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Assessing the Role of Advanced Vehicle Technology in MPO Planning Scenarios

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Objectives and Scope

- How could advanced vehicle technology change investment priorities for MPO's
- What performance outcomes could be affected by low-emission and driverless technology?
- How can we use scenarios to understand how these technologies relate to transportation performance and investment priorities
- Focus is on how performance is evaluated, not on land use, travel behavior and traffic forecasting methods

Approach

- Compare two regional transportation investment options: One highly oriented towards Transit, one Highly Oriented toward Highways
- How would a different vehicle technology paradigm affect the comparison?
- What performance areas are most sensitive to the effects and adoption of these technologies?

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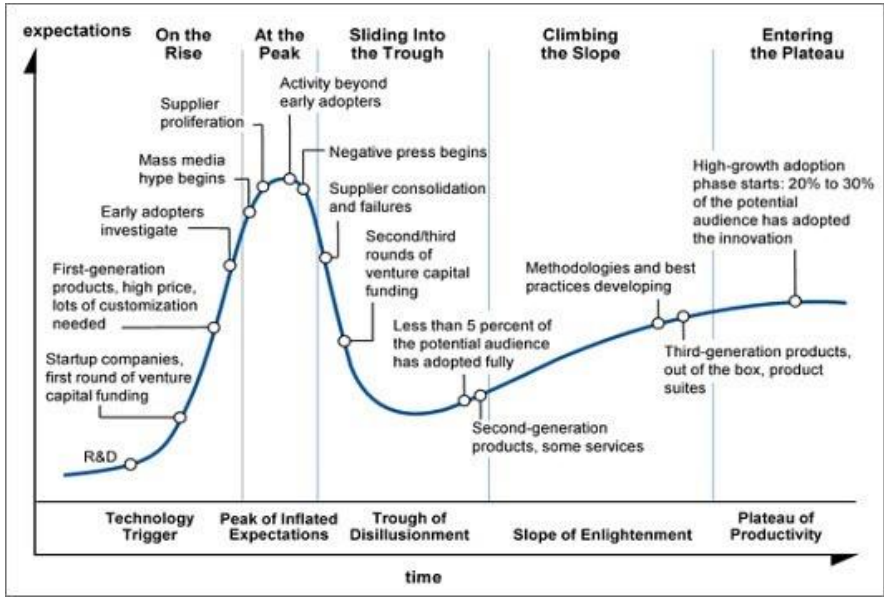
Steps & Dimensions of advanced vehicle economic evaluation scenario

- Begin with traditional investment scenarios (in this case Highway Intensive Vs. Transit Intensive)
- Develop Key Advanced Vehicle Typologies
- Develop Likely Performance Characteristics
- Consider Potential Adoption Rates
- Test Effects on Investment Scenario Evaluation



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Two Investment Options

- Major Highway Investment
- Major Transit Investment

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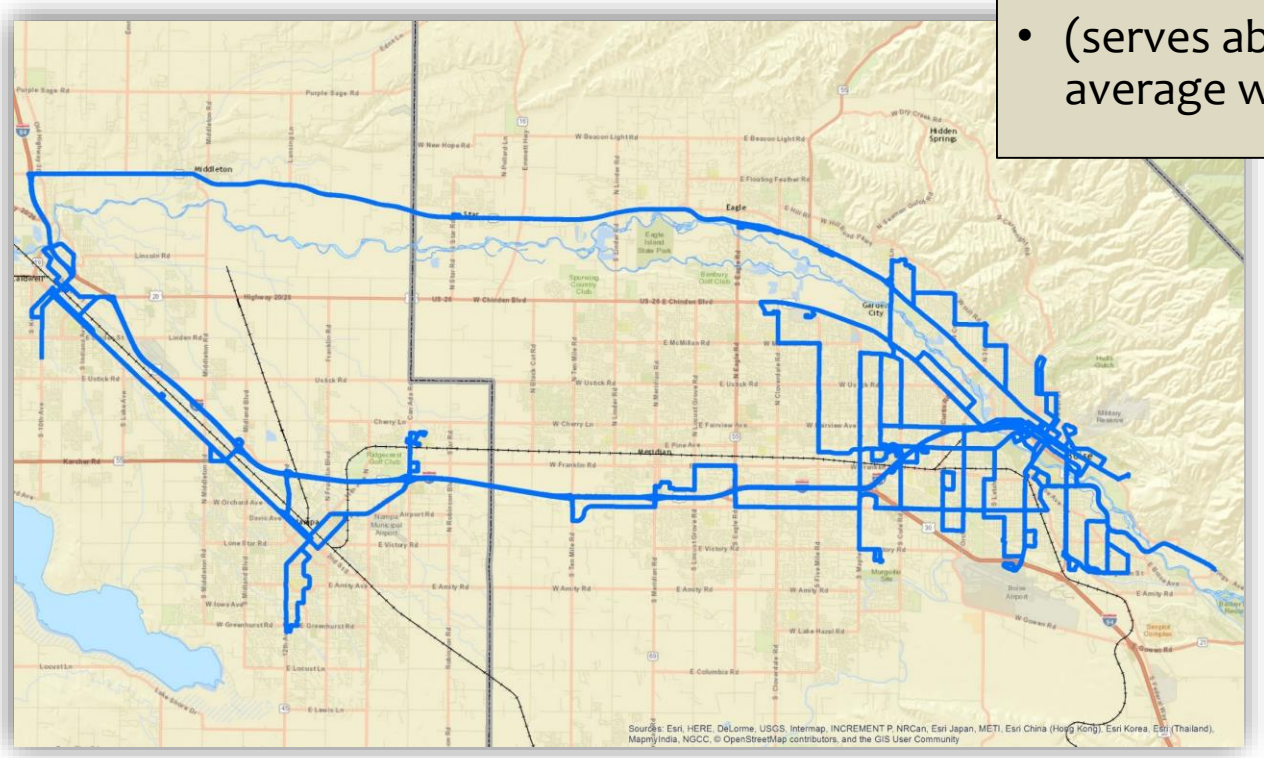
Base Case Condition

- Current Public Transportation System
- $14million / year for Operations
- (serves about 6,000 riders per average weekday)



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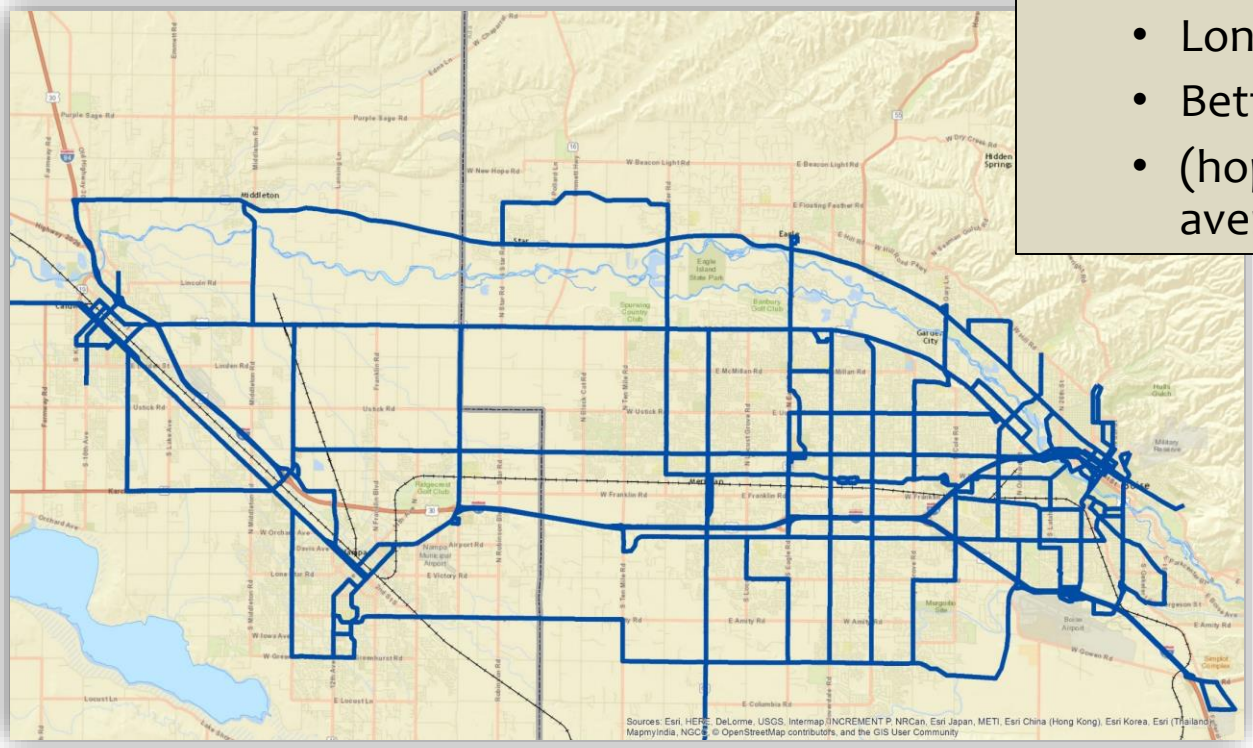
Transit Build Scenario



- 2040 Vision Public Transportation System
- $60million / year for Operations
  - More routes
  - More coverage
  - Longer service hours
  - Better frequency
  - (hope to serve 18,000 riders per average weekday

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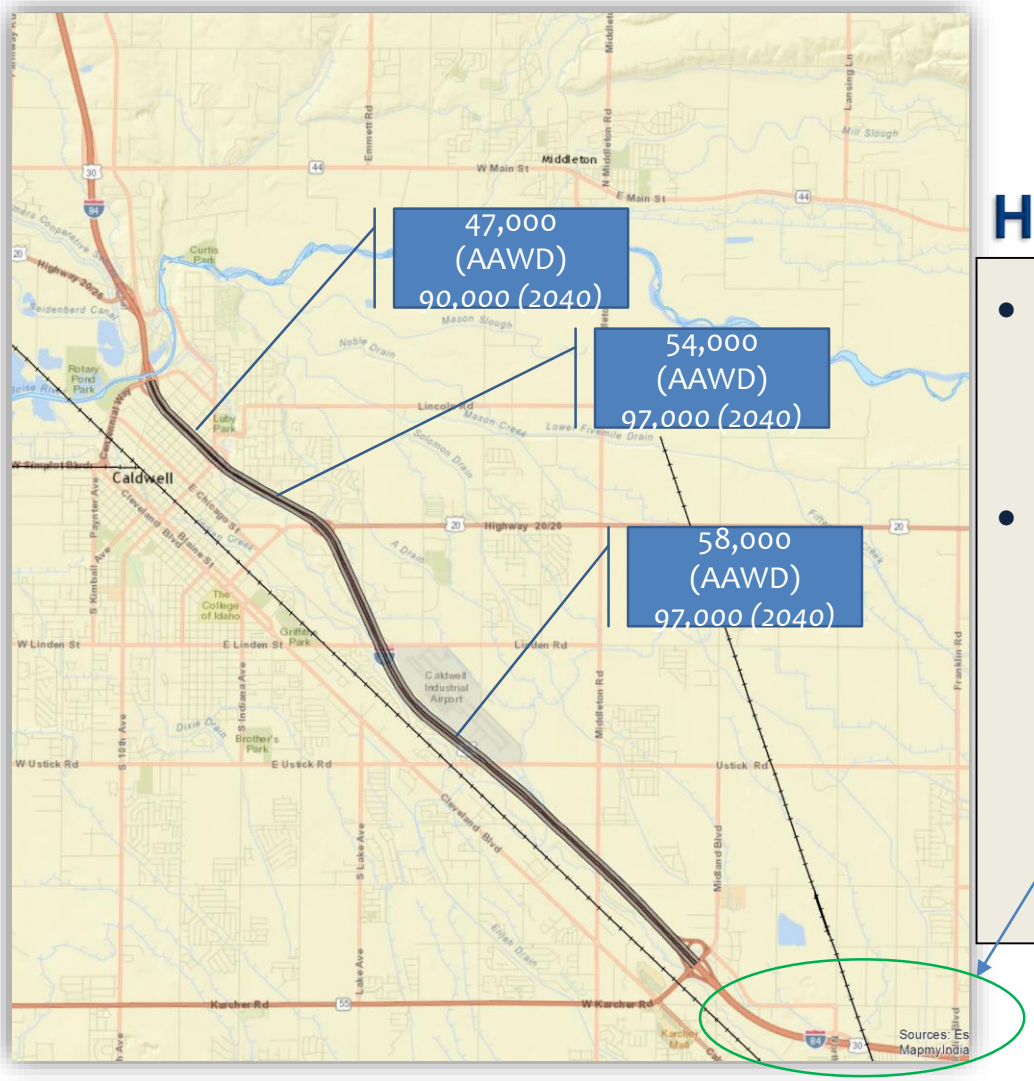

Highway Build Scenario

- Widen 7 miles of interstate from 2 lanes each direction to 3 lanes per direction.
- Cost Unknown
  - Section from Exit 29 to Karcher
    - Environmental Study recently funded
  - Section to the east is funded at $150.4 m

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Questions:

Does advanced vehicle technology affect the business case for either of these investment strategies?

How can this be considered?

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Advanced Vehicle Scenario: technologies & modes

5 Advanced Vehicle Technologies to Consider:

- Ultra Low Emission “Owned” Car
- Ultra Low Emission “Owned” Car with Driverless Capability
- Ultra Low Emission “On-Demand” Car (Driverless)
- Ultra Low Emission Transit Bus with Driverless Capability
- Delivery/Business Truck with Driverless Capabilitiy

Consider Potential Adoption Rates

Technology	Moderate Rate	Aggressive Rate	Moderate 2050%	Aggressive 2050%
ULV – Owned	.5%	1%	16%	31%
ULV/Driverless - Owned	.25%	.5%	8.25%	15.75%
ULV/Driverless – On-Demand	.25%	.5%	8%	15.5%
ULV/Driverless - Transit	N/A	N/A	50%	70%
ULV Local Truck	N/A	N/A	20%	40%

Deriving Adoption Rates:

- Analogous Cities/Regions (US or Abroad)
- Models in Literature
- Local Focus Groups/Interviews (auto dealers, delivery carriers, transit management

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Consider Economic Drivers

Technology	Value of Time	Crash Rate	Emissions	Operation & Fuel Cost	Occupancy
ULV – Owned	=	=	↓	↓	=
ULV/Driverless - Owned	↓	↓	↓	↓	↑
ULV/Driverless – On-Demand	↓	↓	↓	↓	↑
ULV/Driverless - Transit	↓	↓	↓	↓	=
ULV Local Truck	↓	↓	↓	↓	=

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Benefits Shift Based on Vehicle Technology

Performance Areas	Highway Scenario			Transit Scenario		
	No Advanced Vehciles	*Moderate Advanced Vehicles*	*Aggressive Advanced Vehicles*	*No Advanced Vehciles*	*Moderate Advanced Vehicles*	*Aggressive Advanced Vehicles*
Vehicle Operating Costs	$12.20	$6.60	$2.00	-$55.30	-$47.30	-$43.10
Business Time & Reliability Costs	$372.00	$354.10	$340.80	$188.60	$247.80	$245.50
Value of Personal Time & Reliability	$648.50	$636.80	$624.90	$426.90	$500.50	$502.60
Safety Cost	-$34.40	-$32.90	-$31.60	$22.90	$24.00	$23.90
(C) Shipper/ Logistics Cost	$21.70	$21.70	$21.70	$10.10	$10.10	$10.10
(E) Social/ Environ.	$16.70	$14.50	$12.90	$4.90	$13.50	$13.10
Total Benefits	**$1,036.70**	**$1,000.80**	**$970.70**	**$598.10**	**$748.60**	**$752.10**

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Observations Regarding Benefits

- Highway Expansion Benefits are harder to achieve as vehicle technology advances
- Operating Costs, Travel Time and Environmental Costs less a source of benefit as vehicle technology advances
- Safety dis-benefit (of additional VMT) is moderated by advanced vehicle technology
- Transit Benefits may be easier to achieve due to:
  - Potential for more reiliable service (especially if integrated with driverless car modes)
  - Less cost of operating and maintaining transit vehicles
  - Less reliance on costly and high-polluting diesel

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Takeaways

- Economic Benefits/ROI Analysis can sensitivity of major investments to changes in vehicle technology
- Consider multiple adoption rates & technology characteristics
- Integration of additional factors can add further value such as:
  - Congestion effects of Better Utilizing Existing Capacity
  - Land Use Effects & Underlying Spatial Patterns
  - Fiscal Effects of Reduced Fuel Consumption or Land Values
  - Scenarios integrating transit with other types of mobility

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Thank You!

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