

AGS Feasibility Study

PLT Meeting 11
June 11, 2013

Agenda

- ▶ Introduction to the Meeting
- ▶ Public Comment
- ▶ Capital Cost Estimates
- ▶ Operation & Maintenance Cost Estimating Process
- ▶ Ridership Estimates
- ▶ Request for Financial Information (RFFI) Update
- ▶ AGS/ICS/Co-Development Project Coordination
- ▶ Steps Leading to Project Conclusion
- ▶ Conclusion, Final Remarks and Next Steps

Introduction to the Meeting

▶ Meeting Objectives

- Review & Discuss Capital Cost Estimates
- Discuss Operations & Maintenance Cost Estimating Methodology
- Review & Discuss Ridership Estimates
- Update on Request for Financial Information (RFFI)
- Discuss Funding
- Update on AGS/ICS/Co-Development Project Coordination
- Discuss Steps Leading Up To Project Conclusion

Introduction to the Meeting

- ▶ Review and Approve Meeting Minutes from Last Meeting
- ▶ Review Action Items from Last Meeting
- ▶ Website Update
- ▶ Media Outreach

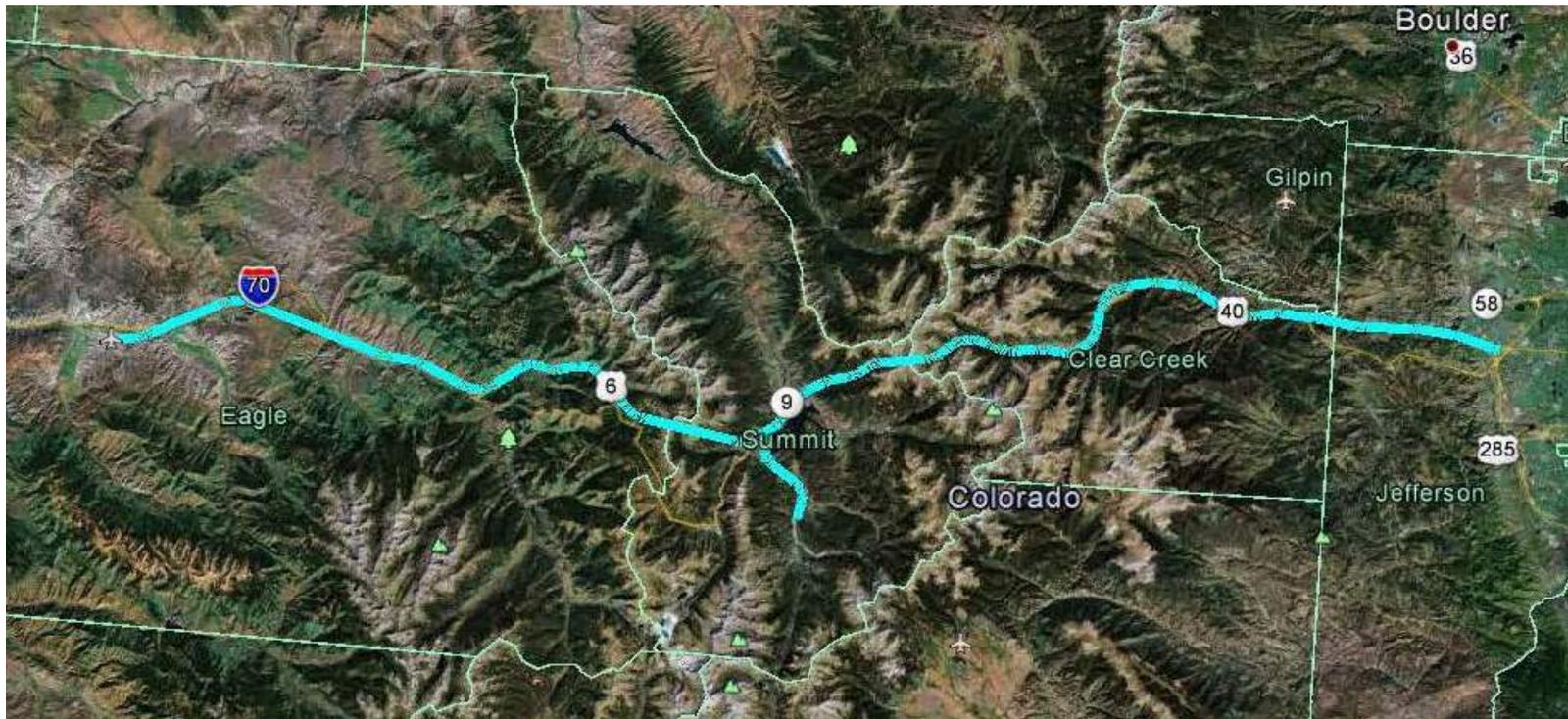
Public Comment

- ▶ The public is invited to make brief comments

Capital Cost Estimating

- ▶ Three Alignment/Technology Alternatives
 - High Speed Steel Wheel on Steel Rail – Greenfield
 - High Speed Maglev – Greenfield
 - 120 mph Maglev – Hybrid Alignment (Combo of I–70 ROW & Greenfield)
- ▶ Inside I–70 ROW Alignment Not Carried Forward
 - American Maglev’s analysis suggests speeds would not meet performance guidelines

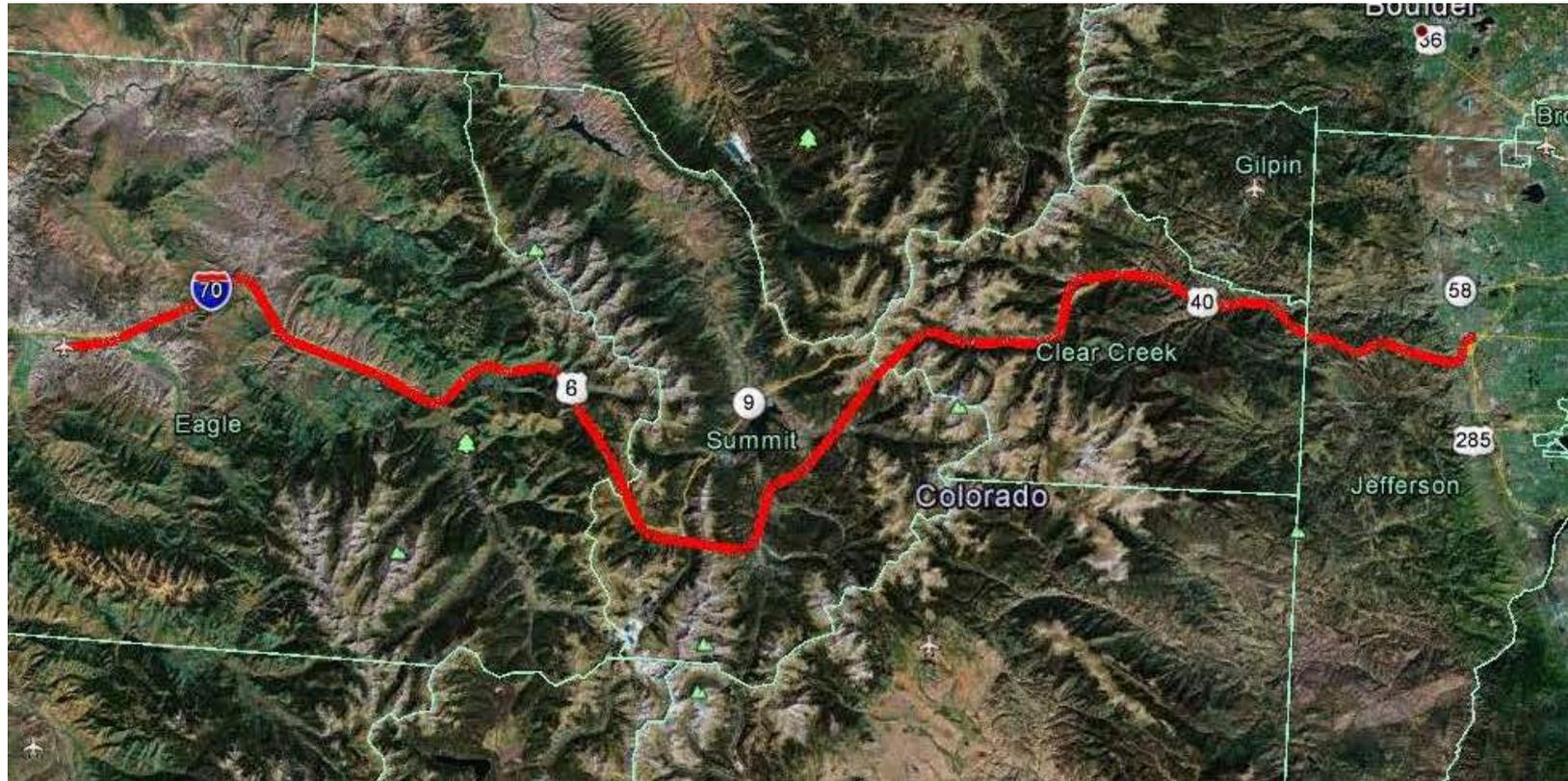
High Speed Steel Wheel on Steel Rail - Greenfield



ADVANCED GUIDEWAY SYSTEM (AGS) FEASIBILITY STUDY



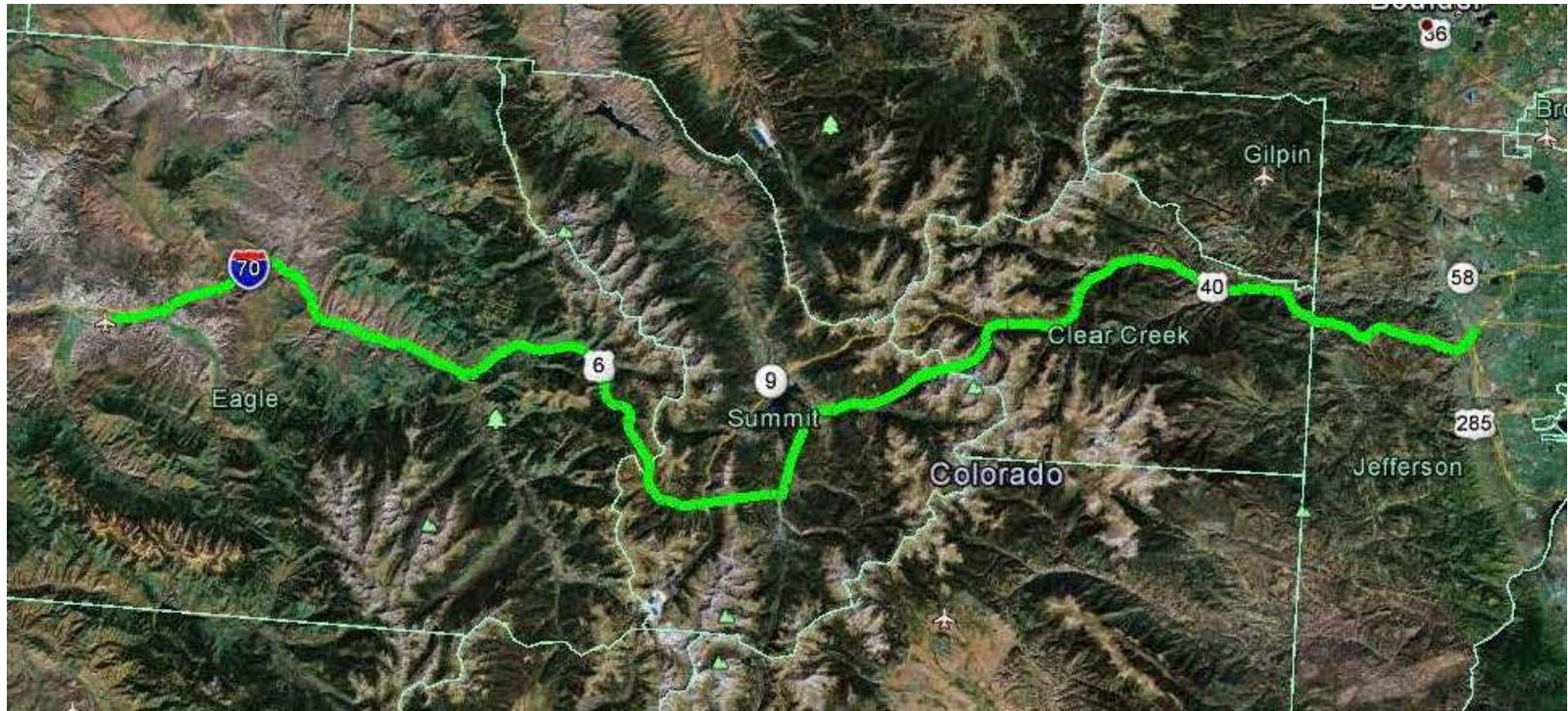
High Speed Maglev – Greenfield



ADVANCED GUIDEWAY SYSTEM (AGS) FEASIBILITY STUDY



120 mph Maglev – Hybrid Alignment

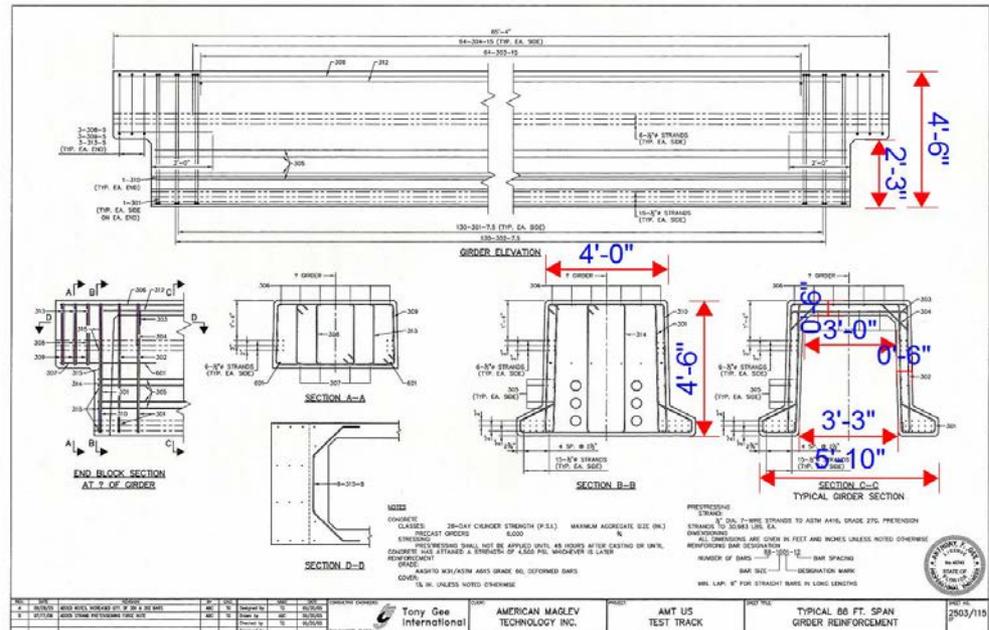
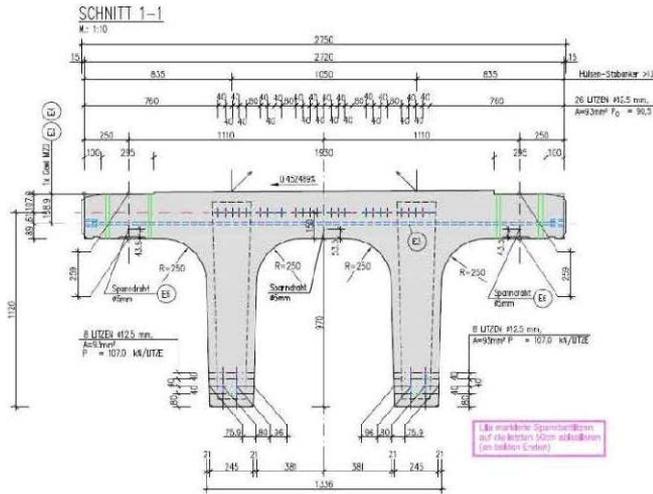


Capital Cost Estimating

- ▶ Bottom Up Approach
- ▶ Each Team Developed Gross Quantities for Alignments
 - Dual and Single Guideways
 - Bridges/Structures
 - Tunnels
- ▶ Gross Quantities were “Deconstructed” to Individual Elements
 - For example, maglev guideway includes girders, pier caps, columns/footings, propulsion system

Capital Cost Estimating

- ▶ Guideway Dimensions were Provided by Technology Providers

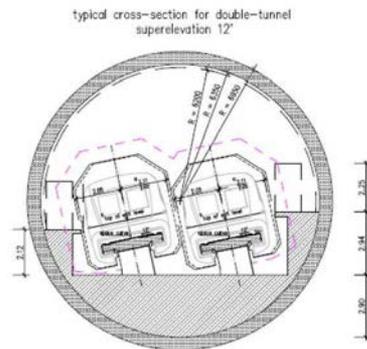


Capital Cost Estimating

- ▶ For Each Element, Material Quantities were Determined
 - Reinforcing steel
 - Concrete
 - Forms, drilling for columns, etc.
- ▶ Local Colorado Based Contractor Provided Prices Based on Quantities
 - Included costs from a precasting facility for elements like girders and pier caps
 - Takes into account building in the mountains

Capital Cost Estimating

- ▶ Tunnel Costs Developed Using Experienced Tunnel Estimator (Jacobs)
 - Very detailed!
 - Geological conditions accounted for based on input from Yeh & Associates
 - Included both Drill & Blast and Tunnel Boring Machine (TBM) tunnels



Capital Cost Estimating

- ▶ **All Civil Infrastructure Costs were Estimated by Team**
 - No reliance on technology provider's costs
- ▶ **For Non-Civil Elements Team Used:**
 - Past estimates developed for Southern California Maglev projects and the Anaheim to Las Vegas Maglev project
 - Data based on TYPESA's experience on costs on HSR projects worldwide
 - Estimates provided by technology providers
 - Most are small percentage of overall cost so reliance on their costs won't have big impact on overall costs

Capital Cost Estimating

- ▶ Other Costs Included:
 - Vehicles
 - Propulsion System
 - Energy Supply Operation Control Technology
 - Communication/Control Technology
 - Stations
 - Operation and Maintenance Facilities
 - Construction Support (precasting facilities, special construction equipment/techniques, etc.)
 - Right of Way

Capital Cost Estimating

- ▶ In addition, a Number of Indirect Costs Were Included
 - Professional Services
 - Design Engineering
 - Insurance and Bonding
 - Program Management
 - Construction Management & Inspection
 - Engineering Services During Construction
 - Integrated Testing and Commissioning

Capital Cost Estimating

- ▶ Indirect Costs Continued
 - Utility Relocation
 - Through Urban Areas
 - Through Rural Areas
 - Environmental Mitigation
 - Noise Mitigation
 - Hazardous Waste
 - Erosion Control

Capital Cost Estimating

▶ Contingencies

- Applied to recognize the very preliminary nature of the design
 - 10% “Mountain” factor applied to all civil infrastructure and systems
 - 30% contingency applied to tunnel costs
 - 30% contingency applied to all Design and Construction Costs (consistent with ICS methodology)

Capital Cost Estimating

	120 MPH Maglev - AMT	
Vehicles	\$240,000,000	
Propulsion System	\$171,600,000	
Energy Supply	included in propulsion	
Operation Control Technology	\$198,000,000	
Communication/Control Technology	included in operation control	
Guideway/Track Infrastructure	\$5,247,590,000	
Guideway/Track		\$1,078,675,411
Bridges & Viaducts		\$229,594,007
Tunnels		\$3,706,475,148
Other		\$232,842,502
Stations	\$129,120,000	
Operations and Maintenance Facilities	\$15,320,000	
Construction Support	\$50,000,000	
Right of Way and Corridor	\$93,660,000	
Professional Services	\$1,597,780,000	
Utility Relocation	\$553,080,000	
Environmental Mitigation	\$153,630,000	
Overall Contingency	\$2,534,930,000	
Grand Total	\$10,984,710,000	

Cost per Mile

\$91,133,880



Capital Cost Estimating

		HS Maglev - Transrapid
Vehicles	\$260,990,000	
Propulsion System	\$823,130,000	
Energy Supply	\$258,500,000	
Operation Control Technology	\$126,720,000	
Communication/Control Technology	\$8,440,000	
Guideway/Track Infrastructure	\$12,203,760,000	
Guideway/Track		\$1,882,753,722
Bridges & Viaducts		\$130,162,098
Tunnels		\$9,547,444,688
Other		\$643,399,579
Stations	\$129,120,000	
Operations and Maintenance Facilities	\$54,180,000	
Construction Support	\$50,000,000	
Right of Way and Corridor	\$93,660,000	
Professional Services	\$3,642,210,000	
Utility Relocation	\$1,260,770,000	
Environmental Mitigation	\$350,210,000	
Overall Contingency	\$5,778,510,000	
Grand Total		\$25,040,200,000

Cost per Mile

\$211,351,928



Capital Cost Estimating

	HS Rail - Talgo	
Vehicles	\$180,000,000	
Propulsion System	included in energy supply	
Energy Supply	\$308,510,000	
Operation Control Technology	\$241,020,000	
Communication/Control Technology	\$61,350,000	
Guideway/Track Infrastructure	\$16,788,770,000	
Guideway/Track		\$1,135,482,548
Bridges & Viaducts		\$717,740,043
Tunnels		\$14,566,942,090
Other		\$368,610,175
Stations	\$80,700,000	
Operations and Maintenance Facilities	\$54,180,000	
Construction Support	\$50,000,000	
Right of Way and Corridor	\$93,660,000	
Professional Services	\$4,643,130,000	
Utility Relocation	\$1,607,240,000	
Environmental Mitigation	\$446,450,000	
Overall Contingency	\$7,366,500,000	
Grand Total	\$31,921,510,000	

Cost per Mile

\$293,065,091



Capital Cost Estimating

- ▶ Minimum Operating Segment
 - West Suburban Station to Breckenridge

Alignment/Technology	Length in Miles	Miles in Tunnels (%)	Travel Time (Golden to Breckenridge)	Number of Stations	MOS Cost	% of Total Cost
120 MPH Maglev	61.4	8.0 (13%)	48 minutes	4	\$5,764,770,000	52%
High Speed Maglev	58.1	25.9 (45%)	33 minutes	4	\$13,527,451,000	54%
High Speed Rail	60.8	37.8 (62%)	42 minutes	4	\$18,654,918,000	58%

Capital Cost Estimating

- ▶ During Final Design Costs Will Likely Go Down Due to Design Refinements
 - Better topographic mapping (we used USGS)
 - Refine alignment to minimize tunneling
- ▶ Costs Are In 2013 Dollars

Operation & Maintenance Costs

- ▶ Level 2 O&M Costs (Included in RFFI)
 - High Speed Rail: \$81.5 to \$115.1 Million
 - High Speed Maglev: \$63.0 to \$89.0 Million
 - 120 MPH Maglev: \$75.1 to \$106.1 Million
- ▶ Level 3 Will Employ Bottom Up Methodology
- ▶ Operating Scenario
- ▶ Cost Categories
 - Personnel
 - Materials and consumables
 - Power consumption
 - Miscellaneous support, marketing, insurance

Operation & Maintenance Costs

- ▶ Different types of jobs will be influenced by different operating characteristics:
 - Wayside maintenance staff >>> system length and system use
 - Vehicle maintenance staff >>> number of vehicles
 - Security >>> stations and trips
 - Administration staff will generally remain a constant level
- ▶ Salary/benefit packages

Operation & Maintenance Costs

- ▶ Unit cost for power and consumption
- ▶ Estimate materials and consumables
- ▶ Support items
- ▶ Add personnel, power, materials/consumables, and support cost

- ▶ Personnel and power costs are usually the largest shares of the total O&M costs

Operation & Maintenance Costs

- ▶ Some Topics To Be Explored During Next Phase Include:
 - Should there be attendants on each consist?
 - Some technologies do not require “drivers.” Will there need to be a driver up front even if not necessary?
 - Should there be baggage handlers at each station, or should passengers just off load their own bags?
 - Is one security person at each station and at HQ for each shift enough?

Break

- ▶ 10 Minutes



Preliminary Ridership

ICS and AGS Technical Modeling

March 20, 2013

Steer Davies Gleave
883 Boylston Street, 3rd Floor
Boston, MA 02116
617-391-2300

www.steerdaviesgleave.com/na



I-70 Transit Ridership History

Source	Annual Riders	Annual Fares	Fare per Ride	Annual O&M Cost	Farebox Recovery
2000 MIS (2020 Horizon)	1.74 M (DIA-Glenwood) ¹		(20¢/mi + \$15 DIA charge, 1998\$)	\$162 M (1998\$)	
2001 CIFGA				\$47 M	
2004 Draft PEIS (AGS)		\$85 M		\$180 M	48 %
2004 Draft PEIS (Rail)		\$83 M		\$135 M	61 %
2010 RMRA 125mph Maglev			\$19.65 ² (35¢/mi, 2010\$)		145 % ²
2010 RMRA 150 mph Rail			\$20.84 ² (35¢/mi, 2010\$)		127 % ²

Notes: ¹Includes 400,000 Vail-Glenwood, ²With both I-25 and I-70 high-speed transit in place.

I-70 Transit Ridership History

Source	Annual Riders	Annual Fares	Fare per Ride	Annual O&M Cost	Farebox Recovery
2000 MIS (2020 Horizon)	1,740,000 (DIA-Glenwood) ¹	n/a	(20¢/mi + \$15 DIA charge, 1998\$)	\$162,000,000 (1998\$)	n/a
2001 CIFGA	5,900,000	n/a	x	\$47,000,000	n/a
2004 Draft PEIS (AGS)	4,160,000	\$85,000,000	\$ 20.43	\$180,000,000	48%
2004 Draft PEIS (Rail)	3,775,750	\$83,000,000	\$21.98	\$135,000,000	61%
2010 RMRA 125mph Maglev	8,271,000	\$162,525,150	\$19.65 ² (35¢/mi, 2010\$)	\$112,086,000	145% ²
2010 RMRA 150 mph Rail	7,626,000	\$158,941,092	\$20.84 ² (35¢/mi, 2010\$)	\$125,150,000	127% ²
2013 AGS 120 mph Maglev	2,880,000	TBD	TBD (35¢/mi, 2013\$)	\$75,100,000– \$106,130,000	TBD
2013 AGS 150 mph Maglev	3,320,000	\$ 76,604,404	\$23.94 (35¢/mi, 2013\$)	\$63,000,000– \$89,000,000	86% – 122% ²
2013 AGS 150 mph Rail	3,430,000	\$64,840,000– \$81,855,140	\$23.86 (35¢/mi, 2013\$)	\$81,500,000– \$115,140,000	71% – 79% ²

Notes: ¹Includes 400,000 Vail-Glenwood, ²With both I-25 and I-70 high-speed transit in place.

Numbers in orange have been factored from daily to annual or result from other factored numbers.

Ridership Results

- ▶ Four Scenarios Done To Date:
 - High Speed Steel Wheel on Rail (With ICS System)
 - With spur to Breckenridge
 - High Speed Maglev (With ICS System)
 - 120 MPH Maglev (With ICS System)
 - High Speed Steel Wheel on Rail (Standalone I-70 System)
 - With spur to Breckenridge

Scenarios Modeled To Date

- ▶ **High Speed Steel Wheel on Rail (With ICS System)**
 - Stations at Golden, Georgetown, Silverthorne, Vail and Eagle County Regional Airport (with spur to Breckenridge)
- ▶ **High Speed Maglev (With ICS System)**
 - Stations at Golden, Idaho Springs, Lake Hills, Breckenridge, Copper Mountain, Vail, Avon and ECRA
- ▶ **120 MPH Maglev (With ICS System)**
 - Stations at Golden, Idaho Springs, Keystone, Breckenridge, Copper Mountain, Vail, Avon and ECRA
- ▶ **High Speed Steel Wheel on Rail (Standalone I-70 System)**
 - Stations at Golden, Georgetown, Silverthorne, Vail and Eagle County Regional Airport (with spur to Breckenridge)

Operating Scenarios

- ▶ 18 Hour Operation Per Day
- ▶ Six Scenarios Developed
- ▶ In Each Scenario, Two Options:
 - Basic Frequency Service Plan
 - 12 hours @ 1 hr. frequency + 6 hrs. @ 30 min frequency = 24 trains/day
 - Capacity–Based Frequency Service Plan
 - 12 hours @ 1 hr. frequency + 6 hrs. @ 15 min frequency = 36 trains/day (4,900 peak hour passengers)
- ▶ Each Scenario has Different Connectivity Assumptions

Preliminary Ridership

	High Speed Rail (With ICS System)	High Speed Maglev (With ICS System)	120 MPH Maglev (With ICS System)
Market	Yearly Riders	Yearly Riders	Yearly Riders
I-70 to I-70	1,438,083	1,500,280	1,259,750
I-70 to Denver Metro	1,040,563	893,312	744,483
I-70 to I-25 North	552,712	534,136	508,969
I-70 to I-25 South	401,574	388,664	369,454
Total	3,432,932	3,316,393	2,882,656
	High Speed Rail (Standalone I-70 System)		
Market	Yearly Riders		
I-70 to I-70, Total	2,992,067		

Additional Ridership Modeling

- ▶ Additional Full Corridor and Phasing Scenarios
- ▶ Sensitivity Analysis
 - Fare elasticity
 - More or fewer stations
 - Add El Rancho?
 - Delete Copper Mountain?
 - Various operating scenarios

Request For Financial Information Update

- ▶ Questions Due June 10, 2013
- ▶ Statements of Financial Information (SOFI) Due June 28, 2013

Request for Financial Information Update

▶ Process for Evaluation

- Statements of Financial Information will be reviewed by Funding & Financial Task Force members
- Summaries of Responses will be prepared
- Possible AGS Technical Committee meeting to discuss?
- Summary will be provided to PLT at July meeting

AGS/ICS/Co-Development Coordination

▶ ICS Progress

- Level 2 completed
- Alignments north and south of Metro Denver have been identified
- Alignments within Metro Denver will be narrowed
 - 2 east-west alignments
 - 2 north-south alignments
- Public meetings held in Front Range locations over past two weeks
- Last public meeting tonight at 5:00 in Silverthorne

AGS/ICS/Co-Development Coordination

- ▶ Traffic & Revenue Study consultant selected
- ▶ I-70 Peak Period Shoulder Lane (Empire Junction to Twin Tunnels) consultant selected
- ▶ PLT's for both have been identified and will be or have already been meeting

Steps Leading to Project Completion

- ▶ RFFI Review
- ▶ Operation & Maintenance Costs
- ▶ Financial Feasibility Determination
- ▶ Station & Land Use Meetings
- ▶ ICS Develops Phasing/Implementation Plan Including Recommended MOS
- ▶ Draft AGS Report
- ▶ Final AGS Report

Conclusions, Final Remarks & Next Steps

- ▶ Discussion of Schedule
 - Station and Land Use Meetings
 - PLT Meetings
 - Late July or 2nd Wednesday in August – RFFI Results & Financial Feasibility
 - Late August or 2nd Wednesday in September – Review Draft Report