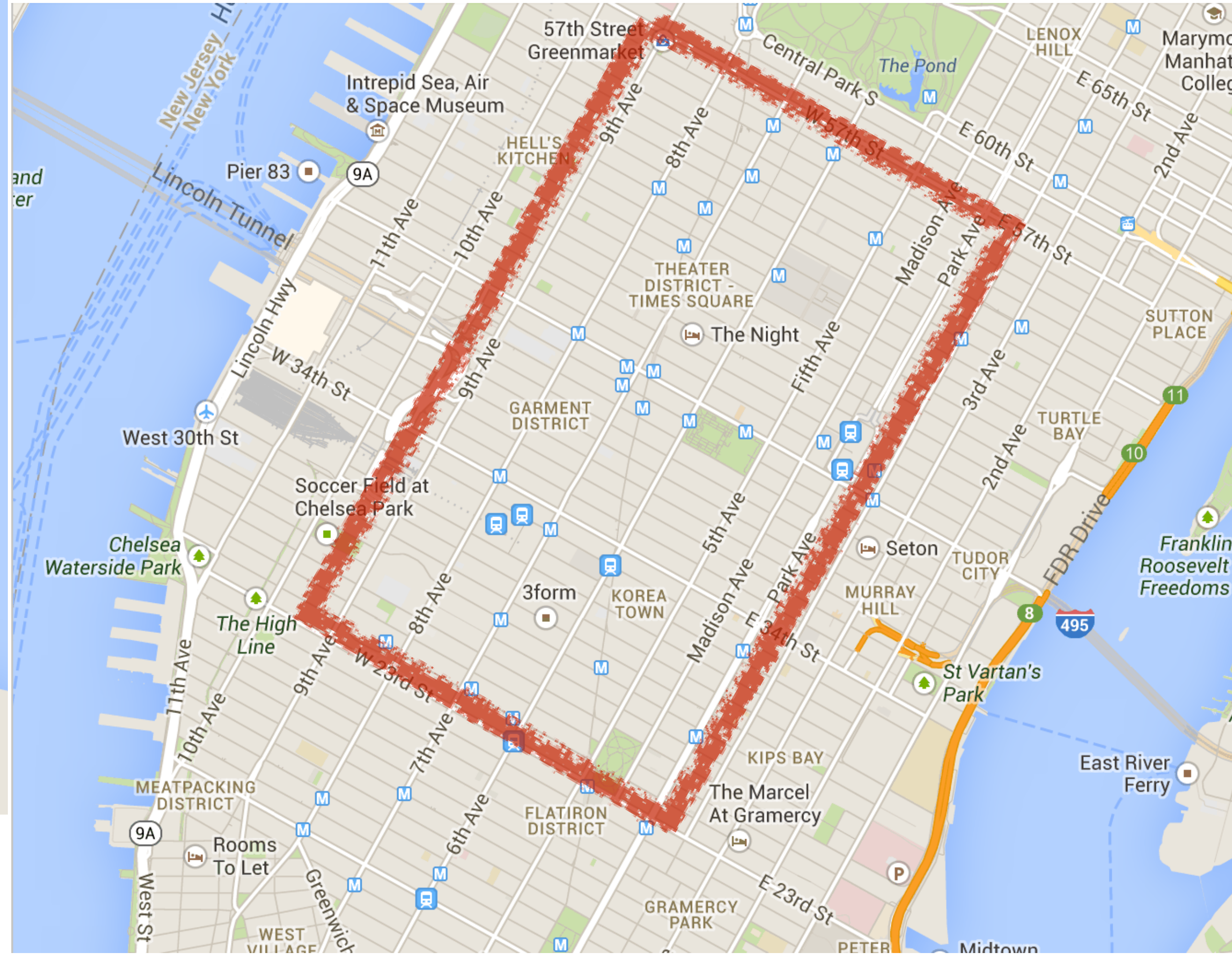

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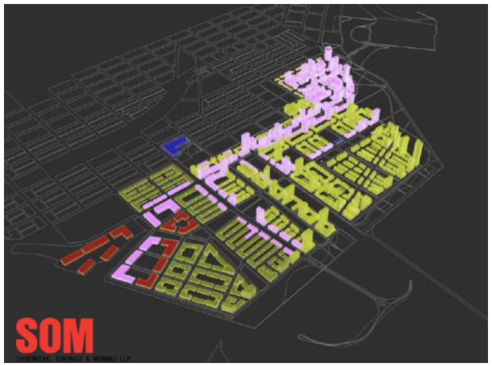
Design



Analyze

Independent consultant studies

weeks to months

Spreadsheets

History-based models

Plan

Energy Supply

Water/Sewage

Storm water treatment & mgmt

Streets, Public Transport

-
-
-

Decide

Pictures

Charts

Reports

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Design | Analyze | Plan | Decide

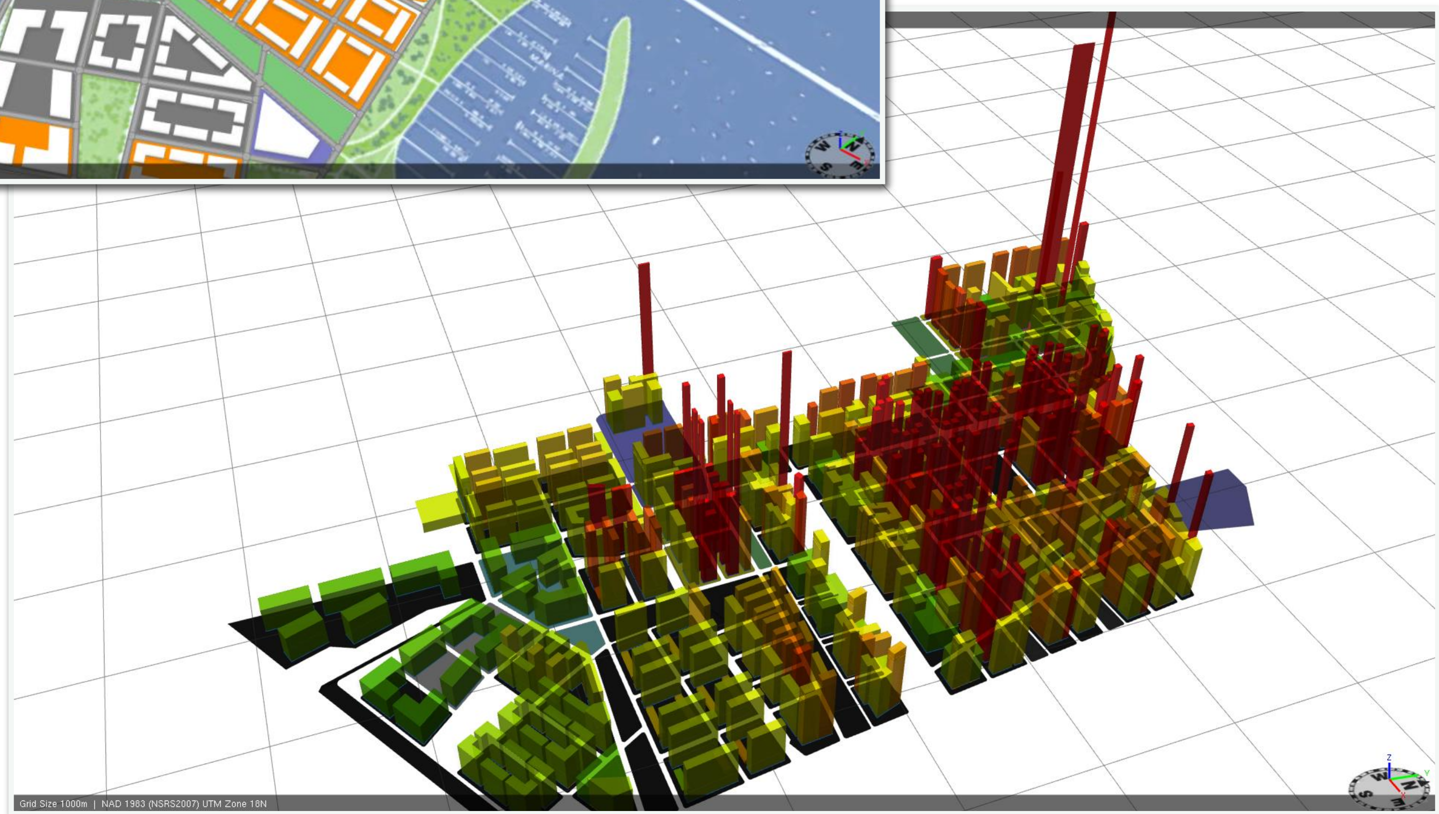
Energy demand → Energy Supply

hours to days

Water → Water/Sewage

Hydrology → Storm water treatment & mgmt

Transportation → Streets, Public Transport



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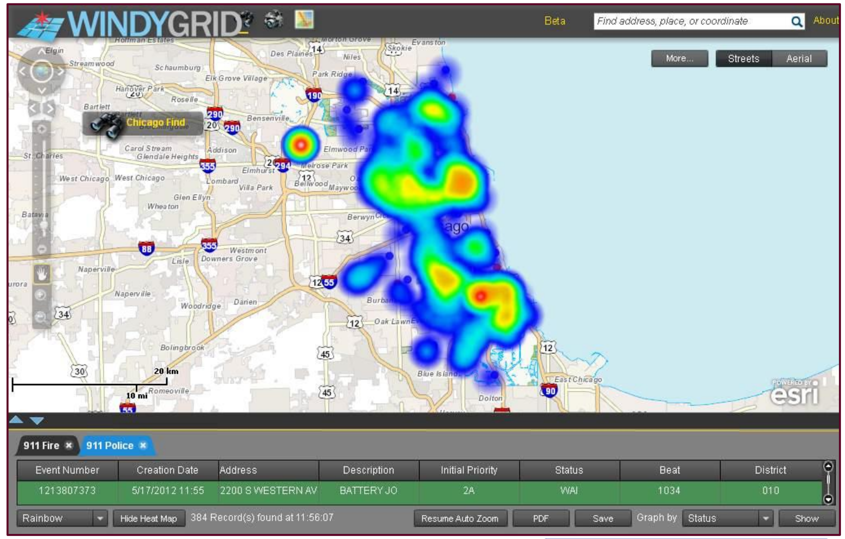
Data Access, Authorization, Privacy

External organizations, citizens

Aldermen, City Employees

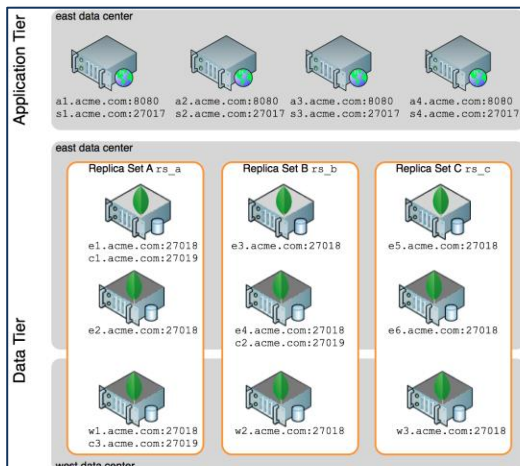
Scientists and Engineers (City Partners)

City Decision-Makers

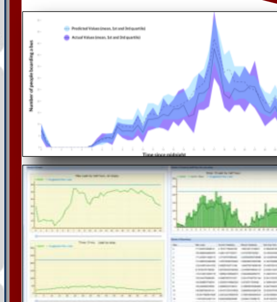


Visual Interaction, Mapping, Analysis Tools

Scalable Data Management

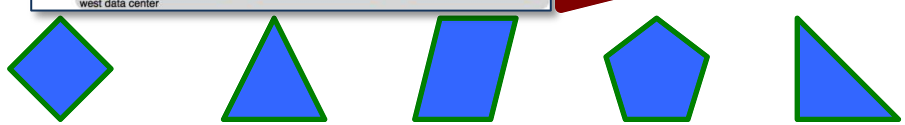


Application Programming Interfaces (API)



Automate Continuous Data Analytics

Data Sources



City Databases Sensor Nets Video GPS Social Media

Initiative 14: Increase and improve City data.

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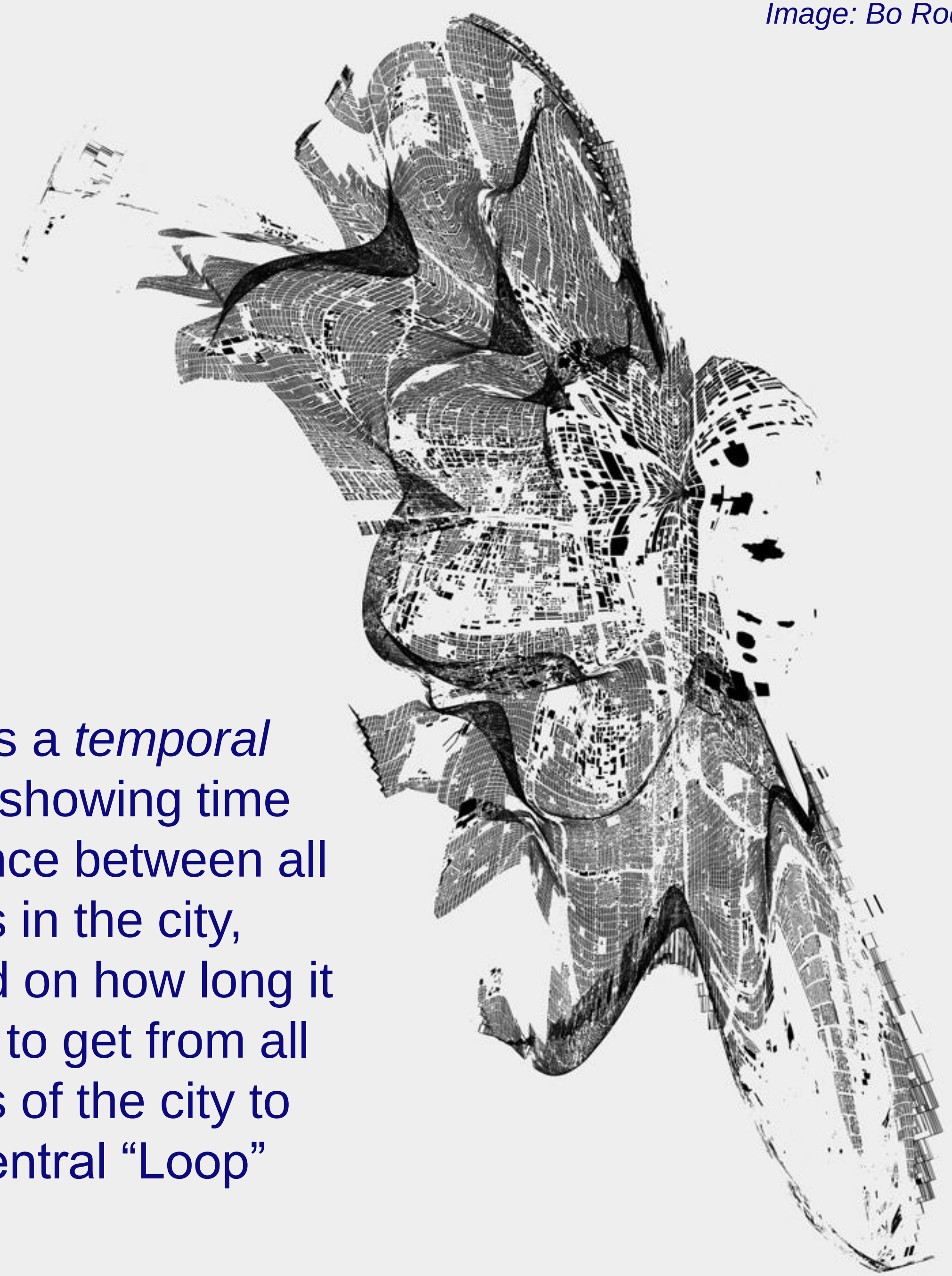
Image: Bo Rodda

More powerful data and tools such as transportation transit estimates can enable scientists to look at cities in new ways.



A common map shows *spatial* distance between all points in the city.

This is a *temporal* map, showing time distance between all points in the city, based on how long it takes to get from all points of the city to the central “Loop” area.

Stanford University
University of California-Irvine
Arizona State University
University of Texas-Austin
University of Wisconsin-Madison
University of Texas-Austin
Instituto Technológico Autónomo de México

University of Chicago
University of Illinois-Chicago
University of Michigan
University of Alabama
Georgia Institute of Technology
Carnegie Mellon University
Cornell University
Israel Institute of Technology

University of Maryland
City University of New York
Columbia University
Yale University
Harvard University
Massachusetts Institute of Technology
University of Cambridge

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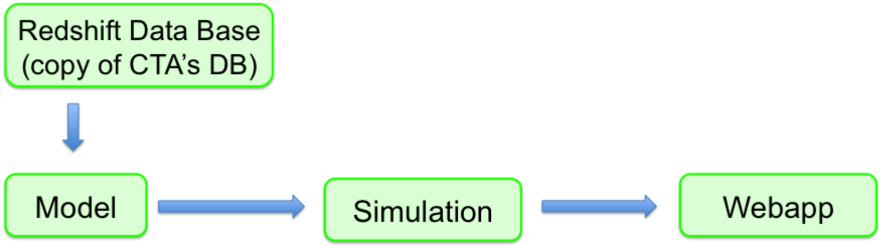
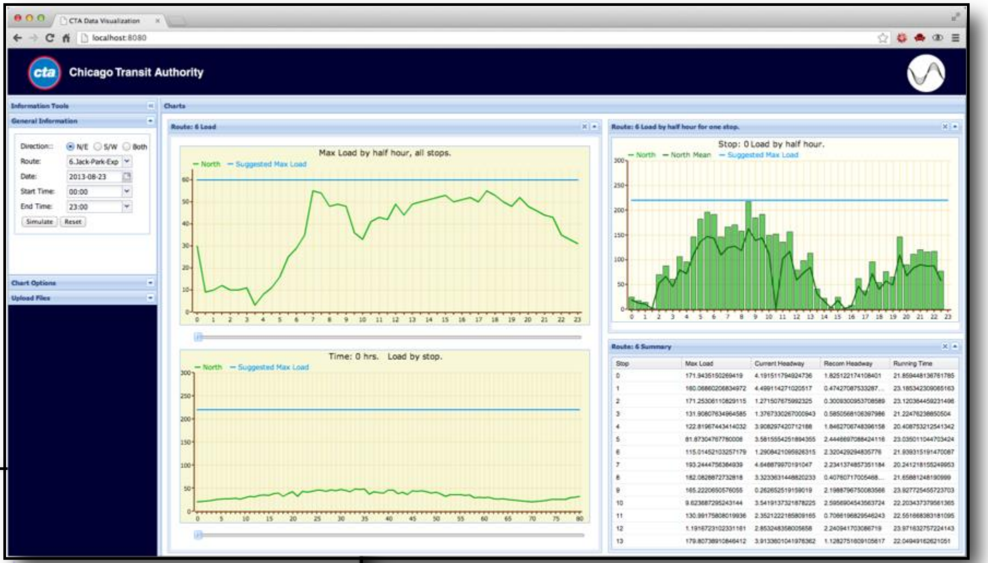
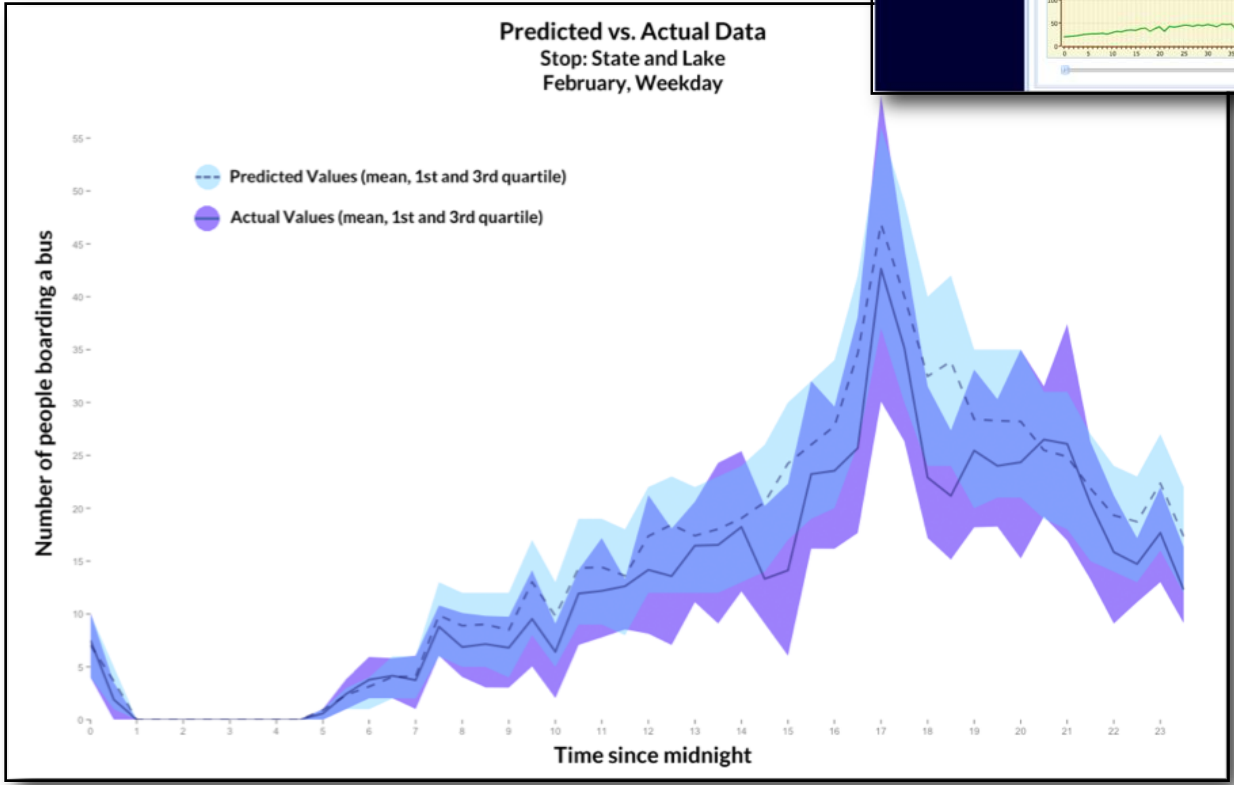
SCHMIDT FAMILY FOUNDATION

MacArthur Foundation







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Jordan Bates, Andrés Akle Carranza, Walter Dempsey, David Sekora, Brandon Willard

Example: City of Chicago Proactive Intervention

Create "**Neighborhood Health Index**" - identify and quantify neighborhoods w.r.t. education, economics, public safety, and other domains. Look for leading indicators to neighborhood decline or revitalization.

Research Capabilities

Analytics, machine learning, and other techniques, guided by social, economic, education, health, and related research areas, to examine urban data as a means to define and measure neighborhoods and related functions.

Impacts on City Challenges

Early detection of at-risk neighborhoods w.r.t. crime, education, sustainable energy use, economics, employment, and other factors, enabling preventative vs reactive intervention.

Predict locations of abandoned buildings/vacant lots.

Predict restaurant failures based on food service reports, social media, and other data.

Estimate economic health ("micro-GNP") of neighborhoods and sub-neighborhoods.

Sophia Alice, Evan Misshula, Skyler Whorton, Tom Plagge

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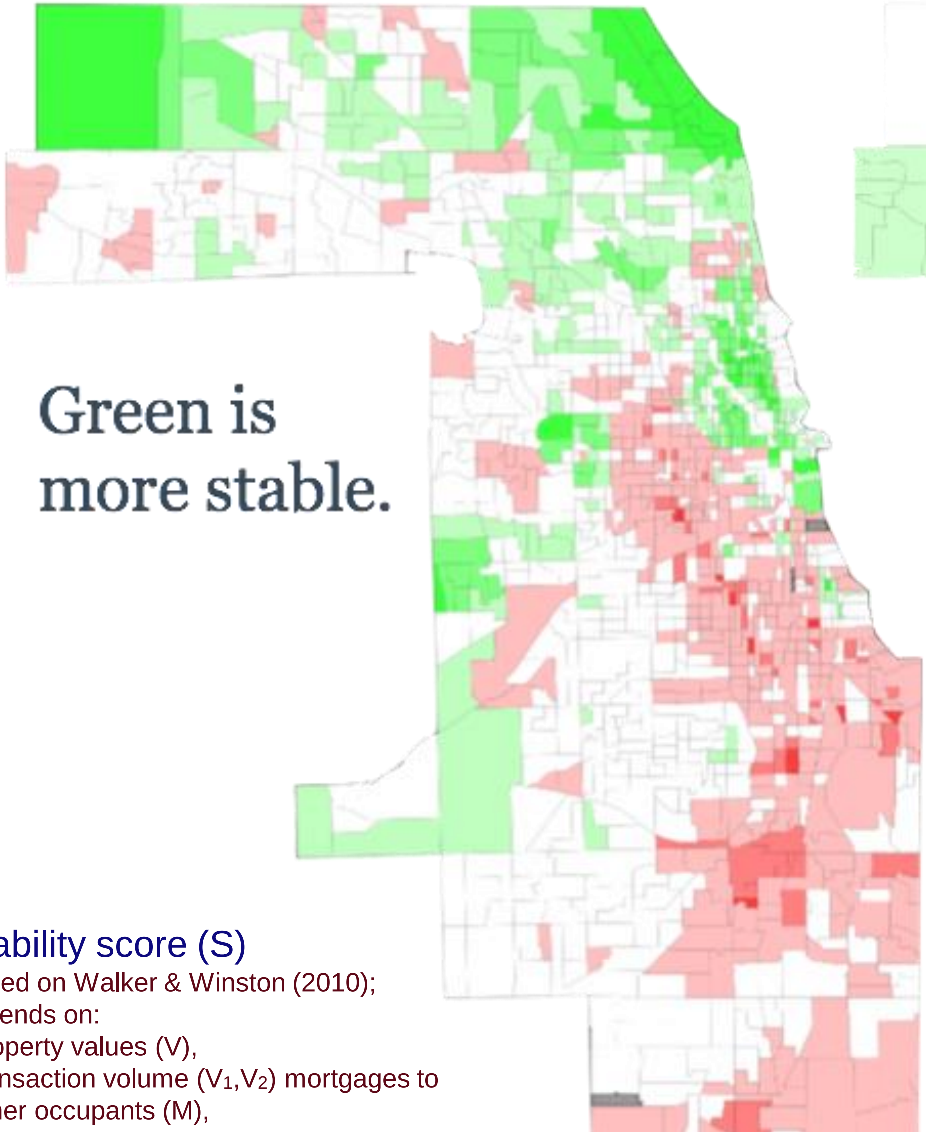
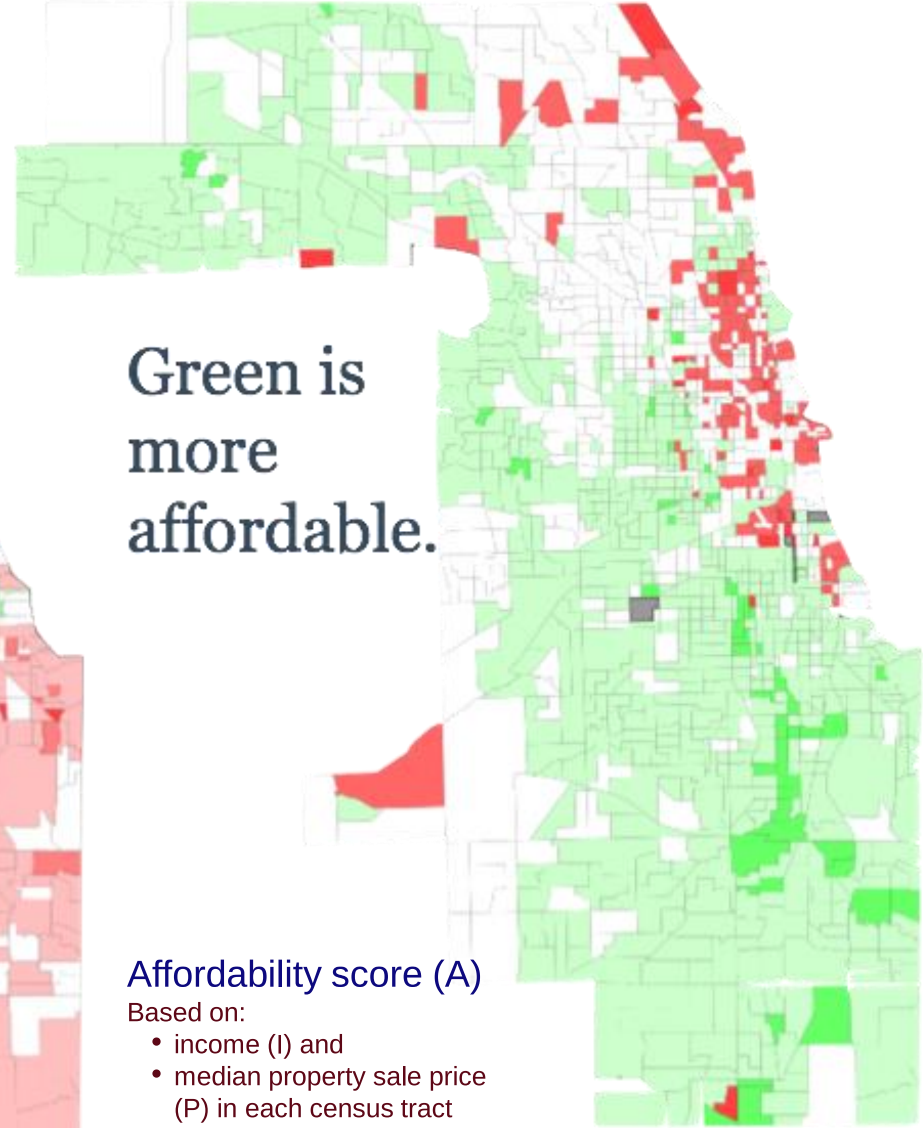
Stability score

$$S = 0.6V + 0.3V_1 + 0.1V_2 + 0.2M - 0.4H$$



Affordability score

$$A = \int_{P/4}^{\infty} f(I)\,dI$$



Stability score (S)

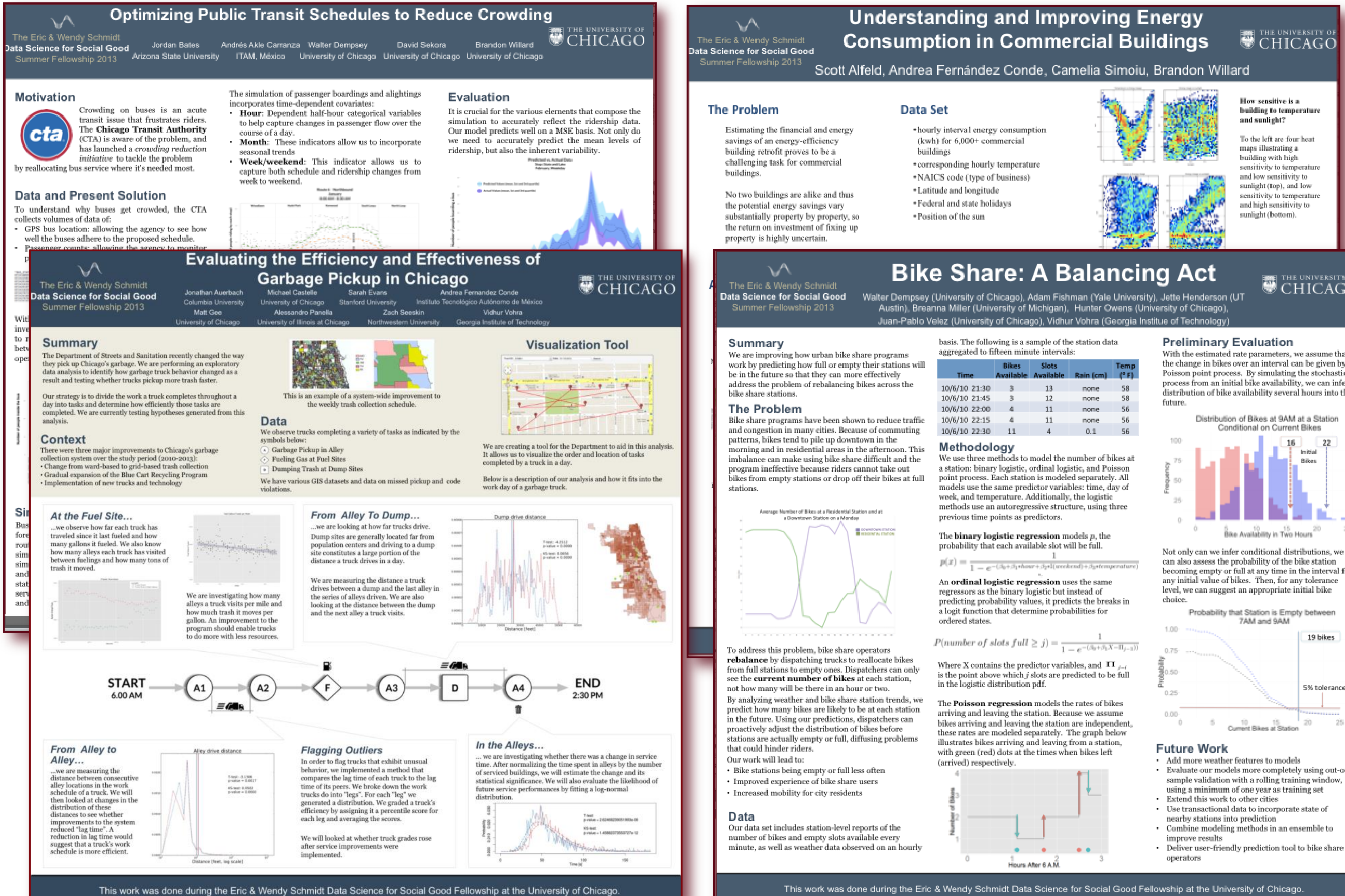
Based on Walker & Winston (2010); depends on:

- property values (V),
- transaction volume (V_1,V_2) mortgages to owner occupants (M),
- prevalence of high-cost lending (H).

Affordability score (A)

Based on:

- income (I) and
- median property sale price (P) in each census tract



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http://dssg.io

SCHMIDT FAMILY FOUNDATION

MacArthur Foundation

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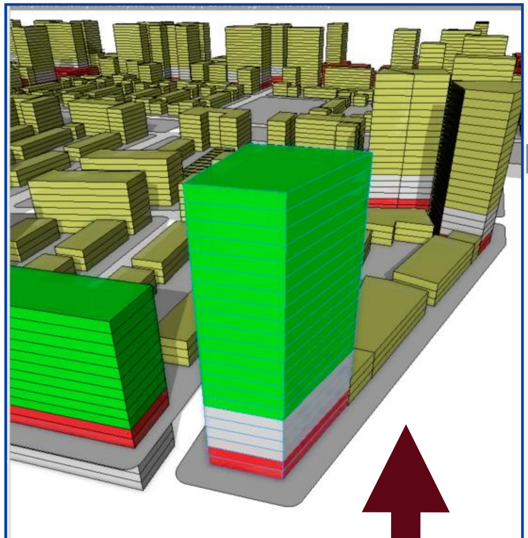
Design



Analyze

Energy demand

hours to days

Water

Hydrology

Transportation

Plan

Energy Supply

Water/Sewage

Storm water treatmen\ & /mgmt

Streets, Public Transport

Decide

Financial, Social, Economic Models