

Pre-Screening and Screening Criteria

The *I-225 Major Investment Study* employed a two-step screening process using criteria defined by both RTD's *MIS Guidance Manual*, which establishes a consistent basis of comparison for each MIS conducted, and corridor-specific criteria developed by the consultant team. A pre-screening analysis, sometimes referenced as a "fatal flaw analysis", identified alternatives that did not meet pre-screening criteria. At the pre-screening level, potential alternatives with excessive costs or impacts were identified for elimination. Pre-screening criteria are expressed in such a way as to yield yes/no answers.

Those alternatives that advanced beyond the "yes-no" responses associated with the pre-screening process were then evaluated against screening criteria. The criteria used in this second step are also defined in RTD's *MIS Guidance Manual* and have matching corridor-level criteria developed by the consultant team. Criteria are expressed in such a way as to identify the degree to which an alternative (or its options) addresses the criteria.

As previously stated, the screening criteria used in both the pre-screening and screening level analyses have two sources. The RTD *MIS Guidance Manual* established criteria to be used in each MIS to allow decision-makers the ability to compare between the different studies. These major criteria categories are presented in **Figure 3-15**. In addition to these common criteria, the I-225 MIS consultant team received input from the technical, policy, and citizen advisory committees regarding additional factors that should be considered in the evaluation of alternatives. This input resulted in the development of corridor specific criteria, presented in **Figure 3-16**. A rating scale was developed and applied as to the level of conformity to the Guidance Manual and Corridor criteria and is presented in **Figure 3-17**.

One criterion used in the pre-screening process, "affordability", was split into two measures. Criterion "2-a" looked at affordability of alternatives based on a comparison of estimated per-mile costs to a corridor budget of \$225 million for an 8-mile length (Parker Road to Smith Road). This corridor budget was based on previous planning, including work that was conducted for the *Guide The Ride* referendum (November 1997). Criterion "2-b" looked at affordability of alternatives based on a comparison of estimated per-mile costs to a corridor budget of \$275 million, based on \$25 million per mile for an 11-mile corridor. The 11-mile corridor, from Parker Road to the proposed East Corridor commuter rail station at 40th/Pena, was identified by the consultant team to include a more desirable northern terminus than Smith Road. The Smith Road terminus, while identified in the East Corridor MIS as the connection between the I-70 Corridor and the I-225 Corridor, does not serve an activity center or residential area. Rather than a terminus with no associated origin or destination, the consultant team recommended that the north end of the study area be extended to include the 40th/Pena (Gateway) area. This location would serve a growing activity center, is a likely destination for trips that use the I-225 corridor, and provides much greater accessibility to and from residential areas, such as Montbello.

Subsequent to the pre-screening efforts, discussions with RTD staff resulted in a revised corridor budget figure. A corridor budget of \$300 million was established and utilized during the conceptual screening process.

Figure 3-15: Guidance Manual Criteria



SCREENING PROCESS EVALUATION CRITERIA

Guidance Manual

The MIS Guidance Manual prescribes criteria for the two steps of the Screening Process.

	<h4>Consistency with Regional Goals and Policies</h4> <p>Intent: To eliminate an alternative that is clearly unacceptable because it violates a regional goal and/or policy.</p>
	<h4>Affordability</h4> <p>Intent: To eliminate an alternative that is clearly beyond the financial ability to implement.</p>
	<h4>Primary Environmental Impacts</h4> <p>Intent: To eliminate an alternative that clearly has irresolvable environmental impact.</p>
	<h4>Community or Agency Opposition</h4> <p>Intent: To eliminate an alternative that has substantial organized opposition from a significant segment of the community.</p>
	<h4>Community or Agency Support</h4> <p>Intent: To advance an alternative that has substantial organized support from a significant segment of the community.</p>
	<h4>Emerging or Proven Technology</h4> <p>Intent: To eliminate an alternative that, due to the undeveloped nature of the technology or its application, is considered to present an unacceptable risk of failure for cost and/or schedule for implementation.</p>

Figure 3-16: Corridor Level Criteria



SCREENING PROCESS EVALUATION CRITERIA

Corridor

In addition to Guidance Manual criteria, corridor-level criteria were developed for the two steps of the Screening Process.



Consistency with Corridor Goals and Policies

Intent: To measure the degree that an alternative meets a local goal and/or policy



Impact to Critical Resources

Intent: To measure whether an alternative has major natural resource or community impact.



Community Opposition

Intent: To measure if an alternative has substantial organized opposition from a significant segment of the local community.



Service to Local or Regional Travel Markets

Intent: To measure how an alternative serves the identified transportation needs of corridor travelers.



Connectivity to Distribution Markets/Sites

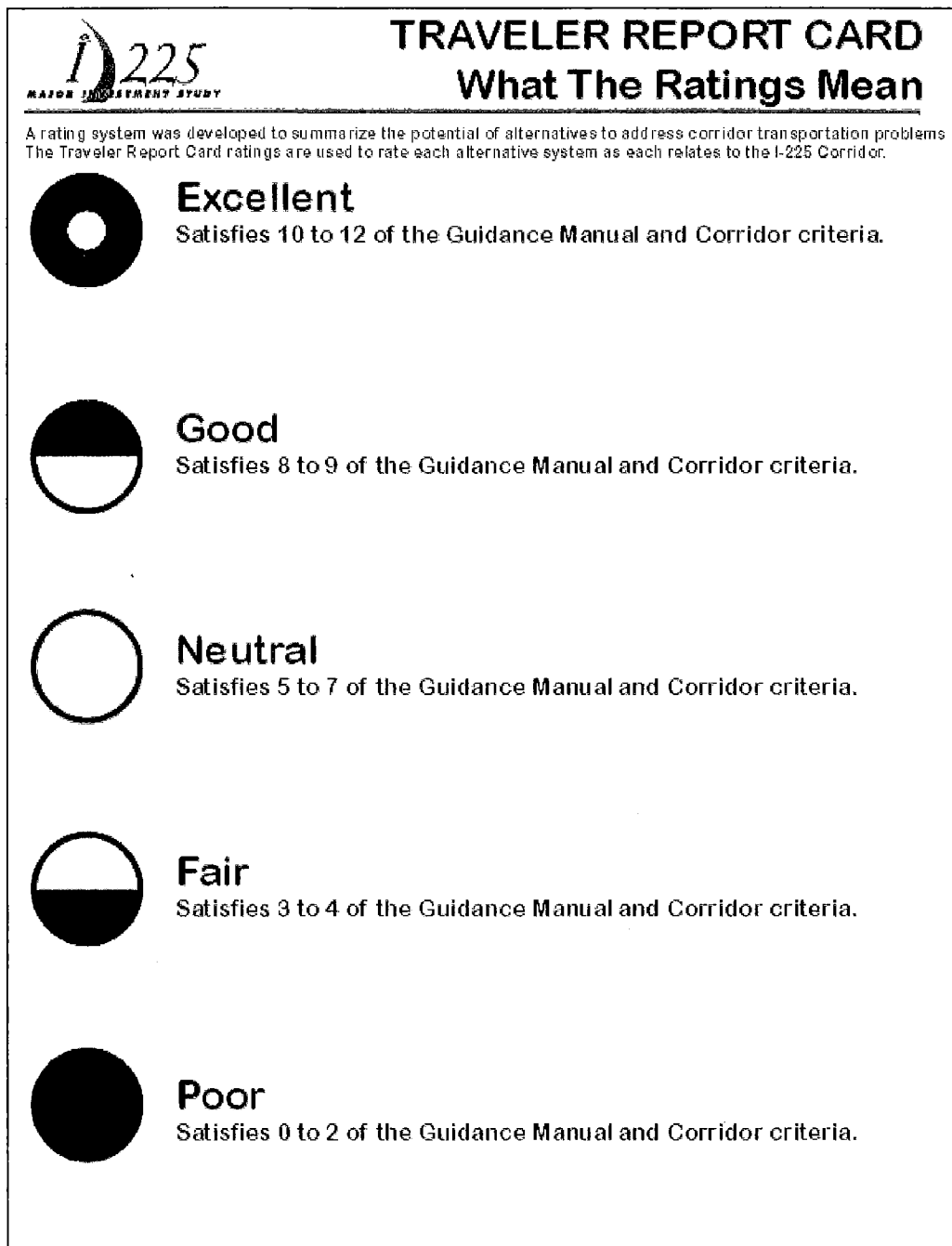
Intent: To measure whether an alternative provides connections to activity centers in the corridor.



Linkage to Southeast & East Corridors

Intent: To measure how readily an alternative can be reasonably constructed (physical and/or cost constraints) to connect to current and future transportation systems for the Southeast and East corridors.

Figure 3-17: Criteria Rating Scale



Pre-Screening Evaluation

The results of the pre-screening analysis are summarized as follows:

- Two alternatives (Automated Guideway Transit and Monorail) were not affordable. The estimated capital cost of these two alternatives is \$70 million or more per mile (the 8 miles between Parker Road and Smith Road would thus be \$560 million or more). See **Figure 3-18** and **Figure 3-19**.
- Personal Rapid Transit (PRT) technology (see **Figure 3-20**) is currently in an advanced state of development and testing, but has not yet been placed in revenue service. Two locations in the United States - Rosemont, IL and the SeaTac Airport, WA - will begin construction of PRT systems in the near future. The consultant team considered the potential for PRT to operate in two ways in the corridor: (1) as a line-haul service, in order to provide the type of comparison to other modes being evaluated, and (2) as a circulator/distributor in activity centers.
- There is no hard evidence that PRT would have sufficient capacity to meet peak hour demand for regional trips.
- If PRT service were provided within the corridor in a manner similar to bus routes, yet being unscheduled (a feature of PRT's), transit terminals would be overwhelmed by the total volume of PRT vehicles theoretically generated to meet demand.
- The potential for regional or line-haul service is constrained by the lack of a PRT network to which PRT in the I-225 corridor could connect.
- Preliminary cost estimates of \$25 to \$35 million per mile, while based on the best available information, are not supported by real-world construction experience. In addition, no operating and maintenance data are available.
- PRT operates as an elevated system, which may have negative visual impacts.
- In consideration of the issues above, the consultant team did not recommend that PRT be advanced as a line-haul technology, but recommended further consideration as a circulator/distributor service.
- For consistency of analysis, the bike alternative (see **Figure 3-21**) was considered for both line-haul and circulator/distributor service. Due to lack of capacity and ability to serve long distance trips, the bike alternative in a line-haul context was dropped. The bicycle alternative also did not meet the needs of a large segment of the traveling public, nor did it respond well to changing weather conditions. The capabilities of bikes to provide access to and from transit stations (regardless of the transit mode) are well documented. The consultant team recommended that the bike mode as a means of access be incorporated into the Transportation Management alternative.

Figure 3-18: Automated Guideway Transit Alternative

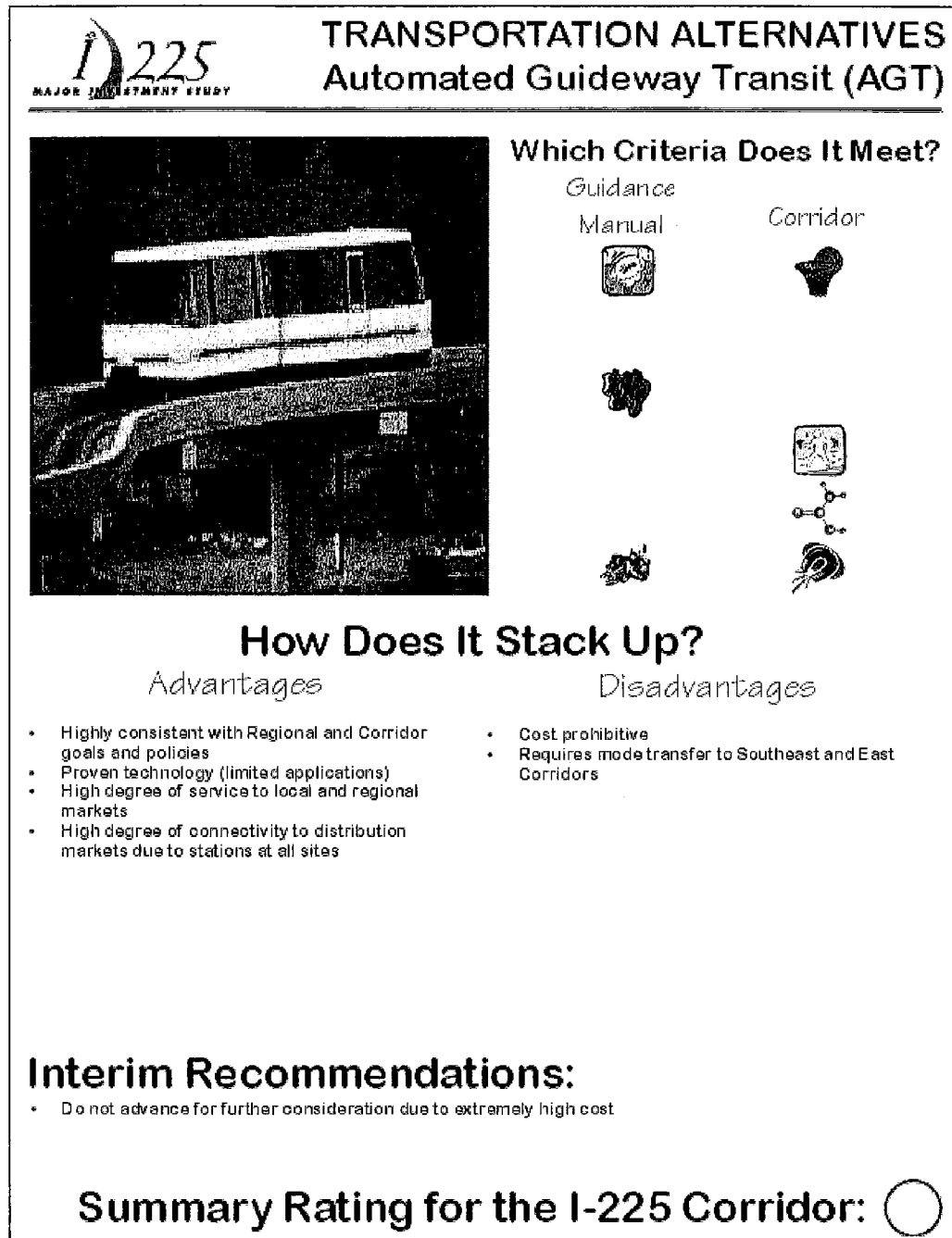


Figure 3-19: Monorail Alternative

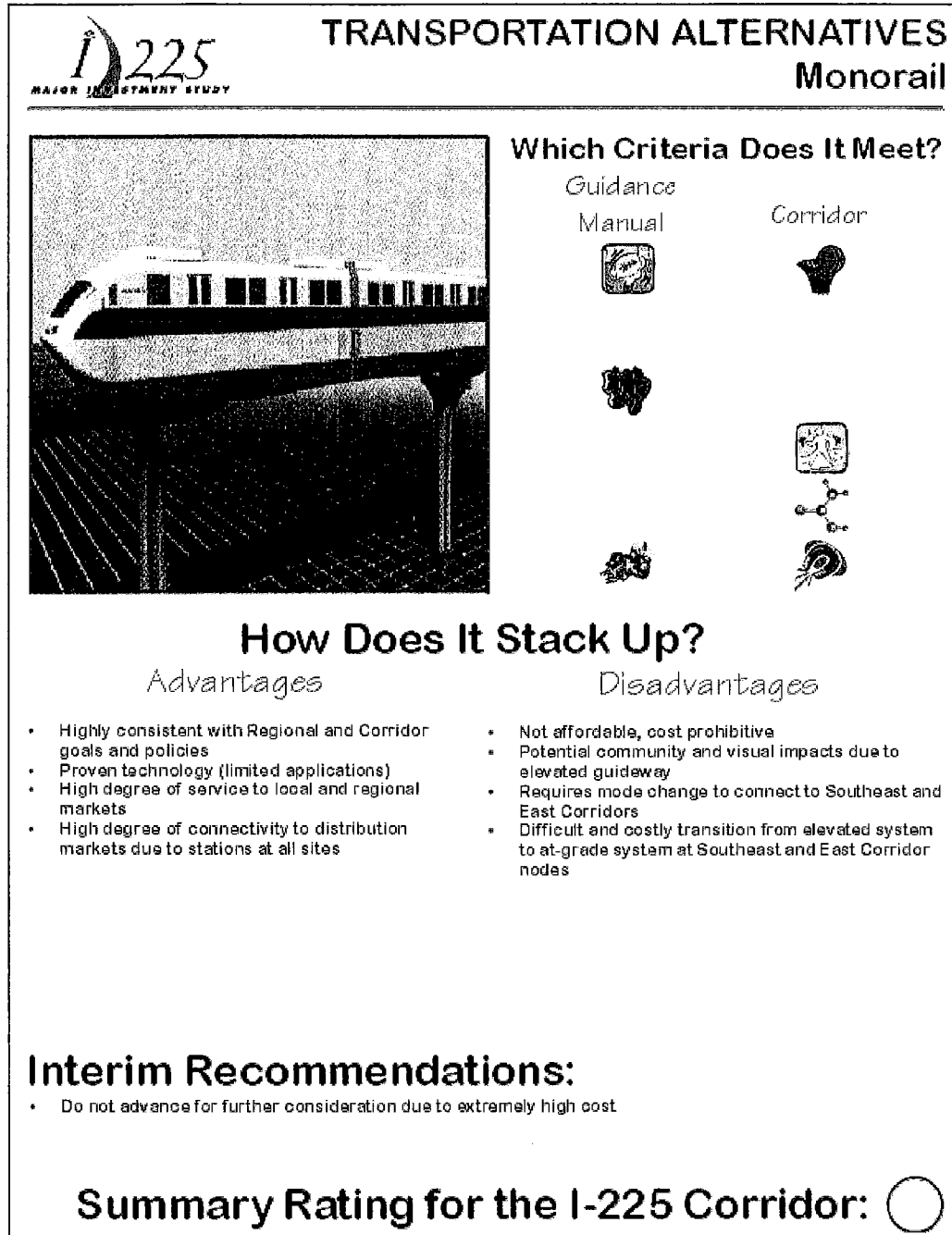


Figure 3-20: Personal Rapid Transit Alternative

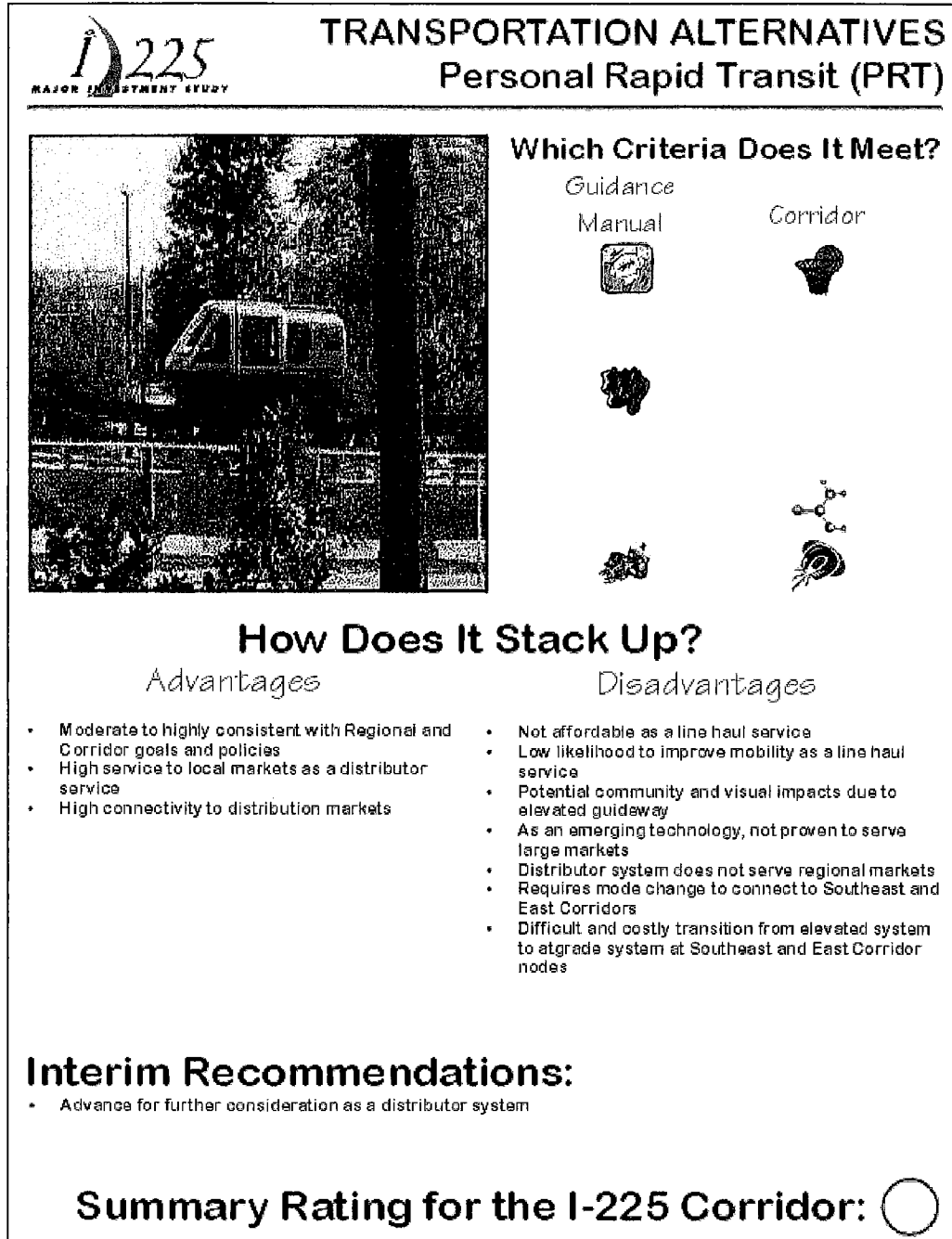
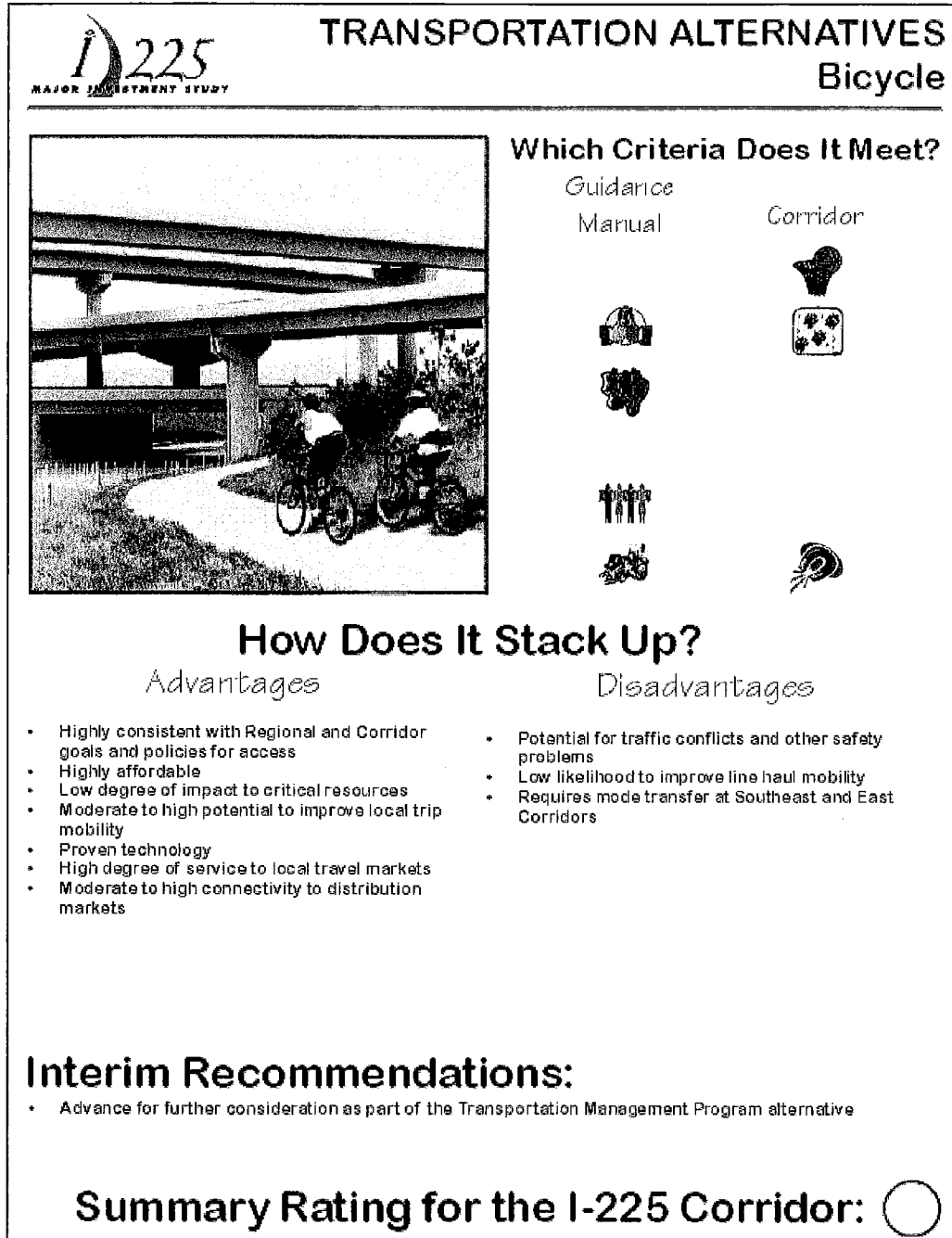


Figure 3-21: Bicycle Alternative



In summary, the pre-screening step indicated that seven alternatives are possible candidates to respond to the I-225 corridor needs and should be advanced to the screening step:

- No Action
- Transportation Management Program (including bike as circulator/distributor)
- Freeway Lane Additions
- Bus/HOV Lanes
- Light Rail Transit
- Commuter Rail
- Personal Rapid Transit (as circulator/distributor only)

Screening Evaluation

The seven alternatives that were advanced to the conceptual screening step were expanded to address various design options and were reviewed in light of their general capabilities. The purpose for defining options was to develop a range of potential service in the corridor that could be provided by each of the alternatives, so that the full capabilities of an alternative could be considered. The conceptual screening of alternatives and associated options are defined in **Figure 3-22**.

As noted earlier, the conceptual screening effort utilized an expanded budget of \$300 million to test affordability for the various alternatives considered in this stage of the project. In addition, the consultant team reviewed the 24 alternatives/options listed in **Figure 3-22** for major safety, operating, or construction issues and other areas of concern that would affect the viability of an alternative. The latter set of reviews are beyond the criteria specified in the *RTD MIS Guidance Manual* for this phase of the study, but were meant to identify critical technical matters of concern as soon as possible.

The screening process has been conducted, using criteria specified in the *RTD MIS Guidance Manual* and corridor-specific criteria developed by the consultant team. The screening assessment indicates the following results, grouped by modal families. Results include Year 2020 regional modeling data provided by DRCOG to the consultant team in August 1998.

No Action and Transportation Management Program


These options will be advanced throughout the study process to provide a baseline and a required basis for comparison. See **Figure 3-23** and **Figure 3-24**.

Freeway Lane Addition Options

All freeway lane additions, beyond the six lanes currently authorized, would be inconsistent with regional and corridor policies. However, because additional lanes are often perceived as a reasonable solution by the public, four options were defined and assessed, with the following results (see **Figure 3-25**):

- The maximum build-out option would exceed the budget criteria and would be likely to have major environmental and community impacts. The consultant team recommended that this option be dropped.


Figure 3-22: Alternatives Screened




TRANSPORTATION ALTERNATIVES

Alternatives Screened


Main alternatives were defined at the pre-screening step. Options were defined for those alternatives advanced to the Screening Step.




No Action
No new projects beyond those currently programmed in the Transportation Improvement Program (six-lane freeway, three lanes each direction)




Transportation Management Program
Combination of relatively inexpensive transportation improvements (for example, adding van pools, adjusting signal timing, and/or installing variable message sign to provide en-route traffic advisories) to enhance mobility and/or safety.




Freeway Lane Additions/Other Highway Improvements
 Option A-1: 8 Lane Freeway
 Option A-2: 10 Lane Freeway
 Option A-3: Exclusive Bus Lane (Shoulder)
 Option B: Maximum Build Out Freeway (14 Lane assumed)




Bus/HOV Lanes
 Option 1-A: Barrier Separated
 Option 1-B: Buffer Separated
 Option B: Continuous Access
 Option C: Reversible HOV Lanes
 Option D: HOV-Only Lane



Light Rail Transit (LRT)
 Option A-1: Median Alignment (Base)
 Option A-2: East Shoulder Alignment
 Option A-3: West Shoulder Alignment
 Option B-1: Median Alignment + "Slide" to Fitzsimons & Aurora Mall
 Option B-2: East Shoulder Alignment + "Slide" to Fitzsimons
 Option B-3: West Shoulder Alignment + "Slide" to Aurora Mall
 Option C: Sable Alignment
 Option D: Peoria Alignment
 Option E: Potomac Alignment



Commuter Rail (CR)
 Option A-1: Median Alignment
 Option A-2: East Shoulder Alignment
 Option A-3: West Shoulder Alignment



Personal Rapid Transit (PRT)
In median or along shoulders or as a distributor

Figure 3-23: No Action Alternative

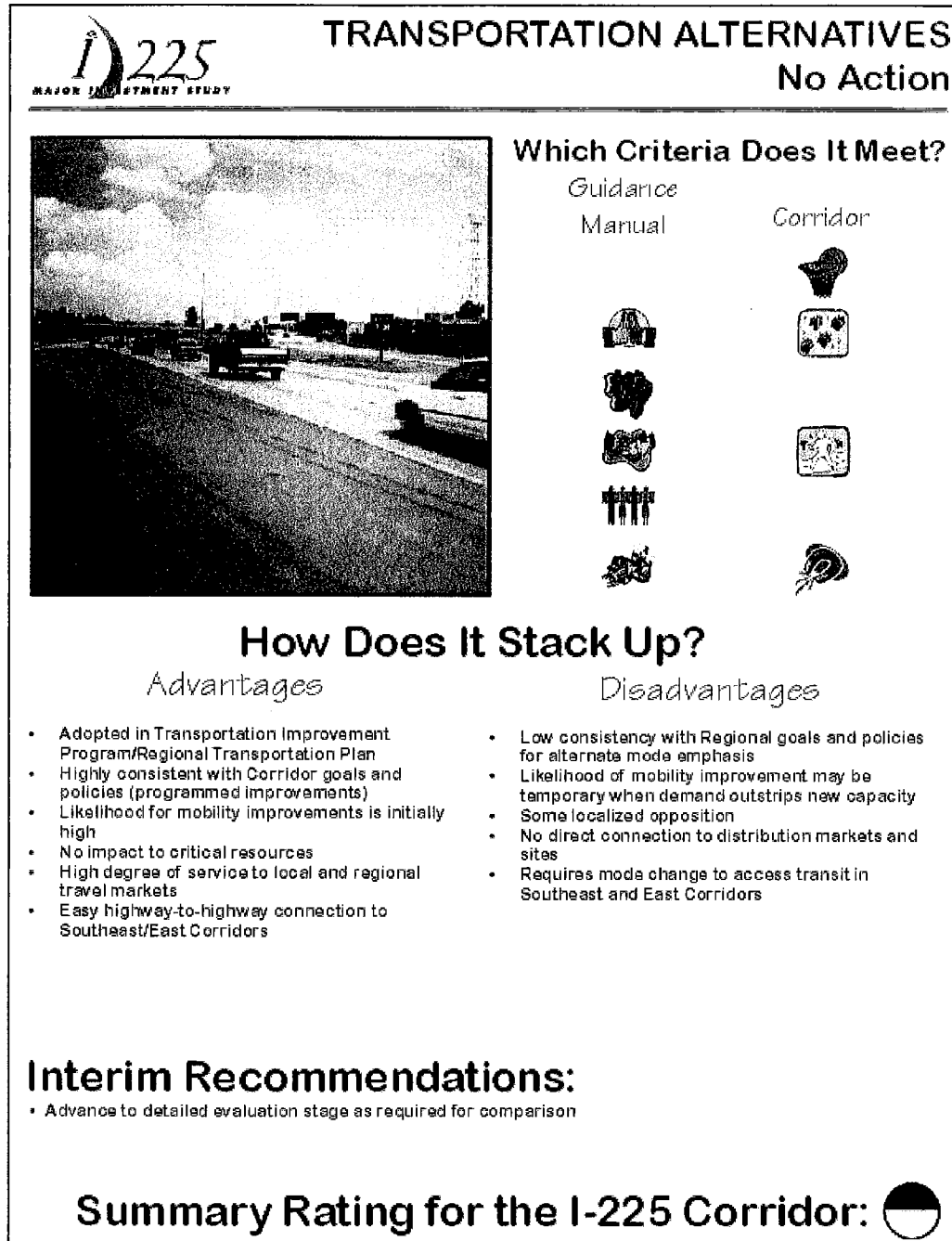

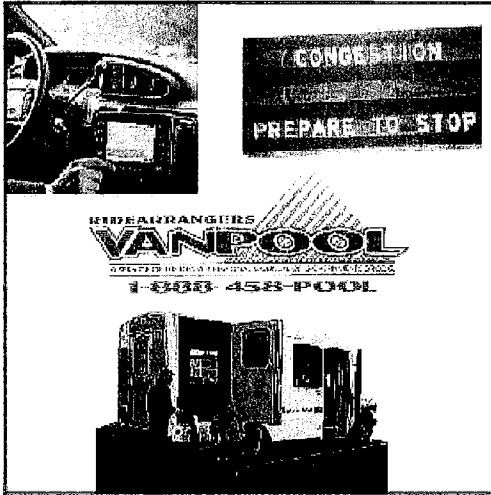


Figure 3-24: Transportation Management Alternative














TRANSPORTATION ALTERNATIVES

Transportation Management Program



Which Criteria Does It Meet?

<i>Guidance</i>	<i>Corridor</i>
Manual	
	
	
	
	
	
	

How Does It Stack Up?

Advantages

- Generally consistent with Regional goals and policies
- Highly affordable
- No major environmental impacts
- No impact to critical resources
- No community opposition
- High degree of service to local travel markets
- Easy highway-to-highway connection to Southeast/East Corridors

Disadvantages

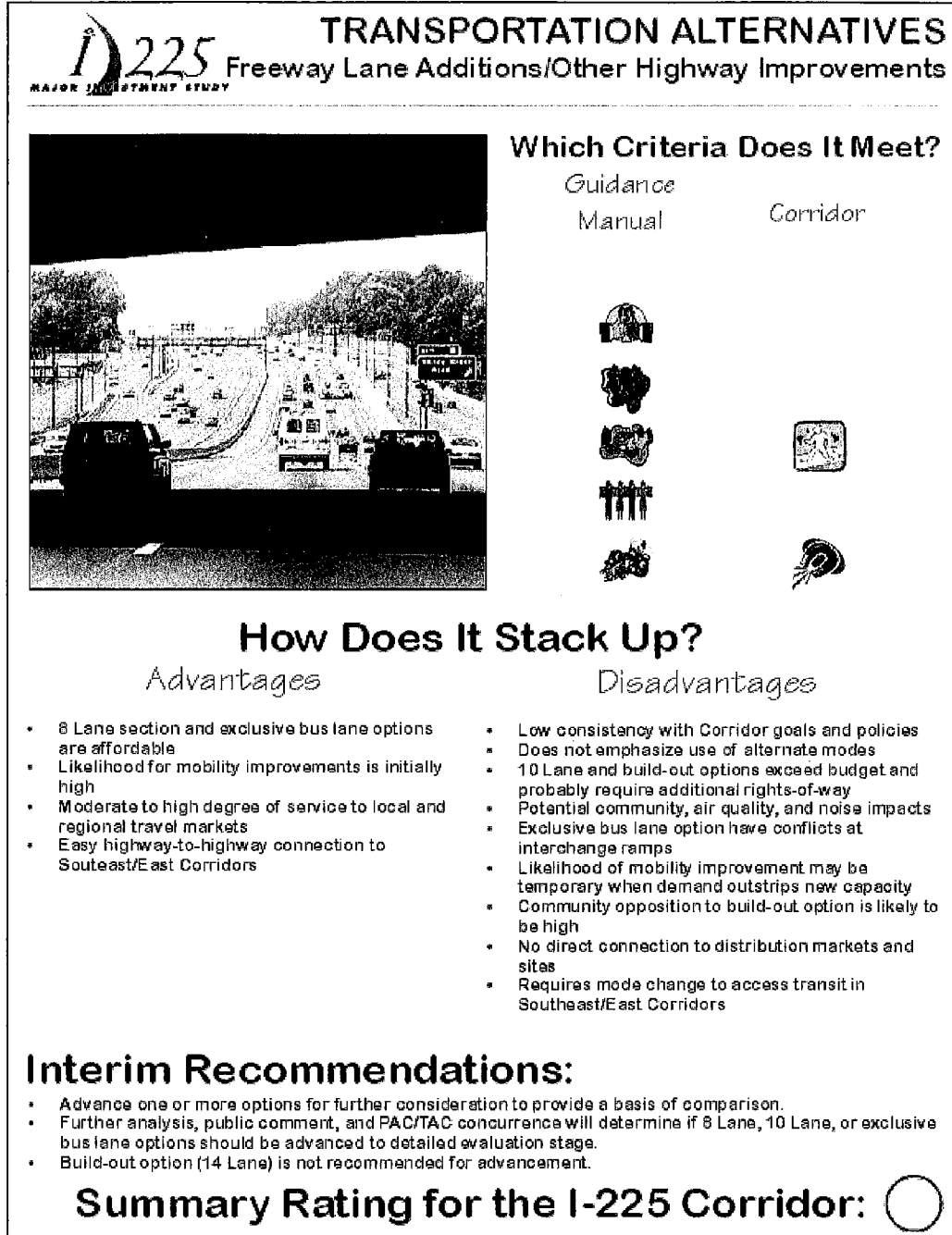
- Mobility improvements are localized
- Low to moderate consistency with Corridor goals and policies
- Low to moderate degree of service to travel markets
- No direct connection to distribution markets
- Requires mode change to access transit in Southeast/East Corridors

Interim Recommendations:

- Advance to detailed evaluation stage as required for comparison

Summary Rating for the I-225 Corridor:

Figure 3-25: Freeway Lane Additions Alternative



A 10-lane freeway is likely to exceed the budget criteria and would likely have major environmental and community impacts.

- An 8-lane freeway could be built within the budget criteria, but would likely have some degree of environmental and community impacts. The consultant team recommended that this alternative be advanced to detailed evaluation as the most viable freeway lane addition option. The work-up for this alternative will permit consideration of flex lanes and auxiliary lanes.
- An identified concern was the potential that expanded freeway capacity could overwhelm the arterial network's capacity to handle traffic to and from the freeway.
- An exclusive bus lane, along the right-hand shoulder, would likely have very low usage levels and presents conflicts at entry/exit ramps. The consultant team recommended that this option be dropped as an exclusive alternative, but suggested that it be considered as a strategy in the transportation management alternative.

Despite these many negative indicators, a freeway lane addition alternative was advanced to the detailed evaluation phase in order to provide comparative information to address public questions. Also, freeway lane additions, in combination with other alternatives, would be investigated to determine if additional lanes would aid in the development of a multimodal solution to meet the I-225 corridor's needs.

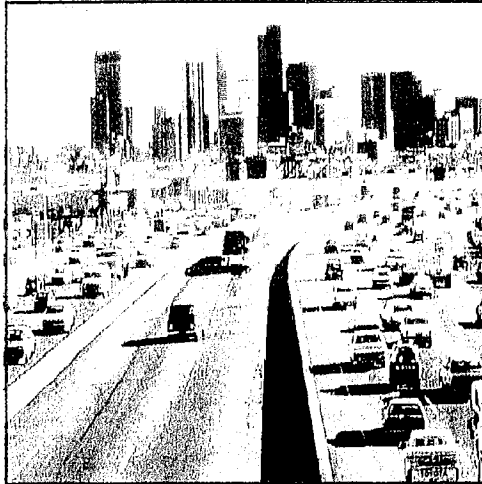
Bus/HOV Options

The viability of Bus/HOV lanes in the I-225 corridor is influenced by the lack of current or planned HOV lanes in the I-70 East Corridor or I-25 Southeast Corridor to which potential I-225 lanes would be able to connect. In addition, there is currently only one RTD route that uses I-225 north of Parker Road - the skyRide to Denver International Airport (DIA). Although additional express routes that could traverse the entire I-225 length might be developed, the consultant team questioned whether there would be sufficient demand to warrant Bus/HOV lanes. Other key findings include the following (see **Figure 3-26**):

- All Bus/HOV Lane Alternatives/Options fall within the budget criteria.
- Three Bus/HOV options related to lane configuration were defined: barrier-separated, buffer-separated and continuous access. The consultant team recommended against consideration of continuous access Bus/HOV lanes because of major safety concerns due to the high accident levels that accompany this type of operation, and the limited mobility improvement potential associated with the short distance between ramp locations. The team recommended that further consideration of Bus/HOV lanes in the median be defined as including direct access ramps to improve mobility and to avoid the safety concerns associated with vehicles having to cross through lanes of moving traffic between right-hand side entry/exit ramps and median HOV lanes. Providing direct access ramps may require additional right-of-way, which could have localized community and environmental impacts.
- Consideration of a reversible Bus/HOV lane looked at the a.m./p.m. directional split of traffic in the corridor (1995). The directional split is about equal, so a reversible lane is not viable and was dropped from further consideration.

Figure 3-26: Bus/HOV Lane Alternative

TRANSPORTATION ALTERNATIVES Bus/HOV Lanes



Which Criteria Does It Meet?

Guidance

Manual



Corridor



How Does It Stack Up?

Advantages

- Generally consistent with Regional and Corridor goals and policies
- Generally affordable
- No known major environmental impacts
- Technology is proven
- No known community opposition
- Moderate degree of service to regional travel markets
- High degree of connectivity to distribution markets if ramps to/from sites are included
- Easy HOV-to-highway connection to Southeast/East Corridors

Disadvantages

- Impacts traffic and may require additional rights-of-way for local ramp connections
- Option B, Continuous Access, presents major safety concerns
- Improvement to mobility is limited due to lack of HOV connectivity with other corridors
- Low degree of service to local travel markets
- Requires a mode transfer to SE/East Corridors
- Option C, Reversible HOV Lanes, does not satisfy directional split requirements
- Option D, HOV-Only Lane, is too costly compared to potential use

Interim Recommendations:

- Do not advance for further consideration due to lack of connectivity in adjoining corridors.
- Further analysis, public comments, and PAC/TAC concurrence will determine if barrier and buffer-separated options should be advanced to detail evaluation stage.
- Continuous Access, Reversible HOV Lane, and HOV-Only Lane options are not recommended for advancement.

Summary Rating for the I-225 Corridor: ○

An HOV-only lane was considered. Without connectivity to HOV lanes in other corridors (which are not currently planned), the likelihood of sufficient demand was deemed low by the consultant team. Cost-effectiveness is likely to be low. Despite its overall positive rating, the consultant team recommended this option be dropped from further consideration.

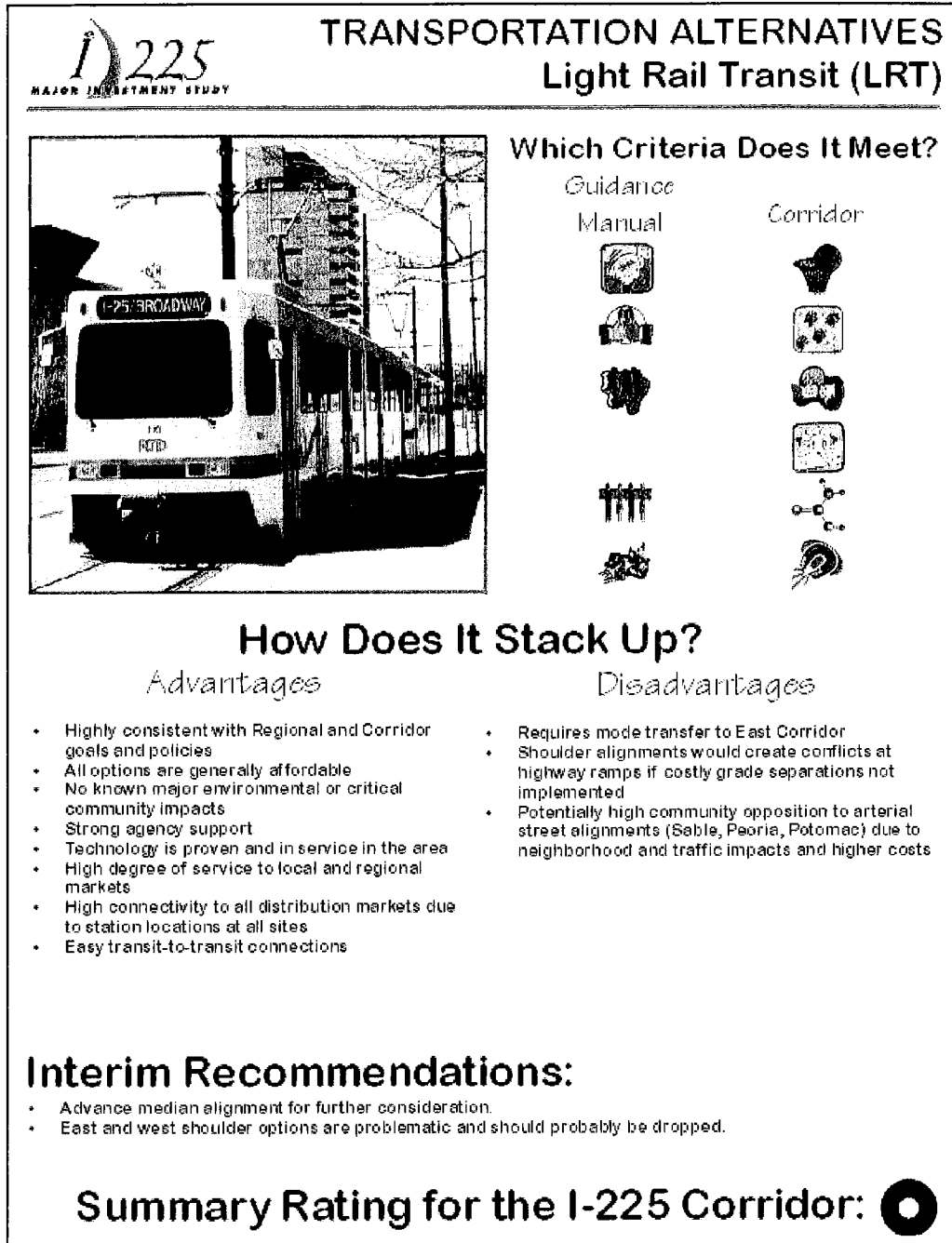
- All Bus/HOV options have significant weaknesses as there are no planned connections with similar facilities outside the defined I-225 Corridor. Discussions with the TAC, PAC, and CCG members supported the elimination of all HOV alternatives.

Light Rail Transit Options

All Light Rail Transit (LRT) options are consistent with regional and local policies. Six alignment options using the I-225 right-of-way were developed to identify whether significant benefits or impacts could be identified at the screening level. In addition, three street-running alignment options on arterials parallel to I-225 were identified. The following conclusions were drawn (see **Figure 3-27**):

- LRT alignment options that would be in the median or along the east or west shoulders of I-225 were compared. The median alignment would have the lowest cost. Alignments along either shoulder would be more costly because of the need to provide grade-separations at six sets of entry/exit ramps to avoid conflict with traffic. The added cost of shoulder alignments with these grade-separations is very likely to exceed the budget criteria. Shoulder alignments without grade separations at entry/exit ramps would present unacceptable risk. (Another possible scenario, using signals and crossing arms at the ramps to control traffic movements when trains are present, was deemed to have unacceptable impacts to traffic and was not supported by officials representing the Colorado Department of Transportation and the Federal Highway Administration). The consultant team's recommendation is that shoulder alignments for the entire length of the corridor not be advanced for further consideration. Options that use shoulders for a portion of the alignment are discussed below. The consultant team recommended that a median LRT alignment be the baseline of comparison among any LRT alternatives that are advanced.
- LRT alignment options that would use either the median, east or west shoulders as the primary alignment, but with shifts to serve the Aurora Mall or Fitzsimons campus were reviewed. The shifts were included to see whether being closer to these key activity centers would raise any significant benefit or impact at the screening level of analysis. The issues of cost and ramp conflict identified above for shoulder alignments would also apply to this group of options. Either shoulder alignment would result in traffic conflicts at six interchanges. Even with the benefits of proximity to an activity center that a shoulder alignment would provide, the consultant team's recommendation was to eliminate shoulder alignments from further consideration.
- A median alignment, with shifts to either Aurora Mall, Fitzsimons, or both, has the potential for higher patronage than a full-median alignment since it would decrease the walk distance from transit stations to origins/destinations at these activity centers, which is known to be a key factor in patronage forecasting. The consultant team recommended that this option be advanced for further study. It should be noted that this recommendation placed the median alternative and these alignment shifts as a single LRT alternative with various design options to be examined.

Figure 3-27: Light Rail Transit Alternative



- The cost of a median alignment with shifts would be higher than a full-median alignment, but was within acceptable corridor budget limits. Trade-off analyses between the costs of median stations versus shifting the alignment proximate to activity centers, compared to patronage impacts, and various other factors will be needed in the detailed evaluation phase of the study.
- Three LRT alignments that used street rights-of-way (Sable, Peoria, and Potomac), instead of I-225 right-of-way were developed for testing purposes. The alignments were developed to permit an examination of a wide range of LRT service in the corridor. The estimated costs of at-grade service for these scenarios met the budget criteria, but the alignment would have significant traffic and community impacts. The inclusion of grade-separations to avoid traffic impacts at major arterial streets would increase the cost of these street alignment options, likely exceeding the budget criteria. These alternatives were dropped from further consideration.
- Review of anticipated future trip-making in the corridor, focusing on planned development at Gateway and redevelopment at Aurora Mall and Fitzsimons, led the consultant team to consider the northern terminus of the corridor. A transit station at Smith Road was suggested by the *East Corridor MIS Report* as the interface point with planned commuter rail service in the I-70 corridor. The team suggested that a different northern terminus should be considered during the detailed evaluation phase to address this mode change, due in part to the following factors:
 - The Smith Road terminal does not serve an activity center. It is more than a mile by roadway to Fitzsimons and more than 2 miles from Gateway.
 - The Smith Road terminal does not serve residential areas. The majority of Morris Heights, south of Smith Road, is not readily accessible from Smith Road and would have long walk distances. Montbello, north of I-70, is effectively barricaded from the terminal by I-70. Patrons from Montbello would have to access the station via Chambers or Peoria.
 - By comparison, if the northern terminus were established at the proposed station at 40th Street and Pena, it would serve a growing activity center. In addition, the Gateway area is a likely destination for trips that use the I-225 corridor. Providing service to this destination without a transfer (and change of mode and associated scheduling difference) at Smith Road may increase overall patronage. This potential increase for trips bound for Gateway would have to be evaluated against the effect on trips bound for downtown Denver via commuter rail, since the transfer point would move east by 2+ miles.
 - Access to/from residential areas would be greater with a Gateway terminus than a Smith Road terminus for Montbello, Parkfield, Green Valley Ranch and new residential developments included in the Gateway projects. This improved accessibility (and lack of a forced transfer at Smith Road, and perhaps more frequent headways) is likely to increase patronage for trips between the residential areas and activity centers along I-225 (Fitzsimons, Aurora Mall/City Center/ DTC).