PLT Meeting No. 8

CDOT Interregional Connectivity Study
Level 3 Evaluation Early Results

CH2MHILL

September 17, 2013

Our objectives:

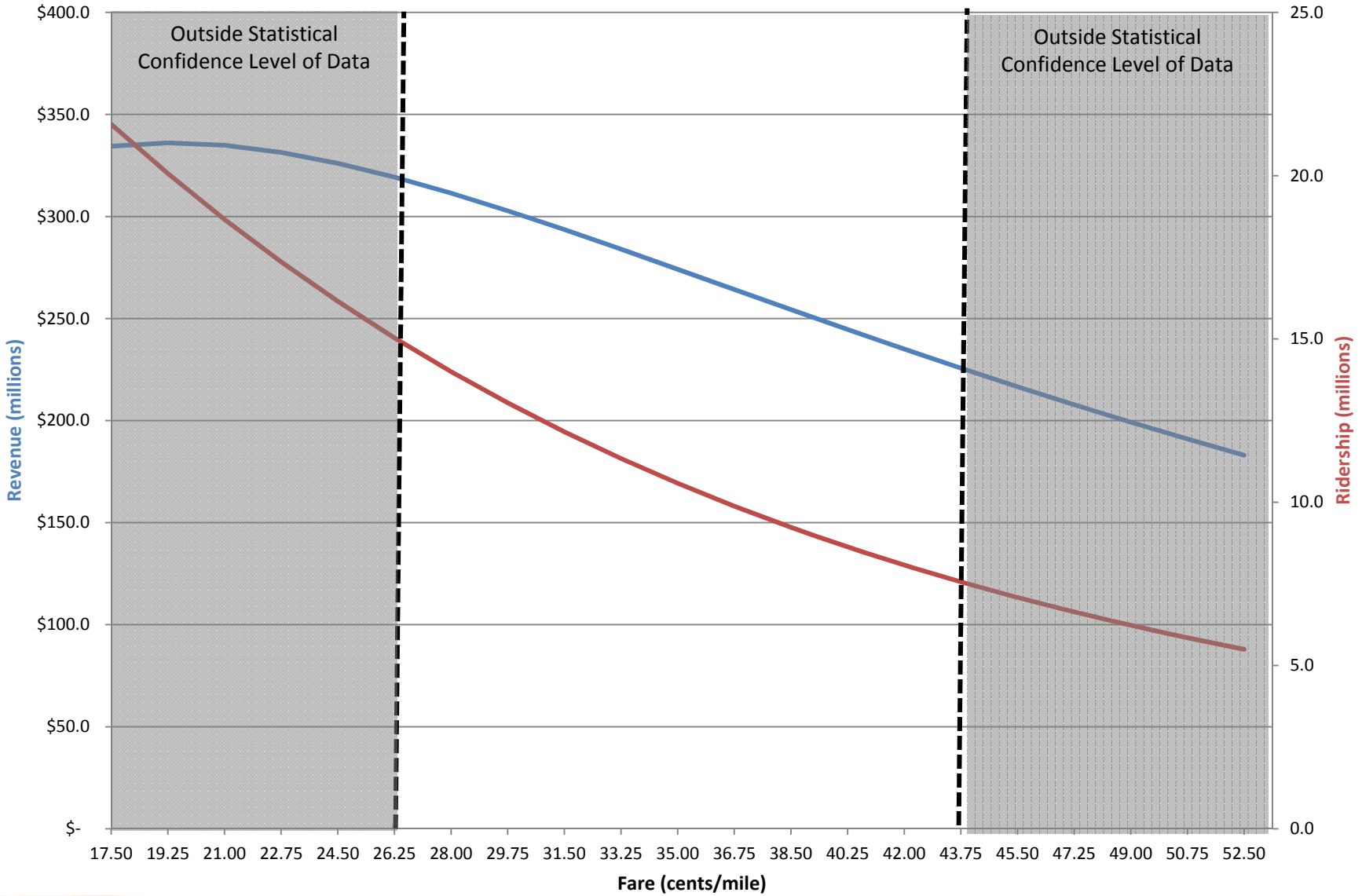
- Results from the ridership elasticity studies
- VE Results of the Full Build Scenarios
  - VE Option 1: Passing Track Where Possible
  - VE Option 2: Passing Track at Stations Only
- MOS Evaluation
  - HSR/Passing Track Where Possible
  - HSR/Passing Track at Stations Only
  - Starter System – 110 mph
- Revised BCA Results

Level 3 Refinements: Ridership Elasticity Studies and Results

Elasticity Studies

- What's Elasticity: Elasticity refers to price sensitivity - with inelastic products or services demand is unaffected by price; with elastic products or services, demand is reduced as price increases.
- Transit service is an elastic product
- The purpose of this study was to determine:
  - the price sensitivity of HSR services
  - The point of diminishing revenue returns
- Maximum ridership/revenue was realized with fares of $0.19/mile – however we believe this position on the curve is outside of the reliability of the model.
- We are recommending $0.26/mile with 18.4 million riders/year

Intercity Revenue Maximization



Ridership at $0.19 per Mile

	19.25 cents/mile, -45%			
Market	**Intercity**	**Intraurban**	**Connect Air**	**Total**
I70-I70	2,660,875	16,005	-	2,676,880
I70-I25N	703,620	583	-	704,203
I70-I25S	2,110,285	15,397	-	2,125,682
I70-DEN	373,085	5,327	51,903	430,314
I25N-I70	703,620	583	-	704,203
I25N-I25N	1,137,009	-	-	1,137,009
I25N-I25S	1,324,022	10,187	-	1,334,209
I25N-DEN	749,662	593,972	-	1,343,634
I25S-I70	2,110,284	15,397	-	2,125,682
I25S-I25N	1,324,022	10,187	-	1,334,209
I25S-I25S	4,223,412	848,761	-	5,072,174
I25S-DEN	761,468	507,164	237,119	1,505,751
DEN-I70	373,085	5,327	51,903	430,314
DEN-I25N	749,662	593,972	-	1,343,634
DEN-I25S	761,468	507,164	237,119	1,505,751
DEN-DEN	-	-	-	-
Total	**20,065,578**	**3,130,026**	**578,044**	**23,773,648**

Ridership at $0.26 per Mile

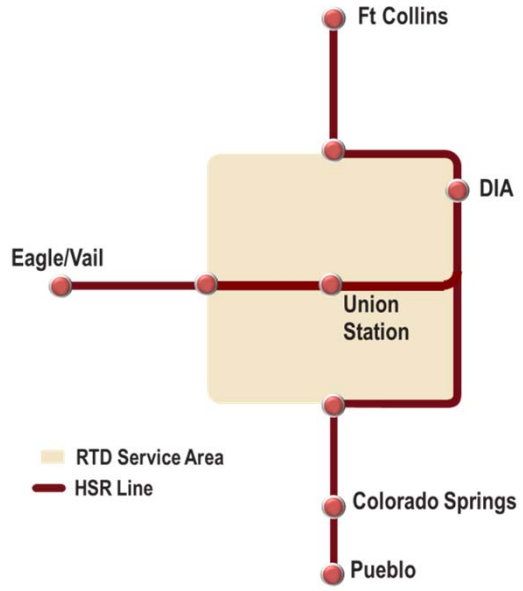
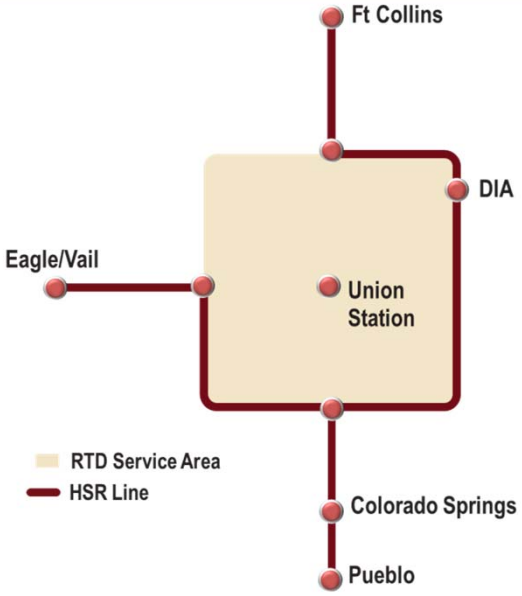
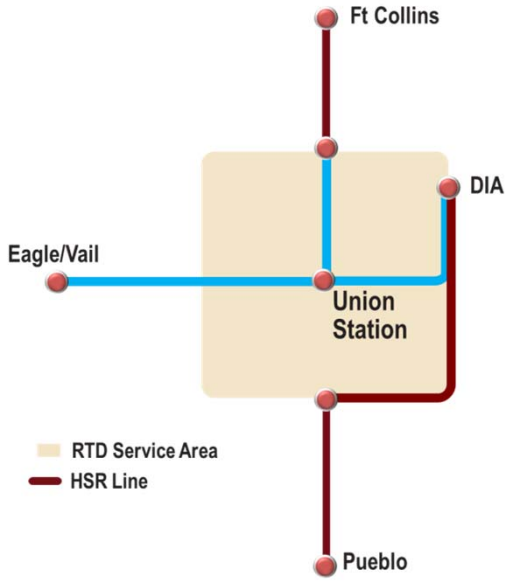
26.25 cents/mile, -25%				
Market	Intercity	Intraurban	Connect Air	Total
I70-I70	2,141,332	15,536	-	2,156,868
I70-I25N	386,762	583	-	387,344
I70-I25S	1,485,342	13,898	-	1,499,240
I70-DEN	231,746	4,219	50,515	286,480
I25N-I70	386,762	583	-	387,344
I25N-I25N	986,169	-	-	986,169
I25N-I25S	881,846	9,970	-	891,816
I25N-DEN	618,932	522,316	-	1,141,248
I25S-I70	1,485,342	13,898	-	1,499,240
I25S-I25N	881,846	9,970	-	891,816
I25S-I25S	3,559,059	837,276	-	4,396,336
I25S-DEN	569,215	423,281	231,325	1,223,822
DEN-I70	231,746	4,219	50,515	286,480
DEN-I25N	618,932	522,316	-	1,141,248
DEN-I25S	569,215	423,281	231,325	1,223,822
DEN-DEN	-	-	-	-
Total	**15,034,246**	**2,801,345**	**563,679**	**18,399,271**

Ridership at $0.35 per Mile

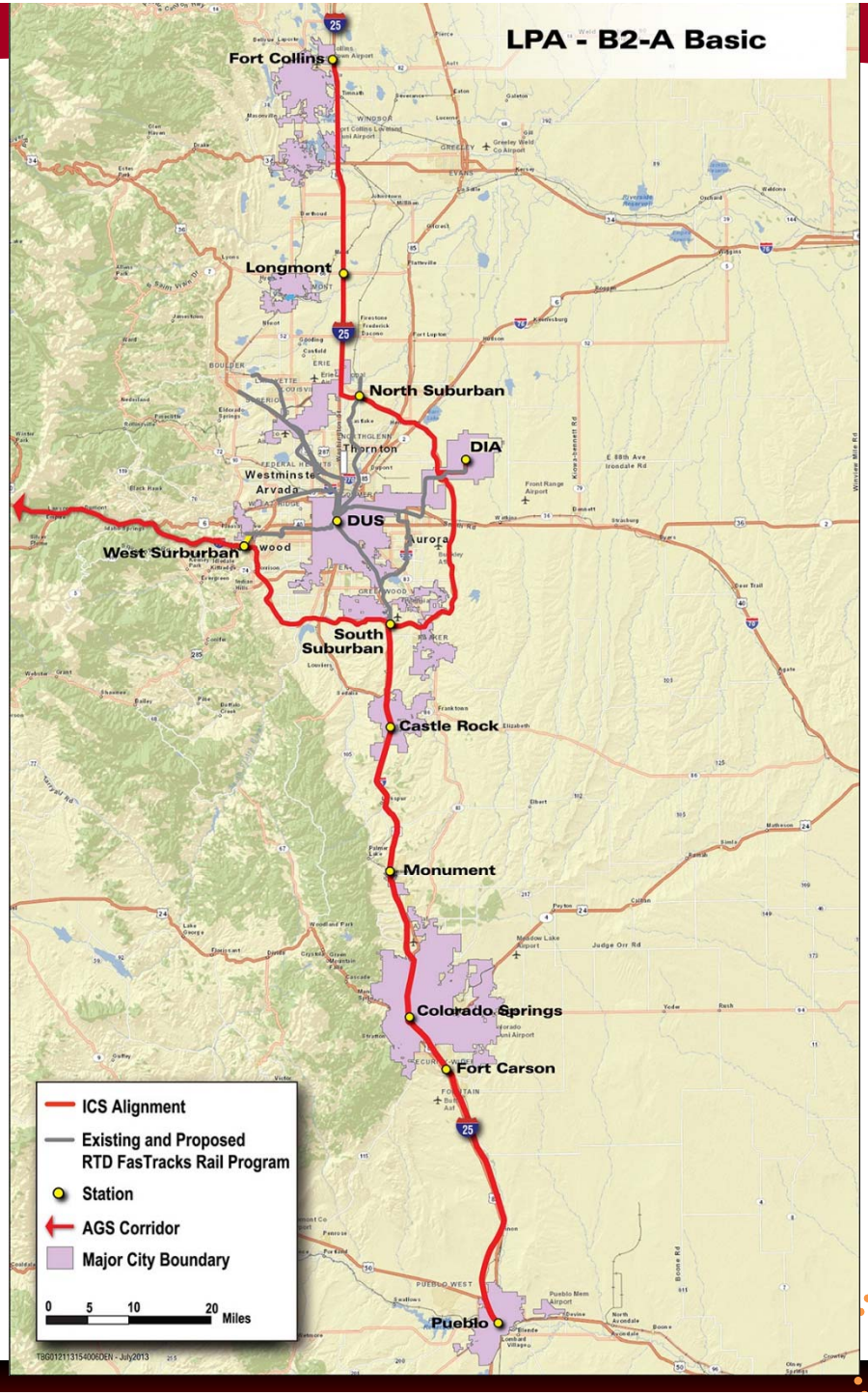
35 cents/mile, 0%				
Market	Intercity	Intraurban	Connect Air	Total
I70-I70	1,604,767	15,227	-	1,619,994
I70-I25N	178,451	583	-	179,033
I70-I25S	951,376	12,431	-	963,808
I70-DEN	121,560	3,898	48,750	174,209
I25N-I70	178,451	583	-	179,034
I25N-I25N	819,901	-	-	819,901
I25N-I25S	519,740	9,993	-	529,733
I25N-DEN	482,068	469,593	-	951,660
I25S-I70	951,376	12,431	-	963,808
I25S-I25N	519,740	9,993	-	529,733
I25S-I25S	2,866,002	825,984	-	3,691,985
I25S-DEN	391,799	388,789	224,792	1,005,380
DEN-I70	121,560	3,898	48,750	174,209
DEN-I25N	482,068	469,593	-	951,660
DEN-I25S	391,799	388,789	224,792	1,005,380
DEN-DEN	-	-	-	-
Total	**10,580,658**	**2,611,785**	**547,085**	**13,739,528**

Level 3 Refinements of the Full Build (Vision) Scenario

As you recall 3 Alternative Scenarios are packaged into the LPA + 2 Design Options

	A-5A	B-2A	C-1
			
CAPEX	$14.2 Billion	$13.4 Billion	$11.5 Billion
OPEX	$186 Million/yr	$206 Million/yr	$189 Million/yr
Ridership	12.9 million/yr	13.8 million/yr	10.8 million/yr
Revenue	$248 Million/yr	$250 Million/yr	$198 Million/yr
OPEX Ratio	1.33	1.21	1.05

LPA – B2-A - Basic



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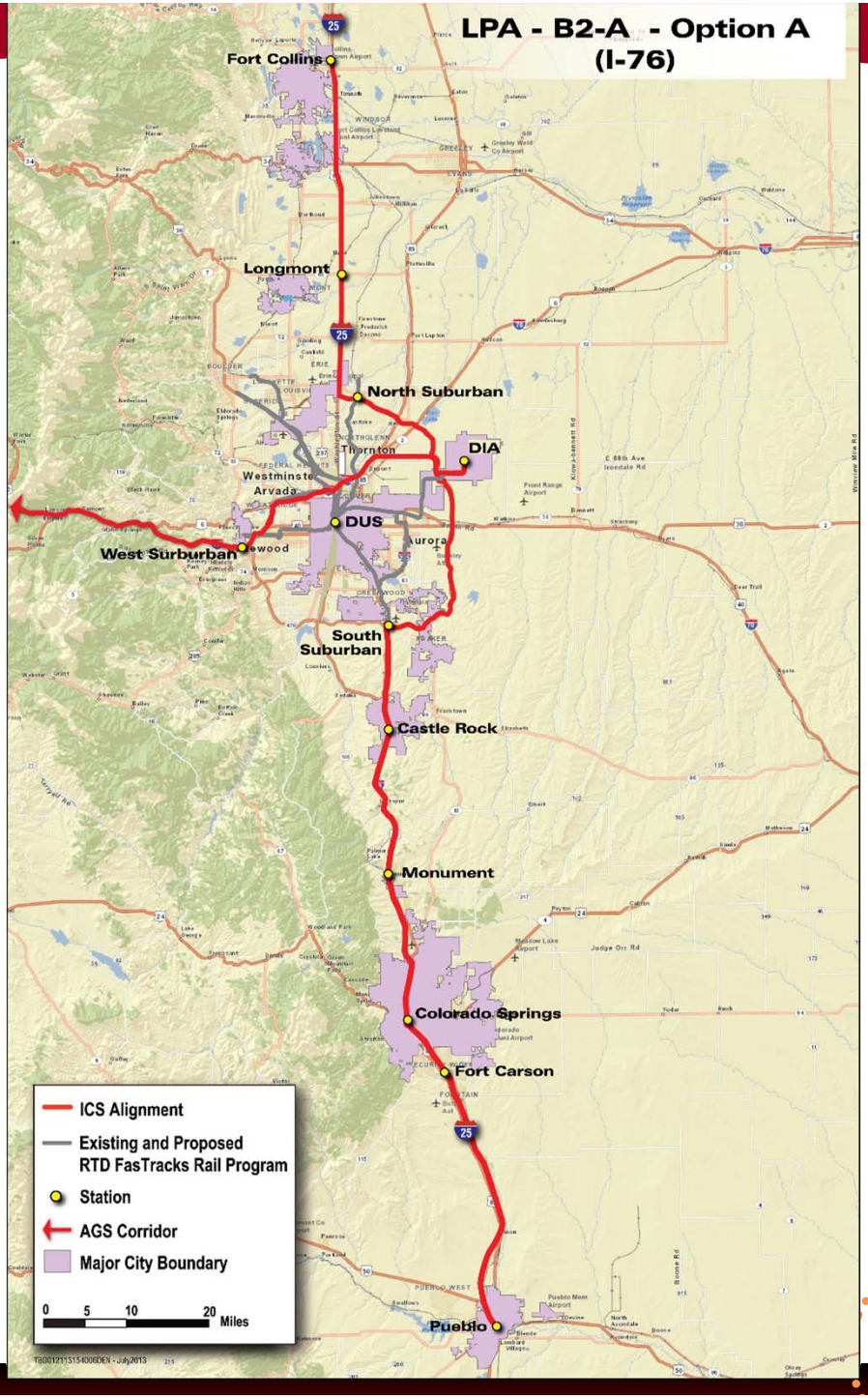
LPA – B-2A – Option A (I-76)



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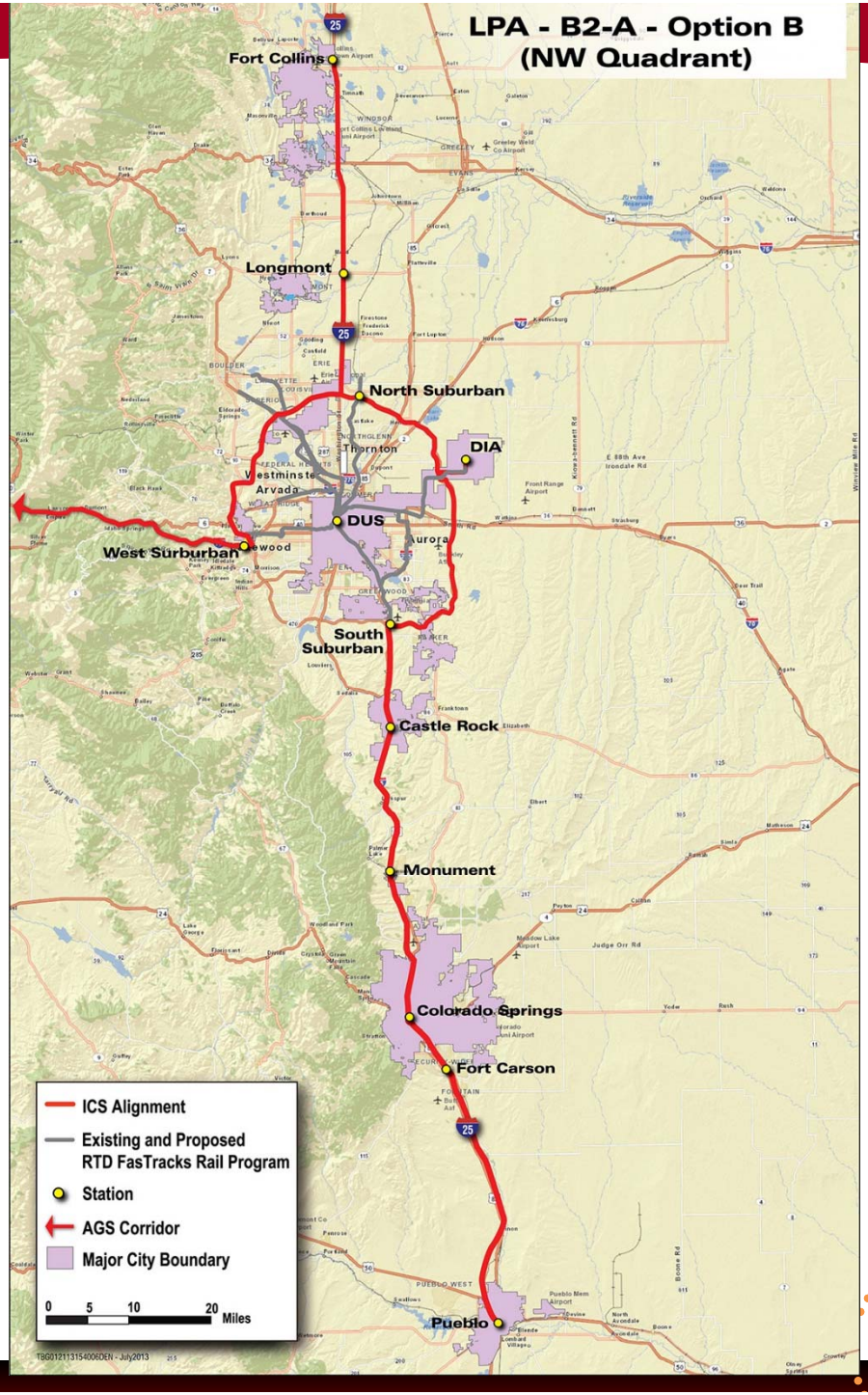
LPA – B-2A – Option B (Northwest Quadrant)

(Note: the NWQ was added to increase future options for traveling east to west due to constructability concerns with the other two options)



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Refinements were based on VE

- Goal: To improve cost-effectiveness
  - Options that do not degrade the service plan
  - Options that do degrade the service plan

- The highest leverage is to reduce the amount of double track and or reduce travel speeds (latter evaluated for MOS only)

- Three VE Options were assessed:
  - VE Option 1: Single Track Where Possible
  - VE Option 2: Passing Track at Stations
  - VE Option 3: Starter System @ 110 mph (MOS only)

What is the starter system?

- Strives to use a technology that can receive an FRA waiver to operate on both LRT and CRT track
- Will travel up to 110 mph
- Electric in developed areas and diesel powered for intercity travel
- Would provide one seat ride to DUS from either Fort Collins or Colorado Springs

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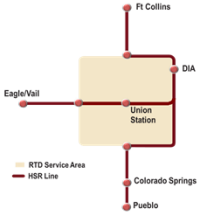
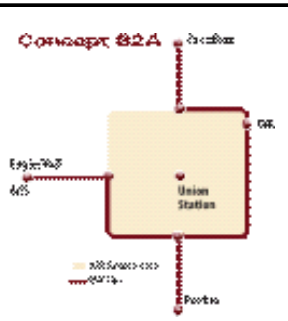
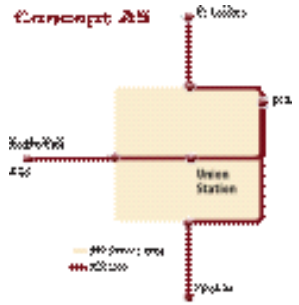
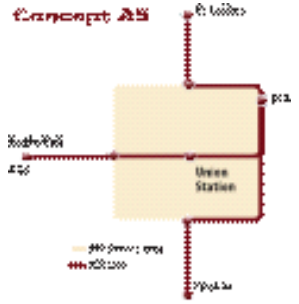
The Percentage of single track dictates the savings possible

VE Analysis: Percentage of Single Track Possible			
		VE Option 1 Passing Track Where Possible	VE Option 2: Passing Track at Stations
B-2A Basic		20%	98%
B-2A Option A (I-76)		34%	98%
B-2 A Option B (NWQ)		20%	98%

Basic Option: VE Options 1 and 2 Results

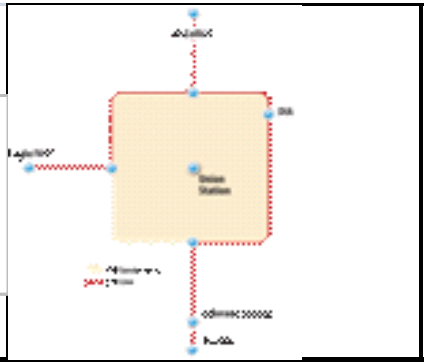
VE OPTION 1: Passing Track where Possible VE Option 2: Passing Track at Stations		
Category	**Scenario B2A -VE Opt 1**	**Scenario B2A -VE Opt 2**
CORRIDOR LENGTH (MILES)	218.56	218.66
10 TRACK STRUCTURES & TRACK	$ 4,768,910.85	$ 3,381,089.47
20 STATIONS, TERMINALS, INTERMODAL	$ 375,000.00	$ 400,000.00
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	$ 16,779.00	$ 16,779.00
40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS	$ 726,711.23	$ 524,097.41
50 COMMUNICATIONS & SIGNALING	$ 436,528.25	$ 308,561.44
60 ELECTRIC TRACTION	$ 1,078,050.61	$ 857,126.95
PROFESSIONAL SERVICES	$ 1,887,504.89	$ 1,399,351.84
UTILITY RELOCATION	$ 302,757.10	$ 224,459.77
ENVIRONMENTAL MITIGATION	$ 185,049.50	$ 137,191.36
CONTINGENCY	$ 2,933,187.43	$ 2,174,597.17
TOTAL SCENARIO COST	$ 12,710,478.86	$ 9,423,254.40

B-2A with Option A (I-76) – VE Options 1 and 2 Results

VE OPTION 1: Passing Track where Possible VE Option 2: Passing Track at Stations		

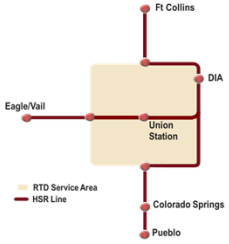
Category	Scenario B2A - Opt A - VE Opt 1	Scenario B2A - Opt A - VE Opt 2
CORRIDOR LENGTH (MILES)	227.26	227.36
10 TRACK STRUCTURES & TRACK	$ 4,668,943.97	$ 3,494,142.54
20 STATIONS, TERMINALS, INTERMODAL	$ 375,000.00	$ 400,000.00
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	$ 16,779.00	$ 16,779.00
40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS	$ 778,437.12	$ 648,509.84
50 COMMUNICATIONS & SIGNALING	$ 429,960.00	$ 321,095.94
60 ELECTRIC TRACTION	$ 1,079,480.61	$ 891,706.95
PROFESSIONAL SERVICES	$ 1,873,893.18	$ 1,471,919.74
UTILITY RELOCATION	$ 138,679.92	$ 111,105.83
ENVIRONMENTAL MITIGATION	$ 183,715.02	$ 144,305.86
CONTINGENCY	$ 2,863,466.65	$ 2,249,869.70
TOTAL SCENARIO COST	$ 12,408,355.47	$ 9,749,435.38

B-2A with Option B (NW Quadrant) – VE Options 1 and 2

VE OPTION 1: Passing Track where Possible VE Option 2: Passing Track at Stations		

Category	Scenario B2A - Opt B - VE Opt 1	Scenario B2A - Opt B -VE Opt 2
CORRIDOR LENGTH (MILES)	224.86	224.86
10 TRACK STRUCTURES & TRACK	$ 4,865,134.51	$ 3,443,432.45
20 STATIONS, TERMINALS, INTERMODAL	$ 375,000.00	$ 400,000.00
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	$ 16,779.00	$ 16,779.00
40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS	$ 726,777.44	$ 524,089.86
50 COMMUNICATIONS & SIGNALING	$ 450,073.25	$ 317,225.94
60 ELECTRIC TRACTION	$ 1,110,810.61	$ 881,306.95
PROFESSIONAL SERVICES	$ 1,923,866.58	$ 1,423,622.72
UTILITY RELOCATION	$ 303,778.68	$ 224,790.14
ENVIRONMENTAL MITIGATION	$ 188,614.37	$ 139,570.85
CONTINGENCY	$ 2,988,250.33	$ 2,211,245.37
TOTAL SCENARIO COST	$ 12,949,084.78	$ 9,582,063.29

Summary of VE Results

Scenario	Concept	Original	VE Option 1 Single Track Where Possible	VE Option 2: Passing Track at Stations
B-2A Basic		Cost: $13.4 B Ridership: 18.4 M	Cost: $12.7 Ridership: 18.4 M	Cost: $9.4 Ridership: 13.0 M
B-2A Option A (I-76)		Cost: $14.2 B Ridership: 17.2 M	Cost: $12.4 Ridership: 17.2 M	Cost: $9.7 Ridership: NA
B-2 A Option B (NWQ)		Cost: $13.9 B Ridership: 18.2 M	Cost: $12.9 Ridership: 18.2 M	Cost: $9.6 Ridership: NA

Minimum Operable Segment Level 3 Results

Process for recommending an MOS

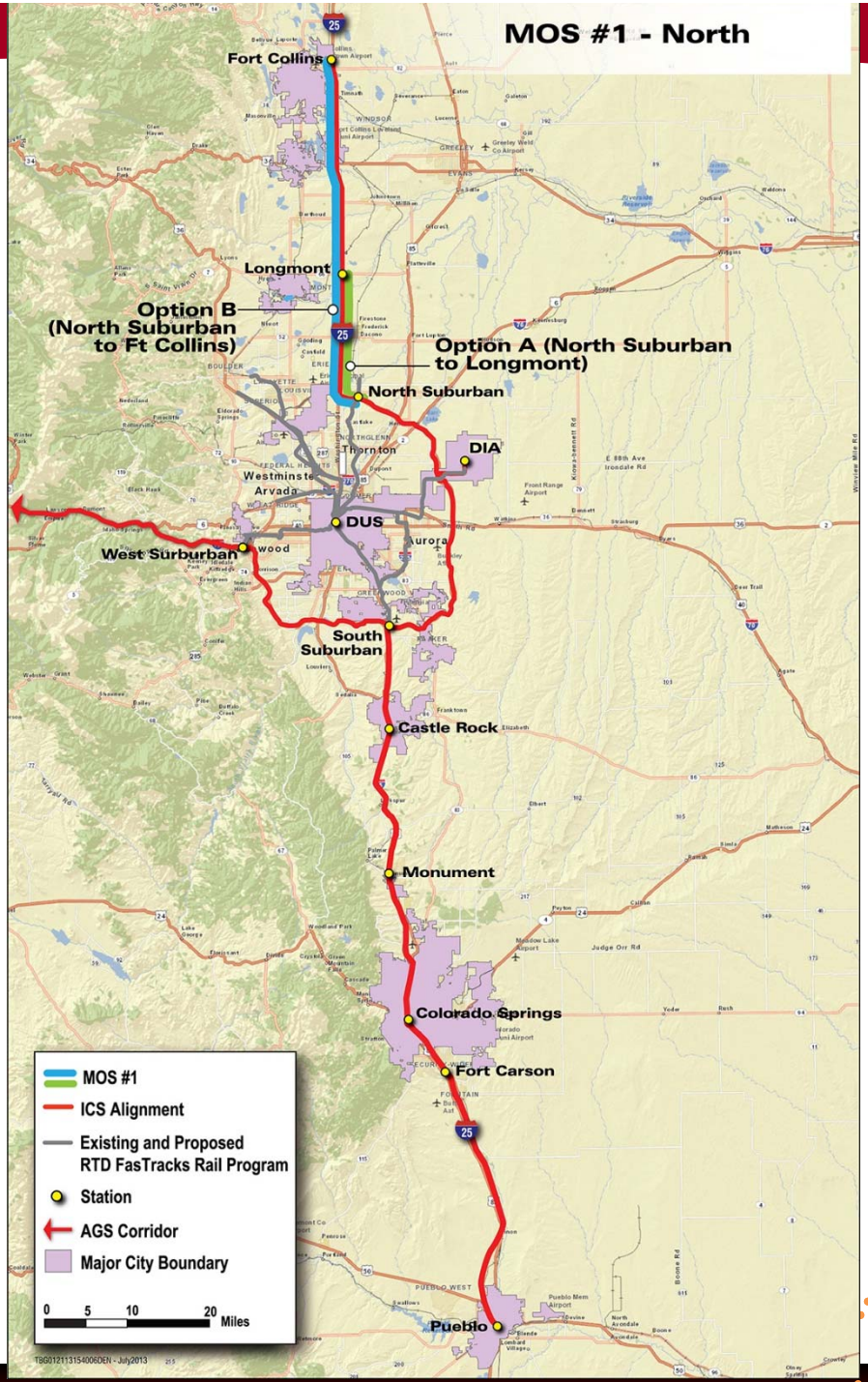
- What are the top options?
  - N. Suburban to Fort Collins
  - DIA to Fort Collins
  - S. Suburban to COS
  - DIA to COS
  - S. Suburban to Monument
  - DIA to Monument

- All top options have 3 permutations:
  - HSR/VE Option 1: Single Track Where Possible
  - HSR/VE Option 2: Passing Track at Stations
  - Starter System: 110 mph with Dual Mode Technology

What about technologies?

- MOS's accommodate all technologies, with two choices:
  - Interoperate with RTD (not agnostic)
  - Forced transfer to RTD (is agnostic)
- Forced Transfer will reduce ridership by 5 to 10 percent
- Conventional technology has the advantage of single track configuration
- The decision is likely 5 years in the future, allowing maturation of alternate technologies

MOS #1 – North Suburban to Fort Collins



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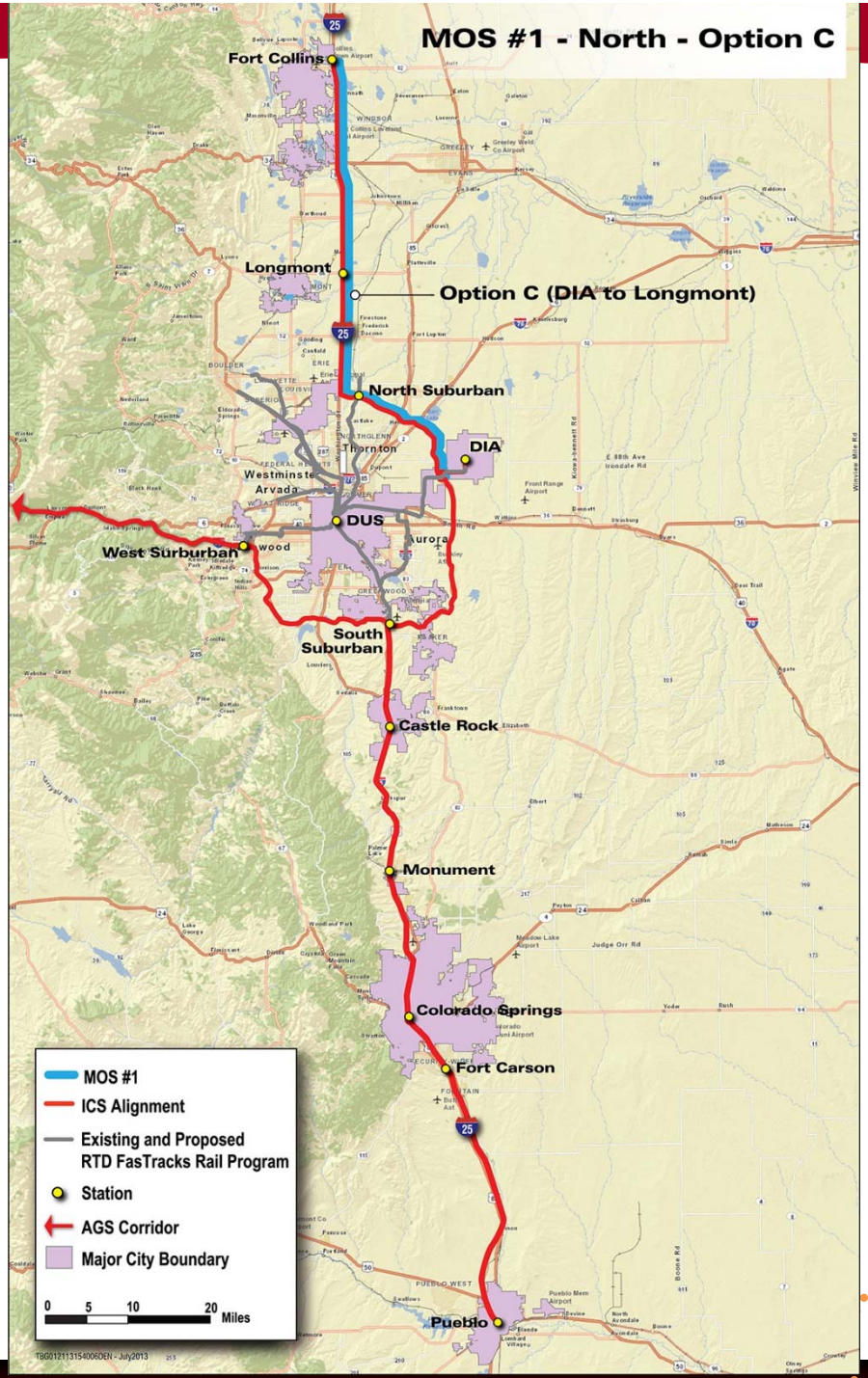
MOS #1A – DIA to Fort Collins



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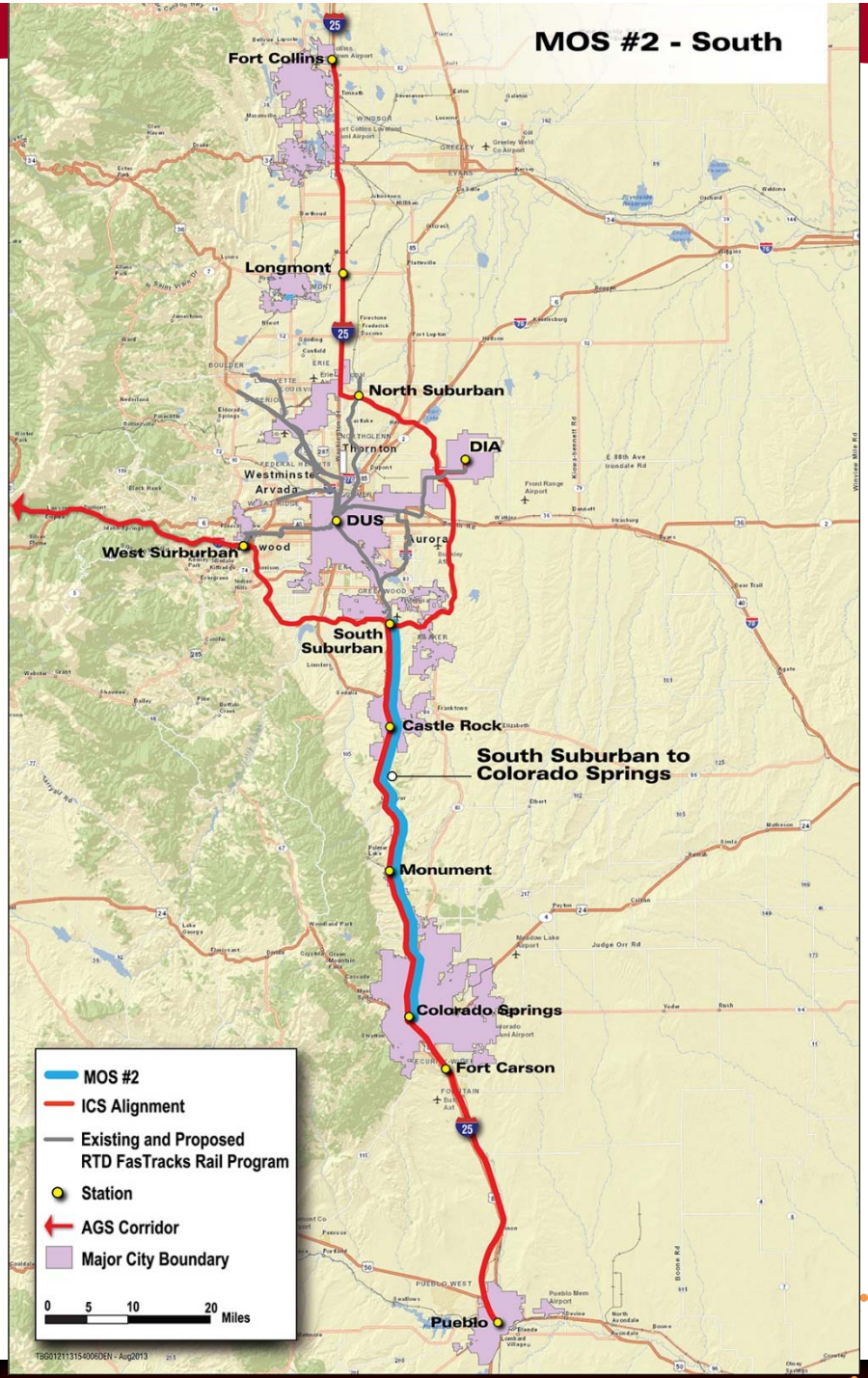
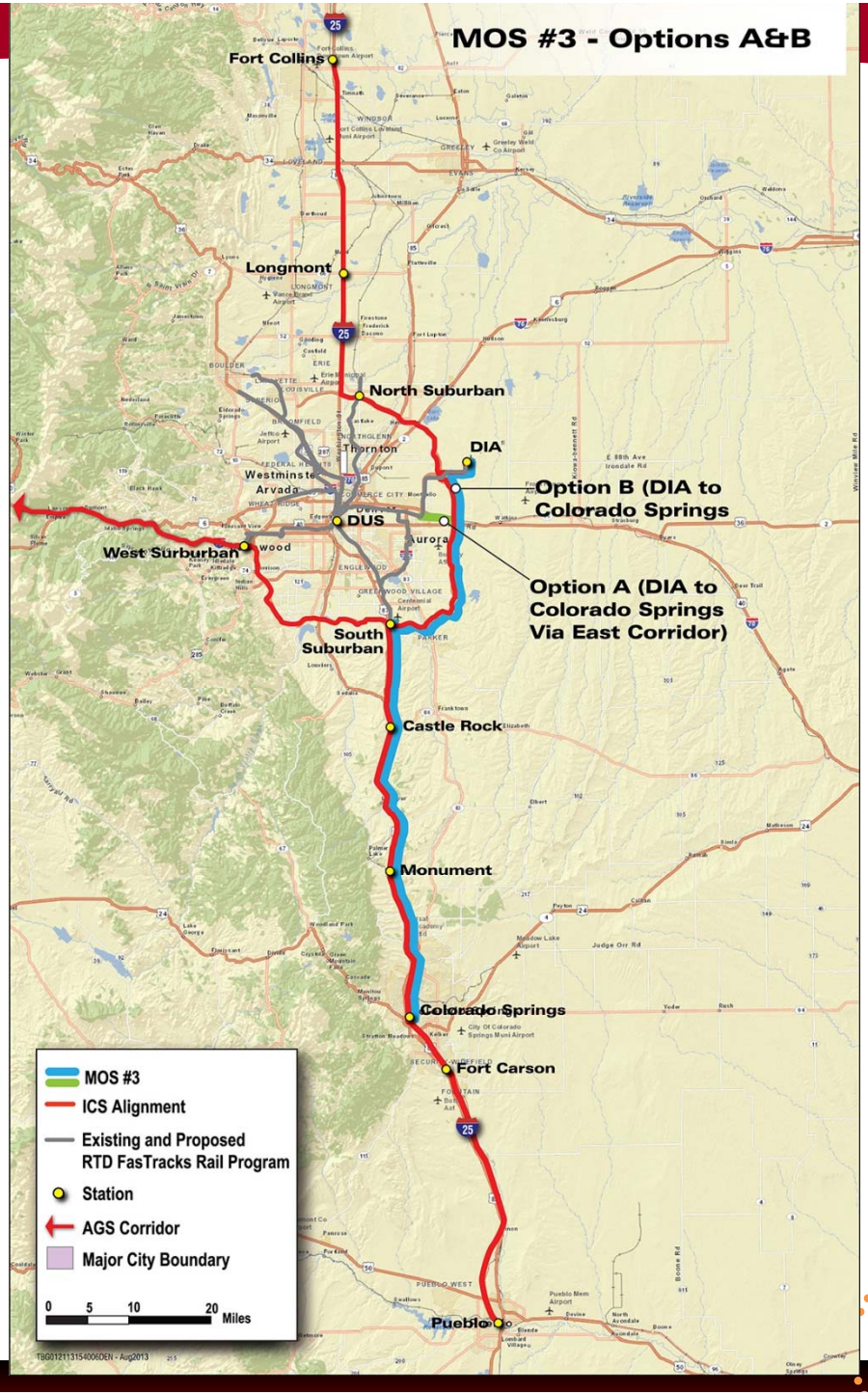
MOS #2 – South Suburban to COS



MOS #3 – DIA to COS



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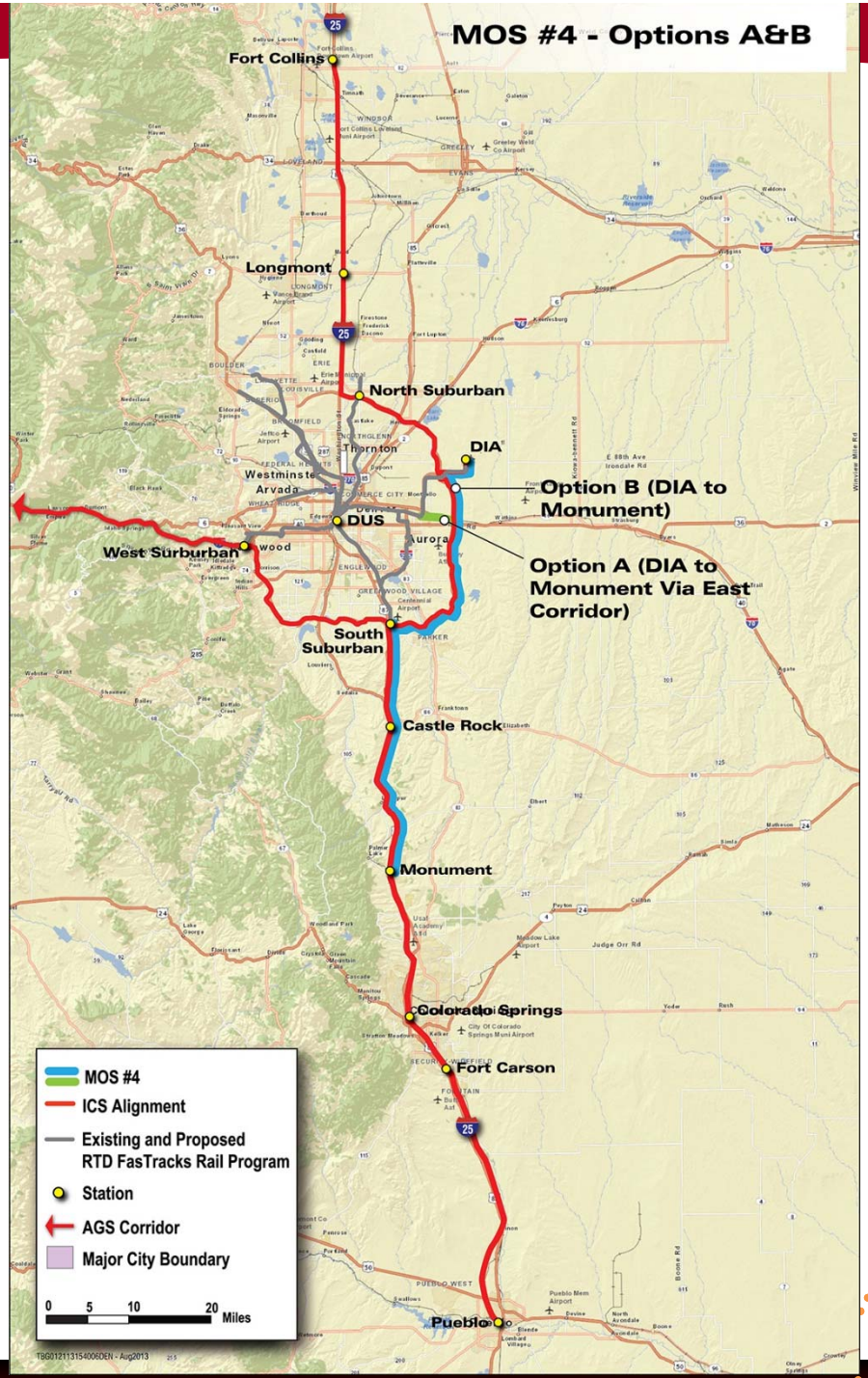
MOS #4 – DIA to Monument A&B



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General MOS conclusions

- MOS Options connecting to DIA are the most cost-effective
- MOS Options to Fort Collins are generally more cost-effective than those traveling to COS
- The most cost-effective MOS is Option 1A-A DIA to Fort Collins at $0.70 per rider mile
- The most cost-effective MOS to the south is Option MOS #3B: DIA to COS with a forced transfer to at DIA at $0.95
- In all cases, the Starter System is the least cost-effective (even though the absolute CAPEX is the lowest)

MOS Options to Fort Collins

ICS MOS Options	CRITERIA				
	CAPEX (B$)	Ridership	Revenue	$/Ride	$/Rider Mile
ICS MOS #1: North Suburban to Fort Collins (assume interoperability with RTD)					
Option A - HSR: Original Service Plan (Passing track where possible)	$1,728,774,848	2,025,559	$28,550,783	$49	$1.13
Option B - HSR: Reduced Service Plan (Passing Track at stations only)	$1,498,287,094	1,627,363	$23,191,899	$53	$1.22
Option C - Starter System (110 mph)	$1,317,321,448	1,142,423	$16,641,415	$67	$1.53
ICS MOS #1A: DIA to FC with transfer to DUS (assume interoperability with RTD)					
Option A - HSR: Original Service Plan (Passing track where possible)	$2,782,092,441	3,557,246	$42,595,706	$45	$0.70
Option B - HSR: Reduced Service Plan (Passing Track at stations only)	$2,336,131,972	2,294,084	$29,246,971	$59	$0.92
Option C - Starter System (110 mph)	$2,205,426,419	1,644,666	$20,654,307	$78	$1.21

MOS Options to Colorado Springs

ICS MOS # 2: Build South Suburban to COS					
Option A - HSR: Original Service Plan (Passing track where possible - Forced transfer at S. Suburban)	$4,151,721,819	2,953,956	$28,963,434	$81	$1.59
Option B - HSR: Reduced Service Plan (Passing Track at stations only - Forced transfer at S. Suburban)	$2,832,433,198	2,147,543	$20,890,973	$76	$1.49
Option C - Starter System (110 mph - dual mode technology, interoperable with RTD)	$1,924,765,778	841,243	$7,859,542	$132	$2.58
ICS MOS # 3: DIA to South Suburban to COS					
Option A - HSR: Original Service Plan (Passing track where possible - Interoperate with RTD East Corridor)	$5,528,207,452	4,163,498	$47,936,145	$77	$1.07
Option B - HSR: Original Service Plan (Passing track where possible - Forced transfer at DIA)	$5,528,207,452	4,340,528	$53,346,512	$74	$0.95
Option C - HSR: Reduced Service Plan (Passing track at stations only - Interoperate with RTD East Corridor)	$3,992,032,586	3,197,004	$36,914,046	$72	$1.00
Option D - HSR: Reduced Service Plan (Passing track at stations only - Forced transfer at DIA)	$3,992,032,586	3,364,479	$41,683,577	$69	$0.88
Option E: Starter System (110 mph - dual moded technology, interoperable with RTD at DIA and S. Suburban	$2,908,060,815	1,482,192	$17,380,912	$113	$1.46

MOS Options to Monument

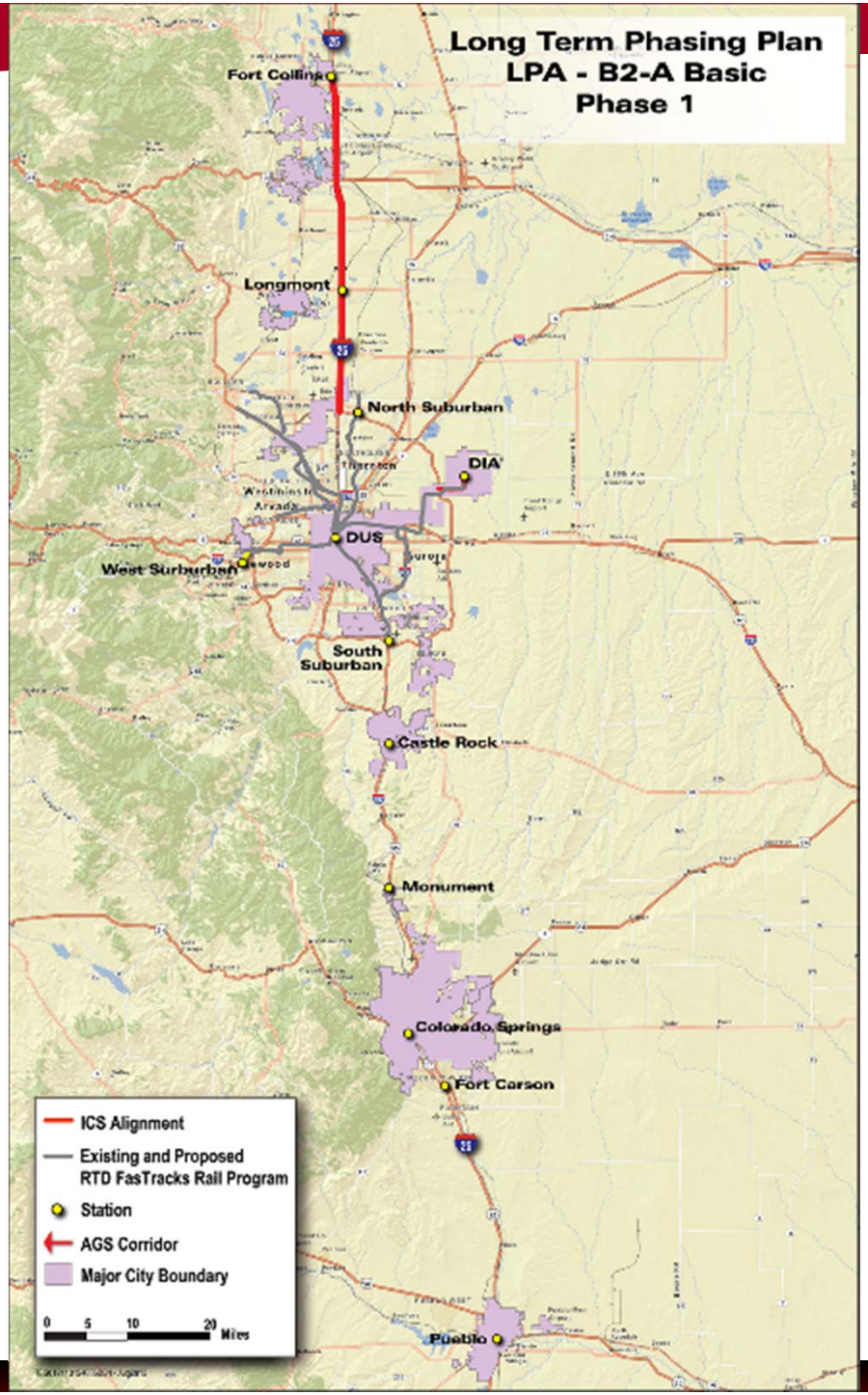
ICS MOS # 4: DIA to South Suburban (via E-470) to Monument					
Option A - HSR: Original Service Plan (Passing track where possible - Interoperate with RTD East Corridor)	$4,396,939,141	2,581,319	$23,329,456	$98	$1.56
Option B - HSR: Original Service Plan (Passing track where possible - Forced transfer at DIA)	$4,396,939,141	2,553,343	$22,700,839	$100	$1.57
Option C - HSR: Reduced Service Plan (Passing at stations only - Interoperate with RTD East Corridor)	$3,229,104,451	2,159,401	$20,430,819	$86	$1.37
Option D - HSR: Reduced Service Plan (Passing track at stations only - Forced transfer at DIA)	$3,229,104,451	2,133,702	$19,853,560	$87	$1.39
Option E: Starter System (110 mph - dual moded technology, interoperable with RTD at DIA and S. Suburban	$2,473,657,028	1,344,532	$13,618,764	$106	$1.69

Possible Phasing Plan

General Conclusions on Phasing

- The most cost-effective MOS may not be the most logical first phase assuming policy considerations
- The phasing plan must provide transit equity
- Be geographically representative to gain political support
- Allow implementation of the program in 30 years
- Even with a 30-year implementation, the cash flow requirements are huge and will require a major new funding source

Phase 1



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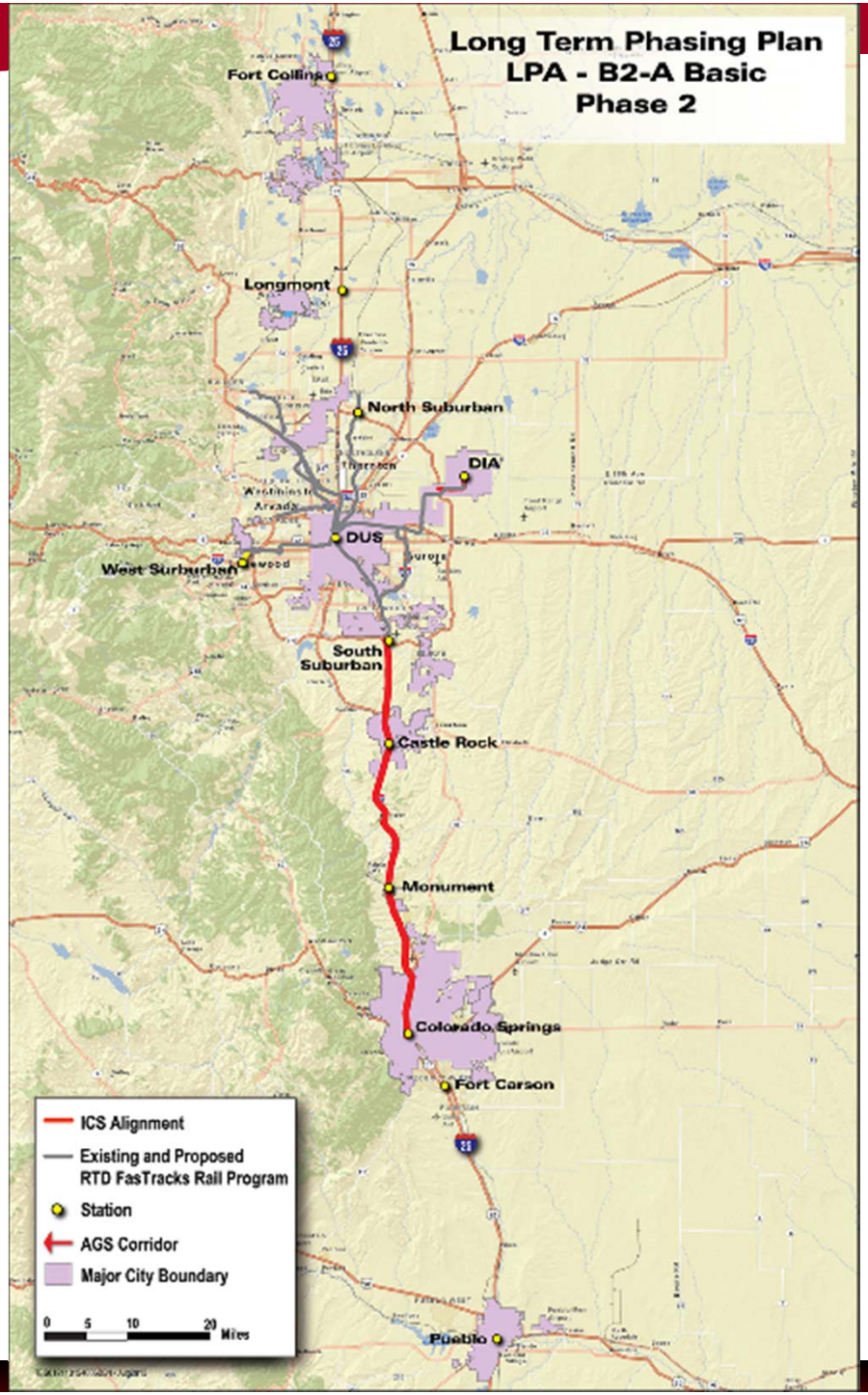
Phase 2



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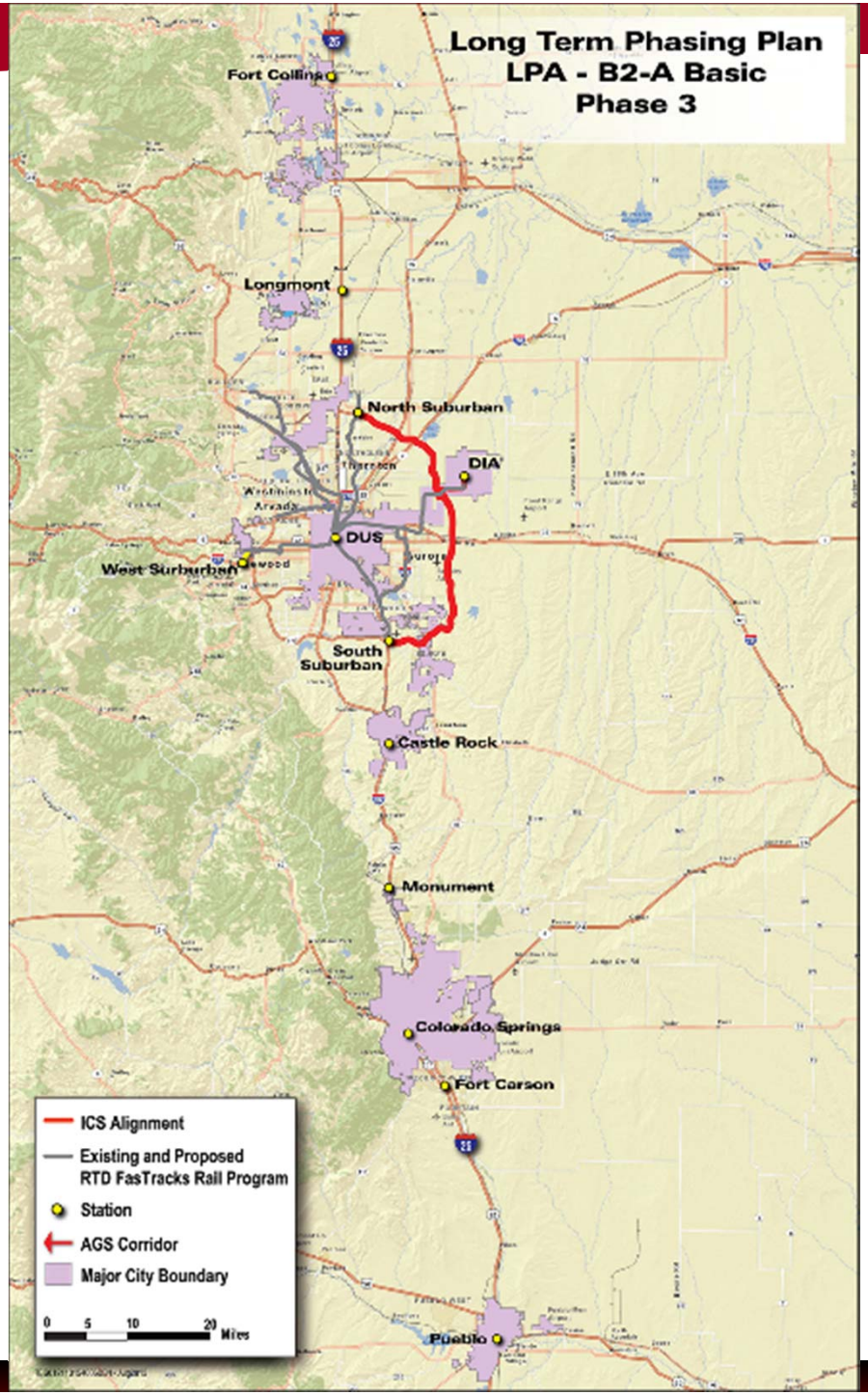
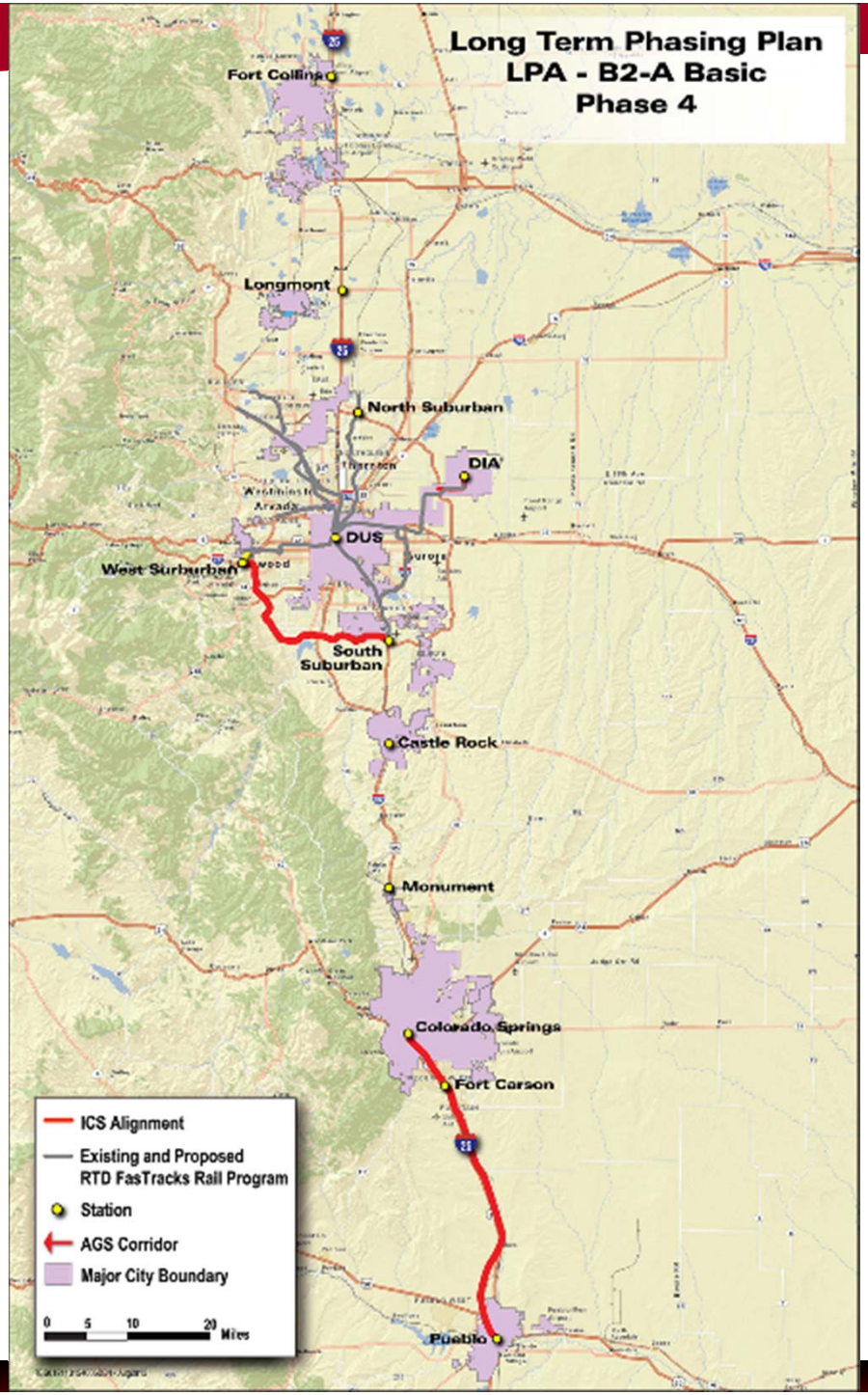
Phase 3



ICS Interregional Connectivity Study

Phase 4



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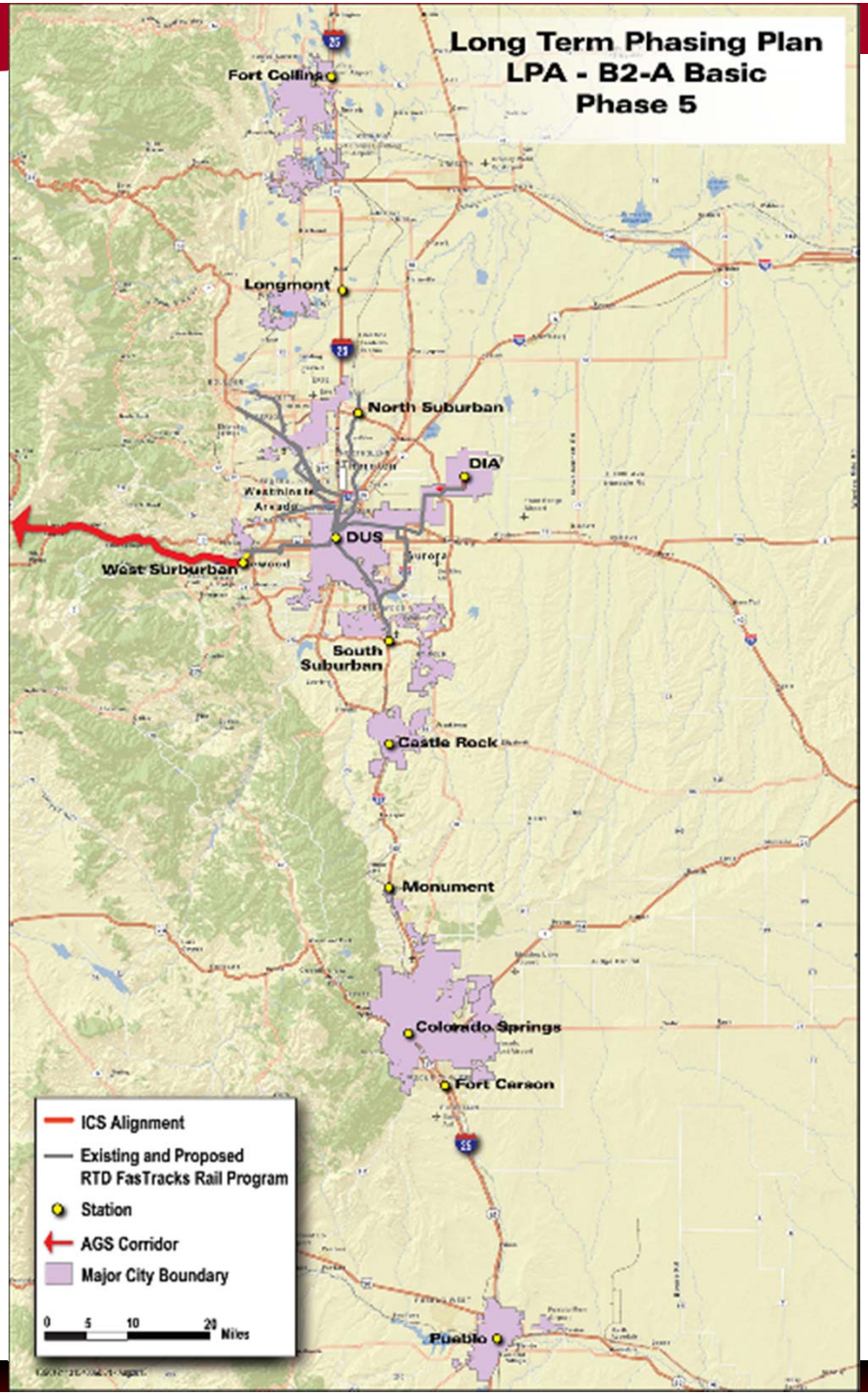
Phase 5



ICS Interregional Connectivity Study

Environmental Considerations for Phasing

- Environmental considerations in ICS study position for future NEPA
- Alignments considered where environmental and community impacts serve as discriminators, with focus on substantive issues
- Next step likely a Tier 1 EIS
  - Additional public involvement
  - Focused comparison of important / significant environmental and social impacts
  - Refined phasing
  - Tier 2 project/analysis recommendations
- MOS would likely be part of Tier 2 NEPA process

Environmental Issues with MOSs

- Not a tradeoff of north, south, or west
  - System will incur impacts
  - MOS is a matter of timing
- North to Fort Collins seems to have relatively fewest environmental and social impacts
- South to Colorado Springs has more environmental issues
- Denver area has potential cumulative impacts with RTD FasTracks
- Single track options may reduce environmental impacts slightly

BCA Update – ICS

Updated BCA Studies

The selection of the design option has little effect on the overall BCA.

It has a slight affect on the OPEX Ratio.

New OPEX estimates have a significant affect on OPEX ratio

Federal fund multiplier effects are the greatest single influence.

B/C Element	Scenario B-2a Basic	Scenario B-2a Option A (I-76)	Scenario B-2a Option B (NWQ)
Costs			
CAPEX ICS	13,397,000,000	$ 14,125,994,000	13,945,000,000
Annual OPEX	$ 110,000,000	$ 92,554,300	$ 103,433,800
OPEX Cost (30 year)	$ 1,901,900,000	$ 1,600,263,847	$ 1,788,370,402
Interest payments	$ 4,814,144,965	$ 5,076,105,314	$ 5,011,066,025
Total Cost	**$ 20,113,044,965**	**$ 22,402,627,008**	**$ 20,744,436,427**
Benefits			
Calculated Benefits (PW basis)			
Increase in Real Estate Value - one time deal, no PW calc.	$ 3,100,000,000	$ 3,100,000,000	$ 3,100,000,001
Fare Box Revenue (30 year)	$ 4,879,549,607	$ 4,815,439,400	$ 4,272,659,117
PW of VMT	$ 2,836,767,384	$ 2,750,528,185	$ 2,756,274,811
PW of VHT	$ 389,449,369	$ 305,262,332	$ 369,462,769
PW of Fatality Avoided	$ 345,477,742	$ 334,975,040	$ 335,674,897
Pollution benefits	$ 1,008,065,553	$ 977,419,837	$ 979,461,942
PW of Operations Jobs	$ 950,950,000	$ 800,131,924	$ 1,788,370,402
PW of Non-basic jobs (1.5 multiplier)	$ 475,475,000	$ 400,065,962	$ 894,185,201
50% Federal funding	$ 6,698,500,000	$ 7,062,997,000	$ 6,972,500,000
Multiplier effect of Federal funding (2.0 multiplier)	**$ 13,397,000,000**	**$ 14,125,994,000**	**$ 13,945,000,000**
Construction Employment	$ 5,432,483,500	$ 5,728,090,567	$ 5,654,697,500
Non-basic jobs (2.0 multiplier)	$ 3,585,439,110	$ 3,780,539,774	$ 3,732,100,350
Total Benefits	**$ 36,400,657,266**	**$ 37,118,447,020**	**$ 37,827,886,990**
Sum of Benefits (PW Cost Basis)	**$ 36,400,657,266**	**$ 37,118,447,020**	**$ 37,827,886,990**
Sum of Costs (PW Cost Basis)	**$ 20,113,044,965**	**$ 20,802,363,161**	**$ 20,744,436,427**
B/C Ratio with Federal Funding Benefit	**1.81**	**1.78**	**1.82**
Operating Ratio	**2.57**	**3.01**	**1.19**
B/C Ratio w/o Federal Funding Benefit	**1.14**	**1.11**	**1.15**

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What Drives the BCA?

- The greatest drivers of the positive results include:
  - Impact of Federal funding with multiplier
  - Construction & spin-off employment
- If we downplay the effects of Federal funding the results are very different:
  - BCA shows a ratio of about 1.15 with a multiplier
- OPEX ratios look much better with the new estimates

Look Ahead Schedule

- Environmental consequence of Full Build Scenario Design Options by October 15
- Cash flow requirements: FB Scenario and MOS by October 15
- Recommended Financial Plan by October 15
- Eng/Environmental complete on the final MOS options on October 8
- PLT October on 15
- Public Open Houses week of October 24 at Fort Collins; October 29 at Pueblo; October 29 at Colorado Springs and October 30 at Denver.
- Transit and Intermodal Committee approves study recommendations on November 21 and 22
- Draft AA Report – November 7
- Project closeout –December 31
- Transportation Commission accepts study findings on December 18 and 19.

Thank you for Attending!