

Red Line/HealthLine Extension Major Transportation Improvement Analysis

Alternatives Analysis Methodology Report



GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

**RED LINE / HEALTHLINE EXTENSION
MAJOR TRANSPORTATION IMPROVEMENT ANALYSIS**

ALTERNATIVES ANALYSIS METHODOLOGY REPORT

VERSION 5



Prepared by:

AECOM

1001 Lakeside Avenue, Suite 1010
Cleveland, OH 44114

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1. Purpose of Report

The purpose of this methodology report is to define the analysis process and methods used for the development, screening and evaluation of No Build, Do Minimum and Build transit alternatives being considered by the Greater Cleveland Regional Transit Authority (RTA) for the Red Line/HealthLine Extension study. The No Build alternative is a planning scenario that would result in “business as usual” consisting of existing and committed projects. The Do Minimum alternative consists of improvements to the transit network that do not require major capital improvements. A Build alternative is defined as an alignment, station locations and mode (e.g., regional rail, heavy rail, light rail, bus) or highway and bus network improvements.

The Red Line/HealthLine Extension Study will develop a considerable body of information on the costs, benefits, and impacts of a variety of transit alternatives and policies under investigation by RTA. An evaluation framework is needed to organize this information in such a way that decision-makers can understand the implications of each alternative and consider the trade-offs involved in selecting a locally preferred alternative (LPA).

This report outlines a structured multi-step process designed to sort through an array of potential alignment and technology options. This methodology report also summarizes the scope of the alternative analysis and project justification and appraisal phases of project development and the steps involved in performing the evaluation and assessments of various transit investment options that will result in a locally preferred alternative.

2. Introduction

The RTA has initiated the Red Line/HealthLine extension study to evaluate transit investment options and compare them to other public transportation system improvements and policies as part of implementing its current strategic plan. The need for the Red Line/HealthLine extension study arises from the findings of RTA’s 2010-2020 Strategic Plan, which serves as a roadmap to reimagining its future. The plan describes actions for refocusing, restructuring, renovating, reallocating and reenergizing RTA’s services and capital investment programs. The strategic plan is a systems level planning document that identifies transportation problems throughout the Greater Cleveland area and proposes an extensive set of solutions, including the establishment of priority transit corridors. The priority corridors and their improvements would be completed in collaboration with the individual cities and communities where the corridors are located.

The strategic plan clearly indicates the urgency of restructuring RTA services to increase the proportion of passenger trips using public transportation, to relieve traffic congestion on the local roadway network and to regenerate economic development in transit corridors. The existing rail and bus rapid transit system would continue to provide a high quality transit spine in Greater Cleveland with direct links among Downtown, University Circle, Cleveland Hopkins International Airport (CLE) and other key locations. The Red Line/HealthLine extension study major transportation improvement analysis will build on the findings and recommendations of the strategic plan and evaluate other reasonable alternatives in the high priority transit corridors identified in the service area under study.

The study area includes the northeast portion of Cuyahoga County bounded by Lake Erie on the north and Lake County on the east and contains portions of three cities: Cleveland, East Cleveland, and Euclid as discussed in Section 2.1 below. Additional public transportation investment can improve urban character and form by reconnecting neighborhoods and communities in the study area with quick and reliable transit services to Downtown Cleveland and University Circle — Ohio’s two largest business districts. Consequently, RTA is investigating the feasibility of extending enhanced high quality transit service (such as bus or rail rapid transit) east from Louis Stokes Station at Windermere along potential

route alignments linking Windermere to the City of Euclid. The proposed Red Line/HealthLine extension project can restructure service on Greater Cleveland’s northeast side by improving access to University Circle, Midtown and Downtown and by reducing travel time and cost from the furthest reaches of RTA’s eastern service area. By providing additional mobility options and improving access to the region’s core throughout the day, redevelopment opportunities will be increased in this part of the RTA service area resulting in substantial economic benefits, which improves regional competitiveness.

2.1 Red Line/HealthLine Extension Study Area

The study area includes the northeast portion of Cuyahoga County bounded by Lake Erie on the north and Lake County on the east and contains portions of three cities: Cleveland, East Cleveland, and Euclid. Specifically, the study area and corridor for the Red Line/HealthLine extension study starts approximately at the CSX Short Line right-of-way in the west (and adjacent former Cleveland Union Terminal railroad) and extends east along the southern boundary defined by the geophysical bluff feature separating the lake plain from the heights area of Cleveland. Figure 2-1 Study Area map illustrates the study area. The transit alternatives that will be evaluated are located within the defined limits of this study area.

Figure 2-1 Study Area



This area is well-served by public transit. Transit services include the Red Line heavy rail and HealthLine bus rapid transit lines, which start at Louis Stokes Station at Windermere. Local bus routes include: 1 (St. Clair); 3 (Superior); 28 (Euclid Avenue); 37 (E. 185 / Taylor); 34 (E. 200 / Green); 39 (Lakeshore); and 94 (E. 260/Richmond). A commuter bus service Route 239 operates from the Euclid Park-N-Ride located at St Clair Avenue and Babbitt Road near the Euclid Square Mall to Downtown Cleveland via I-

90. Laketran provides connecting local bus services at Shoregate Shopping Center in adjacent Willowick and operates express commuter buses from Lake County to Downtown Cleveland.

3. Project Evaluation and Appraisal Framework

The alternatives analysis will comply with FTA requirements for evaluating New Starts transit projects in the United States with regard to mobility improvements, environmental benefits, cost effectiveness, operating efficiencies, economic development effects and technical feasibility. In addition, the preferred build alternative will be subjected to an abbreviated appraisal process utilized by the Department for Transport (DfT) in the United Kingdom to compare the likely benefits and disbenefits of the project against its likely costs. Specifically, the preferred build alternative will be evaluated in terms of making a business case that demonstrates the project represents value for money.

3.1 Framework for Alternatives Analysis

A basic framework for evaluating alternatives is outlined in prior FTA guidance. The FTA guidance for alternatives analysis is considered from several different perspectives:

- **Effectiveness** – the extent to which each alternative meets established goals and objectives, including transportation and sustainability goals.
- **Impacts** – the extent to which the project supports economic development, environmental or local policy goals;
- **Cost effectiveness** – to show the trade-off between the effectiveness of an alternative and its capital and operating costs.
- **Financial feasibility** – the ability to obtain the financial resources needed to build and operate an alternative.
- **Equity** – the distribution of costs and benefits.

The evaluation framework will use the FTA perspectives as a basic organizing structure. Within this structure, goals and objectives will be used to establish the specific evaluation criteria to be addressed that satisfy the project purpose and need. RTA is a signatory to newly adopted sustainability guidelines of the American Public Transportation Association (APTA). The APTA requirements related to sustainability will be included in the evaluation framework.

3.2 Corridor Focus

In contrast to systems planning, corridor planning allows for a more detailed analysis of the costs and benefits necessary to select a mode and alignment. For the most part, each corridor of an urban region has travel patterns that are independent of those in other corridors. Consequently - and unlike systems planning, where highway and transit networks change on a regional scale - corridor planning requires transportation networks to be the same outside of a given corridor so that the costs and benefits of alternatives can be properly identified. By focusing project decision-making at the corridor level, sufficient information on the costs and benefits of each mode and alignment alternative can be produced to provide a sound technical basis for selecting a preferred alternative.

3.3 Multi-Step Screening and Evaluation Process

There must be a rational framework to screen options that eliminate the alignments and technology or service options with obvious fatal flaws or major deficiencies that are “Red Flags.” Most importantly, these flaws or deficiencies need to be documented in a fairly systematic way with sufficient justification to convince RTA decision makers and other stakeholders that the alternatives should not be pursued further. This screening should be structured to permit as many early decisions as possible to simplify

large, complex sets of alternatives so that both the technical work and the volume of information provided to decision makers can be kept to manageable level.

Using a multiple screening framework, alternatives that either have fatal flaws or little opportunity to enhance public transportation in the study corridors will be eliminated. At the earliest stages of the process, a wide range of single-mode alternatives will be evaluated at a broad level against a select few measures that have the greatest potential to discriminate among the alternatives.

This basis for evaluation allows the benefits and impacts of each alternative to be measured with an objective set of criteria that relate to the specific needs for this project. As the evaluation progresses with respect to these criteria, the most suitable options will emerge for more detailed analysis, eventually leading to the adoption/confirmation of the locally preferred alternative by local decision makers. While the methodology offers an objective procedure for comparing potential public transportation options in this specific corridor, it also takes into consideration criteria for evaluating public transportation projects based on an economic appraisal facilitating fully informed decision making. This stream of activities begins by:

- defining the purpose and need for transportation improvements within the study area,
- identifying reasonable and feasible alternatives to be evaluated,
- providing conceptual planning of the alternatives in sufficient detail to provide relative order of magnitude capital cost estimates of the alternatives,
- evaluating the public transportation system improvements that might result from each, and
- analyzing the alternatives with screening criteria based on project goals developed during initial project scoping.

The primary purpose of each step in the screening process is to identify those alternatives that best meet study area needs. Additionally, the screening process should provide insight into how the alternatives can be refined or modified to improve its effectiveness in satisfying local goals and objectives. And finally, the screening process should identify logical sub-areas for analysis and to prioritize and concentrate study resources in those corridors and sub-areas that make the most sense.

Typically the evaluation methodology is a three-step process, whereas increasingly detailed and comprehensive measures of effectiveness (MOEs) are applied to a decreasing number of alternatives. Each step in the evaluation process is thus designed to focus the analysis on progressively fewer alternatives with higher levels of scrutiny. As the process progresses, more quantitative and less qualitative measures are implemented. This analysis will result in the recommendation of a preferred build alternative. In the final step of the evaluation process, the preferred build alternative will be evaluated and compared to the No Build and the Do Minimum Alternatives. The feasibility appraisal process will include the analysis of the DfT “value for money” based on New Approach to Transport Appraisal (NATA) and the revised criteria recently published by FTA. Only one preferred build alternative will be advanced to Tier 3 level of screening, which will compare and contrast the preferred build alternative to the No Build and Do Minimum alternatives where the business case for a locally preferred alternative will be more fully developed and benefit/cost analysis completed.

A description of the indicative evaluation process used to screen alternatives and select the preferred alternative is described below:

Tier 1 Preliminary Screening of the Initial Alternatives

- Meets purpose and need
- Fatal flaw analysis
- Constructability, cost and right-of-way impacts

- Use of GIS to determine station catchment area population and employment
- Mostly qualitative scoring based on comparable systems data

Tier 2 Screening of the Promising Alternatives Advanced from Tier 1 Screen

- A more rigorous and mostly quantitative analysis
- Relies on a detailed definition of each alternative
- Requires conceptual level engineering and order of magnitude capital costs
- National benchmarking for operating and maintenance costs
- Application of STOPS national travel demand model
- Selection of preferred build alternative

Tier 3 Final Screening: Feasibility Study and Appraisal of Preferred Alternative

- More refined capital and operating costs
- Application of a validated travel demand model for ridership estimates
- Introduction of economic analysis
- Introduction of calculated financial analysis
- Appraisal of benefit cost ratios
- Final Report (Business Case)
- Identification and selection of locally preferred alternative (LPA)

3.4 Assessment, Evaluation and Appraisal Methods

The evaluation process uses a combination of assessment, evaluation and appraisal methods to ascertain the reasonableness and feasibility of alternatives under consideration based on a multi-level or tiering process. Logic and reasoning is used throughout the multi-step screening process outlined in this methodology. Different methods of comparative evaluation of the relative merits of alternatives can be employed at levels of screening. These include:

Logic - This method of analysis is based on a description of the alternatives, examining the affected environment and discussing issues associated with each alternative. Using logical reasoning based upon extensive experience, certain alternatives can be discarded as fatally flawed.

Scoring and Qualitative Assessment - This process involves filling in a Multiple Accounts Evaluation matrix that has a listing of evaluation criteria and a listing of each alternative. Based on a technical evaluation, a "score" is given to each alternative for each criterion. Because this process tends to be subjective, caution must be exercised when employing this technique. This technique should be used as a helpful guide not an absolute formula. Table 3-1 provides a framework for the scoring of qualitative assessments. Where qualitative scoring is used, it can be based on a seven-point scale as noted:

Table 3-1 Framework for Qualitative Assessment

| Scale of benefit/effect | | Number of people or instances affected by the benefit/effect | | | |
|-------------------------|------------------------|--|----------|----------|------|
| | | Majority | Moderate | Isolated | None |
| | Significantly positive | ✓✓✓ | ✓✓✓ | ✓✓ | - |
| | Moderately positive | ✓✓✓ | ✓✓ | ✓ | - |
| | Slightly positive | ✓✓ | ✓ | ✓ | - |
| | None | - | - | - | - |
| | Slightly adverse | xx | x | x | - |
| | Moderately adverse | xxx | xx | x | - |
| | Significantly adverse | xxx | xxx | xx | - |

An example of this scoring can be seen in a qualitative assessment of noise impacts. The noise levels of heavy rail trains are quite high and can have a significant impact on sensitive noise receptors such as schools, hospitals, churches, performing arts centers and residential dwellings. The scale of the effect is significantly adverse. If the number of people or instances affected by the noise is isolated, then the qualitative score for the alternative is “moderate.”

Quantitative Analysis - This method of evaluating alternatives relies on quantitative measurements to identify major advantages and disadvantages of each alternative and to select a preferred alternative. The major appraisal tools include: Geographic Information System (GIS) analysis; travel market and available demand data analysis; travel demand model (if available); indicative Cost-Benefit analysis and valuation; and benchmark data.

3.5 Assessment, Evaluation and Appraisal Guidance

Alternatives analysis has been a key part of the FTA New Starts process for advancing fixed guideway transit projects in the United States for over 30 years until recent legislation eliminated the need for a separate Alternatives Analysis Report. Instead, the new legislation relies on reviewing alternatives analyses performed during the metropolitan planning phases of project planning. However, because RTA’s Red Line/HealthLine extension major transportation improvement analysis is funded by a competitive legacy Section 5339 Alternatives Analysis grant, the study process will follow the legacy guidance for alternatives analysis. This includes a project initiation package and related materials.

The alternatives analysis is a locally managed study process that relies to a large extent on information about regional travel patterns, problems, and needs generated as part of the metropolitan transportation planning process, as specified by 23 CFR Part 450 FTA/Federal Highway Administration (FHWA) Joint Final Rule on Metropolitan and Statewide Planning. Local agencies participating in an alternatives analysis have broad latitude in how the study is to be conducted. The RTA 2010-2020 Strategic Plan and NOACA Long Range Regional Transportation Plan satisfies the general requirements of the Joint Final Rule on Metropolitan and Statewide Planning. Red Line/HealthLine extension alignments are considered to be provisional to start the evaluation process. The provisional alternatives will be revisited as part of the project scoping process.

FTA issued its New and Small Starts Evaluation and Rating Process Final Policy Guidance (August 2013) that provides detail on and methods for calculating project justification and local financial commitment criteria specified in statute and guidance included in the final rule that was published January 9, 2013. The final rules and its appendix provide a framework for FTA’s project evaluation process, and the August 2013 policy guidance elaborates and offers details on the New Starts and Small Starts processes. The Red Line/HealthLine extension study will adhere to the August 2013 guidance, which can be found at the FTA Capital Investment Program website:

http://www.fta.dot.gov/documents/NS-SS_Final_PolicyGuidance_August_2013.pdf

The FTA evaluation criteria include:

- Mobility improvements – total number of trips using the project with a weight of two given to trips that would be made by transit dependent people.
- Economic development effects – the extent to which a proposed project is likely to induce additional, transit-supportive development in the future based on a qualitative examination of the existing local plans and policies to support economic development proximate to the project.
- Environmental benefits - the dollar value of the anticipated direct and indirect benefits to human health, safety, energy, and the air quality environment scaled by the annualized capital and operating cost of the project. These benefits are computed based on the change in vehicle miles travelled (VMT) resulting from implementation of the proposed project.
- Cost effectiveness - the annualized capital and operating and maintenance (O&M) cost per trip on the project.
- Land Use - station area population densities, total employment served by the project, and the proportion of “legally binding affordability restricted” housing within ½ mile of station areas to the proportion of “legally binding affordability restricted” housing in the counties through which the project travels.
- Congestion relief- a measure yet undefined by regulation or guidance.
- Local financial commitment - evidence of stable and dependable financing sources to construct, maintain and operate the transit system or extension, and maintain and operate the entire public transportation system without requiring a reduction in existing services.

The livability principles articulated by the Partnership for Sustainable Communities, which is a collaborative effort of the US Departments of Transportation (DOT), Housing and Urban development (HUD) and the US Environmental Protection Agency (EPA) to help American families gain better access to affordable housing, better transportation options and lower transportation costs also will be used to evaluate alternatives.

These livability principles are:

- Provide more transportation choices. Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation’s dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health;
- Promote equitable, affordable housing. Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation;
- Enhance economic competitiveness. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers, as well as expanded business access to markets;
- Support existing communities. Target federal funding toward existing communities—through strategies like transit oriented, mixed-use development, and land recycling—to increase community revitalization and the efficiency of public works investments and safeguard rural landscapes;
- Coordinate and leverage federal policies and investment. Align federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy; and
- Value communities and neighborhoods. Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.

3.6 Business Case Appraisal Guidance

RTA proposes to use a business case approach in developing an appropriate alternative for stakeholder consideration. The Business Case frames the case for project justification and appraises the project in terms of benefit/cost analysis (BCA). The basic inputs provided to the Business Case include:

- Ridership estimates, average daily and annualized boardings and transit trips;
- Automobile trips diverted to transit and each transportation mode's market share;
- User benefits: Travel time savings for transit and highway users;
- Non-user benefits: agglomeration and environmental benefits;
- Capital expenditure;
- Operation and maintenance (O&M) costs; and
- Cash flow estimates for project implementation and 20 years after service start.

The business case approach is part of the long established DfT project development and appraisal process. This is set out in a set of exhaustive web hosted guidance documents that can be found at <http://www.dft.gov.uk/webtag/> and is the basis for many of the newly revised project justification measures promulgated by the FTA.

4. Goals and Objectives

Goals and objectives for a project grow from the purpose and need of the project, which are based on the strategic goals and guiding principles of the RTA established in the 2010-2020 Strategic Plan. The purpose of the proposed extension is to relieve congestion, improve the quality of life, enhance sustainability, increase mobility and accessibility and channel development to the study area. The need for this project stems from expected population and employment changes leading to increased travel demand and the requirement for a more sustainable transportation system.

Based on the review of regional goals and objectives identified in previous studies and plans; FTA's project justification requirements under MAP-21 for Small/New Starts Projects; and DOT-HUD EPA Livability Principles, goals and objectives for the Red Line/HealthLine Extension were developed. The review of the previous studies and development goals and objectives is detailed in the Purpose and Need Statement (October 2013).

The following goals and objectives are proposed for the Red Line/HealthLine Study:

| Goals | Objectives | Corresponds to |
|--|---|---|
| <p>1. Improve mobility for Cleveland residents, employees, customers and visitors.</p> | <ul style="list-style-type: none"> ▪ Provide more transportation choices, especially for transit dependent groups, such as low-income and minority populations, and the aged to jobs, housing and other trip purposes. ▪ Provide high-quality bus and rapid transit service for local trips between new employment in the eastern suburbs and the core study area, as well as for access to key core destinations, including University Circle and downtown Cleveland. ▪ Increase transit ridership and mode share for all communities. ▪ Establish a more balanced transportation system which enhances modal choices and encourages walking, bicycle and transit use. | <ul style="list-style-type: none"> ▪ FTA's <i>Mobility Improvements</i> Justification Criteria ▪ DOT-HUD's Livability Principles - <i>Provide more transportation choices; Value communities and neighborhoods.</i> |
| <p>2. Contribute to and serve as a catalyst for economic development.</p> | <ul style="list-style-type: none"> ▪ Encourage transit-oriented mixed-use development along the corridor that would support population and employment growth along the corridor. ▪ Reinvest in the local economy by maximizing the economic impact of transportation investments as related to land use redevelopment, infrastructure improvements, and housing. ▪ Support regional economic development initiatives. ▪ Incorporate considerations into new development design that support transit as a transportation option. | <ul style="list-style-type: none"> ▪ FTA's <i>Economic Development and Land Use</i> Justification Criteria ▪ DOT-HUD's Livability Principles - <i>Enhance economic competitiveness; Support existing communities.</i> |
| <p>3. Enhance livability, reuse and long-term environmental benefit.</p> | <ul style="list-style-type: none"> ▪ Minimize adverse air, land and water environmental impacts of transportation investments. ▪ Conserve transportation energy. ▪ Serve households at a range of income levels. ▪ Support lifestyle choices for environmentally sustainable communities. ▪ Implement strategies for reducing transportation-related greenhouse gas emissions. ▪ Promote green and sustainable technologies and solutions that enhance economic development opportunities. | <ul style="list-style-type: none"> ▪ FTA's <i>Environmental Benefits, Economic Development and Land Use</i> Justification Criteria ▪ DOT-HUD's Livability Principles - <i>Value communities and neighborhoods; Promote equitable, affordable housing; Enhance economic competitiveness; Support existing communities.</i> |
| <p>4. Improve the image and identity of the residential, commercial, and industrial areas through infrastructure improvements.</p> | <ul style="list-style-type: none"> ▪ Support private investments in transit friendly, and pedestrian and bicycle-focused developments. ▪ Support improvements in neighborhood connectivity through attention to safety, comfort and aesthetics in the design of transportation infrastructure. ▪ Serve areas of and complement initiatives for affordable housing. | <ul style="list-style-type: none"> ▪ FTA's <i>Environmental Benefits, Economic Development and Land Use</i> Justification Criteria ▪ DOT-HUD's Livability Principles - <i>Value communities and neighborhoods; Enhance economic competitiveness; Support existing communities.</i> |

5. Alternatives Analysis Scope of Work

The alternatives analysis process may be divided into four phases and three tiers of analysis as depicted in the flow diagram depicted in Figure 5-1:

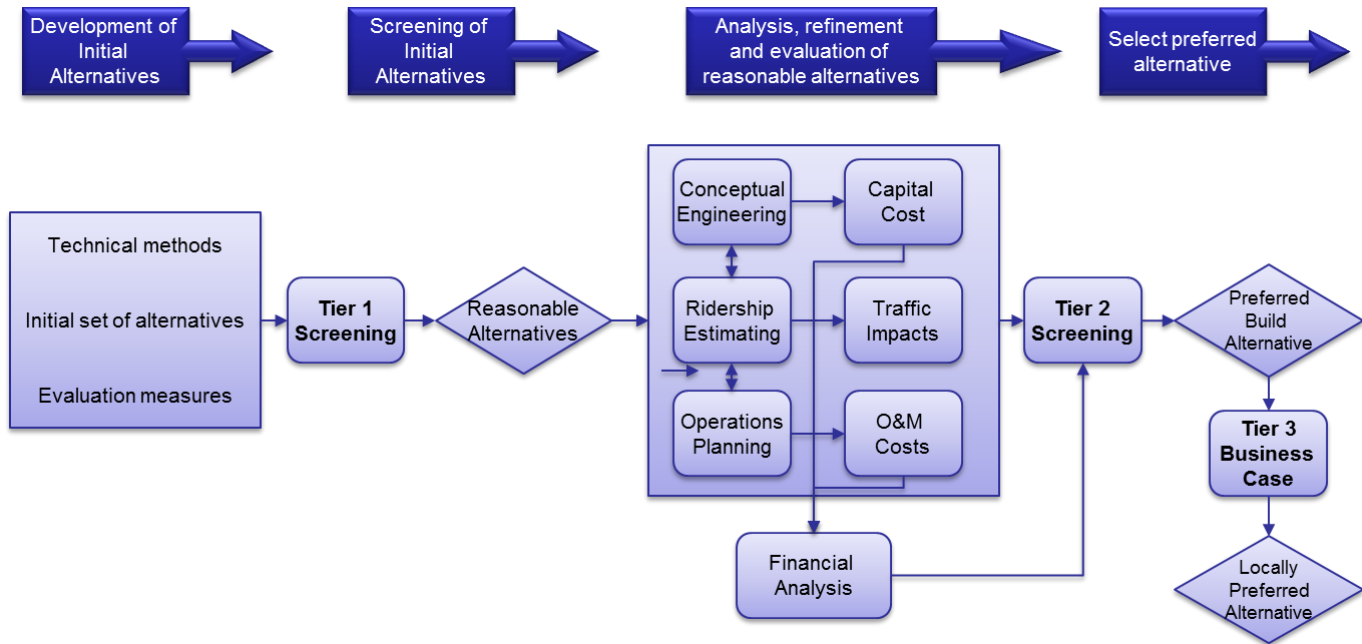


Figure 5-1 Alternatives Analysis Flow Chart

These phases of alternative development and tiered analysis necessarily follow one another in sequence, with the results of each phase and analysis tier serving as necessary inputs to the following phase. The preferred build alternative is then subjected to a project justification and appraisal process designed to permit decision-makers to determine whether the project should be funded and constructed. Only one preferred build alternative will be advanced to Tier 3 level of screening, which will compare and contrast the preferred build alternative to the No Build and Do Minimum alternatives where the Business Case for the LPA will be more fully developed and benefit/cost analysis completed.

5.1 Alternatives Identification Process

There is no hard-and-fast rule regarding what constitutes a reasonable range of alternatives. What constitutes a reasonable range of alternatives depends on the nature of the proposed project and the facts of each case. At the same time, the concept of alternatives must be bounded by some notion of feasibility. The range of alternatives to be considered need not extend beyond those reasonably related to the purposes of the project bounded by feasibility. Reasonable alternatives include those that are practical or feasible from a technical and economic standpoint using common sense, rather than simply desirable from some biased viewpoint. Each alternative should be defined in a way that makes it competitive within the overall set of alternatives under consideration. The alternatives must, within the limits of their technology, respond to the transportation needs in the corridor. Each of the alternatives will be refined to optimize its performance in the corridor. Each mode, alignment and technology has different strengths and limitations. Consequently, it is important that each alternative be refined to ensure that its specifications and operating policies make maximum use of the physical facilities that it would provide.

5.1.1 Alternatives Previously Identified

The Red Line/HealthLine extension study alternatives analysis will rely on the provisional alignment alternatives developed as part of the project initiation phase as a starting point. The RTA 2010-2020 Strategic Plan identified the St Clair and Euclid corridors as priority transit corridors that reinforced the need for transit investments to foster redevelopment in the service catchment area.

5.1.2 Scoping and Stakeholder Meetings

Project scoping workshops with the RTA and stakeholder meetings were conducted during the summer of 2013. Initial alternatives developed for the project were based on discussions in conjunction with the other considerations described above. More detailed information on specific comments received as part of the scoping process will be provided in the Minutes of Meetings from the stakeholder workshops and public meetings conducted in September 2013. Stakeholder and community involvement will be documented in the Alternatives Analysis Report.

5.1.3 Field Reviews and Reconnaissance

Extensive field reviews were conducted during the initial alternative identification process to clearly identify existing rights-of-way, potential new right-of-way, typical sections, building setbacks, landscaping features and adjacent land use/destinations that could be served by potential transit stations and technology options. This information will be combined with other field notes, aerial imagery, and other GIS mapping to identify opportunities and constraints along any particular corridor and potential right-of-way within the project area. This will be presented in a series of maps produced as part of the screening process.

5.1.4 Alternatives to be Evaluated

The principal characteristics of the Red Line/HealthLine extension initial Build alternatives are given in Table 5-1 below. These initial alternatives were developed as part of agency scoping meetings, Steering Committee meetings and guided by stakeholder and public comments at a series of Public Meetings and Open Houses held during early September 2013.

Table 5-1 Principal Characteristics of Initial Build Alternatives

| Route Alignment | | Terminus | Heavy Rail/DMU | | BRT or Rapid + | |
|-----------------|--|------------------------|----------------|----------|----------------|----------|
| | | | Miles | Stations | Miles | Stations |
| A | CSX Short Line | Euclid Square Mall | 7.43 | 6 | | |
| A2 | CSX Short Line (LRT/tram) | Downtown Euclid | 9.75 | 12 | | |
| A3 | CSX Short Line (LRT/tram) | Downtown Euclid | 9.75 | 12 | | |
| B | NS Buffalo Line | Euclid Park-N-Ride | 6.51 | 8 | | |
| C | Hayden - St Clair - E 152 nd - E. 156 th Lakeshore | Downtown Euclid | | | 9.34 | 17 |
| D | Hayden - St Clair - E 185 th Lakeshore | Downtown Euclid | | | 9.21 | 18 |
| E | Euclid - E 152 nd - E. 156 th - Lakeshore | Downtown Euclid | | | 9.38 | 18 |
| F | Euclid - E 276 th | East 276 th | | | 6.78 | 15 |
| G1 | Euclid (Coit) - E. 185 th - Lakeshore | Downtown Euclid | | | 9.26 | 18 |
| G2 | Euclid (Ivanhoe) - E. 185 th - Lakeshore | Downtown Euclid | | | 9.52 | 19 |
| H | Euclid - E 222 nd - Lakeshore | Downtown Euclid | | | 9.07 | 19 |
| I | Euclid - Chardon/E 200th- Lakeshore | Downtown Euclid | | | 6.90 | 18 |

In addition to any of the preferred Build alternatives a No Build and a Do Minimum Alternative will also be analyzed for comparison. The No Build Alternative typically includes all regional transportation actions in the financially constrained NOACA long range regional transportation plan. This is generally considered the existing plus committed (E+C) projects in the long range transportation improvement plan (TIP). The Do Minimum baseline alternative considers transportation system management (TSM) actions that could be taken to provide the best transit service in the project study area without a major capital investment such as the Red Line/HealthLine extension Build alternatives. The No Build and Do Minimum baseline

alternatives will be carried forward throughout the entire alternatives analysis and project appraisal process.

A comparative evaluation of advantages, disadvantages and cost differences of the alternatives will be conducted following the legacy FTA guidance for alternatives analysis. Each of the Build alternatives will be analyzed for the impact on the transportation system, environment, costs and financial feasibility as compared to baseline alternatives defined as the No Build and Do Minimum alternatives.

5.2 Screening and Evaluation Criteria

Screening and evaluation criteria will be used to measure the effectiveness of attaining the goals and objectives agreed to for the metro project. Criteria are also included for each of the evaluation perspectives recommended by FTA. A significant number of the criteria address the goals of improving mobility, relieving traffic congestion, providing improved accessibility and increasing sustainability.

The selected criteria will differentiate between the various metro alternatives that are being considered in the Red Line/HealthLine extension study. For example, the alternatives can be compared in terms of such factors as transit travel time; ridership; service to existing residences, jobs, and zero car households; and cost. A number of the criteria will be useful for comparisons between transit improvements and highway improvements. These include travel time savings, mode share, vehicle miles of travel, displacements, land consumption, and financial feasibility.

FTA's New Starts Criteria are included to the extent that they will be helpful in distinguishing among the metro alternatives. Data for addressing the evaluation criteria will come from a variety of sources. Many will come directly from or are derived from the travel demand forecasting model and from engineering and environmental assessments. The criteria used in the screening included the following indicative areas:

- **Mobility:** Does the proposed alternative improve mobility and connectivity within the area's transportation system? How many trips does the alternative generate and how many trips are made by transit dependent populations?
- **Accessibility:** Does the proposed alternative improve access to opportunities such as employment, education, and health care for area residents?
- **Transport System Capacity:** Does the proposed alternative improve the capacity, reliability and quality of the regional transit system?
- **Cost:** Does the proposed alternative attract sufficient numbers of riders at a reasonable capital and operating cost?
- **Environmental:** Does the proposed alternative improve the quality of the natural environment with a minimum of harmful impacts?
- **Compatibility with Land Use:** Does the proposed alternative fit within the context of the area's existing land use? Does the proposed alternative comply with economic development and Transit-Oriented Development plans for the area?
- **Equity:** Does the proposed alternative disproportionately burden or alleviate the burden on minority populations?
- **Constructability:** Can the proposed alternative be inserted into the urban environment? Can it be constructed within a reasonable time frame, with a minimum of impact on the existing transit system and existing land owners, and by utilizing existing infrastructure?

An additional level in the alternatives evaluation hierarchy is the performance measures. Performance measures are very specific and detailed metrics that will be established for each evaluation criterion.

These metrics are developed for the purpose of measuring and evaluating the relative performance of each of the alternatives according to each criterion. Measures of effectiveness will be developed collaboratively with the RTA. These measures will be applied in a way that permits an increasing level of analysis with each successive screening of alternatives.

5.3 Evaluation and Screening Process

The alternatives screening and evaluation process uses a tiered screening approach. Each tier of screening analysis conforms to a level of detail necessary to make informed judgments regarding the decision at hand. This approach allows alternatives to be narrowed from a wide array of alignments and technologies to the selected preferred alternative by subjecting each alternative incrementally to more detailed technical analysis and assessment.

5.3.1 Tier 1 Screening of the Initial Alternatives

The preliminary screening process will include an evaluation of a long list of alternatives beginning with the provisional alignments and technology defined in the project initiation phase after the first series of public meetings and other options developed during project scoping meetings. The goals, objectives and evaluation criteria will play a role only as a guideline in this preliminary step, since the alternatives will not be technically evaluated in detail.

It is possible that some options will have been identified that do not represent sensible solutions. An initial sift should therefore be undertaken to identify any fatal flaws that are likely to prevent an option progressing at a subsequent stage in the process. Using existing information, field reconnaissance, aerial photography and agency comments a number of alternatives will be screened out based on technical criteria related to technical feasibility, constructability, environmental impacts and clear operational concerns.

The analysis will focus on eliminating alternatives that are not feasible. The process involves discarding options that:

- Would clearly fail to meet the project goals and objectives identified for intervention;
- Do not fit with existing local, regional programs and strategies, and do not fit with wider government priorities (e.g. national programs for livability and sustainability); and,
- Would be unlikely to pass key viability and acceptability criteria (or represent significant risk) in that they are unlikely to be:
 - Deliverable in a particular economic, environmental, geographical or social context; e.g. options which would result in severe adverse environmental impacts which cannot be mitigated against or where the cost of doing so is too high;
 - Technically sound; and
 - Financially affordable based on probable costs.;

The following table outlines indicative criteria used in the Tier 1 screening assessment:

Table 5-2 Criteria used in the Tier 1 screening assessment

| Goal | Objective | Indicative Tier 1 Screening Criteria |
|----------|---|--|
| Mobility | <ul style="list-style-type: none"> • Minimize congestion • Reduce reliance on automobile • Minimize total travel times to points accessible from the proposed rail and bus extensions and network • Provide convenient accessibility and improve interchange with other modes of public transportation • Increase public transportation ridership and mode share | <ul style="list-style-type: none"> • Number of corridor residents within ½-mile of alignment • Number of corridor residents within ½-mile of a station • Number of jobs within ½-mile of a transit alignment • Number of jobs within ½-mile of a transit station • Access to major activity centers along an alignment (ranked as high, |

| Goal | Objective | Indicative Tier 1 Screening Criteria |
|-------------|---|---|
| | <ul style="list-style-type: none"> • Provide improved access to employment centers • Provide for the long-term expansion of the future public transportation system • Provide pedestrian and bicycle accessibility to transit | <ul style="list-style-type: none"> • moderate or low) • Access to intermodal interchange (number of intermodal interchanges and ranked as high, moderate, low) • Major attractions served by alignment |
| Economy | <ul style="list-style-type: none"> • Minimize adverse impacts on existing neighborhoods and communities. • Improve regional connectivity • Improve health and safety for workforce, passengers and communities • Promote positive benefits of public transportation access to significant sites and neighborhoods • Enhance the pedestrian realm • Integrate transportation and land use by locating stations where there is greatest potential for TODs. • Integrate with local development plans • Enhance urban design features and complete streets program • Provide a cost-effective project that moves the most people at the lowest cost • Improve operating efficiency by lowering operating costs • Take account of life-cycle costs when planning alternatives; and • Optimize and prioritize investment initiatives to maximize benefits. | <ul style="list-style-type: none"> • Consistency with local planning efforts (ranked high, moderate or low) • Transit Oriented Development potential (ranked as high, moderate or low) • Support for joint public-private land development (ranked as high, moderate or low) • Assessment of potential construction impacts on adjacent properties and utilities (ranked as high, moderate or low) • Assessment of probable construction cost using length as a proxy of cost based on technology option. • Operational issues and efficiency |
| Environment | <ul style="list-style-type: none"> • Preserve the natural environment • Protect and enhance the cultural heritage, landmarks, national symbols and monuments of the study area • Decrease dependency on single occupant vehicle • Decrease energy consumption and vehicle miles traveled • Improve air quality | <ul style="list-style-type: none"> • Potential noise impacts (number of sensitive receptors within defined distance of alignment per FTA <i>Transit and Noise and Vibration Impact Assessment</i> May 2006. • Number or instances of potential environmental impacts • Environmental “Red Flags” |
| Livability | <ul style="list-style-type: none"> • Provide more transportation choices. • Promote equitable, affordable housing. • Enhance economic competitiveness. • Support existing communities. • Coordinate and leverage federal policies and investment. • Value communities and neighborhoods. | <ul style="list-style-type: none"> • Total network length • Number of stations • Average station spacing • Number of affordable houses within ½-mile of station • Number of parks and acres of green space within ½-mile of alignment. • Number of cultural resources within ½-mile of alignment |

Following the Tier 1 Screen technical assessment, a screening report will be prepared and presented to RTA staff and other stakeholders. The report will document how the alternatives were evaluated and the results of the findings of technical analysis will be presented as a recommendation. Alternatives will be retained if it provides an advantage on alignment, profile, constructability or access to activity centers in the affected corridor within the project service area. The preliminary screening process will result in the conceptual alternatives for the Tier 2 Screening.

5.3.2 Tier 2 Screening of Alternatives Advanced from Tier 1 Screening

The second level of screening will take place after the initial alternatives have been assessed, screened and the alignments recommended for detailed technical evaluation have been approved by RTA. The technology options will be combined with the selected alignment utilizing the features of each technology to best advantage. All the Build alternatives will be compared to the No Build (do-nothing or null) Alternative and to the Do Minimum alternatives. The comparative evaluation of the alignments, technologies and station locations will result in a recommendation for selection of a preferred build alternative, which will be advanced to the project justification and appraisal level of analysis in Tier 3.

This Tier 2 Screen will be more rigorous than the Tier 1 Screen and will identify order of magnitude costs and approximate benefits of each alternative being analyzed using both quantitative and qualitative values for the evaluation criteria, which is linked to the goals and objectives of the project. The Tier 2 screening will include refinement of the alignment options and costs, developing initial ridership estimates, performing a cost-effectiveness analysis, as well as considering technology design issues and constraints for each alternative.

Detailed data and information derived from this Tier 2 screening will provide input for a detailed data matrix for evaluating key performance measures that include environmental, demographic, operational, physical, ridership, and cost characteristics as well as implementation issues associated with each alternative. The evaluation process will apply quantitative factors for comparing each of the alternatives and result in selecting the preferred build alternative including technology option.

The primary criterion will center on cost effectiveness and mobility improvements as measured by ridership. Annualized cost per rider will be used as the measure of cost effectiveness and as a proxy for other benefits not monetized for the Tier 2 screening.

Alternatives will be screened by evaluating comparative tradeoffs between the objectives and/or goals. A typical tradeoff analysis involves the analysis of the performance of Build alternatives according to some benefit criterion in relation to their costs when compared to the other alternatives.

Following the Tier 2 Screen, a Draft Alternatives Analysis Report will be prepared and presented to RTA staff and other stakeholders and committees for comment. The report will document how the alternatives were developed, screened, evaluated and what the results of the technical analysis and findings are.

Only one preferred build alternative will be advanced to Tier 3 level of screening, which will compare and contrast the preferred build alternative to the No Build and Do Minimum alternatives where the business case for the LPA will be more fully developed and benefit/cost analysis completed.

The following table outlines indicative criteria used in the Tier 2 screening assessment:

Table 5-3 Criteria used in the Tier 2 screening assessment

| Goal | Objective | Indicative Tier 2 Screening Criteria |
|-----------------|---|--|
| Mobility | <ul style="list-style-type: none"> • Improve regional connectivity • Promote positive benefits of public transportation access to significant sites and neighborhoods • Enhance the pedestrian realm • Provide convenient accessibility and improve interchange with other modes of public transportation • Reduce reliance on automobile • Minimize total travel times to points accessible from the proposed metro rail and bus network • Increase public transportation ridership and mode share • Provide for the long-term expansion of the future public transportation system • Provide pedestrian and bicycle accessibility to transit | <ul style="list-style-type: none"> • Travel time savings and other transportation system user benefits • Travel time saving per passenger mile • Number of jobs within ½-mile of the stations • Number of people within ½-mile of the station • Total ridership (boardings) • Total linked trips • Congestion relief (reduction in highway trips or trips diverted to transit; change in mode shares) • Peak period travel times • Comparison of highway, and transit trips times between major travel pairs) (running times, headways, average system speed and station spacing) • Transit network length • Number of stations |

| Goal | Objective | Indicative Tier 2 Screening Criteria |
|--------------------|--|--|
| Economy | <ul style="list-style-type: none"> Minimize congestion Provide improved access to employment centers Provide a cost-effective project that moves the most people at the lowest cost Improve operating efficiency by lowering operating costs Take account of life-cycle costs when planning alternatives; and Optimize and prioritize investment initiatives to maximize benefits. | <ul style="list-style-type: none"> Estimates of probable capital costs Estimates of probable operating and maintenance costs Annualized cost per rider O&M cost per passenger km Annualized costs per new transit rider |
| Environment | <ul style="list-style-type: none"> Preserve the critical natural environment Protect and enhance the cultural heritage, landmarks, national symbols and monuments Decrease dependency on single occupant vehicle Decrease energy consumption and vehicle miles traveled Improve air quality | <ul style="list-style-type: none"> Assessment of noise impacts (number of sensitive receptors within 100 meters of alignment) Number or instances of potential environmental impacts Vehicle-miles traveled (VMT) within study area Potential for reductions in CO2. Total public transportation system ridership as a proxy for economic benefits. |
| Livability | <ul style="list-style-type: none"> Minimize adverse impacts on existing neighborhoods and communities. Improve health and safety for workforce, passengers and communities Integrate transportation and land use by locating stations where there is greatest potential for TODs. Integrate with local development plans Enhance urban design features and complete streets program | <ul style="list-style-type: none"> Number of streets closed or improved with “complete streets” treatments Number of buildings impacted Number of residential households impacted Number of households affected within 25 yards of the alignment Impacts on public parklands and open spaces Number of zero car households |

5.3.3 Tier 3 Final Screening: Feasibility Study and Appraisal of Preferred Build Alternative

The Tier 3 Final Screening will introduce new criteria that require more specific and comprehensive economic analysis that would be too time consuming and costly to do for a longer list of alternatives. Many of the criteria to be utilized in the final screening will include technical data that are required in FTA’s New Starts project rating process and the DfT Value for Money appraisal process. Table 5-4 shows the indicative criteria to be used in appraising the Business Case for the preferred build alternative.

Table 5-4 Criteria used in the Tier 3 Business Case Appraisal

| Goal | Objective | Indicative Tier 3 Appraisal Criteria |
|-----------------|---|--|
| Mobility | <ul style="list-style-type: none"> Improve regional connectivity Promote positive benefits of public transportation access to significant sites and neighborhoods Enhance the pedestrian realm Provide convenient accessibility and improve interchange with other modes of public transportation Reduce reliance on automobile Minimize total travel times to points accessible from the proposed metro rail and bus network Increase public transportation ridership and mode share Provide for the long-term expansion of the future public transportation system Provide pedestrian and bicycle accessibility to transit | <ul style="list-style-type: none"> Travel time savings and other transportation system user benefits Total ridership (boardings) Number of trips made by transit dependent population Total number of linked trips using the project as calculated from NOACA regional travel demand model. Congestion relief (reduction in highway trips or trips diverted to transit; change in mode shares) Peak period travel times Comparison of highway, and transit trips times between major travel pairs) (running times, headways, average system speed and station |

| Goal | Objective | Indicative Tier 3 Appraisal Criteria |
|--------------------|--|--|
| | | spacing) • Transit network length • Number of stations |
| Economy | <ul style="list-style-type: none"> • Minimize congestion • Provide improved access to employment centers • Provide a cost-effective project that moves the most people at the lowest cost • Improve operating efficiency by lowering operating costs • Take account of life-cycle costs when planning alternatives; and • Optimize and prioritize investment initiatives to maximize benefits. | <ul style="list-style-type: none"> • Estimates of probable capital costs • Estimates of probable operating and maintenance costs • Annualized cost per rider • O&M cost per passenger km • Annualized costs per new transit trip on the project • Estimated change in VMT attributable to the estimated change in development patterns • Performance of transit supportive plans and policies • Potential impact of transit project on regional development • Plans and policies to increase affordable housing • Travel times savings benefits • Accident cost reduction benefits • Environmental benefits • Wider economic benefits • Benefit/cost ratio |
| Environment | <ul style="list-style-type: none"> • Preserve the critical natural environment • Protect and enhance the cultural heritage, landmarks, national symbols and monuments • Decrease dependency on single occupant vehicle • Decrease energy consumption and vehicle miles traveled • Improve air quality | <ul style="list-style-type: none"> • Change in air quality criteria pollutants. • Change in energy use • Change in greenhouse gas emissions • Change in safety • Changes in regional VMT |
| Livability | <ul style="list-style-type: none"> • Minimize adverse impacts on existing neighborhoods and communities. • Improve health and safety for workforce, passengers and communities • Integrate transportation and land use by locating stations where there is greatest potential for TODs. • Integrate with local development plans • Enhance urban design features and complete streets program | <ul style="list-style-type: none"> • Number of zero car households within ½-mile of station areas • Number of affordable housing units within ½-mile of stations. |

6. Documentation of the Alternatives Analysis Process

The entire alternatives analysis process is documented through a series of technical reports and other deliverables. These include technical working papers and reports justifying the need for an improvement, such as a problem statement defining the project purpose and need; a series of reports describing the conceptual and refined definition of the alternatives under study; a report (or reports) describing the technical methodologies used in the alternatives analysis; and a report (or reports), that summarize the results of each step of the screening process and a final alternatives analysis report.

These technical documents are important for both internal management of the study and external communication of its analyses and results. A robust - and timely - technical documentation effort facilitates this important coordination function. Moreover, the breadth of the study's technical analyses is best managed and presented when documented separately from the study itself. The final product of the alternatives analysis is a final study report. More detailed information and analysis can be covered in the series of technical working papers and reports.

Following agreement on a study scope of work, initial efforts and documentation are focused on refining a corridor purpose and need statement with goals and objectives, and at least a preliminary set of evaluation factors and conceptual alternatives designed to address identified corridor problems and needs. This is followed by refining the set of alternatives to the point that their implications for the technical work can be identified. Once agreement on a specific definition of alternatives is reached, work can proceed on the preparation of the methodology reports that describe the technical procedures and methods which will support the study. Following the finalization of the methodologies, the heart of the technical work occurs. The results of this work are documented in one or more results reports. Collectively, this body of documentation backs up the alternatives analysis study.

Reports/documentation on a corridor problem statement, range of alternatives, technical methodologies, and analytical results will be prepared by the AECOM consultant team and reviewed by the RTA and Steering Committee. AECOM notes that while the term "report" is applied in this section to each of the documents, there are no specific formats for them; they may just as easily be titled "technical memoranda."

Key documentation includes technical methodologies, which are intended to be brief and focus on those aspects of the methodologies that either vary from FTA or DfT guidance and/or are necessary to understand the approach in such areas as capital and O&M cost estimation and travel demand forecast modeling.

The documents that are to be prepared include the following:

- Alternatives Screening and Evaluation Methodology Report
- Ridership Forecasting Methodology Report
- Initial Alternatives and Tier 1 Screening Report
- Capital Cost Estimating Methodology Report
- Operations and Maintenance Cost Estimating Methodology Report
- Draft Alternatives Analysis Report
- Final Alternatives Analysis Report

The Tier 3 screening report will be incorporated as a chapter in the Final Alternatives Analysis Report. The AECOM team will prepare the report and present its findings, determinations and recommendations for project implementation to the RTA.

At the end of the preparation of the portion of the evaluation effort, RTA staff will present recommendations to the RTA Board of Trustees for its determination of the locally preferred alternative (LPA) to be adopted. Once the Board of Trustees approves the recommended locally preferred alternative, they will authorize the RTA to move forward with presenting the LPA to NOACA for inclusion in the region's long range transportation plan.

7. Abbreviations and Acronyms

| | |
|-------------|---|
| AA | Alternatives analysis |
| AGT | Automated guideway transit |
| BRT | Bus rapid transit |
| CBD | Central Business District |
| CFR | Code of Federal Regulations of the United States |
| DfT | Department for Transport, United Kingdom |
| E+C | Existing and committed highway and bus networks |
| FHWA | Federal Highway Administration of the US Department of Transportation |
| FTA | Federal Transit Administration of the US Department of Transportation |
| HOV | High occupancy vehicle |
| HRT | Heavy rail transit (metro) |
| HRV | Heavy rail vehicle |
| LOS | Level of service |
| LPA | Locally preferred alternative or preferred alternative |
| LRT | Light rail transit |
| LRV | Light rail vehicle |
| MOS | Minimum operable segment |
| NATA | New Approach to Transport Appraisal |
| PE | Preliminary engineering |
| RFI | Request for Information |
| ROW | Right-of-Way |
| TOD | Transit oriented development |
| TSM | Transportation system management |
| VfM | Value for money |
| VMT | Vehicle miles traveled |

8. Glossary of Terms

Alignment: the route that bus or urban rail line improvement could take through a corridor.

Alternative: a feasible transportation improvement that is under consideration defined by route, technology and station locations.

At-grade: running on street-level.

Bus Rapid Transit (BRT): combines the quality of rail transit and the flexibility of buses. It can operate on exclusive roadways for buses only, high occupancy lanes, expressways, or ordinary streets. It is a system that combines intelligent transportation systems technology, priority for transit, cleaner and quieter vehicles, rapid and convenient fare collection, and integration with land use policy.

Capital Costs: the expense of designing and constructing a new project.

Central Business District: A commercial area of a city with very high land valuation, traffic flow and concentration of retail business, commercial offices, hotels and related services.

Corridor: A broad geographical band that follows a directional flow connecting major sources of trips that may contain a number of streets, highways and public transportation alignments or proposed alignments.

Cost effectiveness –The extent to which the costs of the alternatives are commensurate with their benefits.

Dwell time: The scheduled time a bus or train is allowed to discharge and take on passengers at a stop or station, including opening and closing doors.

Effectiveness - The extent to which an alternative solves the stated transportation problems in the corridor.

Equity – The extent to which costs and benefits are distributed fairly across different population groups.

Exclusive Right-of-Way: A highway or track facility that can only be used by buses or trains.

Fatal Flaws – “Red Flags”: environmental or operations conditions that would render an alternative compromised in terms of its feasibility.

Final Design: begins after the environmental document is approved and includes the preparation of detailed engineering plans, specifications, and estimates for approved transportation projects in addition to right-of-way acquisition, utility relocation and construction contract advertisement and award.

Financial feasibility – the extent that funds required to build and operate the alternatives are likely to be available.

Fixed Guideway: a system of public transportation vehicles that can only operate on an exclusive travel way constructed for that purpose including rail or guided bus.

Headway: Time interval between public transportation vehicles moving in the same direction on a particular route.

Heavy rail transit: A metropolitan urban railway with a capacity for a high volume of passenger traffic characterized by exclusive rights-of-way, multi-car trains, high speed and rapid acceleration, sophisticated signaling and high platform loading; also known as metro.

Impact: an effect that a transportation improvement could have, such as an environmental impact or the extent to which the alternatives impact --- positively or negatively - nearby natural resources and neighborhoods, air quality, the adjacent transportation network and facilities, land use, the local economy, etc..

Intermodal: Activities that involve or affect the interchange between transportation modes including transfer connections, choices, cooperation and coordination; also known as “multi-modal.”

Joint Development: Ventures undertaken by the public and private sectors for development of land around public transportation stations or stops.

Kiss-and-Ride: A place where commuters are driven and dropped off at a station to board a public transportation vehicle.

Layover time: Time built into a schedule between arrival at the end of route and the departure for the next return trip, used for recovery of delays and preparation for the return trip.

Light Rail Transit (LRT): lightweight passenger rail cars operating singly (or in short, usually two to four-car trains) on fixed rails in right-of-way that can be separated or not separated from other traffic for much of the way. Light rail vehicles are driven electrically with power being drawn from an overhead electric line through a roof mounted pantograph.

Line: the reference to a specific routing of an urban rail transit vehicle traveling between two terminal stations.

Locally preferred alternative (LPA): The transit technology option, alignment, stations, and termini locations selected for the development of a high capacity transit system by the RTA Board of Trustees and adopted by the metropolitan planning organization (NOACA) into the region's long-range transportation plan. The LPA is the end result of the Alternatives Analysis process.

Load factor: The ratio of passengers actually carried versus the total passenger capacity of public transportation vehicle.

Mixed-flow: automobiles and transit vehicles sharing the same roadway.

Mixed-use: a type of development where residences and businesses are located in the same area.

Modal split or share: A term of art that describes the percentage of people using private automobiles as opposed to the percentage of using public transportation.

New Starts: US government program that is the primary financial resource for supporting locally-planned, implemented, and operated transit "fixed guideway" capital investments. Projects eligible for New Starts funding include any fixed guideway system which utilizes and occupies a separate right-of-way, or rail line, for the exclusive use of mass transportation and other high occupancy vehicles, or uses a fixed centenary system and a right-of-way usable by other forms of transportation. This includes, but is not limited to, metro heavy rail, light rail, commuter rail, automated guideway transit, people movers, and exclusive facilities for buses (such as bus rapid transit) and other high occupancy vehicles.

No Build Alternative: The "No Build" alternative essentially maintains the present condition and includes planned and committed conditions (E+C) for the future planning horizon year. This also serves as a baseline for the evaluation of the Build alternatives during the project appraisal phase of project development.

Operating and Maintenance (O & M) Costs: The expense of keeping a project running once it's built.

Park-N-Ride: A place where commuters park their cars prior to boarding a public transportation vehicle either at a bus or rail station or stop.

Preferred Build Alternative: The transportation improvement option selected by decision-makers as the solution best suited to address the needs and problems in a corridor after the Tier 2 screening, which will be subjected to additional evaluation and appraisal in the Tier 3 business case appraisal prior to adoption as the LPA.

Preliminary Engineering (PE): The level of project design that defines the project limits and horizontal and vertical alignments to use as a baseline for determining right-of-way requirements, environmental impacts, and project costs.

Rapid transit: Urban rail or motor bus public transportation service operating completely separate from all other modes on an exclusive or semi-exclusive right-of-way.

Route: A course or way of track between two points on a rail system.

Stakeholder: A person or agency that has a strong interest in the transportation decisions being made, such as a resident, business owner, developer or utility in the corridor.

Transit-oriented development (TOD): Moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities

designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more new buildings whose design and orientation facilitate transit use.

Travel demand model: A mathematical analytical tool used to forecast travel choice behaviors and calculate mode share and travel time savings and other data needed to assess transportation system impacts of transportation investment decisions on travel patterns, air quality and energy consumption.

Transportation System Management (TSM): Modest investment strategies aimed at improving the overall performance of the transportation network without resorting to large-scale, expensive capital improvements. TSM integrates techniques from across disciplines to increase safety, efficiency and capacity for all modes in the transportation system by effectively using more of an existing transportation system.