Meta Analysis of Economic Impact Studies: Implications for Highway Investment Planning

Presented by:

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SHRP2 C03 Study & Meta Analysis Objectives

- Identify LONG-TERM Economic Impacts from New/Capacity-Enhancing Highway Investments
- Provide Findings that Illustrate the Interaction between Highway Infrastructure and Non-Highway Investments and Initiatives
- Develop Preliminary Assessment Guidance for Policy-makers and Practitioners
- Design Case-Based Web-Based Tool for Illustrating and Communicating Economic Impacts
- Create Flexible System for Adding New Cases

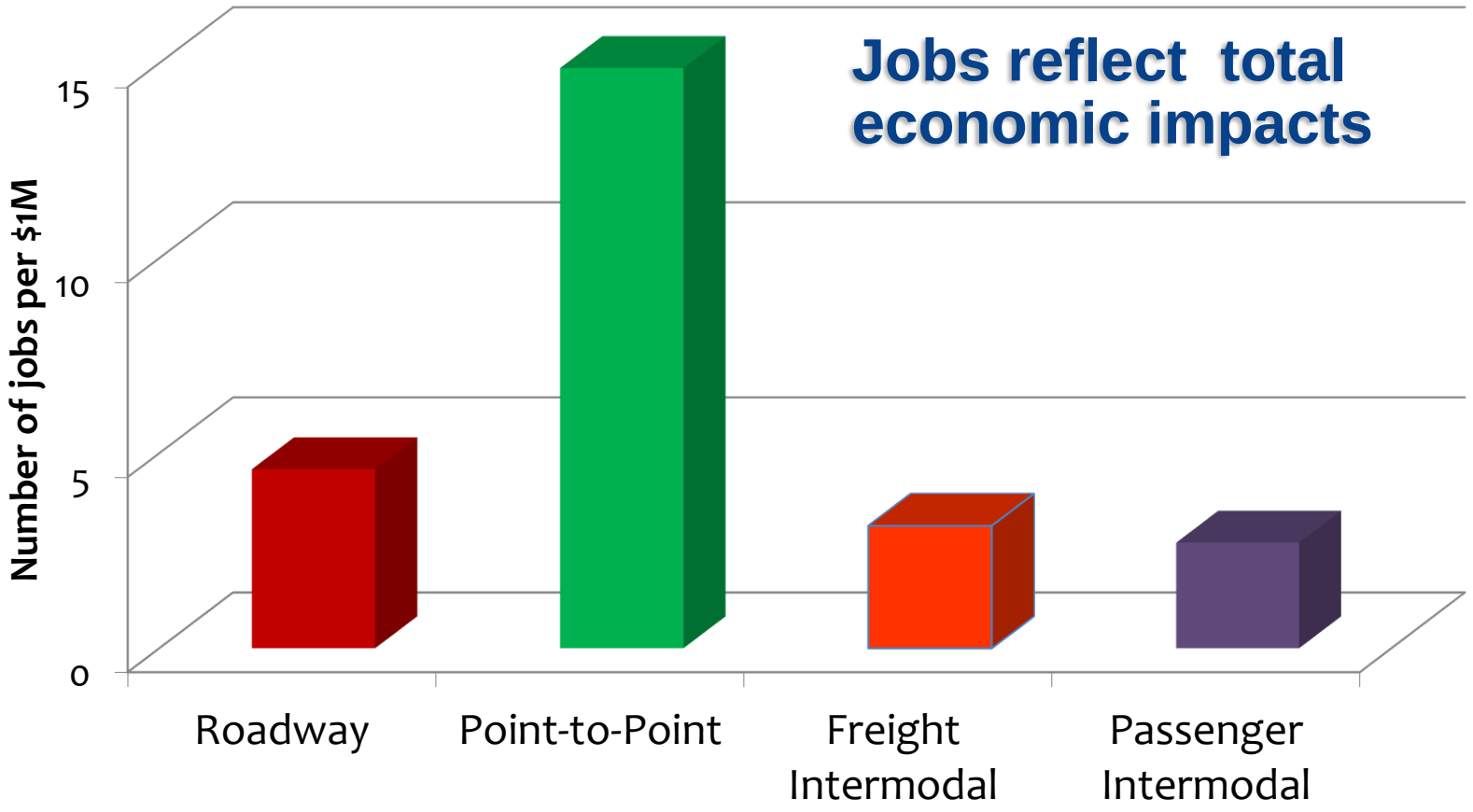
How Findings Were Developed

- Synthesis of Case Studies/Interviews
  - Focused on project types & factors influencing economic impacts
- Literature Review
  - Assessed prior studies, cases & ED research
- Assessment of Existing Models
  - Reviewed structural composition of ED models
- Statistical Analysis of Case Data
  - Identified key interactions & controlled for key factors
- Common Sense

Case Characteristics (US Projects)

Project Type	No. Cases	Median cost per mile (*millions*)	Median AADT
Access Road	7	$1.61	5,502
Beltway	8	$30.68	88,000
Bridge (includes 1 non-US)	9	$39.22	23,600
Bypass (includes 2 non-US)	11	$5.34	19,774
Connector	8	$21.79	16,910
Interchange	12	$14.05	53,450
Limited Access Road	14	$11.05	46,150
Widening	9	$46.17	24,000
Freight Intermodal	10	n/a	n/a
Passenger Intermodal	9	n/a	n/a
All Project Types (excluding 3 international)	***97***	***$14.98***	***28,856***

Median Jobs per $1M



(Beltway, Bypass, Major Highway, Widening)

(Access Road, Bridge, Connector, Interchange)

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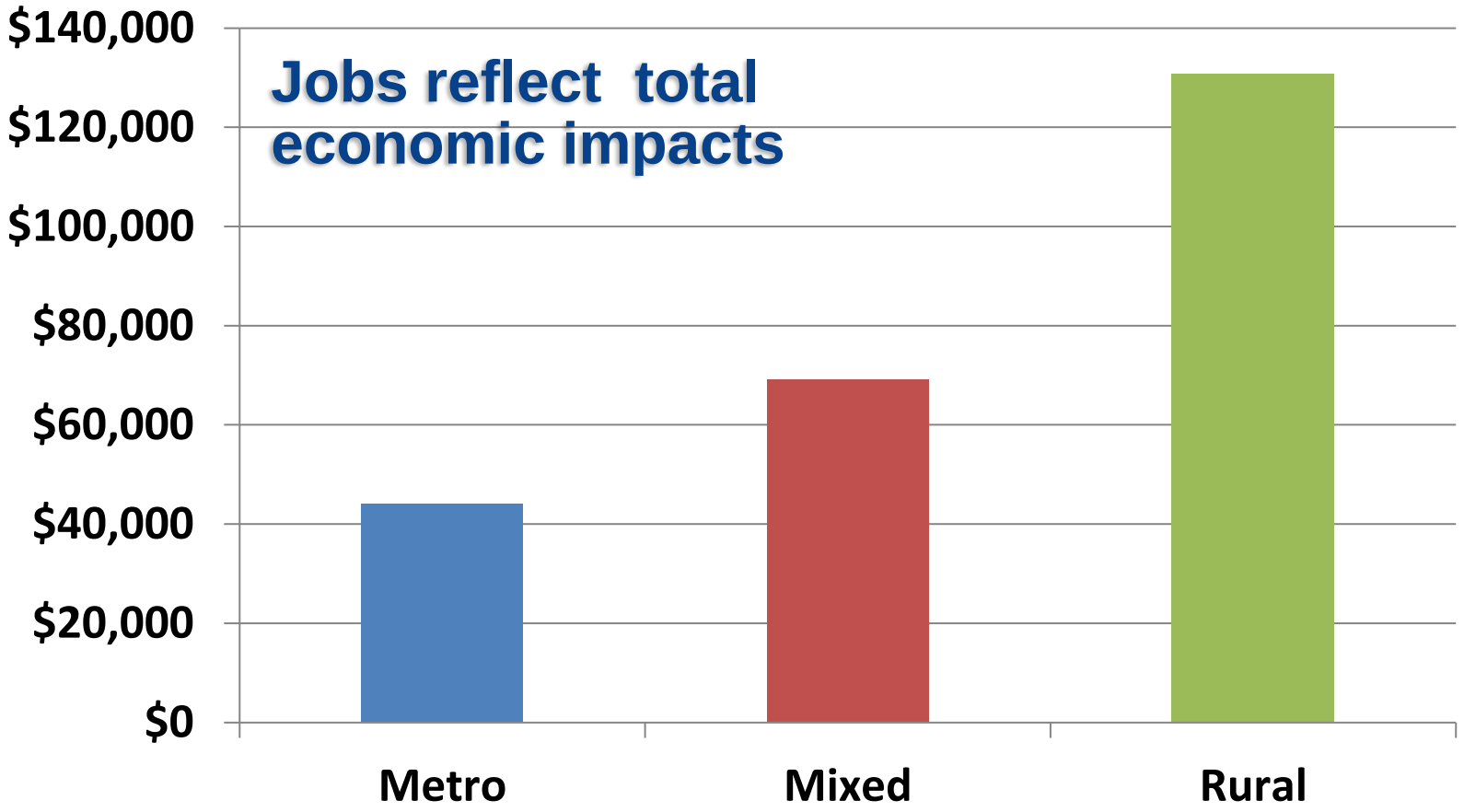
Median Cost Per Job by Setting



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Exploring Differences in Metro/Rural Settings

	Metro/Mix Setting			Rural Setting		
	#	Jobs Created		#	Jobs Created	
	Cases	Low	High	Cases	Low	High
Access Road	2	478	3,195	5	7	680
Beltway	7	2,106	43,753	-	-	-
Bridge	6	0	11,771	3	0	319
Bypass	5	0	23,977	6	0	1,420
Connector	6	0	14,578	2	0	412
Interchange	12	0	23,520	-	-	-
Limited Access Road	13	90	50,505	-	-	-
Widening	6	14,989	15,484	2	3,785	4,080
All Project Types*	57	0	50,505	18	0	4,080

**Excluding Passenger and Freight Intermodal*
Jobs reflect total economic impacts

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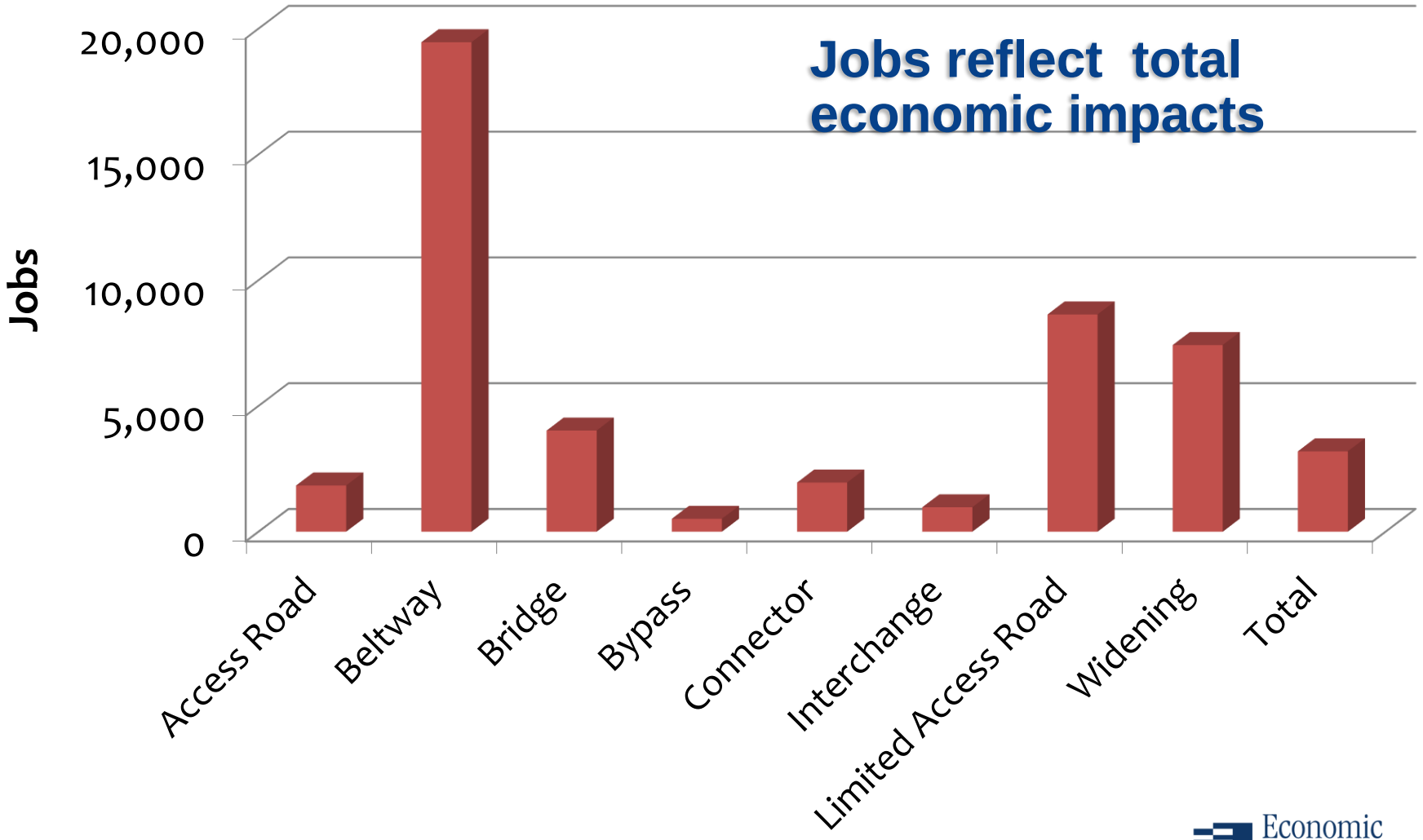
Median Jobs by Project Type - Metro/Mixed Setting



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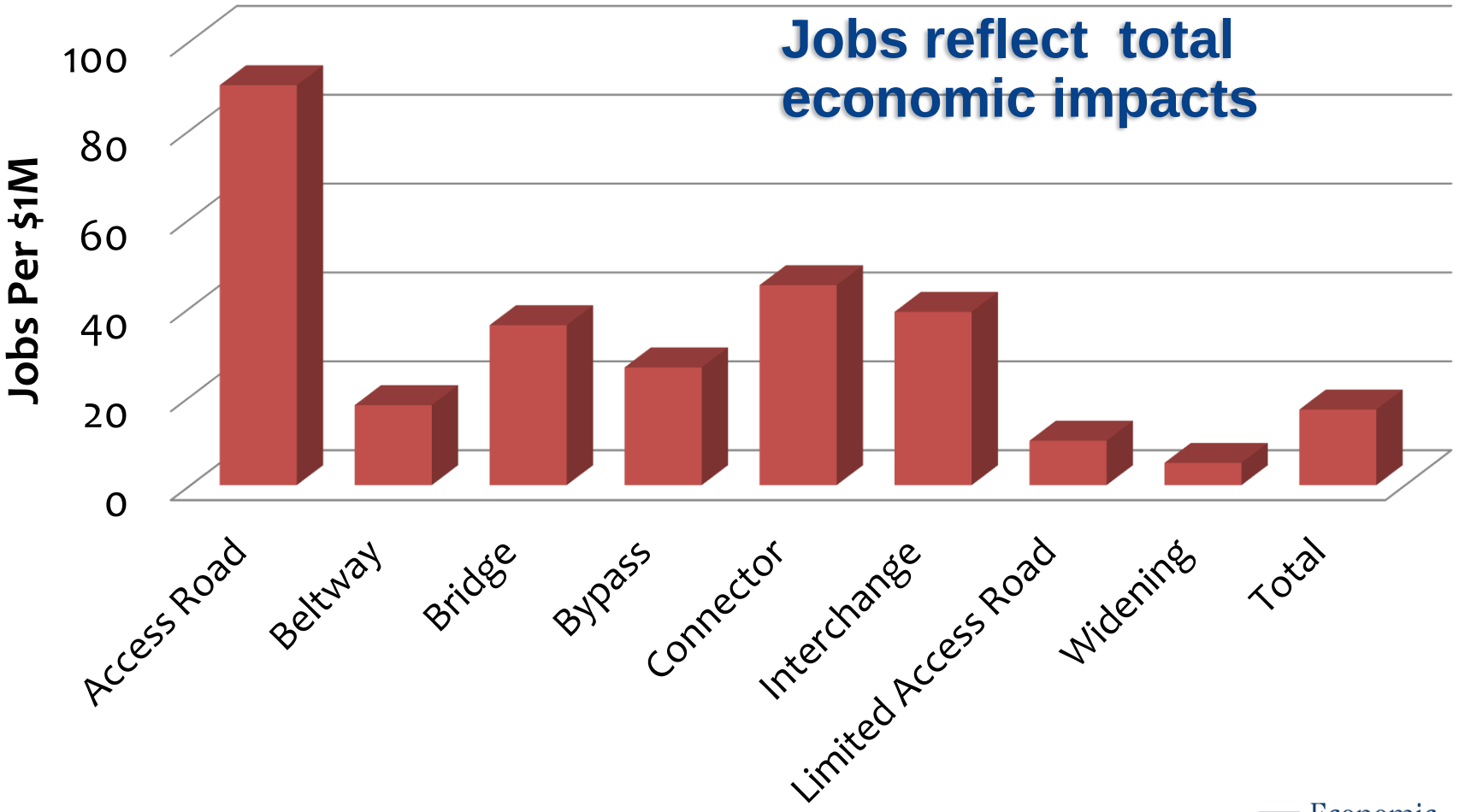
Jobs per $1 Million Project Cost by Type - Metro/Mixed Setting



* Excluding Passenger and Freight Intermodal

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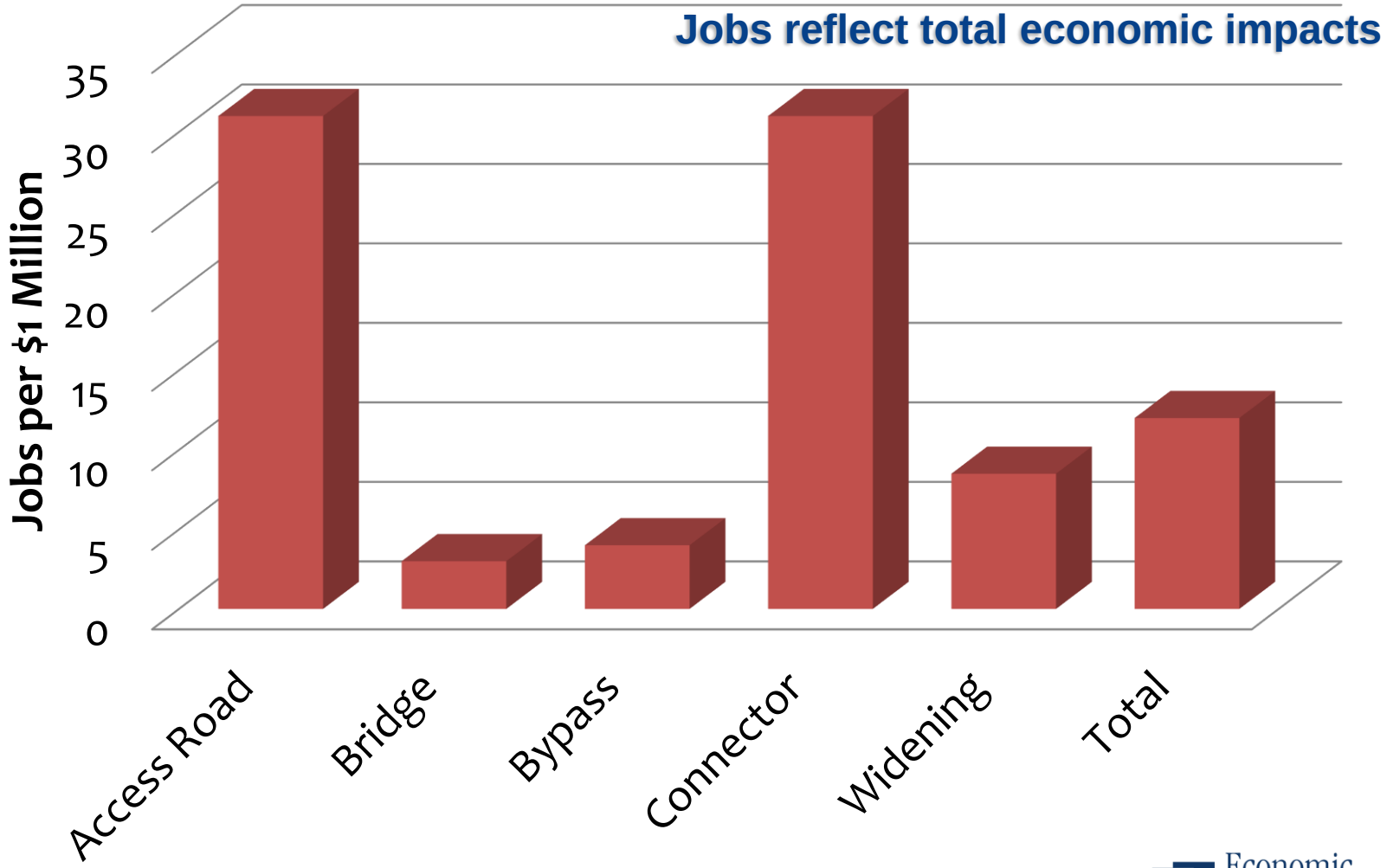
Median Jobs per $1 Million Project Cost by Type – Rural Setting



* Excluding Passenger and Freight Intermodal

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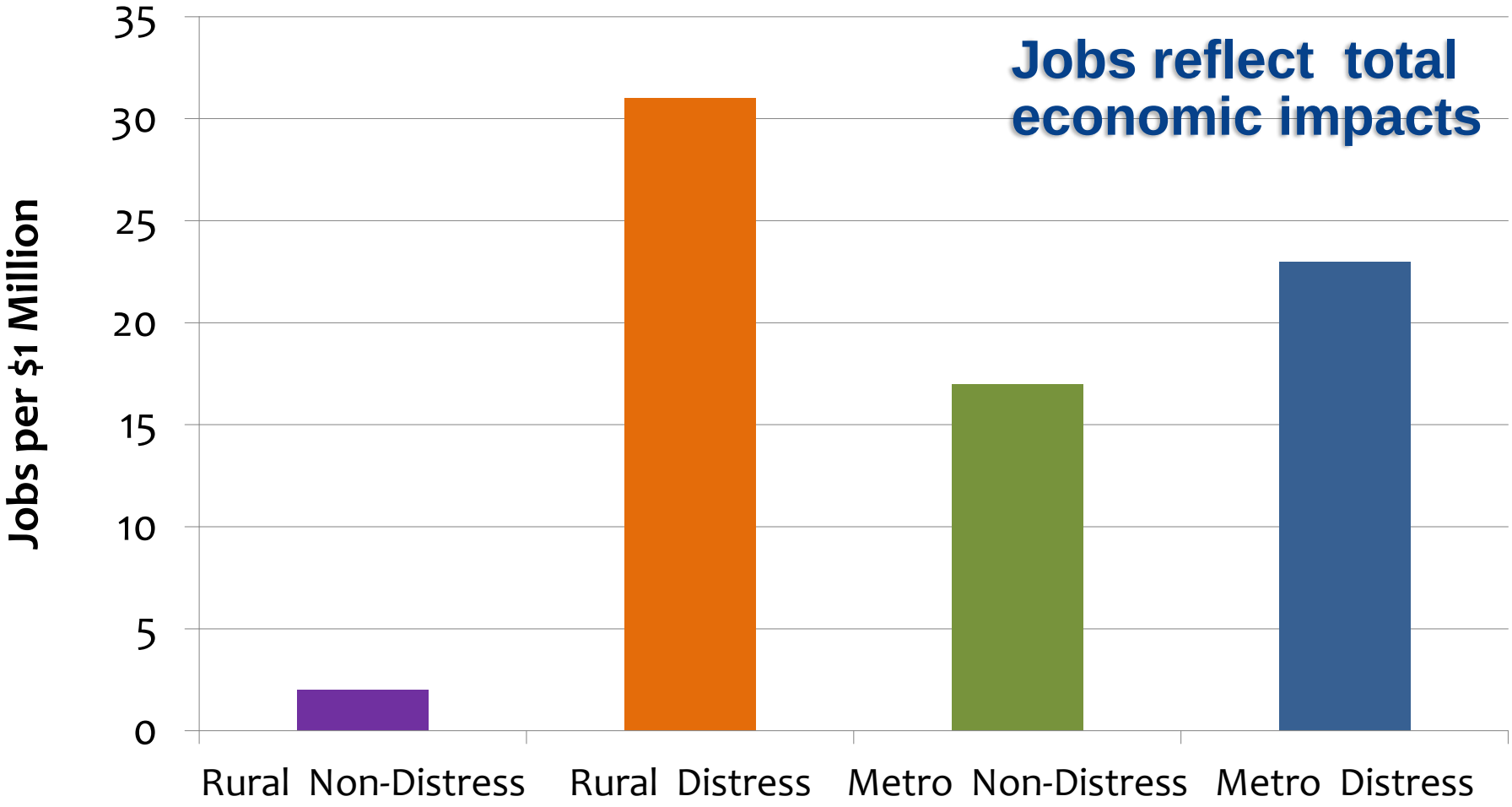
Median Jobs per $1 Million Spent by Project Setting



* Excluding Passenger and Freight Intermodal

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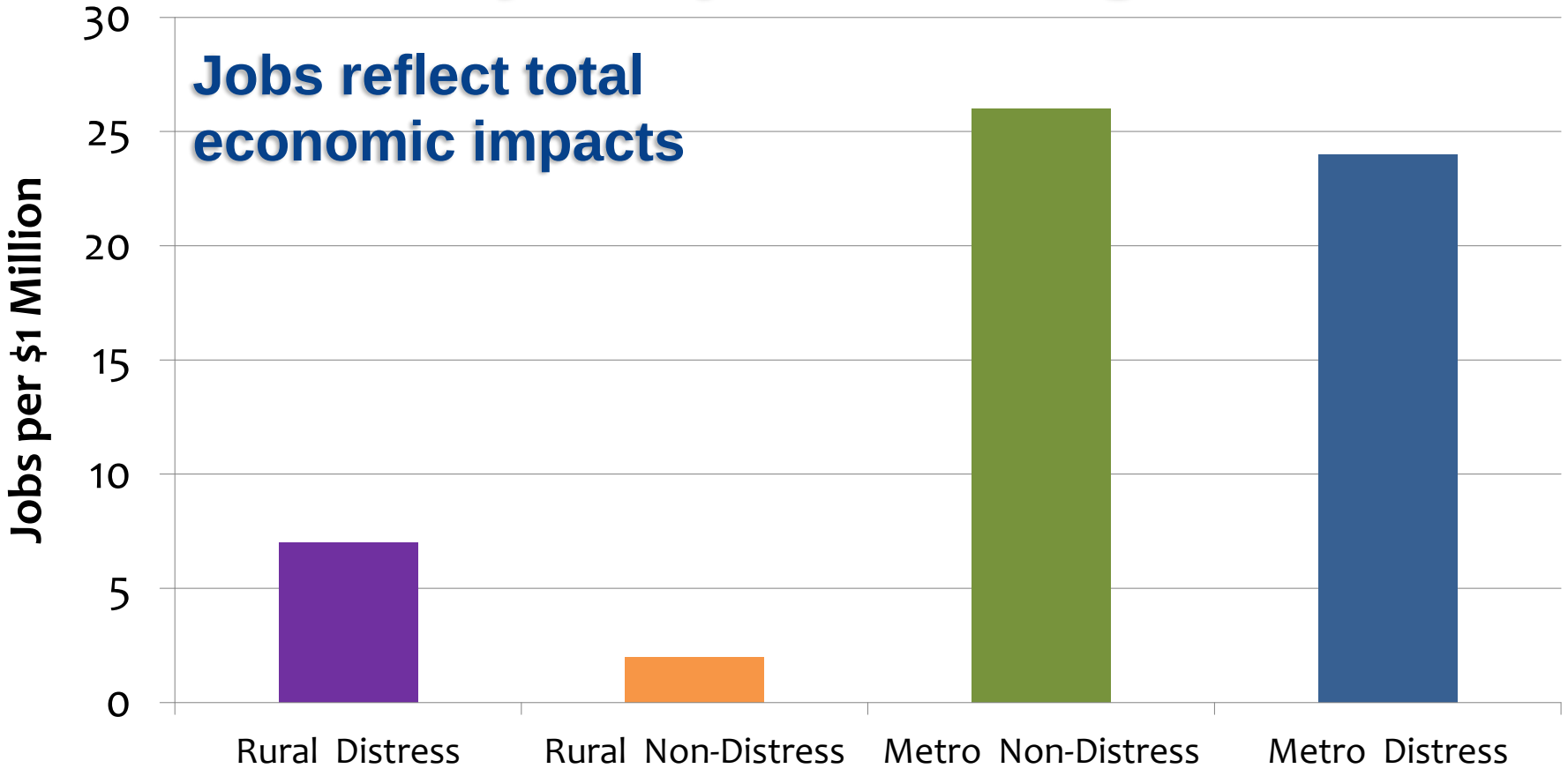
Freight and Passenger Intermodal Median Jobs Per $1 Million Project Cost by Project Setting



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Findings & Implications

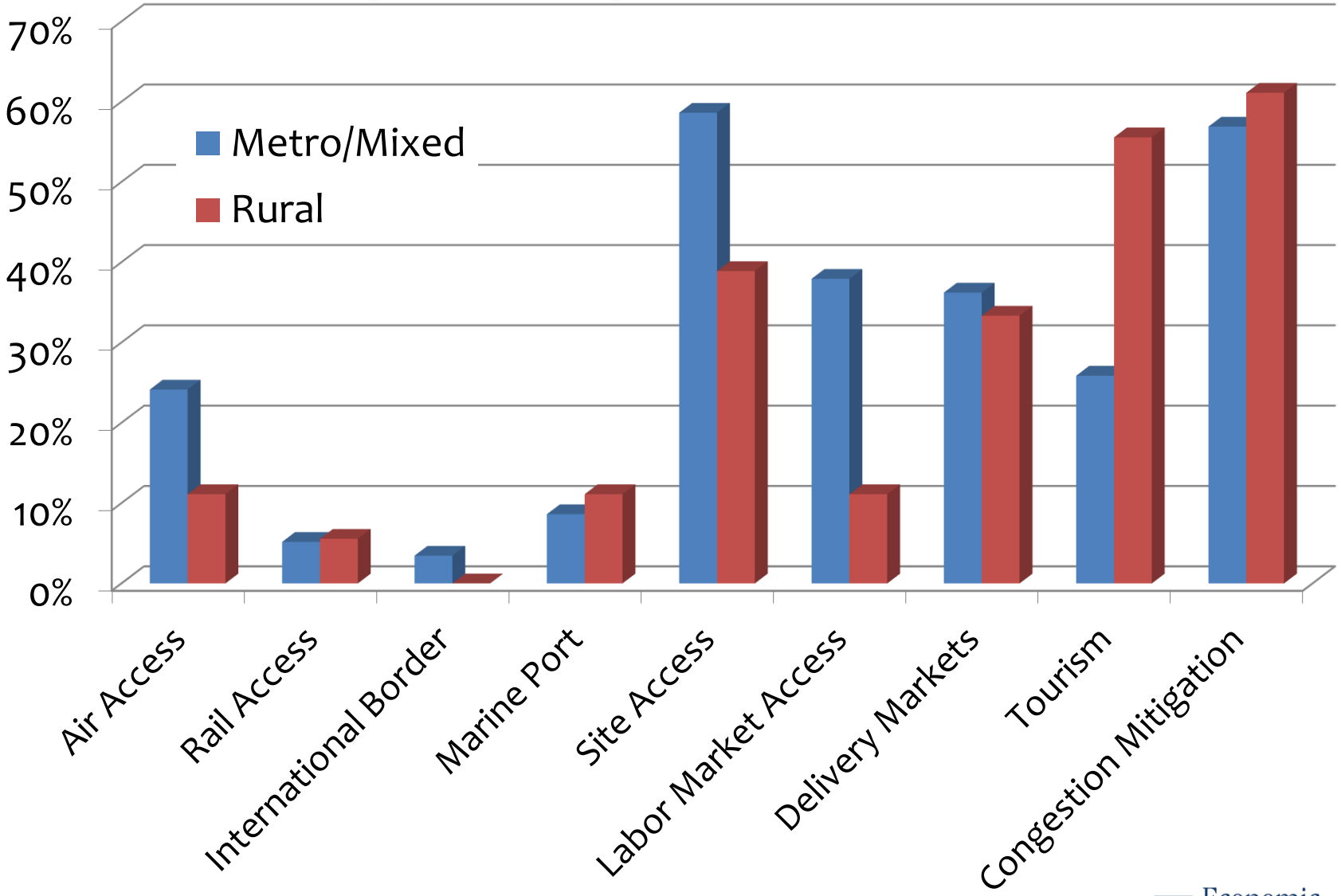
SHRP2 C03 – Findings

- Size of Investment ($$) is not the Primary "Driver" of Long-Term Economic Impacts
- Project Types and Economic Conditions Have Greatest Influence on Investment Outcomes
- Non-transportation Initiatives Matter
- Greatest Economic Effects Attributable to:
  - Regional setting
  - Current level of economic activity/distress
  - Location and intensity of use
  - Concurrent economic development policies

Key Interaction Factors

- Access to Alternative Modes
  - Airports
  - Rail Intermodal Facilities
  - Seaports
- Market Access
  - Labor Markets
  - Freight/Delivery Markets
- Congestion
  - Shifts spatial distribution of economic impacts

% of Projects by Stated Motivation



* Excluding Passenger and Freight Intermodal

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Complementary Infrastructure and Policies

	Factor	Number Reported
Positive Synergies	Infrastructure (sewer, water, broad band, transit, etc.) - positive	33
	Land Use Management - positive	45
	Financial Incentives/ Business Climate - positive	47
Lack of Appropriate Synergies	Financial Incentives/ Business Climate - negative	5
	Infrastructure (sewer, water, broad band, transit, etc.) - negative	10
	Land Use Management – negative	6

Effects of Interactions

- Effects of Concurrent Infrastructure
  - Water, sewer, broadband, power, etc.
    - Range of effects: -35% to +20%
- Supportive Land Use Policies
  - Permitting, zoning, special districts, etc.
    - Range of effects: -20% to +11%
- Business Incentives
  - Tax increment financing, abatements, job training programs, etc.
    - Range of effects: -5% to +5%

Regression Analysis

Regression Analysis – Job Creation

- Regressions were performed for both analysis of job creation (defined as post – pre)
- Predicting job creation only of present-day variables (without the knowledge of “future events” such as income per capita development in the affected countries
- Relationship between project cost and job impact – not straightforward
- Many kinds of estimations were used – log-log, log-linear, with intercept. In most cases the best fit was obtained using standard linear regressions, including usage of dummy variables
- Most of the regressions were based on a sample size of 30 and more, in a few cases, due to insufficient data we went below that

Regression Analysis – Job Creation

Project Population	Significant Explanatory Variables for Predicting Direct Job Impacts *(those with statistical significance of over 80%)*	R^2_{adj}
Rural Projects, Point to Point and Roadway	Level of Traffic Activity (VMT) Market Scale (pop. size) Underlying Growth Trend (per capita income growth) Economic Health (per capita income level)	70.2%
Metro & Mixed, Roadway Projects	Level of Traffic Activity (AADT) Project Scale (Lane Miles) Urbanization (Population Density) Market Scale (pop. size) Underlying Growth Trend (local population & job growth)	80.9%
Metro, Road	Level of Traffic Activity (AADT) Project Scale (Lane Miles) Urbanization (Population Density) Underlying Growth Trend (local population & job growth)	90.9%

Regression Analysis – Job Creation (cont.)

Project Population	Significant Explanatory Variables for Predicting Direct Job Impacts *(those with statistical significance of over 80%)*	R^2_{adj}
Mixed, Road	Level of Traffic Activity (AADT) Project Scale (Lane Miles) Urbanization (Population Density) Market Scale (pop. size) Terrain (Mountain Terrain)	85.2%
Urban, Point to Point	Economic Distress (dummy variable) Underlying Growth Trend (regional job & income growth)	57.5%
Rural & Mixed, Point to Pont	Level of Traffic Activity (VMT) Urbanization (Population Density) Underlying Growth Trend (regional & local income growth) Economic Health (per capita income level)	88.3%

Regression Analysis – Job Creation using present-day variables

Project Population	Variables for Direct Jobs – Present Knowledge Only	R^2_{adj}	Stat. Significance
Rural Projects, Point to Point and Roadway	Project Scale (miles)	42%	88%
All Roadway Projects	Level of Traffic Activity (AADT) Project Scale (Lane-miles) Urbanization (Population Density) Market Scale (pop. size)	41%	70%
Metro and Mixed Roadway Projects	Level of Traffic Activity (AADT) Project Scale (Lane-miles) Urbanization (Population Density) Market Scale (pop. Size)	35%	70%

Regression Analysis – Job Creation using present-day variables (cont.)

Project Population	Variables for Direct Jobs – Present Knowledge Only	R^2_{adj}	Stat. Significance
Mixed, Road	Level of Traffic Activity (AADT) Project Scale (Lane-miles) Urbanization (Population Density) Market Scale (pop. Size) Terrain (Mountain Terrain)	91%	>90%
Rural & Mixed, Point to Pont	Level of Traffic Activity (AADT) Project Scale (miles)	61%	>90%

Regression Analysis – Project Cost vs. Direct Job Creation

Dependant Variable(s)	T-Score of Dependent Variable	T-Score of Constant Term	Adj. R^2 (share of variance explained)	N
Project Cost*	9.14	3.42	.455	100
Cost per Mile	5.50	3.82	.275	78
Cost per Lane Mile	5.36	3.71	.270	76
Cost AADT	8.83 2.06	1.80	.472	100
Cost AADT Length	8.26 2.24 1.88	1.07	.485	100
Cost VMT	8.98 4.62	2.24	.549	100

* All project costs in $2008

Project Cost vs. Direct Job Creation – Metro Vs. Rural Projects

Urbanization Setting	Dependant Variable(s)	T-Score Variables	T-Score Constant	Adj. R^2 (share of variance explained)
Metro	Cost	7.82	3.56	.44
Metro	VMT	3.85	2.41	.53
	Cost	7.73		
Metro	AADT	1.35	2.09	.45
	Cost	7.63		
Metro	AADT	1.55	1.37	.46
	Length	1.53		
	Cost	7.11		
Metro	Length	1.33	2.81	.45
	Cost	7.37		
*All project costs in $2008	N= 77 for Metro and Mixed			

Project Cost vs. Direct Job Creation – Metro Vs. Rural Projects

Urbanization Setting	Dependant Variable(s)	T-Score Variables	T-Score Constant	Adj. R^2 (share of variance explained)
Rural	Cost	4.76	1.41	.50
Rural	VMT	4.10	1.05	.71
	Cost	5.86		
Rural	AADT	0.04	1.0	.47
	Cost	4.64		
Rural	AADT	-0.26	0.82	.69
	Length	3.94		
	Cost	5.72		
Rural	Length	4.02	0.87	.71
	Cost	5.86		
*All project costs in $2008	N=23 for Rural projects			

Conclusions

- The project cost, in most cases, is not a good predictor of the number of jobs which might be created.
- Job creation is mostly dependent on the type of project, and its underlying characteristics
- Future job creation is dependent not only on the project investment, but how that investment is parlayed into the development of the specific area where the project is located (in terms of higher per capita income, etc.).
- A wonderful opportunity exists now to measure investment (ARRA) and its future effects – road for further research and analysis.

Acknowlegements

SHRP2 C03: Interactions between Transportation Capacity, Economic Systems, and Land Use

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Thank You

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