

CHAPTER II

Alternatives

This chapter describes the range of alternatives that were developed during the Draft EIS phase to correct the existing and future problems identified in Chapter I. The development and evaluation of alternatives were based on engineering evaluations; agency coordination; consideration of social, economic and environmental impacts; and public input. Among the alternatives analyzed were the desirability of bypassing the SIU 4 portion of I-70, the possibility of implementing alternatives that would not require the complete reconstruction of the existing corridor (such as the No-Build Alternative¹ or transportation demand/management) as well as various complete reconstruction alternatives. The alternatives retained for detailed analysis are described in this chapter. The justifications for eliminating alternatives from further consideration are also discussed. This chapter concludes by describing the recommended preferred alternative and the justification for its identification.

A. Development of Alternatives

In its regulations for implementing the NEPA, the Council on Environmental Quality (CEQ) recognizes that many alternatives that address a project’s purpose and need may exist. However, to remain consistent with the CEQ’s goal of fostering more effective and concise EISs, only the reasonable alternatives are presented and evaluated in detail in this document. Reasonable alternatives must fulfill the purpose and need of the project (as defined in Chapter I) and must be practical and feasible from engineering, environmental and economic standpoints.

1. Identifying Reasonable Alternatives

The process to identify the reasonable alternatives was based on a screening process that began by identifying a wide range of initial alternatives to address the transportation needs of I-70. The wide range of alternatives were then screened based on engineering evaluations; agency coordination; consideration of social, economic and environmental impacts; and public input. The basic steps were as follows:

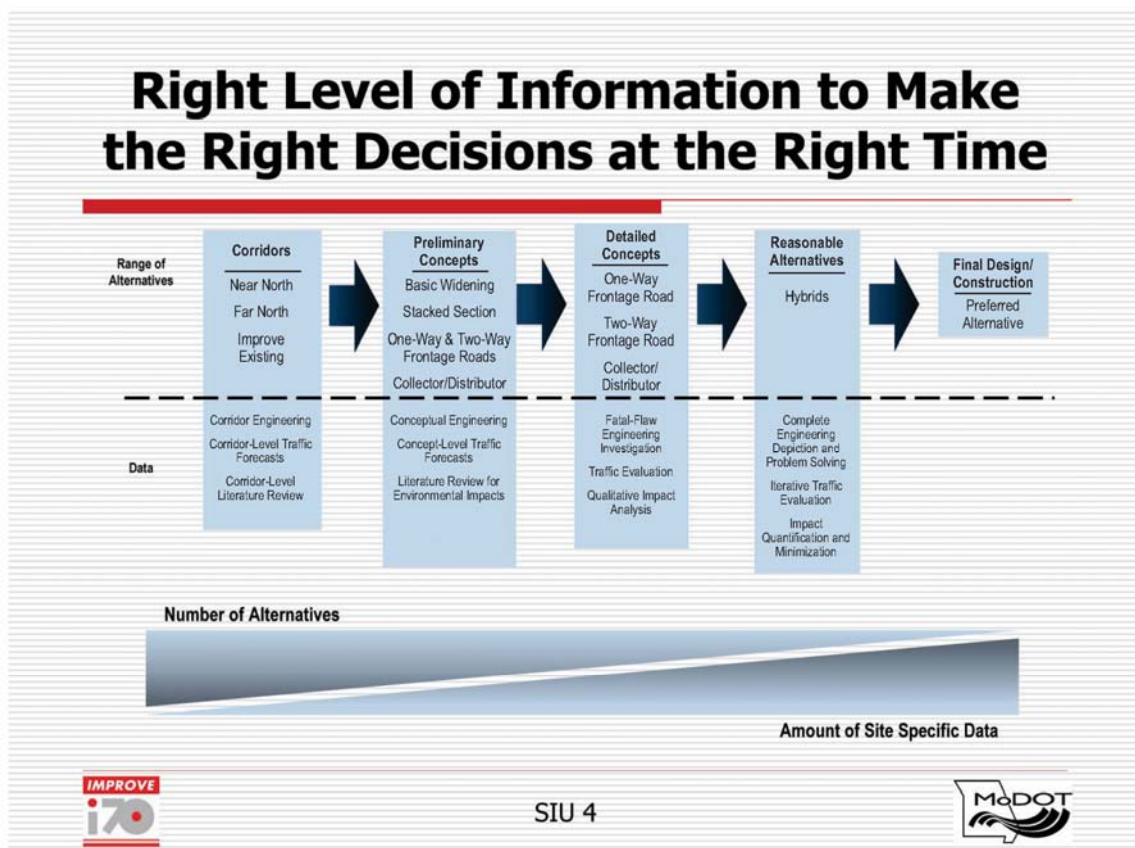
- Reevaluate the **corridors** that emerged from the First Tier EIS. The corridor alternatives include improving the existing I-70 corridor, developing a Near North Corridor and developing a Far North Corridor. The Near North and Far North Corridors are one-mile-wide (1.3-km-wide) bands without a specific freeway alignment.
- Screen the corridors to determine whether improvements to only the existing I-70 corridor would address future transportation needs or whether improvements in multiple corridors would be required to safely accommodate future traffic volumes.

¹ The No-Build Alternative would not require the complete reconstruction of the corridor, but would require substantial maintenance-type construction.

- Develop a range of preliminary alternatives or **concepts** within the corridor(s) that have been screened.
- Determine whether each concept is reasonable and responsive to the project purpose and need and retain alternatives that address the existing deficiencies of I-70 (**reasonable alternatives**).
- Identify a **preferred alternative** and explain the justification for its selection.

Figure II-1 depicts the overall process of alternative development and evaluation.

Figure II-1: Process of Alternative Development and Evaluation



a. Design Criteria

An important concept related to the development of alternatives are the design criteria that would determine what is acceptable. The project has several fundamental criteria to determine what is acceptable. These criteria will shape decision making throughout the project. First, the project must accommodate projected future needs. Consequently, the design year of 2030 was used for all traffic projections. Chapter I discusses the purpose and need of the project, using traffic projections for conditions in the year 2030. Another goal of the Improve I-70 project is to improve the roadway to meet the current standards. The existing I-70 corridor has several

outdated design elements that do not meet current standards required of modern roadway facilities. The following roadway design criteria, summarized in **Appendix II-A**, were used to develop reasonable alternatives:

- Design Speed,
- Lane Width,
- Median Width,
- Outside Shoulder Width,
- Inside Shoulder Width,
- Safety Clear Zone,
- Slopes,
- Maximum Horizontal Curve,
- Vertical Clearance,
- Grade,
- Crest Vertical Curve,
- Sag Vertical Curve,
- Passing Sight Distance,
- Superelevation,
- Pavement Cross Slope, and
- Ditch Depth.

As discussed in Chapter I, many aspects of the existing corridor do not meet the design criteria established for SIU 4. For example, at three separate locations, the horizontal curvature is greater than the criteria of $1^{\circ}30'$. Nearly one-half of the vertical curves fail to meet length requirements for crest or sag curves. Roughly one-half of the overpass bridges fail to meet the vertical clearance requirements and no existing median widths meet the criteria. Approximately 19 percent of the pavement in SIU 4 is rated as poor or very poor. Consideration of these outdated design elements were important to the development of the alternatives.

Typical sections incorporating these criteria are shown in **Appendix II-B**.

2. Frontage Roads²

Frontage roads are a key element to the improvement of I-70 through SIU 4, as well as throughout the entire 200 miles of the I-70 corridor. A Frontage Road Master Plan was developed to address frontage road continuity from a corridor-wide perspective. The goals of the plan include establishing the design criteria and study approach for frontage road issues for the Second Tier studies. The SIU 4 project team reviewed the Frontage Road Master Plan and performed further analysis to determine where frontage roads are necessary to either maintain access to individual properties or to provide benefits to mainline operations.

Throughout SIU 4, continuous frontage roads or parallel roads currently exist on both sides of I-70 in most locations except between the MO-J/O interchange and the Sorrels Overpass. The existing frontage road system is composed of multiple roadway links including the I-70 Drives and other roadways. The operation of the frontage roads was found to be integral to the operation of I-70. Consequently, the investigation of frontage roads was carried through each successive step in the preliminary development process. All of the exhibits in Chapter II include frontage roads. The frontage roads proposed in the various alternatives presented in this document (including the recommended preferred alternative) are necessary for the operation of the overall system.

B. Corridors

1. Introduction to Corridors

With the approval of the First Tier EIS for SIU 4 in December 2001, FHWA approved the continued investigation of the *Widen Existing I-70 Strategy* for improving I-70. The *Widen Existing I-70 Strategy* proposed reconstructing I-70 within its existing corridor (see **Figure II-2**). Within SIU 4, it also proposed to investigate a new four-lane freeway, within a new corridor north of existing I-70³, while also reconstructing existing I-70 to the extent necessary. The First Tier EIS identified two unique relocation corridors, described below and shown in **Figure II-2**. For the

² The First Tier EIS stated the long-term goal of providing continuous frontage roads for the purposes of incident management – frontage roads could provide an alternative route and system redundancy should an incident occur on I-70. The MoDOT is currently in the process of developing a statewide incident management plan, including a plan for I-70 across the state, to respond quickly and efficiently to incidents. Providing continuous frontage roads along the corridor, on at least one side or the other, would provide redundancy within the system and would fully complement and further amplify the benefits of incident management. In the event of an incident, traffic can be efficiently rerouted to the adjacent frontage road system, as necessary, to maintain traffic flow in the corridor.

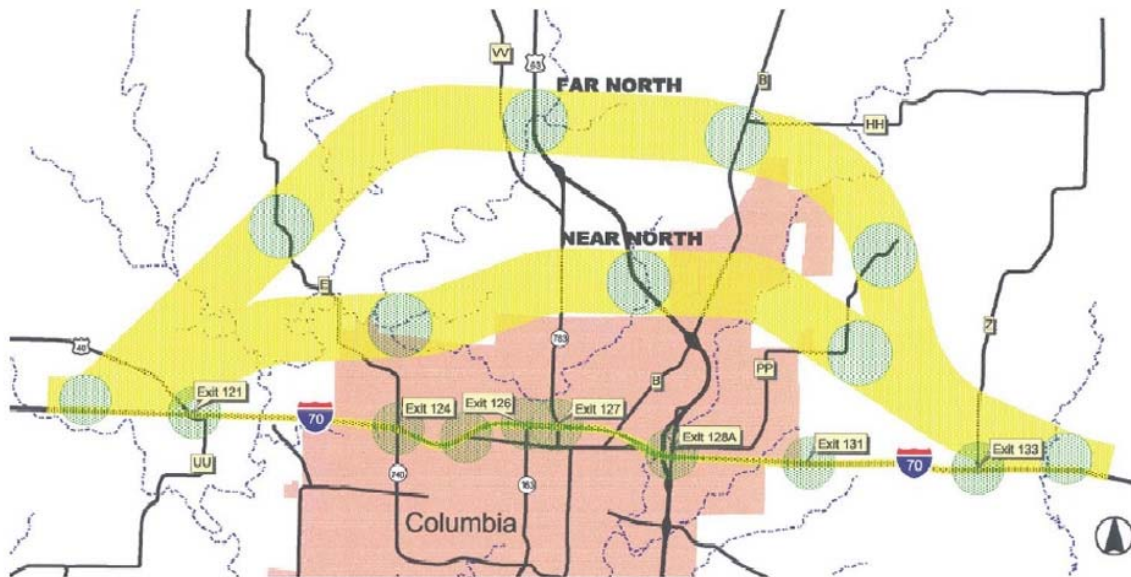
Though continuous frontage roads are a long-term goal and are included as part of the proposed action for environmental planning purposes, continuous frontage roads are not a high priority. Including continuous frontage roads as part of the proposed action provides a long-term master plan for the corridor, but MoDOT is not committed to building continuous frontage roads in the near term. MoDOT is committed, however, to construct frontage roads for the purposes of maintaining existing local service connections and maintaining existing access to adjacent properties. Each frontage road will be assessed on an individual basis as to whether or not any existing discontinuities will be addressed as part of the initial construction. Improvement of existing discontinuities will depend on the availability of construction funding and relative priorities.

For the purposes of this environmental document, since it is reasonably anticipated that full build-out of the frontage road system will occur at some point in the future, continuous frontage roads have been considered in the impact assessments as direct impacts. As such, the analysis of the improvement alternatives has fully considered the implications of the future continuous frontage system on the layout and configuration of the initial I-70 improvements (i.e., proposed action). Recommendations for the improvements have been based on the anticipated full build-out of the corridor. Construction cost estimates do not include continuous frontage roads.

³ The First Tier EIS concluded that a relocating I-70 to the south of Columbia should not be considered because of unacceptable impacts to the environment and excessive travel distances. Therefore, only corridors to the north would be considered further.

Second Tier EIS, both relocation corridors were assumed to be one mile (1.6 km) wide. The relocation concept also assumed four travel lanes with 12-foot (3.7-m) inside and outside shoulders and a 124-foot (37.8-m) median.

Figure II-2: Corridor Location Map



a. Existing I-70 Corridor

The existing I-70 corridor extends from a point just west of the MO-J/O interchange to a point just east of the MO-Z interchange. In general, the width of the existing right of way is approximately 240 feet (73.2 m) wide within Columbia and approximately 370 feet (112.8 m) wide, elsewhere. Proposed improvements would attempt, to the extent possible, to contain construction within the existing right of way.

b. Far North Corridor

The Far North Corridor begins at the U.S. 40 interchange (exit 121, or the Midway interchange) and jogs to the northeast, running well north of the city limits. After crossing U.S. 63 north of the U.S. 63/MO-763 interchange and crossing MO-B, the corridor bears south, reconnecting with I-70 east of the MO-Z interchange (exit 133). There are numerous possible interchange locations throughout this corridor. Grade separations would be provided, as needed, to allow access for local traffic across the new facility. The interchange with U.S. 63 and the connections to I-70 are assumed to be standard diamond interchanges.

c. Near North Corridor

The Near North Corridor is similar to the Far North Corridor in every aspect except that it is closer to existing I-70. The corridor begins just west of the U.S. 40 interchange and runs east just north of the city limits. After crossing U.S. 63, south of the U.S. 63/MO-763 interchange, it

turns to the southeast, reconnecting with I-70 east of the MO-Z interchange. There are numerous potential interchange locations throughout this corridor. Among the possible interchange locations include a local interchange northwest of Columbia, U.S. 63 and an interchange northeast of Columbia to serve the area. Because of the proximity of MO-B to U.S. 63, an interchange with MO-B would be difficult. Grade separations would be provided, as needed, to allow access for local traffic across the new facility. The interchange with U.S. 63 and the connections to I-70 are assumed to be standard diamond interchanges. These and other possible interchange locations were included in the analysis of the corridor.

2. Corridor Screening Methodology

a. Corridor Traffic Model

During the First Tier EIS, MoDOT used a statewide traffic model to predict traffic volumes in the Columbia area. The model was macroscopic, concentrating on the operation of I-70 on a statewide level.

Chapter I described the expected traffic growth between the existing year (2000) and the design year (2030) for the No-Build condition. To develop effective transportation solutions for the Second Tier, it was important to understand how the projected traffic growth would change based on improvements to the existing traffic network. The I-70 Columbia Travel Demand Model incorporated local traffic counts and specific long-range growth plans for the Columbia/Boone County region. It also included the latest applicable census data and updates of long-distance through-trip information (based on statewide model information). A comprehensive land use working session was held to achieve consensus about distribution of growth in the community and the revised land use patterns were placed in the model for the project. The I-70 Columbia Travel Demand Model was then used to forecast 2030 volumes for the respective Build Alternatives described later in this chapter. These volumes were different from the 2030 No-Build volumes in that they incorporated new local connections and the respective changes in travel patterns that resulted from the Build Alternatives.

Certain locations present more complex conditions that make it more challenging to develop future traffic forecasts. Within the SIU 4 portion of I-70, Stadium Boulevard is one such location. The combination of the high travel demand and densely developed commercial area in the Stadium Boulevard/I-70 interchange area required more detailed analysis of the future travel demand and development patterns. The project team made additional modifications to the I-70 Columbia traffic model in the Stadium Boulevard area in order to better understand how specific improvements to I-70 and the local road network would impact future travel demand.

b. Corridor Traffic Evaluation

The analysis in the First Tier EIS concluded that while a northern I-70 corridor might reduce traffic on I-70, these traffic reductions would not be large enough to preclude the need to improve existing I-70. It is expected that under a No-Build scenario, all of I-70 within Columbia would operate worse than LOS D by 2030. Using the need to improve existing I-70 as a starting point, there were two steps in the Second Tier EIS corridor screening analysis. First, to confirm whether the First Tier EIS finding was still true with the updated I-70 Columbia traffic volumes. Secondly, if the first part was true, determine whether transportation deficiencies on I-70 would be best addressed by improving only the existing highway or by improving the existing highway and developing a new highway north of I-70. The first step in comparing the corridors was to

determine I-70 traffic volumes in 2030 without a northern corridor and traffic volumes with a Near North Corridor and a Far North Corridor (including traffic volumes on I-70).

The I-70 Columbia Travel Demand Model was used to forecast 2030 volumes for the existing, Far North and Near North Corridors (see **Table II-1**). In forecasting the 2030 volumes, the model assumed that the roadway in the northern corridors would be a four-lane divided facility and that I-70 would be a six-lane divided highway. The I-70 Columbia Travel Demand Model indicated that ADT (vehicles per day) would range from 30,000 to 60,000 on the Near North Corridor, from 5,000 to 16,000 on the Far North Corridor and from 72,200 to 118,000 under the existing I-70 corridor.

Of particular interest to the project team was the degree to which the two northern corridors would divert traffic from existing I-70. The 2030 ADT on I-70 would range from 20,000 to 91,700 under a scenario with a Near North Corridor. The 2030 ADT on I-70 would range from 60,800 to 116,000 under a scenario with a Far North Corridor. The important finding here is that even if a new bypass is constructed, traffic volumes on I-70 would increase substantially. Consequently, the level of improvements required on I-70 to accommodate future traffic volumes would be roughly equivalent, regardless of whether or not a new corridor is constructed. **Exhibits II-1 and II-2** depict the volume of traffic diverted from I-70 to the Near North and Far North Corridors. The Far North Corridor is predicted to remove about 2,000 vehicles per day from the I-70 corridor, a reduction of roughly two percent, whereas the Near North Corridor would divert about 26,000 vehicles per day, a reduction of about 22 percent. These results confirmed the First Tier findings that a new northern corridor would not attract enough traffic from I-70 to eliminate the need for its improvement, the cost of which would be substantial because adding even one lane would require the reconstruction of all existing interchanges.

Table II-1: Corridor Screening Traffic Volume Forecasts (2030)

Corridor	Volumes on New Corridors (ADT)	Volumes on Existing I-70 (ADT)*	Predicted Traffic Reductions on I-70
Improve Existing I-70 Only	N/A	72,200–118,000	N/A
Far North	5,000–16,000	60,800–116,000	2%
Near North	30,000–60,000	20,000–91,700	22%

* Volumes on I-70 reflect three through lanes in each direction on the existing I-70 corridor.

Although the new corridors would not preclude a substantial reconstruction of I-70, there was strong local support for further consideration of the Near North and Far North Corridors. In response to the local support for the northern corridor, a sensitivity analysis was conducted. The sensitivity analyses sought to investigate the merits of the new northern corridor options through a detailed examination of the following 2030 operational thresholds:

- **Average Travel Time (minutes) for Person Trips Using the I-70 Corridor** expresses the true economy of transportation service; that is, the time needed to move passengers and goods from place to place. This measure allows comparisons of alternatives that may produce higher speeds but longer travel distances.
- **Average Speed (miles per hour) for Person Trips Using I-70 Corridor** reflects the capacity of the highway; that is, the LOS. This measure takes into account travel speeds

but not distance between points (e.g., between a new corridor and I-70). The average speed along each corridor was compared to the LOS D minimum speed of 57.6 mph. Level of Service was determined to be inadequate if the roadway cannot satisfy this benchmark.

- **Vehicle Miles of Travel (VMT) per Day, Operating at a Given Level of Service along I-70** takes into account traffic volume, speed and distance between origin and destination. A higher VMT usually indicates better transportation efficiency, provided the highway continues to operate at LOS D or better. A VMT threshold was calculated using the density, speed and time above which the corridor would operate below LOS D.

The three screening measures were investigated for all trips along I-70, for through trips only and for trips originating outside SIU 4 but ending within it. Included in the analysis was the existing I-70 corridor (as a baseline for comparison) and the Business Loop 70 corridor. The Business Loop 70 Corridor was added to the analysis at the request of the local business community to determine whether improvements in that corridor could reduce the level of improvements needed on I-70. The analysis also included several different roadway configurations and/or interchange locations for the Far North, Near North, Existing I-70 and Business Loop 70 corridors. See **Table II-2**.

Table II-2: Corridor Configurations/Interchange Locations used in the Development/Evaluation of Corridor Screening Measures

Option	Proposed New Facilities	Proposed New Interchange Configuration/Locations	Improvements to Existing I-70 in Columbia Area
Far North Corridor			
1A	New four-lane freeway	Maximum number of interchanges	Widened to six lanes
1B	New four-lane freeway	Maximum number of interchanges	Widened to six to eight lanes
2	New four-lane freeway	Interchanges at selected routes only	Widened to six to eight lanes
Near North Corridor			
3A	New four-lane freeway	Maximum number of interchanges	Widened to six lanes
3B	New four-lane freeway	Maximum number of interchanges	Widened to six to eight lanes
4	New four-lane freeway	Interchanges at selected routes only	Widened to six to eight lanes
5	New four-lane freeway	On the west side only, terminate new freeway at U.S. 63	Widened to six lanes
6A	New primary arterial facility	At-grade intersections with major north-south roadways and an interchange with U.S. 63	Widened to six lanes

Table II-2: Corridor Configurations/Interchange Locations used in the Development/Evaluation of Corridor Screening Measures

Option	Proposed New Facilities	Proposed New Interchange Configuration/Locations	Improvements to Existing I-70 in Columbia Area
6B	New primary arterial facility	At-grade intersections with major north-south roadways and an interchange with U.S. 63	Widened to six to eight lanes
Improvements to Existing I-70 Only			
7	N/A	N/A	Widened to six lanes
8	N/A	N/A	Widened to six to eight lanes
Business Loop 70			
9	Widen Business Loop to six-lanes	New interchange at 163 and connect Route PP to Bus. Loop	Widened to six lanes

Because the number and location of interchanges influence the potential effectiveness of attracting interstate traffic, this sensitivity analysis ensured that the new northern corridors would attract the maximum amount of I-70 traffic possible thereby increasing the potential diversion of traffic from I-70.

The sensitivity analysis found that all of the options listed in **Table II-2** minimally satisfy the established corridor screening measures. While the operational threshold results were inconclusive, the analysis did yield important conclusions⁴. Among the important findings used in the decision-making process were the following:

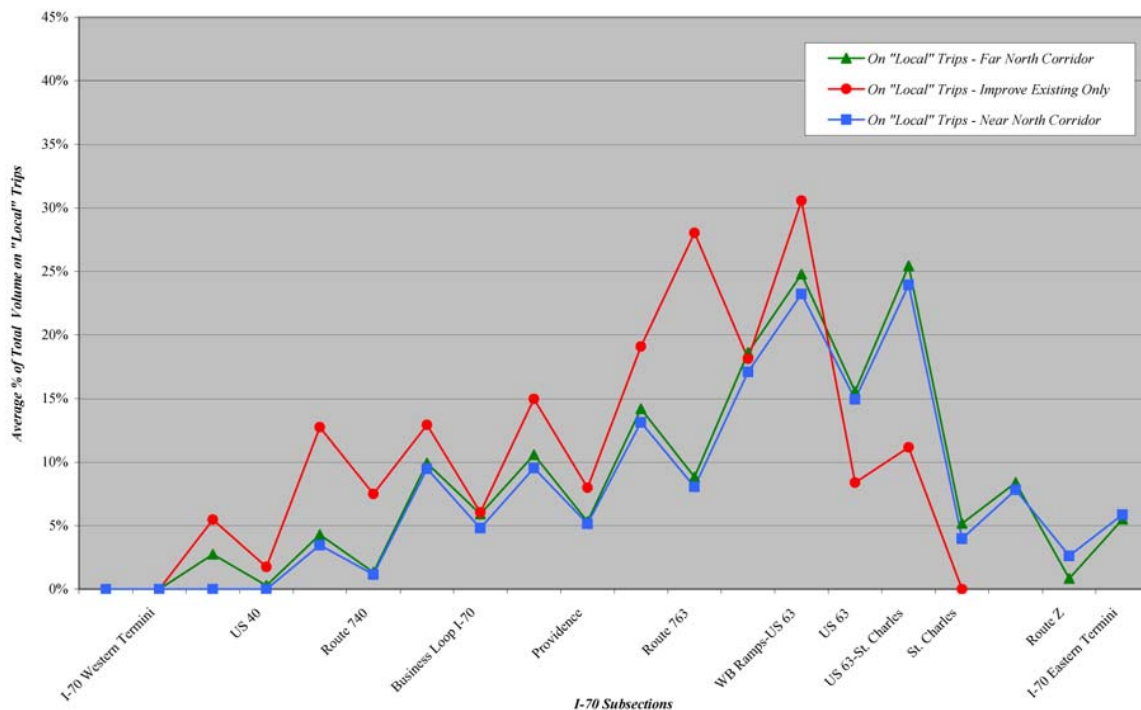
- The Far North and Near North Corridor options were underused throughout their design life. This means that the volume of traffic using those corridors would be substantially lower than the volume those corridors would be capable of accommodating. Given the cost of developing roadways and the competition for funding, developing underused facilities is generally avoided. On average, only 10,700 vehicles per day would utilize a Far North Corridor; 95,300 would use existing I-70. On average, 39,800 vehicles would utilize a Near North Corridor while 73,900 would use existing I-70.
- To meet current design standards, this analysis suggested that three lanes in each direction would be required along the existing I-70 corridor from the western project terminus to U.S. 40 and four lanes in each direction would be required from U.S. 40 to the eastern project terminus.
- A large number of I-70 travelers are on local trips. This work quantified these levels and examined how a Near North Corridor and a Far North Corridor might affect them. Based on these data, local trips would continue to be high on existing I-70. In

⁴ The complete analysis is contained in the Traffic Performance Screening (June 11, 2003). This analysis is one of the documents that is available upon request. See the Table of Contents for other documents available and instructions on how to request them.

general, if a new corridor is constructed the number of local travelers on existing I-70 is only slightly reduced. **Figure II-3** shows the local trips on existing I-70 under typical Near North, Far North and the Improve I-70 only scenarios (on a percentage basis). The pattern is similar using the actual number of local travelers. If substantial numbers of through traffic were diverted to a new corridor, large increases in the percentage of local traffic might be expected. Rather, the pattern remains relatively constant. Through traffic is not attracted to the Near North Corridor or the Far North Corridor. Additionally, local trips would be a substantial component of a new corridor's makeup. The sensitivity analysis also recommended improvements to the area's frontage road system as a solution to addressing local traffic on I-70.

- The sensitivity analysis also included a scenario where only the existing I-70 Business Loop is improved to six lanes (Option 9). This was examined to determine how much traffic such an alternative might divert from existing I-70. The results were virtually identical to those from options only improving I-70. Without traffic benefits, the option was dropped from further consideration.
- The sensitivity analysis concluded by confirming earlier indications that even though a new northern corridor may attract a fair amount of traffic, it would not be from travelers diverted from existing I-70. Consequently, the new corridor options would not appreciably improve conditions on existing I-70 or lessen the need for improvements.

Figure II-3: Local Trips on I-70



c. Elimination of Far North Corridor from Further Consideration

Based on the Corridor Traffic Evaluation, the Far North Corridor was eliminated from further consideration because it was inconsistent with the purpose and need of the project. As depicted in **Exhibit II-1**, there is very little diversion of existing I-70 traffic onto the Far North Corridor. Diversion is independent of the location of interchanges in that corridor. Overall, only about two percent of the traffic on I-70 would be rerouted to the Far North Corridor. Because the Far North Corridor would divert so few vehicles, it would have virtually no benefit on existing I-70 traffic operations. Consequently, the improvements required within the I-70 corridor would be virtually identical even after incurring the impacts and costs associated with developing the Far North Corridor.

The elimination of the Far North Corridor was discussed with the project's Advisory Group at meetings during early 2003. It was also presented to the public during the series of public involvement events conducted throughout the project. New corridor supporters questioned the project team regarding the fact that while the project team claimed the Far North Corridor would fail to divert traffic from I-70, a relatively large number of users were predicted to use the new corridor. Underlying the conclusion that the Far North Corridor would not attract enough traffic from existing I-70 is the fact that most of the traffic along the Far North Corridor would be attributable to diversion from the local arterial network, not from I-70. Thus, eliminating the Far North Corridor as a solution to the transportation problems associated with I-70 was reasonable, even though it might add some value to the local traffic network.

d. Near North Corridor Impact Assessment

The Near North Corridor would divert about 22 percent of the I-70 traffic. This represents roughly 26,000 vehicles per day, enough to warrant additional consideration. Because the Near North Corridor would offer some traffic relief to I-70, MoDOT decided to investigate the level of environmental and socio-economic impacts associated with constructing a freeway in that corridor and compare those impacts to the impacts of improving the existing I-70 corridor. Information on environmental and socio-economic constraints was gathered from record searches and from data collected during Advisory Group meetings and the public information meeting conducted in April 2003.

To obtain a better understanding of the impacts associated with the near north and existing I-70 corridors, representative alignments within each corridor were developed that minimized impacts to the extent practicable. **Table II-3** summarizes the results of the impact assessment.

The Near North Corridor was assumed to be a standard four-lane divided, limited access highway with high-capacity interchanges at the eastern and western termini with existing I-70. Additional standard-type interchanges were placed at Route E, Creasy Springs, MO-763, Route PP and St. Charles Road. Because, even with the Near North Corridor, I-70 would need to be improved to allow it to operate at a minimally acceptable level, the work required to accomplish this is also included in the near north impact total. This I-70 work principally includes the addition of a new (third) travel lane in each direction. Because the additional lanes cannot be built within the space available under the existing interchanges and overpasses, this concept includes their reconstruction or replacement. Consequently, the overall impact of the Near North Corridor would be from both the Near North and the Improve Existing I-70 work.

Table II-3: Near North Corridor Impact Assessment

Criteria	Measure	Widen Existing I-70 Only	Build Near North and Widen I-70
Engineering			
Reconstructed Freeway Lanes	lane-miles	75	75
New Freeway Lanes	lane-miles	45	105
Reconstructed Standard Interchanges ^a	#	8	8
New Standard Interchanges	#	0	5 ^b
New High Capacity Interchanges	#	2 ^c	4 ^d
Replaced Structures ^e	#	9	9
New Structures ^f	#	0	10
Environmental Impacts			
Total Right of Way	Acres	450	1,950
Parks	Acres	10	10
Wetlands	Acres	10	30
Floodplains	Acres	70	250
Woodlands	Acres	70	380
Agricultural	Acres	120	1,110
Stream Crossings	#	14	35
Threatened & Endangered Species	#	0	0
Historic/Archaeological Resources	#	18	23
Hazardous Waste Sites	#	0	0
Socioeconomic			
Residential Displacements	#	175	725
Business Displacements	#	110	100
Approximate Cost	2003 Millions \$	\$375	\$650
^a Located at MO-J/O, MO-740, BL 70W, MO-163, MO-763, BL 70E, St. Charles Road and MO-Z. ^b Located at MO-E, Creasy Springs, MO-763, MO-PP and St. Charles Road. ^c Located at U.S. 40 and U.S. 63. ^d Located on the NN at the Western Terminus, U.S. 63, the Eastern Terminus AND on existing I-70 at U.S. 63. ^e Does not include structures associated with interchanges or outer (frontage) roads. ^f Does not include new structures required for outer (frontage) roads.			

The existing I-70 improvement configuration used in the corridor impact assessment was the level of improvement expected to allow I-70 to operate at an acceptable LOS. The preliminary engineering drawing that emerged from the First Tier EIS was used as the principal guide for the impact assessment. The First Tier design included additional travel lanes, the reconstruction of interchanges and an improved frontage road system.

Overall, the analysis showed that the cost to build the Near North Corridor and minimal I-70 improvements would cost \$275 million more than improving I-70 alone. The difference is largely the result of the need for new roadways and structures. Other impacts associated with the Near North Corridor include approximately 1,500 acres of property acquisition, 180 acres of floodplain encroachments, 550 residential displacements and 990 acres of farmland impacts. Any alignment within the Near North Corridor would have higher costs and environmental and socio-economic impacts compared to building all the required improvements along the I-70 corridor only.

e. Elimination of Near North Corridor from Further Consideration

Following the completion of the corridor traffic evaluation and the corridor impact assessment, the Near North Corridor was eliminated from further consideration for the following reasons listed below. Official public notification of the elimination of the Near North Corridor occurred at the May 29, 2003 Advisory Group Meeting. To date, no new information has surfaced for to reconsider reasonableness of the Near North Corridor.

- The traffic analysis indicated that the Near North Corridor would draw significantly less traffic than its capacity could support. Conversely, alternatives consisting solely of improvements to I-70 would maintain a higher volume of traffic while operating at levels that meet the project's operational thresholds. Thus, the increase in expected impacts of building a highway along a new alignment in the Near North Corridor, in addition to the impacts of improving I-70, is not offset by a comparable increase in system economy.
- Even with the Near North Corridor, additional lanes would be needed on I-70 to allow it to operate at a minimally acceptable level. Even one additional lane would require replacement of every bridge along I-70 and the reconstruction of each interchange along the entire SIU 4 section of I-70 because of the way the existing structures are constructed, at a cost on the order of hundreds of millions of dollars.
- The analysis determined that any alignment within the Near North Corridor would have considerable environmental and socio-economic impact as compared to building all the required improvements along the I-70 corridor only. Regardless of the optimum alignment, taking approximately 1,500 acres of land not currently used for highway purposes would result in numerous additional impacts.

Improving the existing I-70 corridor remains the most beneficial of the alternative corridors. It meets the purpose and need elements discussed in Chapter I at considerably less cost and environmental impact than either the Far North Corridor or the Near North Corridor.

C. Concepts Within the Existing I-70 Corridor

The transportation problems within the I-70 corridor can be solved in several ways. The different solutions are referred to as *concepts*. This section discusses the work done at the concept-stage of the project. First, the plausibility of concepts that do not involve the complete reconstruction of the existing facility were examined. Concepts that would not require the complete reconstruction of the existing facility include the No-Build concept and other standard traffic management techniques that attempt to either improve the overall system or to modify demand. While these concepts do not involve the complete reconstruction of the existing facility,

they would involve some level of reconstruction. Concepts that require the complete reconstruction of the existing I-70 corridor include a basic widening, a stacked section, two-way and one-way frontage road systems and a collector/distributor road system.

The concepts were evaluated in two stages. First, the concepts were developed and underwent a preliminary evaluation. Based on this evaluation, concepts determined to be feasible were advanced for a more detailed evaluation. This more detailed evaluation included detailed engineering, detailed traffic evaluations and quantification of project-related impacts. In general, the concepts represented the application of a single transportation technique across the entire urban or rural corridor. All five concepts were considered for the central city section (Stadium to U.S. 63). Only the basic widening and two-way frontage road concepts were considered for the remaining sections of the corridor.

1. Non-Reconstruction Concepts

a. Transportation Demand Management

Transportation Demand Management (TDM) attempts to reduce traffic volume through nonstructural means, such as increased transit ridership or ridesharing (carpooling). Although this approach would not affect through traffic volume on I-70, it may reduce local trips along the interstate highway.

The local publicly funded bus system is known as Columbia Transit. Columbia Transit runs four full-service fixed routes and one commuter route and offers complementary paratransit service for disabled persons within the city. Currently, there is no service beyond the city limits. Buses operate along the routes during peak travel hours (6:25 A.M. to 6:05 P.M.) Monday through Saturday and evenings (until 10:00 P.M.) Thursday through Saturday. The estimated population served is 57,370. Fixed route and paratransit ridership for 1999 was 602,547. Only 1.4 percent of work trips are made by bus. The CATSO 2025 RTP recommends examining options for expanding public transportation services in the unincorporated parts of the metro area to improve ridership. However, some system changes would need to be incorporated to reduce the travel time and attract riders. The RTP states, "Household survey information indicates that the average transit travel time to work is 29 minutes, which is double the average for all other modes except carpools. For transit to begin to attract ridership from other modes, the average travel time would need to be approximately 21 minutes." Columbia Transit would have to study and implement changes to its system, but it appears that no foreseeable changes in the transit system would significantly affect local traffic volumes on I-70.

Other techniques that can help to reduce transportation demand include encouraging ridesharing through associations and business incentives. Park-and-ride lots provide sites at outlying residential areas where commuters may park free and carpool to business centers, thereby reducing vehicular traffic. Statistics indicate that this strategy generally reduces the transportation demand only slightly, on the order of 0.5 percent (CATSO, 2025 RTP). Travel demand management methods (such as land use management, restricted parking to encourage other modes of transportation, staggered work hours, telecommuting and electronic commerce) may be effective locally, but they are less effective regionally because they must be adopted and implemented voluntarily by individual businesses.

TDM is a legitimate method for improving transportation efficiency, but its limitations forego its use as a stand-alone solution for the problems of I-70. Expansion of the roadway is necessary

to accommodate the projected future traffic. Nevertheless, TDM is an important technique that should be pursued as an adjunct to the preferred alternative.

b. Transportation System Management

Transportation system management (TSM) methods are technological means that can improve capacity by facilitating more efficient movement of traffic. Transportation system management methods are more likely to be effective than TDM over the short term because they can be incorporated into the existing roadway system and do not depend on voluntary compliance. Transportation system management methods applicable to an interstate include access management (improved interchange design and signalization), coordinated interchange signals with cross road/frontage road signals and ITS.

Systematically, interchange congestion is not considered an encumbrance to through traffic flow along I-70, although poor interchange LOS directly affects the local traffic stream. Interchanges operating at LOS E or F could cause traffic queuing along the entire length of an off-ramp, blocking one lane of through traffic and thereby reducing the LOS along the mainline of I-70. All interchanges would require reconstruction to accommodate the widening of I-70. None of the diamond interchanges in SIU 4 (all interchanges except for the eastern Business Loop 70 interchange) meet the guideline of 800 feet (243.8 m) between ramp termini from the "Median Area Study, Design Criteria and Estimating Guide". Several interchanges also do not meet MoDOT's guideline of 430 feet (131.0 m) between the ramp termini and outer roads. The Business Loop East interchange includes a left-hand exit ramp from westbound I-70. While left-hand exit ramps meet current interstate design standards under certain circumstances, they are not a preferable design and are often inconsistent with driver expectations. Three interchanges are noted in the First Tier EIS as operating at an unacceptable LOS: MO-740 (Stadium Boulevard), MO-763 and U.S. 63. By 2030, several additional interchanges are expected to operate at LOS E or F.

Separation of truck traffic from auto traffic may be the most effective method for improving commercial vehicle operations along the mainline of the interstate. This separation may be accomplished by separate truck lanes or restricting trucks to outer (right) lanes. This approach has been examined through the First Tier analysis and remains an option that is being considered by MoDOT through the statewide I-70 corridor. Commercial traffic movement can also be improved by removing vertical and horizontal constraints and by improving geometric design at grade-separated interchanges in accordance with the access management guidelines.

The implementation of an ITS along the I-70 corridor would improve the operating efficiency of the corridor under both the No-Build and Build Alternatives. The movement of people and goods along the corridor would be safer, faster and more reliable. Intelligent Transportation Systems improve safety by identifying hazards and providing information on those hazards to drivers and system operators. Efficiently identifying and managing incidents in the I-70 corridor would reduce the occurrences of congestion, which reduces average travel time and improves travel time reliability. Implementing ITS technology along I-70 would maximize the return on the investment being made on the critical I-70 corridor. The following ITS systems are recommended for deployment along the I-70 corridor:

- Commercial Vehicle Operations (CVO);
- Parking Management;
- Road Weather Information Systems;

- Incident Detection and Management;
- Traffic and Travel Information; and
- Work Zone Management.

c. **No-Build Alternative**

The No-Build Alternative includes no expansion of I-70 and no improvement to the existing interchanges. Interstate 70 would remain a four-lane facility (two lanes in each direction) through SIU 4, and the frontage road system would remain the same. Interchanges would not be upgraded to current access management guidelines, unless done so as stand-alone future projects – such as the safety improvements being conducted now at the St. Charles interchange and the U.S. 63 interchange.

Clearly, this alternative does not satisfy the project purpose and need: to accommodate existing and future traffic on existing I-70, improve deficiencies, accommodate all users of I-70 and improve user safety. Although the system would not be improved, it would continue to be maintained to current structural standards. System maintenance likely would be performed as several localized projects, but would not improve the overall capacity, efficiency or safety of the interstate system.

Major investment in roadway pavement would still be required. Approximately 19 percent (13 lane-miles) of the pavement along I-70 in SIU 4 is in poor to very poor condition. Those sections would likely require major rehabilitation or complete replacement.

Major investment in bridges would also still be required. Most of the bridges were built when the interstate was constructed in the 1950s and 1960s and completed around 1965. At a minimum, three bridges require replacement, regardless of whether the No-Build Alternative is selected. The other bridges are serviceable but aging. As many as 10 bridges are in need of substantial repair in the near future to maintain their structural integrity.

2. Reconstruction Concepts

The reconstruction of I-70 in SIU 4 can be done in a variety of ways. The reconstruction would need to address not only the highway lanes of I-70 itself but also the connections of I-70 to adjoining highways and local roadways. The following text will first discuss the important design aspects associated with improving the mainline portions of I-70. The engineering standards for improving the mainline would affect the development of alternatives throughout the preliminary development process. The mainline discussion will be followed by the introduction of the SIU 4 concepts developed to improve I-70 along its existing alignment. These concepts will be discussed throughout the rest of this document.

a. **Mainline Widening**

The First Tier EIS included highway configuration and construction sequencing options, developing typical sections for the rural and urban sections. In the rural section, the recommended approach was one with an open median of 124 feet (37.8m) and widening either to the south or north of the existing I-70 mainline. In either scenario, one direction of travel would remain in its current location, with the other offset from existing, providing the wider median. This approach also reduces construction delays and cost by allowing for the continued use of the existing lanes during construction. In the urban section, the recommended approach

was one with a closed median of 26 feet (7.9m). The recommended widening approach would shift one direction of travel to the other side, using the shoulders and a slight temporary widening to accommodate the lanes. A median barrier would separate the opposing directions. One travel direction would be constructed and all traffic would shift to the new pavement, allowing the other side to be constructed. Traffic would then be shifted to their permanent positions.

Two distinct development types exist within the SIU 4 corridor, rural and urban. Based upon expected future growth in the area, the rural section occurs between MO-J/O and U.S. 40. The urban section occurs between U.S. 40 and MO-Z.

In the rural section, the 124-foot (37.8 m) open median concept is best suited for this section of the corridor. A project specific evaluation of the required right of way acquisitions indicated that widening to the south would be the most cost effective and have the least impacts. The widening to the south minimizes impacts and allows for a seamless transition to the Missouri River crossing that occurs in SIU 3 (approximately 1.3 miles [2.1 km] west of the SIU 4 terminus). East of MO-Z, SIU 5 widens to the south, so the alignment transition from the urban section to the south at the eastern end of the corridor. The existing median width is 40 feet (12.2m). See **Appendix II-B (Exhibit II-Ba)** depicts the rural typical section). The North-South Rural Screen Evaluation, available upon request (see the Table of Contents for request information), provides additional data on this issue.

In the urban section, topographic, cost and right of way impacts would be minimized with a closed median. The existing median width is 40 feet (12.2 m) from U.S. 40 to MO-740, and from Paris Road to MO-Z. Between MO-740 and Paris Road, the existing median width is 12 feet (3.7 m). Right of way limits for the project have been developed and evaluated to leave MoDOT the opportunity for expansion in the corridor beyond 2030. An additional 24 feet (7.3 m) has been provided for the further development of the alternatives. This expansion could provide an additional lane of traffic in either direction or provide space for an alternative mode of transportation in the corridor without purchasing additional right of way. An additional 24 feet (7.3 m) has been provided in the median for the development of the alternatives. For the purpose of this document, the 24 feet (7.3 m) has been placed in the median, leaving 50 feet (15.2 m) (26 feet [7.92 m], plus two 12-foot (3.7 m) shoulders) between eastbound and westbound lanes, separated by a barrier, in the year 2030. Assuming expansion took the form of additional traffic lanes, future widening would take place in the median under this widening option. Another option exists to develop a 26-foot median by 2030 and leave the extra width on the outside so that future lane expansion would occur on the outside edge of the freeway. The 2030 typical section would be selected as part of a future engineering study. While the type of expansion is undecided at this time, the exhibits illustrate the addition of future through lanes in the median of I-70. See **Appendix II-B (Exhibit II-Bb)** depicts the urban typical section and **Exhibits II-Bc and II-Bd** depict special sections).

The typical sections for the rural and urban sections are common to each of the alternatives developed and evaluated.

b. Introduction to Concepts

The reconstruction of a major highway can be done in numerous ways. Because of the numerous highway lanes, interchanges, frontage roads and other connections, the number of possible permutations is virtually unlimited. The development of alternatives focused on

accomplishing the transportation problems facing the area and building on previous work. As early as the First Tier EIS, the area's roadway needs began to take shape. Needs commonly associated with SIU 4 include:

- Improved access management at the MO-740 (Stadium Boulevard) interchange (exit 124);
- Auxiliary lanes along mainline I-70 between Stadium Boulevard and MO-163 (Providence Road - exit 124 to exit 126);
- Frontage road pairs between Providence Road and MO-763 (Range Line - exit 126 to exit 127), consolidating two interchanges into one split diamond interchange with slip ramps because the two single interchanges are too closely spaced, creating unacceptable weaving conditions along I-70;
- Auxiliary lanes between Range Line Road and U.S. 63 (exit 127 to exit 128a); and
- Improvements at the U.S. 63 interchange (exit 128a).

In order to address these needs the Second Tier EIS project team developed five concepts: stacked section, basic widening, two-way frontage road, one-way frontage road and collector/distributor road. Within the framework of these concepts, nearly all reasonable techniques to achieve the project's goals are possible.

Stacked Section Concept

Within the context of the First Tier EIS, the stacked section concept consisted of constructing four through traffic lanes (two in each direction) that are elevated above existing I-70 (see **Exhibit II-3**). Existing I-70 would serve local traffic. The stacked traffic lanes would be express lanes; that is, they would not have access to local traffic lanes or interchanges in the Columbia area. The stacked lanes would extend from a point west of MO-740 (Stadium Drive) to a point east of U.S. 63, for a distance of about 5.6 miles (9.0 km). East and west of the elevated lanes, I-70 would need to be widened to six lanes leading into the split between the local and express lanes. Based on the current traffic model, existing I-70 would still need to be widened to six lanes through Columbia to serve the local traffic.

The stacked section concept would provide sufficient capacity for future I-70 traffic. It would also improve safety and efficiency of traffic flow because through traffic (including through truck traffic) would be separated from local traffic. However, it has several significant disadvantages. The elevated lanes would cause a visual and access barrier across the highway. Interstate 70 is already considered a major obstacle to pedestrian, bicycle and wheelchair traffic. The stacked section would also cause greater noise impacts to surrounding lands. Access for emergency and maintenance vehicles along the stacked section would be inadequate. Trucks destined for Columbia businesses and U.S. 63 would still use the existing I-70. The elevated lanes would also be subject to icing risk, the same as overpasses and bridges. Construction of this alternative, while maintaining traffic on the existing roadway, would be difficult. Finally, the maintenance and construction costs of the stacked section concept were expected to be much higher than any other concept. Because the stacked section concept requires the development of a second (elevated) roadway and much more complicated bridge structures, professional judgment places the cost of the stacked section as much as one and one half times the cost of more traditional improvement concepts.

Basic Widening Concept

The basic widening concept (**Exhibit II-4**) can be thought of as a minimum Build scenario. It consists of expanding the through lanes on I-70 and reconstructing the existing interchanges. Most improvements would be made within the existing right of way. The basic widening concept would maintain the existing freeway, frontage roads and access patterns. Interchanges may be upgraded only to the extent that they can be within the existing right of way. This could include realignment of termini in compliance with MoDOT access management guidelines. The frontage road system would remain essentially the same, although some realignment may be necessary to accommodate the new roadway width and interchange upgrades.

One-Way Frontage Road

During the First Tier EIS investigations generated a concept where one-way frontage roads were used in Columbia. The concept assumed that most local traffic would remain on the frontage roads, because most local traffic exits the interstate one or two interchanges after entering. This concept would allow the redesign of interchanges more in accordance with MoDOT access management guidelines. The existing frontage road system would be realigned or incorporated where possible to improve local traffic flow.

The one-way frontage road concept (**Exhibit II-5**) is similar to the frontage road concept in the First Tier EIS. It includes frontage roads along each side of the interstate: one-way west on the north side of I-70 and one-way east on the south side. The frontage road would be accessible from a limited number of carefully located private driveways and would have at-grade intersections with cross roads. Existing frontage roads would be incorporated into the frontage road system wherever possible. Thus, the frontage roads are more an element of the local arterial network than of the interstate system.

Two-Way Frontage Road

The two-way frontage road concept (**Exhibit II-6**) is comparable to the one-way concept, except that the frontage roads would allow two-way travel on both sides of the interstate. Like the one-way concept, the two-way frontage roads would have at-grade intersections with cross roads. All access to the interstate from the frontage road and other surface streets would occur at separated grade interchanges at cross roads. This concept's frontage roads would be incorporated into the existing frontage road system wherever possible.

Collector/Distributor Road

The collector/distributor concept (**Exhibit II-7**) employs additional lanes, separated from the mainline, along each side of I-70 through the urban area. Interchanges would continue to connect the collector/distributor lanes to cross roads, so that weaving to and from interchange ramps would occur along the collector/distributor lanes. Interstate 70 would be widened to six lanes throughout the limits of the concept. In effect, the collector/distributor lanes would serve as local lanes and the mainline lanes as through lanes. Access to and from the interstate through the urban area would be consolidated onto several ramps between the collector/distributor lanes and the mainline.

The collector/distributor concept is similar to the frontage road concepts except that the collector/distributor lanes would act as extensions of the interstate. The collector/distributor lanes would have limited access, meaning no private driveways would directly access the

collector/distributor lanes. Local traffic would still need to access the interstate by traveling along other local streets to the interchanges at cross roads. Existing frontage roads would require some realignment to accommodate the collector/distributor lanes.

3. Preliminary Concept Evaluation

To begin the evaluation of the reconstruction concepts, a set of evaluation factors was developed. In all, 33 evaluation factors were developed to represent the important aspects of the project, allowing realistic summarization of each concept. It was also meant to allow even-handed comparison of advantages and disadvantages of concepts. Concepts determined to be feasible were advanced for more detailed evaluation, including detailed engineering, detailed traffic evaluations and quantification of project-related impacts. **Table II-4** is a version of the evaluation matrix summary used in the public involvement process.

The following text will first summarize the nature of the evaluation factors, then evaluate how well the concepts satisfied the evaluation factors and finally present the conclusions drawn from this analysis.

a. Evaluation Factors

The preliminary concept evaluation factors were grouped into five categories: purpose and need, environmental impacts, land use impacts, socio-economic/community impacts and engineering. Each factor was evaluated to determine whether it was positive, negative or neutral/contradictory/unclear relative to decision-making. A more complete explanation of the 33 evaluation factors is included in **Appendix II-C**.

A total of ten purpose and need evaluation factors were developed. These factors were intended to evaluate how well the concept satisfied the four critical elements of the project's purpose and need (see Chapter I). Among the concepts that the factors incorporated were the ability to meet highway design and capacity guidelines, the ability to meet access management guidelines, the ability to obtain traffic thresholds and the ability to regulate traffic flows.

A total of seven environmental evaluation factors were developed. These factors were intended to evaluate the impact the concepts might have on important environmental resources. The ability to assess potential environmental impacts at this stage in the project is limited because the footprints of the concepts cover virtually the same area. Further, the concepts occur in a developed corridor, and fine differences among them can be identified only when the concepts are developed completely. Nevertheless, each concept was investigated to determine whether there were reasons to believe that they could not avoid significant impacts to important known resources.

A total of six land use evaluation factors were developed. Because all of the concepts under consideration involve reconstruction of an existing facility and because that facility runs through the city of Columbia, land use impacts are expected to be substantial. Potential business impacts, potential residential impacts and potential secondary impacts were the main focus of these evaluation factors.

A total of five socioeconomic/community impact evaluation factors were developed. Similar to the notion of land use impacts, reconstruction of the I-70 corridor is expected to have important impacts on the existing community. To assess these impacts, qualitative assessments were

performed of the expected overall travel pattern disruptions, the expected construction-related travel pattern disruptions, the expected visual impacts, the potential for environmental justice impacts and the potential for disruptions to the delivery of community services such as emergency medical, fire and police services.

Finally, a total of five engineering-related evaluation factors were developed. These preliminary evaluation factors examined the aspects of the concepts that relate to construction, maintenance and costs.

b. Results of the Preliminary Concept Evaluation

The evaluation matrix was developed to gather and process all the available data associated with the concepts under consideration. The format allowed presentation of an extensive amount of data in a very concise manner. **Table II-4** is the overall summary of the evaluation (all concepts and evaluation factors). The overall summary was used routinely during the public involvement process. **Appendix II-C** contains concept-specific versions of the evaluation matrix that present more background data on the specifics of the evaluation. The balance of this section discusses the findings of this evaluation.



TABLE II-4 PRELIMINARY CONCEPT EVALUATION SUMMARY

Improve I-70: Columbia Area (SIU #4)



Public Involvement Meeting – December 11, 2003

This table summarizes the benefits, costs and impacts of the five preliminary concepts considered for widening and reconstructing I-70. Because this evaluation illustrated that the costs far outweighed the benefits of the Basic Widening and Stacked Highway concepts, they have been eliminated from further evaluation.

EVALUATION FACTORS/PRELIMINARY CONCEPTS	Concept					
	1	2	3	4	5	
	Basic Widening	One-Way Frontage Road	Two-Way Frontage Road	Collector-Distributor Road	Stacked Highway	
PURPOSE AND NEED						
1. Accommodate existing and future traffic volumes on I-70						
-Increase capacity to 6-lanes in rural/8-lanes in urban areas	+	+	+	+	0	
-Meet highway Level of Service guidelines (volume/capacity)	+	+	+	+	+	
-Flexibility for future expansion in the corridor	0	0	+	+	-	
2. Improve outdated I-70 design elements						
-Uncorrectable design elements associated with concept	0	+	+	+	0	
3. Accommodate all users of I-70						
-Make provisions for all major I-70 traffic streams	-	0	+	+	+	
-Implement interchange designs with acceptable Level of Service	+	+	+	+	0	
-Maintain Columbia-area access points	-	0	+	+	0	
4. Improve user safety						
-Comply with MoDOT Access Management guidelines	-	+	+	+	-	
-Effectively manage truck traffic	-	0	0	+	0	
-Reduce conflicting traffic movements at on/off ramps	0	0	+	+	0	
ENVIRONMENTAL IMPACTS						
Avoid Section 4(f) sites like Cosmo Park, other parks, historic sites	-	-	-	-	-	
Total expected Phase I Environmental Site Assessments	0	0	0	0	0	
Avoid prime farmland parcels	0	0	0	0	0	
Avoid impacts to the waters of the United States	0	0	0	0	0	
Avoid impacts to threatened and endangered species	-	-	-	-	-	
Avoid noise impacts	0	0	0	0	-	
Avoid cultural resource impacts (e.g., sites on Historic Register)	0	0	0	0	0	
LAND USE IMPACTS						
Business displacements	+	+	-	-	0	
Access to businesses from I-70	0	+	+	0	-	
Access to businesses from local roadways	-	-	+	+	-	
Residential displacements	+	+	-	-	0	
Residential access impacts	-	0	+	+	-	
Secondary impacts	0	0	0	0	0	
SOCIO-ECONOMIC/COMMUNITY IMPACTS						
Expected travel pattern disruptions – overall	-	0	+	0	-	
Expected travel pattern disruptions – during construction	-	0	0	+	-	
Visual impacts	0	0	0	0	-	
Potential for Environmental Justice issues	0	+	+	+	0	
Potential for community service disruptions (EMS, fire, police)	-	0	+	+	-	
ENGINEERING						
Estimated construction cost**	+	0	0	0	-	
Total estimated Right of Way	+	+	-	-	0	
Constructibility	0	0	0	+	-	
Maintenance of traffic	0	0	0	+	-	
Other engineering-related constraints	0	0	0	0	-	
Legend/Footnotes						
Positive Impact – Important Decision-Making Factor	+	7	10	15	17	2
Neutral/Unclear/Contradictory Impact	0	15	20	13	11	15
Negative Impact – Important Decision-Making Factor	-	11	3	5	5	16

*This element focuses on the potential impacts to service delivery (police runs, ambulance routing etc.) As engineering details are revealed, other types of community service impacts can be discussed.

**Cost estimates on construction projects of this complexity are very difficult. Until all details are finalized, the costs are subject to change. The cost estimates for concepts are useful in the relationship between the various alternatives they reveal. The opinions of cost for the concepts shown at this meeting (one-way frontage, two-way frontage and collector/distributor) were found to be approximately 10 percent apart (statistically equivalent). The collector/distributor cost was the highest, and the one-way frontage was the lowest.

Basic Widening

Overall, the basic widening concept received seven positives, 15 neutrals and 11 negatives.

The basic widening concept received few positives. It received more negative purpose and need ratings than positive. For these reasons, it was concluded that the basic widening concept did not provide enough benefit to satisfy the project's purpose and need. The additional through lanes would be beneficial, but the concept does almost nothing else to address the project's other transportation needs. The limited construction associated with the basic widening accounts for its failure to satisfy the project's purpose and need. This also led to the concept's more positive aspects: It had the lowest construction cost, the lowest right of way acquisition needs and few relocations.

Another shortcoming of the basic widening concept is the fact that it allows the existing system of discontinuous frontage roads to remain. The increase in traffic volume expected to occur over the design life of the project would render that network so ineffective as to make it a serious hindrance.

One-Way Frontage Road

Overall, the one-way frontage road concept received ten positives, 20 neutrals and three negatives. The concept received no negatives relative to purpose and need. Half of the purpose and need evaluation factors were positive. Based on these findings, it was concluded that the one-way frontage road would satisfy the project's purpose and need.

The concept would fundamentally alter the pattern of local traffic within the project area. This is not necessarily negative, but many of the evaluation factors that might otherwise have been graded as positive were graded as neutral because of the confusion/uncertainty that might accompany that change. On the other hand, the concept was expected to require the smallest footprint among the frontage road concepts. In general, a smaller footprint corresponds to lower impacts.

Two-Way Frontage Road

Overall, the two-way frontage road concept received 15 positives, 13 neutrals and five negatives. It was concluded that the two-way frontage road concept would satisfy the project's purpose and need - it received no negatives for purpose and need.

Because the concept would maintain the basic nature of the existing frontage road system while improving the system's functionality, it received positives for evaluation factors pertaining to connectivity and traffic pattern issues. This included three access evaluation factors under the land use category and two under the socioeconomic and community impact category. Most of the negatives were associated with the concept's relatively large footprint (only the collector/distributor concept was larger overall) and the need for numerous residential and business displacements.

Collector/Distributor Road

Overall, the collector/distributor concept received 17 positives, 11 neutrals and five negatives. It was concluded that the concept would satisfy the project's purpose and need - it received no negatives for purpose and need.

The connectivity gains associated with collector/distributor led to positives under those evaluation factors associated entirely with I-70 operations. This included the evaluation factors related to constructibility. The uncertainty associated with the connection between the local roadway system and I-70 led to neutrals for other connectivity issues. Most of the negatives were associated with the concept's large footprint.

Stacked Section

Overall, the stacked section concept received two positives, 15 neutrals and 16 negatives. The stacked section concept received the fewest positives of all concepts and also received many negatives. The stacked section concept received few positives with respect to purpose and need. More than 60 percent of the purpose and need factors were found to be contradictory or negative. Based on these findings, it would be difficult to conclude that the stacked section concept would satisfy the project's purpose and need. Even though its performance relative to purpose and need was poor, the other evaluation factors also supported the elimination of this concept.

The deficiencies of the stacked section concept can be grouped into three basic areas. First, even though the stacked section concept places through lanes high above the existing lanes, it has a large footprint. The reason is that to construct the numerous structures over I-70 (interchanges/overpasses), it is necessary to have longer approaches to clear the stacked section. Thus, the impact reductions from a smaller footprint that might be expected simply are not there. Second, the stacked section is essentially a bridge, and bridges are expensive to construct and maintain. Third, the stacked section makes I-70 a larger barrier that poses service implications. Emergency Medical Services (EMS) resources would have difficulty getting to crash sites on the stacked section. In addition, visual and noise impacts would be considerable and traffic access would be costly and constrained.

c. Conclusions of the Preliminary Concept Evaluation

Based on the preliminary concept evaluation, the basic widening and stacked section concepts were eliminated from further consideration.

The basic widening concept would not even minimally satisfy the project's purpose and need. It has no provisions for accommodating the various traffic streams that use I-70, it fails to provide adequate access to the city of Columbia, it cannot comply with MoDOT access management guidelines and it does nothing to manage truck traffic. Thus, basic widening is not a reasonable concept for improving I-70 within SIU 4.

While it was unclear whether the stacked section concept could minimally satisfy the project's purpose and need, its other deficiencies led to its elimination from further consideration. The stacked section does not reduce project impacts, it has significant negative engineering impacts and it makes I-70 a larger and more insurmountable barrier. Based on its numerous shortcomings, the stacked section concept is not reasonable for SIU 4.

In addition to eliminating the basic widening and stacked section concepts from further consideration, other important conclusions were derived from the Preliminary Concept Evaluation. Findings incorporated into the development of detailed concepts include the following:

- **Use a Two-Way Frontage Road system outside central Columbia.** Outside the central parts of SIU 4⁵, there is a discontinuous two-way frontage road system. Within SIU 4, the rural transportation problems are far less acute than those associated with Columbia proper. The major transportation problems on I-70 outside of Columbia relate to the need for additional I-70 lanes in the future, individual interchange service deficiencies and poor connectivity due to a discontinuous two-way frontage road system. These problems can be addressed adequately by lane widening, completing the existing frontage road system and reconstructing individual interchanges. Consequently, outside of Columbia the detailed concepts can use the same lane widening and frontage road configurations. The detailed concepts would focus on the individual interchange configurations while employing the same I-70 lane structure and frontage road system. The concepts would all employ a two-way frontage road system outside central Columbia. All the interchange configurations developed during the detailed concept stage would be applicable to all three central city detailed concepts.
- **Investigate increased functionality at the I-70/U.S. 63 interchange.** With respect to statewide and interstate travel, the interchange between I-70 and U.S. 63 is the most important single facility within SIU 4. Thus, MoDOT undertook a Major Investment Study (MIS) to investigate what would undoubtedly be a very expensive and technically challenging project (published June 2000). The preferred alternative from the MIS was a four-movement system interchange that would not allow all movements between the two highways to proceed without encountering stops. Nevertheless, it was determined that the consequences of a more complex eight-movement system interchange should be investigated. The advantages of an eight-movement system interchange are considerable. For instances, it would measurably diminish travel times between I-70 and U.S. 63. Since the scope of the MIS was limited (focused solely on the I-70/U.S. 63 intersection), it was deemed reasonable to investigate the impacts of the operationally superior interchange design in the Tier II EIS.
- **Standardize common elements among detailed concepts.** To facilitate the evaluation of costs and benefits, the development of detailed concepts should use as many common elements as possible. The complexity of the detailed concepts would make it difficult for anyone but the designers to keep track of all the impacts to minor changes that might be applied at this stage. Consequently, a concerted effort would be made to use standard design elements. This must be balanced against the need to develop each detailed concept optimally. Without such an approach, informed decision-making would be extremely cumbersome.
- **Maintain existing interchange locations but retain flexibility regarding details.** The traffic analysis concluded that existing interchange locations would not need to be eliminated in order to achieve the basic traffic operation thresholds established for the project. However, operational improvements can result through the application of various design elements at the individual interchange locations. As a result, the detailed concepts would maintain the existing interchange locations while retaining flexibility regarding design elements.
- **Consider new interchanges only if the existing cannot operate adequately.** It is common to receive requests for additional interchanges on the Interstate Highway

⁵ Defined here as west of the Stadium Interchange (MO-740, exit 124) and east of the U.S. 63 interchange (exit 128A).

System. Relative to SIU 4, this pressure is most acute to the west of the Stadium (MO-740) interchange. As discussed in the Purpose and Need, one of the transportation problems that needs to be solved is developing solutions that would allow the existing interchanges to operate adequately. At this point in the study, the traffic analysis suggests that the existing interchanges can be reconstructed, in place, and adequately achieve the specified operational characteristics. New interchanges would be considered only if this is not possible.

- **Begin or increase coordination with the business community.** During the Preliminary Concept stage, it became very clear that the potential short-term impacts to the business community immediately adjacent to the existing I-70 corridor would be substantial. As a result, the need for more and better coordination with the business community was recognized. One of the more visible elements of this coordination was a business inventory and business survey. The business inventory was the identification and geographic information system (GIS) cataloging of the business units within the I-70 corridor. The business survey was a questionnaire-based study intended to investigate the nature of the business community in the vicinity of I-70 and how the individual businesses would respond to a potential displacement or other project-related impact. The business survey is more fully addressed in Chapter II.B.2.d.
- **Recognize commitment to pedestrian and bike connectivity.** Missouri Department of Transportation is committed to making provisions for bike, pedestrian and wheelchair access across I-70, wherever possible and reasonable. Although a specific access plan has not yet been developed, the detailed concepts would need to be mindful of MoDOT's commitment.
- **Potential for operational improvements from additional overpasses.** Similar to the discussion regarding design flexibility and the existing interchange locations, operational improvements may be possible through the use of other design elements, such as additional I-70 overpasses. These would be investigated during the detailed concept stage.
- **Recognition that project costs would be a limiting factor.** As it becomes clearer how much the improvements would cost, the budgetary constraints also become clearer. As a result, the detailed concept stage would begin the process of considering how to organize the project and achieve the needed operational improvements to the extent possible.

4. Detailed Concept Evaluation

In September 2003, the two-way frontage road, one-way frontage road and collector/distributor road concepts were selected to undergo a more detailed evaluation. The detailed concept evaluation included developing functional engineering depictions of the concepts, an iterative traffic engineering process to develop a configuration that would meet established traffic threshold levels and a quantitative impact assessment. The preliminary concept evaluation allowed unsuitable concepts to be screened out and refinement of what would constitute a suitable concept. The balance of this section presents the engineering depictions, traffic evaluations and impact assessments conducted for the one-way frontage road, two-way frontage road and collector/distributor road concepts.

a. Functional Engineering Depiction of Concepts

The basis for the detailed evaluation of concepts is their functional engineering depiction. This includes detailed concepts of the proposed I-70 lanes, reconstruction of the project's interchanges, all connecting ramps and all frontage roads necessary to show a complete and functioning roadway system. An iterative evaluation process was followed as the detailed concepts were refined. The depictions also evolved as part of the project's public involvement plan. The project's Advisory Group was routinely presented with the evolving depictions. The project Web site and various public meetings/workshops also presented the evolving engineering depictions. Each detailed concept is discussed below. Because the three detailed concepts vary only within the central parts of Columbia (between exits 124 and 128A), the eastern and western parts of SIU 4 will be discussed separately.

Two-Way Frontage Road Concept

The two-way frontage road concept, depicted on **Exhibits II-8A and B** uses as much of the existing frontage road system as possible, whereas much of the existing frontage road system is discontinuous or fragmented, the two-way frontage road concept seeks to improve connectivity, while minimizing alterations to existing access and travel patterns.

The two-way frontage road concept includes additional I-70 lanes, incorporated by symmetrical widening on both sides of the existing lanes (all detailed concepts use a similar approach to I-70). To facilitate ingress to and egress from I-70, the two-way frontage road concept employs a system of braided ramps parallel to I-70, between exits 124 and 128. These five interchanges are linked in this way because of their proximity, but the interchange ramps fall outside the existing footprint of I-70. The ramp system allows for all existing movements to and from I-70. The Stadium Drive interchange is a modified urban/tight diamond design, with a slight alteration to the alignment of MO-740. The configuration of exit 125 is substantially altered to allow all interchange movements. It also includes the removal of the Creasy Springs Road roundabout. The ramps for exits 126 and 127 are abandoned in favor of the braided ramp system. The connection between I-70 and the eastern terminus of the I-70 Business Loop is relocated to just west of the Paris Road (MO-B) overpass. New roads are needed to provide the interchange with a connection to Business Loop 70. This new interchange would service all directions on I-70, whereas the current interchange does so only to and from the east.

The U.S. 63 interchange used in the two-way frontage road concept is a system interchange that provided all movements to and from U.S. 63 and I-70, both from the west as well as from the east. This is often referred to as an eight-movement system interchange. Travel between U.S. 63 and I-70 would be organized so vehicles are not required to stop during these movements. The major movements at this interchange include the following: (1) U.S. 63 (southbound) to I-70 (westbound), (2) U.S. 63 (southbound) to I-70 eastbound), (3) U.S. 63 (northbound) to I-70 (westbound), (4) U.S. 63 (northbound) to I-70 (eastbound), (5) I-70 (eastbound) to U.S. 63 (northbound) (6) I-70 (eastbound) to U.S. 63 (southbound), (7) I-70 (westbound) to U.S. 63 (northbound) and (8) I-70 (westbound) to U.S. 63 (southbound). This represents the highest level of utility possible. This configuration exceeded the recommendations that emerged from the 2000 MIS conducted for MoDOT. The MIS recommended a four-movement system interchange providing the movement to and from U.S. 63 (north and southbound) and I-70 (eastbound only). The intent of evaluating all eight movements was to reexamine the U.S. 63 interchange configuration issue in light of the other improvements to I-70.

The frontage road system as part of the two-way frontage road concept consists primarily of reconstructing parts of the existing system and connecting others. The Business Loop, I-70 Drives (NW and SW) and Vandiver Road are the principal components of the frontage road system. In some cases, the frontage roads are depicted as new construction if, due to other construction, they are expected to require substantial relocation.

The footprint of the two-way frontage road concept is fairly large and requires considerable local roadway work. On the other hand, it maintains the possible existing connectivity pathways and largely meets existing driver expectations.

One-Way Frontage Road Concept

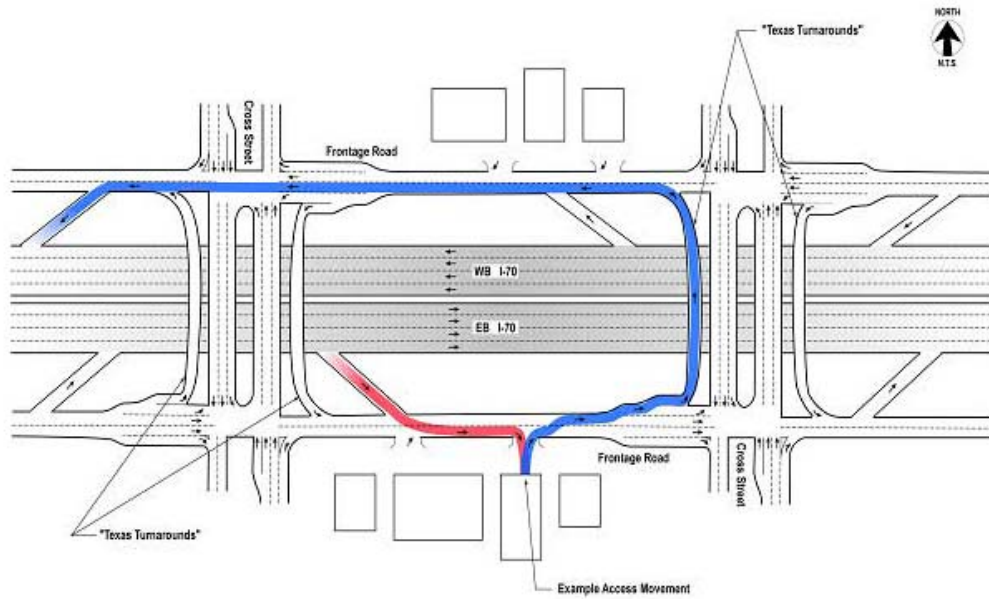
The one-way frontage road concept, depicted in **Exhibits II-9A and B**, provides additional local roads that separate local trips from through trips on I-70. The ramp system must be combined with a frontage road system that allows travel in only one direction. This creates a fundamental change in traffic patterns. The concept employs such techniques as the Texas Turnaround (see **Figure II-4**) to minimize out-of-direction travel.

The one-way frontage road concept includes additional I-70 lanes, incorporated by symmetrical widening on both sides of the existing lanes. Parallel to the I-70 lanes is the one-way frontage road, consisting of two or more lanes. To facilitate ingress to and egress from I-70, the concept employs a system of slip ramps that deliver exiting I-70 traffic to the left lane of the frontage road, and entering frontage road traffic to the right lane of I-70. Each intersection with the local roadway system is signalized. Traffic destined for the other side of I-70 would use the Texas Turnarounds, thereby avoiding traffic signal delay. For the land uses immediately adjacent to the frontage road, only right-in/right-out movements are permitted at a few carefully positioned locations. The frontage roads are immediately adjacent to the I-70 lanes, minimizing the overall footprint. The system allows all existing movements to and from I-70. The locations of the interchange overpasses remain unchanged, but the slip ramps alter the location of the existing interchange ramps. The U.S. 63 interchange used is the same eight-movement system interchange used in the two-way frontage road concept. The only changes necessary are those to connect to the one-way frontage road system on the west side of the proposed interchange. The existing two-way frontage road system (Business Loop, I-70 Drives NW and SW and Vandiver Road) would remain in place, with minor improvements as necessary. The connection between I-70 and the eastern terminus of the I-70 Business Loop is relocated to just west of the Paris Road (MO- B) overpass. New roads are needed to provide the interchange with a connection to Business Loop 70. This new interchange would service all directions on I-70, whereas the current interchange does so only to and from the east.

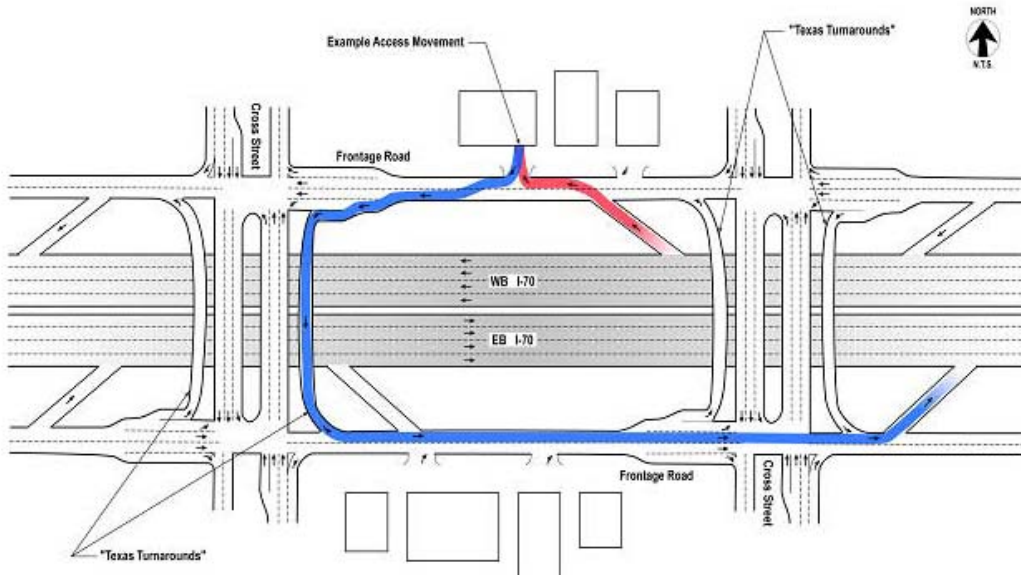
The footprint of the one-way frontage road concept is relatively small and minimizes the amount of local roadway work. However, it fundamentally alters existing connectivity pathways and travel patterns and may be contrary to local user expectations during the early stages after implementation.

Figure II-4: Texas Turnaround

One-Way Frontage Road "Texas Turnaround" Diagram From and To the West



One-Way Frontage Road "Texas Turnaround" Diagram From and To the East



Collector/Distributor Road Concept

The collector/distributor road concept, shown in **Exhibits II-10A and B**, separates through traffic from local traffic and minimizes disruptions and stoppages on the frontage road. To separate local and through traffic, a collector/distributor road is used. Columbia-bound travelers on I-70, on their approach to Columbia, would be directed to the "All Columbia Exits" roadway. This two-lane collector/distributor road parallels I-70 and extends from U.S. 63 to the Stadium interchange, thus removing local traffic from I-70. There is also one mid-system slip ramp between I-70 and the collector/distributor road. Because there are no traffic signals on the collector road, local travelers would use the collector/distributor road instead of using I-70, as they would under the other concepts. Ramps would give travelers on the cross roads access to the local roadway system. This mechanism serves to minimize disruptions to frontage road operations.

The collector/distributor road concept includes additional I-70 lanes, incorporated by symmetrical widening on both sides of the existing lanes. Parallel to the I-70 lanes is the one-way collector/distributor road, consisting of two lanes. To facilitate ingress to and egress from the one-way collector road, the collector/distributor road concept employs a system of service ramps that deliver exiting I-70 traffic to their respective cross road destinations. This gives the collector/distributor road concept the largest footprint. The collector/distributor road has no signals or stop signs. For the land uses immediately adjacent to the collector/distributor road, no access is provided. All local access must come from the existing two-way frontage road system. The locations of the interchange overpasses remain unchanged. The connection between I-70 and the eastern terminus of the I-70 Business Loop is relocated to just west of the Paris Road (MO-B) overpass. New roads are needed to provide the interchange with a connection to Business Loop 70. This new interchange would service, via the collector/distributor road, all directions on I-70, whereas the current interchange does so only to and from the east. The U.S. 63 interchange used is the eight-movement system interchange described in the two-way frontage concept. The existing frontage road system (Business Loop, I-70 Drives NW and SW and Vandiver Road) remains, with minor improvements as necessary.

The footprint of the collector/distributor road concept is the largest. It has a modest amount of local roadway work. It also alters the existing pathways to and from I-70 and the local roadway network, while also more effectively separating local and through traffic and minimizing stoppages.

Concept Configurations East and West of Columbia

Outside Columbia, a two-way frontage road system would be used uniformly to the east of U.S. 63 (exit 128A) and to the west of MO-740 (exit 124), regardless of the treatments within Columbia. Each existing interchange would be reconstructed to attain the required threshold level of operation. **Exhibits II-11A through E** depict the I-70 work, the alternative interchange configurations and proposed two-way frontage road system. To the east and west of Columbia, additional I-70 lanes would be incorporated. The existing frontage road system would be completed only where necessary. The existing two-way operation and a complete/unlimited access pattern would be maintained. Released from the systemic constraints that affect I-70 within Columbia, it is possible to generate and evaluate various interchange configurations at these outer locations.

MO-J/O Interchange (exit 117). Because of apparent lack of obvious constraints, the configuration at the MO-J/O interchange is limited to a standard diamond design.

U.S. 40 Interchange (exit 121). Because of potential impact/resource considerations, in addition to connectivity issues between two major roads (I-70 and U.S. 40), several interchange configurations were developed. *Configuration #1* provides system movements for southbound U.S. 40 to eastbound I-70 movements and eastbound I-70 to northbound U.S. 40 movements via implementation of a loop. The other movements are accomplished through design similar to a standard diamond interchange. *Configuration #2* is designed to facilitate a direct connection for southbound U.S. 40 to eastbound I-70 movements, southbound U.S. 40 to westbound I-70 movements and westbound I-70 to northbound U.S. 40 movements. This is overlaid on a large diamond interchange for the other I-70 to U.S. 40 movement and for local access purposes. *Configuration #3* is a standard diamond interchange, with no direct connection provisions. *Configuration #4* is a standard diamond interchange with a loop ramp that provides a direct connection for southbound U.S. 40 to eastbound I-70 movements only.

St. Charles Interchange (exit 131). Because of potential impact/resource considerations, several interchange configurations were developed to replace the existing diamond. *Configuration #1* is a tight diamond interchange configuration. *Configuration #2* is a standard diamond interchange configuration. *Configuration #3* is a standard diamond configuration offset to the south, with the northern ramp termini located nearly coincident with their existing location (the footprint north of I-70 is minimized). The interchange has an asymmetrical configuration as the southern ramps of the interchange are placed to maintain the needed distance between the ramps.

MO-Z Interchange (exit 133). Because of potential impact/resource considerations, several interchange configurations were developed. *Configuration #1* is a standard diamond. *Configuration #2* is a standard diamond with a loop ramp for the eastbound I-70 to MO-Z movement; this removes a ramp from the southwestern quadrant of the interchange. *Configuration #3* is a standard diamond with a loop ramp for the westbound I-70 to MO-Z movement; this removes a ramp from the northwestern quadrant of the interchange. *Configuration #4* is a standard diamond configuration, with the southern ramps located as far north as possible (the footprint south of I-70 is minimized), creating an asymmetrical configuration as the northern ramps of the interchange are located to maintain the distance between the ramps required to provide appropriate access management.

b. Iterative Traffic Evaluation of Detailed Concepts

A detailed work plan was developed to evaluate the traffic operations of the detailed concepts. The work plan is summarized below. Based on the framework established in the work plan, key traffic assumptions were made for redistributing 2030 traffic volumes for each concept, thus allowing comparison against threshold levels. As the results of the traffic evaluations became available, an iterative process of engineering revisions was undertaken to work toward concepts that would attain all threshold criteria.

Traffic Evaluation Work Plan

It was initially determined that the basic freeway configuration of I-70 under the detailed concepts would be three lanes through the entire project, with a fourth lane between the U.S. 40 and St. Charles Road interchanges. Further analysis, however, revealed that the four-lane section would actually need to extend beyond the St. Charles Road interchange to the MO- Z

interchange. The fourth lane would be added/dropped at the U.S. 40 and MO-Z interchanges for each respective direction. The four-lane section could be modified to three lanes for the one-way frontage road or collector/distributor road concepts if the demand on the freeway would not require a four-lane section. The analysis addressed all existing interchanges, including a relocated Business Loop East interchange (exit 128). The interchange configurations developed for areas outside Columbia were also included in the evaluation. An additional interchange west of Stadium Boulevard interchange was not analyzed⁶.

The I-70 Columbia Travel Demand Model, in conjunction with existing traffic counts, was used to generate 2030 morning and afternoon peak hour traffic volumes for the detailed concepts and to distribute traffic. The project team then distributed the 2030 traffic along I-70 and the interchanges, frontage roads and cross roads for each detailed concept to determine how it would operate. Sensitivity factors (percentages) were used to account for trip diversions that would occur as vehicles adjust to the improved roadway system.

To be able to compare the operational characteristics of the detailed concepts, the project team established threshold (acceptable) conditions for freeway operations, arterial function and interchange operations. Listed below are the standards the project team developed:

- The project team used Highway Capacity Manual (HCS) software (version 4.1) for the analysis. The HCS determined whether the detailed concepts would attain LOS D or better for freeway operations (mainline, merge/diverge and weaving areas) between MO-740 (Stadium Boulevard) and St. Charles Road interchanges, and LOS C or better for all others outside the area.
- The project team used Synchro software (version 5) to determine whether the detailed concepts would attain LOS D for the intersections along and between the Stadium and U.S. 63 interchanges and LOS C for all other intersections. For the urban intersections, individual movements could operate at a level worse than the established threshold of LOS D as long as the overall intersection operated at LOS D or better. For the rural intersections, individual movements could operate at a level worse than the established threshold of LOS C as long as the intersection operated at LOS C or better.

Traffic Evaluation

In general, all concepts and configurations developed during the detailed concept stage were found to satisfy the applicable thresholds. Nearly all out-of-threshold results could be resolved using engineering solutions. This subsection discusses the most difficult and important operational characteristics uncovered by the traffic evaluation. The discussion focuses on the two-way frontage road, collector/distributor road and one-way frontage road concepts within the urban area, because all configurations for the areas east and west of Columbia would operate acceptably with reasonable design configurations.

Traffic Evaluation and the Two-Way Frontage Road Concept

The primary traffic-related issue associated with the two-way frontage road concept was at the Stadium interchange (exit 124).

⁶ Only if the existing Stadium interchange could not be made to operate adequately would a new interchange be considered.

If a single point urban interchange (SPUI) is used at Stadium Boulevard, it would operate at LOS E in the afternoon peak hour. During the 2030 morning peak hour, an increase in volume of only one percent would cause it to operate at LOS E. The signalized intersection at Bernadette Drive (immediately south of I-70 at the Stadium) is also problematic. With a SPUI, the intersection at Bernadette would operate at LOS D in the afternoon. Increasing the volume at one of the intersection's movements (eastbound on Bernadette) by a small amount (eight percent) would cause the overall intersection to be LOS E. These problems can be corrected only by using a different interchange and frontage road configuration at Stadium Boulevard. Consequently, a different interchange configuration at Stadium Boulevard would be required.

The interchanges with MO-163 and MO-763 were also found to be problematic (these problems are common to all of the concepts). While all the signalized intersections associated with the interchanges operate at an acceptable LOS, there are long queues for the northbound through movement at the MO-163 interchange south ramp terminals. Furthermore, an additional lane at the westbound I-70 entrance ramp may be required. Finally, because of the weaving required in the area between MO-163 and MO-763, it may be difficult to taper traffic before it enters I-70. None of the three concepts is satisfactory regarding these merges.

Traffic Evaluation and the Collector/Distributor Road Concept

The traffic problems associated with the collector/distributor road concept were related to weaving movements along the collector/distributor road. There are also some limited interchange concerns related to spacing of access to and from I-70. None of these difficulties could be described as fatal flaws.

The following road lengths were found to be deficient for weaving: the eastbound collector/distributor road between I-70 and Business Loop East, the westbound collector/distributor road between Business Loop East and I-70 and the westbound collector/distributor road between MO-163 and Business Loop West. Increasing the weaving lengths could alleviate the problems.

Interchange problems for this concept include the MO-163 and MO-763 issues (long queues, additional entrance ramp lanes and difficult tapers/merges) identified previously in the two-way frontage road discussion. This is a problem common to all of the concepts. Another interchange issue relates to the tight diamond interchange used at Stadium Boulevard under the collector/distributor road concept. While it meets all 2030 thresholds, minor intersection volume increases (nine percent) would result in LOS E during the morning peak.

Traffic Evaluation and the One-Way Frontage Road Concept

The traffic problems associated with the one-way frontage road concept are focused in the Stadium Boulevard and MO-763 areas. The LOS at these two interchanges was worse than the established thresholds for LOS. Operations concerns associated with the one-way frontage road concept are the following:

- The signalized intersections at the Stadium interchange were worse than the established threshold in both the morning and the afternoon peak period.
- The signalized intersection at Bernadette operates at LOS D in the afternoon peak period, but would decrease to LOS E with a three percent increase in volume.
- The weaving section on EB I-70 between Business Loop East and U.S. 63 operates at LOS E in the afternoon peak period.

- The weaving area of the frontage road between the slip ramps and the signalized intersections at the Stadium Boulevard interchange operate worse than the established threshold for LOS.
- The weaving area of the frontage road between the slip ramps and the signalized intersections at MO-763 would operate worse than the established threshold for LOS.

c. Quantitative Impact Evaluation



An impact assessment was conducted to evaluate impacts to the human and natural environments associated with the three detailed concepts. The assessment used the environmental data gathered for the project to quantify the level of impacts that could be expected. **Table II-5** is from a display/handout provided at the December 11, 2003 Public Involvement Meeting. It summarizes the impacts associated with the three detailed concepts. The remainder of this section will discuss the impact projections developed for the concepts⁷ and will follow the organization of **Table II-5**. This discussion is not intended to be exhaustive, but rather highlight the potential concept-related impacts that would assist decision-making.

Land Use Impacts

Among the three concepts, the footprint of the collector/distributor road concept is the largest and the one-way frontage road concept is the smallest. Overall, the collector/distributor is 38 percent larger than the one-way frontage road concept. Within the city of Columbia, between 190 and 263 acres of new right of way are expected to be required. Aside from the overall size, the distribution of land uses directly impacted by the concepts is similar:

- Residential: 13 percent,
- Commercial: 45 percent,
- Industrial: nine percent,
- Agricultural: 25 percent,
- Public: five percent, and
- Other: two percent.

⁷ Noteworthy findings for those areas outside of the central portions of Columbia will be discussed at the conclusion of each subsection.

 TABLE II-5 QUANTITATIVE IMPACT EVALUATION: DETAILED CONCEPTS Improve I-70: Columbia Area (SIU #4) 			
Public Involvement Meeting – December 11, 2003			
This table represents an evaluation of the potential impacts of three widening concepts being considered for the central area of Columbia, between Stadium Boulevard and U.S. 63. The ability to avoid, minimize and/or mitigate these impacts is a key decision-making factor. These numbers are approximate and could change as improvement alternatives are further developed and analyzed.			
IMPACT/CONCEPT	One-Way Frontage Road	Two-Way Frontage Road	Collector- Distributor Road
LAND USE IMPACTS (PRIMARY USE FOR TAX PARCEL WITHIN FOOTPRINT, IN ACRES)			
Total Project Footprint	190	232	263
Residential	26	28	38
Commercial	86	105	116
Industrial	14	21	25
Agricultural	49	58	69
Public (Parks and other publicly owned parcels)	10	15	10
Other (e.g. utilities, institutional, fraternal organizations)	5	5	5
ECOLOGICAL IMPACTS, SOME WITH STRINGENT REGULATIONS			
Wetland Encroachments, in acres (Executive Order 11990 requires no practicable alternative)	2.1	2.1	2.5
100-Year Floodplain Encroachments (acres)	26	25	28
Stream Crossings (#)	8	9	8
Potential Threatened/Endangered Species Involvement (Y/N) – Only known encroachment in I-70 corridor is to Bristled Cyperus, which is being re-located by Missouri Department of Natural Resources	Yes	Yes	Yes
POTENTIAL IMPACTS ON IMPORTANT COMMUNITY RESOURCES			
Structures on, or potentially eligible, for National Register of Historic Places	2	2	2
Parks, in acres (Only Cosmo Park is located along I-70)	0.1	0.7	0.9
Churches (existing facilities within footprint)	No	Yes	No
Cemeteries (existing facilities within footprint)	No	No	No
Schools (existing facilities within footprint)	No	No	No
Hospitals (existing facilities within footprint)	No	No	No
ESTIMATED DISPLACEMENT IMPACTS			
Residential (estimated number of structures)	82	110	109
Commercial (estimated number of business operations)	118	115	125
Industrial (estimated number of facilities)	11	13	14
Total Number of Structures within Footprint (multiple structures per parcel)	224	263	274

The public land uses include not only park land (Cosmo Park) but also publicly owned buildings. The extent of commercial encroachments is not surprising, given the location of the project. However, to better evaluate the potential impacts to the existing business community, a business inventory and a business survey were initiated. The former identified the business operations within the project area while the latter was a questionnaire-driven analysis intended to quantify the nature of the businesses and determine how they might respond to a potential displacement. This would allow for the development of strategies to minimize negative impacts. Outside of Columbia the percentage of agricultural and residential land uses within the footprint increased with a corresponding reduction in commercial and industrial land uses.

Ecological Impacts

Because the detailed concepts work within the existing highway corridor and because that corridor traverses an urban area, the ecological impacts are similar and modest. Wetland encroachments were predicted to be between two and three acres. Floodplain impacts are virtually identical, as are stream impacts. The only identified endangered species impact is with a small population of bristled cyperus (state protected plant species) within an I-70 on-ramp island. Virtually any I-70 road work would negatively impact this small population. Missouri Department of Transportation is currently working with the Missouri Department of Natural Resources (MDNR) to relocate the cyperus population.

Potential Impacts on Important Community Resources

Important community resources in the vicinity of I-70 include historic buildings, parks, cemeteries, churches, schools and hospitals. The design of the concepts was intended to avoid direct impacts of these, to the extent possible. As shown in **Table II-5**, the design team was largely successful. However, continued work to minimize direct impacts was still needed. For example, as developed, all concepts encroached on Cosmo Park. Section 4(f) would require an analysis of whether there are feasible and prudent alternatives to avoid these encroachments. The smaller footprint of the one-way frontage road concept translates into the smallest encroachment (0.1 acres). The Cosmo Park area is among the most difficult from a design standpoint. Adjacent to Cosmo Park is the Stadium Boulevard interchange. On the opposite side of I-70 are the Columbia Mall and other assorted commercial enterprises. As more detailed engineering studies were initiated, the investigations would focus on techniques to avoid Cosmo Park. Ultimately, reasonable alternatives were developed that completely avoided Cosmo Park. Another community resource issue is the location of historic structures. All of the concepts were designed to avoid direct impacts on the only listed National Register of Historic Places (NRHP) site within the project area (the Candle Light Lodge Retirement Center). A second site potentially eligible for the NRHP was identified, in the southwestern quadrant of the MO-Z interchange, during the literature review conducted for the corridor. It was expected that all of the concepts could also avoid this site, if needed. Ultimately, onsite investigations concluded that this site was not eligible for the NRHP.

Estimated Displacement Impacts

By far the most discussed element of **Table II-5** was the estimates of the displacements that the concepts would require within Columbia. Overall, 274 structures were located within the footprint of the collector/distributor road concept, 263 within the two-way frontage road concept and 224 within the one-way frontage road concept. To give these numbers greater meaning, estimates were made of the number of residential displacements, business operation

displacements and industrial operation displacements expected under the three concepts. Based on these estimates, between 82 and 110 residential structures would be displaced, between 115 and 125 business operations would lose at least one of their existing buildings and between 11 and 14 industrial facilities would experience substantial encroachments. When considering the extent and location of the project, these impacts become understandable. The reasonable alternatives would need to evaluate all available avoidance and minimization techniques while also maintaining the project's goals and design standards.

d. Conclusions of Detailed Concept Evaluation

The detailed evaluation included developing functional engineering depictions of the concepts, an iterative traffic engineering process to develop a configuration that met traffic threshold levels and a quantitative impact assessment. Based on this work it was determined that, on their own, no individual concept was optimal. As a result, a design process was undertaken to address the issues associated with the concepts and develop a range of reasonable alternatives that satisfy the project's purpose and need, and minimize overall project-related impacts. The reasonable alternatives would be hybrids—combinations and modifications of the concepts previously discussed. The aforementioned single continuous concepts were eliminated from further consideration.

The important conclusions of the detailed concept evaluation that guided the development of the reasonable alternatives included the following:

- **Need to consider phased implementation and overall cost minimization.** As engineering details increase, the ability to develop accurate opinions of cost increases. The indications are that the costs associated with the SIU 4 portion of I-70 would exceed the current anticipated projected cost. As a result, the need to carefully consider construction phasing – breaking the project into separate constructible areas –would help guide the development of the reasonable alternatives. This included determining the order in which the I-70 improvements would be implemented to accommodate traffic needs. It would also include planning to organize improvements to be as cost-effective as possible.
- **Need to merge acceptable Stadium Boulevard configurations with appropriate frontage roads.** While the Stadium Boulevard interchange proved to be a difficult engineering problem, solutions were found. These solutions were not always consistent with the frontage road systems under consideration. Consequently, the integration of acceptable interchange configurations with appropriate frontage road systems would need to be investigated further.
- **Need to find better solutions to the merging problems at exits 126, 127 and 128.** Referred to as "the triplets" by the design team, these three closely placed interchanges presented some difficult operational challenges. The solutions contained within the concepts were unacceptable. To be considered reasonable, better design solutions were needed.
- **Need to address the access issues raised during preliminary development.** As the access ramifications of the concepts became evident, requests for fine tuning also began. The project team worked closely with Boone County, the City of Columbia, the Advisory Group and the public at large. To the extent possible, the design team strove to address local concerns.

- **Need to minimize project-related impacts.** The impacts associated with the I-70 project would be considerable. The development of the reasonable alternatives would continue the process of avoiding and minimizing negative impacts.
- **Need to implement the most appropriate access control system.** The evaluation of a single concept of access control (one-way, two-way, collector/distributor) was useful. It allowed for the systematic evaluation of the pros and cons of the technique. It also made it simpler for people outside the project team to visualize the concepts, which improved the public involvement process. Through this process it became clear that a uniform system is not the optimum solution. The development of the reasonable alternatives would need to more efficiently provide access.
- **Need to address implications of a new interchange west of Stadium Boulevard.** Alternative development at the Stadium Boulevard interchange has been complicated by potential resource impacts as well as by operational concerns. As is often the case, there is also local interest for a new interchange (to relieve pressure). Within the scope of this I-70 project, an additional interchange would be considered if the existing interchange cannot be designed to meet the applicable traffic-related thresholds. To fully investigate the merits of an additional interchange, an additional round of interchange investigations was initiated.
- **Need to balance the impacts and the needs of U.S. 63 interchange.** The U.S. 63 interchange used in the concept-stage was an eight-movement system-to-system interchange that provided all movements to and from U.S. 63 and I-70. Vehicles are not required to stop during such movements. Evaluation of this interchange concluded that the expected traffic needs could be accommodated through a more modest configuration – specifically a four-movement system interchange. The four-movement system configuration provided the most critical vehicle movements with non-stop connections between U.S. 63 and I-70. These major movements include (1) U.S. 63 (southbound) to I-70 (westbound), (2) U.S. 63 (northbound) to I-70 (westbound), (3) I-70 (eastbound) to U.S. 63 (northbound) and (4) I-70 (eastbound) to U.S. 63 (southbound). This configuration is also the recommendation that emerged from the 2000 MIS conducted for MoDOT. The use of a four-movement system instead of an eight-movement system configuration had important cost and impact benefits, while at the same time meeting all the project's traffic-related threshold levels.

The engineering studies that accompany a preliminary development project seldom dovetail precisely into the steps depicted throughout this chapter. The engineers are routinely investigating options, answering questions and trying to refine methods. There are many reasons for these engineering design studies; they often arise from public involvement or agency coordination. These design studies proceed long enough to answer the questions being investigated. Consequently, they may not neatly fit into the decision making process depicted in **Figure II-2**. **Appendix II-D** contains depictions of other design studies that have been investigated during this project.

D. Reasonable Alternatives

The reasonable alternatives presented in this section represent those techniques that satisfy the project's purpose and need, meet the established traffic-related threshold levels, meet engineering requirements and minimize impacts to the human and natural environment.

All of the improvements shown and discussed in this document are required for the design year 2030. It is important to note that all improvements will not be constructed initially. Construction of the improvements will be phased to accommodate the needs and funding streams.

The reasonable alternatives emerged from the information that was developed during the concept phase of the project and validated by supplemental investigations conducted for the reasonable alternatives. Chapter 3 presents the details of the various resource specific investigations conducted for the reasonable alternatives. The reasonable alternatives are summarized in **Table II-6**. They are organized by location and the individual areas can be combined in every possible combination.

1. Western Portion of the Project Area: Western Terminus to Stadium

The western portion of the project area covers 8.4 miles (13.5 km) from the western terminus to just prior to the existing Stadium Boulevard (MO-740) interchange (mile marker 116.2 to 124.6). The MO-J/O and U.S. 40 interchanges are within this portion of the project. The general elements associated with the reasonable alternatives include the construction of one additional I-70 lane in each direction between the west project terminus and the U.S. 40 interchange and two additional lanes in each direction east of U.S. 40. This widening would take place on the south side of I-70 between MO-J/O and U.S. 40, and symmetrical about the existing I-70 centerline between U.S. 40 and MO-740. Among the reasons for a southern widening include compatibility with the I-70 work being conducted to the west (SIU 3), ability to more easily construct the improvements and impact minimization (especially in terms of displacements). The existing discontinuous frontage roads would be improved in phases and made continuous in certain locations over time. On the south side of I-70, the frontage road would be made continuous over time from the western terminus to Stadium Boulevard. On the north side of I-70, the frontage road would be made continuous over time between the western terminus and the MO-J/O interchange and between the U.S. 40 interchange and Stadium Boulevard. The frontage roads would mostly parallel I-70, but the alignment does vary to minimize impacts. The frontage roads would include new crossings of Perche Creek. The Sorrels Overpass Drive would also be replaced in its existing location.

The reasonable alternatives in this portion of the project area are associated with the MO-J/O interchange and the U.S. 40 interchange configurations. The reasonable alternatives in the western portion of the project area are depicted on **Exhibits II-12, II-13, and II-14**.

a. Mile Marker 116.2 to Mile Marker 120.0, Including MO-J/O Interchange

Because of the lack of obvious constraints, the reasonable alternatives at the MO-J/O interchange are limited to a standard diamond design. This configuration is consistent with the one used during the concept stage of the project. I-70 would overpass MO-J/O. The interchange ramps would be somewhat wider than the existing condition, in accordance with current standards. Frontage road intersections (potentially signalized) would be placed approximately 1,350 feet (411.5 m) from the signalized interchange ramp intersections. A service road would provide access to the existing properties in the interchange's northeast quadrant. See **Exhibit II-12**.

Table II-6: Key to Reasonable Alternatives

Western Portion of Project Area: Western Terminus to Stadium Boulevard Interchange
<i>Mile Marker 116.2 to Mile Marker 120.0, including MO-J/O Interchange</i>
Reasonable Alternative #1: Diamond Interchange
<i>Mile Marker 120.0 to Mile Marker 124.6, including U.S. 40 Interchange</i>
Reasonable Alternative #1: Enhanced Diamond Interchange
Reasonable Alternative #2: Diamond Interchange with Southwestern Loop Ramp
Central Portion of Study Area: Columbia between Stadium Boulevard and U.S. 63
<i>Mile Marker 124.6 to Mile Marker 125.2, Stadium Boulevard Interchange</i>
Reasonable Alternative #1: Interchange with Northwestern Loop Ramp
Reasonable Alternative #2: Tight Diamond Interchange
Reasonable Alternative #3: Single Point Urban Interchange
Reasonable Alternative #4: Split Diamond Interchange
<i>Mile Marker 125.2 to Mile Marker 126.0, Business Loop West Interchange</i>
Reasonable Alternative #1: Two-Point Interchange
<i>Mile Marker 126.0 to Mile Marker 128.0, MO-163, MO-763 and Business Loop East Interchanges</i>
Reasonable Alternative #1: One-Way Frontage Road System
Reasonable Alternative #2: Collector/Distributor System
<i>Mile Marker 128.0 to Mile Marker 130.0, U.S. 63 Interchange</i>
Reasonable Alternative #1: Tight Right of Way Interchange Design
<i>Eastern Portion of Project Area: U.S. 63 to MO-Z</i>
<i>Mile Marker 130.0 to Mile Marker 132.0, including St. Charles Interchange</i>
Reasonable Alternative #1: Tight Diamond Interchange
Reasonable Alternative #2: Offset Diamond Interchange
<i>Mile Marker 132.0 to Mile Marker 134.0, including MO-Z Interchange</i>
Reasonable Alternative #1: Diamond Interchange
Reasonable Alternative #2: Diamond Interchange with Northwestern Loop Ramp

b. Mile Marker 120.0 to Mile Marker 124.6, Including U.S. 40 Interchange

The reasonable alternatives include two interchange configurations at the intersection of I-70 and U.S. 40. During the concept stage, four interchange configurations were developed. Two of the concept interchange configurations (#1 and #2, see **Exhibit II-11B**) attempted to provide system movements between I-70 and U.S. 40 (because of their importance within the overall highway system of Missouri). These connectivity techniques were rejected from further consideration. Cost, impact and safety issues made them unreasonable. Because of the high percentage of trucks on

these roads, the high speeds, turns and stopping made these ramps unsuitable for further consideration.

The first U.S. 40 reasonable alternative is a modified diamond interchange (U.S. 40 enhanced diamond). During the concept stage, Configuration #3 was a standard diamond. The standard diamond was abandoned, in part, because it failed to provide for effective connectivity between MO-UU and U.S. 40 (each end at I-70). The U.S. 40 enhanced diamond resolves many of the deficiencies of the standard diamond. The new bridge passing over I-70 is located approximately 150 feet (45.7 m) east of the existing bridge. The realignment allows for enhanced connectivity between U.S. 40 and MO-UU. It also allows for the northern and southern frontage roads to connect to U.S. 40 and MO-UU. The U.S. 40 enhanced diamond is depicted on **Exhibit II-13**.

The second U.S. 40 reasonable alternative is a diamond interchange with a loop ramp in the southwestern quadrant (U.S. 40 loop ramp). This configuration is similar to concept alternative #4 (see **Exhibit 11B**) and would provide continuity between U.S. 40 and MO-UU. It would also provide a system movement between U.S. 40 southbound and I-70 eastbound by implementing a loop ramp in the southwest quadrant of the interchange. The U.S. 40 Loop Ramp is depicted on **Exhibit II-14**.

2. Central Portion of the Project Area: Columbia – Stadium Boulevard (MO-740) to U.S. 63

The central portion of the project area covers approximately 5.4 miles (8.7 km) through the city of Columbia from Stadium Boulevard interchange to the U.S. 63 interchange (mile marker 124.6 to 130.0). In addition to the Stadium Boulevard and U.S. 63 interchanges, this portion of the project also includes four other interchanges. Among these are the Business Loop West interchange, interchanges at MO-163, MO-763 and the Business Loop East interchange.

The general elements associated with the reasonable alternatives include the construction of additional I-70 lanes; four lanes in each direction. Between Garth and U.S. 63, widening would take place symmetrically/evenly on both sides of the existing I-70 centerline. Slight asymmetrical widening to the north between MO-740 and Business Loop West, and to the south between Business Loop West and MO-163 minimizes impacts in these locations. A median treatment (26 feet [7.92 m], plus two 12-foot [3.7 m] shoulders) with a median barrier would be used. See **Appendix II-B** for a depiction of the special section.

All existing overpasses of I-70 would be replaced, and an additional pedestrian/bicycle overpass is proposed for the vicinity of Clinkscale Road. The existing frontage roads adjacent to I-70 would be retained, mostly along their existing alignments. All existing interchanges would be retained, but in some cases modified substantially. For example, the Business Loop East interchange (exit 128) would be relocated approximately 0.6 miles (1.0 km) east of its existing location, and it would provide access to all directions.

The reasonable alternatives in this portion of the project area include four MO-740 (Stadium Boulevard) interchange configurations, one interchange at Business Loop West and two system configurations at MO-163/MO-763/ Business Loop East. The reasonable alternatives in the central portion of the project area are depicted on **Exhibits II-15** through **II-22**.

a. Mile Marker 124.6 to Mile Marker 125.2, Including Stadium Boulevard Interchange

Traffic deficiencies, environmental constraints and a densely built urban environment make this among the most constrained locations within the project area. The reasonable alternatives include four interchange configurations. These configurations differ from those developed and evaluated at the concept stage. The reasonable alternatives represent the incorporation of public involvement and agency coordination. Further, the reasonable alternatives incorporate the efforts undertaken to avoid and minimize impacts to social, economic and environmental resources. They are also the product of more detailed traffic investigations, designed to maximize, to the extent possible, the operational characteristics of I-70 and the local roadway system. These alternatives meet the objectives of the project's purpose and need and satisfy the project-related traffic threshold service levels.

The first Stadium Boulevard reasonable alternative is a modified diamond interchange with a loop ramp in the interchange's northwestern quadrant (Stadium Boulevard northwest loop ramp). The loop ramp is provided to eliminate the left turns associated with westbound I-70 traffic exiting at Stadium Boulevard. This greatly increases the footprint of the project in the northwestern quadrant but yields operational benefits. Two fly-over ramps are also essential parts of this configuration. One allows westbound I-70 traffic to bypass the Stadium Boulevard interchange and exit to the south side of I-70 via Fairview Road. The other ramp allows travelers to enter I-70 (eastbound) from Fairview Road. These ramps reduce traffic at the Stadium Boulevard interchange and the Bernadette/Stadium intersection by directing it to Fairview Road. Further discussion on the ramps to and from Fairview is located below. The Stadium Boulevard northwest loop ramp is depicted on **Exhibit II-15**.

The second Stadium Boulevard reasonable alternative is a tight diamond interchange (Stadium Boulevard tight diamond). The Stadium Boulevard tight diamond attempts to minimize the footprint while retaining the functionality of a standard diamond. Footprint savings are accomplished through the use of retaining walls and context sensitive design tolerances. These techniques are usually restricted to highly developed areas because of the high construction and maintenance costs. The tight diamond can generally be described as being symmetrically centered on the existing interchange. Two fly-over ramps are also essential parts of this configuration. One allows westbound I-70 traffic to bypass the Stadium Boulevard interchange and exit to the south side of I-70 via Fairview Road. The other ramp allows travelers to enter I-70 (eastbound) from Fairview Road. These ramps reduce traffic at the Stadium Boulevard interchange and the Bernadette/Stadium intersection by directing it to Fairview Road. The Stadium Boulevard tight diamond is depicted on **Exhibit II-16**.

The third Stadium Boulevard reasonable alternative is a SPUI. It is similar to the diamond in general appearance, but functions quite differently. It achieves operational benefits by combining the two signalized ramp intersections of a typical diamond into a single signalized intersection. Two fly-over ramps are also essential parts of this configuration. One allows westbound I-70 traffic to bypass the Stadium Boulevard interchange and exit to the south side of I-70 via Fairview Road. The other ramp allows travelers to enter I-70 (eastbound) from Fairview Road. These ramps reduce traffic at the Stadium Boulevard interchange and the Bernadette/Stadium intersection by directing it to Fairview Road. The Stadium Boulevard SPUI is depicted on **Exhibit II-17**.

The fourth Stadium Boulevard reasonable alternative is a modified split diamond interchange (Stadium Boulevard split diamond). To segregate movements (and thus improve efficiency and

mobility), Fairview Road is used to provide access to traffic to and from the west on I-70, thereby reducing the volume of traffic required to use the Stadium Boulevard interchange and the Bernadette/Stadium intersection. This uses an overpass at Fairview, one-way connections between Fairview and Stadium and multiple exits to accomplish this goal. The Stadium Boulevard split diamond is depicted on **Exhibit II-18**.

Fairview Road Ramps

The first three reasonable interchange alternatives noted above include fly-over ramps onto Fairview Road from westbound I-70 and from Fairview Road onto eastbound I-70. The inclusion of these ramps is a result of considerable detailed analysis, in coordination with CATSO, of the operations of the Stadium interchange.

A detailed traffic analysis of the Stadium interchange revealed that in the design year 2030, heavy volumes at the intersection of Bernadette and Stadium would cause the Stadium interchange to operate at an unacceptable LOS. Traffic queues at this intersection extended to the Stadium interchange and caused significant traffic problems at the south ramp terminal. The north ramp terminal also suffered heavy congestion in 2030 due to the heavy turning volume from westbound I-70 to southbound Stadium.

Early in the development of the interchange alternatives, consideration was given to providing ramps at Fairview Road to and from the east on I-70. Both ramp terminals and the intersection with Bernadette would see improved levels of service with the reduced traffic. Traffic destined for the commercial area in the southwest quadrant of the interchange would also have a less congested alternative access route.

During this period, CATSO adopted a placeholder on its Major Roadway Plan for a new interchange between Stadium Boulevard and Perche Creek. The CATSO adopted interchange, referred to as the Scott interchange by many because of its general location, was intended to address traffic flows on a regional basis for the western part of Columbia. In order to make the best possible decision, CATSO agreed that the appropriate course of action was to allow the SIU 4 team to complete its I-70 analysis. The analysis would include the investigation of the Stadium Boulevard interchange and the issues associated with the new interchange supported by CATSO.

The SIU 4 project team analyzed the effects of a new interchange at various locations west of the existing Stadium interchange to determine its effectiveness in mitigating the traffic problems at Bernadette and Stadium. The traffic analysis was performed after reviewing and updating land use assumptions in this part of Columbia with CATSO. This land use update involved significant coordination with and concurrence from CATSO staff to determine what types of land use would be expected with the addition of a new access point onto I-70 in this general area.

The traffic analysis performed showed that the CATSO placeholder location provided benefit to traffic flows on the regional roadway network, primarily Broadway and Stadium near Broadway. However the Scott interchange did not draw enough traffic away from the Stadium interchange and the intersection with Bernadette to improve operations. Through this analysis it was determined that ramps to and from the east at Fairview Road provided the most effective traffic relief to allow the Stadium interchange and the Bernadette/Stadium intersection to operate at acceptable LOS.

It is important to note that while the traffic analysis dictates that these ramps would be required for proper operations in the design year 2030, it also shows that it is not necessary to build these ramps during initial construction of the Stadium Boulevard interchange improvements. The need for, and the timing of, the construction of the ramps to and from Fairview Road would be dependent upon growth patterns in western Columbia. Missouri Department of Transportation would continue to work with the City of Columbia on the further development of these ramps and the inclusion of the ramps in the City's Major Roadway Plan. Provisions for the ramps are included in the Stadium Boulevard interchange analysis.

Because the Scott interchange provided traffic benefits to the regional network, the City of Columbia expressed interest in potentially pursuing this project in the future. It appears that there is adequate spacing for the additional interchange. However, it should be noted that it may not comply with MoDOT's Access Management Guidelines.

b. Mile Marker 125.2 to Mile Marker 126.0, Including Business Loop West Interchange

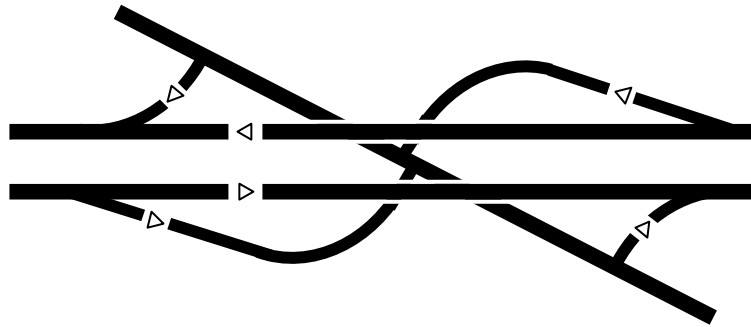
Within this short portion of the I-70 corridor, there are two important design elements to consider. First, the alignment of a widened I-70 would not be symmetrical to the existing alignment. The alignments of the existing through lanes between Stadium and Business Loop West interchanges are on a curve that exceeds the maximum degree of curvature as established by the Improve I-70 Study. This design element does not meet the Improve I-70 Study Criteria, but does meet the current MoDOT criteria. The design element would be corrected by flattening the curve, leading to a northward shift of I-70 approximately 220 feet (67.0 m). Between Business Loop West and MO-163, the curve was flattened to reduce impacts to the Parkade neighborhood, shifting the road approximately 50 feet (15.2 m) south of its present location.

The other element in this portion of the corridor is the Business Loop West interchange. The preliminary engineering investigated several interchange variations that provided for all movements. Because of the substantial skew between I-70 and the Business Loop, the interchange designs considered were two- and three-point diamond configurations. The three-point configuration creates three distinct intersections (from west to east): (1) Creasy Springs and I-70 westbound on-ramp, (2) I-70 westbound off-ramp and I-70 eastbound off-ramp and (3) I-70 Drive (SW) and I-70 eastbound on-ramp. This configuration has a large footprint with proportionally large impacts. The two-point configuration creates two distinct intersections by using underpass structures to combine the movements into the fewest number of intersections. From west to east, the two-point configuration has the following intersections: (1) Creasy Springs, I-70 westbound on-ramp and I-70 eastbound off-ramp and (2) I-70 Drive (SW), I-70 eastbound on-ramp and I-70 westbound off-ramp. Construction and maintenance costs are higher, with lower impacts and a simplified traffic pattern. The movements associated with two-point and three-point interchanges are illustrated on **Figure II-5**.

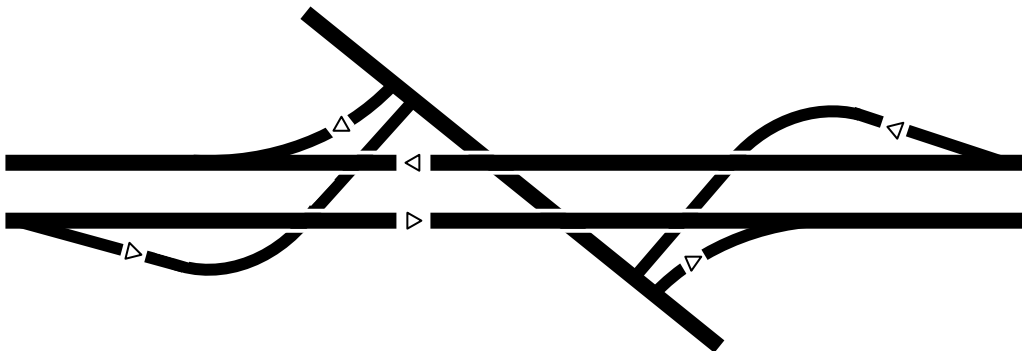
Because of its benefits, only the two-point interchange was determined to be reasonable for further consideration (Business Loop West). The Business Loop West interchange is depicted on **Exhibit II-19**.

Figure II-5: Two-Point and Three-Point Interchange Movement Diagrams

THREE POINT INTERCHANGE



TWO POINT INTERCHANGE



c. Mile Marker 126.0 to Mile Marker 128.0, Including 163/763/Business Loop East Interchanges

These tightly spaced interchanges would operate best as a system. The configurations developed at the detailed concept level were found to require improvement. The reasonable alternatives discussed here incorporate those improvements. The names (two-way frontage road system, one-way frontage road system and collector/distributor road system) were retained and still accurately describe the alternatives. Because the area is one of the most heavily developed portions of the study corridor, the two-way frontage road system was ultimately eliminated. Support for the two-way frontage road system was low and even with improvement, its operational characteristics were poor. The one-way and collector/distributor systems were deemed reasonable once their footprints were reduced and the needed operational modifications incorporated. The two reasonable alternatives for this area represent the logical conclusion relative to addressing the design pressures present in this area.

The first reasonable alternative is a one-way frontage road system (163/763/Business Loop one-way system). This alternative utilizes one-way frontage roads and Texas Turnarounds to access all directions to and from I-70. It also uses signals at each cross road. The widths of the frontage roads vary from two to four lanes to accommodate turning movements and ramp merging/diverging. The 163/763/Business Loop one-way system also provides the potential for a limited number of and carefully located access points for adjoining landowners. The 163/763/Business Loop one-way system is depicted on **Exhibits II-20A and B**. See **Appendix II-B** for a depiction of the special section in the vicinity of MO-163/MO-763.

The second reasonable alternative is a collector/distributor road system (163/763/Business Loop collector/distributor system). This alternative does not require traffic on the collector/distributor road to stop at the cross roads because the road is grade separated with the cross road. Connections with the cross road are provided by ramps to and from the collector/distributor road. The 163/763/Business Loop collector/distributor system is a high-speed system and provides no access for adjoining land owners. Access would be provided through the interchange ramp connections to the crossroads. The 163/763/Business Loop collector/distributor system is depicted on **Exhibits II-21A and B**.

d. Mile Marker 128.0 to Mile Marker 130.0, Including U.S. 63 Interchange

The costs, impacts and disruptions of the eight-movement system interchange at the intersection of I-70 and U.S. 63, used during the corridor stages of the project, confirmed that this configuration was not reasonable. The eight-movement system is depicted in **Exhibit II-8B**, **Exhibit II-9B** and **Exhibit II-10B**. As a result, a four-movement system interchange combined with Business 63 as a tight diamond is the only reasonable alternative at this location. This configuration is the recommendation that emerged from the 2000 MIS conducted for MoDOT. This configuration optimizes travel between U.S. 63 and I-70 so that the most critical vehicle movements are not required to stop. These major movements include (1) U.S. 63 (southbound) to I-70 (westbound), (2) U.S. 63 (northbound) to I-70 (westbound), (3) I-70 (eastbound) to U.S. 63 (northbound) and (4) I-70 (eastbound) to U.S. 63 (southbound).

Because of these benefits, only the four-movement system interchange combined with Business 63 as a tight diamond was determined to be reasonable for further consideration (U.S. 63 tight right of way interchange). The U.S. 63 tight right of way interchange is depicted on **Exhibit II-22**.

3. Eastern Portion of the Project Area: U.S. 63 to MO-Z

The eastern portion of the project area covers approximately 4.0 miles (6.4 km) from the U.S. 63 interchange to the MO-Z interchange (mile markers 130.0 to 134.0). Also within this area is the St. Charles Road interchange.

The general elements associated with the reasonable alternatives include the construction of additional I-70 lanes; four lanes in each direction. This widening would take place symmetrically/evenly on either side of the existing I-70 centerline. The median treatment would transition (from west to east) from the narrower urban treatment (26 feet [7.9 m], plus two 12-foot (3.7 m) shoulders) to the wider rural treatment (124 feet [37.8 m]) east of MO-Z. As a component of the complete build out of the project, the existing two-way discontinuous frontage roads would be connected by short lengths of road to the existing portions of the frontage road system.

The reasonable alternatives in this portion of the project area include two St. Charles interchange configurations and two MO-Z interchange configurations. The reasonable alternatives in the eastern portion of the project area are depicted on **Exhibits II-23** through **II-26**.

a. Mile Marker 130.0 to Mile Marker 132.0, Including St. Charles Interchange

The reasonable alternatives include two interchange configurations at the intersection of I-70 and St. Charles Road. During the concept stage, three interchange configurations were developed. These were all variations of a diamond interchange. They attempted to optimize the configuration of the interchange with the development occurring in the interchange area.

The first St. Charles reasonable alternative is a tight diamond interchange (St. Charles tight diamond). The St. Charles tight diamond is depicted on **Exhibit II-23**.

The second St. Charles reasonable alternative is an offset diamond interchange (St. Charles Offset diamond). This configuration locates the north terminus as far south as practical. The southern ramps are then pushed south to maintain the appropriate access management spacing. The St. Charles Offset Diamond is depicted on **Exhibit II-24**.

b. Mile Marker 132.0 to Mile Marker 134.0, Including MO-Z Interchange

The reasonable alternatives include two interchange configurations at the intersection of I-70 and MO-Z. During the concept stage, four interchange configurations were developed. These were all variations of a diamond interchange. Concepts #2 and #3 (**Exhibit II-11E**) were developed specifically to eliminate impacts from the intersection's southwestern quadrant – to avoid a structure initially identified as being potentially eligible for the NRHP. This structure was ultimately found not to be eligible.

The first MO-Z reasonable alternative is a standard diamond interchange (MO-Z Diamond), similar to concept configuration #1. The MO-Z Diamond is depicted on **Exhibit II-25**.

The second MO-Z reasonable alternative is a diamond interchange with a loop ramp in the northwestern quadrant (MO-Z Loop Ramp), similar to concept configuration #3. The MO-Z Loop Ramp is depicted on **Exhibit II-26**.

4. Selection of Recommended Preferred Alternative

Based on all of the work conducted within the Improve I-70 project, a recommended preferred alternative has been identified. The project team believes that this alternative satisfies the project's purpose and need, minimizes negative environmental impacts (eliminates all avoidable significant negative impacts) and, overall, best balances the costs and benefits of project development. This section will describe the recommended preferred alternative and examine the key data associated with its identification.

Notwithstanding the identification of a recommended preferred alternative, all reasonable alternatives presented would remain under consideration through the public hearing and Draft EIS review and comment period. Missouri Department of Transportation would officially identify the preferred course of action (in the Final EIS) after evaluating all comments received from the public hearing following the availability of the Draft EIS for public and agency review.

The recommended preferred alternative consists of the following reasonable alternative elements:

Western Part of Project Area: Western Terminus to Stadium Interchange

Mile Marker 116 to 120, MO-J/O Interchange	Diamond Interchange	Exhibit II-12
Mile Marker 120 to 124, U.S. 40 Interchange	Enhanced Diamond	Exhibit II-13

Central Part of Study Area: Columbia between Stadium and U.S. 63

Mile Marker 124 to 125, Stadium Interchange	Tight Diamond	Exhibit II-16
Mile Marker 125 to 126, Business Loop West	Two-Point Interchange	Exhibit II-19
Mile Marker 126 to 128, 163/763/Business Loop East	One-Way Frontage Road	Exhibit II-20
Mile Marker 128 to 130, U.S. 63 Interchange	Tight Right of Way Interchange	Exhibit II-22

Eastern Part of Project Area: U.S. 63 to MO-Z

Mile Marker 130 to 132, St. Charles Interchange	Tight Diamond	Exhibit II-23
Mile Marker 132 to 134, MO-Z Interchange	Diamond Interchange	Exhibit II-25

A complete depiction of the recommended preferred alternative is contained in **Exhibit II-27**.

The process that led to the selection of the recommended preferred alternative included evaluations of impacts (see Chapter III). The impact analysis included right of way impacts, environmental impacts, community impacts, displacement impacts, and engineering impacts along with an examination of the compatibility with CATSO priorities. Among the important engineering evaluations were investigations of construction staging and maintenance of traffic. Discussions relating to the construction staging and maintenance of traffic aspects of the reasonable alternatives are contained with **Appendix II-B. Summary Tables S-1, S-2, S-3 and S-4** (at the beginning of this document) contain a summary of the impacts associated with the reasonable alternatives. A version of this summary was used at the project's March 18, 2004, Advisory Group meeting when the recommended preferred alternative was publicly presented for comment. This was the 19th public event that the SIU 4 Second Tier EIS hosted. Again, valuable information was gained leading to modifications to specific project elements. Project-related impacts will be discussed at much greater length in Chapter III. It is also important to note that the impacts developed at the reasonable alternatives stage are much more accurate

than those developed earlier in the project. Overall, the impacts associated with the reasonable alternatives are substantially lower than might be assumed based on the earlier detailed preliminary concepts.

The remainder of this section will outline the some of the key elements that led to the identification of the recommended preferred alternative.

a. Western Portion of Project Area: Western Terminus to Stadium Interchange

This portion of I-70 extends between mile 116 to 124, including the MO-J/O interchange and the U.S. 40 interchange. The mainline widening would occur to the south and grass medians would be maintained. The widening to the south minimizes impacts and allows for a seamless transition to the Missouri River crossing that occurs in SIU 3 (approximately 1.3 miles [2.1 km] west of the SIU 4 terminus). This would also minimize delays by using existing lanes during the construction process and reducing costs by minimizing the use of additional right of way.

Because of the rural nature of the site and the overall lack of constraints, a standard diamond interchange design at MO-J/O was identified as the recommended preferred alternative. The diamond interchange is in accordance with First Tier EIS recommendation for diamond interchanges in rural areas, whenever possible. The standard diamond also achieves the access management goals promoted by MoDOT. Very few buildings will be displaced as a result of the J/O interchange. The five dwelling units listed on the Reasonable Alternative Impact Summary under J/O are actually the result of the I-70 widening. In fact, at J/O the largest impacts occur to MoDOT facilities. The maintenance facility in the northeastern quadrant of the J/O interchange would lose three structures (1417, 1425 and 1428, see **Exhibit III-3**). The interchange's small footprint and simple design is cost-effective and has relatively few impacts. There has been little controversy, at this location, as the project progressed through the preliminary development process.

The enhanced diamond interchange design was identified as the recommended preferred alternative at U.S. 40. This design creates direct connectivity between U.S. 40 (north of I-70) and MO-UU (south of I-70). The enhanced diamond design is the simpler and smaller of the two reasonable alternatives, reducing costs and impacts. The operation of the two reasonable alternative interchanges is acceptable. The loop ramp was not determined to be an essential element. In addition, the enhanced diamond was preferred by CATSO and would better be able to accommodate future expansions. Displacements and property takes are reduced under the enhanced diamond – including two fewer structure displacements of existing business operations, 20 percent lower right of way takes and requires the least alteration to the existing development pattern around the interchange.

b. Central Portion of Study Area: Columbia between Stadium Boulevard U.S. 63

This portion of the study area extends from mile 125 to 130, including the Stadium Boulevard, Business Loop West, MO-763, MO-163, Business Loop East and U.S. 63 interchanges. Overall, the mainline widening occurs symmetrically on each side for the existing highway⁸. Room for a maximum of eight lanes would be available. The existing frontage roads would be maintained and, in some cases, improved.

⁸ One important exception occurs in the vicinity of the Business Loop West interchange. An existing substandard curve would be corrected in this area, resulting in widening to the north for the portion of I-70 west of Business Loop and to the south for the portion of I-70 east of Business Loop.

The tight diamond design was identified as the recommended preferred alternative for the Stadium Boulevard (MO-740) interchange. The important constraints, such as Cosmo Park and the highly developed Stadium Boulevard corridor, forced all of the reasonable alternatives into very similar and very constrained areas. The tight diamond is expected to have marginally lower displacement impacts and construction costs. The fly-over ramps are a concern for many stakeholders. Fairview Road is not typically viewed as a road closely associated with the interstate. Its use, as proposed, would require its re-designation on the CATSO Major Roadway Plan. However, the tight diamond is still favored in regard to satisfying CATSO priorities. The issues associated with Fairview Road and the local transportation planning are discussed in several places in Chapter III (III.B.1.c, III.B.2.k, and III.B.3.c and d).

The Two-Point interchange was identified as the recommended preferred alternative for the Business Loop West interchange. Overall, the footprint in this portion of I-70 is very tight, resulting in relatively low right of way acquisitions. The overall level of impact is generally low. However, the West Manor Village and Terrace Retirement Apartments would be displaced due to the realignment of I-70 required in this area.

The one-way frontage road system was identified as the recommended preferred alternative for the area encompassing the MO-163, MO-763 and the Business Loop East interchange. The impacts associated with the reasonable alternatives are virtually identical. The one-way frontage road was selected over the collector/distributor road because of traffic operational differences and higher levels of support by the public, MoDOT and other stakeholders. The one-way frontage road could potentially allow greater direct local access to abutting properties than other alternatives, but that access would be limited by the available capacity on the one-way system. Sensitivity analyses of the one-way system indicated that it could absorb an additional 15 percent (approximate) increase in design year volume without exceeding the established threshold limits. Development along the frontage roads and the associated traffic using the access points along the one-way system would need to be regulated to keep the additional volumes from impacting the level of service at the interchanges. Limited right-in/right-out movements would be possible in a few select locations.

The existing ramps between I-70 and the eastern end of the I-70 business loop are relocated to a new interchange located approximately 0.6 mile (1.0 km) east of the MO-763 interchange. This new interchange provides traffic benefits to the overall traffic system by providing additional access to I-70 and improving safety on I-70. It also impacts a property eligible for the NRHP (the impact has been determined to be an Adverse Affect). This has Section 106 and Section 4(f) ramifications. Section 106 issues are discussed in **Chapter III.D.13**. Section 4(f) issues are addressed in **Chapter IV**.

c. Eastern Portion of Project Area: U.S. 63 to MO-Z

This portion of the study area extends from mile 130 to the eastern terminus, including the St. Charles Road and MO-Z interchanges. The mainline widening would occur symmetrically on each side for the existing highway. The existing frontage roads would be maintained and, in some cases, improved. Room for a maximum of eight lanes would be available.

The tight diamond was identified as the recommended preferred alternative for the St. Charles interchange. The tight diamond interchange minimizes impacts, supports CATSO's priorities and accommodates the anticipated future development in the immediate vicinity of the interchange.

The standard diamond was identified as the recommended preferred alternative for the MO-Z interchange. The diamond interchange is in accordance with First Tier EIS recommendation for diamond interchanges, whenever possible. The standard diamond also achieves the access management goals promoted by MoDOT.

d. Traffic Operations of the Recommended Preferred Alternative

The recommended preferred alternative would operate well in the design year 2030. It would perform at or better than the established thresholds for acceptable operations. **Table II-7** shows the 2030 Peak Hour LOS for the mainline and interchange areas. **Table II-8** shows the ramp terminal signalized intersection peak hour LOS for 2030.

Table II-7: Level of Service – Recommended Preferred Alternative

SIU 4 Subsections		2030 Peak Hour Level of Service		
		Desired LOS	Eastbound	Westbound
1	MO-BB to MO-J/O	C	C	C
	MO-J/O Interchange Area	C	C	C
2	MO-J/O to U.S. 40	C	C	C
	U.S. 40 Interchange Area	D	C	C
3	U.S. 40 to MO-740	D	C	C
	MO-740 Interchange Area	D	C	C
4	MO-740 to Bus Loop West	D	D	D
	Bus Loop West Interchange Area	D	C	C
5	Bus Loop West to MO-163	D	D	D
	MO-163 Interchange Area	D	D	D
6	MO-163 to MO-763	D	C	C
	MO-763 Interchange Area	D	C	C
7	MO-763 to Bus Loop East	D	C	C
	Bus Loop East Interchange Area	D	D	D
8	Bus Loop East to U.S. 63	D	C	C
	U.S. 63 Interchange Area	D	C	D
9	U.S. 63 to St. Charles Road	D	C	C
	St. Charles Interchange Area	D	D	C
10	St. Charles Road to MO-Z	D	B	C
	MO-Z Interchange Area	D	C	B

The interchange Area LOSs are composite LOSs, meaning that they represent the worst LOS of the respective ramps and mainline traffic within each interchange area.

Table II-8: Interchange Crossroad/Ramp Terminal LOS – Recommended Preferred Alternative

Signal Location	Desired Level of Service	2030 Peak Hour Level of Service
I-70 eastbound at MO-J/O	D	A
I-70 westbound at MO-J/O	D	B
I-70 eastbound at U.S. 40	D	B
I-70 westbound at U.S. 40	D	C
I-70 eastbound at MO-740	D	C
I-70 westbound at MO-740	D	C
MO-740 at Bernadette	D	D
I-70 eastbound at Bus Loop West	D	C
I-70 westbound at Bus Loop West	D	B
I-70 eastbound at MO-163	D	C
I-70 westbound at MO-163	D	B
I-70 eastbound at MO-763	D	C
I-70 westbound at MO-763	D	C
I-70 eastbound at Bus Loop East	D	C
I-70 westbound at Bus Loop East	D	B
I-70 eastbound at U.S. 63	D	B
I-70 westbound at U.S. 63	D	B
I-70 eastbound at St. Charles	D	C
I-70 westbound at St. Charles	D	C
I-70 eastbound at MO-Z	D	C
I-70 westbound at MO-Z	D	C

E. Opinion of Cost

The recommended preferred alternative is estimated to cost \$653,808,000. **Table II-9** summarizes the main components that constitute this opinion of cost⁹. This estimate is based on the preliminary engineering conducted to date. Because of the developed nature of the project corridor, the right of way costs are a large component of the total estimated cost; one

⁹ Costs are presented in 2005 dollars, as the construction timeline is extended, costs are subject to change due to inflation.

that is notoriously difficult to estimate. For comparison, the projected costs associated with the No-Build Alternative are also included in **Table II-9**.

The Missouri Transportation Investment Strategy recently identified toll financing as a possible means of raising funds for Missouri's future transportation improvements. To further investigate the possibility of tolling Missouri's roadways, MoDOT commissioned the *Missouri Toll Feasibility Study - Phase I*. The purpose of this toll feasibility study was to estimate the potential revenue that could be generated from several candidate toll projects within the state. In this study, I-70 was identified as a corridor worthy of further study for tolling. A Phase II study will be performed in the future to provide a more detailed assessment of the possibility to toll I-70.

Table II-9: Opinion of Cost Comparison (2005 Dollars)

	Preferred Alternative	No-Build Alternative
Construction	\$469,630,000	N/A
Right of Way	\$134,886,000	N/A
Design Engineering	\$23,481,000	N/A
Rehabilitation, O & M	\$12,135,000	\$23,171,000
ITS:		
Implementation Cost	\$5,300,000	\$5,300,000
Annual O & M Cost	\$8,376,000	\$8,376,000
Total	\$653,808,000	\$36,847,000

A comparison of the opinion of cost for the recommended preferred alternative with the reasonable alternatives is shown in **Table II-10**. The costs associated with the various reasonable alternatives include only the construction, right of way and design engineering costs.

Table II-10: Comparison of Costs for Reasonable Alternatives (2005 Dollars)

Reasonable Alternatives	Construction	Right of Way	Design Engineering	Total
Route J/O Interchange	\$47,857,000	\$2,415,000	\$2,393,000	\$52,665,000
U.S. 40: Enhanced Diamond	\$73,348,000	\$3,522,000	\$3,667,000	\$80,537,000
U.S. 40: Diamond with SW Loop	\$82,788,000	\$4,306,000	\$4,139,000	\$91,233,000
Stadium: Northern Loop	\$52,588,000	\$55,605,000	\$2,629,000	\$110,822,000
Stadium: Tight Diamond	\$53,642,000	\$42,509,000	\$2,682,000	\$98,833,000
Stadium: SPUI	\$79,986,000	\$42,509,000	\$3,999,000	\$126,494,000
Stadium: Split Diamond	\$50,941,000	\$45,274,000	\$2,547,000	\$98,762,000
Bus. Loop West	\$23,159,000	\$16,682,000	\$1,158,000	\$40,999,000
163/763/Business Loop East: One-Way	\$104,017,000	\$34,543,000	\$5,201,000	\$143,761,000
163/763/Business Loop East: Collector/Distributor System	\$120,950,000	\$37,781,000	\$6,048,000	\$164,779,000
U.S. 63	\$81,370,000	\$22,030,000	\$4,068,000	\$107,468,000

Table II-10: Comparison of Costs for Reasonable Alternatives (2005 Dollars)

Reasonable Alternatives	Construction	Right of Way	Design Engineering	Total
St. Charles: Tight Diamond	\$43,383,000	\$3,793,000	\$2,169,000	\$49,345,000
St. Charles: Offset Diamond	\$40,048,000	\$8,273,000	\$2,003,000	\$50,324,000
MO-Z: Diamond Interchange	\$42,854,000	\$9,392,000	\$2,143,000	\$54,389,000
MO-Z: Diamond with NW Loop Ramp	\$47,096,000	\$3,912,000	\$2,355,000	\$53,363,000
Total Preferred Alternative	\$469,630,000	\$134,886,000	\$23,481,000	\$627,997,000*

Note: Reasonable alternatives in bold indicate preferred alternatives.

* Rehabilitation and ITS costs are not included in this table due to their corridor-specific nature. Accounting for those costs would bring the total cost for the recommended preferred alternative to \$653,808,000 (see Table II-9).

The main components of the opinion of cost are discussed below.

1. Construction Costs

Construction costs were computed from preliminary design layouts for each area. The following items are included in the construction costs: earthwork, bases and pavements, incidental construction, structures, roadside development, traffic control facilities, mobilization and construction engineering. Roadway pavement, bridges and retaining walls account for over one-half of the construction costs.

2. Right of Way Costs

Right of way costs include the cost to acquire real estate and to relocate residents and businesses. Each affected parcel would undergo an acquisition process conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. This would require appraisal of each acquisition. **Table II-11** presents the right of way cost portion of the total construction estimate. The estimates are based on methodologies established for the project and do not follow the methodologies used to determine property values/tax revenue losses. It's expected that the process of acquiring real estate for the recommended preferred alternative would cost \$135 million: \$17 million for land, \$66 million for structures, \$47 million to conduct and administer the program (including moving and other benefits) and \$5 million for advertising sign removal.

Widening of I-70 will typically result in the need to acquire and remove existing billboards located where new right of way is required. Under current state and federal law, some of the billboards that are removed may be able to be replaced on other land adjacent to the new right of way limits. Minimum spacing and other requirements are likely to prevent other billboards from being replaced. The cost estimates assume that a greater cost will have to be paid for billboards that cannot be replaced, than for those which are able to be set back and replaced at their approximate original milepost location. These estimated costs are roughly approximate, due to uncertainties in the variables of time, potential changes in billboard laws and valuation, plus the unique circumstances that affect the value of each current billboard.

Within SIU 4, we estimate that construction of a build alternative would require the removal of approximately 82 to 101 existing billboards, depending on the alignment of the build alternative

selected. A substantial number of these large billboards would be able to be set back and rebuilt at their same approximate milepost location under current law.

Under the No-Build Alternative, the existing billboard structures would not be affected.

Table II-11: Summary of Right of Way Costs (2005 Dollars)

Reasonable Alternatives	ROW Land Cost	Structure Costs	Relocation Cost	Advertising Removal Cost	Total ROW Costs
Route J/O Interchange	\$357,000	\$865,000	\$593,000	\$600,000	\$2,415,000
U.S. 40: Enhanced Diamond	\$259,000	\$1,271,000	\$892,000	\$1,100,000	\$3,522,000
U.S. 40: Diamond with SW Loop	\$1,671,000	\$1,221,000	\$1,264,000	\$150,000	\$4,306,000
Stadium: Northern Loop	\$5,733,000	\$28,740,000	\$20,232,000	\$900,000	\$55,605,000
Stadium: Tight Diamond	\$4,371,000	\$21,971,000	\$15,467,000	\$700,000	\$42,509,000
Stadium: SPUI	\$4,371,000	\$21,971,000	\$15,467,000	\$700,000	\$42,509,000
Stadium: Split Diamond	\$4,651,000	\$23,400,000	\$16,473,000	\$750,000	\$45,274,000
Business Loop West	\$2,702,000	\$7,575,000	\$6,005,000	\$400,000	\$16,682,000
163/763/Business Loop East: One-Way	\$772,000	\$20,538,000	\$12,833,000	\$400,000	\$34,543,000
163/763/Business Loop East: Collector/ Distributor System	\$1,516,000	\$21,809,000	\$14,156,000	\$300,000	\$37,781,000
U.S. 63	\$5,326,000	\$8,552,000	\$7,202,000	\$950,000	\$22,030,000
St. Charles: Tight Diamond	\$1,601,000	\$683,000	\$1,009,000	\$500,000	\$3,793,000
St. Charles: Offset Diamond	\$3,207,000	\$2,225,000	\$2,741,000	\$100,000	\$8,273,000
MO-Z: Diamond Interchange	\$1,116,000	\$4,548,000	\$3,328,000	\$400,000	\$9,392,000
MO-Z: Diamond with NW Loop	\$735,000	\$1,710,000	\$1,317,000	\$150,000	\$3,912,000
Total for Recommended Preferred Alternative	\$16,504,000	\$66,003,000	\$47,329,000	\$5,050,000	\$134,886,000

Note: The opinions of cost assume that impacts to billboards would be paid for based on the actual cost to replace the billboards in kind. In some cases, existing billboards do not conform to MoDOT policy, and there may be additional cost implications in order to bring them into compliance. These potential costs are subjective based on each individual occurrence and therefore have not been included in the estimate.

3. Design Engineering Costs

Design engineering costs include costs associated with the design of each subsection. Design engineering costs are based on six percent of the construction costs, and do not include the construction services and construction management costs.

4. Rehabilitation, Operations and Maintenance Costs

Rehabilitation and operations and maintenance (O&M) costs were prepared for both the Build and No-Build Alternatives. Rehabilitation costs include pavement resurfacing, pavement replacement, bridge redecking/rehabilitating and O&M. Rehabilitation costs were calculated from 2005 to 2030 and discounted to 2005. Pavement replacement and resurfacing schedules were created based on the PSR. Pavements were considered to have a 20-year initial life with a 20-year cycle of milling and overlaying the existing pavement. Bridge redeckings/rehabilitations were based on the Bridge Deck Inspection rating. The bridge decks were considered to be redecked/rehabilitated on a 25-year cycle. Bridge replacements were not included with

rehabilitation costs. Operations and maintenance costs were based on lane-miles of roadway and were calculated from 2005 to 2030 and discounted to 2005.

The No-Build Alternative included pavement replacement costs for pavements with low PSRs. It was assumed that approximately 13 lane-miles of pavements with a PSR of poor or very poor were replaced in kind in 2005 and 2006. The remaining pavements would be milled and overlaid beginning in 2007. All pavements were resurfaced based on a 20-year cycle milling and overlaying. Bridges were rehabilitated starting in 2005 with the lowest deck inspection ratings and reoccurring on a 25-year cycle. For the No-Build Alternative, none of the bridges were considered for total replacement during this time period. By the year 2030, 20 of the 24 bridges would have exceeded 50 years in age. Most of the bridges would have exceeded the 50-year mark by 50 percent. Operation and maintenance costs were considered for all lane-miles of the roadway.

The Build Alternative cost estimates assumed that approximately 13 lane-miles of pavement with PSRs of poor and very poor would be resurfaced in 2005 and 2006. This provides for additional pavement life until the Build Alternatives would reconstruct these pavements. All pavements were resurfaced based on a 20-year cycle milling and overlaying. Bridges were rehabilitated only for bridges with low bridge deck inspection ratings to provide additional life until the Build Alternatives would reconstruct these bridges. Operation and maintenance costs were considered for all lane-miles of the roadway including new construction.

5. Intelligent Transportation Systems

The capital cost for implementing ITS is \$5,300,000 with an estimated annual operation and maintenance cost of \$530,000. These costs reflect a typical urban ITS deployment within Columbia, but do not include the cost for developing and operating a Columbia/I-70 corridor traffic operations center.