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Capturing the Transportation Benefits of Mixed Use Development

Smart Growth Partners

February 2012

"D" Factors that Reduce Trips and VMT

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1. **Density** dwellings, jobs per acre
2. **Diversity** mix of housing, jobs, retail
3. **Design** connectivity, walkability
4. **Destinations** regional accessibility
5. **Distance to Transit** rail proximity
6. **Development Scale** pop, jobs
7. **Demographics** household size, income
8. **Demand Management** pricing …

1D

Single-Family Detached Housing
(210)

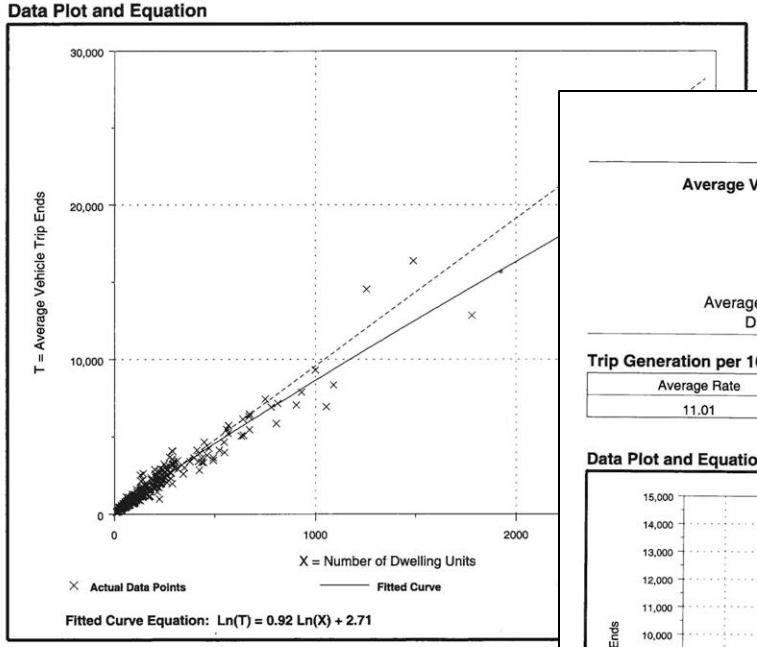
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 350
Avg. Number of Dwelling Units: 197
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.57	4.31 - 21.85	3.69

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.71

General Office Building
(710)

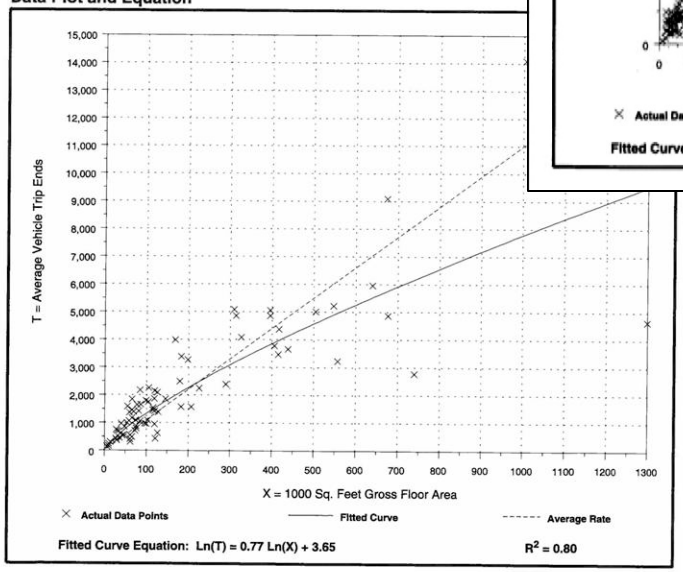
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Flo
On a: Weekday

Number of Studies: 78
Average 1000 Sq. Feet GFA: 199
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Sta
11.01	3.58 - 28.80	

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.77 Ln(X) + 3.65 R^2 = 0.80

Shopping Center
(820)

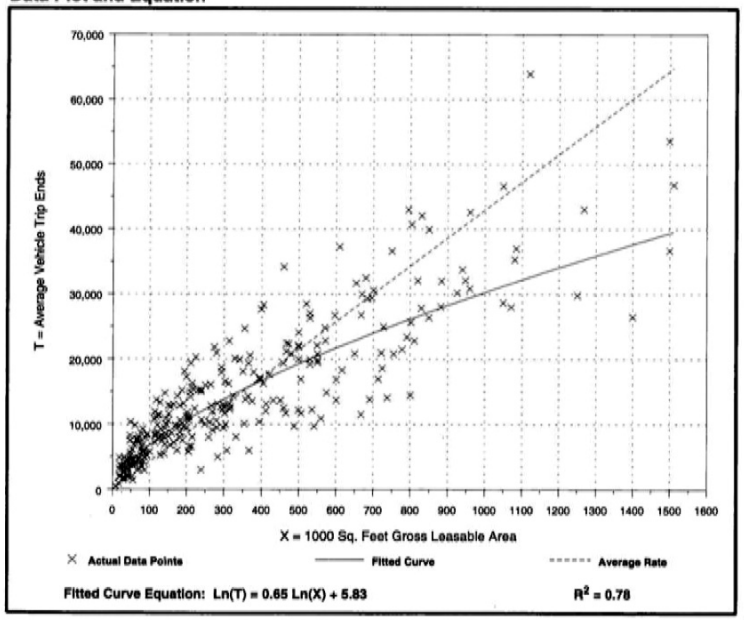
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday

Number of Studies: 302
Average 1000 Sq. Feet GLA: 328
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
42.94	12.50 - 270.89	21.38

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.65 Ln(X) + 5.83 R^2 = 0.78

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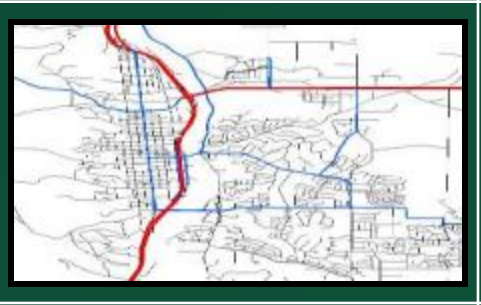
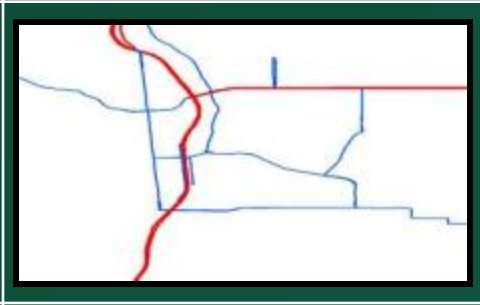
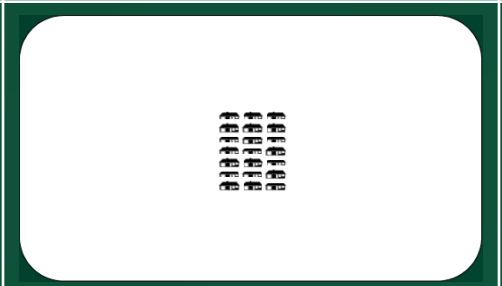
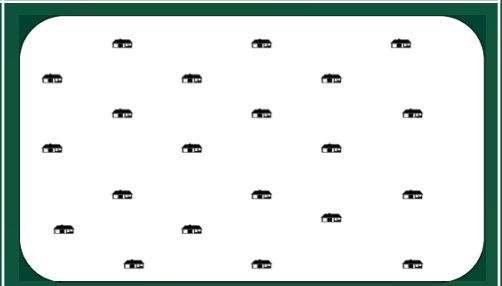
Typical 4-Step Model "Blind Spots"

	Reality	Model's View
Circulation Network		
Walking Environment		
Density, Clustering		

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7D Analysis of Travel Survey Data

- Statistical relationships from travel data for sites meeting ITE multi-use definition
- Assess influence of 7D's, mix and scale
- Validate through comparison to field data

Nationwide Survey of Mixed-Use Travel

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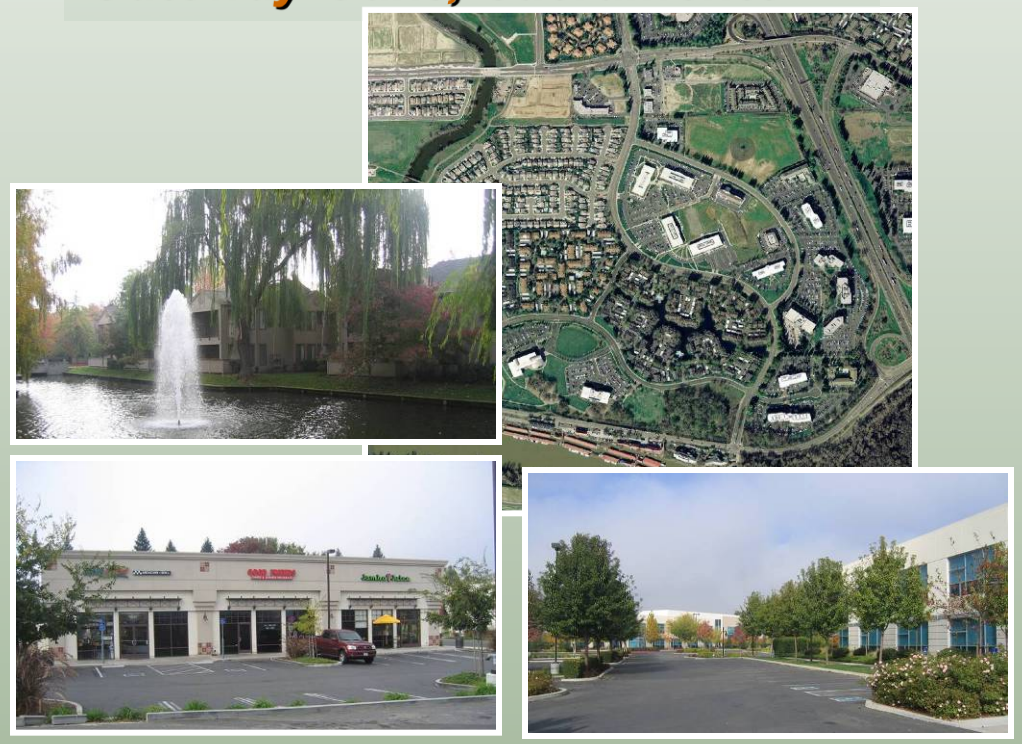
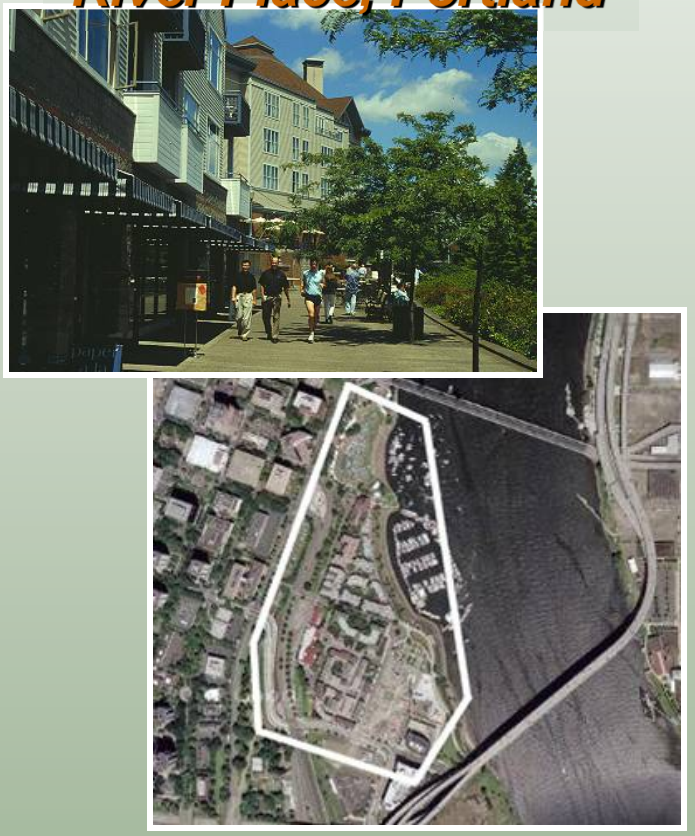
239 MXD: Seattle, Portland, Sacramento, Boston, Atlanta, Houston

Validation: Northern and So. Cal, Texas, Georgia, Florida, Utah

Gateway Oaks, Sacramento



River Place, Portland



7D Factors Correlated with Reduced Travel

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- **Density** of population and employment
- **Diversity:** jobs/housing relative to regional balance
- **Diversity:** balance of commercial, office, and public
- **Design:** intersections per square mile
- **Destination Accessibility:** jobs within 1 mile
- **Destination Accessibility:** jobs within a 30 min by transit
- **Distance to Transit:** rail station, bus stops within ¼ mile
- **Development Scale:** MXD population and employment
- **Demographics:** household size, vehicle ownership

** Internal travel and walking, transit use, trip length*

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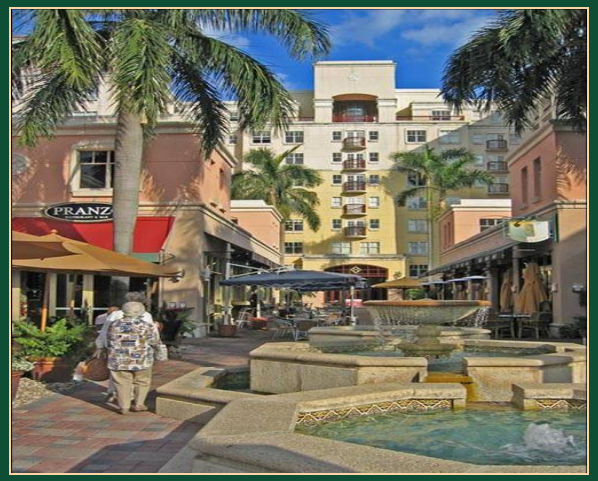
28 Nationwide Validation Sites

- 7 Florida sites
  (including ITE *Trip Generation Handbook)*
- 15 California sites
- 2 sites in Texas
- 2 in Georgia, S Carolina
- 2 sites in Utah
- Variety of scale, mix, design



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Atlantic Station, Atlanta

Uptown District, San Diego

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Irvine California

Plano Texas

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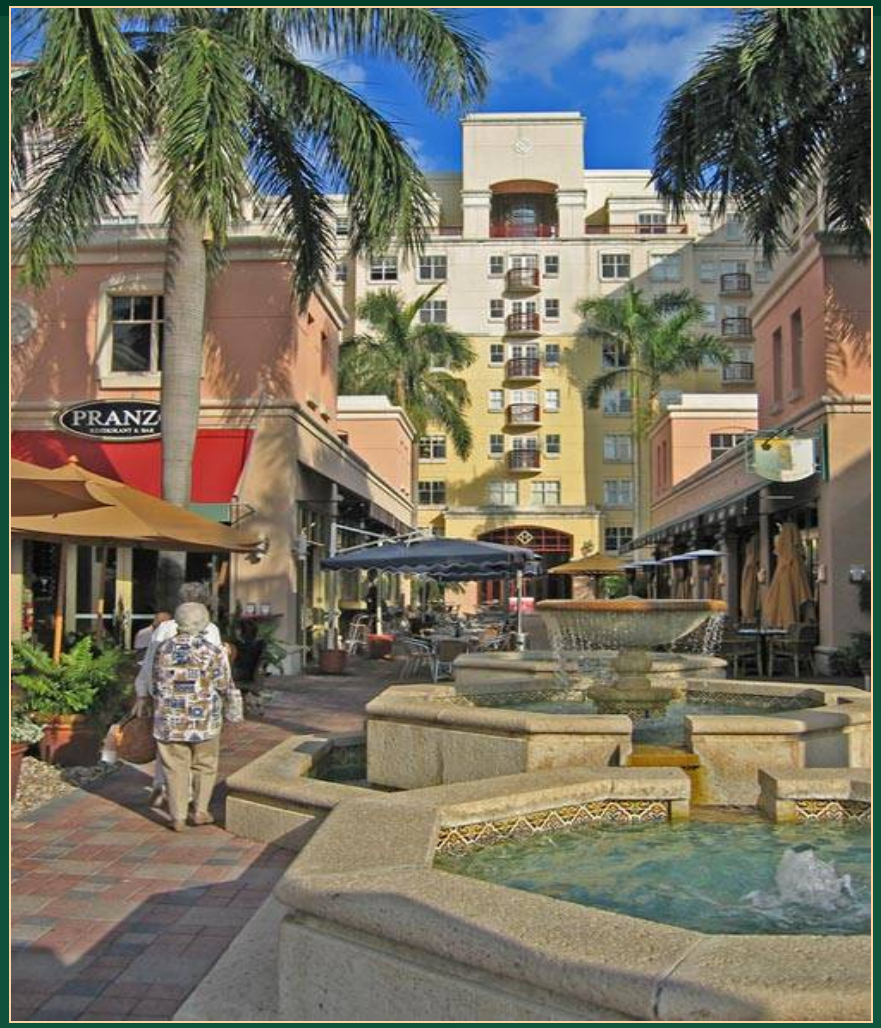

Mixed-Use Centers, California and Florida

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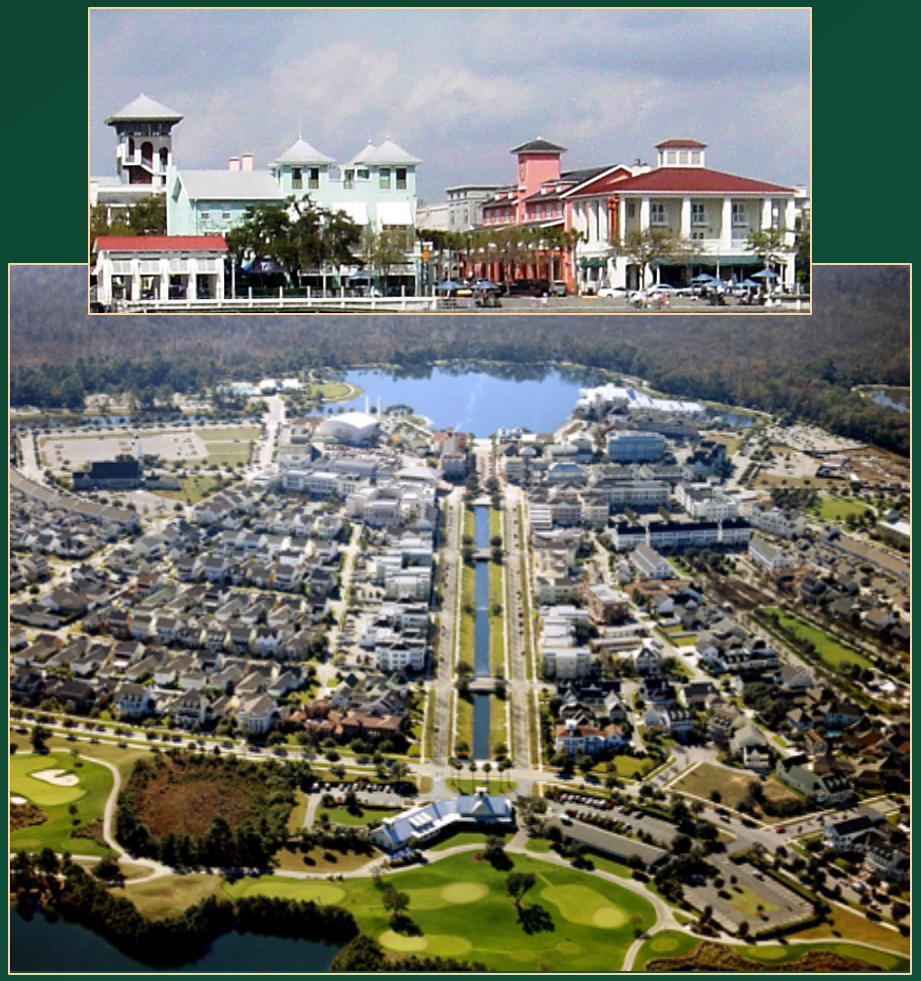

Celebration Florida

Otay Ranch California

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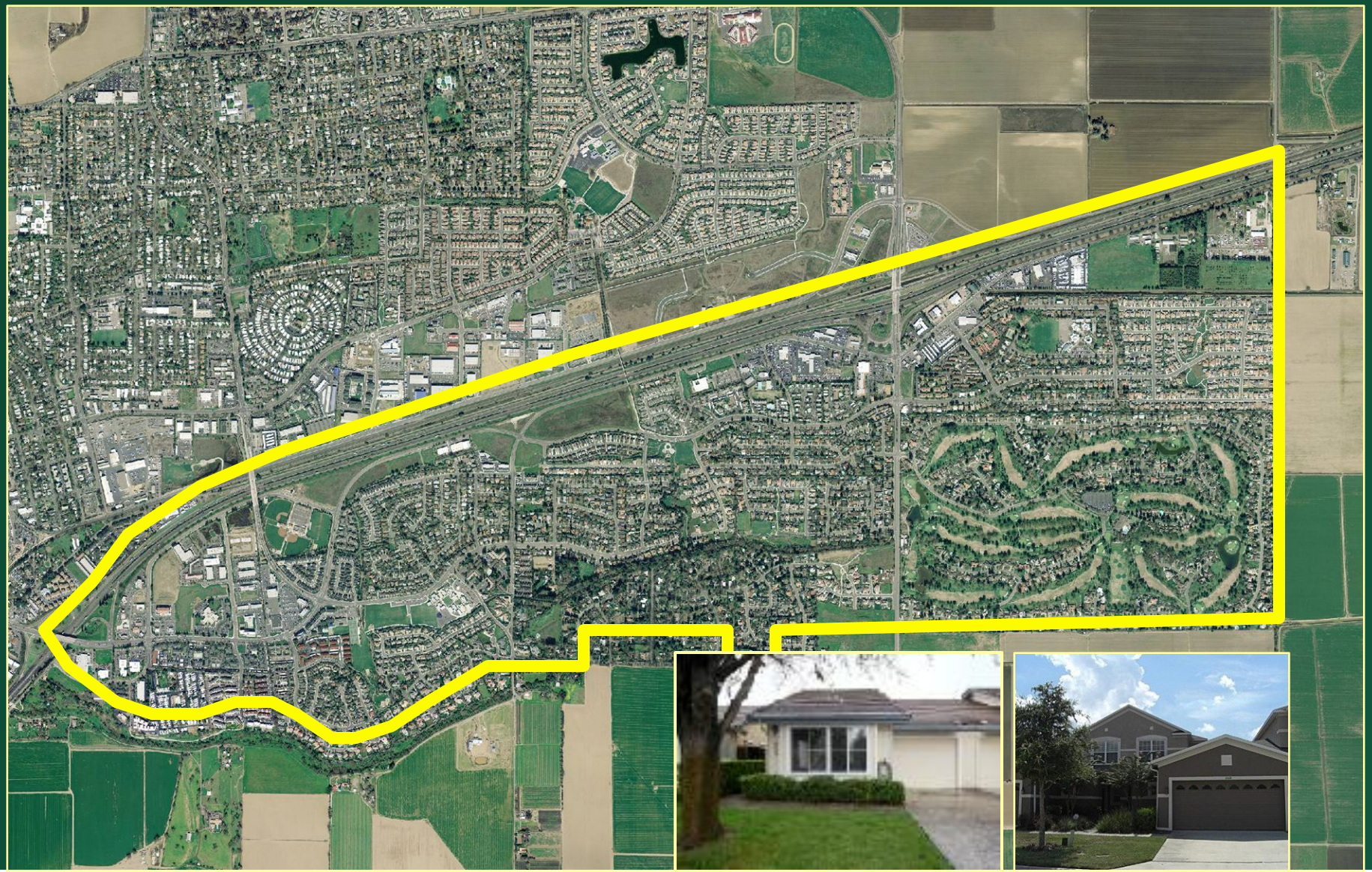
South Davis, CA



Moraga, CA

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Mockingbird Station, Dallas

Bay Street, Emeryville, CA

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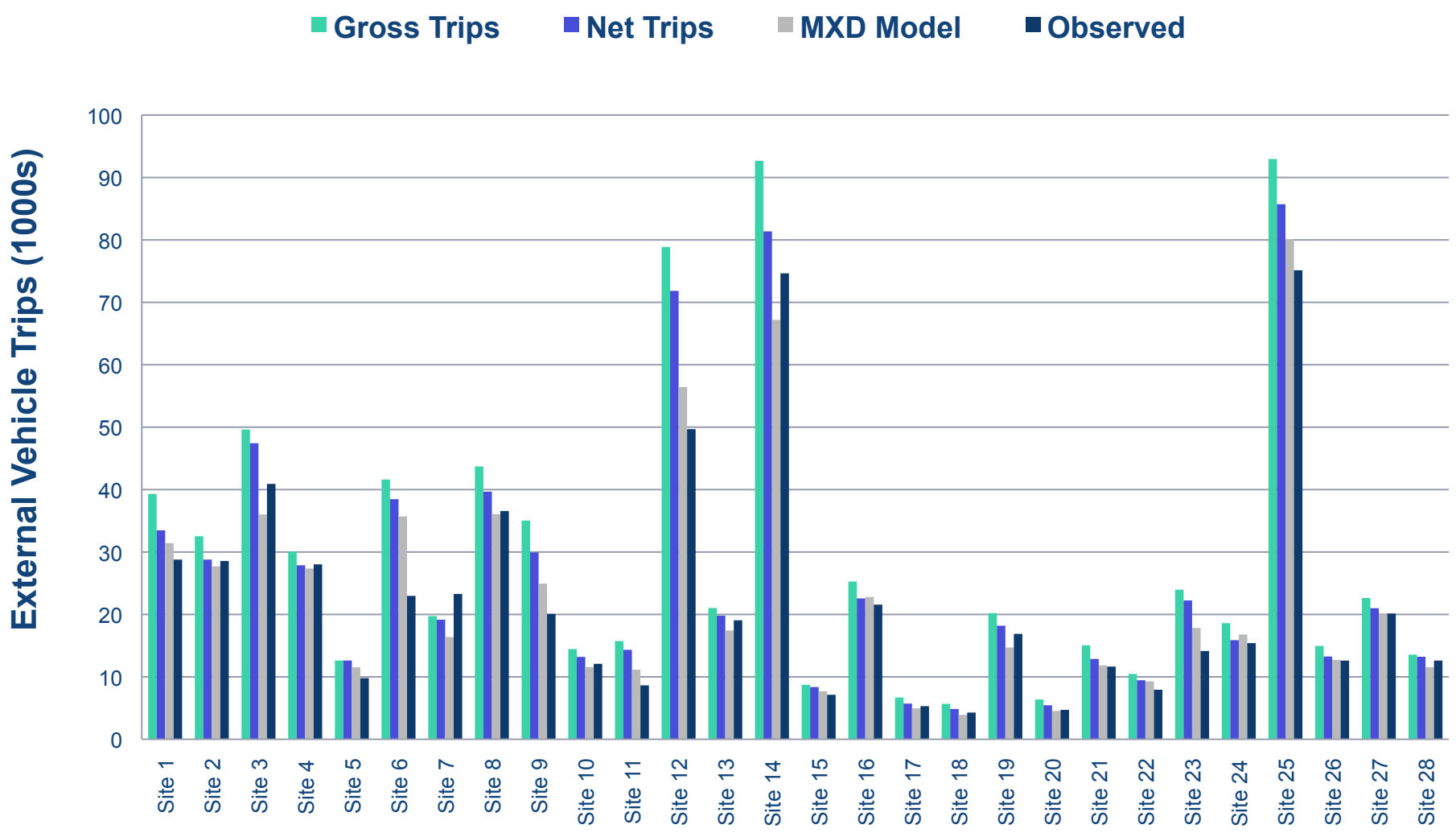
MXD Model Validation



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Comparison of MXD Model to Other Methods
(28 Validation Sites)

	Raw ITE or San Diego	Current Methods	MXD Model
Average Model Error	30%	17%	4%
%RMSE	42%	28%	17%
R Squared (% of difference among sites explained by method)	72%	87%	95%

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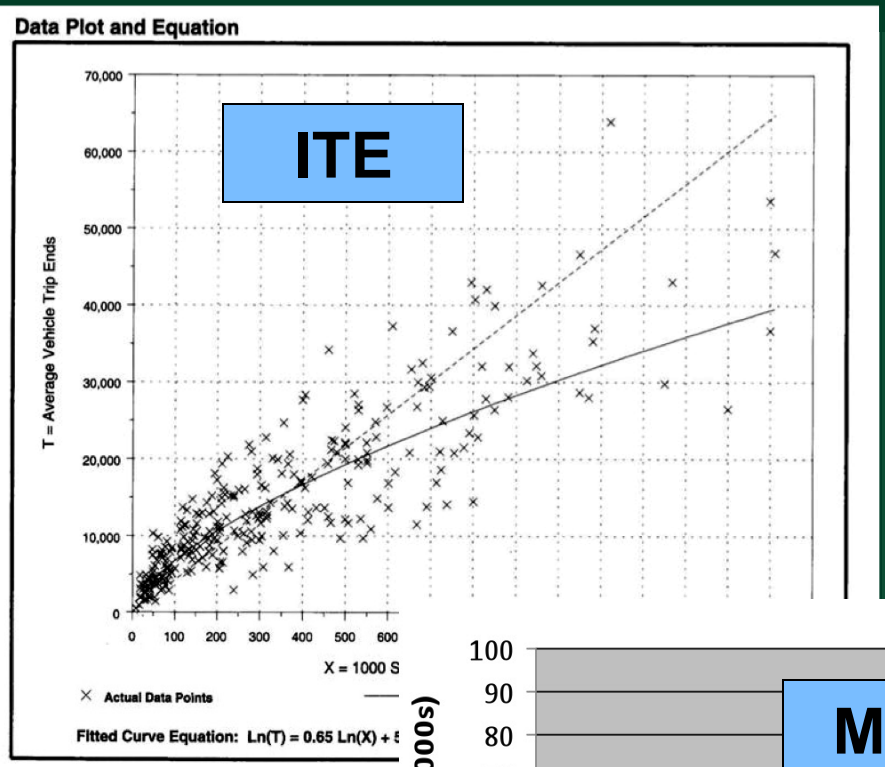
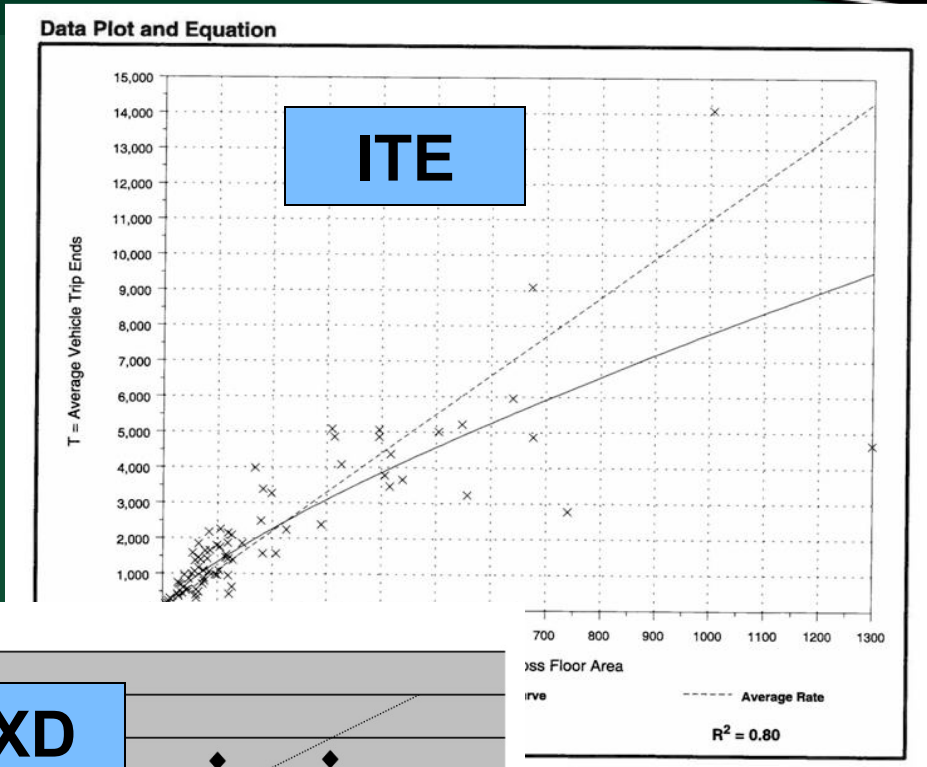
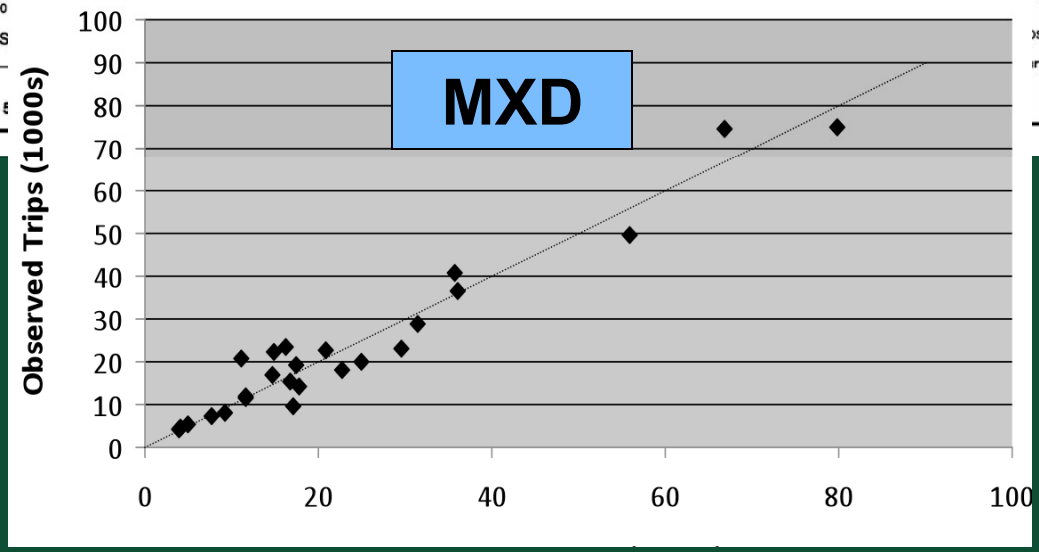
MXD Model Compared with ITE







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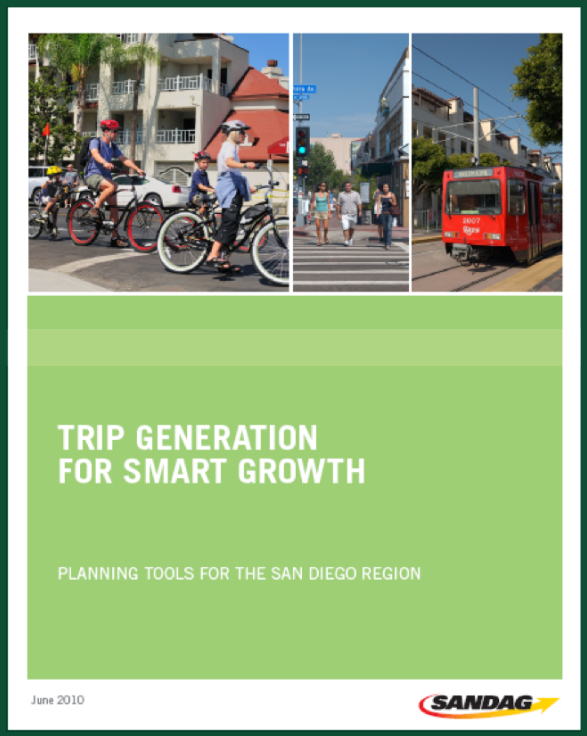
MXD Acceptance