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Evaluation of Alternatives Methodology Report

Indianapolis Metropolitan Area Rapid Transit Study

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1.0 INTRODUCTION

The Indianapolis Regional Rapid Transit Study (RTS) alternatives evaluation methodology has been developed to screen the rapid transit build alternatives in order to recommend a single Locally Preferred Alternative (LPA). Based on an array of measures, the proposed methodology focuses on an objective, relative comparison of build alternatives in order to determine the best possible alternative for rapid transit implementation within the Northeastern Corridor.

1.1 Project Description

The Indianapolis Metropolitan Planning Organization (MPO) is sponsoring a Rapid Transit Study (RTS) for the nine-counties that comprise the Indianapolis Metropolitan Statistical Area. The RTS has identified and documented a system plan for the implementation of a rapid transit system to satisfy the needs of the multi-county Indianapolis region through the year 2030. In addition to the system plan, the RTS also has identified the Northeast Corridor as a locally preferred corridor (LPC) to take into the federal Alternatives Analysis (AA) and National Environmental Policy Act (NEPA) Draft Environmental Impact Analysis (DEIS) processes.

The study's goal is to make the Indianapolis region a better place to live, work and do business by achieving a consensus on what type of transportation improvements will best solve the mobility and safety concerns in the area. Within the Northeast Corridor, the first corridor selected for detailed study, a variety of alternatives will be considered, including options for rail transit and the implementation of exclusive bus transitways.

Primary study objectives include relieving lengthy travel times, particularly on public transportation, and supporting community development efforts. Air quality and pedestrian/motorist safety also top the list of concerns. Specifically, the project's goals include:

- Maximize Engineering Feasibility and Public Safety.
- Maximize Community Benefits and Personal Safety.
- Minimize Environmental Impacts.
- Maximize Operational Efficiency.
- Minimize Costs.

The Northeast Corridor includes such radial alignments as the following: Keystone Avenue, Binford Boulevard/I-69, the Hoosier Heritage Railroad, and Allisonville Road, as well as the radial alignments of US 36/SR 67 and the CSX-Cleveland Railroad Line that connect Indianapolis downtown with Anderson. Among the key lateral feeder lines are SR 32 and the Central Indiana & Western Railroad (shortline), SR 38, SR 238, and CR 600W/Mount Comfort Road, which is proposed for a County highway upgrade. Key CBD activity centers in the Northeast Corridor are Fishers, Noblesville, Lawrence, and Anderson with smaller concentrations at McCordsville, Fortville, Pendleton, and Lapel. Major corridor employment centers include the following: Roche Diagnostics Corp.; the Northeast Center at Lawrence; and the Delco Remy Headquarters and the Orchard Industrial Park, both southwest of Anderson. Several high density centers are located in the Northeast Corridor, including the following: the Fort Harrison Reuse Authority's redevelopment program and State Park; Castleton Corporate Park; Castleton Square Shopping Mall/Center; Castleton Park; the Castle Industrial Park; the McCordsville Industrial Park; the Verizon Wireless Music Center; and the Hoosier Business Park southeast of Anderson. In addition, the corridor includes a concentration of high-density housing north of 96th Street and east of the White River. This area includes the Geist Reservoir development area with surrounding high-end housing subdivisions, retail and commercial businesses.

The AA will evaluate a range of potentially viable transportation improvements, including both rail transit and bus rapid transit (BRT) alternatives, by treating them in an unbiased manner in a systematic evaluation process.

1.2 Purpose of Report

This document explains the methodology through which the evaluation and comparison of build alternatives will be accomplished. The evaluation of alternatives will be based on a wide range of criteria developed during the course of the study, and supported through the comprehensive public outreach efforts undertaken during Phase II and to be undertaken during AA activities. The goal of the evaluation is to determine the Locally Preferred Alternative (LPA) to be carried forward into the Draft Environmental Impact Statement (DEIS).

2.0 EVALUATION PROCESS

The proposed evaluation process will be accomplished in three steps. During the development of alternatives, a fatal flaws analysis will be conducted to ensure that only viable candidate alternatives are carried into the evaluation process. Once a set of potential alternatives has been identified and screened by a fatal flaws analysis, appropriate evaluation measures will be developed. Finally, the evaluation measures will be applied to provide an assessment of each build alternative relative to the others.

2.1 Development of Evaluation Measures

In July 2003, a telephone survey was conducted to gain a better understanding of the public's views with respect to transportation in the Indianapolis region. A total of 891 surveys were conducted within the nine-county MSA. As part of the survey process, participants were asked which of the following characteristics were most important:

- Personal Safety
- Reliability
- Travel time
- Personal Cost
- Personal Comfort and Convenience

The survey indicated that personal safety and reliability were the two most important characteristics to be considered in the selection of a transportation alternative.

Early in 2004, the public was asked to assist in the development of general goals and specific objectives for a regional rapid transit system. Six public meetings were held between February 17 and February 26 at locations throughout the Indianapolis area, with one meeting held in the vicinity of a corresponding corridor of study (no meeting was held within the North Corridor as it was added to the study at the end of Phase II.) At each meeting, those in attendance were asked to assist in the development of project goals by which transit alternatives could be evaluated. The resulting set of general goals was discussed in Section 1.1: Project Description. During the public involvement process, interested citizens were also asked to assist the MPO in prioritizing these goals by ranking them in order from one to five. This ranking exercise was used to develop a Criteria Utility Vector based on the public's stated preference.

A preliminary list of evaluation measures has been identified based on the project's goals and objectives. The intent is that each of the evaluation measures will provide a relative indication of how well an alternative performs with respect to a particular goal and relative to the other build alternatives under consideration. The evaluation measures focus on objective assessments; however, some measures will require the use of professional judgment by project planners and engineers.

The Purpose and Need Statement (and the evaluation measures which will be used to measure the impact/trade-off/benefits of each alternative) must flow precisely from the study's community involvement based goals and objectives - - and vice-versa. Specific objectives have been developed (also developed in community consultation) which provide greater definition to the generalized statement of community goals. As the MPO viewed the community involvement based statements of generalized community goals, and more specific community objectives related to each of the community goals, a set of performance measures was adopted which create a metric for assessing the performance of each of the alternatives relative to the goals and objectives statements. Typically, numerous "metrics" are used to provide (in most cases) an objective measure of the performance of an alternative with respect to a specific community goal. In those cases where an individual performance measure does not lend itself to the objective assignment of a "metric" or "score," the system defaults to a subjective assessment (e.g., high, medium, low) of the performance of a given alternative with respect to the performance measure under study.

The performance measures used to score each alternative, relative to its ability to meet community goals and objectives (including those goals and objectives specifically focused on mobility), are grouped as sub-sets of each generalized community goal; that is to say, each performance measure is directly related to one of the five broadly stated community goals. This one-for-one relationship exists between each performance measure on the one hand, and the goal associated with that performance measure, on the other. In the evaluation methodology, this precise relationship of numerous discreet performance measures and the goal associated with each grouping of performance measures is clear. In the performance measures that collectively provide the metrics against which the performance of a given alternative relative to a community goal is scored, numerous measures relate back to solving the defined mobility problem. Such metrics span the range of concerns (such as environmental justice, improvement of air quality, reduction of noise and vibrations, access to employment centers, travel times, and cost effectiveness).

All performance measures associated with cost are grouped under Goal #5 – Minimize Costs (see goal #5, below). The various categories of cost (by each of the three technologies) are: Capital Costs (per mile cost, total, and annualized cost); Annual Operating and Maintenance costs; Annual Local Funding Required (and implicitly Total Funding Required); and Cost Effectiveness (Total Annual Cost of Rapid Transit divided by Total Annual Ridership). Through the scoring of all alternatives based on the specific performance measures in Goal Category #5, the Evaluation Methodology explicitly deals with cost (both capital and operating) and explicitly reflects on the financial analysis. Additionally, this phase of the rapid transit study (as with all previous phases), includes a comprehensive financial analysis undertaken precisely as required by the FTA Green Book guidance on project financial analysis procedures. Consistent with the Green Book, the financial analysis considers both operating cost and capital cost for all modes of mass transportation in the Indianapolis system (i.e., fixed guideway, bus, and paratransit) as well as all potential revenue streams available to the region to meet both capital and operating funding requirements for mass transit. These financial analyses were subjected to a range of assumptions
regarding each of the independent variables considered.

A brief summary of each proposed evaluation measure, including how the measure is to be applied and/or quantified, is found below. In addition, the public's stated priority (as a percentage – the five sum to 100%), or "public opinion factor," is included after each of the five goals.

Goal #1: Maximize Engineering Feasibility and Public Safety (Public opinion factor - 22%)

- Constructability: Involves factors that can extend or complicate the construction process, such as maintenance of traffic considerations, utility impacts, or construction within sensitive areas (i.e. floodplains, etc.) that may shorten the construction season. A high level of constructability indicates that an alternative would be relatively easy to build.
- Congestion: Congestion will be based on the percentage of vehicular travel on congested arterials; congested arterials are to be defined as arterial roadways with a volume-to-capacity ratio (V/C) over 1.0. The network-wide number of vehicle hours of travel on such arterial roadways will be compared to the total number of hours of travel on all arterials, resulting in a percentage. Lower percentages will indicate a less congested roadway network.
- Grade crossings: The estimated number of required at-grade crossings will be quantified.
- Impacts to street capacity: Adverse impacts to the existing roadway network will be approximate and evaluated in terms of high, moderate, or low levels of negative impacts.

Goal #2: Maximize Community Benefits and Personal Safety (Public opinion factor - 24%)

- Ridership: Alternatives will be modeled using the MPO's travel demand model and average daily ridership forecasts will be reported.
- Residential displacements: The approximate number of residential displacements will be quantified.

- Business displacements: The approximate number of business displacements will be quantified.
- Visual impacts: Potential adverse visual impacts will be quantified.
- Service to activity centers: The degree to which existing activity centers are served will be evaluated and quantified in terms of high, moderate, or low levels of service.
- Service to the transit dependent: Census data will be utilized to quantify the percentage of transit-dependent households potentially served by each alternative.

Goal #3: Minimize Environmental Impacts (Public opinion factor - 17%)

- Environmental Justice Impacts: Environmental Justice issues will be addressed by: 1) determining the percentage of displacements of minority and low-income households and comparing to the regional demographic averages; and 2) determining the percentage of minority and low-income households potentially served by each alternative and comparing to the regional demographic averages.
- Wetlands: The potential acreage of wetlands required (requiring mitigation) in the construction of each build alternative will be quantified. National Wetlands Inventory (NWI) mapping will be utilized in this analysis.
- Noise: The number of potentially noise-sensitive receptors within 500' of the centerline of each build alternative will be quantified. Sensitive sites will include, but not necessarily be limited to, schools, churches, and hospitals.
- Historic sites: A records search for sites listed on the National Register of Historic Places (NRHP) will be conducted to determine the number of sites within 500' of the centerline of each build alternative. (A direct taking of a site listed in the NRHP will be considered a fatal flaw and will remove an alternative from further consideration.)
- Archaeological sites: A records search for potential archaeological sites will be conducted to determine the number of sites within 500' of the centerline of each build alternative.
- Parks: The potential for adverse impacts to existing parklands will be evaluated in terms of high, moderate, or low levels of negative impacts. (A direct taking of parklands will be considered a fatal flaw and will remove an alternative from further consideration.)
- Streams: The total length of stream encroachment will be estimated for each build alternative.
- Floodplains: The total length of each alternative within the 100-year floodplain will be estimated based on Federal Emergency Management Agency (FEMA) Q3 flood data.
- Farmland: The total acreage of farmland required in the construction of each build alternative will be quantified.
- Superfund/CERCLIS sites: The number of Superfund/Comprehensive Environmental Compensation, and Liability Information System (CERCLIS) sites within a half-mile of each build alternative will be determined. A high number of such sites within proximity to an alternative could lead to the need for remediation.
- Endangered wildlife habitats: A records search for federal and state-listed endangered species found within a half-mile of the centerline of each build alternative will be conducted to determine the number of potential habitats impacted.

Goal #4: Maximize Operational Efficiency (Public opinion factor - 23%)

- Travel time: The MPO regional travel demand model will be utilized to determine the approximate travel time to the Downtown Transit Center (DTC) from a starting point common to all the build alternatives.
- Expandability: Surrounding land use and the potential for the phased development of an alternative will be considered for expandability, and each alternative will be rated as having a high, moderate, or low level of expandability. A highly expandable alternative will be one that readily allows for future growth in terms of additional fixed guideway and station facilities.

- Ease of system integration (bus/rapid transit): The ease of system integration will be evaluated based on the interface between the proposed alternatives and existing bus transit lines and facilities. Alternatives that will serve current heavily used bus lines and stops will be rated as having a high level of system integration.

Goal #5: Minimize Costs (Public opinion factor - 14%)

- Capital costs: Capital costs will be developed based on the methodology contained in the *Capital, Operations & Maintenance Cost Estimation Methodology Report.*
- Operating and Maintenance costs: Operating and maintenance costs will be developed based on the methodology contained in the *Capital, Operations & Maintenance Cost Estimation Methodology Report.*

2.2 Application of Evaluation Measures

The screening of build alternatives will be conducted through an objective evaluation process coupled with a public outreach based weighting process. A number of data sources will be utilized to provide the necessary information to complete the evaluation, including but not limited to existing Geographic Information System (GIS) data, US Census Bureau data, Indiana Department of Natural Resources (IDNR) records, Indiana Department of Environmental Management data, and the professional expertise of project engineers and planners. Field reconnaissance will supplement these existing data sources where additional information is necessary.

Where quantitative evaluation is possible (i.e. number of residential displacements required by an alternative or the number of grade crossings required), evaluations will be based on the relative difference between the alternatives for each criterion. The relative differences between the build alternatives will be normalized to a 1.0-10.0 scale by interpolating the evaluation measure based on the best and worst performers, and then correlating that interpolated value to a rating between 1.0 and 10.0. The poorest performer (or performers) for each criterion will be given a rating of 1.0 and the best performer(s) will be given a rating of 10.0. The remaining alternatives will be assigned a normalized rating based upon how well each performs relative to the best and worst performers.

Where quantitative evaluation is not possible, a qualitative evaluation approach will be utilized. This methodology includes criteria generating a relative response of “low”, “moderate” or “high”. “High” responses will be given a rating of 1.0 or 10.0, “moderate” responses a 5.5, and “low” responses a 1.0 or 10.0, each depending on the criterion. For example, a high level of constructability, indicating that an alternative can be built with relative ease, would be given a 10.0 whereas a high level of (negative) impacts to street capacity would be given a 1.0.

Once the evaluations are complete and tabulated, the average overall ratings for each of the five goals will be calculated. In order to account for the public’s stated priority for each of the five project goals, the “public opinion factor” will be utilized to weight the results of the objective evaluations. The average rating for each alternative will be multiplied by the public opinion factor, resulting in a weighted rating for each goal. These five weighted ratings will be summed (the maximum possible score will be 10.0) and the alternative with the highest overall weighted rating will be recommended to the IRTC Policy Committee for consideration as the LPA.

An example for the evaluation of six build alternatives, A, B, C, X, Y, and Z, is presented below. Each alternative is evaluated with respect to the four criteria that comprise goal number one, “Maximize Engineering Feasibility and Public Safety.” The example dataset and results are shown in Table 1. The best performers in each evaluation measure are highlighted for clarity.

Table 1: Example Evaluation for Goal #1

GOAL #1: Maximize Engineering Feasibility and Public Safety	**ALTERNATIVE**					
	A	**B**	**C**	**X**	**Y**	**Z**
Constructability	M	H	H	M	L	M
Rating	5.5	10	10	5.5	1	5.5
Congestion	45%	65%	55%	65%	75%	50%
Rating	10	3	7	3	1	8
Grade Crossings	10	0	15	0	15	5
Rating	3.3	10.0	1.0	10.0	1.0	6.7
Impacts to Street Capacity	H	L	M	M	H	L
Rating	1	10	5.5	5.5	1	10
Total (out of 40) *Average Rating*	20 *5.0*	33 *8.3*	23 *5.8*	24 *6.1*	4 *1.0*	31 *7.6*
Public Opinion Factor ***0.217***						
Weighted Rating (Out of a possible 2.17)	**1.08**	**1.81**	**1.26**	**1.32**	**0.22**	**1.65**
RANK	**5**	**1**	**4**	**3**	**6**	**2**

In this scenario, the following results are shown:

- Constructability: Alternatives B and C are considered to have a high level of constructability and are given a score of 10.0 Alternative Y is considered to have a low level of constructability and is given a 1.0.
- Congestion: Alternative A requires the least amount of travel on congested arterials (45%) and is rated as a 10.0. Alternative Y requires the highest percentage of congested travel and is rated as a 1.0.
- Grade crossings: Alternatives B and X require no at-grade crossings and are rated as 10.0's. Alternatives C and Y require 15 grade crossings each, the highest number of all the build alternatives, and are rated as 1.0's.
- Impacts to Street Capacity: Alternatives B and Z have the least adverse impact on existing street capacity, resulting in their "low" impacts and 10.0 ratings. Alternatives A and Y have a high level of negative impacts to existing street capacity and are rated as 1.0's.

The average values for these four evaluation measures are calculated for each build alternative and multiplied by the public opinion factor for Goal #1 (0.217 or 21.7%). The resulting weighted ratings indicate that Alternative B is the best performer of the six alternatives, followed by Alternative Z. Alternative Y was the poorest performer.

This process would be replicated for each of the five project goals and the five resulting weighted ratings would be summed. The highest overall weighted rating would be the best performing alternative and would be recommended to the IRTC Policy Committee for consideration as the LPA.