



GATEWAY CORRIDOR
Alternatives Analysis

Capital Cost Estimating Methodology & Results Report

Prepared for:
Washington County
Regional Railroad Authority
on behalf of the
Gateway Corridor Commission



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Submitted by

CH2MHILL



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Executive Summary

This technical memorandum summarizes the methodology used to prepare capital cost estimates for the Gateway Corridor Alternatives Analysis (Gateway Corridor AA). Capital cost estimates identify the one-time expenditure to build the system; this typically includes guideways, tracks, stations, structures, signalization and communications systems, operations and maintenance facilities, vehicles, and right-of-way acquisition. Also included are “soft costs” for items such as engineering, construction services, insurance, and owner’s costs, as well as contingencies for uncertainty in both the estimating process and the scope of the project. Capital cost estimates were prepared using the format and procedures required by the Federal Transit Administration (FTA).

At this stage of Gateway Corridor study, there is not sufficient definition or detail to prepare true construction cost estimates for alternatives under consideration. Rather, the capital cost estimates were developed using representative typical unit costs or allowances on a per unit basis that is consistent with the level of alternatives definition. The capital cost estimates developed during this AA level of study will be refined based upon additional design development work during future phases of study.

This report provides the key components needed to develop cost estimates for this level of AA study. These components include: capital cost estimate organization methodology (section 2.0); global parameter assumptions (section 3.1); the basis for unit prices, including the quantification methods for capital elements and contingencies (section 3.2); and the basis for cost estimation by alternative (section 3.3).

Results

The estimated capital costs for Gateway alternatives are summarized in the table below.

TABLE 1
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Segment 1 (Interchange to Union Depot)						12.1 miles	
10 GUIDEWAY & TRACK ELEMENTS						\$88,619,664	
20 STATIONS, STOPS, TERMINALS						\$3,061,133	
40 SITEWORK & SPECIAL CONDITIONS						\$54,049,762	
50 SYSTEMS						\$18,367,800	
60 ROW, LAND, EXISTING IMPROVEMENTS						\$15,968,552	
<i>Segment Cost</i>	\$0	\$0	\$0	\$0	\$0	\$180,066,911	\$0
<i>Professional Services and Unallocated Contingency</i>	\$0	\$0	\$0	\$0	\$0	\$103,959,752	\$0
<i>Segment Subtotal</i>	\$0	\$0	\$0	\$0	\$0	\$284,026,663	\$0
Segment 2 (Union Depot to east of Manning Ave)		11.5 miles	13.3 miles	11.5 miles	13.3 miles	13.4 miles	11.2 miles
10 GUIDEWAY & TRACK ELEMENTS		\$79,460,928	\$77,442,792	\$97,329,660	\$112,000,504	\$70,005,865	\$21,998,592
20 STATIONS, STOPS, TERMINALS		\$39,300,000	\$27,144,000	\$35,340,000	\$40,680,000	\$9,183,399	\$49,680,000
40 SITEWORK & SPECIAL CONDITIONS	\$625,842	\$35,710,778	\$41,874,241	\$57,868,757	\$64,129,950	\$4,329,888	\$166,280,763
50 SYSTEMS	\$1,057,500	\$4,620,000	\$10,350,000	\$104,848,181	\$130,074,909	\$22,077,240	\$2,115,000
60 ROW, LAND, EXISTING IMPROVEMENTS		\$9,672,116	\$47,051,300	\$14,109,740	\$55,181,998	\$742,768	\$7,478,904
<i>Segment Cost</i>	\$1,683,342	\$168,763,822	\$203,862,333	\$309,496,338	\$402,067,361	\$106,339,160	\$247,553,259
<i>Professional Services and Unallocated Contingency</i>	\$976,338	\$97,592,853	\$116,828,614	\$179,084,585	\$231,543,609	\$61,654,429	\$143,356,525
<i>Segment Subtotal</i>	\$2,659,680	\$266,356,675	\$320,690,947	\$488,580,923	\$633,610,970	\$167,993,589	\$390,909,784

TABLE 1
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Segment 3 (Manning Avenue to east of Hudson)						9.6 miles	3.2 miles
10 GUIDEWAY & TRACK ELEMENTS						\$11,865,786	\$9,225,216
20 STATIONS, STOPS, TERMINALS						\$3,061,133	
40 SITEWORK & SPECIAL CONDITIONS	\$12,506,667	\$12,506,667	\$12,506,667	\$12,506,667	\$12,506,667	\$2,566,504	\$9,905,247
50 SYSTEMS	\$352,500	\$352,500	\$352,500	\$352,500	\$352,500	\$15,566,868	\$352,500
60 ROW, LAND, EXISTING IMPROVEMENTS	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$20,600	\$2,600,000
<i>Segment Cost</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$33,080,891</i>	<i>\$22,082,963</i>
<i>Professional Services and Unallocated Contingency</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$19,186,299</i>	<i>\$12,730,119</i>
<i>Segment Subtotal</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$52,267,190</i>	<i>\$34,813,082</i>
Segment 4 (Hudson to Eau Claire)						64.6 miles	
10 GUIDEWAY & TRACK ELEMENTS						\$81,009,860	
20 STATIONS, STOPS, TERMINALS						\$9,183,399	
40 SITEWORK & SPECIAL CONDITIONS	\$4,560,869	\$4,560,869	\$4,560,869	\$4,560,869	\$4,560,869	\$7,504,764	\$4,560,869
50 SYSTEMS	\$1,057,500	\$1,057,500	\$1,057,500	\$1,057,500	\$1,057,500	\$103,034,868	\$1,057,500
60 ROW, LAND, EXISTING IMPROVEMENTS	\$1,353,000	\$1,353,000	\$1,353,000	\$1,353,000	\$1,353,000	\$3,868,080	\$1,353,000
<i>Segment Cost</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$204,600,971</i>	<i>\$6,971,369</i>
<i>Professional Services and Unallocated Contingency</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$118,552,521</i>	<i>\$4,002,805</i>
<i>Segment Subtotal</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$323,153,492</i>	<i>\$10,974,174</i>
	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8

TABLE 1
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Maintenance Facility and Vehicles							
30 SUPPORT FACILITIES		\$1,551,000	\$1,551,000	\$56,907,600	\$56,907,600	\$30,451,680	\$0
70 VEHICLES	\$8,032,500	\$18,165,000	\$20,475,000	\$117,810,000	\$186,900,000	\$67,548,600	\$18,637,500
	\$8,032,500	\$19,716,000	\$22,026,000	\$174,717,600	\$243,807,600	\$98,000,280	\$18,637,500
<i>Professional Services and Unallocated Contingency</i>	\$2,570,400	\$6,712,380	\$7,451,580	\$70,705,608	\$92,814,408	\$39,277,527	\$5,964,000
<i>Segment Subtotal</i>	\$10,602,900	\$26,428,380	\$29,477,580	\$245,423,208	\$336,622,008	\$137,277,807	\$24,601,500
Alternative Totals							
	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Total 2012	\$48,584,238	\$328,106,713	\$385,490,185	\$769,325,788	\$1,005,554,637	\$964,718,742	\$461,298,540
Total 2019	\$61,812,721	\$417,443,369	\$490,451,170	\$978,797,249	\$1,279,346,315	\$1,227,391,653	\$586,900,569

1. Methodology

Capital cost estimates were prepared using the format and procedures currently required for project evaluation by the Federal Transit Administration (FTA). The FTA methodology includes the use of standard cost categories (SCC) and groupings for organization of the data, and detailed spreadsheets for development of forecast year estimates and annualized capital costs.

The FTA SCC organization for capital cost estimates was developed for application to many different types of transit improvements, and on project phases ranging from alternatives analysis to final design and construction. The capital cost elements for the Gateway Corridor AA Study are organized into the FTA SCC format as indicated in Table 2.

TABLE 2
FTA SCC Capital Cost Estimate Organization

Standard Cost Categories (SCC)	Description
	Guideway
SCC 10	Guideway grading and drainage; retaining walls, bridges and tunnels; trackwork; busway construction
	Stations
SCC 20	Construction of station platforms, enclosures, canopies and fixtures; elevators, escalators and stairs; park-and-ride facilities
	Support Facilities
SCC 30	Operations, maintenance, and storage facilities
	Sitework and Special Conditions
SCC 40	Demolition, clearing, and excavation; utilities and utility relocation; hazardous soil and water remediation; environmental mitigation; reconstruction of roadways, intersections and non-guideway structures; pedestrian and bicycle accommodations, sidewalks and trails; landscaping, fencing and lighting
	Systems
SCC 50	Train control signals; roadway grade crossing protection; traction power substations; overhead catenary system; communication systems; central control hardware and software; automated fare collection systems; roadway traffic signals
	Right-of-Way
SCC 60	Acquisition of right of way or easements for guideway, stations, and other facilities; relocation of existing households and businesses
	Vehicles
SCC 70	Light rail vehicles, BRT or standard buses, and non-revenue vehicles
	Professional Services
SCC 80	Preliminary engineering; final design; project management for design and construction; construction administration and management; insurance; legal, permits review fees; surveys, testing, investigation, inspection; agency force account work

TABLE 2
FTA SCC Capital Cost Estimate Organization

Standard Cost Categories (SCC)	Description
SCC 90	Unallocated Contingency Overall project contingency and reserves
SCC 100	Finance Changes Estimated expenses for local financing of project activities prior to Federal funding commitment

Source: Federal Transit Administration, 2011.

The level of detail of the capital cost estimates for this study corresponds with the current level of Gateway Corridor alternatives definition, engineering, and environmental analyses. The level of estimating detail typically increases as the project progresses through the various phases of development during the AA study, Environmental Impact studies, Preliminary Engineering, and eventually into Final Design.

As the level of design detail increases, more and more items are specifically costed, leading to lower contingency costs in the estimate. Ideally, such project design and cost estimating maturization will not materially change the overall total capital cost estimate, but will make the estimate more specific in nature.

The Gateway Corridor AA capital cost estimates were developed using a segmented and a tiered approach. Each of the alternatives was divided into geographic segments, some of which were common to multiple alternatives. Within each geographic segment the estimates were separated into the individual SCC categories. Within each SCC category, multiple line items with corresponding quantities and unit prices were developed.

The methodology differs for corridor-wide capital cost elements such as vehicles and support facilities, and for “soft costs” such as professional services and unallocated contingencies. Cost estimates for those elements are identified and added after the individual segment estimates are combined for each full corridor alternative.

2. Assumptions

The capital cost estimates were based upon a number of important assumptions derived from various sources. These assumptions include capital cost parameters applied at certain steps during the process, unit prices for the various capital cost line items, and specific quantity, location, and design information taken from each of the alternatives.

2.1 Parameters

Capital cost parameters are necessary assumptions that are not related to the specific location or design features of the corridor or the alternatives under consideration. The Gateway Corridor AA capital cost estimates are based upon the following parameters:

- **Base Year** – Year 2012 is used as the base year for definition of the unit prices and development of the capital cost estimates.

- **Forecast Year** – Year 2018 is planned to be the first year of construction for a Gateway transitway. Year 2019 was used as the forecast year for projecting base year capital costs estimates. With an estimated 3 year construction period, 2019 is intended to represent the approximate midpoint of the capital cost expenditures.
- **Allocated Contingencies** – Allocated contingencies are associated with individual cost estimate categories that are intended to compensate for unforeseen items of work, quantity fluctuations, and variances in unit costs that develop as the project progresses through the various stages of design development. The level of allocated contingency applied to each cost category reflects the relative potential variability of those estimates. The allocated contingencies that were applied to the capital cost estimates are described in greater detail in Section 3.2.9.
- **Unallocated Contingency** – As described in Section 3.2.9, an unallocated contingency of 25% is included in the capital cost estimates. This contingency was applied to the total estimated capital cost for each alternative, and is in addition to any specific estimating contingencies included (allocated) to the various cost categories.
- **Escalation Factor** – An annual escalation factor of 3.5% was used to inflate capital cost estimates from the base year to the forecast year.
- **Annualization Factors** – Annualization factors were necessary to convert base year capital cost estimates into annualized capital costs, which were used in the calculation of cost effectiveness measures. The FTA-recommended annualization factors (based upon a 7% internal rate of return) were used for these estimates.

2.2 Unit Prices

Base year unit prices for the various capital cost elements were developed using several references and resources. Primary sources for unit price assumptions include:

- Central Corridor Preliminary Engineering, 2008
- Southwest Transitway Alternatives Analysis, 2006
- Northstar Corridor LRT Connection Final Design, 2006
- Bottineau Transitway Alternatives Analysis, 2010
- Cedar Avenue Transitway, Final Design, 2010
- FTA Capital Cost Database (2010 Version)

The unit price assumptions from these sources were reviewed to determine applicability to the Gateway Corridor AA alternatives and compatibility with the methodology and format being used. In all cases the unit prices were adjusted to Year 2019 dollars using the annual escalation factor.

2.2.1 SCC 10 – Guideway

The Guideway SCC (see Table 3) includes all of the civil and structural costs directly associated with construction of the guideway structures, roadbed, and pavement or track.

TABLE 3
SCC 10 - Guideway

SCC Line	Guideway & Track Elements (route miles)	Description
10.01	Guideway: At-grade exclusive right-of-way	--
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	--
10.03	Guideway: At-grade in mixed traffic	--
10.04	Guideway: Aerial structure	Includes foundation excavation; guideway structures including caissons, columns, bridges, viaducts, cross-overs, fly-overs.
10.05	Guideway: Built-up fill	Includes construction of earthen berms.
10.06	Guideway: Underground cut & cover	Includes excavation, retaining walls, backfill, underground guideway structure and finishes.
10.07	Guideway: Underground tunnel	Includes tunneling by means of a tunnel boring machine, drill blasting, mining, and immersed tube tunneling; tunnel structure and finishes.
10.08	Guideway: Retained cut or fill	Includes excavation, retaining walls, backfill, underground guideway structure and finishes.
10.09	Track: Direct fixation	Includes rails, connectors.
10.10	Track: Embedded	Includes rails, ties; ballast where applicable
10.11	Track: Ballasted	Includes rails, ties and ballast.
10.12	Track: Special (switches, turnouts)	Includes transitional curves.
10.13	Track: Vibration and noise dampening	Includes upcharge for vib/noise dampening to any track condition above.

Source: Federal Transit Administration, 2011.

2.2.2 SCC 20 – Stations

The Stations SCC (see Table 4) includes construction costs for station platforms, ramps, platform fixtures, canopies, and passenger amenities, along with costs for vertical circulation (elevators, escalators and stairs) to the platform, where necessary. It also includes estimated costs for park and ride stalls.

TABLE 4
SCC 20 - Stations

SCC Line	Stations, Stops, Terminals, Intermodal (number)	Description
20.01	At-grade station, stop, shelter, mall, terminal, platform	--
20.02	Aerial station, stop, shelter, mall, terminal, platform	Includes station structures including caissons, columns, platforms, superstructures, etc.

TABLE 4
SCC 20 - Stations

SCC Line	Stations, Stops, Terminals, Intermodal (number)	Description
20.03	Underground station, stop, shelter, mall, terminal, platform	Includes retaining walls, backfill, structure.
20.04	Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	--
20.05	Joint development	"Per FTA's Joint Development Guidance, 'Joint development is any income-producing activity with a transit nexus related to a real estate asset in which FTA has an interest. . .Joint development projects are commercial, residential, industrial, or mixed-use developments that are induced by or enhance the effectiveness of transit projects. . .'"
20.06	Automobile parking multi-story structure	Includes retaining walls, backfill, structure.
20.07	Elevators, escalators	--

Source: Federal Transit Administration, 2011.

2.2.3 SCC 30 – Support Facilities

The Support Facilities SCC (see Table 5) includes the capital cost of operations, maintenance, and storage facilities for the corridor.

TABLE 5
SCC 30 – Support Facilities

SCC Line	Support Facilities: Yards, Shops, Administration Buildings	Description
30.01	Administration Building: Office, sales, storage, revenue counting	--
30.02	Light Maintenance Facility	Includes service, inspection, and storage facilities and equipment.
30.03	Heavy Maintenance Facility	Includes heavy maintenance and overhaul facilities and equipment.
30.04	Storage or Maintenance of Way Building	--
30.05	Yard and Yard Track	Includes yard construction, guideway and track associated with yard.

Source: Federal Transit Administration, 2011.

2.2.4 SCC 40 – Sitework and Special Conditions

The Sitework and Special Conditions SCC (see Table 6) includes estimated costs for all other construction activities that were not accounted for in the Guideway, Stations, Support Facilities, or Systems categories.

TABLE 6
SCC 40 – Sitework and Special Conditions

SCC Line	Sitework & Special Conditions	Description
40.01	Demolition, Clearing, Earthwork	Includes project-wide clearing, demolition and fine grading.
40.02	Site Utilities, Utility Relocation	Includes all site utilities - storm, sewer, water, gas, electric.
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments	Includes underground storage tanks, fuel tanks, other hazardous materials and treatments, etc.
40.04	Environmental mitigation, e.g. wetlands, historic/archeological, parks	Includes other environmental mitigation not listed.
40.05	Site structures including retaining walls, sound walls	--
40.06	Pedestrian / bike access and accommodation, landscaping	Includes sidewalks, paths, plazas, landscape, site and station furniture, site lighting, signage, public artwork, bike facilities, permanent fencing.
40.07	Automobile, bus, van accessways including roads, parking lots	Includes all on-grade paving.
40.08	Temporary Facilities and other indirect costs during construction	--

Source: Federal Transit Administration, 2011.

2.2.5 SCC 50 – Systems

The Systems SCC (see Table 7) includes capital costs for many elements, including train control signals; communication systems; central control hardware and software; traction power substations; overhead catenary systems; underground ductbanks; automated fare collection; grade crossing protection; and roadway traffic signal systems.

TABLE 7
SCC 50 - Systems

SCC Line	Systems	Description
50.01	Train control and signals	--
50.02	Traffic signals and crossing protection	Includes signal prioritization at intersections.
50.03	Traction power supply: substations	--
50.04	Traction power distribution: catenary and third rail	--
50.05	Communications	Includes passenger information systems at stations and on vehicles (real time travel information; static maps and schedules). Includes equipment to allow communications among vehicles and with central control.
50.06	Fare collection system and equipment	Includes fare sales and swipe machines, fare counting equipment.
50.07	Central Control	--

Source: Federal Transit Administration, 2011.

2.2.6 SCC 60 – Right-of-Way

The Right-of-Way SCC (see Table 8) includes costs for acquisition of right-of-way needed for construction and operation of the project.

TABLE 8
SCC 60 – Right-of-Way

SCC Line	ROW, Land, Existing Improvements
60.01	Purchase or lease of real estate
60.02	Relocation of existing households and businesses (in Compliance with Uniform Relocation Act)

Source: Federal Transit Administration, 2011.

2.2.7 SCC 70 – Vehicles

The Vehicles SCC (see Table 9) includes costs for light rail vehicles, BRT buses, and standard buses. It also includes an allowance for other service vehicles to support operations and maintenance.

TABLE 9
SCC 70 - Vehicles

SCC Line	Vehicles (number)	Description
70.01	Light Rail	Includes light rail and streetcar rail using electric, diesel or other power supply.
70.02	Heavy Rail	--
70.03	Commuter Rail	Includes locomotives (diesel, electric, or other), trailer cars, self-propelled multiple units (EMU electric or DMU diesel, or other power supply).
70.04	Bus	Includes "rubber-tired" buses and trolleys including new, used, historic replica, articulated, using electric, diesel, dual-power, or other power supply.
70.05	Other	Includes Vans, Sedan/Station Wagon, Cable Car, People Mover, Monorail, Car/Inclined Railway, Ferry Boat, Transferred Vehicle
70.06	Non-revenue vehicles	--
70.07	Spare parts	--

Source: Federal Transit Administration, 2011.

2.2.8 SCC 80 – Professional Services

Cost estimates for the Professional Services SCC were generated by applying assumed rates to different categories of the estimate. Table 10 lists the professional services assumptions that were incorporated into the capital cost estimates.

TABLE 10
Professional Services Estimated Rates

SCC Line	Description	Construction	Right-of-Way	Vehicles
80.01	Preliminary Engineering	2%	-	-
80.02	Final Design	5%	2%	1%
80.03	Project Management for Design and Construction	2%	2%	2%
80.04	Construction Administration and Management	8%	1%	-
80.05	Professional Liability and other Non-Construction Insurance	4%	-	-
80.06	Legal; Permits; Review Fees by Other Agencies, Cities, etc.	1%	5%	-
80.07	Surveys, Testing, Investigation, Inspection	2%	10%	2%
80.08	Agency & RR Force Account Work	6%	10%	-
80.08	Start Up	3%		1%
	Total	33%	30%	7%

Source: Federal Transit Administration, CH2M Hill and SEH, 2011.

2.2.9 SCC 90 – Unallocated Contingencies

The capital cost estimates include two types of contingencies: allocated and unallocated. Allocated contingencies are associated with individual cost estimate categories. These are intended to compensate for unforeseen items of work, quantity fluctuations, and variances in unit costs that develop as the project progresses through the various stages of development. The level of contingency applied to each cost category reflects the relative potential variability of those costs. Table 11 lists the allocated contingencies by SCC category.

TABLE 11
Allocated Contingencies

SCC Category	Allocated Contingency
10: Guideway and Track Elements	20%
20: Stations	20%
30: Support Facilities	20%
40: Sitework and Special Conditions	20%
50: Systems	20%
60: Right-of-Way	100%
70: Vehicles	5%

Source: CH2M Hill and SEH, 2011.

Unallocated contingencies (SCC Category 90) are applied to the overall total capital cost estimate for each alternative. The estimates prepared for the Gateway Corridor AA include an unallocated contingency of 25%.

2.3 Basis of the Estimate

The Gateway Corridor AA capital cost estimates are based upon the alternatives as defined in the Detailed Definition of Alternatives Report. The report was accompanied by conceptual design

drawings for each alternative, which provide sufficient information to estimate quantities for the various capital cost elements.

This section identifies and describes many of the specific assumptions regarding the alternatives that were necessary to prepare the capital cost estimates. In conjunction with the Detailed Definition of Alternatives and the conceptual design drawings, these assumptions represent the basis of the capital cost estimates. Where necessary, this information was supplemented by analysis and results from other project tasks, including ridership forecasting, operations planning, and environmental assessment.

2.3.1 Enhanced Baseline Bus Alternative: Transportation System Management Alternative

By definition, the Transportation System Management (TSM) Alternative has limited capital costs. The specific components of the TSM capital cost estimate consist of additional buses and infrastructure costs at selected bus stop locations. The infrastructure costs are dependent on the detailed definition of the TSM Alternative, but likely will include construction of conventional bus stops with shelters, and park-and-ride facilities at certain locations.

2.3.2 LRT, BRT, BRT Managed Lane, and Commuter Rail Alternatives

The detailed definition and conceptual design of each BRT, LRT, and commuter rail alternative were evaluated, quantified, and summarized in terms of the various unit cost elements required for the capital cost estimate.

2.3.2.1 Guideway

The principal guideway components of each individual alternative are represented by a limited number of typical cross sections along the entire route. In addition to typical section costs, assumptions about significant guideway structures (bridges, tunnels, retaining walls) are identified and quantified for each alternative.

2.3.2.2 Stations

The station elements of each alternative were defined and quantified for each individual BRT or LRT station, and include typical platforms and amenities, vertical circulation for grade separated stations, feeder bus drop-off and layover facilities, pedestrian and bicycle access elements, and assumed quantities for surface or structured park-and-ride stalls. Typical platform sizes for BRT and LRT stations were dictated by the assumed operating plan for each alternative.

2.3.2.3 Support Facilities

For the Gateway Corridor LRT alternatives, it was assumed that excess capacity would not be available at the existing Hiawatha operations and maintenance center or at the proposed Central Corridor maintenance facility. During this AA study potential sites for a Gateway Corridor LRT operations and maintenance were investigated and included in the capital cost estimates.

The requirements for BRT support facilities are dependent on the type of vehicle, the size of the fleet, and the maintenance needs of the system. The BRT alternatives were assumed to utilize low-floor hybrid diesel-electric buses. It is currently unclear whether an entirely new facility would be needed to support a Gateway Corridor BRT line or whether existing Metro Transit facilities could be modified and expanded to meet the need.

The requirements for a Commuter Rail maintenance facility are dependent on the train type and the assumed operations plan. The Commuter Rail alternative is assumed to utilize

diesel-hauled rail cars in a push-pull configuration. It is assumed that the maintenance facility would be located near the western end of the corridor and that an end-of-line storage yard/light repair facility would be required in Eau Claire. The assumed requirements and locations for support facilities are identified in the detailed definition of alternatives, the conceptual design, and the operating plan.

2.3.2.4 Sitework and Special Conditions

Assumed quantities for the various items in this category were determined from the conceptual design of each alternative. In cases where the unit cost allowances were classified by degree of potential impact or mitigation, the designation was made with guidance from the project environmental planners.

2.3.2.5 Systems

The systems elements assumed for the BRT alternatives were based upon a high-amenity BRT concept that has characteristics similar to LRT. Both BRT and LRT elements include passenger communication systems and automated fare collection systems at each station, a communication backbone, and allowances for some type of central control and monitoring system. New traffic signal systems were assumed for to be necessary every intersection along the guideway.

In addition, the LRT alternatives include quantities for typical grade crossings and substations, and allowances for systems ductbanks, train control signals, overhead catenary systems, and corrosion control requirements. LRT systems components include traction power supply and distribution and the standard signals and communication systems as are typically installed for the LRT operating in Minneapolis/St. Paul. Commuter rail systems components include upgrade of the existing freight railroad signal system to allow those signal systems to safely dispatch and control the combined freight and commuter rail operations in the corridor.

2.3.2.6 Right-of-Way

The right-of-way requirements were derived from the detailed definition and conceptual design of each alternative. For continuous guideway right-of-way, the quantities were estimated by the route length. Right-of-way needs for stations, park-and-ride facilities, substations, and support facilities were quantified by typical requirements for each element. In all cases the right-of-way quantities were further classified by assumed land use characteristics or ownership. In addition, the capital cost estimates were quantified and classified locations where specific relocations were identified by the conceptual design.

2.3.2.7 Vehicles

The vehicle requirements for BRT and LRT service were specified in the operating plans for the various alternatives. The mainline BRT vehicles were assumed to be low-floor hybrid diesel-electric buses, and the LRT vehicles were assumed to be consistent with current Hiawatha and Central Corridor LRVs. In both cases the assumed quantity of additional standard buses was taken from the operating plan. The quantities for all buses and LRVs were adjusted to reflect a spare ratio of not less than 15 percent. The basis of the non-revenue vehicle allowance for each alternative is the total route length.

3. Results

Using the methodology presented above, capital cost estimates were developed for each of the Gateway build alternatives. The estimates are summarized below and presented in greater detail in Table 12.

Alternative 2 – TSM: Year 2012 = \$48.6 million; Year 2019 = \$61.8 million

Alternative 3 – BRT Hudson Rd: Year 2012 = \$328.1 million; Year 2019 = \$417.4 million

Alternative 4 – BRT 7th St/White Bear Ave/Hudson Rd: Year 2012 = \$385.5 million; Year 2019 = \$490.5 million

Alternative 5 – LRT Hudson Rd: Year 2012 = \$769.3 million; Year 2019 = \$978.8 million

Alternative 6 – LRT 7th St/White Bear Ave/Hudson Rd: Year 2012 = \$1.01 billion; Year 2019 = \$1.28 billion

Alternative 7 – Commuter Rail: Year 2012 = \$964.7 million; Year 2019 = \$1.23 billion

Alternative 8 – BRT Managed Lane: Year 2012 = \$461.3 million; \$586.9 million

TABLE 12
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Segment 1 (Interchange to Union Depot)						12.1 miles	
10 GUIDEWAY & TRACK ELEMENTS						\$88,619,664	
20 STATIONS, STOPS, TERMINALS						\$3,061,133	
40 SITEWORK & SPECIAL CONDITIONS						\$54,049,762	
50 SYSTEMS						\$18,367,800	
60 ROW, LAND, EXISTING IMPROVEMENTS						\$15,968,552	
<i>Segment Cost</i>	\$0	\$0	\$0	\$0	\$0	\$180,066,911	\$0
<i>Professional Services and Unallocated Contingency</i>	\$0	\$0	\$0	\$0	\$0	\$103,959,752	\$0
<i>Segment Subtotal</i>	\$0	\$0	\$0	\$0	\$0	\$284,026,663	\$0
Segment 2 (Union Depot to east of Manning Ave)		11.5 miles	13.3 miles	11.5 miles	13.3 miles	13.4 miles	11.2 miles
10 GUIDEWAY & TRACK ELEMENTS		\$79,460,928	\$77,442,792	\$97,329,660	\$112,000,504	\$70,005,865	\$21,998,592
20 STATIONS, STOPS, TERMINALS		\$39,300,000	\$27,144,000	\$35,340,000	\$40,680,000	\$9,183,399	\$49,680,000
40 SITEWORK & SPECIAL CONDITIONS	\$625,842	\$35,710,778	\$41,874,241	\$57,868,757	\$64,129,950	\$4,329,888	\$166,280,763
50 SYSTEMS	\$1,057,500	\$4,620,000	\$10,350,000	\$104,848,181	\$130,074,909	\$22,077,240	\$2,115,000
60 ROW, LAND, EXISTING IMPROVEMENTS		\$9,672,116	\$47,051,300	\$14,109,740	\$55,181,998	\$742,768	\$7,478,904
<i>Segment Cost</i>	\$1,683,342	\$168,763,822	\$203,862,333	\$309,496,338	\$402,067,361	\$106,339,160	\$247,553,259
<i>Professional Services and Unallocated Contingency</i>	\$976,338	\$97,592,853	\$116,828,614	\$179,084,585	\$231,543,609	\$61,654,429	\$143,356,525
<i>Segment Subtotal</i>	\$2,659,680	\$266,356,675	\$320,690,947	\$488,580,923	\$633,610,970	\$167,993,589	\$390,909,784

TABLE 12
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Segment 3 (Manning Avenue to east of Hudson)						9.6 miles	3.2 miles
10 GUIDEWAY & TRACK ELEMENTS						\$11,865,786	\$9,225,216
20 STATIONS, STOPS, TERMINALS						\$3,061,133	
40 SITEWORK & SPECIAL CONDITIONS	\$12,506,667	\$12,506,667	\$12,506,667	\$12,506,667	\$12,506,667	\$2,566,504	\$9,905,247
50 SYSTEMS	\$352,500	\$352,500	\$352,500	\$352,500	\$352,500	\$15,566,868	\$352,500
60 ROW, LAND, EXISTING IMPROVEMENTS	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$20,600	\$2,600,000
<i>Segment Cost</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$15,459,167</i>	<i>\$33,080,891</i>	<i>\$22,082,963</i>
<i>Professional Services and Unallocated Contingency</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$8,888,317</i>	<i>\$19,186,299</i>	<i>\$12,730,119</i>
<i>Segment Subtotal</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$24,347,484</i>	<i>\$52,267,190</i>	<i>\$34,813,082</i>
Segment 4 (Hudson to Eau Claire)						64.6 miles	
10 GUIDEWAY & TRACK ELEMENTS						\$81,009,860	
20 STATIONS, STOPS, TERMINALS						\$9,183,399	
40 SITEWORK & SPECIAL CONDITIONS	\$4,560,869	\$4,560,869	\$4,560,869	\$4,560,869	\$4,560,869	\$7,504,764	\$4,560,869
50 SYSTEMS	\$1,057,500	\$1,057,500	\$1,057,500	\$1,057,500	\$1,057,500	\$103,034,868	\$1,057,500
60 ROW, LAND, EXISTING IMPROVEMENTS	\$1,353,000	\$1,353,000	\$1,353,000	\$1,353,000	\$1,353,000	\$3,868,080	\$1,353,000
<i>Segment Cost</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$6,971,369</i>	<i>\$204,600,971</i>	<i>\$6,971,369</i>
<i>Professional Services and Unallocated Contingency</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$4,002,805</i>	<i>\$118,552,521</i>	<i>\$4,002,805</i>
<i>Segment Subtotal</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$10,974,174</i>	<i>\$323,153,492</i>	<i>\$10,974,174</i>
	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8

TABLE 12
Cost Estimate Summary

	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Maintenance Facility and Vehicles							
30 SUPPORT FACILITIES		\$1,551,000	\$1,551,000	\$56,907,600	\$56,907,600	\$30,451,680	\$0
70 VEHICLES	\$8,032,500	\$18,165,000	\$20,475,000	\$117,810,000	\$186,900,000	\$67,548,600	\$18,637,500
	\$8,032,500	\$19,716,000	\$22,026,000	\$174,717,600	\$243,807,600	\$98,000,280	\$18,637,500
<i>Professional Services and Unallocated Contingency</i>	\$2,570,400	\$6,712,380	\$7,451,580	\$70,705,608	\$92,814,408	\$39,277,527	\$5,964,000
<i>Segment Subtotal</i>	\$10,602,900	\$26,428,380	\$29,477,580	\$245,423,208	\$336,622,008	\$137,277,807	\$24,601,500
Alternative Totals							
	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Total 2012	\$48,584,238	\$328,106,713	\$385,490,185	\$769,325,788	\$1,005,554,637	\$964,718,742	\$461,298,540
Total 2019	\$61,812,721	\$417,443,369	\$490,451,170	\$978,797,249	\$1,279,346,315	\$1,227,391,653	\$586,900,569