

BUILDING THE MONORAIL
ETC SEATTLE POPULAR MONORAIL PLAN

AUGUST 5, 2002

ETC Seattle Popular Monorail Plan

P r e p a r e d i n r e s p o n s e t o

Seattle Citizens Initiative 53

Approved by Voters November 7, 2000

Elevated Transportation Company

A Public Development Authority

ETC Board

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August 5, 2002

Dear Friend:

Being stuck in traffic doesn't have to be a way of life.

By approving citizens Initiative 53, Seattle voters asked for an alternative to traffic congestion through a new, expanded monorail system that would speed travelers up and over the cars below. The Elevated Transportation Company was asked to plan the new monorail and develop a proposal to build it.

This document, the ETC Seattle Popular Monorail Plan, is our response. In it, we call for the creation of a 5-line, 58-mile citywide monorail system, and present a detailed proposal for the first line to be built, the 14-mile Green Line from Ballard and West Seattle to Downtown. The Plan includes a proposed route for the Green Line as well as cost, revenue, and ridership estimates, together with a proposal to fund Green Line construction and start-up.

As we present this Plan today, we do so with great enthusiasm for the promise of monorail transportation in 21st century Seattle. A monorail system will give us a fast, elevated alternative to traffic congestion, and seamless mobility between Downtown and the neighborhoods. It will be safe, separated from cars and pedestrians. And it will be good for the environment, with its non-polluting electric cars running quietly along the guideway beams.

Our work has undergone extensive public review and comment as well as rigorous technical analysis from independent experts. The Plan has been refined and strengthened over the months and we are confident that it not only proposes a viable and efficient transit system, but also includes a budget that is adequate to the task of completing the Green Line and making preparations for future monorail lines.

To all those who have contributed to this effort with your ideas, comments, and suggestions, we offer you our thanks. Two years ago, through Initiative 53, you asked for a new Seattle monorail. Today, in response, we present this ETC Seattle Popular Monorail Plan for your consideration.

Sincerely,

**Tom Weeks
Board Chair**

Harolynne Bobis

Kristina Hill

Cindi Azevedo Laws

Dick Falkenbury

Donald King

Craig Norsen

Marie L. Groark

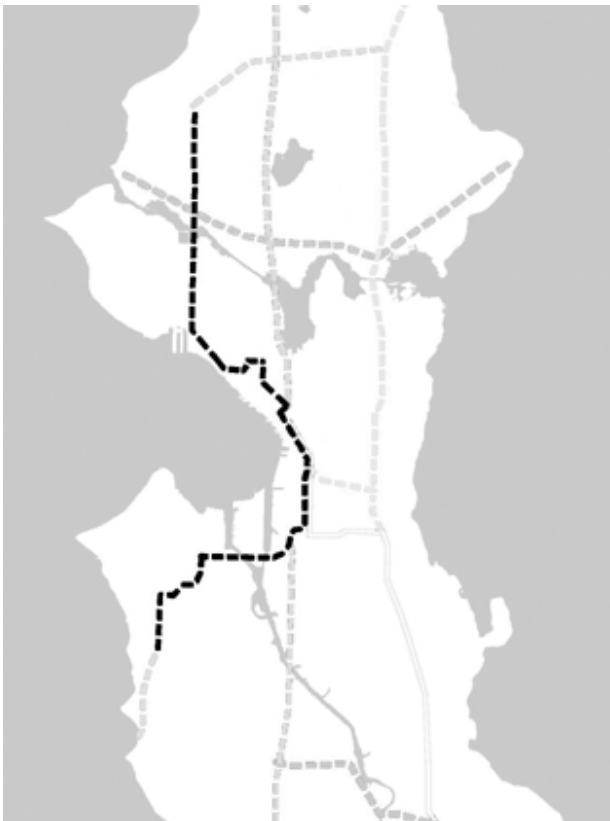
Jeanne Kohl-Welles

Stuart Rolfe

PLAN SUMMARY

This plan, **Building the Monorail: ETC Seattle Popular Monorail Plan,¹** is presented as the Elevated Transportation Company's response to Initiative 53. For purposes of legislation implementing state enabling legislation, this plan shall be considered the ETC Plan. It proposes creating a 58-mile, 5-line citywide monorail system. The Green Line, the first monorail line to be built, would stretch 14 miles from Ballard and West Seattle to Downtown, Seattle Center, and the stadiums.

The Elevated Transportation Company (ETC) believes that monorail technology – and particularly the system contemplated by this Plan – can offer fast, safe, and reliable transportation elevated above traffic congestion.



CITYWIDE MONORAIL PLAN.

The ETC proposes a citywide monorail plan with five corridors that would eventually crisscross the city. Three of the lines would run north/south; two would run east/west. This citywide monorail system would link people in neighborhoods throughout Seattle with each other and with Downtown. The corridors through which the monorail would travel were identified by studying where people live, work, shop, and play, as well as by talking with citizens and examining existing transportation systems and adopted neighborhood plans.

GREEN LINE ROUTE.

For “Phase I”² of the citywide monorail system, the ETC has identified a 14-mile line starting in Ballard and West Seattle and connecting with Key Arena, Seattle Center, Belltown, Downtown, Pike Place Market, King Street Station, Safeco Field, and the Seahawks Stadium. This first route, called the Green Line, was identified based on the language of Initiative 53, which called for a monorail system that would link neighborhoods and Downtown,

and after considering analysis from the City of Seattle and suggestions from hundreds of people at community meetings. The route is described in the Green Line Route section of this Plan.

RIDERSHIP.

The ETC estimates that the Green Line would have approximately 20.4 million passenger boardings each year by 2020, or about 69,000 each weekday. Passengers on the Green Line would include weekday riders, who would take the Green Line to work, school, or shop; event riders, who would use the Green Line to

travel to Seattle Center, Key Arena, Safeco Field, or the Seahawks Stadium; and tourists, who would find the Green Line a convenient way to travel and sightsee around Seattle.

MONORAIL TECHNOLOGY.

Because monorails are now being built and operated successfully all over the world, many different monorail technologies exist to choose from. After extensive study, the ETC selected “traditional” monorail technology. This technology was chosen because it has a proven track record, can travel at speeds over 50 miles per hour, and can be configured to easily accommodate 3,000-plus passengers per hour per direction when trains are traveling at four-minute frequency. There are a number of competitive suppliers for this type of monorail technology.



1962 Monorail.

BUILDING AND OPERATING THE MONORAIL.

Green Line monorail trains would run on concrete or steel beams, which they would straddle and grip with their tires. These beams would be supported by columns, which could be as small as 36" in diameter and would typically range in height from 22 to 40 feet, with greater height where needed.

The Green Line would have up to 19 stations plus up to six additional locations where stations could possibly be added in the future if the Seattle Popular Monorail Authority determines that ridership or other factors merit their development. The stations would be designed with accessibility, attractiveness, ease of use, and safety in mind. Once the Green Line is built and open, it should operate at least 19 hours a day, 365 days a year. Trains should run about every 4 to 6 minutes during peak times and about every 8 to 10 minutes at other times. The trains would be automated to run without drivers. The system would have station attendants and security staff.

The Green Line and the other lines on the citywide monorail system would be owned and operated by the Seattle Popular Monorail Authority (SPMA), an independent city transportation authority, which would be accountable to the people of Seattle. The Seattle Popular Monorail Authority would be governed by nine Board members, seven of whom would be appointed and two of whom would be elected. The Seattle Popular Monorail Authority would have a number of special accountability provisions, including a requirement that each future phase of the citywide monorail system be submitted to voters for their approval. Between 2005 and 2009, a ballot measure would be put forward to ask voters whether a majority of the SPMA Board should be elected.

COSTS, REVENUES AND FINANCING.

The ETC has been carefully analyzing the costs to build and operate the monorail's Green Line, as well as the revenue that would come from fares, advertising and other sources. Based on this analysis, the ETC estimates that project costs to build the Green Line would be \$1.29 billion (in year 2002 dollars) and that all project capital costs - including project costs plus financing costs, agency costs, project reserves, a construction escalator to account for construction over time, and a planning allowance - would total \$1.749 billion (in year of expenditure dollars).

The ETC has proposed that Phase I of the monorail system be funded by a 1.4% Motor Vehicle Excise Tax (MVET). The MVET would annually cost car owners in the city of Seattle 1.4% of the value of their vehicle, as determined by the State Department of Licensing. For example, the owner of a median-value car (at \$6,700, the value at which half the cars in Seattle are worth less and half are worth more) would pay \$94 a year. The owner of a \$10,000 car would pay \$140 a year. And the owner of a \$15,000 car would pay \$210 a year. Because the MVET can be deducted from Federal income tax, the after-tax cost would be less for those who itemize deductions for their taxes.

The MVET was recommended to fund the monorail because cars have contributed to Seattle’s traffic congestion problem and therefore should be part of the solution. In addition, the MVET is a progressive tax, costing more for people who own more expensive cars, and is environmentally progressive, providing an incentive for people to own fewer cars.

NEXT STEPS.

This ETC Seattle Popular Monorail Plan presents a proposal that has been shaped and strengthened through extensive community outreach and rigorous technical review. It will now be placed on the ballot for voters to consider. If the ballot measure is approved, the Elevated Transportation Company would be dissolved and replaced by the Seattle Popular Monorail Authority, which would implement this Plan by building and operating the Green Line and planning for additional monorail lines.



Monorail guideway in Kuala Lumpur, Malaysia.

¹ *This plan has also been called the “ETC plan” and the “Seattle popular transit plan.”*

² *This term is defined below in the Citywide Plan section of this Plan.*

WHY MONORAIL?

This Plan, Building the Monorail: ETC Seattle Popular Monorail Plan, is presented as the Elevated Transportation Company's response to Initiative 53. It proposes to create a 58-mile, 5-line citywide monorail system. The Green Line, the first monorail line to be built, would stretch 14 miles from Ballard and West Seattle to Downtown.

MONORAIL IN SEATTLE

Seattle has had a love affair with its monorail for forty years. But could a full-scale monorail system be a viable transit option in 21st century Seattle? Would the benefits of building a monorail that allows tens of thousands of people to travel around the city above the traffic, every day, be worth the cost, the construction hassles, and the view blockages along the streets where the monorail guideway would run? When people vote on the proposal to build a monorail, they will answer that question for themselves. This plan provides information to help people weigh that decision.

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As part of its planning process, the ETC conducted an extensive public outreach effort. Many of the citizens who participated in that process noted that a monorail system could be particularly well suited to Seattle's unique conditions:

ACCESS AND MOBILITY DESPITE WORSENING CONGESTION.

Seattle's traffic congestion is bad, and studies project even worse traffic in the years ahead. But monorails don't get stuck in traffic. Ridership forecasts show that tens of thousands of people would use the Green Line monorail every day, including people going to work, to school, to shop, or to meet a friend at

Seattle Center or Downtown. Green Line riders would be able to travel quickly regardless of the level of traffic congestion below.

AN EASY TRIP TO DOWNTOWN. Downtown is an exciting place to be for both Seattleites and tourists, with the Market, great shopping, theatres, museums, the Symphony, and restaurants. But getting to and around Downtown by car during rush hour, on game days, or during special events can be difficult. A monorail that links Downtown with the neighborhoods could make traveling Downtown to eat dinner, go shopping, or see a show convenient and easy. And since the monorail would operate most hours of the day and night with frequent service, it would be easy to ride the monorail Downtown nearly any time of day.

LESS TRAFFIC AT THE BALL GAME. Mariners, Sonics, Storm, Sounders, and Seahawks games are exciting and popular. But they also involve traffic problems, both for those heading to or from the games and for residents and workers near the stadiums or Key Arena. Initial studies show that thousands of people would use the Green Line to go to Safeco Field, Key Arena, and the Seahawks stadium. Monorail would make their trip to the game less time consuming and less of a hassle, and would take their cars off the road.

THE MONORAIL INITIATIVES

The monorail idea has been alive in Seattle for nearly a century. In 1910, as Model Ts clogged downtown streets, the Universal Elevated Railway Company approached City leaders and tried to convince them to invest in a monorail system that would elevate travelers above the busy streets below. The City decided to invest in a ground-level trolley system instead, but the seeds of interest in a monorail had been planted and would be nurtured by Seattle visionaries for the next 50 years.



Seattle's new monorail made national headlines in 1962.

In 1962, Seattle finally built its monorail, the first full-scale monorail system in the country, in time for the Seattle 'Century 21' World's Fair. The 1.2-mile monorail, which was built in just 10 months for a cost of \$3.5 million, was designed to whisk fair-goers between downtown and Seattle Center, thus avoiding parking and traffic problems at the Center. The monorail proved an instant hit. It carried nearly 8 million riders in its first six months and earned back its construction costs in just five months. Residents and visitors alike lined up to ride the sleek, futuristic trains, thrilling at the expansive views of downtown and the mountains as they raced above the streets.

Today, 2.5 million passengers a year ride the monorail's original two train cars from Westlake Center through the Experience Music Project to Seattle Center and back. Owned by the City of Seattle and operated by a locally owned, private company, it remains one of the only publicly owned transit systems in the U.S. to operate at a profit.

INITIATIVE 41.

As Seattle's traffic became progressively worse during the 1990s, it was perhaps inevitable that people would again begin to think of monorail as a solution. In 1997, activists and volunteers launched Initiative 41, which proposed an X-shaped, 40-mile monorail system that would stretch across the city.

Initiative 41 was approved by 53% of Seattle voters in November 1997, and the Elevated Transportation Company (ETC) was created to begin planning an expanded monorail system.

INITIATIVE 53.

In summer 2000, however, the Seattle City Council repealed Initiative 41 and disbanded the ETC. In response, citizen activists and volunteers formed an organization called Rise Above it All, and led a signature drive for a second monorail initiative, Initiative 53.

Initiative 53, which was approved by 56% of Seattle voters in November 2000, reinstated the ETC and gave it two years and \$6 million to create a plan to build a monorail. The initiative provided a number of directives for that planning work. It required that the monorail system be:

- **Elevated**, up and out of traffic;
- **Quiet**, using rubber tires or technology as quiet as rubber;

- **A link** between Seattle's neighborhoods and downtown;
- **Compatible** with other forms of transportation; and
- **Extendable**, through and beyond Seattle's city limits.



Seattle's monorail travels through downtown.

Initiative 53 directed the ETC to develop a plan outlining the following features for the proposed monorail system:

- A route and stations;
- The estimated cost to build the system and operate the monorail;
- A financing plan to pay for the cost to build and operate the monorail;
- A new authority to build and operate the monorail; and
- The type of monorail technology to be used.

Initiative 53 also required the ETC to finish this plan within two years, and return it to the voters for a decision on whether to fund it.

WHY MONORAIL?

As uniquely Seattle as the monorail may be, monorail is no longer unique to Seattle. Cities all over the world — including Las Vegas, Miami, Kuala Lumpur, Sydney, and Tokyo — have turned to monorail to help people move around town quickly and safely. Their systems, like Seattle's, offer riders and residents alike a number of advantages:

SPEED.

Because monorail guideways are elevated above traffic, monorail is one of the fastest forms of public transit available. Monorail trains can travel at speeds in excess of 50 miles per hour, and average 25 to 30 miles per hour along a route when stops are factored in. Because monorail systems ride above congestion, trains do not need to wait for traffic, pedestrians, or traffic lights.

RELIABILITY.

Monorails in Japan and in other cities around the world operate at greater than 99% reliability. In Seattle, the Seattle Center monorail's two original train cars are still operating, 40 years after they were first put in service. Both are being renovated in 2002, for the first time since they began running in 1962.

SAFETY.

Because monorails travel above city streets, they cannot collide with cars, trucks, trains, or pedestrians. And because they straddle their guideway beams, they cannot derail. Monorails have operated for years in cities around the world with few accidents. The Tokyo Haneda line, for instance, has carried more than one billion passengers without a single fatality. Monorail beams and support columns are designed to be stable even in an earthquake. The monorail in Osaka, Japan not only withstood the 1995 earthquake in nearby Kobe but became an even more vital transportation link as traffic on the damaged roads below slowed.

ENVIRONMENTAL SUSTAINABILITY.

Monorails' electric motors don't pollute. Their motors and their rubber tires are relatively quiet. And guideway support columns are narrow enough to cause minimal disruption to surrounding land uses. The support columns for the current Seattle monorail are 48" square and are spaced approximately 80 feet apart. Technology currently exists to make columns narrower and to increase the distance between columns to up to 120 feet apart or even longer where required. Because of these factors, monorail trains can be



Seattle monorail leaving Seattle Center.

routed through buildings, shopping centers, or environmentally sensitive areas. Both Sydney and Broadbeach, Australia, for instance, have taken advantage of monorail technology by locating stations inside downtown shopping centers.

QUICK CONSTRUCTION.

The Seattle Center monorail's guideway structure was built in just ten months, and its stations were built in eight months. Fifth Avenue remained open throughout construction. Because guideway components can be prefabricated elsewhere and then brought to the site to be assembled, monorail construction can be relatively quick and simple, with only modest adverse impacts on surrounding residents and businesses.

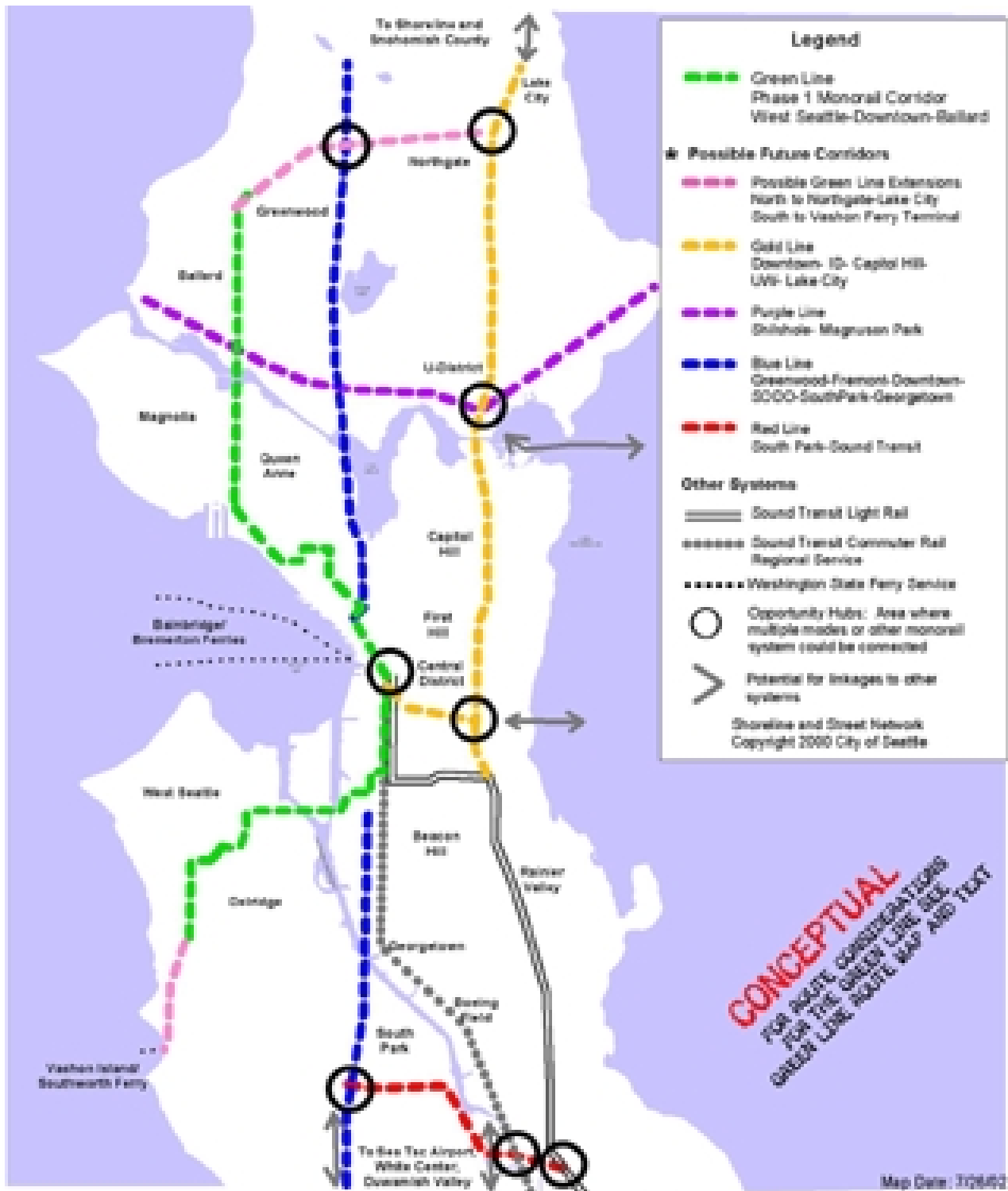
COST-EFFECTIVE CONSTRUCTION AND OPERATION.

Monorails can be constructed for less than the cost of tunneling underground. The Green Line would follow Initiative 53's directive to run primarily within existing rights-of-way, thus minimizing the need for expensive property acquisition. The trains would be automated to run without drivers, helping operation to be very cost-effective. Both Seattle's existing monorail and monorails in Japan are operated by private businesses that make a profit each year.

POPULARITY.

As the Seattle Center monorail demonstrates every day, people love to ride the monorail. Monorail offers passengers sky-level views and safe, speedy travel.

CITYWIDE MONORAIL PLAN



1 0 1 2 3 Miles



* Footnote: The specific location of future corridors and lines identified in the Plan is conceptual only, and may change over time as a result of future studies, public input, environmental review, and decision-making.



Citywide Map

CITYWIDE MONORAIL PLAN

Forty years ago, Seattle's leaders had big plans for the monorail. In the midst of a World's Fair dedicated to science and the future, they had created – in less than a year – a transportation system that seemed as if it had come straight from the 21st century. As excited fair-goers thronged to ride the space age train, plans were already being made to extend the new monorail to the airport and even beyond.



1962 monorail passengers enjoy sky-high views of Downtown Seattle.

Today, the monorail is a fond part of our heritage, its space age origins now a part of the past. But it is still outpacing the traffic it was designed to beat, moving, perhaps, even faster now in relation to the cars below than it did during the World's Fair. And its long service has won it a new chance to realize in the 21st century the potential it brought to the 20th.

With this **ETC Seattle Popular Monorail Plan**, the Elevated Transportation Company builds on the monorail's legacy in Seattle by proposing a new **citywide monorail system serving five corridors** that would eventually cover the city. Three of the corridors would stretch north/south, and two would stretch east/west, linking people in neighborhoods throughout

Seattle with each other and with Downtown.

WHERE WOULD THE MONORAIL GO?

Initiative 53 called for a citywide monorail system that would link Seattle's neighborhoods and Downtown. As the ETC began planning the new monorail, it identified corridors that would be close to where people live, work, shop and play:

CLOSE TO JOBS AND HOMES. The ETC studied existing population and employment, and analyzed neighborhood plans and zoning to identify neighborhoods that are expecting growth.

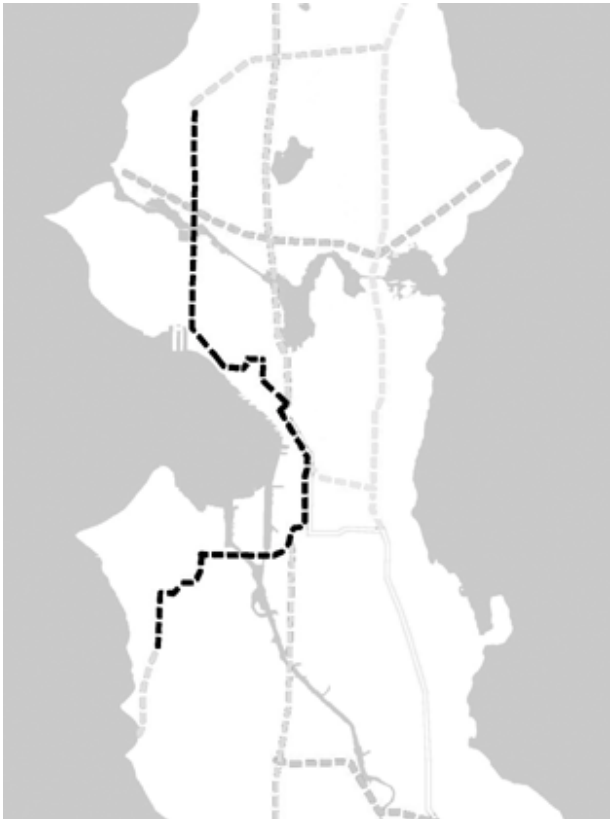
COMPLEMENTING CITYWIDE TRANSIT POLICY AND INFRASTRUCTURE. The ETC mapped transit lines through the city and then identified hubs, or easy transfer points, where monorail could be particularly useful in helping passengers move from one mode of transportation to another.

CONNECTING NEIGHBORHOODS WITH REGIONAL AND CIVIC VENUES. Monorail planning also focused on connecting with as many of Seattle's major venues as possible, including the stadiums, Pike Place Market, and Seattle Center.

MINIMIZING TECHNICAL CONSTRAINTS. Potential monorail corridors were studied for problems – such as steep slopes, minimal street right-of-way, or unstable soils – that might make building a monorail more difficult or more expensive.

CITYWIDE MONORAIL PLAN

Using these concepts, and building on the work of the Seattle Transportation Initiative's Intermediate Capacity Transit Study – that evaluated potential corridors that might be served by streetcars, bus rapid transit, or monorail – the ETC identified five corridors through Seattle that could be well served by a monorail. The ETC also identified one of these corridors, the Green Line, as the first monorail line to be developed and has identified a route for that line.



The term “corridor” in this Plan is meant to reflect the general idea of connecting major activity points or destinations at a conceptual level, but does not identify the specific route a monorail line might follow between those points. Four of the five corridors identified by the ETC and described in this section of the Plan are described at the “corridor” or conceptual level.

The term “route” refers to the actual street (or other physical feature) down which a monorail line would run. The ETC has proposed a route for the Green Line, the first monorail line to be built. This route is described in the Green Line Route section of this Plan on pages 16 through 24.

“Phase I” of the citywide monorail plan refers to the planning, financing (including without limitation costs of issuance), construction, acquisition, completion, operation, charging for, and maintenance of the Green Line, as well as the Seattle Popular Monorail Authority's overhead and operations, operation and maintenance of other Seattle Popular Monorail Authority facilities, equipment, and systems, and planning for later phases of the citywide monorail system.

This Plan's central objective is to build the citywide monorail system described here, starting with the Green Line. To do that successfully, however, the Seattle Popular Monorail Authority should not be so limited by this Plan that it could not adequately respond to facts or circumstances that require some adjustments. For these reasons, notwithstanding other parts of this Plan (except the following paragraph), the Seattle Popular Monorail Authority will determine the particular specifications of the Plan (including Phase I) and will have enough flexibility to adopt, modify, and implement the Plan that it can fulfill the purposes of the state legislation that authorizes its creation. This flexibility may mean that the Seattle Popular Monorail Authority could decide that it has become impractical to implement all or any portion of the system proposed by the Plan, because of environmental, engineering, or legal conditions or constraints, changed conditions, or costs in excess of the amount of tax levies estimated to be available, and that the system (or some portion of it) thus should not be completed or operated.

However, the Plan's provisions describing where the Green Line route is to be sited, in the Green Line Route section of this Plan on pages 16 through 24, will not be changed without the approval of the City's voters.

The Seattle Popular Monorail Authority would strive to propose additional phases of the citywide monorail system for possible construction in the future. If the SPMA Board decides to proceed with any additional phases, then proposals to raise the funds to pay for them must be submitted to Seattle voters. The Green Line would be designed to allow for connections to additional monorail lines.

Three of the corridors identified by the ETC as part of the citywide monorail plan stretch north/south; two stretch east/west. (The ETC also studied an alternative citywide plan that would have two north/south corridors and two east/west corridors, but did not pursue this alternative because it would offer less north/south monorail service.)

GREEN LINE: West Seattle – Downtown – Ballard. This corridor would extend from Ballard and West Seattle to Downtown. A route along this corridor, the Green Line, would be developed first, as Phase I of the citywide monorail system. A route for the Green Line is described in detail in the next section. The Green Line could eventually be extended from Ballard to the Northgate Transit Center and Lake City to the North; and from West Seattle to the Fauntleroy Ferry Terminal to the South.

The corridor descriptions below are meant to be conceptual only. These corridors may change as actual monorail route alternatives are developed to reflect public comment and environmental and engineering considerations.

GOLD LINE: Downtown – International District – Capitol Hill – University of Washington – Lake City. This corridor could connect Downtown, the International District, and the University District along the East side of Capitol Hill. Connection hubs to transit service across Lake Washington to Bellevue and Kirkland via SR-520 or future ferry service could be provided. This corridor could connect to Lake City, allowing for linkages to out-of-city systems to the northeast.

PURPLE LINE: Shilshole Marina – Magnuson Park. This corridor could provide a North Seattle east/west route linking Ballard, Fremont, Wallingford, the University District, and Sand Point. It could link to north/south corridors along the way, and provide connections between recreational venues, employment centers, the University of Washington, medical services, and neighborhoods.

BLUE LINE: Northgate – Greenwood – Downtown – SODO – South Park – Georgetown. This corridor could serve Fremont, Phinney Ridge, and Greenwood, with a connection to Northgate. It could connect through Downtown to SODO, South Park, and Georgetown. This corridor could provide future links to the Seattle-Tacoma International Airport and other destinations to the South.

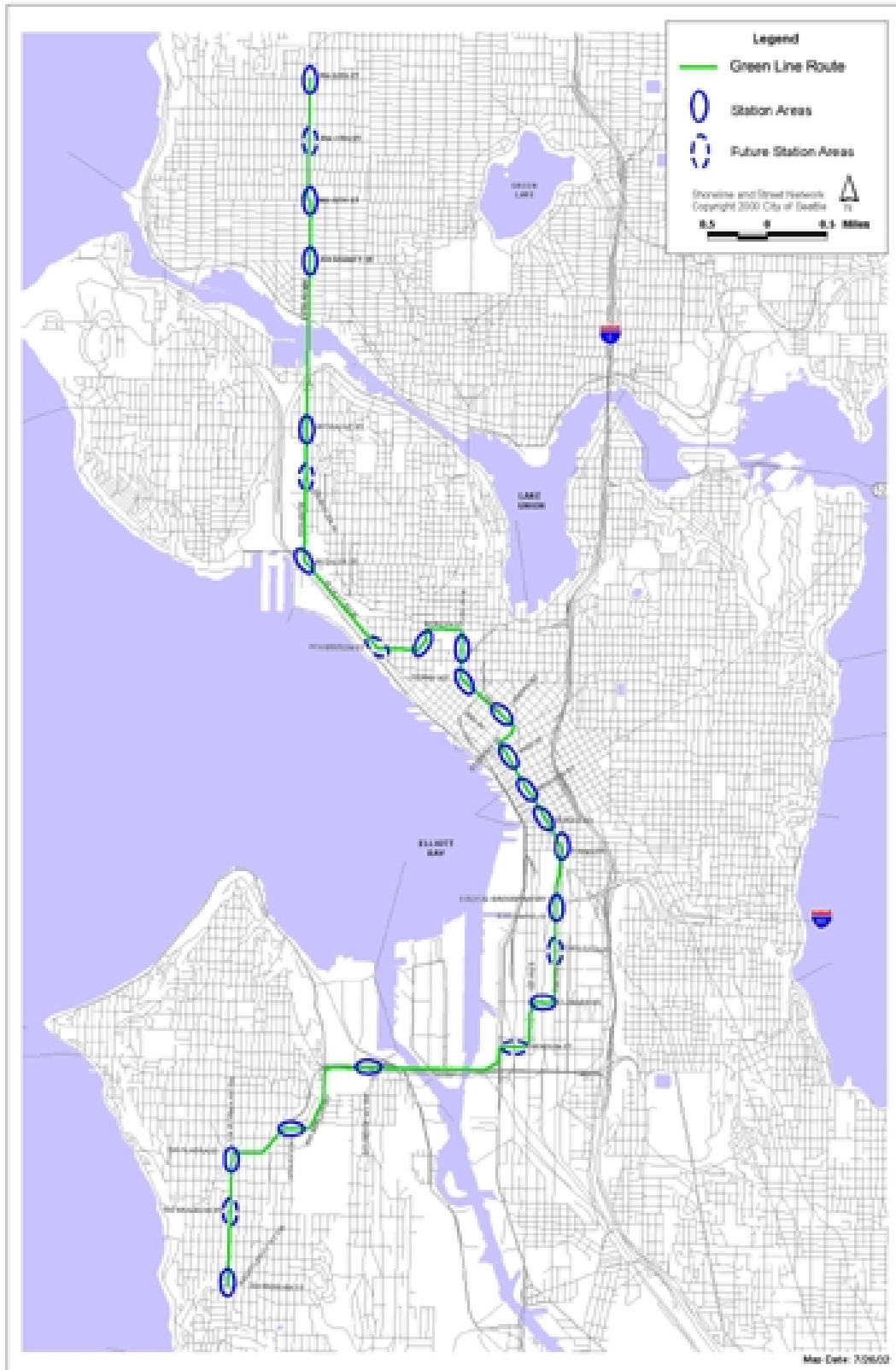
RED LINE: South Park – Sound Transit. This corridor could provide a South Seattle east/west route linking the monorail's Blue Line in the South Park neighborhood with Sound Transit's commuter and light rail lines, and offering a cross-town connection to passengers in Southeast Seattle.

TRANSIT HUBS

The corridors described above could intersect with each other and with other transportation systems at a series of passenger hubs. Opportunities for transit hubs could include:

- **Northeast Hub, East of Northgate.** This hub could connect to communities north of Lake Washington, including Kenmore, Bothell, and Juanita, and east to Kirkland and Redmond.
- **North Central Hub, in Greenwood.** Connections could be provided to Shoreline, Edmonds, and Everett.
- **University of Washington Hub.** This hub could connect across Lake Washington via SR-520 to Bellevue, Kirkland, and Redmond.
- **King Street Station Hub.** Connections could be provided to commuter rail, light rail, and Amtrak service.
- **I-90 Hub.** This hub could connect monorail lines and other modes of transportation across the I-90 Bridge to the Eastside, including Bellevue and Issaquah.
- **Boeing Field Hub.** Connections could be provided to other transit modes in Tukwila and Renton.
- **South Park Hub.** This hub could connect to points south, possibly including Seattle-Tacoma International Airport.
- **Southeast Seattle Hub.** This hub could connect with Sound Transit's light rail and commuter rail lines.

GREEN LINE ROUTE



Green Line Route Map

GREEN LINE ROUTE

The citywide plan for the monorail, described in the previous section, identifies a corridor called the Green Line that would stretch north/south along the western side of the city. This 14-mile Green Line from Ballard and West Seattle to Downtown would be the first monorail line to be developed.



The Green Line route was identified after considering suggestions from hundreds of people at community meetings, coordinating with other transportation agencies, and evaluating information on cost, ridership, travel time, growth management, potential connections to future citywide monorail routes and other transportation systems, potential maintenance facility sites, likelihood of utilities and traffic disruption, soil conditions, constructibility, and environmental factors such as noise, visual characteristics, hazardous material sites, and historic resources.

The Green Line would serve a different part of the city than light rail, offering complementary service to light rail. Because the light rail line and monorail line are being planned to complement each other, riders could have travel flexibility and easy opportunities to transfer between the two systems. The ETC has worked with Metro, Sound Transit, and other transit agencies to plan for linkages between bus, train, ferry, and monorail.

The route for the Green Line is described below in five segments from North to South:

- **SEGMENT 1: BALLARD**
NW 85th Street to south of the Lake Washington Ship Canal
- **SEGMENT 2: INTERBAY/WESTLAKE**
South of the Lake Washington Ship Canal to Denny Way
- **SEGMENT 3: DOWNTOWN**
Denny Way to South King Street
- **SEGMENT 4: SODO**
South King Street to South Spokane Street
- **SEGMENT 5: WEST SEATTLE**
South Spokane Street to SW Morgan Street

PLANNING THE GREEN LINE TO SERVE PEOPLE

As the ETC considered potential route alternatives along the Green Line, it studied ways to make the route serve people as they live, work, shop and play.

CONVENIENT STATION LOCATIONS.

The ETC sought to plan for station locations near high densities of jobs and homes and at transportation hubs so that stations would be easily accessible to as many people as possible. Station locations were identified with accessibility to bus, light rail, ferry, Amtrak, car, foot, bicycle, and other forms of transportation in mind.

SHORT TRAVEL TIME.

The ETC set a travel time goal of as close to 15 minutes as possible – including time spent stopped at stations along the way – from the end stations in Ballard and West Seattle to Downtown. Short travel times due to dependable, automated operation and an exclusive elevated guideway above traffic could allow the monorail to attract and serve passengers who might not otherwise take public transit.

HIGH FREQUENCY OF SERVICE.

Ridership studies have shown that by operating at high frequencies, public transit can attract and serve new passengers who might not otherwise leave their cars. To achieve this goal with monorail, the ETC studied ways to design the system so that monorail trains would run frequently.

EFFICIENT NUMBER OF STATIONS.

The ETC identified station locations with passenger service in mind. Selecting the appropriate number of stations is a balancing act between serving more people at more frequent stations and running trains more quickly along the route.

BUS FEEDER SERVICE TO MONORAIL STATIONS.

The ETC also examined bus service when studying route alternatives, to identify station locations that could be well served by buses. The ETC and King County Metro have developed a set of basic principles that would result in Metro redirecting some bus routes to serve monorail stations, increasing to the extent possible the frequency of bus lines leading to monorail stations, and truncating bus routes along the monorail's Green Line that continue into Downtown Seattle. Redistributing existing bus service could increase overall transit ridership by providing passengers greater access to both the bus and monorail. Downtown Seattle businesses and citizens could also benefit from the reduced number of buses traveling along downtown streets.

These concepts were used to study route alternatives and potential station locations. Using these concepts, the ETC developed a West Alternative, an East Alternative, and Options and Linkages for each of five segments along the Green Line. These route alternatives were published in April. After publishing the route alternatives, the ETC embarked on additional study and analysis and worked with each of the communities along the Green Line. Following that work, the ETC published a Draft 2 Plan in June that recommended a 'most promising' route for the Green Line.

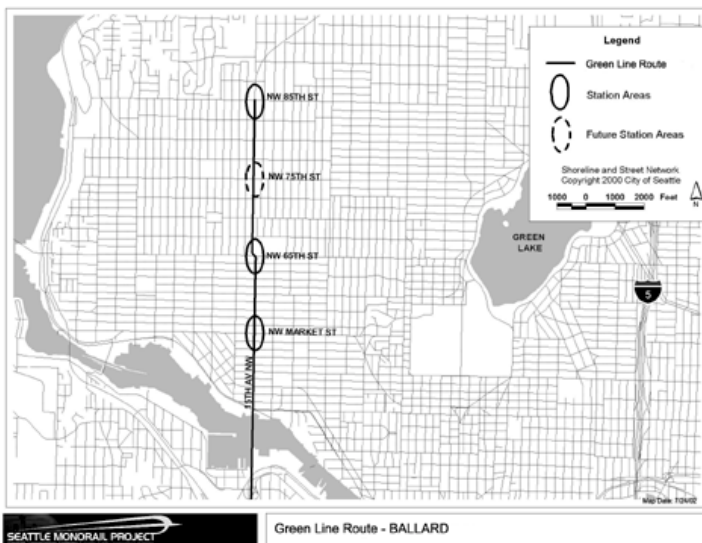
Since June, the ETC has continued to seek public comment and has worked closely with the communities

through which the Green Line would travel. The ETC has also continued to work with engineers, other transit agencies, and technical experts to study the route in more detail. Based on this public process and extensive review of route alternatives, the ETC has identified a route for the Green Line. This route is described below, with some portions remaining flexible in their implementation as noted. These areas of flexibility recognize that additional route refinement may benefit the monorail project or mitigate site-specific impacts upon detailed engineering, environmental, and alignment work that would be undertaken after the vote.

The Seattle Popular Monorail Authority will determine the ultimate number of stations developed along the Green Line during a post-vote design process that would include public review. Station locations are particularly subject to the need for flexibility because of prevailing conditions and opportunities that may arise as the Green Line is built. Stations may be located alongside of or adjacent to the public right-of-way so as to minimize impacts.

SEGMENT 1: BALLARD

NW 85th Street to south of the Lake Washington Ship Canal



Both the Crown Hill and Ballard neighborhood plans set improving mobility and encouraging transit as goals. In addition, both indicate support for actions that would ‘knit back’ the communities on either side of 15th Avenue NW, the busy arterial that bisects Ballard.

The north end of the monorail line would begin in the vicinity of NW 85th Street and run south along 15th Avenue NW (although stations could be located off the public right-of-way). It would meet the neighborhood’s goals by drawing people from both sides of 15th. The route may run directly along 15th and/or to its east or west, to coordinate with the location of the monorail’s crossing of the Ship Canal via a bridge that would be constructed just for the monorail. This bridge would be

approximately 125 feet high so that it would not need to open for ships, and would have a span that could be up to approximately 600 feet. It would be located to the east or west of the existing Ballard Bridge subject to engineering and environmental factors and its impact on the Fisherman’s Terminal complex and waterway operations.

The ETC has identified up to three station locations for this segment of the route in the vicinity of:

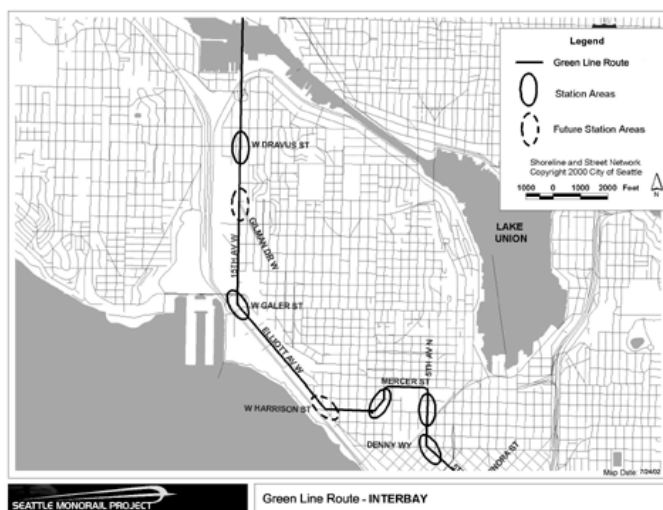
- **15th Ave NW and NW 85th Street**
- **15th Ave NW & NW 65th Street**
- **15th Avenue NW & NW Market Street**

A route along or near 15th Avenue NW has been selected because, in the ETC's view, it offers a quicker and more direct route through the neighborhood, at lower cost, than other alternatives that were examined. This route could also offer wide street rights-of-way that could minimize interference with traffic. And 15th Avenue NW would have less interaction with potential hazardous materials sites than other alternatives. Stations would be located near major community amenities such as Ballard Pool and Ballard High School.

The monorail would be built so that a station could be constructed in the future in the vicinity of 15th Avenue NW and NW 75th Street if the Seattle Popular Monorail Authority concludes that ridership growth or other factors merit it.

SEGMENT 2: INTERBAY

South of the Lake Washington Ship Canal to Denny Way.



The second segment of the Green Line would serve Interbay, a developing light industrial and commercial neighborhood between Magnolia and Queen Anne. This community has a mixture of residential, office space, and light industrial uses. This route segment would also serve Seattle Center and the Queen Anne Uptown neighborhood.

The route through Interbay was selected because, in the ETC's view, it offers a short, quick trip to Seattle Center at lower cost than a Fremont/Dexter route. It also would cause fewer noise and travel lane impacts for nearby residents than other alternatives, and fewer impacts on private views.

In this segment, the monorail would travel south from the Ship Canal water crossing along or adjacent to 15th Avenue West/Elliott Avenue West to West Harrison Street. In the vicinity of West Dravus Street, the route may be located closer to 16th Avenue West to serve the commercial, mixed-use area there.

The monorail would then travel east on West Harrison to First Avenue North and the Seattle Center grounds in the vicinity of Key Arena. The monorail would serve the Seattle Center and connect First Avenue North to Fifth Avenue via a route to Mercer Street and to Fifth Avenue North, or across the Seattle Center grounds, or through other options that may be selected by the Seattle Popular Monorail Authority.

With its 10 million visitors a year, the Seattle Center is projected to be one of the highest ridership destinations on the Green Line. The 'most promising' route developed by the ETC in its Draft 2 Plan proposed to serve the Center by traveling around it with two stations at the Center's western and eastern borders. However, many people, organizations that operate within the Center, and policymakers including Mayor Nickels contacted the ETC after the release of the Draft 2 Plan to ask whether the 'around the

Center' route could be reconsidered in favor of a 'through the Center' route.

Some believe that a route through the Seattle Center grounds could prove detrimental to the Center's open spaces, grounds, and views. Others believe that a monorail route through the Center would enhance the Center's viability by providing better access to attractions, maintaining the integrity of the distinctive building designed around the monorail, and hearkening back to its World's Fair origins.

The Seattle Popular Monorail Authority would coordinate a public process after a successful vote on the monorail project to determine the final route in the vicinity of Seattle Center. This process should include representatives from the Center, organizations that operate at the Center, neighborhood residents and businesses, interested citizens, and/or policymakers.

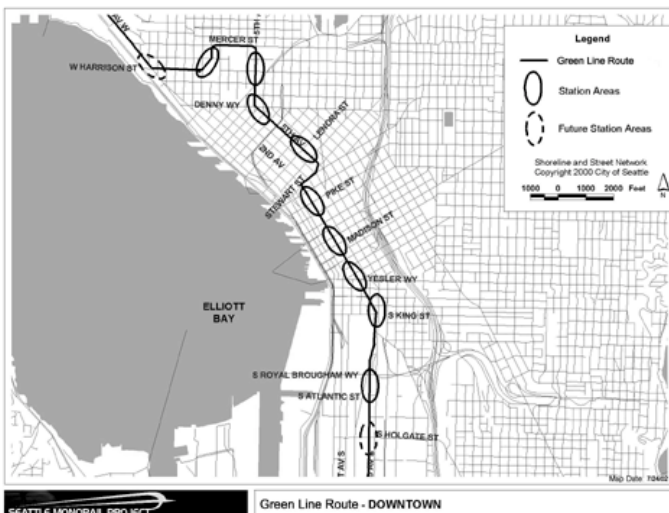
Subject to determination of the final route through or near the Seattle Center, the ETC has identified up to four station locations for this segment of the route in the vicinity of:

- **16th Avenue West and West Dravus Street;**
- **15th Avenue West/Elliott Avenue West and West Galer Street;**
- **Northwest Corner of Key Arena; and**
- **Memorial Stadium at Harrison Street.**

The stations in the vicinity of Seattle Center may be relocated based on the final decision regarding a route through or around Seattle Center.

The monorail would be built so that possible stations could be constructed in the vicinity of 15th Avenue West and West Gilman Drive; and West Harrison near Elliott Avenue West. Either or both of these stations could be constructed in the future if the Seattle Popular Monorail Authority concludes that employment or residential growth in the neighborhood or other factors merit them.

SEGMENT 3: DOWNTOWN **South from Denny Way to South King Street**



The Downtown segment of the monorail line would continue south along Fifth Avenue to the retail core. The retail core is a very high ridership destination for the Green Line. The 'most promising' route proposed by the ETC in its Draft 2 Plan would serve the retail core with stations in the vicinity of Fifth and Lenora and Second and Pike. Both of these stations would be within easy walking distance of the retail core. However, after the Draft 2 Plan was released, a number of people and businesses contacted the ETC to ask whether the station on Fifth Avenue could be located closer to Westlake Center or whether the existing monorail station at Westlake Center could be retained.

At the same time, a number of people asked whether the ETC could find a way to preserve the existing Seattle Center monorail trains, stations, or guideway. The ‘most promising’ route proposed by the ETC would upgrade the existing monorail guideway, replacing it with narrower columns spaced farther apart, beams higher above the ground, and a guideway system that would meet current seismic codes.

The ETC has studied a number of options that could respond to these requests by relocating stations or by developing a route configuration in this area that could integrate the existing monorail, perhaps in a separate ‘third beam’ configuration. This configuration could maintain the existing stations serving Downtown and Seattle Center and preserve the existing monorail cars in active service. A final route configuration and station locations in this area would be determined by the Seattle Popular Monorail Authority through a public process following a successful vote on the monorail project. In addition, the Seattle Popular Monorail Authority should work with historic preservation groups and/or interested citizens to attempt to find a home for the 40-year-old Seattle Center monorail trains, either in active service as part of a ‘third beam’ shuttle line or as special event cars on the Green Line, or on display at a museum or other setting.

Within Downtown, the monorail would travel west on Stewart Street to Second Avenue, and then would travel south through Downtown on Second Avenue, with stations in the vicinity of Pine Street, Madison/Marion Streets, and Yesler Way.

The route through Downtown following Fifth Avenue to Second Avenue was selected because, in the ETC’s view, it offers the opportunity to provide efficient service to Seattle Center, provide access to people who will work and live in new development planned near Fifth Avenue, and connect to a direct route through Downtown. Ridership at the stations along Second Avenue in the Downtown core (near Pine, Madison/Marion, and Yesler) would be higher than for other route alternatives studied through Downtown. And compared to a route along Fourth, Second Avenue would offer better access to and from the Ferry Terminal.

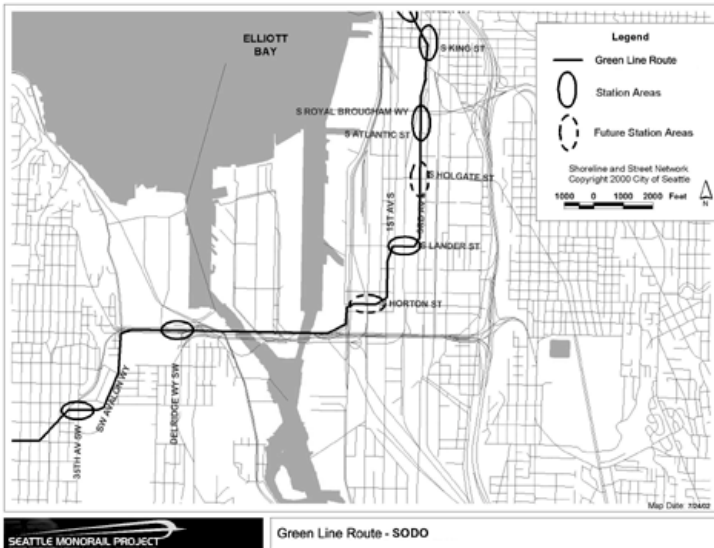
The ETC has identified up to six station locations for this segment of the route in the vicinity of:

- **Fifth Avenue and Denny Way;**
- **Fifth Avenue and Lenora Street;**
- **Second Avenue and Pine Street;**
- **Second Avenue and Madison/Marion Streets;**
- **Second Avenue and Yesler Way; and**
- **King Street Station** (East of the King Street Center building and West of King Street Station).

Final station locations in this area may be adjusted based on the configuration chosen for the route along Fifth Avenue from Seattle Center to and through the retail core.

SEGMENT 4: SODO

South King Street to South Spokane Street



South of Downtown, the monorail would serve the International District, Safeco Field, the Seahawks Stadium, the Exhibition Hall, and the employees who work in the SODO area. After the King Street station, the route would continue south along Third Avenue, on the east side of the stadiums. The monorail would turn west on or near South Lander Street to First Avenue South or a parallel street to best position the monorail for its approach to the West Seattle Bridge. From there, the route would again turn west to cross the Duwamish Waterway.

The monorail would stop at King Street and then near Safeco Field, between Royal Brougham Way and Atlantic Street. The Third Avenue route would, in the

ETC's view, be best suited to handle crowds at the stadiums, particularly at Safeco Field.

The next stop would be located between First Avenue South and Third Avenue South on or near South Lander Street and would serve both the School District's new headquarters and nearby SODO Center.

After the South Lander Street station, the monorail would curve south on First Avenue South or a parallel street to South Horton Street, turning west across Highway 99. The ETC has been working with the Port of Seattle to avoid conflicts between the monorail route and the redevelopment of Terminal 25. The ETC has also worked with the Department of Transportation to make the monorail compatible with potential improvements to the Alaskan Way Viaduct and Spokane Street.

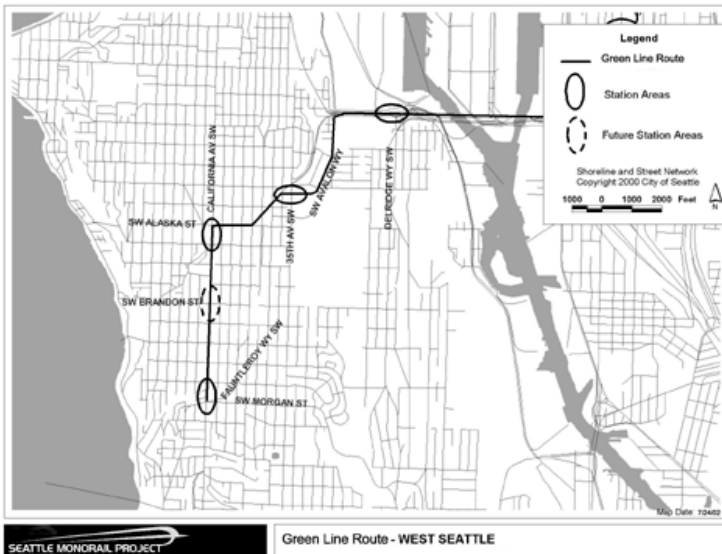
The ETC has identified up to two station locations for this segment of the route in the vicinity of:

- **Safeco Field** on Third Avenue South between South Royal Brougham Way and South Atlantic Street (Event Station – may only be used during events at nearby stadiums); and
- **South Lander Street** between First and Third Avenues South.

The monorail would be built so that stations could possibly be constructed on Third Avenue South near South Holgate Street and on First Avenue South near South Horton Street. Either or both of these stations could be constructed in the future if the Seattle Popular Monorail Authority determines that the neighborhood's growing employment base or other factors merit their development.

SEGMENT 5: WEST SEATTLE

South Spokane Street to SW Morgan



This segment would cross the Duwamish Waterway to serve the Delridge neighborhood and would then climb into West Seattle and travel to the Alaska and Morgan Junctions. Monorail is proposed as a transit choice in the West Seattle Neighborhood Plan to help residents avoid congestion on the West Seattle Bridge. Monorail is seen as particularly desirable in West Seattle because the neighborhood's steep hills make many other forms of transit difficult.

Engineering studies to date, including coordination with the City of Seattle Transportation Department, indicate that it is feasible to structurally strengthen the West Seattle Bridge and then construct a monorail guideway atop the bridge deck in the median area.

Engineers believe this could be done in such a way as to avoid the loss of any current traffic lanes on the bridge. The monorail could approach the West Seattle Bridge via a special bridge structure in the vicinity of SR 99, north of Spokane Street, and could exit the West Seattle Bridge in the vicinity of Delridge Way SW. Alternatively, the monorail could travel alongside the West Seattle Bridge, if the Seattle Popular Monorail Authority determines that option to be necessary or preferable. The Duwamish Waterway crossing would be coordinated with plans for the redevelopment of Terminal 25 and for upgrades or changes to the Alaskan Way Viaduct and Spokane Street.

After crossing the Duwamish Waterway, the monorail would stop near Delridge Way SW, then travel south up SW Avalon Way or via streets adjacent to the south side of the Fauntleroy expressway structure or more suitable routing to the south.

The monorail would then travel on or near Fauntleroy Way SW and/or SW Alaska Street to a station east or west of California Avenue SW to serve the Alaska Junction, coordinating opportunities for access to transit service and other transportation infrastructure in the neighborhood. The monorail would then angle over to or adjacent to California Avenue SW and continue south to the vicinity of SW Morgan Street, where it would have its southern terminus.

This route through West Seattle was identified because it would serve two of the community's three commercial junctions with a route that, in the ETC's view, is faster, less costly, more constructible, and with less potential for utility disruption than other alternatives that were examined. The West Seattle segment of the Green Line would offer significant opportunities for bus connections to the monorail, thus reducing the number of buses on the often-congested West Seattle Bridge.

The ETC has identified up to four station locations for this segment of the route in the vicinity of:

- **West Seattle Bridge and Delridge Way SW;**
- **35th Avenue SW and SW Avalon Way;**
- **42nd Avenue SW and SW Alaska Street; and**
- **California Avenue SW and SW Morgan Street.**

The monorail would be built so that a possible station could be constructed on California Avenue SW near SW Brandon Street. This station could be constructed in the future if the Seattle Popular Monorail Authority concludes that ridership or other factors merit it.

RIDERSHIP

The ETC estimates that in 2020 the Green Line would have approximately 20.4 million passenger boardings a year or some 69,000 each weekday. Ridership estimates have been calculated based on the Green Line route described in this Plan.

Estimating how many people might ride the monorail and when and where they might ride was extremely important to the ETC. Ridership forecasts were considered as the ETC developed the Green Line route, selected technology (since both the size and the number of the train cars needed depend on the number of passengers), and estimated capital and operating and maintenance costs and projected revenues.



Tokyo commuters travel above traffic congestion.

THE GREEN LINE: PART OF A CITYWIDE SYSTEM, BUT FULLY FUNCTIONAL ON ITS OWN

The monorail's Green Line has been planned to be part of a citywide monorail system, which people could use to travel around the city between the neighborhoods and Downtown, and to connect to other forms of transportation.

However, even without the other lines that would form the citywide monorail system, the Green Line would be a fully functional transit line. Because it would link communities along Seattle's western side with each other and with Downtown, and would connect passengers with Seattle Center and the sports stadiums, it would be able to operate independently of other monorail lines, serving about 69,000 passengers each weekday.

Ridership has not yet been estimated for the other monorail lines that would form the citywide system. The estimates presented in this Plan refer only to the Green Line.

ESTIMATING RIDERSHIP

As the ETC estimated ridership for the Green Line, it analyzed three types of information:

- **The other transportation choices** potential monorail passengers would have available to them, to determine how attractive monorail would be when compared with other choices;
- **The number of jobs and homes** in the communities along the Green Line and, specifically, within walking distance of proposed Green Line stations; and

- **The transit patterns for special events** at Seattle Center, Downtown and the neighborhoods, such as the Bite of Seattle, Torchlight Parade, Ballard Seafood Fest, and others, and for games and events at the stadiums, to determine how monorail could serve tourists and event-goers.

Based on this analysis, the ETC estimates total passenger boardings on the monorail's Green Line to be approximately 20.4 million a year in 2020 or some 69,000 each weekday. The ETC estimated that average weekday ridership could be as high as 72,000, but reduced that figure to 69,000 based on its planning assumptions about fare policies.

The ridership estimates developed for the Green Line consider riders in three categories:



A passenger enjoys smooth travel on the monorail.

- **Weekday Rides**, by the residents and commuters who would travel to work or between neighborhoods each day. Ridership in this category was estimated using a regional transit forecasting model during June 2002, based on the Green Line route and potential station locations. This led to an estimate of weekday ridership of approximately 57,000 in 2020, for an average annual ridership of 14.25 million.
- **Event rides**, by residents or tourists traveling to a ball game or a major event at Seattle Center or Downtown. Event rides were estimated by compiling a list of the major event venues the Green Line would serve, analyzing the current transportation and transit use patterns at these events, and studying event ridership on the existing Seattle Center monorail.

This analysis led to an estimate of approximately 2.5 million event rides a year on the Green Line in 2020 by passengers traveling to and from major events. Clearly, event ridership would not be the same each day. It would be higher on days with a major event and lower on days without events. However, the annual estimate was spread over the course of the year to produce an estimate of an average 8,000 rides a day.

- **Tourist rides**, by visitors riding the monorail to see the sights. Tourist ridership is difficult to differentiate from regular weekday ridership. However, tourist ridership was estimated by studying current ridership patterns on the Seattle Center monorail and by analyzing local tourism figures. The ETC has made a conservative estimate of 1.2 million tourist rides a year – approximately 4,000 a day – or slightly more than the amount the current Seattle Center monorail now carries.

These ridership estimates are summarized in the table below.

Monorail Daily Ridership Estimates – 2020 Green Line Route

RIDERSHIP ELEMENT	Estimated		WEEKDAY Average Rides
	Daily Rides	ANNUAL RIDES	
Weekday*	57,000	14,250,000	57,000
Holidays*	21,000	200,000	N/A
Weekend*	21,000	2,200,000	N/A
Tourists**	4,000	1,200,000	4,000
Events**	8,000	2,500,000	8,000
TOTAL		20,350,000	69,000

NOTE: All estimates have been rounded.

*Ridership forecast documentation, URS Corporation (June 3, 2002)

**Transpo Study (March - June 2002)

Planning assumptions that were used to form the basis for the ridership estimate for the Green Line include:

- Route:** 14-mile route from Ballard and West Seattle to Interbay, Seattle Center, Downtown, and SODO.
- Stations:** 19, with specially designed event stations in the vicinity of Safeco Field and Key Arena.
- Train travel time:** 33 minutes one-way trip, up to 50 miles per hour, 20 second station stops.
- Train frequency:** 19 hours per day, seven days per week, approximately 4 minutes between trains during peak periods (3 hours in both morning and afternoon) and special events, approximately 8 minutes between trains during non-peak periods (remaining weekday hours, weekends, holidays).
- Fare basis:** Although fares for the monorail will be set by the Seattle Popular Monorail Authority, the ridership analysis assumed fares similar to Metro bus fares, with no Downtown monorail-free zone, and a 50% transfer between bus and monorail. .

MONORAIL TECHNOLOGY

Since Seattle built its monorail in 1962, elevated transit and monorail systems have been built and operated successfully in a number of cities around the world. There are now many different technologies to choose from.

After study and extensive discussion, the ETC selected “traditional” monorail technology for the Green Line. This technology was chosen because it has a proven record in other cities around the world, can travel at speeds exceeding 50 miles per hour, and can easily accommodate 3,000-plus passengers per hour per direction when trains are traveling at 4-minute frequency. If demand requires it, trains could run at 2-minute intervals, doubling the capacity. In most instances, the beams and support columns for traditional monorail technology can fit in existing street rights-of-way, without taking away regular lanes of traffic. In addition, there are a number of competitive suppliers for this type of monorail technology.

Traditional monorail systems consist of linked cars that straddle a single beam that provides electric power to run the vehicles. Train cars run on rubber tires that are locked into the beams. Traditional monorail systems can be automated and not require drivers.

EVALUATING MONORAIL TECHNOLOGY

The ETC used ten different planning factors to evaluate different monorail technologies. These factors were:

ABILITY TO EXTEND the technology outside Seattle. All of the technologies the ETC studied could be extendable to reach throughout the city and beyond.

AFFORDABILITY, in light of the many demands on public resources. The ETC studied the costs of monorail systems that have been constructed in other cities as the first step in developing estimates for the costs of monorail construction and operation in Seattle.

APPEARANCE. Each type of monorail technology has its own look and image. The ETC evaluated different monorail technologies to determine how trains and guideways would fit in Seattle’s landscape.

COMPETITION, with more than one supplier for the technology to provide competition.

COST, as calculated in dollars per passenger mile. Capital costs for a monorail system can be divided into three major categories:

- Vehicle and systems;
- Construction facilities (stations and guideways); and
- Costs for design, administration, utility relocation, etc.

Operating costs for a monorail system can include:

- Administering the monorail system;
- Monitoring the automated operation;
- Maintaining the system;
- Collecting fares; and
- Maintaining and monitoring stations.

The ETC studied the capital and operating costs of different types of monorail technology, analyzing the tradeoffs between technologies with lower capital costs but higher operating costs and technologies with higher capital costs but lower operating cost or higher levels of service for a set operating cost.

EXPERIENCE with the technology in similar applications in other locations. The ETC paid careful attention to the experiences of other cities that have installed different types of monorail technologies.

FLEXIBILITY to fit within existing rights-of-way. Most of the technologies studied by the ETC would operate on a dual-lane, line-haul guideway that could be located within the right-of-way.


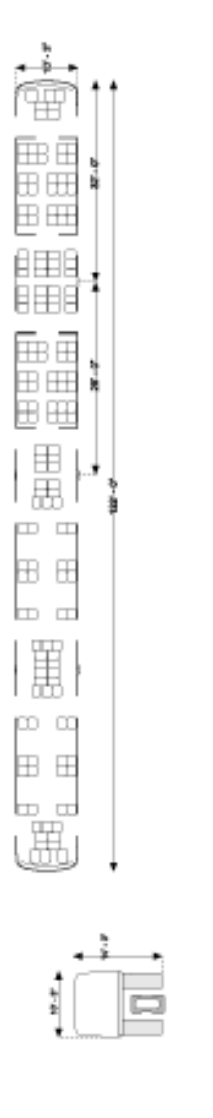

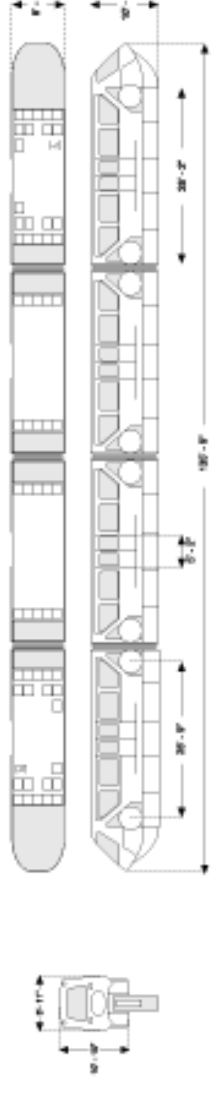





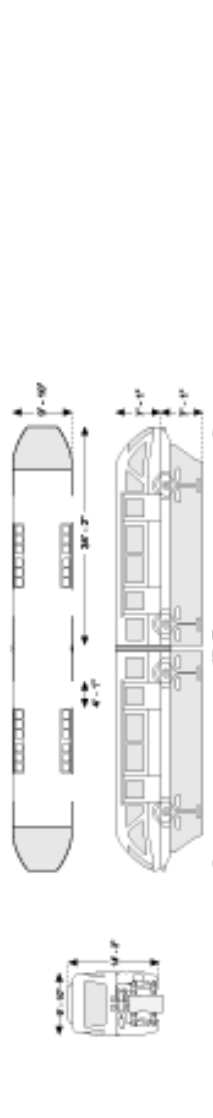
RELIABILITY of technology based on experience elsewhere. The ETC focused on systems that have been implemented elsewhere in automated service and have demonstrated reliability of 99.5%.

SPEED OF CONSTRUCTION, with a goal of five years to complete construction.

TRIP TIME from origin to destination. The ETC evaluated different technologies to determine how quickly trains could travel from one end of the Green Line to the other.

Using these planning factors, the ETC chose “traditional” monorail.

The photos and drawings on the next page illustrate some of the options available with traditional monorail technology.

<p>ALWEG Seattle, WA / 2 4-Car Trains / 1982</p> 		
<p>BOMBARDIER M-VI Las Vegas, NV / 9 4-Car Trains / 2004</p> 		
<p>HITACHI SERIES 1000 Naha Okinawa, Japan / 13 2-Car Trains / 2003 Tokyo, Japan / 16 4-Car Trains / 1993 Osaka, Japan / 17 4-Car Trains / 1990 Kibi Aiyukku, Japan / 10 4-Car Trains / 1995</p> 		
<p>HITACHI SERIES 3000 Tokyo, Japan / 19 6-Car Trains / 1984 - 1989</p> 		
<p>MONORAIL MALAYSIA Kuala Lumpur, Malaysia / 12 Trains / 2002</p> 		

BUILDING & OPERATING THE MONORAIL

How does elevated transit work? And how would Seattle’s new monorail be built and operated? This section describes the major structural components of a monorail system; outlines the anticipated construction process; lists the planning assumptions the ETC developed for the Green Line; and discusses the structure and function of the Seattle Popular Monorail Authority, the organization that would be formed following a successful vote to build and operate the Green Line and plan future monorail lines.

COMPONENTS OF A MONORAIL SYSTEM

MONORAIL BEAMS.

Monorail trains travel on elevated steel or concrete beams, which they straddle and grip with their tires. The beams are laid out in pairs so that two trains traveling the opposite direction can pass each other. The beams allow some flexibility for winding through urban landscapes, and can curve on a radius as sharp as 150 to 200 feet.

SUPPORT COLUMNS.

The beams on which monorail trains run are supported at a typical height of 22 to 40 feet above ground level by columns, and higher where needed. Seattle’s current monorail is supported by columns that are 48” square and are located approximately 80 feet apart. Technologies available today allow typical columns as small as 36” in diameter to be placed up to 120 feet apart or farther apart when required.

SPECIAL STRUCTURES.

Special structures would be used in the monorail guideway system in unusual or difficult areas that cannot be crossed using typical structural elements or in areas in which the monorail must be elevated above 60 feet in height. For example, crossing unusually wide streets or skewed roadways could require longer beam lengths. And the monorail’s entrance to and exit from the West Seattle Bridge could require a special structure to elevate the monorail to the height needed above the bridge deck. In some cases, a “straddle-bent” would place a column on either side of the guideway beam so that autos and trucks could drive beneath.



Center platform monorail station in downtown Tokyo.

WATER CROSSINGS.

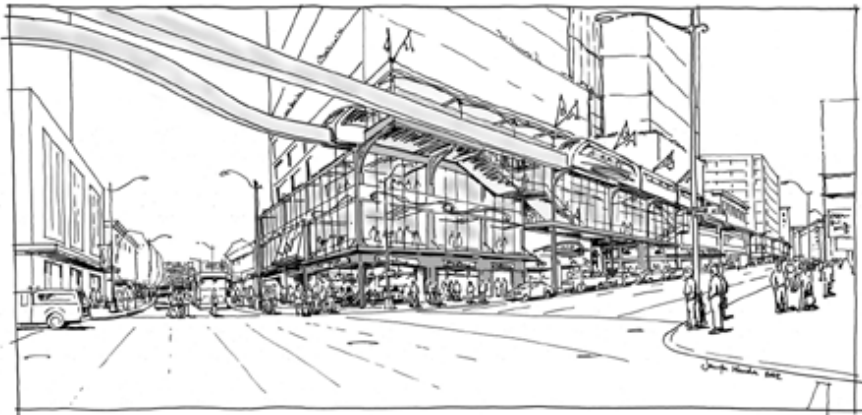
The monorail’s Green Line would have two major water crossings. The first would be over the Lake Washington Ship Canal east or west of the existing Ballard Bridge. A new bridge for the monorail would be constructed to cross the Ship Canal. The bridge would be high enough to allow vessels to pass beneath. The second water crossing would be over the Duwamish Waterway. Engineering studies indicate that the most efficient way to cross the Duwamish would be by strengthening the West Seattle Bridge and then constructing a monorail guideway atop the existing bridge deck, with the guideway constructed so as not to interfere with traffic flow on the bridge.

Alternatively, the monorail could cross the Duwamish adjacent to the West Seattle Bridge, if the Seattle Popular Monorail Authority determines that option to be necessary or preferable.

STATIONS.

In addition to its guideway, the Green Line would have up to 19 stations with up to six additional locations where stations could be constructed in the future if the Seattle Popular Monorail Authority concludes that factors such as ridership or residential or employment growth merit them. Stations would be designed with accessibility, attractiveness, ease of use, and safety in mind. Stations might be constructed alongside of or adjacent to the public right-of-way to minimize impacts. The general size and characteristics of monorail stations would be determined by a few critical factors:

- The length of a train;
- The number of riders who need to be accommodated on the station platform during boarding or exiting assuming two trains are in the station at the same time, one in each direction; and
- Circulation elements such as the stairs, elevators, or escalators needed for people to get to and from the platform.



Potential monorail station near Pike Place Market

The ETC has developed a general station program to use for design and cost estimating. This program calls for platform area approximately 22 to 27 feet wide and 140 to 160 feet long. Some stations may have mezzanine levels.

Station design would be coordinated by the Seattle Popular Monorail Authority through an approximately 12-24-month

design, engineering, and public participation process. The public participation process would include interested citizens and community professionals.

MAINTENANCE FACILITY.

The monorail system would require a maintenance facility at which trains could be stored and serviced. In addition – whether located at the maintenance facility or elsewhere – the automated trains would require a command and control facility, at which train performance and progress would be monitored via computer, video, and/or other technologies. The ETC has identified several possibilities – in the Interbay and SODO neighborhoods – as possible locations for a monorail maintenance facility. Locations in either of these neighborhoods could provide for efficient operations and staging of trains to serve special events. To the maximum extent possible, the monorail’s administrative and command/control facilities would be co-located with the maintenance facility.

CONSTRUCTING THE GREEN LINE

When the Green Line is constructed, the beams and possibly the support columns would most likely be fabricated off-site and then assembled on-site in stages. Construction would be staged and organized to the extent practicable to minimize impacts on traffic and surrounding properties. Active construction for utility relocation, foundation construction, and column, beam, and walkway assembly could require about 30 active construction days for each block. These construction days could be spread over a period of months, with work scheduled to the extent possible for nights or off-peak days with the intent of minimizing impacts on traffic circulation and maintaining access to adjacent properties. In between periods of active construction, traffic lanes would typically be open; during construction, traffic would be diverted to the minimum extent possible.

PLANNING ASSUMPTIONS FOR SYSTEM OPERATIONS

In creating its proposal for the Green Line, the ETC developed a number of planning assumptions about eventual system operations:

- **Hours of operation.** For planning purposes, the ETC assumed that the monorail would operate at least 19 hours per day, 365 days per year, and that there would be different service levels for peak, non-peak, and weekend/holiday periods.
- **Capacity.** The ETC assumed that the monorail would be developed so as to be able to easily carry 3,000-plus passengers per hour per direction during peak periods, assuming a 4 minute interval between trains; and that this capacity could be doubled if needed by running trains at 2 minute intervals.
- **Travel Time.** The ETC estimated a travel time for the entire 14-mile route at about 30 minutes. Monorail cars would be capable of a cruise speed of 50 mph.
- **Service Life.** The ETC assumed that vehicles used on the Green Line would be designed to run for 30 years or 3,000,000 miles.
- **Reliability.** The ETC assumed that the system would set a goal of 99.5% reliability.
- **Safety.** The ETC determined that the system would be automated, with independent computers checking all control decisions. The system would be designed to accommodate emergencies, and stations would be designed with issues of passenger safety in mind, with system attendants and security staff.

GOVERNANCE

Initiative 53 requires that the Seattle Monorail be built, owned, operated, and maintained by an organization that is accountable to the people of Seattle. This organization would replace the ETC if voters approve the monorail ballot measure.

Because Initiative 53 listed several different options for the form of this organization, the ETC analyzed different governing structures, including a department within the City of Seattle, a Seattle Public Development Authority, and an Independent Municipal Authority. Based on this analysis, the ETC decided to pursue state legislation that would allow voters to create an Independent Municipal Authority to build and operate the monorail.

ESSB 6464, which was passed by the 2002 Legislature, allows Seattle voters to create a new Seattle Popular Monorail Authority (SPMA) as a “city transportation authority” that would have separate taxing and bonding authority. Since that legislation has passed, the ETC has worked to develop a proposal for the structure of this new organization to submit to Seattle voters in November. As it studied different governance options, the ETC set as its goals that the Seattle Popular Monorail Authority give citizens control over the monorail and that it be clearly accountable to the public. To meet these goals, the ETC recommends that:

CITIZENS VOTE ON EACH PHASE OF THE MONORAIL SYSTEM.

Popular control of the monorail would be through voter approval of each phase of the monorail system following Phase I.

BOTH ELECTED AND APPOINTED MEMBERS.

The ETC recommends that the Seattle Popular Monorail Authority have a blended Board of Directors comprised of a mix of elected and appointed members. Two members of the nine-member Board would be directly elected by Seattle citizens for two-year terms. The remaining seven Board members would be nominated and appointed by the Mayor, City Council, and SPMA Board for three-year terms.

The ETC considered the merits of a directly-elected SPMA Board, an appointed Board, and a blended Board of elected and appointed members. The ETC concluded that a blended Board with a mixture of elected and appointed members could be efficient and effective at focusing on its single purpose – carrying out the voters’ mandate to build a monorail system – while also providing clear accountability to Seattle citizens.

If the monorail ballot measure this November is successful, the ETC would be dissolved and replaced by the Seattle Popular Monorail Authority. To allow the Seattle Popular Monorail Authority to move forward quickly with Green Line construction, its Board would be formed in stages:

- **Interim Board.** By state law, if the ballot measure is successful, immediately after it is validated the members of the ETC Board would become the members of a new Interim Board to administer the Seattle Popular Monorail Authority. This Interim Board would be empowered to take action to build the Green Line until new Board members can be appointed and elected.

- **First Board.** As quickly as possible, a First Board comprised of nine appointed members would be formed to replace the Interim Board. Five of the members of this First Board would be nominated by the SPMA Interim Board and appointed by the City Council; two would be nominated by the Mayor and appointed by the SPMA Interim Board; and two would be nominated by the City Council and appointed by the SPMA Interim Board. These new Board members would have staggered terms of from one to three years each. One each of the Mayor and City Council nominees would have terms that would expire in January 2004 in anticipation that two new members of the SPMA Board would be elected in November 2003 and seated on the Board in January 2004.
- **SPMA Board.** The ETC anticipates that two members of the SPMA Board would be elected through a citywide, non-partisan election in November 2003. These members would be elected to two-year terms. All members of the SPMA Board would be required to be registered voters within the Seattle Popular Monorail Authority's "Authority Area" (currently defined as the City of Seattle) when elected or appointed and throughout their terms of service. Members would be limited to serving nine consecutive years on the Board. City elected officials, appointed officers, and employees would be prohibited from serving on the SPMA Board.

After the SPMA Board is formed, Seattle voters would have an additional opportunity to shape its structure. Between 2005 and 2009, a ballot measure would be put forward to ask voters whether a majority of the SPMA Board should be elected.

ADDITIONAL ELEMENTS OF OPENNESS AND ACCOUNTABILITY.

In addition to the SPMA Board selection process and the requirement for public votes on subsequent monorail lines, the ETC recommends several additional elements of openness and accountability for the Seattle Popular Monorail Authority. These elements are:

- Public input regarding SPMA Board nominees for appointed positions through community groups, Web sites, notices at monorail stations, and/or other sources.
- A provision that an appointed SPMA Board member could be removed by a 2/3 majority (six votes) of the SPMA Board. (Elected members of the SPMA Board could be removed pursuant to applicable law.)
- A provision to dissolve the Seattle Popular Monorail Authority and end the monorail project (except for continued collection of taxes and fees

necessary to retire outstanding obligations) by citizen initiative if there are significant financial problems with the project. (This is a provision that the ETC supported in the state law that authorized the Seattle Popular Monorail Authority.)

SPMA BOARD BYLAWS AND POLICIES.

Like most other organizations, the Seattle Popular Monorail Authority would have bylaws. These bylaws would set provisions, as the SPMA Board determines is necessary, for: SPMA Board committees; the number and duties of Seattle Popular Monorail Authority officers and their method of selection; processes to comply with public meetings laws; ethics requirements; conflict of interest provisions; and other issues, including procedures to amend the bylaws. The bylaws should provide that each SPMA Board member would be eligible to receive up to \$7,500 each year in compensation for services (adjusted annually for increases in the Consumer Price Index) and to receive expense reimbursement, and should set policies relating to that compensation and reimbursement. Members of the Interim Board should not be eligible for compensation but should be eligible to be reimbursed for expenses.

The SPMA Board should also adopt guiding principles outlining the expectations for SPMA Board members' participation. The SPMA Board should expect any candidate for SPMA Board membership to confirm his or her understanding of and support for these guiding principles.

The SPMA Board should also set policies for compensation, benefits, and expense reimbursement for employees; benefits for SPMA Board members and employees; defense and indemnity of Seattle Popular Monorail Authority employees and SPMA Board members; and other issues that it finds necessary and appropriate.

COST AND FINANCING

The ETC has been carefully analyzing the costs to build and operate the monorail's Green Line, as well as the revenue that would come from fares, advertising, and other sources. Based on this analysis, the ETC estimates that:

- **Project costs** to build the Green Line are estimated to be \$1.29 billion (in 2002 dollars).
- **Operating and Maintenance Costs** to run the Green Line are estimated to range between \$25 and \$33 million a year depending on the level of staffing and security at monorail stations.
- **Revenues** from fares and advertising from the Green Line are estimated to range between \$24 and \$42 million a year, and could be equal to operating and maintenance costs by the year 2015.
- **A startup operating subsidy** of \$25 million would be spread over the first nine years of the Green Line's operation as its ridership base grows; additional subsidies may not be required once the Green Line reaches the ridership estimates presented in this Plan.
- **Agency costs**, estimated at \$73 million, would be funded to cover the Seattle Popular Monorail Authority's overhead and operations, including but not limited to pre-design work and pre-construction engineering tasks and to coordinate the construction of the Green Line.
- **Project reserves**, estimated at \$355 million, would provide for inflation in construction costs over time and would cover sales tax payments.
- **A planning allowance** of \$6 million would allow the Seattle Popular Monorail Authority to begin the engineering and environmental studies needed to plan the second monorail line.
- **A 1.4% Motor Vehicle Excise Tax (MVET)** is recommended by the ETC to fund the Green Line. This tax level is anticipated to cover all Phase I costs, including project costs, project oversight, planning for a second monorail line, a reserve against inflation, and the Green Line's startup operating subsidy.

ESTIMATING PROJECT COSTS

During its planning process, the ETC undertook several different types of analysis to develop, review and refine cost estimates for construction and operation of the Green Line:

ENGINEERING STUDIES.

Engineering studies were conducted to more thoroughly assess the conditions in which construction along the Green Line would occur. These studies included the development of an Operational Requirements Document for the Green Line; geo-technical and hazardous materials investigations; a structural analysis of the West Seattle Bridge; preliminary engineering for the monorail guideway; design guidelines for the guideway and stations; an analysis of maintenance facility needs; and utility relocation discussions with the City of Seattle.

SITE VISITS to other cities with monorail and/or elevated transit systems that included:

- Hitachi systems in Japan, including guideways, stations, switches, maintenance facilities, operation centers, and the factory where trains and switches are produced.
- Bombardier systems in Vancouver, B.C. (SkyTrain), Las Vegas, and Orlando, including guideways, stations, maintenance facilities, operation centers, factory, and monorail construction sites.
- Monorail Malaysia system in Kuala Lumpur, including monorail guideway and station construction sites and train manufacturing facility.

AN INDEPENDENT INDUSTRY EVALUATION OF COSTS, in which industry leaders in construction and transit system development were asked – for no compensation – to review the ETC’s capital cost estimates. The work of the independent industry teams was synthesized and coordinated with the ETC’s cost estimates by an independent cost estimating firm.

A TRANSPORTATION RISK AND UNCERTAINTY EVALUATION. The City of Seattle commissioned an independent analysis of the risks inherent in the monorail Plan to determine the likelihood that Phase I could be completed within the project budget developed by the ETC. This type of analysis is fairly new (but has become familiar to local policymakers because it was recently conducted on proposals to upgrade the Alaskan Way Viaduct to assess the estimated budget levels for that project). The risk analysis conducted for the monorail concluded that the project cost estimate (including project costs, financing costs, project reserves, startup operating subsidy, agency costs, and planning allowance) presented here for Phase I are valid cost estimates. Moreover, even in those situations in which costs could exceed the proposed budget, there is a 90% chance that the proposed 1.4% MVET would be sufficient to cover the extra costs.

A BENEFIT-COST ANALYSIS. An independent economist analyzed the economic value of the Green Line's benefits, which include travel time savings for Green Line riders, parking savings, reduced auto operating and ownership costs, additional road capacity for private drivers, reduced accidents, and improved reliability. According to the analysis, the present value of these benefits should exceed the present value of the estimated capital and operating costs for the Green Line over a 30-year time frame. The analysis concluded that from an economic perspective the proposed Green Line represents a sound public investment, as it should generate significant benefits to system users and others that surpass the costs of building and operating the line.

As the ETC conducted its analyses and consulted with technical experts, it determined that three major factors would be critical in controlling capital costs and budget risks for the Green Line. Those factors are:

- **Staying focused on moving people:** The ETC determined that progress on the Green Line would be most efficient if City of Seattle permitting departments support decisions that minimize schedule delays and costs, and if City policymakers refrain from using the monorail as a funding source for other, non-monorail improvements.
- **Designing to a budget:** The Seattle Popular Monorail Authority should strive to design a monorail system that meets the budget and to avoid allowing the scope to increase during design and construction. The risk analysis identified ongoing governance and staffing as a primary risk to the project, noting that to be most efficient the Seattle Popular Monorail Authority should organize itself and hire staff quickly so that it can begin work expeditiously, and should commit to making the difficult decisions that will be necessary to design to a budget and prevent costs from rising.
- **Opening the Green Line for service as quickly as possible:** The Seattle Popular Monorail Authority should strive to complete and open the Green Line as quickly as possible to minimize construction inflation, property acquisition costs, and project overhead. This may mean relying on local funding rather than Federal funding, which may be available for future monorail phases but not for the Green Line. On this note, the bonds that will finance Phase I, if issued as soon as possible after a successful vote, could receive current low interest rates.

To control these risk factors and to allow both the Seattle Popular Monorail Authority and the public to carefully track the project budget, the ETC recommends that the new authority conduct a risk analysis of project costs and other factors each quarter during the early years of Green Line construction.

GREEN LINE PROJECT COSTS

The costs³ to build and begin operation of the Green Line (Phase I) are comprised of the following components.

PROJECT COSTS.

Costs, estimated to be a total of \$1.29 billion (in 2002 dollars), include the physical components of the Green Line: its trains and control systems, stations, beams, columns, foundations, water crossings, a maintenance facility, power supply, utility relocation, acquisition of rights of way, mitigation of hazardous materials, and design and administration. Each item in the cost budget was estimated with a contingency amount associated with it, based on the level of risk that item carries. The ETC's cost estimate anticipates that a comprehensive labor agreement would be reached by the Seattle Popular Monorail Authority for the construction of the Green Line.

PROJECT RESERVES.

Costs for the Green Line have been estimated in 2002 dollars. However, because the Green Line will not be built in 2002, those project costs must be escalated to account for the fact that costs increase over time. In addition, building the Green Line would require the Seattle Popular Monorail Authority to pay sales taxes, as well as to maintain project reserves in the event of changes as the project is designed and constructed. These project reserves are not contingency costs, in that they are not associated with the uncertainty related to specific components of the cost budget. Rather, these reserves account for the costs that would be incurred as the project is funded over time and provide for potential changes in the scope of the project. Project reserves are estimated at \$355 million in year of expenditure (YOE) dollars.

AGENCY COSTS.

Agency costs include the Seattle Popular Monorail Authority's oversight and management of the pre-design, pre-construction and construction processes and its work coordinating the pre-design, environmental and engineering tasks that would be needed to develop procurement documents for the Green Line's design and construction, as well as general overhead and operations of the Seattle Popular Monorail Authority itself as it moves forward with Phase I. Agency costs are estimated at \$73 million (YOE \$).

OPERATING SUBSIDY.

A comparison of operating and maintenance costs and revenue projections indicates that the Green Line may be able to be self-sufficient once it is constructed, funding its ongoing operations from advertising and fares and not requiring additional public subsidy. However, the ETC estimates that the Green Line would require an operating subsidy during its first approximately nine years of operation when only the first segments of the line are open and while its passenger base is growing. The cost estimate includes a \$25 million startup operating subsidy for the Green Line, which would be spread over approximately nine years.

SECOND LINE PLANNING.

\$6 million (YOE \$) is included in the project budget to allow the Seattle Popular Monorail Authority to coordinate the community outreach and environmental, land use, and engineering review needed to plan a second monorail line.

Adding all these costs and escalating all costs into year of expenditure (YOE) dollars produces a total project cost estimate of \$1.749 billion (YOE \$).

The project cost estimate is summarized below.

GREEN LINE PROJECT COSTS ESTIMATE

Item	Design-to-Cost	Contingency	TOTAL
Trains and Control Systems	\$ 225,000,000	\$ 30,000,000	\$ 255,000,000
Stations	\$ 115,000,000	\$ 20,000,000	\$ 135,000,000
Beams, Columns, Foundations	\$ 260,000,000	\$ 40,000,000	\$ 300,000,000
Water Crossings	\$ 100,000,000	\$ 20,000,000	\$ 120,000,000
Maintenance Facility	\$ 20,000,000	\$ 10,000,000	\$ 30,000,000
Power Supply	\$ 80,000,000	\$ 15,000,000	\$ 95,000,000
Utility Relocation	\$ 60,000,000	\$ 20,000,000	\$ 80,000,000
Rights of Way	\$ 25,000,000	\$ 5,000,000	\$ 30,000,000
Hazardous Materials	\$ 5,000,000	\$ 5,000,000	\$ 10,000,000
Design and Administration	\$ 190,000,000	\$ 45,000,000	\$ 235,000,000
Sub Total in 2002	\$1,080,000,000	\$210,000,000	\$1,290,000,000
Project Reserves		Cost escalation to YOE:	\$ 199,000,000
		Sales tax in YOE:	\$ 80,000,000
		Agency Reserves in YOE:	\$ 76,000,000
Agency Costs		Pre-construction planning/design:	\$ 32,000,000
		Program management:	\$ 41,000,000
Operating Subsidy		Nine-year startup operating subsidy:	\$ 25,000,000
Second Line Planning		Agency costs for planning:	\$ 6,000,000
TOTAL COST ESTIMATE³ (YOE \$):			\$1,749,000,000

Planning Assumptions: Please note that these cost estimates are based on the following planning assumptions:

Trains and Control Systems: Four-minute train frequency at peak hours, eight-minute train frequency at non-peak times, a Smart Card fare collection system, and fully automated operations.

Stations: Nineteen stations with basic design and function, dynamic signage, elevators plus up escalators, parking management and circulation features, and bus, bike, and pedestrian amenities.

Beams, Columns, Foundations: Fourteen-mile guideway with columns that are narrower and spaced farther apart than the current Seattle Center monorail with funds to improve column appearance. Emergency walkway along the guideway, premiums for nighttime construction to minimize construction impacts on nearby properties and streets, and staging tracks at which trains could be held ready during major events.

Water Crossings: A Ship Canal crossing east or west of the existing Ballard Bridge would be a new structure constructed for the monorail that would be approximately 125 feet high (high enough for ships to pass under) and have a span of up to approximately 600 feet to minimize impacts on the waterway. West Seattle Bridge crossing would be elevated on the existing structure with no traffic lane reduction or, alternatively, alongside the West Seattle Bridge.

Maintenance Facility: Basic design and function, and co-location of control center, maintenance facility, and headquarters in the same building.

Power Supply: Redundant supply and emergency backup power.

Utilities: All utility relocation costs and some undergrounding of electrical wires. A division of actual relocation work between the City and private contractors.

Rights of Way: Market value paid on the limited number of properties that must be acquired, some easements to be purchased, and high-value properties resold when construction is completed.

Hazardous Materials: Estimate was based on site review and assumes a 100% contingency in the event that additional hazardous materials are discovered.

Design and Administration: Covers all design work, bonding and insurance, contractor profits, needed overhead and administrative costs, and a public art program. Assumes that work would be completed by union contractors paying living wages to their workers, and that a comprehensive labor agreement would be developed.

The cost estimate proposed by the ETC includes a contingency for each item in the budget. These contingencies were set at different levels depending on the level of certainty or uncertainty of each item's cost. The contingency for trains and control systems, for example, is only 12%, as the cost to construct train cars and control systems is relatively certain. For hazardous materials, on the other hand, the budget includes a 100% contingency, as it is possible that additional hazardous materials that would need to be mitigated could be discovered during construction.

Reserve for sales tax. The State Legislature may allow the Seattle Popular Monorail Authority to defer the sales tax it pays, and pay sales tax over time out of its operating and maintenance budget. However, in the event that the Seattle Popular Monorail Authority is required to pay sales tax immediately, this reserve fund would be used.

Reserve for construction escalation. The costs listed above have been estimated in 2002 dollars. However, inflation over time means that the costs of labor and materials will rise each year. This reserve provides a fund that was estimated based on the region's construction cost inflation level.

Agency reserve. *The cost estimates and contingencies presented in this plan have been developed based on the decisions and scope of work outlined throughout the Plan. Should the scope of the project change, this fund would be meant to cover the additional costs that would be incurred.*

Pre-construction planning/design. *During the time before procurement documents for a design-build contract can be issued, the Seattle Popular Monorail Authority would be responsible for pre-design work and for conducting detailed environmental and preliminary engineering studies for the Green Line.*

Program management. *After a design-build contract has been awarded, the Seattle Popular Monorail Authority would be responsible for managing construction, safety certification, and system testing oversight. In addition to managing the work of its design-build contractor, it is assumed in this budget that the Seattle Popular Monorail Authority would also fund a dedicated City of Seattle permit team to process the permits that would be needed. The Seattle Popular Monorail Authority may choose to pursue a Design-Build-Operate-Maintain contract and, if so, would oversee the implementation of that contract.*

Second Line Planning. *In order to develop the 5-line, 58-mile citywide monorail system proposed in this Plan, the Seattle Popular Monorail Authority would begin work quickly on the environmental and engineering work and public involvement needed to plan a second line.*

OPERATING COSTS AND REVENUE

OPERATING AND MAINTENANCE (O&M) COSTS to run the Green Line are estimated at between \$25 and \$33 million a year, depending on the level of staffing and security at monorail stations. O&M costs include the costs to operate and maintain the Green Line, including its trains, guideway, power supply, facilities, and equipment; the overhead and operating costs of the monorail authority; and additional overhead and/or operating costs incurred by the monorail system.

Although the Green Line would be fully automated, it would require a number of staff to operate its systems. Green Line staff would include a small number of management staff; operating staff including station attendants, security personnel, and the technicians who would operate and monitor the automated controls that would drive the monorail cars; and maintenance engineers, who would service the trains and the guideway.

The ETC's current operating and maintenance budget estimate provides a staffing proposal that ranges from a low of one attendant per every two monorail stations to a high of one attendant per station. This range was developed based on the ETC's site visits to and analysis of other transit systems, including three days of operational meetings with staff at the Vancouver, B.C. SkyTrain, which operates with the lower staff level of one attendant per every two stations.

In addition to station attendants, the Green Line would have approximately three full-time armed police officers during normal operating hours. The operating and maintenance budget estimate assumes this amount would be doubled during special events.

And, in addition to station attendants and police officers at stations, this budget estimate assumes that each station would be monitored by staff at the operations center through closed circuit television systems or other technology.

Assumptions for O&M costs were developed in a range with a low, a medium, and a high cost scenario. Those assumptions and the O&M estimates they produce are listed below.

Green Line O&M Assumptions
(2020 Ridership Levels, 2002 Dollars)

	Low	Medium	High
Management Staff	8	8	8
Operations Staff	55	55	94
Maintenance Staff	54	54	72
Total Staff	117	117	174
Average Salary	\$ 88,000	\$ 88,000	\$ 83,000
Average Daily Trips	69,000	69,000	69,000
Facilities/Equipment	\$3,100,000	\$3,100,000	\$3,350,000
Services	\$3,470,000	\$3,980,000	\$5,500,000
Parts	\$2,000,000	\$2,000,000	\$2,000,000
Utilities	\$4,660,000	\$4,660,000	\$4,660,000
Insurance	\$1,000,000	\$3,000,000	\$3,000,000
TOTAL O&M COST	\$24,530,000	\$27,040,000	\$32,900,000

REVENUE to operate the Green Line is anticipated to come primarily from two sources:

- **Fares.** The fares that monorail passengers pay to ride would be used to fund the costs of operating the Green Line. For the purposes of estimating revenues for the Green Line, the ETC has evaluated ridership with several different fare levels, some similar to Metro bus fares and some assuming that value-based pricing would be implemented. Value-based pricing means that monorail riders might be charged more for taking the monorail to a special event, riding during peak hours, or riding a longer distance. The smart card fare system that would be installed at monorail stations would allow this type of variable pricing to be implemented. The ETC will not set actual fares for the Green Line; thus the revenue assumptions displayed here are simply illustrative. Fares would be established by the Seattle Popular Monorail Authority following a public review process.
- **Private Sector Funds.** Private funding, through advertising, concessions, or partnerships with private businesses, would be pursued.

Revenues were estimated using low, medium, and high scenarios. Assumptions about the factors that would constitute each of these three scenarios are summarized in the table below.

Green Line Revenue Assumptions

(2020 Ridership Levels, 2002 Dollars)

	Lower	Medium	High
Peak Fares (2002 \$)	\$1.50	\$2.00	\$2.50
Off-peak Fares (2002 \$)	\$1.25	\$1.75	\$2.25
Bus Transfer (2002 \$)	50% discount	50% discount	50% discount
Advertising	\$100,000/station	\$250,000/station	\$500,000/station

The three scenarios outlined above were then combined with the ridership estimates for weekday, event, and tourist riders to produce revenue projections for each scenario

Green Line Revenue Projections

(2020 Ridership Levels, 2002 Dollars)

	Lower	Medium	High
Commute	\$17,900,000	\$21,900,000	\$24,700,000
Events	\$ 2,875,000	\$ 4,000,000	\$ 5,000,000
Tourist	\$ 1,500,000	\$ 2,100,000	\$ 2,700,000
Fare Revenue	\$22,275,000	\$28,000,000	\$32,400,000
Advertising	\$ 1,900,000	\$ 4,750,000	\$ 9,500,000
Total Revenue	\$24,175,000	\$32,750,000	\$41,900,000

Please note that because fare levels have not yet been set, these projections are simply illustrative of revenues that could be achieved at different fare levels.

OPERATING SUBSIDY.

Using these projections, the ETC next compared the range of potential revenues with the range of estimated O&M costs to estimate whether the Green Line would require an ongoing operating subsidy.

The ETC anticipates that after initial startup, the Green Line may be able to operate without a subsidy. As a result, the cost estimate presented here includes nine years of startup operating subsidy and then assumes that the Green Line would operate without a subsidy. Should revenues fall within the lower scenario and/or O&M expenses be higher, the Seattle Popular Monorail Authority may need to take measures to address this, including considering lowering costs, raising fares, seeking outside funding sources, and/or asking voters to support continued operation of the Green Line.

The assumption that the Green Line may not need an ongoing operating subsidy is consistent with the experience of other automated transit systems around the world. Vancouver B.C.'s SkyTrain system supports itself from fares and advertising. And the Las Vegas monorail that is currently under construction is expected to cover its own operating expenses and contribute to its capital costs.

FINANCING PLAN

FUNDING TO PAY FOR GREEN LINE CONSTRUCTION COSTS has been focused around revenue sources that would be related to the use of automobiles. The ETC has taken this approach for two reasons. First, since cars have caused the congestion the monorail will help address, it makes sense to ask those who own or use cars to help pay for the system. Second, drivers would benefit from the monorail, as the monorail would divert both buses and cars from busy city streets.

The ETC received approval from the State Legislature to seek voter approval for any or all of three potential local tax options related to automobile use: a Motor Vehicle Excise Tax (MVET) of up to 2.5%, motor vehicle license fee (car tabs) of up to \$100 per car, and a tax on car rentals of up to 1.944%. In addition to these automobile-related tax sources, the ETC also was authorized to seek voter approval for a regular property tax levy of up to \$1.50 per \$1,000 of assessed valuation.

After considering its tax options, the ETC has proposed a Motor Vehicle Excise Tax (MVET) of 1.4%. The ETC has proposed an MVET because it is both economically and environmentally progressive. It costs more for people who own more expensive cars and provides an incentive for people to own fewer cars.

The MVET would apply to all vehicles registered by residents in the City of Seattle, except for vehicles that would be exempt from the MVET per State law. The ETC understands that the following types of vehicles would be exempt:

- Vehicles owned by governments (including transit agencies) (RCW 82.44.010)
- Vehicles used entirely on private property (RCW 82.44.010(2))
- Vans used for ridesharing (RCW 82.44.015)
- Mobile homes, travel trailers, and campers (RCW 82.44.010(2))
- Vehicles owned by nonresident military personnel (RCW 82.44.010(2))
- Private school buses (RCW 46.16.035, 82.44.010)
- Vehicles registered by leasing corporations (i.e. rental cars) (RCW 82.44.023)
- Tribal members (WAC 308-96A-400)
- Medal of Honor recipients (RCW 46.16.305)
- Disabled Veterans and Prisoners of War (WAC 308-96A-046)
- Taipei Economic Cultural Office (RCW 82044.025)

To calculate the amount of MVET you would owe for the monorail each year, simply multiply the value of your car by 0.014.

The ETC also understands that car dealers would be exempt from paying the MVET on vehicles in their lots. The MVET would be paid only when a vehicle is purchased, and then would be paid annually by the purchaser of the vehicle not by the car dealer.

A 1.4% MVET would annually cost each car owner 1.4% of the value of the car, as determined by the State Department of Licensing. To calculate the amount of MVET owed for the monorail, a car owner would simply multiply the value of the car by 0.014.

The median car in Seattle, that is the level at which half the cars in Seattle are worth less and half are worth

more, is currently valued at \$6,700. For the owner of the median car, the 1.4% MVET would equal \$94 a year. However, the MVET can be deducted from Federal income tax by those who itemize. For the median car owner who itemizes, the after-tax cost of the MVET would drop from \$94 to \$68 a year, assuming that the car owner has a marginal income tax rate of 27%.

The following chart shows the annual cost of a 1.4% MVET for different types of cars:

Type of Car	Annual Tax per Car Without Federal Tax Deduction	After-tax cost per Car With Federal Tax Deduction
Median Seattle car (value \$6,700)	\$ 94.00	\$ 68.00
1987 Nissan pickup (value \$1,000)	\$ 14.00	\$ 10.00
1998 Ford Windstar (value \$11,000)	\$150.00	\$110.00
2000 Honda CR-V (value \$18,000)	\$246.00	\$179.00

Note that Federal tax deduction assumes a 27% marginal tax rate.

The Seattle Popular Monorail Authority will not, without voter approval, issue more than \$1.5 billion (in 2002 dollars) principal amount of debt to finance Phase I costs (the "Bonding Limit"). The Bonding Limit will automatically increase from \$1.5 billion (in 2002 dollars) by an annual adjustment to account for inflation (measured by reference to the Seattle Building Cost Index maintained by Engineering News Record or, in the event that such index is no longer published or otherwise available, by reference to a comparable building cost inflation index selected by the Seattle Popular Monorail Authority). This Bonding Limit does not apply to debt incurred to finance or refinance obligations previously issued or incurred within the Bonding Limit.

As noted above, the risk analysis conducted for the monorail determined that these bonds, if issued as soon as possible after a successful vote, could take advantage of current low interest rates.

The ETC's financing plan – with its recommendation for a 1.4% MVET – was developed based on a detailed, year-by-year financing model that correlates the project's anticipated construction schedule (and therefore the need for funds and, eventually, the availability of revenues) with bond issuance and repayment. This financing model is available for review at the ETC offices.

The ETC estimates that the 1.4% MVET would cover Phase I costs, including project costs, financing costs, reserves, agency costs for overhead and operations, Green Line construction, startup operating subsidy, and planning of a second monorail line.

The Seattle Popular Monorail Authority will not, without future voter approval, continue to levy the MVET after all debt issued to plan, finance, build, acquire, complete, operate, charge for, or maintain Phase I, or debt issued to refund such debt, has been repaid or its payment irrevocably provided for. The Seattle Popular Monorail Authority will adopt policies governing any debt refinancing to provide that any such refinancing or restructuring benefits taxpayers.

Further, the Seattle Popular Monorail Authority will not accumulate a surplus from the proceeds of the MVET beyond Phase I expenses, except as determined by the SPMA Board to be required for prudent management of the Seattle Popular Monorail Authority, including without limitation funding for agency overhead and operations, debt service reserves, complying with debt covenants, and providing for reasonable construction and operational contingencies. If a surplus would otherwise accrue, the Seattle Popular Monorail Authority should consider shortening the term of debt, or reducing the MVET rate.

If the SPMA Board determines to proceed with any proposed additional phases beyond Phase I, then proposals for raising funds to pay for them shall be submitted to the voters. And, should revenues prove to be lower than operation and maintenance expenses plus debt service, the Seattle Popular Monorail Authority shall take measures to address this, including considering lowering costs, raising fares, seeking outside funding sources, and/or asking voters to support continued operation of the Green Line.

Without limiting the foregoing paragraphs, if the Seattle Popular Monorail Authority determines that the long-term operation of the Green Line (i.e., payment of the costs of future operation and maintenance after Phase I debt has been repaid or its payment irrevocably provided for) requires ongoing taxpayer subsidies, the Seattle Popular Monorail Authority will seek voter approval for any such subsidies.

³*Exclusive of financing costs*

NEXT STEPS

This ETC Seattle Popular Monorail Plan presents a proposal that has been shaped and strengthened through extensive community outreach and rigorous technical review. It will now be presented to the voters this November. If the ballot measure is successful, the Elevated Transportation Company would be dissolved and replaced by the Seattle Popular Monorail Authority, which would implement this Plan by building and operating the Green Line and planning for additional monorail lines.

Thousands of people have taken the opportunity to comment on the monorail plan or propose suggestions by attending public meetings, sending letters and e-mails, and calling ETC staff or Board members. Their insights have been extremely valuable as the ETC has considered route and station alternatives and monorail construction and operations.

In addition to the community outreach process, the monorail plan has been scrutinized by technical experts, including independent industry evaluators who reviewed the ETC's proposed capital budget; private cost estimators who helped refine the ETC's capital and O&M budget estimates; economists who conducted benefit-cost analysis on the monorail proposal; and independent project analysts who evaluated the financing plan, budget, and schedule in light of the risks the project could face. This technical review provides a greater level of certainty about the feasibility of the monorail proposal.

Now that the Seattle Popular Monorail Plan for Phase I of the monorail system is complete, it will be subjected to another level of review in that it will be placed before Seattle voters, who will determine whether the ETC Seattle Popular Monorail Authority should be created and whether the monorail plan should be funded.

BIBLIOGRAPHY

For those wishing more information on any of the subjects covered in this Plan, the following technical documents can be viewed at the offices of the Elevated Transportation Company at 701 Fifth Avenue, Suite 3600 and/or the Web at www.elevated.org. These documents include:

Environmental Analysis

Draft Environmental Impact Statement

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General

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