



EVIDENCE-BASED PLANNING TOOLS PREDICTING EQUITY, HEALTH & ECONOMIC BENEFITS OF LAND USE & TRANSPORTATION INVESTMENTS

Albuquerque New Mexico

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URBAN DESIGN 4 HEALTH

URBAN DESIGN 4 HEALTH (UD4H)

- 25 year background and depth of experience in the modeling of health and built environment relationships
- UD4H and its collaborators have led over \$25 million in research linking transportation and land use development actions with health outcomes
- Among the most published scholars on health and built environment globally – top 1% (Thompson and Reuters)
- Dr. Frank is one of the top 2 most cited planning academics
- Key Focus Areas:
 - Tool & Evidence Development
 - Objective Measuring & Surveying
 - Education, Outreach & Policy Development

Walkability Pioneers

- First to link active transportation with walkability
- Coined term “walkability”
- Research foundation for WalkScore
 - Funded streetsmart / network based WalkScore
- First to integrate health into scenario planning and commonly used practice based tools
- First to monetize health impacts of the built environment
- Authored 2 main books on topic:
 - Urban Sprawl and Public Health
 - Health and Community Design

OUR CLIENTS

Puget Sound Region:



King County



DOTs/MPOs:



National Authorities:



CORE EXPERTISE

- Measuring spatial phenomena including walkability, transit LOS, regional accessibility and pedestrian environments
- Developing predictive models of travel patterns for non-motorized, transit, private vehicle based demand
- Providing guidance for project-level programming and prioritization of transport investments
- Linking health with built, natural, and social environment features

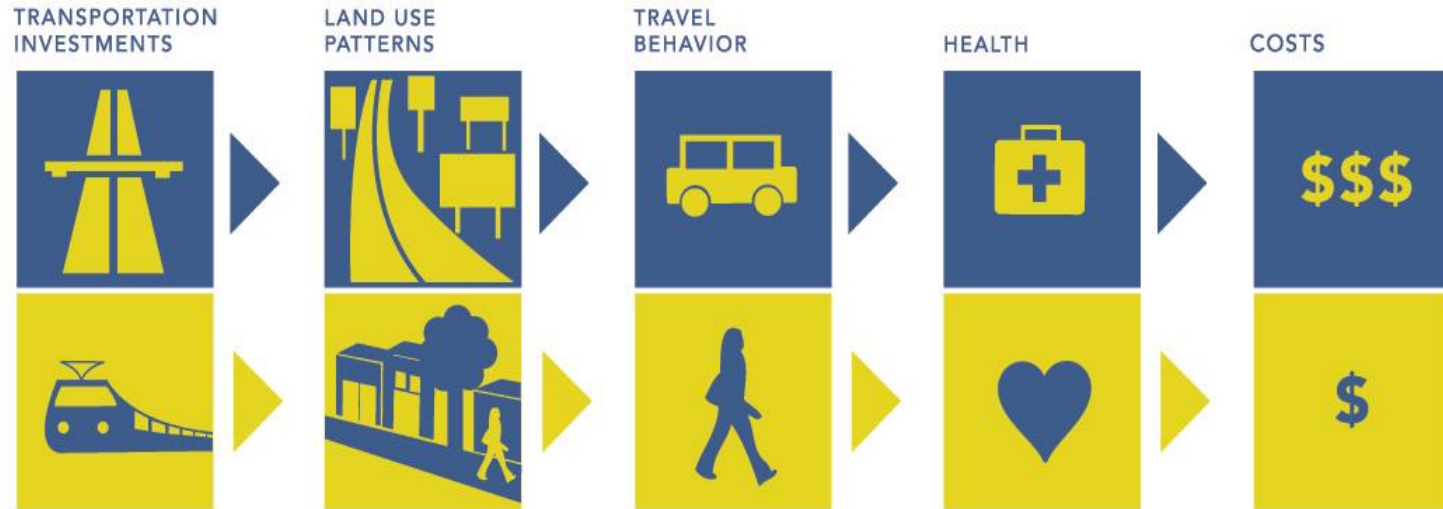
PRIMARY DATA COLLECTION EXAMPLES

Dataset	Study Period	Age Cohort	Sample Size	Health Outcomes	Built Environment
Senior Neighborhood Quality of Life I & II	2008, 2012	Ages 66+	N = 958 (KC: 498; MD: 460)	Objectively measured physical activity, self-reported physical activity, transportation behavior, BMI, overweight/obesity	Participant-specific neighborhood walkability: net-residential density, intersection density, retail FAR, land use mix, microscale pedestrian streetscape urban form, self-reported built environment
Teen Environment & Neighborhood Study (TEAN)	2008	Ages 12-16	N = 1078 (KC: 497; MD: 581)		
Neighborhood Impact on Kids (NIK)	2006	Ages 8-11	N = 789 (KC: 405; SD: 384)		
Neighborhood Quality of Life (NQLS Prime)	2005	Ages 18-65	N = 2,199 (KC = 1,287; MD: 935)		

ADDITIONAL SPECIALIZATION

- Integrating co-benefits of investments to support walking, cycling and transit into transportation planning discussions
- Monetizing workforce productivity and health care cost savings from active transportation and transit infrastructure investments
- Modeling at the sub-trip scale GHG and criteria pollutant emissions

HOW TRANSPORTATION IMPACTS HEALTH COSTS



“The Hidden Health Costs of Transportation”

Frank et al 2010

American Public Health Association

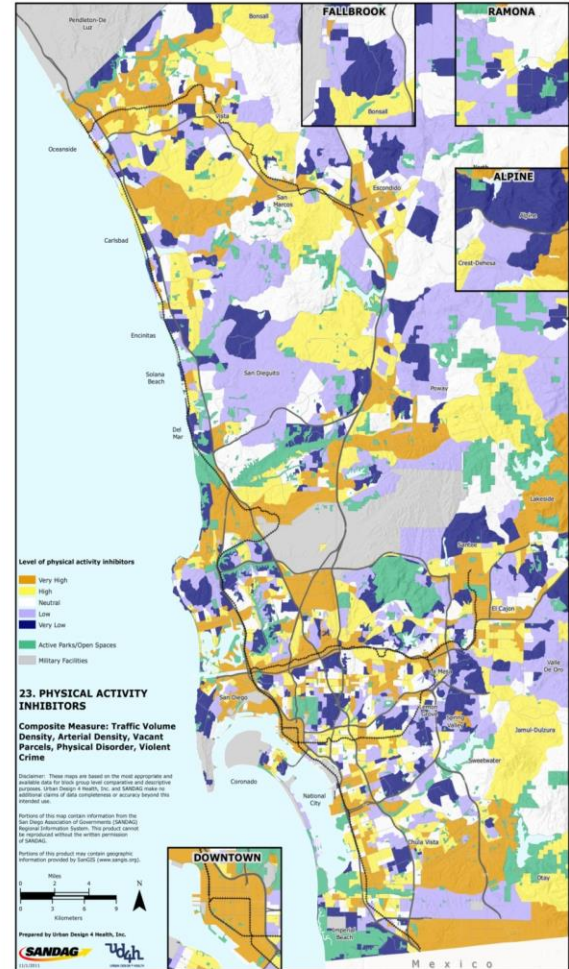


Physical Activity Inhibitors: Composite Map Methodology

Made up of the following Base Maps:

Traffic Volume Density
Arterial Density
Vacant Parcels
Physical Disorder
Violent Crime

- To calculate the composite score:
- Each Base Map measure was given a standardized value (z-score) for each block group.
- The final composite score per block group is the average of the Base Map z-scores.
- Block groups were separated into quintiles (5 groups with equal numbers of block groups in each) based on their composite score.
- Although only the western third of the region is shown in the map, the analysis is based on all 1,762 block groups in the San Diego region.



SAN DIEGO

Objective physical Activity and Objective Built Environment

- 2005 study found that residents of the most walkable areas in Atlanta were 2.4 times more likely to get the recommended amounts of physical activity
- 18 percent in the lowest Versus 37 Percent in the highest levels of walkability got recommended levels of physical activity

Frank LD, Schmid TL, Sallis JF, Chapman JE, Saelens BE. 2005. "Linking Objective Physical Activity Data with Objective Measures of Urban Form." American Journal of Preventive Medicine. Volume 28, No. 2 (Suppl2): pp. 117-125.

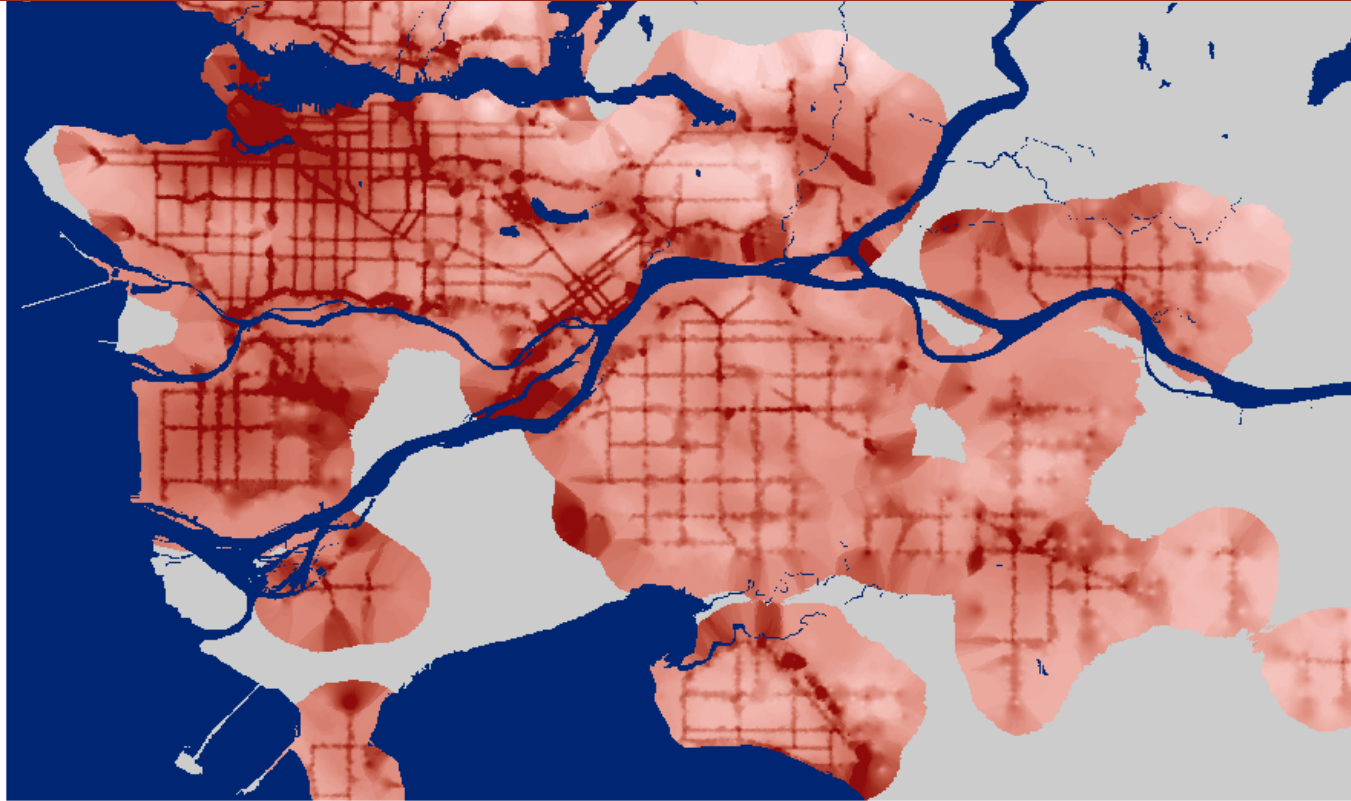
Predictors of Obesity

	Coefficient	t-Ratio	P-Value
↑ Age	0.012	6.00	0.000
↓ Education	-0.080	-4.71	0.000
↓ Income	-0.057	-4.75	0.000
↓ Walk Distance	-0.049	-2.04	0.034
↑ Car Time	0.001	2.875	0.003
↓ Land Use Mix	-2.035	- 5.65	0.000
↑ Black Male	0.311	3.930	0.000
↑ Black Female	0.372	5.09	0.000
↓ White Female	-0.871	-11.3	0.000
Constant	-0.497	-2.22	0.026

Obesity, Driving, and Walking

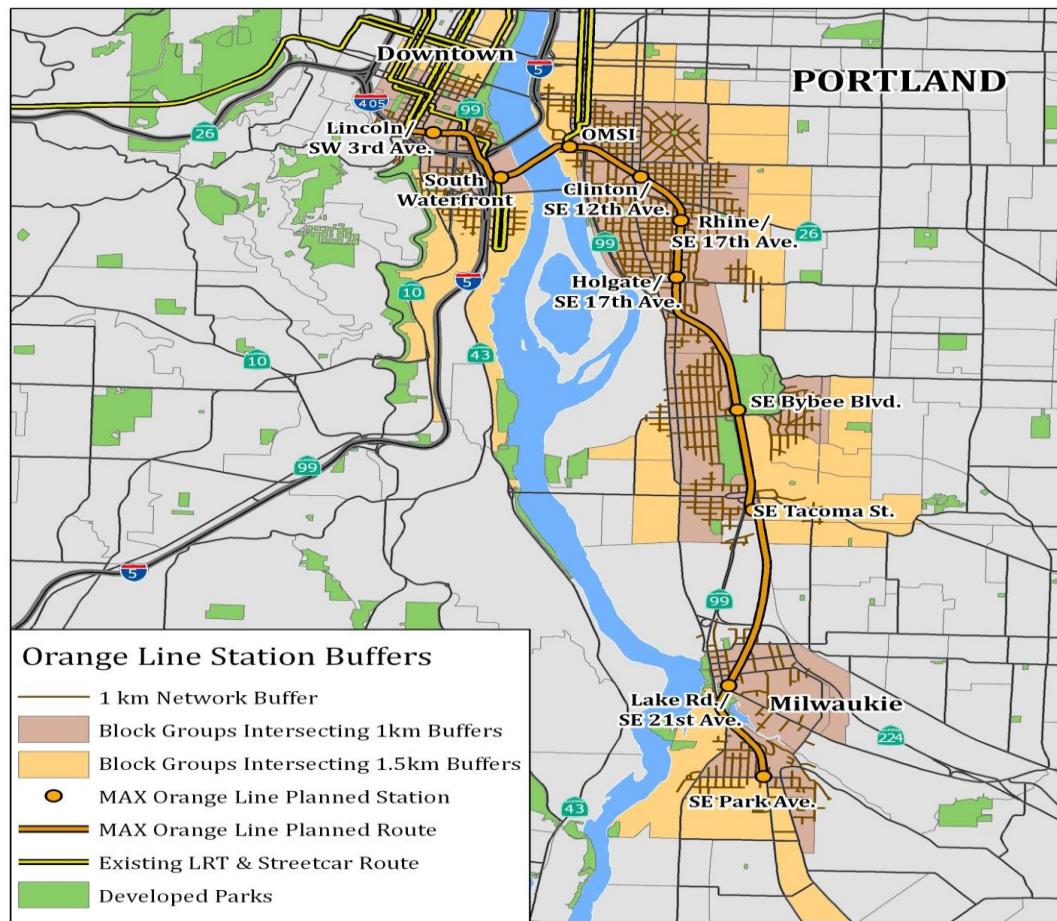
- Every additional **hour** per day in a car translates into a **6** percent increase in the likelihood of obesity
 - Time spent driving increases as walkability decreases
- Every additional **Kilometer (.6 miles) walked** translates into **4.8** percent reduction in the likelihood of being obese
 - Distances walked increases with walkability

Air Pollution and Walkability

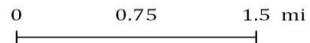


*Nitric
Oxide*

Marshall JD, Brauer, M, Frank, LD. 2009. Healthy Neighborhoods: Walkability and Air Pollution Environmental Health Perspectives. 117, 1752-1759.



Scale: 1:50,000



KAISER PERMANENTE®



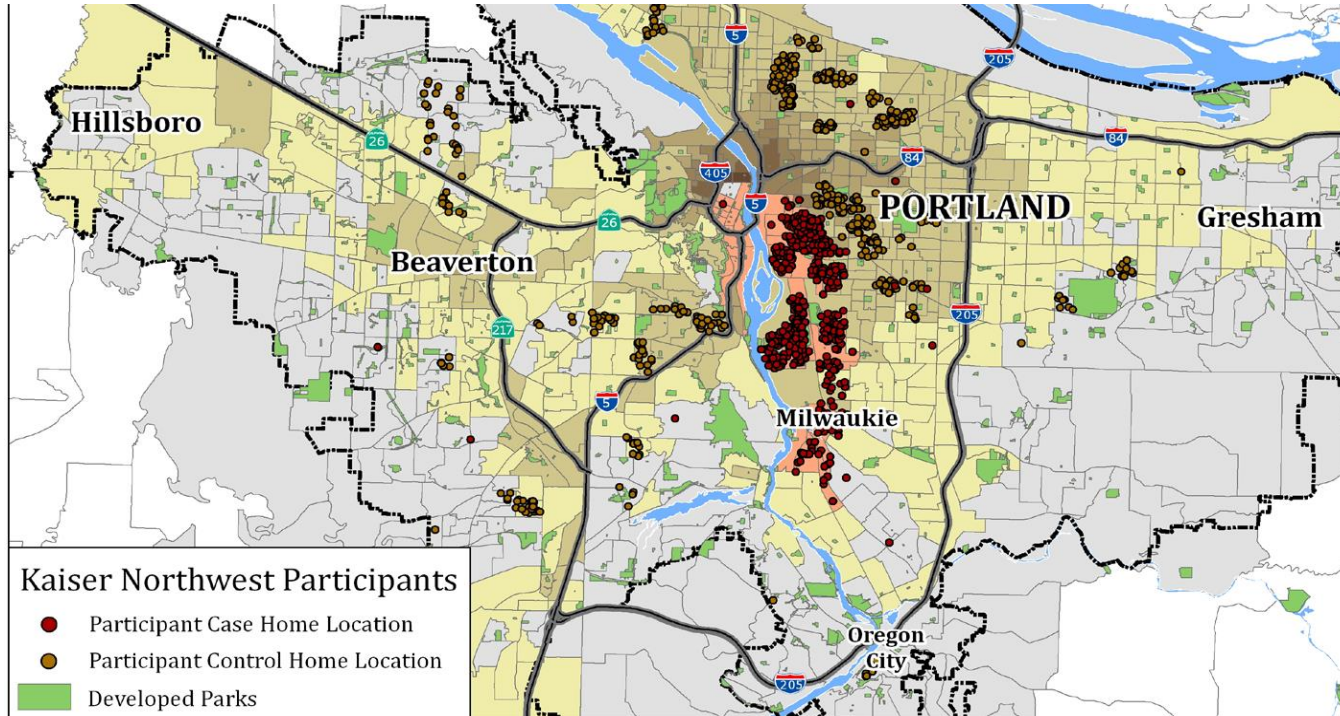
Data Source: Oregon Metro, 2014.

Urban Design 4 Health, Inc.

MEASURING HEALTH CARE COST REDUCTION FROM PORTLAND TRANSIT INVESTMENT

- Document weight, blood pressure, blood lipids, and healthcare utilization in KPNW members age 18-74 living near new Milwaukie line stations before and after the line opens (n = ~3500)
- Measure changes in total and transportation-related physical activity in a subset of 600 participants
- Measure changes in health care utilization and cost before and after opening of the rail extension

Location of Cases and Controls



APPLYING THE EVIDENCE

SCENARIO PLANNING OVERVIEW

- Scenario planning is a method for analyzing and comparing the impacts of various land use and transportation alternatives
- Typical impacts considered include financial costs, transportation accessibility & housing availability
- More recently health impacts are being added
- Results are used to inform decision-making about infrastructure investments, master planning, development proposals, etc.

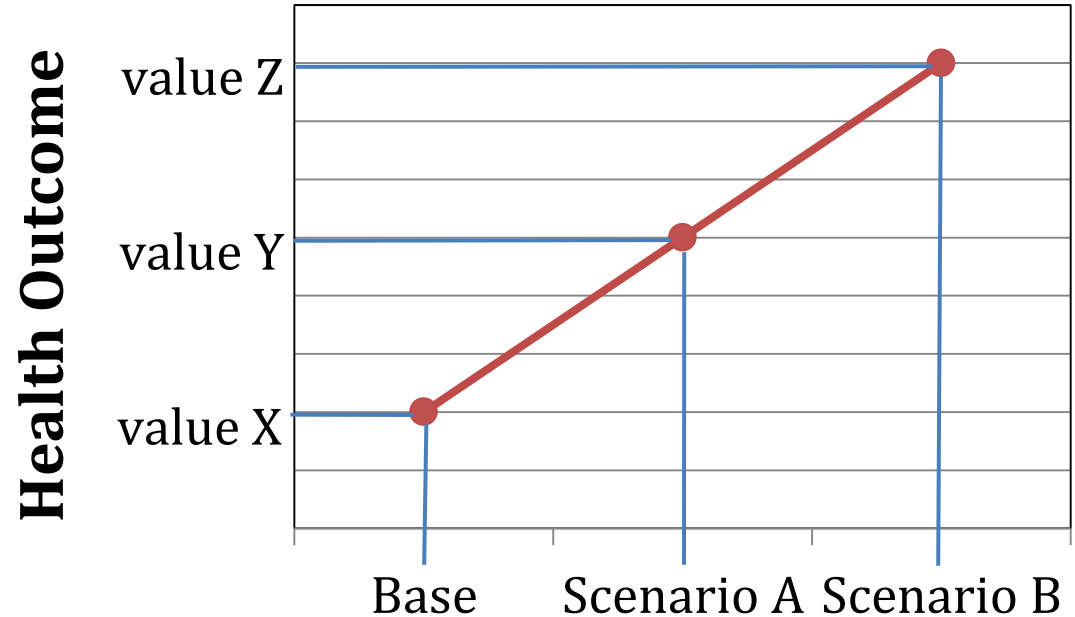
INTRODUCTION

- Bringing health into scenario planning
 - San Diego Healthy Works Tool (CPPW / ARRA)
 - Canadian Example - Surrey BC & Toronto Tool
 - California Public Health Assessment Model (CHPAM)
 - Southern California Association of Government's (SCAG) Regional Transportation Plan (RTP)
 - National Public Health Assessment Model (NPHAM)
 - National Environmental Database (NED)
- Monetizing Southern California (LA's) Long Range Transportation Plan's Health outcomes

SCENARIO PLANNING OVERVIEW

Examples:

- Determine benefits of proposed infill projects on physical activity and health of nearby residents
- Determine relative impacts of alternate transportation and land use scenarios on diabetes and cardiovascular disease



GENESIS OF TOOL DEVELOPMENT

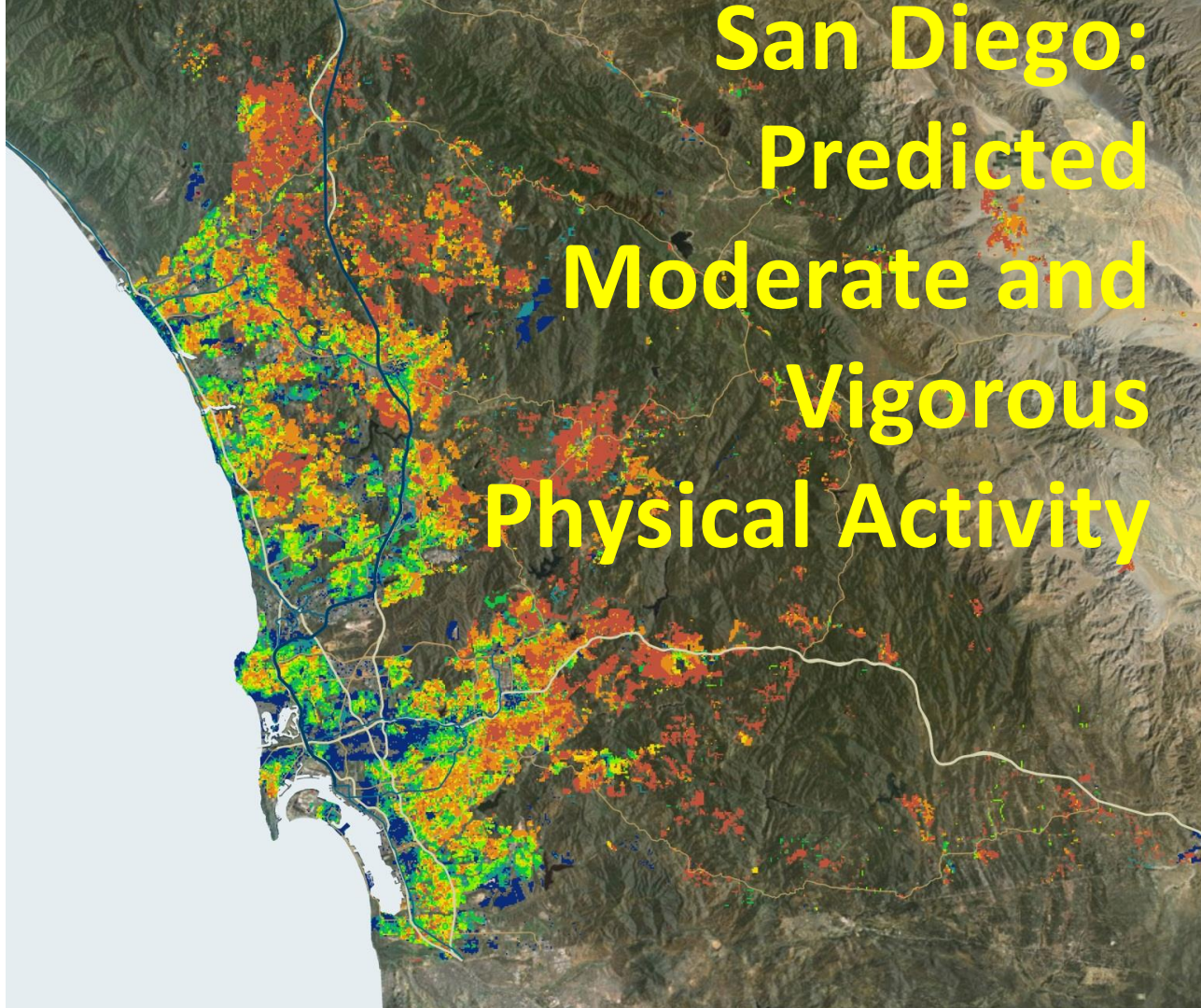
- **2005:** INDEX: Livable Community Initiative: Atlanta (SMARTRAQ)
- **2007:** I-PLACE3S: King County, added health module
- **2011:** UrbanFootprint: Vision California
- **2012:** CommunityViz: San Diego, & Toronto, Ontario & Surrey, BC—added health module
- **2015:** California Public Health Assessment Module (CPHAM) for Urban Footprint 2.0
- **2016:** National Public Health Assessment Model (NPHAM) supported by National Environment Database (NED)

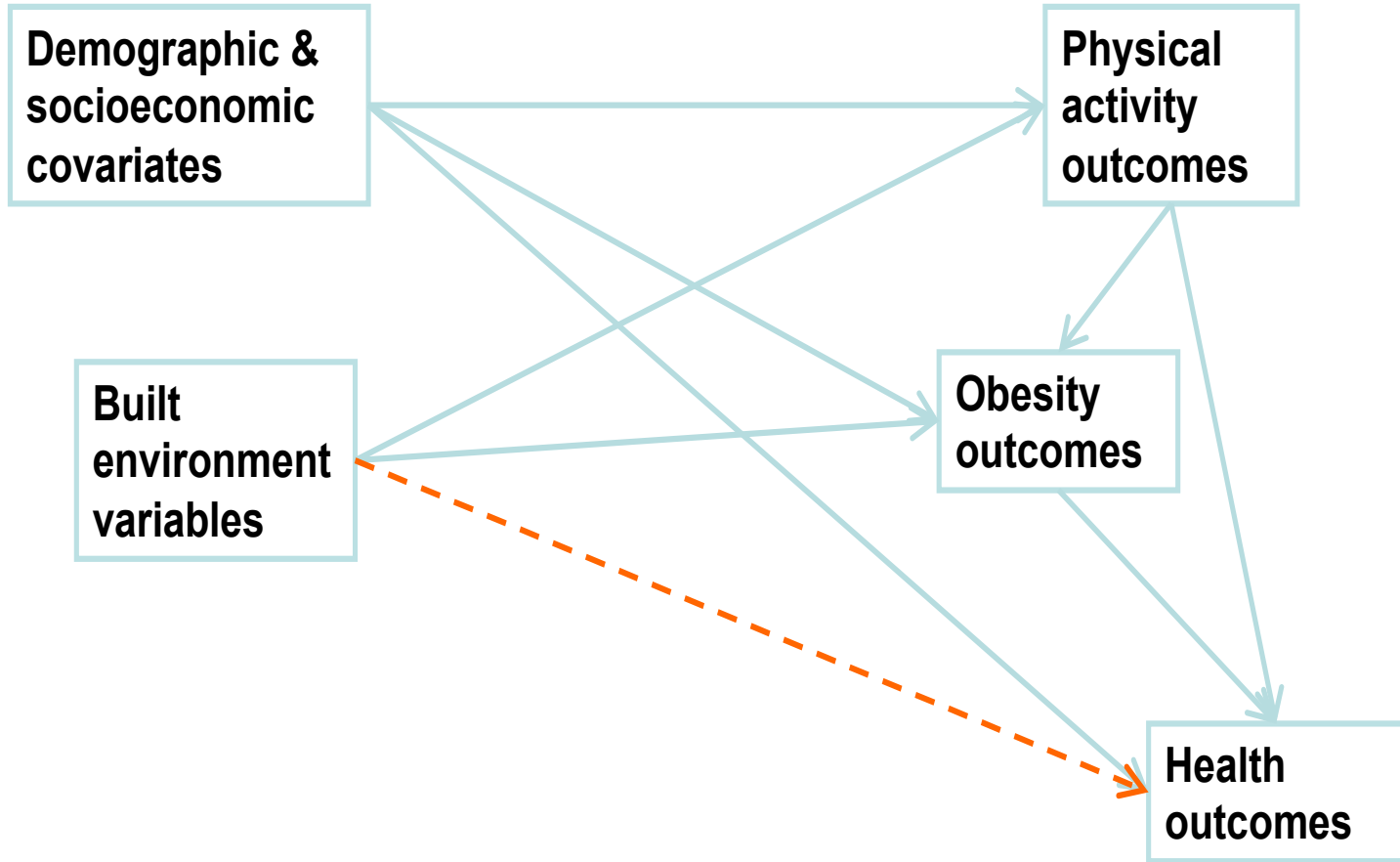
SAN DIEGO COUNTY

- Tool – CommunityViz
- Project – Healthy Works
- UD4H created statistical models, which were programmed into the software, creating a new health module
- Application– Palomar Gateway Development

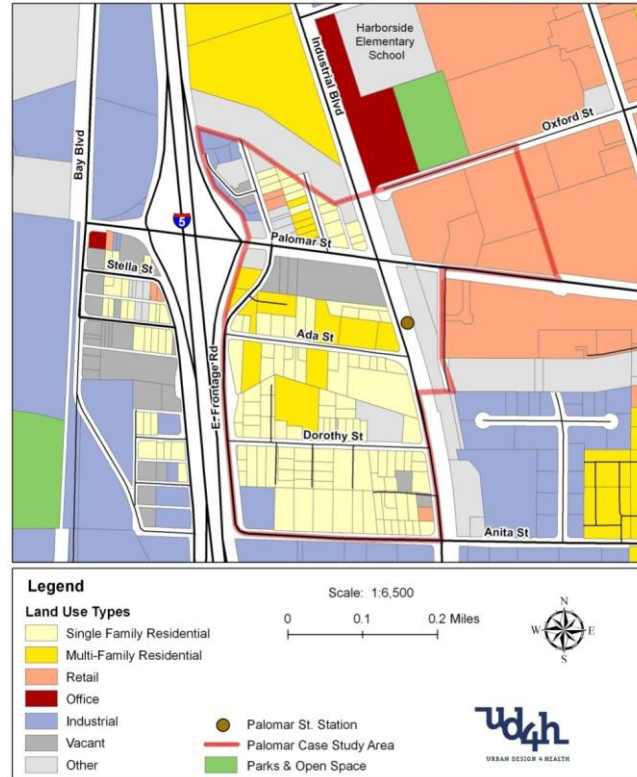


San Diego: Predicted Moderate and Vigorous Physical Activity





CASE STUDY: PALOMAR GATEWAY



PALOMAR GATEWAY: BUILT ENVIRONMENT CHANGES

Variable	Base Scenario	Change Scenario	Units
Single Family DU	192	80	housing units
Multi-Family DU	155	1626	housing units
Total Population	884	3841	people
Residential Area	44.3	68.5	acres
Net Residential Density	7.8	24.9	units/acre
Retail Floorspace	370073	395221	square feet
Retail Area	15.7	7.3	acres
Retail FAR	0.5	1.3	
Office Floorspace	0	41238	square feet
Office Area	0	1.2	acres
Office FAR	0	0.8	
Civic and Education Floorspace	0	20035	square feet
Recreation and Entertainment Floorspace	0	68393	square feet
Park Area	1.2	1.2	acres
Number of Schools	0	0	
Number of Transit Stops	3	3	
Number of Grocery Stores	1	2	
Total Road Centerline Miles	4.2	4.2	miles
Total Sidewalk Miles	4.5	5.5	miles
Sidewalk Coverage	53%	66%	
Total Bike Miles	0.5	1.2	miles

PALOMAR GATEWAY RESULTS SUMMARY

- All adult health metrics improved in the change scenario, including
 - 68% increase minutes of daily transportation walking
 - 15.4% reduction in prevalence of high blood pressure
 - 9.6 % reduction in prevalence of type II diabetes
- Child/teen results were mixed
 - Physical activity predicted to increase for children/teens
 - Obesity prevalence for teens predicted to increase
 - Asthma prevalence for children/teens predicted to increase
- Collision risk factor increased

PALOMAR GATEWAY RESULTS - ADULTS

HEALTH INDICATOR	Regional average	Base Scenario	Change Scenario*	Percent Change*
Daily minutes in car – adults (age 16 and up)	55.81	49.04	44.89	-8.46%
Daily minutes transportation walking – adults (age 16 and up)	6.61	6.1	10.24	67.87%
Daily minutes leisure walking - adults (18 and up)	12.27	8.42	8.87	5.34%
Daily minutes leisure moderate activity (adults 18+; not incl. walking)	34.21	17.33	18.38	6.06%
Percent visiting park in last 30 days (adults 18 and up)	70.3	56.95	59.23 (59.37)	4.00% (4.25%)
Body Mass Index - Adults 18 and up	26.73	28	27.65 (27.64)	-1.25% (-1.29%)
Percent of adults obese	21.7	32.73	31.66	-3.27%
Percent of adults overweight or obese	59	68.91	66.98 (66.9)	-2.80% (-2.92%)
Percent of adults with high blood pressure	28.2	30.92	26.16	-15.39%
Percent of adults with Type 2 Diabetes	4.4	8.63	7.8	-9.62%
Percent of adults 18 and up with current asthma	10.8	5.69	5.43	-4.57%
Pedestrian and Bike Collision Risk Factor 1-100 (all age groups)	39.55	46.71	47.65 (47.01)	2.01% (0.64%)
Self-rated general health (5 = highest) per adult 18 and up	2.42	3.21	3.28	2.18%
*Numbers in parentheses are results of an additional 10 percent decrease in traffic volumes				
Color Key				
 1-10% change - positive health impact	 1-10% change - negative health impact			
 10-25% change - positive health impact	 10-25% change - negative health impact			
 over 25% change - positive health impact	 over 25% change - negative health impact			

CALIFORNIA PUBLIC HEALTH ASSESSMENT MODULE (CPHAM)

Funder: California Strategic Growth Council



CALIFORNIA STRATEGIC
GROWTH COUNCIL

Key Elements:

- Quantitative statistical models of **built environment & health**
 - Outcomes include BMI, likelihood of being obese, likelihood of having high blood pressure/heart disease/type 2 diabetes
- Integrated into Calthorpe's UrbanFootprint



C-PHAM STUDY REGION

30 counties across five California regions:

- San Francisco Bay Area
- Sacramento
- San Diego County
- San Joaquin Valley
- Southern California
(including Los Angeles)



Extensive Peer Review Process

- Transportation, Built Environment, and Public Health Experts From:
 - UCLA
 - UC Berkeley
 - Rand Corporation
 - California Dept. of Public Health
 - San Diego County Health and Human Service
 - Strategic Growth Council
 - Governor's Office of Policy Research
 - MPO's (SCAG / LA Region, SACOG Sacramento Region)

CALIFORNIA PUBLIC HEALTH ASSESSMENT MODULE (CPHAM)

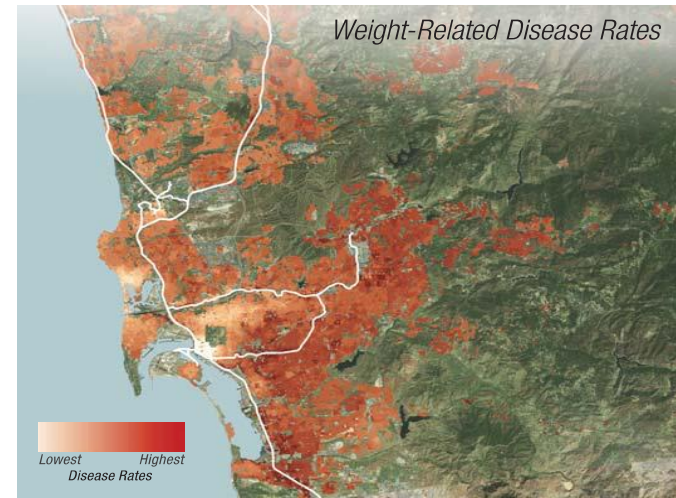
Key Elements continued:

- **Data** from parcel level and address-level large, representative surveys
 - Parcel level built environment data (density, connectivity, etc) from UrbanFootprint
 - Household Travel Survey Data
 - Health Survey Data
 - 5 major regions
- **Fine spatial scale** analysis and predictions
 - 1-km buffers around 150x150 grid cells

CALIFORNIA PUBLIC HEALTH ASSESSMENT MODULE (CPHAM)

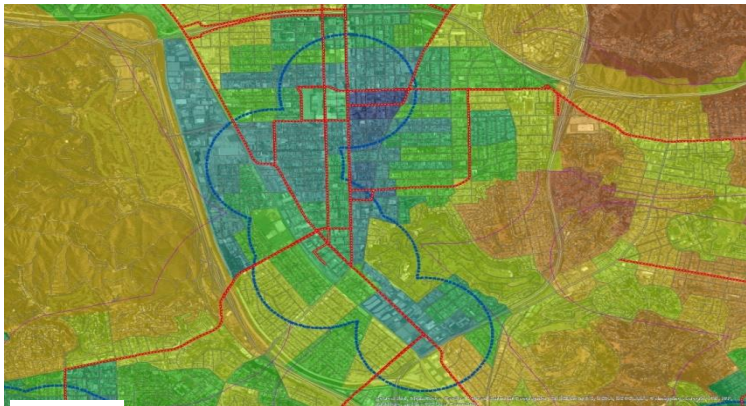
Key Elements continued:

- Outcomes:
 - Recreation Physical Activity - Minutes Daily
 - Walking - Minutes Daily
 - Biking - Minutes Daily
 - Auto - Minutes Daily
 - Obese Population (%)
 - High Blood Pressure (%)
 - Heart Disease (%)
 - Diabetes - Type 2 (%)



UrbanFootprint measures weight-related disease rates based on the urban form and demographic characteristics of scenarios.

Applying Evidence to the Los Angeles Long Range Plan



Adults: Ages 18-65	Base Year 2012	Net Change: (2012 - 2040)
Recreation Physical Activity - Minutes Daily	13 min	+ 9%
Walking - Minutes Daily	23 min	+ 10%
Biking - Minutes Daily	3 min	+ 12%
Auto - Minutes Daily	55 min	- 6%
Obese Population (%)	21.5%	- 3%
Poor Health Population (%)	24.1%	- 13%
High Blood Pressure (%)	19.6%	- 1%
Heart Disease (%)	4.3%	0%
Diabetes - Type 2 (%)	5.6%	- 11%

Source: California Public Health & Activity Model –
Scenario Planning for Southern California Association of Governments

Urban	Compact	Standard	Land Development Category Comparison (Typical Household, 2012)
4,500 mi/yr	12,000 mi/yr	26,500 mi/yr	<u>Household VMT</u>
35 min/day	23 min/day	7 min/day	<u>Walking</u> (per person)
55,000 gal/yr	82,000 gal/yr	142,000 gal/yr	<u>Residential Water Use</u>
39 mil btu/yr	58 mil btu/yr	79 mil btu/yr	<u>Residential Energy Use</u>
5 MT/year	9 MT/year	16 MT/year	<u>Carbon Emissions</u>
\$4,400 \$/year	\$9,600 \$/year	\$19,000 \$/year	<u>Household Costs</u>

From driving, residential energy, water related energy. Excludes commercial energy use.

Transport, Bldg. Energy, Bldg. Water

Data from: 2012, 2010, 2000, 1990, 1980, 1970, 1960, 1950, 1940, 1930, 1920, 1910, 1900, 1890, 1880, 1870, 1860, 1850, 1840, 1830, 1820, 1810, 1800, 1790, 1780, 1770, 1760, 1750, 1740, 1730, 1720, 1710, 1700, 1690, 1680, 1670, 1660, 1650, 1640, 1630, 1620, 1610, 1600, 1590, 1580, 1570, 1560, 1550, 1540, 1530, 1520, 1510, 1500, 1490, 1480, 1470, 1460, 1450, 1440, 1430, 1420, 1410, 1400, 1390, 1380, 1370, 1360, 1350, 1340, 1330, 1320, 1310, 1300, 1290, 1280, 1270, 1260, 1250, 1240, 1230, 1220, 1210, 1200, 1190, 1180, 1170, 1160, 1150, 1140, 1130, 1120, 1110, 1100, 1090, 1080, 1070, 1060, 1050, 1040, 1030, 1020, 1010, 1000, 990, 980, 970, 960, 950, 940, 930, 920, 910, 900, 890, 880, 870, 860, 850, 840, 830, 820, 810, 800, 790, 780, 770, 760, 750, 740, 730, 720, 710, 700, 690, 680, 670, 660, 650, 640, 630, 620, 610, 600, 590, 580, 570, 560, 550, 540, 530, 520, 510, 500, 490, 480, 470, 460, 450, 440, 430, 420, 410, 400, 390, 380, 370, 360, 350, 340, 330, 320, 310, 300, 290, 280, 270, 260, 250, 240, 230, 220, 210, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10, 0



SOUTHERN CALIFORNIA
ASSOCIATION of GOVERNMENTS

Health Monetization of Active Transportation

UNDERLYING COSTS TO THE REGION

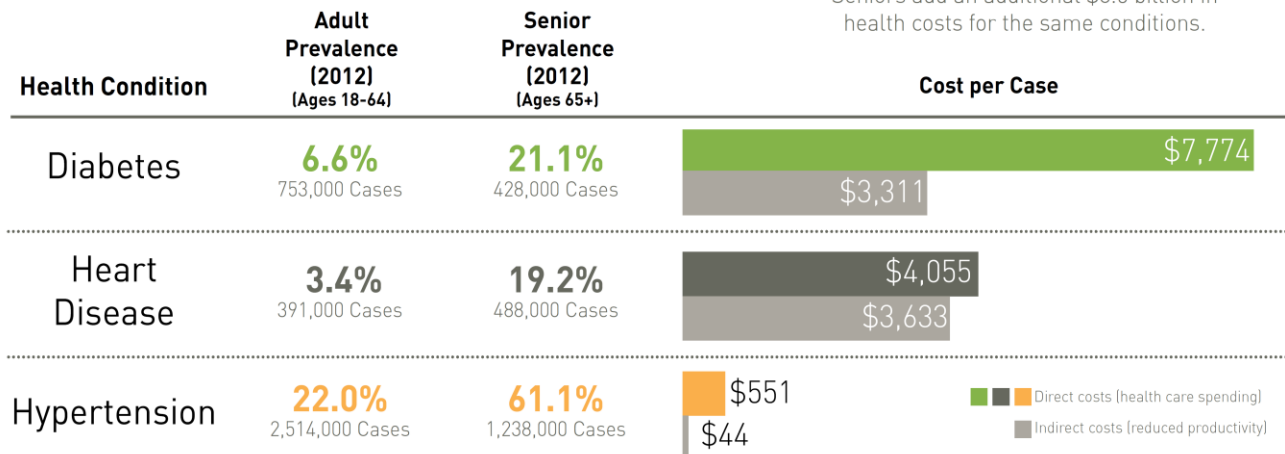
SCAG Region Economic Burden of Disease

Chronic diseases are costly, contributing to both health care expenditures and lost productivity expenses. Using econometric modeling, cost-of-illness studies calculate a “per case” estimate of additional spending attributable to diabetes, heart disease, and hypertension.



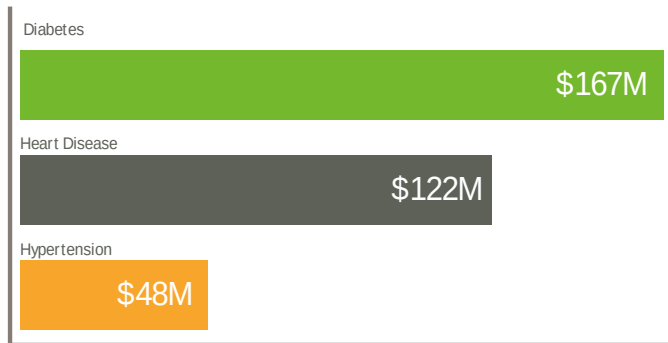
\$12.8 Billion

Total annual regional costs of diabetes, heart disease, and hypertension in ages 18-64. Seniors add an additional \$8.5 billion in health costs for the same conditions.



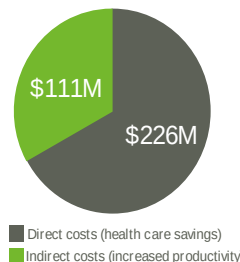
BENEFITS OF RTP/SCS IMPLEMENTATION

Predicted Annual Physical Activity Savings in 2040 for Adults (Age 18-64)



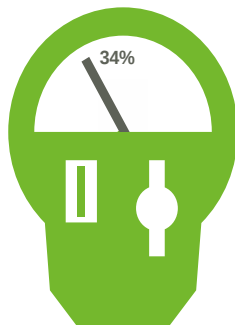
\$337 Million

Predicted annual physical activity savings in 2040 in adults ages 18-64 from full RTP implementation



\$4.5 Billion

Overall, accumulated savings from reduced hypertension, diabetes, and heart disease in adults (ages 18-64) is predicted to be \$4.5 billion throughout the life of the RTP.



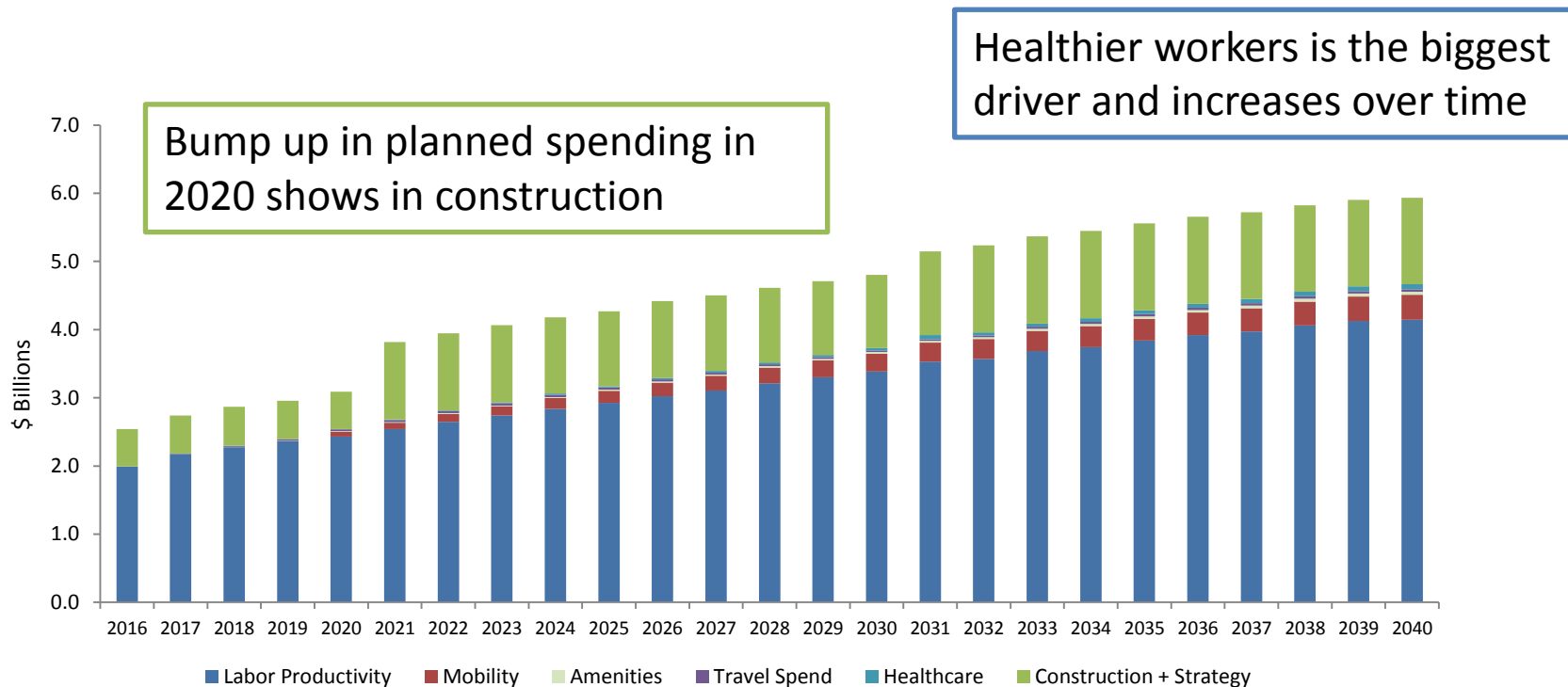
\$12.9 Billion

RTP spending on active transportation including bikeways, sidewalks, and educational campaigns.

EVALUATING HEALTH RIPPLE THROUGH ECONOMY

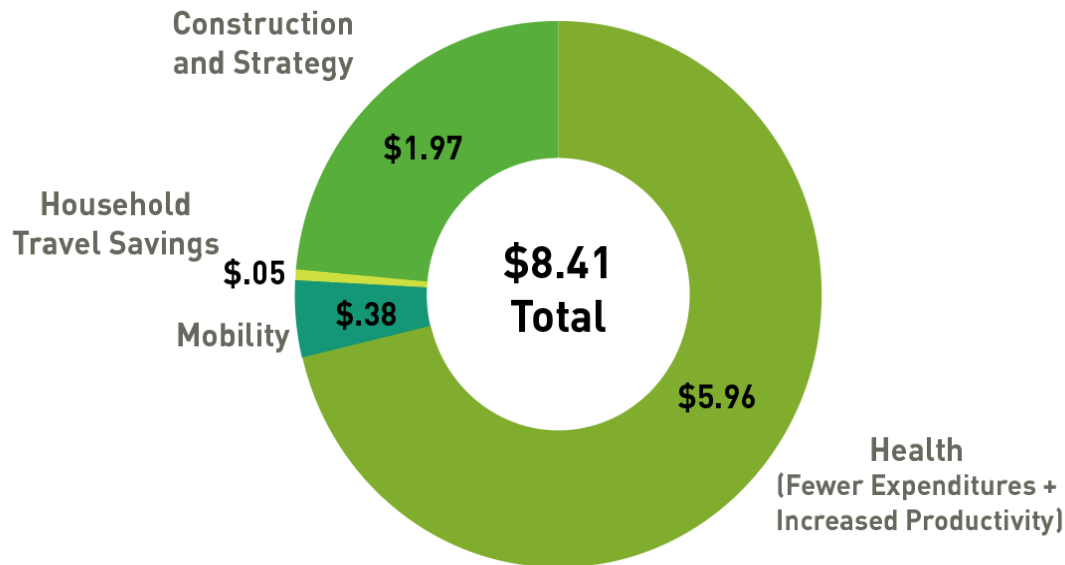
- **Induced Demand**
 - Construction worker buys lunch → fast food worker buys a phone → etc.
- Use REMI TranSight model
- SCAG's (LA) \$12.9 Billion in AT-RTP Spending
- Over the life of the plan, cumulative
 - \$36 Billion in **Personal Income**
 - \$114 Billion in **Sales Output**
 - **Numbers include construction and other drivers – but health plays a big roll**

SALES OUTPUT & PERSONAL INCOME FROM AT-RTP



SALES OUTPUT FROM ACTIVE TRANSPORT-RTP

Per \$1 Spent on AT-RTP 2016-2040



National Environmental Database (NED)

Goal: Develop a nationally consistent database of built, natural, and social environmental indicators

Funder: Robert Wood Johnson Foundation

Key Elements:

- Built, natural, and social environment
- Data must be
 - Consistent at block group scale
 - Nationally available
 - Public and routinely updated
- Complements National Public Health Assessment Model (NPHAM)



Thank You!

***Change is Inevitable. In a progressive
Country change is constant.
Benjamin Disraeli, 1867***